

## Abstract Archives of the RSNA, 2023

M2-SPBR

### Breast Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPBR-1 Stand-alone Performance of Artificial Intelligence-based Computer-assisted Diagnosis in Screening Automated Breast Ultrasound**

##### Participants

Haejung Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the stand-alone performance of artificial intelligence-based computer-assisted diagnosis (AI-CAD) in screening automated breast ultrasound (ABUS) interpretation and find the factors associated with false-negative and false-positive results.

##### METHODS AND MATERIALS

The ABUS source data of 435 women in a single institution were retrospectively analyzed using AI-CAD system (LUCAS). Three volume data of antero-posterior, medial, and lateral scanning were obtained for each breast. Of total 435 women, 97 were breast cancer patients with screening detected single malignant lesion between October 2019 and June 2020, and 338 were women who underwent screening ABUS between May 2019 and June 2019 and showed negative final diagnosis. We reviewed the results of AI-CAD system in detecting malignant lesion on ABUS and analyzed the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). Also the associated factors with false-negative and false-positive results were analyzed.

##### RESULTS

The sensitivity, specificity, PPV, and NPV of AI-CAD in ABUS interpretation were 0.75 (73 of 97; 95% confidence interval, 0.65 to 0.83), 0.58 (195 of 338; 95% CI, 0.52 to 0.63), 0.34 (73 of 216; 95% CI, 0.30 to 0.37), and 0.89 (195 of 219; 95% CI, 0.85 to 0.92), respectively. The average number of CAD-detected lesion was 1.2 per study (1.8 in patients with cancer, and 1.0 in patients without cancer). True positive lesions were detected in 1.81 of 3 volumes of breast, while false positive lesions were detected in 1.30 of 3 volumes (1.5 in benign lesions and 1.1 in pseudo-lesions). False-negative results in breast cancer were more frequent for isoechoic mass ( $p < 0.001$ ) and mass without echogenic rind ( $p = 0.043$ ). Among 143 patients with false-positive results, 49 (34.3%) had pseudo-lesions. False-positive results were more frequent for dense breasts on mammography ( $p < 0.001$ ), however, the background echotexture of ABUS was not associated with false positive results or pseudo-lesions.

##### CONCLUSION

s AI system showed NPV of 89% for negative interpretation of ABUS. However, radiologists should carefully recheck the results of AI-CAD system to reduce false-positive results and recall rate.

##### CLINICAL RELEVANCE/APPLICATION

By providing information on the stand-alone performance of AI-CAD in screening ABUS interpretation, it helps to correctly understand the advantages and disadvantages of AI-CAD system and apply them to clinical practice.

#### **M2-SPBR-2 A Novel Triage Model for Screening Mammograms Based on a Density AI and a Cancer Detection AI**

##### PURPOSE

To estimate the effectiveness of a triage model for breast cancer screening examinations based on two AI systems: one for breast density assessment and one for cancer detection.

##### METHODS AND MATERIALS

For this retrospective simulation study, a dataset of 2,981 tomosynthesis screening examinations was collected. The dataset included 696 biopsy-proven cancer cases and 2,285 negative screens (verified by a negative follow-up). For each collected screen, the interpretation made by the primary reader was also collected. A two-steps triage model was set up based on two AI systems: one estimating the breast composition, and one detecting and characterizing regions suspicious for malignancy (hereafter referred to as AI-density and AI-detection). The first step was based on density: examinations whose density was assessed as C or D by AI-density were considered as requiring human interpretation. Examinations whose density was assessed as A or B were further processed by AI-detection: those with an AI-detection score lower than a given threshold were considered negative and not worth of reader interpretation, otherwise they were considered as requiring human interpretation. The proposed triage model is based on the French breast screening context where patients with high density breasts systematically undergo both mammography and ultrasound, and autonomous offloading of examinations by AI is mainly applicable to low density breasts. We examined the effect on recall rate and workload reduction keeping constant the cancer detection rate. We used inverse probability weighting to compensate for distribution differences between the used dataset and a typical screening population.

##### RESULTS

AI-density assessed 611 exams (20.5%) as density A, 1,024 (34.35%) exams as density B, 967 exams (32.44%) as density C and 379 exams (12.71%) as density D. Based on AI-detection scores of examinations assigned with densities A and B, 26.43% of

women were considered negative without significantly affecting the cancer detection rate (which remained constant around 5/1000 - 95% CI 4.6/1000 to 5.7/1000). The recall rate decreased from 10.02% (8.74% - 11.29%) to 8.2% (7.07% - 9.32%).

## CONCLUSION

Results have shown that the proposed two-step triage strategy could safely select patients to be removed from radiologists' workload without affecting the cancer detection rate. A prospective study that applies this model has been set up in France and is supposed to start including patients on January 2024.

## CLINICAL RELEVANCE/APPLICATION

Using two AI systems (one for density and one for cancer detection) to triage mammograms could potentially reduce radiologist workload at constant cancer detection rate, and decrease the rate of women recalled back for further examinations.

### M2-SPBR-3 Automated Assessment of Breast Positioning and Image Quality Using Artificial Intelligence for Digital Breast Tomosynthesis (DBT) with Two-Dimensional Synthetic Mammography and Full-Field Digital Mammography (FFDM)

#### PURPOSE

This study aimed to evaluate the accuracy of an artificial intelligence based tool for automated assessment of breast positioning and image quality in DBT, using synthetically reconstructed projection images.

#### METHODS AND MATERIALS

A total of 150 mammography examinations were enrolled in this study. Subjects underwent screening mammography including DBT with 2D-SM and FFDM. The AI-assisted automated assessment tool evaluated the quality of breast positioning in each image set. Nine image quality criteria evaluating the appearance of the nipple, breast rotation, pectoral muscle, inframammary fold, pectoral nipple line, shoulder overlap shadow, abdominal skin, contralateral breast and foreign body were used for craniocaudal and mediolateral-oblique views. Image quality of cases were also evaluated with the standards of Mammography Quality Standards Act (MQSA) as grade "adequate" or "inadequate". The performance of the AI system was evaluated using accuracy, sensitivity, and specificity. The inter-rater agreement and comparison of their findings with those reported by the AI system was calculated using Cohen's kappa coefficient.

#### RESULTS

The AI algorithm demonstrated high accuracy in distinguishing between adequate and inadequate images, with an overall accuracy of 93%, sensitivity of 94% and specificity of 92% for FFDM and an accuracy of 92%, sensitivity of 95 and specificity of 91% for DBT with 2D-SM. In terms of breast positioning, the AUC of poor imaging quality prediction by AI system according to incomplete gland, incomplete pectoralis muscle, over or insufficient exposure was (0.903 vs 0.937 vs 0.982). Overall accuracy of AI system were 0.958 for FFDM and 0.932 for DBT with 2D-SM. Inter-observer agreement for image quality assessment was found to be 0.82 (95% confidence interval [CI]: 0.77-0.87), indicating substantial agreement between radiologists and AI system using 2D-SM images. The kappa coefficients for breast positioning assessment were also calculated and found to be moderate to substantial, with values ranging from 0.57 to 0.83 (95% CI: 0.48-0.67 and 0.78-0.88, respectively).

## CONCLUSION

The results showed a high degree of agreement between the automated and manual assessments, also indicating the performance of the AI tool in assessing breast positioning and image quality in DBT using 2D-SM images was comparable with that in FFDM.

## CLINICAL RELEVANCE/APPLICATION

The study demonstrated the potential of this AI assisted system to improve the efficiency, accuracy, and reliability in DBT screening.

### M2-SPBR-4 TopoTxR: A Topology-based Framework for Breast Parenchyma Characterization on DCE-MRI

#### Participants

Prateek Prasanna, PhD, Stony Brook, NY (*Presenter*) Nothing to Disclose

#### PURPOSE

In order to comprehensively analyze the biology of breast cancer, it is necessary to examine the surrounding breast parenchyma. Automated characterization of breast parenchyma using DCE-MRI is challenging due to the intricacy of the parenchymal tissue structures. Existing quantitative techniques, when combined with deep learning, are unable to accurately represent the complex structures, such as fibroglandular tissue. The fibroglandular tissue may undergo malignant transformation. To better evaluate the subtle structures of the breast, we propose a novel approach, TopoTxR, that incorporates topological features extracted from persistence diagrams as auxiliary information. This enables the convolutional neural network (CNN) to directly focus on the biologically-relevant topological structures.

#### METHODS AND MATERIALS

We train and validate TopoTxR to predict pathological complete response (pCR) using ISPY-1 post-contrast DCE-MRI data. Our study involves 161 patients, with 47 achieving pCR and 114 not. To enhance the performance of the 3D CNN, we integrated a mask-guided attention module that leverages a prepared topology-related mask. This mask approximates the curvilinear tissue-like structures enclosed by tissues and glands in their proximity. While inputting the raw DCE-MRI as the input of the CNN backbone, we applied the topological structure mask to guide the generation of the attention map in the latent space. TopoTxR takes advantage of the noise-free topological structures while retaining other biologically relevant information of the original data. Finally, we employed a classifier to the attention-filtered features for pCR prediction, followed by a custom loss function combined mask guided loss and refined the classification loss to address the sample imbalance problem.

#### RESULTS

TopoTxR utilizes the topological mask as supplementary input combined with the original image and incorporating Focal Loss. It improves pCR prediction significantly compared to previous methods and it also surpasses the state-of-the-art, Densenet-KD, by

3% in accuracy. Our ablation studies show the effectiveness of mask-guided attention modules and Focal Loss, respectively.

## CONCLUSION

Our novel method leverages pre-computed topological biomarkers to enhance the performance of 3D CNN in pCR prediction. This model reasonably integrates both topology and full image information to obtain and evaluate high biological related features.

## CLINICAL RELEVANCE/APPLICATION

Predicting treatment response enables physicians to plan and determine the most effective treatment strategy for their patients prior to disease progression (i.e. immediate surgical intervention in cases where neoadjuvant chemotherapy is predicted to fail).

### M2-SPBR-5 Cloud-Based Machine Learning Platform for the Detection and Localization of Breast Cancer on DCE-MR Scans

Participants

Gavin Jones, Hummelstown, PA (*Presenter*) Nothing to Disclose

Michelle Le, BEng, Allentown, PA (*Presenter*) Nothing to Disclose

## PURPOSE

Breast cancer is the most common cancer diagnosed in US women and is second to lung cancer as a cause of death in women. Machine learning (ML) can play a role in aiding breast radiologists with the detection and localization of tumors on MRI. The aim of this project was to create an ML algorithm using cloud-based software capable of accurately identifying breast cancer on DCE-MRI. The trained algorithm may be used as a radiologist adjunct in the early identification of lesions.

## METHODS AND MATERIALS

Breast cancer MR images were obtained from a publicly available dataset of 922 radiologist-annotated and biopsy-confirmed breast cancer. The provided annotations denoted a 3D bounding box of each tumor. Using these coordinates, multiple 2D slices of the tumor were selected to augment the total number of tumor-containing images to 1267 training and 396 test images. Tumor images were further processed to exploit contrast enhancement data by compiling pre-contrast tumor slices with their corresponding early and late post-contrast slices into a single RGB image. Cloud-based ML software was then used to train the algorithm on the processed 1267 pre-annotated MR images. Following training, the algorithm's accuracy and precision were assessed using the remaining 396 test images. Tumor subgroup analyses were also performed to assess detection performance on classifiers such as ductal and lobular histology and molecular features such as luminal A/B, HER2+/-, ER +/-, PR+/-, and triple-negative carcinomas.

## RESULTS

The trained ML model had 94.3% recall and 89.8% precision when the probability and overlap thresholds were set to 95% and 30% respectively. When tested on the 396 non-annotated validation images, the model localized breast cancer tumors with a recall of 88.6% and an average precision of 86.5% with a confidence interval of 0.95 and an F1 score of 0.89. For the subgroup analyses, HER2 enriched molecular subtype (n=20) had the highest overall average precision (95.5%), recall (95.5%), and F1 (0.95). The lowest-performing subgroup was lobular carcinoma (n=31) with average precision (88.8%), recall (84.4%), and F1 (0.90).

## CONCLUSION

Our study has shown that ML techniques trained on a large set of annotated MR images can produce a highly accurate breast cancer detection and identification tool. The performance of tumor classifiers varies depending on tumor type, receptor status, and molecular subtype.

## CLINICAL RELEVANCE/APPLICATION

An ML tool that can accurately detect and localize breast cancer tumors can improve care by providing women with diagnoses and thus treatment options more quickly. In the future, this ML model can be made accessible within an online tool that will quickly review breast MR slices and determine if there is breast cancer and localize tumors.

### M2-SPBR-6 Artificial Intelligence-Supported Additional Review of Screening Mammography Improves Radiologist Cancer Detection Rate

## PURPOSE

Studies estimate that for every 5 cancers detected by screening mammography, there is 1 false negative. A common method of reducing the false negative rate is "double-reading," where two readers interpret mammograms. However, double-reading is costly, and single-reading is standard practice in the USA. The purpose of this study was to explore the utility of an Artificial Intelligence (AI) supported additional review process (AIAR) where AI identifies the most suspicious exams for selective additional review. The goal is to realize the benefit of decreased false negatives through double-reading while minimizing additional workload.

## METHODS AND MATERIALS

A total of 522,078 digital breast tomosynthesis screening mammograms from March 2021 to August 2022 underwent AIAR at 5 practices in the US. The dataset contained 2,739 screen-caught cancers. In the AIAR process, screening mammograms were assessed using a custom AI algorithm. Exams considered suspicious by the AI algorithm that were not recalled by the interpreting radiologist (i.e. given a BIRADS 1 or 2) were flagged for review by an experienced radiologist. The reviewer could consult with the interpreting radiologist if they thought a recall was warranted, who could decide whether to revise to a BIRADS 0 and recall the patient. Performance metrics, including recall rate (RR), cancer detection rate (CDR), and positive predictive value 1 (PPV1) were computed for 98 individual interpreting radiologists.

## RESULTS

A total of 19,560 exams were flagged by AIAR, and 201 additional cancers were detected. Thus, with AIAR only 4% of exams required an additional review, while yielding an 8% increase in cancer detection. AIAR increased CDR across practices (range 5-21%), while minimally impacting RR (range 1-3%). PPV1 also increased at every practice (range 3-16%), indicating AIAR finds more cancers for each recall. Radiologists with lower pre-AIAR CDRs improved more compared to those with high pre-AIAR CDR (e.g., CDR increase of 0.55 vs 0.35 for radiologists with pre-AIAR CDR of 2-4 vs 4-6). Finally, AIAR could be further improved to identify up to 243 more cancers by standardizing the consult rate to ~5 consults per 100 reviews which would maximize the positive predictive

value of consults at ~35 cancers per 100 consults.

## CONCLUSION

s AIAR increases cancers detected, while minimizing the additional workload required to identify and recall at-risk patients in a large real-world dataset.

## CLINICAL RELEVANCE/APPLICATION

AIAR is a practical means to improve cancer detection in the real-world, and therefore reduce false negatives without incurring substantial additional costs.

## M2-SPBR-7 Sonographic Prediction of Breast Cancer Patients Non-Responding to Neoadjuvant Chemotherapy at Baseline: Comparison of Standard B-mode and a Deep-Learning Model

Participants

Panagiotis Kapetas, MD, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate whether pre-therapeutic breast ultrasound (US) can serve in the prediction of breast cancer (BC) patients non-responding to neoadjuvant chemotherapy (NAC) and to compare two different models.

## METHODS AND MATERIALS

This retrospective, IRB-approved study included 245 patients with histologically confirmed invasive BC who underwent NAC. The dataset was divided into a training (165 cases) and a validation set (80 cases). A representative B-mode US image of each tumor from the pre-treatment examination was selected. 2 experienced breast fellows independently evaluated the lesions using standard BI-RADS descriptors. Logistic regression was used to identify independent predictors of response to NAC in the training set and create a model. Additionally, a Resnet18-based neural network with Dropout layers to decrease the amount of overfitting was trained to predict the treatment outcome. The performance of both models was evaluated on the validation set using descriptive statistics. Postoperative histology was the standard of reference for treatment response: absence (pathological complete response- pCR) or presence of residual invasive tumor in the breast or axillary lymph nodes.

## RESULTS

145 patients (59.2%) did not achieve a pCR. From the BI-RADS descriptors, oval or round shape, microlobulated or spiculated margin and the presence of calcifications or edema proved to be independent predictors of pCR. A model using these showed an accuracy, sensitivity, specificity, positive and negative predictive value of respectively 65%, 82%, 41%, 67% and 61% for the prediction of non-responders to NAC. Compared to that, the DL-based model achieved an accuracy, sensitivity, specificity, positive and negative predictive value of 72%, 83%, 55%, 74% and 69%.

## CONCLUSION

s Breast US can accurately predict lack of response to NAC for BC patients prior to its initiation. A DL model using images from the baseline US examination demonstrates an increased diagnostic performance as compared to standard B-mode BI-RADS descriptors.

## CLINICAL RELEVANCE/APPLICATION

Pre-therapeutic breast ultrasound offers accurate information, which may aid in the management of breast cancer patients, planned to undergo neoadjuvant chemotherapy.

## M2-SPBR-8 Prediction of Pathologic Response to Neoadjuvant Chemotherapy in Patients with Breast Cancer Based on Artificial Intelligence Techniques

Participants

Ahmed Sharafeldein, Louisville, KY (*Presenter*) Nothing to Disclose

## PURPOSE

The aim is to develop a computer aided diagnosis (CAD) system to accurately predict the response of neoadjuvant chemotherapy on breast cancer patients based on magnetic resonance imaging (MRI). The system aims to predict three possible responses, which are complete response (indicating the complete disappearance of the lesion), partial response (in which the tumor partially disappeared), or no response (suggesting that the tumor did not respond to chemotherapy).

## METHODS AND MATERIALS

The proposed system is composed of four distinct stages. The first stage involves manual delineation of the breast tumor by an experienced radiologist. Secondly, four distinct features are extracted from the manually segmented tumor, namely functional imaging markers, apparent diffusion coefficient (ADC), computed from diffusion-weighted imaging (DWI) using baseline scans and b-500, b-1000, and b-1500 scans, along with texture features, grey level co-occurrence matrix (GLCM) and grey level run length matrix (GLRLM), extracted from T1-weighted, T2-weighted, and STIR models. Thirdly, these features are statistically represented using percentiles, which helps to capture the salient aspects of the data distribution while minimizing the impact of outliers. Finally, the features are combined together and then fed into a gradient boosting classifier.

## RESULTS

To evaluate the effectiveness of the proposed system, a dataset of 110 breast cancer patients was used, with 28 patients showing complete response, 53 with partial response, and 29 with no response. The system's performance is assessed using k=15 cross-validation approach. The findings demonstrated that the proposed system outperforms the accuracy of classifying each feature individually as well as other statistical machine learning classifiers, achieving an impressive accuracy of 85.5 a specificity of 73.5 a sensitivity of 98.5. The results clearly indicate that integrating functional imaging markers and texture markers using majority voting approach significantly enhances the diagnostic system's performance.

## CONCLUSION

s The proposed CAD system accurately predicts the response of neoadjuvant chemotherapy on breast cancer patients by utilizing

various markers related to the pathology. The system's performance is further improved by integrating functional imaging markers and texture markers in a non-invasive manner.

#### **CLINICAL RELEVANCE/APPLICATION**

The motivation behind this objective is to reduce the risk of exposure to neoadjuvant chemotherapy, which can be painful and dangerous. By assessing the response of the impact of chemotherapy exposure, physicians can determine whether chemotherapy is necessary or if the patient should undergo surgery directly.

#### **M2-SPBR-9 Analyzing the Collinearity of Race and Breast Tissue Density in Misclassification of Abnormality in Screening Mammograms**

##### **PURPOSE**

Deep learning techniques have been developed to assist the assessment of potential breast cancer in screening mammograms. Research has shown gaps in model performance within subgroups of some demographic and imaging features in classifying abnormality in mammograms presenting region of interests (ROIs); However, the collinearity between such features is unknown. The purpose of this study was to investigate the collinearity of those demographic and imaging characteristics in association with the performance of deep learning model in classifying abnormality in screening mammograms.

##### **METHODS AND MATERIALS**

We applied a modified ResNet152V2 convolutional neural network structure trained on 39,054 and tested on 13,390 mammogram patches from (REDACTED) dataset. Positive patches are the ROIs annotated by the original interpreting radiologists on BI-RADS 0 images; Negative patches were randomly selected from regions in BI-RADS 0 images avoiding ROIs, and regions in BI-RADS 1 and BI-RADS 2 images. The classification result of test set patches was aggregated to their source images, while only images containing all correctly classified patches were considered as successful prediction. Image-level classification results on 5,723 test images containing ROIs were analyzed by logistic regression models for the association with race and tissue densities, separately and together. Variance inflation factor (VIF) was calculated for race and tissue density.

##### **RESULTS**

VIF between race and density is 1.000005, showing features are moderately, nearly not correlated. Experiment 1 combined three race groups and four densities into 12 subgroups, no significant correlation with image misclassification was found. Experiment 2 had three models built in White, Black and Other races populations separately, we found that only in Black population, BI-RADS densities C ( $p=0.026$ ) and D ( $p=0.012$ ) have significantly higher chance to be misclassified.

##### **CONCLUSION**

The study reveals there is no collinearity issue with race and tissue density in the dataset and deep learning structure that were used.

#### **CLINICAL RELEVANCE/APPLICATION**

This can be used as a guide for future model development.

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## Abstract Archives of the RSNA, 2023

M2-SPCA

### Cardiac Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPCA-1 Construction of a Predictive Model Combining Clinical and CCTA Parameters for the Coronary Collateral Circulation in Patients with Ischemic Heart Disease**

Participants  
Ting Mao, MA, Changsha, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Coronary computed tomographic angiography (CCTA) currently cannot directly assess coronary collateral circulation due to limited spatial and temporal resolution. The aim of this study is to construct a predictive model combining clinical and CCTA parameters for the good coronary collateral circulation (CCC) in patients with ischemic heart disease (IHD).

#### **METHODS AND MATERIALS**

This study is a retrospective analysis of 634 consecutive patients with IHD whose luminal stenosis of at least 70% on coronary angiography (CAG) and underwent CCTA within 2 months prior to CAG. According to the CAG, patients with a Rentrop grade of 2-3 were defined as having good CCC and those with a Rentrop grade of 0-1 as having poor CCC. Finally, 80 patients with good CCC were enrolled, while 80 age- and sex-matched patients with poor CCC were randomly selected as the control group. Complete clinical data were collected and pericoronary fat attenuation index (FAI) and CT-fraction flow reserve (CT-FFR) were measured. CT-FFR measurements included lesion-specific CT-FFR (2 cm distal to the stenosis), vessel-specific CT-FFR (distal-most vessel with diameter of 2 mm) and  $\Delta$ CT-FFR (difference between proximal and distal CT-FFR of the lesion). The correlation and predictive value of these clinical and imaging parameters with good CCC were analyzed.

#### **RESULTS**

The differences in RCA-FAI,  $\Delta$ CT-FFR and lesion-specific CT-FFR in patients with good CCC were statistically significant compared with controls [-78.49 $\pm$ 10.92HU vs. -73.54 $\pm$ 8.92HU, 0.09 (0.06, 0.15) vs. 0.13 (0.10, 0.16), 0.67 (0.62, 0.73) vs. 0.66 (0.59, 0.70), P=0.002, 0.001, 0.027, respectively]; Spearman correlation analysis showed that Beta-blocker use and lesion-specific CT-FFR were positively correlated with good CCC (r=0.282, 0.176, P=0.001, 0.026, respectively), and TG, TG/HDL-C, RCA-FAI, and  $\Delta$ CT-FFR were negatively correlated with good CCC (r=-0.252, -0.245, -0.233, -0.257, P=0.001, 0.002, 0.003, 0.001, respectively). Multifactorial logistic regression analysis showed that Beta-blocker use, RCA-FAI and  $\Delta$ CT-FFR were independent predictors of good CCC. The combined model constructed by these three indicators predicted good CCC with an AUC of 0.747, a sensitivity of 65.00% and a specificity of 80.00%.

#### **CONCLUSION**

The FAI and CT-FFR by CCTA correlated with CCC, and the combined Beta-blocker use, RCA-FAI and  $\Delta$ CT-FFR helped to noninvasively assess the extent of CCC in patients with IHD.

#### **CLINICAL RELEVANCE/APPLICATION**

Good CCC is known to reduce the incidence of major adverse cardiovascular events in patients with IHD. Our study shows that combined CCTA-derived FAI, CT-FFR and clinical indexes may contribute to the non-invasive assessment of CCC in clinical work.

#### **M2-SPCA-2 Lipoprotein(a) Associated with Myocardial Infarction in Patients with Low Attenuation Plaque: A Multicenter Prospective Study**

#### **PURPOSE**

Lipoprotein(a) [Lp(a)] is associated with an increased risk of myocardial infarction (MI). However, the mechanism underlying this association has yet to be fully elucidated. To evaluate whether association between Lp(a) and MI risk is modified by the presence of low-attenuation plaque (LAP) identified by coronary CT angiography (CCTA).

#### **METHODS AND MATERIALS**

Between January 2010 and July 2022, consecutive patients suspected of coronary artery disease who underwent CCTA and Lp(a) measurement were prospectively enrolled from three institutions. High Lp(a) was defined as Lp(a) = 50 mg/dL. The primary endpoint was a composite of time to fatal or nonfatal MI. Multivariable Cox regression analysis was applied to compare survival rates.

#### **RESULTS**

A total of 5607 patients (mean age, 54  $\pm$  11 years) were included. Multivariable logistic regression analysis revealed that elevated Lp(a) levels were independently associated with the presence of LAP at CCTA (adjusted OR=5.21, 95% CI: 4.44 to 6.26, p<0.001). Furthermore, multivariate linear regression analysis indicated that Lp(a) levels were positively associated with LAP volume (standardized  $\beta$ =0.46, p<0.001). During a median follow-up of 8.2 [7.2, 9.3] years, 261 (4.6%) patients experienced MI events. In the overall population, elevated Lp(a) levels were associated with MI occurrence [adjusted hazard ratio (aHR)= 1.91, 95% CI: 1.46 to 2.49, p<0.001]. An Lp(a)-by-LAP interaction was observed (p interaction < 0.001). When stratified by the presence or absence

of LAP, Lp(a) was associated with MI in patients with LAP (aHR= 3.03, 95% CI: 1.92 to 4.76, p<0.001); however, no association was observed among the patients without LAP (aHR=1.12, 95% CI: 0.74 to 1.70, p=0.570). The principal findings remained unchanged in the patients with CT-FFR > 0.8.

## CONCLUSION

Elevated lipoprotein(a) predominantly augmented the risk of myocardial infarction in patients with low-attenuation plaque identified by coronary CT angiography.

## CLINICAL RELEVANCE/APPLICATION

The mechanism underlying the association between lipoprotein(a)[Lp(a)] and myocardial infarction (MI) has yet to be fully elucidated. Our study evaluate whether association between Lp(a) and MI risk is modified by the presence of low-attenuation plaque (LAP) identified by coronary CT angiography. We find that elevation of Lp(a) was exclusively associated with MI in patients with evidence of LAP but not in those without LAP. Our study indicated that Lp(a) is not an equivalent risk factor for MI, which has important implications for risk assessment as well as the use of preventive therapies.

## M2-SPCA-3 Preliminary Investigation of the Right Ventricular Scalloping Index as a Novel CMR-derived Marker for Diagnosing Arrhythmogenic Right Ventricular Cardiomyopathy

### PURPOSE

The cardiac magnetic resonance (CMR) evaluation of right ventricular (RV) morphologic abnormalities in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC) is subjective. Here we aimed to develop a novel index, the right ventricular scalloping index (RVSI), to standardize the measurement of RV free wall scalloping and aid in the imaging diagnosis.

### METHODS AND MATERIALS

We retrospectively included 15 patients with definite ARVC and 45 age- and sex-matched patients with idiopathic right ventricular outflow tract ventricular arrhythmia (RVOT-VA) as controls. The RVSI was measured from cine images on four-chamber view to evaluate its ability to distinguish between ARVC and RVOT-VA patients.

### RESULTS

The RVSI was significantly higher in the ARVC than RVOT-VA group (1.57±0.22 vs. 1.27±0.07, p<0.001). The RVSI demonstrated high intra- and interobserver reliability (intraclass correlation coefficient, 0.94 and 0.93, respectively). A cut-off value of RVSI = 1.38 provided high sensitivity of 86.7% and high specificity of 95.6%. Moderate linear correlations were found between RVSI and RVEF (r=-0.42, p<0.001) as well as between RVSI and RVEDVI (r=0.5, p<0.001). The subgroup analysis revealed a moderate linear correlation between RVSI and RVEDVI (r=0.67, p=0.006) in the ARVC subgroup. In a multivariable analysis, a family history of ARVC or sudden cardiac death (odds ratio, 98.14; 95% confidence interval, 2.34-4116.35; p=0.016) and an RVSI = 1.38 (odds ratio, 145.24; 95% confidence interval, 9.90-2131.10; p<0.001) remained predictive of definite ARVC.

## CONCLUSION

RVSI is a quantitative method with good performance for distinguishing ARVC and RVOT-VA patients.

## CLINICAL RELEVANCE/APPLICATION

ARVC is among the major differential diagnoses to be considered in patients with an initial impression of RVOT-VA, image survey with CMR before ablation is recommended to provide a comprehensive assessment of RV morphology, and RVSI is easy and intuitive to measure.

## M2-SPCA-4 Regional Variation of Left Ventricular Myocardial T2 Mapping Values and Diagnostic Performance for Active Cardiac Sarcoidosis

Participants

Jordan Chamberlin, MD, Charleston, SC (*Presenter*) Nothing to Disclose

### PURPOSE

Myocardial tissue characterization with T2 mapping has been shown to aid in diagnosis of cardiac sarcoidosis, but the regional variation and diagnostic performance has not been well evaluated.

### METHODS AND MATERIALS

2503 patients undergoing 1.5T cardiac MRI from 2017-2022 were queried. 326 patients with biopsy proven extracardiac sarcoidosis were enrolled in this retrospective cohort analysis, of which 110 were found to have complete T2 mapping series. The left ventricle was manually delineated into the 16 corresponding anatomic segments and 7 regions (Basal, mid, apical, anterior, inferior, septal, and lateral) according to the American Heart Association segmentation guidelines. Active cardiac sarcoidosis (aCS) was defined using the 2017 Japanese Circulation Society criteria within 30 days of imaging. Optimal thresholds were calculated using a balanced resampling bootstrapping technique. The optimal thresholds were rounded to the nearest integer for ease of clinical use. Mann-Whitney U Tests were used for comparing continuous distributions.

### RESULTS

37 (33.6%) patients (mean age 57 years, 65.9% males, 63.4% Black) were found to meet aCS criteria. T2 values across all myocardial regions were found to be significantly higher for patients meeting criteria for aCS (P < 0.05). Median regional T2 values in patients with aCS ranged from 48.6 ms (septal) to 50.8 ms (apical) and median regional T2 values in patients without aCS ranged from 47.0 ms (lateral) to 49.5 ms (apical). Utilizing optimized thresholds (>50ms), the septal myocardium was most specific for active disease (specificity = 0.923). The single region most sensitive for active disease involvement was the inferior segments (sensitivity = 0.630). Using a 50 ms positive threshold for each region, the positive predictive value (PPV) increased proportionally with the addition of each positive region (PPV 1 region > 50ms, = 0.42, PPV 5 regions = 0.65, PPV 6 regions = 0.88, PPV 7 regions = 1.00). Correspondingly, using a < 47 ms negative threshold, the negative predictive value for ruling out aCS was highest for three segments < 47 ms (NPV = 0.82).

## CONCLUSION

s T2 mapping values vary significantly across the left ventricular myocardium. The best threshold for active disease was found to be  $> 50$  ms, and the best threshold for ruling out active disease was  $< 47$  ms. Elevated regional T2 mapping (especially in the septal and inferior segments) is highly specific for active disease and shows a proportional relationship of myocardial involvement with diagnostic performance.

#### CLINICAL RELEVANCE/APPLICATION

T2 mapping, with attention to regional variation, can help identify patients with active cardiac sarcoidosis.

#### M2-SPCA-5 Cardiac Magnetic Resonance Feature-tracking Assessment of Whole-heart Myocardial Mechanics: Prognostic Value for Early Outcomes in Non-ischemic Dilated Cardiomyopathy

Participants

Gryte Galnaitiene, MD, Kaunas, Lithuania (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the prognostic value of whole-heart myocardial strain parameters derived from feature tracking (FT) on cardiac magnetic resonance imaging (CMRI) for early outcomes in patients with nonischemic dilated cardiomyopathy (NIDCM).

#### METHODS AND MATERIALS

This was a single-center prospective study involving 97 patients (mean age  $49.5 \pm 10.1$  years; 69.1% males) with NIDCM. We identified the baseline CMRI-derived whole-heart myocardial mechanical parameters: global longitudinal and circumferential strains of the left ventricle (LVGLS and LVGCS, respectively), global longitudinal strain of the right ventricle (RVGLS), peak longitudinal strain of the left atrium (LA strain) and right atrium (RA strain). The volumes of both ventricles and areas of both atria were also assessed. We evaluated the prognostic impact of the mechanical parameters for early outcomes that were: cardiac death, heart transplantation and hospitalization for worsening heart failure (HF) at 1 year after diagnosis of NIDCM. Logistic regression analysis was used to assess the potential predictors of these early outcomes.

#### RESULTS

The patients were divided into two groups according to the presence of early outcomes. The groups did not differ in mean age and males ( $p > 0.05$ ). The early outcomes were established in 32 patients (3 heart transplantations, 9 cardiac death, and 30 hospitalizations for HF worsening). All patients' left ventricular ejection fraction (LVEF) was severely reduced (mean LVEF  $28.9 \pm 8.9\%$ ) and more decreased in the group with early adverse outcomes ( $23.7 \pm 10.1\%$  vs  $32.9 \pm 10.6\%$ ,  $p < 0.001$ ). Both ventricles and atria were more dilated in the group with early adverse outcomes ( $p < 0.05$ ). Patients without early outcomes had higher LVGLS and RVGLS values ( $-8.2 \pm 4.1$  vs  $-11.7 \pm 4.6$  and  $-12.7 \pm 5.3$  vs  $-16.8 \pm 6.5$ , respectively,  $p < 0.05$ ). The similar tendency was noticed in LA strain and RA strain parameters ( $8.4 \pm 5.0$  vs  $14.6 \pm 4.3$  and  $11.5 \pm 6.9$  vs  $17.1 \pm 8.0$ , respectively,  $p < 0.05$ ). Logistic regression analysis showed that LVGLS was an independent predictor of early adverse outcomes in patients with NIDCM after 1 year ( $p = 0.001$ ).

#### CONCLUSION

s LVGLS derived from FT on CMRI can be a significant independent predictor of early adverse outcomes in patients with NIDCM.

#### CLINICAL RELEVANCE/APPLICATION

The mechanics of all parts of the heart in patients with NIDCM were evaluated. It was revealed that LVGLS has an additive prognostic value to predict early adverse outcomes in patients with severely reduced LVEF and NIDCM.

#### M2-SPCA-6 Evaluation of Myocardial Histological Properties by Pharmacokinetic Analysis Using Golden-angle Radial Sparse Parallel Imaging-volumetric Interpolated Breath-hold Examination (GRASP-VIBE)

Participants

Masaru Shiotani, RT, Suita, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Golden-angle radial sparse parallel imaging-volumetric interpolated breath-hold examination (GRASP-VIBE) is a sequence used for dynamic contrast-enhance (DCE) MRI that is robust to motion and enables to evaluate of tissue dynamic contrast analysis. This study examined the feasibility of myocardial perfusion imaging under free-breathing conditions using the GRASP-VIBE method and the possibility of assessing myocardial properties using pharmacokinetic analysis.

#### METHODS AND MATERIALS

Prior to cardiac contrast-enhanced MRI, written informed consent was obtained from all 60 subjects enrolled in the study. Perfusion imaging was performed using GRASP-VIBE for 100 seconds following bolus injection of contrast agent. 3D-image reconstruction was performed with a temporal resolution of 3.0 seconds with liver gate, a breath correction technique using liver tracking. The reconstructed images were visually evaluated for streak and cardiac motion artifacts using a 5-point scale, and the image set with the best visual quality was chosen for pharmacokinetic analysis. The analysis was conducted using a workstation (Syngo Tissue 4D) and involved placing a region of interest (ROI) in the septum of the left ventricular myocardium and calculating the volume transfer constant (Ktrans) using curve fitting with the Tofts model. The myocardial properties were evaluated by pharmacokinetic analysis for the three groups of hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (DCM), and normal subjects, as diagnosed from clinical information. ROC analysis determined cutoff values for differentiation of these diseases using Ktrans, and sensitivity and specificity were calculated.

#### RESULTS

Among the participants, 7 were diagnosed as normal, 14 as HCM, and 8 as DCM. The Ktrans was significantly lower in the HCM (0.606,  $p = 0.0104$ ) and DCM (0.694,  $p = 0.0188$ ) groups compared to the normal group (1.299). The area under the curve (AUC) for differentiating HCM from normal myocardium was 0.964, and the sensitivity and specificity were 0.857 and 1.00, respectively, when a cutoff value of 0.816 was used. The AUC for differentiating DCM from normal myocardium was 0.939, and the sensitivity and specificity were 0.875 and 1.00, respectively, when a cutoff value of 0.834 was used.

#### CONCLUSION



s GRASP-VIBE is a promising tool for evaluating myocardial perfusion and has the potential to become a new myocardial histological characterization index using pharmacokinetic analysis.

#### **CLINICAL RELEVANCE/APPLICATION**

GRASP-VIBE can acquire myocardial perfusion images without motion artifacts under free breathing without ECG synchronization. Ktrans might be a new biomarker for assessing myocardial properties.

#### **M2-SPCA-7 Coronary Microvascular Dysfunction in Nonobstructive Hypertrophic Cardiomyopathy: A Cardiac Magnetic Resonance First-pass Perfusion Study**

Participants

Wei Gao, Kunming, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Coronary microvascular dysfunction (CMD) may be associated with adverse cardiovascular outcomes in nonobstructive hypertrophic cardiomyopathy (NOHCM). The aims of this study were to assess CMD in patients with NOHCM using cardiac MR rest first-pass perfusion imaging, and explored significant risk factors for CMD.

#### **METHODS AND MATERIALS**

This was a retrospective cohort study of patients with NOHCM (n=47), obstructive hypertrophic cardiomyopathy (OHCM, n=18), and healthy controls (HCs, n=28). Maximal wall thickness, late gadolinium enhancement (LGE), and perfusion parameters including time to peak (Tpeak), peak signal intensity (SI peak), and up-slope were assessed according to AHA-16 myocardial segments. The ratio between the left ventricular outflow tract (LVOT) and aorta (AO) diameter was measured. Based on the segmental presence or absence of hypertrophy or LGE, segments in HCM were divided into four subgroups: H-LG-, H-LG+, H+LG-, H+LG+, and perfusion parameters were compared.

#### **RESULTS**

The OHCM group had significantly increased Tpeak and reduced up-slope compared with the NOHCM group (both  $P < 0.001$ ). The NOHCM group had significantly prolonged Tpeak and decreased up-slope compared with HCs (Tpeak:  $30.85 \pm 3.35$  vs.  $25.10 \pm 3.69$  s; up-slope:  $18.36 \pm 4.73$  vs.  $23.62 \pm 4.84$ , both  $P < 0.001$ ). The H-LG- segments (n = 217) in the NOHCM group had a longer Tpeak and lower up-slope compared with segments in HCs (n = 448) (Tpeak:  $29.98 \pm 3.64$  vs.  $25.11 \pm 4.11$ s; up-slope:  $18.99 \pm 4.88$  vs.  $23.84 \pm 6.99$ , both  $P < 0.001$ ). In patients with NOHCM, smaller LVOT/AO diameter ratio is closely associated with increased Tpeak (adjusted  $\beta$ :  $-0.501$ ,  $P < 0.001$ ) and decreased up-slope (adjusted  $\beta$ :  $-0.499$ ,  $P = 0.002$ ).

#### **CONCLUSION**

s CMD is highly prevalent in subjects with NOHCM even in the H-LG- segments. In NOHCM, CMD is related to the reduction of LVOT/AO diameter ratio.

#### **CLINICAL RELEVANCE/APPLICATION**

Our results urge that reconsideration of the management decisions in patients with NOHCM, and more attention should be paid to their CMD, leading to a more thoughtful assessment of risk stratification. It also implied that LVOT/AO diameter ratio may be a useful early imaging biomarker that could potentially be used to monitor disease progression and response to treatment outcomes.

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## Abstract Archives of the RSNA, 2023

M2-SPCH

### Chest Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPCH-1 Low-field MRI to Visualize Interstitial Lung Disease Yields High Conformity with CT in Assessing Fibrosis Extent**

Participants

Nadine Bayerl, Erlangen, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The purpose of this study was to assess the feasibility of lung imaging using a 0.55 T MRI for visualization of interstitial lung disease (ILD) compared to high-resolution CT (HRCT) as the current standard of reference.

#### **METHODS AND MATERIALS**

This ongoing prospective clinical trial complied with the Declaration of Helsinki and enrolled 25 consecutive patients so far (mean age  $63 \pm 13$  years; male  $n=15$ ; female  $n=10$ ). Inclusion criteria were confirmed ILD on HRCT and the absence of MRI contraindications. Underlying primary diseases were systemic sclerosis ( $n=16$ ), anti-synthetase syndrome ( $n=3$ ), rheumatoid arthritis ( $n=2$ ), mixed collagenases ( $n=1$ ), systemic lupus erythematosus ( $n=1$ ) and idiopathic pulmonary fibrosis ( $n=2$ ). All patients gave informed written consent. Within the maximum of 30 days, patients underwent conventional HRCT and lung MRI on a 0.55 T scanner. In the latter, two-dimensional turbo-spin-echo (TSE) proton density-weighted sequences (TE/TR=35/2000 milliseconds) with BLADE (periodically rotated overlapping parallel lines with enhanced reconstruction) readout,  $1.25 \times 1.25$  mm<sup>2</sup> in plane-resolution,  $304 \times 304$  matrix and 6 mm slice thickness were acquired in transversal plane for visualization of pulmonary findings. Evaluating the visualization of ILD was performed at five defined levels of the lung by assessing the overall extent of ILD, ground-glass opacity (GGO) and reticulation. Wilcoxon signed-rank tests were performed to evaluate the differences between the paired groups. Significance was assumed for  $p < 0.05$ . Statistical analysis was carried out using GraphPad Prism 9 for macOS, Version 9.4.1 (458).

#### **RESULTS**

Low-field MRI of the lung allowed an assessment of the overall extent of pulmonary fibrosis comparable to CT (MRI, median=10 %, interquartile range IQR=5-40%; CT, median=15%, IQR=5-40%) with no significant differences between the two modalities. In MRI the extent of reticulation was slightly underestimated compared to CT (MRI, median=5%, IQR=5-18%; CT, median=10%, IQR=5-20%), and the extent of GGO was overestimated (MRI, median=5%, IQR=0-20%; CT, median=5%, IQR=0-10%), both reaching significance ( $p < 0.01$ ). The main limitation of this still ongoing study is the small sample size. Our observations will be substantiated in further studies.

#### **CONCLUSION**

Our study indicates that low-field MRI of the lung provides a reliable visualization of overall extent of ILD and could be useful for monitoring in follow-up examinations as a radiation-free alternative to HRCT.

#### **CLINICAL RELEVANCE/APPLICATION**

Patients undergo CT scans up to once a year to monitor the extent of ILD, resulting in repeated radiation exposure. Low-field MRI has the potential to be a promising radiation-free alternative to CT for follow-up.

#### **M2-SPCH-2 Idiopathic and Infection-triggered Acute Exacerbation of Idiopathic Inflammatory Myopathies-associated Interstitial Lung Disease: Clinical, Radiological Features and Prognosis**

#### **PURPOSE**

Acute exacerbation (AE) of idiopathic inflammatory myopathies-associated interstitial lung disease (IIM-ILD) is a life-threatening event. According to the newly proposed diagnostic criteria for the AE of rheumatic disease-associated interstitial lung disease (RD-ILD), infection is regarded as one of the triggers of AE, and AE could be categorised as idiopathic (I-AE) or infection-triggered (IT-AE). In the present study, we aimed to investigate the differences in the clinical, radiological features and prognosis between I-AE and IT-AE of IIM-ILD patients.

#### **METHODS AND MATERIALS**

We retrospectively analysed 69 patients with AE-IIM-ILD (I-AE (34), IT-AE (35)) in our hospital consecutively between January 2014 and December 2020. Infection was identified as confirmation of bacteria, virus, or fungus in samples obtained from the respiratory tract. The outcome was 1-year all-cause mortality.

#### **RESULTS**

I-AE patients showed higher haemoglobin and PaO<sub>2</sub>/FiO<sub>2</sub> ratio than IT-AE patients ( $P < 0.05$ ), and lower pulse, body temperature, white blood cell (WBC) count, neutrophil percentage (NEU), lower C-reaction protein, erythrocyte sedimentation rate, lactate dehydrogenase, hydroxybutyrate dehydrogenase levels, and lower extent of ground-glass opacities (GGO) on HRCT than IT-AE

patients ( $P < 0.05$ ). Multiple logistic regression analysis showed that the combination of NEU and the extent of GGO could help discriminate I-AE from iT-AE patients; the area under the receiver operating characteristic (ROC) curves (AUC) was 0.812 (95%CI 0.711-0.913, Sensitivity 0.714, Specificity 0.735, Accuracy 0.725). There is a significant difference in 1-year all-cause mortality between I-AE and iT-AE patients (mortality: I-AE 17.9%, iT-AE 54.3%; log-rank test,  $P = 0.0023$ ).

## CONCLUSION

s Infection-triggered AE-IIM-ILD suffered a poorer prognosis than the idiopathic AE-IIM-ILD. The combination of NEU and the extent of GGO on HRCT could help differentiate between the two groups.

## CLINICAL RELEVANCE/APPLICATION

Distinguishing infection-triggered AE from idiopathic AE of IIM-ILD is essential in clinical practice for providing appropriate treatment. NEU combined with GGO extent on HRCT could help differentiate idiopathic AE from infection-triggered AE of IIM-ILD. Infection-triggered AE-IIM-ILD suffered a poorer prognosis than the idiopathic AE-IIM-ILD.

## M2-SPCH-3 Role and Accuracy of MRI in Connective Tissue Disease Related Interstitial Lung Disease

### PURPOSE

To determine diagnostic accuracy of MRI with respect to HRCT in connective tissue disease related interstitial lung disease CTD-ILD.

### METHODS AND MATERIALS

Prospective single-center diagnostic study with sample size of 31 patients of CTD-ILD. Patients underwent HRCT chest and MRI chest on a 1.5 T scanner. PFT and 6-minute-walk-test were done. Warrick-scores and extent-scores were calculated for HRCT and MRI. Warrick score is sum of morphology-score extent-score. Morphology score is sum of scores given for presence/absence of various CT findings with maximum score of 5 for subpleural cyst and minimum score of 1 for ground-glass-opacity, 0 for absence. Extent-score is calculated for each morphology based on number of bronchopulmonary-segments involved, 1 for less than 3, 2 for 4 to 6 and 3 for more than 6 segments. Each MRI sequence was scored independently and combined-MRI-score was also calculated.

### RESULTS

MRI showed agreement with HRCT for extent of subpleural-line (50%;  $p=0.0015$ ), honeycombing (46.67%;  $p=0.0004$ ), subpleural-cysts (60%;  $p<0.0001$ ) and ground-glass-opacities (50%;  $p=0.003$ ). Best sequences to look for subpleural-line, honeycombing, subpleural-cyst and ground-glass-opacities were STIR (46.67%;  $p=0.0194$ ), 4-minute postcontrast sequence (61.11%;  $p=0.0290$ ), BTFE (50%;  $p=0.0003$ ). Among combined-scores calculated excluding postcontrast sequences, only 1/31 cases had different score than combined-score derived from all 10 sequences (including postcontrast sequences). Ground-glass-opacities were overestimated by MRI (higher scores in 13; lower scores in 2). Combined-MRI-score showed significant correlation with FEV1( $r=0.3484$ ;  $p=0.05$ ), FEV1/FVC( $r=0.4086$ ;  $p=0.02$ ), MEF50( $r=0.4203$ ;  $p=0.03$ ) post-walk test fatigue score(0.4639;  $p=0.01$ ).

### CONCLUSION

s MRI shows moderate, statistically significant, agreement with HRCT and clinical-parameters in morphological and global assessment of ILD extent in CTD patients. Abbreviated MRI protocol for ILD assessment would be T2, STIR, BTFE in axial planes as these sequences show closest correlation with the CT-scores. Post-contrast sequences didn't contribute significantly to global-score. With evolving MRI technology, shorter scan times and longer lifespan of patients, MRI becomes an attractive radiation-free option for serial follow-up of such patients.

### CLINICAL RELEVANCE/APPLICATION

MRI has the potential to provide a radiation free imaging alternative to CT in follow up of ILD.

## M2-SPCH-4 Prediction Model of Mediastinal Lymph Node Metastasis of Lung Cancer Based on Radiomics Abstract

Participants

Chunyu Gu, Xianyang, China (*Presenter*) Nothing to Disclose

### PURPOSE

Predicting the mediastinal lymph node metastasis of lung cancer based on radiomics construction model, it is an important guide for doctors to develop surgical plans

### METHODS AND MATERIALS

Retrospectively collecting 70 cases of lung cancer patients with enhanced CT imaging and biopsy confirmed by surgery or biopsy. Seventy patients underwent routine CT enhanced scan and magnetic resonance chest scan. Evaluation of mediastinal lymph node metastasis using DWI lymph node high signal as a gold standard in magnetic resonance plain scan, then divided patients into metastatic and non-transfer groups. The patient's aortic phase image was imported into ITK-SNAP to manually delineate the tumor boundary as the region of interest, and then imported into A.K. software for feature extraction, and 396 features were extracted from each tumor. Using LASSO regression to reduce data and establish a predictive model. The receiver operating characteristic curve (ROC) was used to evaluate the diagnostic efficacy of angiography in predicting lymph node metastasis, and the area under the curve (AUC), sensitivity and specificity were calculated.

### RESULTS

There was no statistically significant difference in age and gender between the two groups. LASSO regression data reduction achieves a total of three non-zero coefficient parameters. The area under the ROC curve of the constructed prediction model is 0.844 (95% CI: 0.709-0.980), the sensitivity is 78.6%, and the specificity is 87.5%.

### CONCLUSION

s The construction of mediastinal lymph node metastasis model based on lung cancer imaging pedigree has certain diagnostic efficacy.

### CLINICAL RELEVANCE/APPLICATION

Based on the imaging parameters of lung cancer, it has a good predictive value for lymph node metastasis of lung cancer, which can provide a reference for the clinician's surgical plan and patient prognosis evaluation.

## **M2-SPCH-5 An Explainable Artificial Intelligence to Detect Histopathological UIP Pattern from HRCT Images and Validation of its Ability**

### **Participants**

Ryoko Egashira, MD, PhD, Saga, Japan (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, AstraZeneca PLC; Speakers Bureau, Shionogi & Co, Ltd; Speakers Bureau, KYORIN Holdings, Inc; Speakers Bureau, DAIICHI SANKYO Group; Speakers Bureau, Bayer AG; Speakers Bureau, Otsuka Holdings Co, Ltd;

### **PURPOSE**

To create an explainable artificial intelligence that can predict histopathological UIP pattern from HRCT images by machine learning and to validate its ability

### **METHODS AND MATERIALS**

233 cases of interstitial lung diseases (ILDs) of mixed etiologies with volumetric CT images were retrospectively identified for this study from an archive with pathologically proven ILDs. The cases were divided into CT-training set for CT-imaging features (n=74), pathology-training set for UIP/non-UIP labels (n=61, UIP: non-UIP=34:27), and a test set (n=98, UIP: non-UIP=60:38). CT-training set cases were selected to include a variety of morphologic patterns and etiologic backgrounds. A custom machine learning model was trained to CT-imaging features. CT-feature extractors for 2D patches from volumetric CT images were created using self-supervised learning. The CT patches with similar features were clustered based on the output features and then pulmonologists/radiologist integrated the radiologically synonymous clusters. Using the integrated clusters as labeled data, deep-learning models to classify the CT findings were created by transfer-learning. A UIP/non-UIP classifier model to classify the cases into UIP or non-UIP by distribution of CT findings in each lung zone using Random Forest. The model was validated using leave-one-out cross validation. Unaware of the labels, two board-certified radiologists classified the test-set cases into UIP/non-UIP pattern according to modified Fleischner's UIP criteria. The validation and test set results were presented as an average of UIP/non-UIP classifier output. The performance of the model was compared with the radiologists' performance.

### **RESULTS**

The accuracy and area under curve (AUC) of the model in validation were 71.47%, 0.785, respectively. In the test set, the accuracy, AUC, sensitivity, specificity and F1 score of the model were 78.67%, 0.843, 84.16%, 70%, and 82.88%. The radiologists' accuracy, sensitivity and specificity were 74.49%, 58.3% and 92% in reader A, 68.37%, 48.3% and 92.1% in reader B, respectively.

### **CONCLUSION**

The model's performance in predicting pathological UIP pattern in various ILDs was 78.67% in accuracy and 82.88% in F1 score, which was better than the radiologists' performance using modified UIP criteria. While radiologists' performance was excellent in specificity.

### **CLINICAL RELEVANCE/APPLICATION**

The detection of histopathological UIP pattern is a key to the prediction of progressive pulmonary fibrosis. There are currently no diagnostic HRCT criteria for UIP pattern other than IPF, this predictive model may be useful.

## **M2-SPCH-6 Effect of Contrast Enhancement on Diagnosis of Interstitial Lung Abnormalities in Automatic Quantitative CT Measurement**

### **PURPOSE**

To evaluate the effect of contrast enhancement on the diagnosis of interstitial lung abnormalities (ILA) in automatic quantitative CT measurement

### **METHODS AND MATERIALS**

Patients who underwent preoperative chest CT for lung cancer between April 2017 and December 2020 were retrospectively included. Each examination consisted of a pair of nonenhanced and contrast-enhanced CT scans, and images were analyzed using a commercially available deep learning-based automated quantification software for ILA. According to quantified results based on the definition by the Fleischner Society, patients were divided into normal and ILA groups. The agreement for the diagnosis of ILA was estimated with kappa values. Reproducibility and measurement variability were also estimated using the intra-class correlation coefficient (ICC) and Bland-Altman method.

### **RESULTS**

Of the 1199 included patients (mean age, 62.2 years  $\pm$  10.9 [SD]; 595 females), ILA was identified in 46 (3.8%) and 76 (6.3%) on pre- and post-contrast images, respectively. Pre-contrast and post-contrast CT scans showed substantial agreement (weighted Kappa: 0.67) in the diagnosis of ILA. Of the 46 patients diagnosed with ILA on pre-contrast scans, 42 were also diagnosed with ILA on post-contrast scans. Post-contrast images showed a greater extent of total ILA than pre-contrast images (mean percentage,  $0.99\% \pm 2.2$  vs  $0.63\% \pm 1.6$ ,  $p < 0.0001$ ). Pre- and post-contrast images showed excellent reproducibility for fibrotic ILA (ICC = 0.96), but only fair reproducibility for non-fibrotic ILA (ICC = 0.74). Measurement variability was wider in nonfibrotic ILA than in fibrotic ILA (95% limits of agreement, nonfibrotic: [-2.3, 3.0] vs. fibrotic: [-0.1, 0.1]).

### **CONCLUSION**

Contrast enhancement influenced the quantification of ILA with a tendency to overestimate, especially for nonfibrotic ILA.

### **CLINICAL RELEVANCE/APPLICATION**

Automatic quantitative assessment for ILA on contrast-enhanced CT images may lead to overdiagnosis of ILA; thus care should be taken in the diagnosis of ILA and subsequent visual assessment may be needed.

## **M2-SPCH-7 Quantitative CT-based Regional Lung Function and PFT at Baseline Predict One-Year Change of DLCO**

## in Idiopathic Pulmonary Fibrosis

### PURPOSE

While carbon monoxide lung diffusing capacity (DLCO) test is an important functional measure for idiopathic pulmonary fibrosis (IPF), it is also difficult for patients to conduct. We aimed to predict future DLCO using regional lung function variables computed from quantitative CT (QCT) and baseline pulmonary function test (PFT) variables, via machine learning.

### METHODS AND MATERIALS

Full inspiratory and full expiratory CTs, demographics, and PFT measurements (spirometry and DLCO) at baseline and DLCO at 1-year follow-up visits were prospectively collected of 45 IPF patients (age=71±5, M:F=39:6) at 5 institutions in South Korea (under IRB approval and with subject consent, using a common dose-reduced QCT protocol). 113 multiscale lung structural and functional features were derived from QCT analysis, using VIDA Vision (Coralville, IA) and in-house software. QCT, demographics, and PFT features significantly correlated with percent predicted DLCO (DLCO%pred) after one year ( $p < 0.05$ , Pearson's correlation) were then used to predict DLCO%pred after one year using XGBoost machine learning algorithm. Model performance was evaluated by  $R^2$  and mean absolute error (MAE).

### RESULTS

QCT variables had significant correlations with DLCO. Baseline percent predicted DLCO ( $r=0.76$ ;  $p < 0.001$ ), percent predicted forced expiratory volume in the first second (FEV1%pred) ( $r=0.65$ ;  $p < 0.001$ ) and forced vital capacity (FVC%pred) ( $r=0.64$ ;  $p < 0.001$ ). Among QCT variables, regional ventilation index (RRAVC) at whole lobe and Right lower lobe (RLL) ( $r=-0.35$ ,  $-0.13$ ;  $p=0.03$ ,  $0.04$ ), high attenuation area percent (HAA%) at whole lung, left upper lobe (LUL) and left lower lobe (LLL) ( $r=-0.45$ ,  $-0.40$ ,  $-0.39$ ;  $p=0.04$ ,  $0.02$ ,  $0.03$ ) also contributed in predicting future DLCO score. Normalized tracheal wall thickness (WT\*trachea) was also negatively associated with future DLCO ( $r=-0.3$ ;  $p < 0.03$ ). XGBoost model's performance in  $R$ -squared ( $R^2$ ) and mean absolute error (MAE) were 0.73 and 9.01, implying 73% of the total variation and predictions off by 9.01 units from the actual values. Results suggest association of left lung RRAVC, HAA% and tracheal wall thickening with smaller future DLCO in IPF.

### CONCLUSION

QCT based regional lung structure-function and PFT features can predict DLCO after 1 year via machine learning.

### CLINICAL RELEVANCE/APPLICATION

Predicting DLCO after 1 year via machine learning provide pathophysiological interpretation of regional changes in lung structure and function in IPF.

## M2-SPCH-8 Severe Asthma Patient Treatment Response Evaluation Using Visual and Quantitative Analysis of Chest CT

### Participants

Miji Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

Visual and quantitative analysis on chest CT for bronchiectasis(BE) score and mucus impaction(MI) extent in patients with severe asthma investigate the correlation with the patient's treatment response.

### METHODS AND MATERIALS

The 34 asthma patients (mean age; 55.1±12.8 years, male;female=40%;60%) who had undergone initial and 1 year follow up inspiration/expiration CT after treatment. Experienced thoracic radiologists independently determined the change of BE score and MI extent. Using Aview software (Coreline Soft), quantitative air-trapping and airway were analyzed at the initial and 10months follow up CT scan. Clinical parameters considered in patient have FEV1 and FEV1/FVC, sputum and blood eosinophils. For statistical analysis, intraclass correlation coefficient and correlation analysis were used.

### RESULTS

In the intraclass correlation coefficient between the two readers, the bronchiectasis(BE) score showed a reliability of 78% and the mucus impaction showed a reliability of 89%. Table 1 shows the greater the BE score and MI extent, the closer the pattern of obstructive lung disease is derived from both readers. MI extent was positive correlated with eosinophils. In the quantitative analysis, FEV1 and FEV1/FVC showed a positive correlation in the normal lung area, but a negative correlation in the case of functional air-trapping with and without emphysema. Quantitatively, when the counted branch segment increases, the PFT result shows a positive correlation, and the Pi10 and wall area measurements show a negative correlation. According to table 2, changes in BE score and MI extent showed a relatively significant correlation with changes in clinical parameters. Only Pi10 showed a negative correlation with PFT, and quantitative normal lung and functional air-trapping changes did not show any correlation.

### CONCLUSION

In patient with asthma, changes in MI extent with treatment have clinical significance rather than the severity of BE score itself. Visual changes in MI extent after treatment of asthma on CT and quantitatively decreased Pi10 correlated with changes in PFT and eosinophilia.

### CLINICAL RELEVANCE/APPLICATION

Through quantitative analysis of airway and visual analysis of mucoid impaction extent, post-treatment response can be evaluated in patients with severe asthma.

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## Abstract Archives of the RSNA, 2023

M2-SPER

### Emergency Radiology Monday Poster Discussions

#### Sub-Events

#### M2-SPER-1 **Classification of Acute Superior Mesenteric Artery Occlusion on CT using a 3D Machine Learning Model**

#### PURPOSE

Acute superior mesenteric artery (SMA) occlusion is a life-threatening condition that requires immediate diagnosis and treatment. Although our group has previously developed a machine learning 2D model to identify SMA occlusion by analyzing each CT slice individually, it is sometimes not possible to identify an occlusion on a single CT slice. We hypothesized that we could train a machine learning 3D model to identify SMA occlusion on CT with full volumetric context.

#### METHODS AND MATERIALS

Natural language processing (NLP) of radiology CT reports was used retrospectively to identify studies containing SMA occlusion. An axial image series from each of these studies was annotated by a Board Certified radiologist by segmenting the region of occlusion using an in-house brush tool. These segmentations were converted into 3D bounding boxes; 615 annotated volumes were used as positives, and 618 CT volumes with no SMA occlusion were used as negatives in the training dataset. A RetinaNet 3D model using the Medical Open Network for AI (MONAI) framework was implemented for training. The model was applied to a test dataset consisting of 20 negative studies and 59 studies positive for SMA occlusion. The positive studies were cases where the pathology had been missed by the initial reading radiologist (quality assurance cases). Prior to running the RetinaNet 3D model, a separate CT anatomy classification model was run on each series and only slices with abdominal anatomy were kept, to reduce the total image volume inferred by the RetinaNet 3D model. The highest probability from bounding boxes generated by the RetinaNet 3D model was taken as the overall model result for a study.

#### RESULTS

The highest validation accuracy during training was 0.678, at which point the final model was saved. The model achieved an AUC of 0.837 on the test dataset. At a threshold of 0.88, sensitivity was 63.6% with a specificity of 100%, suggesting that over half of missed SMA occlusion cases at our practice would have been caught had this model been in place.

#### CONCLUSION

An artificial intelligence model was trained to identify SMA occlusion on CT imaging. To our knowledge, this is the first use of a machine learning 3D model to identify SMA occlusion on CT images. This model is currently undergoing iterative retraining with false positives and false negatives from prospective data and will be continually updated in preparation for live clinical deployment.

#### CLINICAL RELEVANCE/APPLICATION

SMA occlusions on CT must be timely diagnosed to improve patient outcome and are sometimes missed by radiologists. A 3D model to identify these cases for both worklist prioritization and quality assurance would be highly relevant to improving patient care.

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## Abstract Archives of the RSNA, 2023

M2-SPGI

### Gastrointestinal Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPGI-1 A Preliminary Study on the Value of Multi-frequency MR Elastography in Auxiliary Evaluating the Efficacy of Neoadjuvant Chemoradiotherapy for Locally Advanced Rectal Cancer**

#### **PURPOSE**

To investigate the value of multi-frequency magnetic resonance elastography (m-MRE) in auxiliary evaluating the efficacy of neoadjuvant chemoradiotherapy (nCRT) for patients with locally advanced rectal cancer (LARC).

#### **METHODS AND MATERIALS**

From Nov. 2021 to Dec. 2022, 81 patients with rectal cancer were prospectively recruited and after screening by exclusion criteria, 64 patients who underwent radical resection after nCRT were finally enrolled. All patients underwent MRI and rectal elastography examination within 1 week before surgery. Maps of shear-wave speed  $c$  ( $c$ -map) and phase angle of the shear modulus  $f$  ( $f$ -map) were generated and then measured  $c$  and  $f$  values for tumor or rectum wall. According to the collected pathologic ypTN stages and tumor regression grades (TRG), patients were divided into Group1: ypT0-1 (Good response, GR) and ypT2-4 (Poor response, PR) groups, Group2: ypN0 and ypN1-2 groups and Group3: pCR (TRG0) and Non-pCR (TRG1-3) groups. To analyze whether the differences of m-MRE parameters ( $c$ ,  $f$ ,  $c+f$ ) among different groups were statistically significant, and drew ROC curve to analyze the diagnostic efficiency. Compared with T2WI+DWI, to explore whether m-MRE ( $c+f$ ) can show better diagnostic efficacy in distinguishing different groups and to further analyze whether the combination of T2WI+DWI and m-MRE ( $c+f$ ) can achieve higher diagnostic efficacy. To explore whether the combination of T2WI+DWI and m-MRE ( $c+f$ ) could improve the diagnostic accuracy and consistency than that of T2WI+DWI, with pathological results as gold standard.

#### **RESULTS**

Significant differences of  $c$  and  $f$  values were observed in Group 1 and Group 3 ( $P < 0.05$ ), but not in Group 2. m-MRE ( $c$ ,  $f$  and  $c+f$ ) showed good diagnostic efficacy both in Group 1 with AUC values 0.810, 0.736 and 0.853, and Group 3 with AUC values 0.810, 0.736 and 0.853 (all  $P < 0.05$ ). m-MRE ( $c+f$ ) had significantly higher AUC values ( $P < 0.05$ ) than T2WI+DWI in Group 1 and Group 3. Furthermore, the combination of T2WI+DWI and m-MRE ( $c+f$ ) can get higher AUC values ( $P < 0.05$ ) than T2WI+DWI in Group 1 and Group 3 as well. Besides, it could also improve the diagnostic accuracy and consistency than that of T2WI+DWI, with pathological results as gold standard.

#### **CONCLUSION**

m-MRE has a potential auxiliary value in evaluating the efficacy of nCRT for LARC patients.

#### **CLINICAL RELEVANCE/APPLICATION**

Reliable preoperative methods to accurately evaluate tumor regression and identify patients with pCR are significant to LARC patients, which can promote making personalized clinical treatment plans.

#### **M2-SPGI-2 Predicting the Risk of Postoperative Distant Metastasis in Patients with Locally Advanced Rectal Cancer: Using MRI-based Delta-imaging Methods**

#### **PURPOSE**

To predict the risk of postoperative distant metastases in patients with locally advanced rectal cancer by using delta-imaging features extracted from MRI before and after nCRT.

#### **METHODS AND MATERIALS**

A total of 213 patients with locally advanced rectal cancer were retrospectively enrolled in Yunnan Cancer Hospital from January 2016 to June 2019. All patients underwent surgical treatment after nCRT and underwent MRI examination before and after nCRT. All patients were followed up for at least 3 years after surgery, except those with postoperative endpoint events. They were randomly divided into training group and verification group (training group  $n=149$ , verification group  $n=64$ ) in a ratio of 7:3, which were used for feature selection and verification respectively. Tumor lesions were delineated layer by layer on T2-weighted imaging (T2-weighted imaging) before and after nCRT, and 3D-slicer software was used for feature extraction. Delta-image omics features are defined as the difference in image omics features before and after nCRT. Using The least absolute shrinkage and selection operator algorithm (LASSO) for feature reduction and extraction, three delta-image omics models were constructed. It includes the Delta-Imagomics model and the combined Delta-imagomics model based on the absolute and relative variation of imagomics features before and after nCRT. Receiver operating characteristic curve (ROC) was used to evaluate the predictive value of the model for DM.

#### **RESULTS**

A total of 213 patients with LARC were included in this study (42% female and 58% male), with an average age of  $58.50 \pm 12.37$  years and a median follow-up time of 39.8 months. A total of 36 patients (16.9%) developed DM after surgery. 1382 features were extracted from each lesion before and after nCRT. After feature reduction and screening, 7 key features were included in the delta-

imaging model based on absolute and relative changes of imaging features before and after nCRT in the training set. In the training set, the area under ROC curve of the absolute and relative variation Delta-Imaging model and the combined Delta-imaging model were 0.77, 0.74 and 0.82, respectively, and the AUC of the corresponding test set were 0.73, 0.70 and 0.84, respectively.

## CONCLUSION

s The combined prediction model based on delta-imaging features of MRI is helpful to predict the risk of distant metastasis after local advanced rectal cancer surgery, and is better than the pure delta-imaging model of absolute and relative changes.

## CLINICAL RELEVANCE/APPLICATION

To predict the risk of postoperative distant metastases in patients with locally advanced rectal cancer .

## M2-SPGI-3 Machine Learning-based Response Assessment in Patients with Rectal Cancer After Neoadjuvant CCRT: Radiomics Analysis for the Assessment of Tumor Regression Grade Using T2-weighted MR Exam

### PURPOSE

We investigated the machine learning model-based radiomics analysis for the assessment of tumor regression grade using T2-weighted MR images in patients with rectal cancer after neoadjuvant chemotherapy-radiation therapy (CRT).

### METHODS AND MATERIALS

A total of 100 patients with rectal cancer who underwent magnetic resonance (MR) imaging at baseline and after CRT between January 2010 to May 2021 were included. The median age was 64 (31-89) and male was 66% (66/100). All MR scans were acquired with two different 3T scanners (Achieva 3.0T MR system, Philips Healthcare; MAGNETOM Vida, Siemens Healthineers) and included the oblique axial T2-weighted images acquired perpendicular to the long axis of the tumor. Region of interest (ROI) for each cancer lesion was drawn and extracted by a radiologist and 116 radiomics-feature was analyzed using MEDIP software (MEDICAL IP, Seoul, Republic of Korea, medicalip.com/Medip). Treatment responses were evaluated by the radiologist using MR tumor regression grade (mrTRG). Responses were classified into two groups ('good' versus 'poor'); mrTRG 1, 2, and 3 were categorized as 'good', and mrTRG 4 and 5 were categorized as 'poor'. We implemented the 3-principle component analysis (PCA)-ensemble model to predict the response group. Model performance was evaluated by calculating the area under a receiver operating curve (AUROC) for each feature-set, and selected combination of the feature sets.

### RESULTS

Texture-feature based sets and selected combinations were compared with qualitative mrTRG assessment to identify the significant feature sets in predicting the treatment responses. With the volume feature set (3D), the mean volume change was calculated, and overall 38.55% of volume has decreased. In comparison between the two groups, good response group showed lower baseline tumor volume and larger volume loss at post-CRT MR (50.32%) while poor response group showed larger baseline tumor volume and lesser volume loss at post-CRT MR(29.54%). Of all texture-feature sets and selected combinations of the feature sets, volume feature set (3D) combined with histogram-based contrast feature set (1st order) achieved the largest AUC of 0.79 for differentiating good and poor response.

## CONCLUSION

s Machine learning based radiomics analysis using T2-weighted MR imaging demonstrated feasible diagnostic ability for the response assessment in patients with post CRT rectal cancer. This radiomics analysis enables quantification of tumor volume and texture change.

## CLINICAL RELEVANCE/APPLICATION

Machine learning based radiomics analysis represents quantitative assessment of treatment response in post-CRT rectal cancer, and can be a useful assistant for treatment response assessment.

## M2-SPGI-4 Are Systematic Reviews of Diagnostic Tests for Rectal Cancer Trustworthy? A Cross-sectional Study

### PURPOSE

Many systematic reviews (SRs) have evaluated the value of different diagnostic tests for rectal cancer. But the quality of these SRs remains unclear. This study aimed to examine epidemiological characteristics, methodological and reporting quality of SRs of diagnostic tests for rectal cancer, and to explore factors that may affect the quality.

### METHODS AND MATERIALS

PubMed, EMBASE, Cochrane Library, and Chinese Biomedicine Literature were searched to identify SRs evaluating diagnostic tests for rectal cancer. We used AMSTAR to assess the methodological quality and PRISMA-DTA for reporting quality.

### RESULTS

33 SRs were included in our analysis and the number of publications had gradually decreased each year. 33 SRs involved 8 topics and 6 diagnostic tests. The median number of index test was 1 (range: 1-5) and there were 6 index tests, of which MRI (22/33, 66.7%) was the most studied index test. PubMed/Medline (100.0%) was the most frequently searched database. Only 15 (45.5%) SRs reported search strategy. The overall methodological quality was poor. All the SRs were not fully assessed the scientific quality of the included studies, only 33.3% performed a comprehensive literature search, 21.2% used the scientific quality appropriately in formulating conclusions, and 33.3% assessed the publication bias. There were many flaws in reporting quality. None of the SRs presented a structured summary, protocol or registration, only 6.1% provided the results of individual studies, 6.1% conducted additional analyses, 36.4% fully reported limitations, and 21.2% completely reported funding.

## CONCLUSION

s The quality needs to be further improved, especially referring to the performance of comprehensive literature search, assessment of scientific quality of included studies, assessment of publication bias, structured summary, protocol and registration, additional analyses, limitations, and funding.

## CLINICAL RELEVANCE/APPLICATION



There are many deficiencies in the reporting including structured summary, protocol and registration, search, additional analyses, limitations, and funding.

## **M2-SPGI-5 Personalized Weight-Based Dosing of Iodinated Contrast Material: Dose Savings and Effect on Image Quality in Abdominal Computed Tomography (CT)**

### **PURPOSE**

Fixed dosing of iodinated contrast material (CM) (i.e., using the same amount of contrast for all patients or based on weight buckets) is a standard practice among many institutions for abdominal CT. This study aims to investigate effects of personalized weight-based dosing (1.14 mL/kg) of CM on saving of contrast and on image quality of abdominal CT.

### **METHODS AND MATERIALS**

376 patients who underwent abdominal CT at a large urban academic medical center were included in this study. Each patient had at least two CT of abdomen performed within a one-year interval, with one study using a fixed dose of iodine contrast and the other implementing weight-based dosing. Studies were matched by imaging protocol, peak kilovoltage (kVp), and phase of enhancement. The amount of administered contrast for each study was collected. Attenuation of various organs and structures including portal vein, aorta, inferior vena cava, hepatic veins, liver, and spleen was measured. In addition, noise, contrast-to-noise ratio, and subjective image quality were calculated. Values were compared using paired and unpaired t-test. Sub-analysis based on patients' BMI was also performed.

### **RESULTS**

In the fixed-dose protocol, the mean iodine dose was 35 g, compared to 26.2 g and 32.6 g in the weight-based protocol in patients with normal/low weight (BMI = 25) and those with high weight (BMI > 25), respectively. The weight-based protocol also resulted in an average cost reduction of 16.3% with average savings of \$72.58. There were no differences in noise between the two protocols. In patients with high weight, except for the aorta, there were no significant differences in enhancement at the selected ROI between the two contrast protocols. Patients with a normal or low weight with weight-based contrast dosing had lower enhancement ( $p < 0.001$ ), with mean difference in degree of enhancement ranging 7.4-28.1 HU depending on the organ/structure, compared to the studies with a fixed dosing.

### **CONCLUSION**

The results of this study demonstrate that a personalized weight-based CM dosing strategy can result in significant saving of contrast. The saving is more pronounced in patients with lower BMI. In patients with higher BMI, the enhancement of abdominal organs was non-inferior to fixed-dosing CTs. Despite the lower degree of enhancement of structure in low-BMI group, as expected with the lower amount of administered iodine, the difference in degree of enhancement was small with no significant effect on subjective perceived image quality.

### **CLINICAL RELEVANCE/APPLICATION**

These data support that a weight-based contrast protocol can maintain image quality (especially in larger patients) while improving patient safety and reducing healthcare costs.

## **M2-SPGI-6 Deep Learning Image Reconstruction Improves Image Quality at Reduced Dose in Dual-energy Computed Tomography Enterography**

### **PURPOSE**

To demonstrate the clinical advantages of a deep learning image reconstruction (DLIR) in low-dose dual-energy computed tomography enterography (DECTE) by compare images with standard-dose adaptive iterative reconstruction-Veo (ASIR-V) images.

### **METHODS AND MATERIALS**

This was an IRB-approved prospective study. 58 patients undergone DECTE scans. The early-enteric phase scan was acquired using standard-dose (noise index: 8) and datasets were reconstructed 1.25mm slice thickness with 40%ASIR-V. A late-enteric phase low-dose scan (noise index: 12) was added and datasets were reconstructed at 1.25mm slice thickness with ASIR-V 40% and DLIR at two reconstruction strengths (medium, high). Objective parameters including image noise, artifact index, SNR and CNR were measured. Subjective indicators including subjective noise, image contrast, bowel wall sharpness, mesenteric vessel clarity and small structure visibility were assessed by two radiologists blindly. Radiation dose was compared between the early- and late-enteric phases.

### **RESULTS**

The late-enteric phase reduced radiation dose by 50% compared with the early-enteric phase. The DLIR images significantly improved both objective and subjective image quality even with reduced dose. The low-dose 1.25mm DLIR-H images had lowest image noise and highest SNR, CNR values compared with the standard-dose ASIR-V40% images, and significantly higher scores in image contrast, bowel wall sharpness, mesenteric vessel clarity and small structure visibility.

### **CONCLUSION**

DLIR significantly reduces image noise and improves diagnosis confidence in DECTE, compared to conventional ASIR-V 40% images, while providing 50% radiation dose reduction.

### **CLINICAL RELEVANCE/APPLICATION**

Computed tomography enterography is widely used as a first-line imaging study for examining the small bowel to evaluate patients with suspected or known bowel disease. But wide range and multiphase scanning of CTE will increase radiation exposure of patients. Numerous methods have been introduced and applied to limit radiation exposure of patients during a CT scan. However, simply reducing radiation dose will inevitably, increase the image noise and artifacts, which is not conducive to diagnosis. How to reduce the radiation dose while improve the overall image quality is the focus of research in low-dose CTE.

## **M2-SPGI-7 Effect of the Body Water and the Body Composition, Calculated by Bioelectrical Impedance Analysis on Contrast-enhanced Dynamic Computed Tomography Images of the Liver**

Participants

Takanori Masuda, PhD, Okayama, Japan (*Presenter*) Nothing to Disclose

### **PURPOSE**

To improve its diagnosis on contrast-enhanced dynamic CT (CE-DCT) scans, contrast injection protocol must yield stable arterial contrast enhancement. To investigate how the body-water distribution and the body composition, calculated by bioelectrical impedance analysis (BIA), affect aortic and hepatic enhancement on CE-DCT scans.

### **METHODS AND MATERIALS**

This retrospective study was approved by our institutional review board; informed patient consent was waived. Between January 2019 and May 2020, 236 patients with liver cirrhosis underwent CE-DCT before BIA. The CT number (in Hounsfield units, HU) of the abdominal aorta at the celiac artery level on unenhanced scans and during the hepatic arterial phase (HAP) scans was recorded. And, the mean CT number of the hepatic parenchyma of both hepatic lobes at the celiac artery level on unenhanced and portal venous phase (PVP) scans was recorded. We calculated changes in the iodine dose per contrast enhancement (mgI/HU) (IDCE) to evaluate the effect of the patient age and of various constituents of the body composition by performing BIA.

### **RESULTS**

The IDCE of the abdominal aorta during HAP was  $121.5 \pm 32.1$  mgI/HU; it was  $698.7 \pm 211.1$  mgI/HU in the hepatic parenchyma during the PVP. Among the parameters used in our BIA, the total body weight (TBW) was the most important factor affecting the IDCE of the liver abdominal aorta on CE-DCT scans acquired during the HAP ( $r = 0.83$ ). The TBW and the skeletal muscle index most strongly affected the IDCE of the hepatic parenchyma on CE-DCT scans obtained during the PVP ( $r = 0.69$ ).

### **CONCLUSION**

s The TBW had the strongest effect on contrast enhancement. The skeletal muscle index exhibited the strongest correlation with hepatic parenchymal contrast enhancement during the PVP.

### **CLINICAL RELEVANCE/APPLICATION**

We found that many body parameters included in BIA affect IDCE on CE-DCT images. Most exhibited a more than moderate correlation with IDCE of vessels and the hepatic parenchyma. It may be a useful index for machine learning to obtain a stable contrast enhancement on CE-DCT.

## **M2-SPGI-8 Effect of the CT Values for Abdominal Aorta and Liver Parenchyma During Contrast Enhancement Dynamic CT with or without the Splenomegaly**

Participants

Hiroyuki Ikenaga, BS, Kurashiki, Japan (*Presenter*) Nothing to Disclose

### **PURPOSE**

To compare CT (computed tomography) values for abdominal aorta and liver parenchyma during dynamic contrast-enhanced (CE) CT in cirrhotic patients with and without splenomegaly.

### **METHODS AND MATERIALS**

We considered 258 patients (83 males and 46 females for the splenomegaly group, and 83 males and 46 females for the control group) for this study. We measured CT values in the abdominal aorta and hepatic parenchyma during the hepatic arterial (HAP) and portal venous (PVP) phases. The aortic CE at HAP and the hepatic parenchymal CE at PVP were compared between the two groups. For depiction ability, we also calculated the optimal CE rates ( $>280$  HU in the abdominal aorta and  $>50$  HU in the hepatic parenchyma) for each group.

### **RESULTS**

The median and range of the CE for all patients with abdominal aorta and liver parenchyma were 273.0 HU (110.9-477.3 HU) and 54.0 HU (19.9-78.6 HU), respectively, in the Splenomegaly (SM) group and 298.9 HU (158.6-494.0 HU) and 54.0 HU (16.5-78.5 HU), respectively, in the non-SM group. In the SM group, the CE for abdominal aorta decreased during the aortic phase for a dynamic CE CT ( $p < 0.05$ ). For the depiction ability, there were significant differences in the rates of optimal CE between both the groups ( $p < 0.05$ ).

### **CONCLUSION**

s The diagnostic ability and CE for abdominal aorta during the aortic phase exhibited a significant decrease during dynamic CE CT in SM patients.

### **CLINICAL RELEVANCE/APPLICATION**

It is necessary to change the injection rates and contrast materials volume during CE CT depending on the presence or absence of SM.

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## Abstract Archives of the RSNA, 2023

M2-SPGU

### Genitourinary Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPGU-1 Fidelity of Iodine and HU Values in a Renal Phantom using a Novel edge-on-irradiated Si-based Photon-Counting Detector CT**

##### Participants

Fides Schwartz, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the accuracy of a new edge-on-irradiate silicon-based photon-counting detector CT (Deep Si-PCCT) prototype for quantification of iodine concentration and stability of HU values in moderately and strongly enhancing kidney parenchyma.

##### METHODS AND MATERIALS

A phantom that simulates moderately and strongly enhancing kidney parenchyma (at 180 and 240 HU) inside a small patient (23 cm diameter) was scanned using a novel, Deep Si-PCCT prototype. The simulated kidney parenchyma contains an internal dense water-equivalent rod at 60 HU and a rod of 2.2 mg/mL iodine concentration to simulate a proteinaceous, non-enhancing and a mildly enhancing cystic renal lesion. The rods were positioned in the kidney parenchyma in two separate setups, so each rod was imaged within both levels of kidney enhancement. The accuracy and stability of the iodine quantification and HU values were evaluated with repeated ROI measurements of the same size across consecutive slices along the length of the simulated kidney parenchyma and the internal rods. Images were reconstructed with prototype soft tissue kernel at 2.5mm slice thickness without additional denoising.

##### RESULTS

The Deep Si-PCCT accurately quantified the iodine concentration in the small rod at  $2.1 \pm 0.02$  and  $2.1 \pm 0.04$  mg/mL (Setup 1 and 2, respectively), and the quantification was stable across the length of the internal rod, with both setups. The water equivalent rod was also quantified correctly, showing iodine concentrations within the standard deviation and HU values of  $58 \pm 0.5$  HU and  $60 \pm 0.9$ . The HU values of moderately and strongly enhancing renal parenchyma were stable across the length of the rod and correlated with the know ground-truth values. The figure also shows images of the first patient with cystic renal lesions scanned on the new Deep Si-PCCT at 120 kVp with 400 mAs and 1 second rotation (axial scan), reconstructed with a standard soft tissue kernel.

##### CONCLUSION

The Deep Si-based PCCT is a promising tool for accurate and stable quantification of iodine concentration and measurement of HU values in cystic lesions within moderately and strongly enhancing kidney parenchyma. It has the potential to improve the diagnosis and management of cystic renal lesions.

##### CLINICAL RELEVANCE/APPLICATION

The novel Deep Si-based photon-counting detector CT provides, accurate iodine quantification and HU values in kidney parenchyma and cystic lesions, which is crucial for the classification and management of cystic renal lesions.

#### **M2-SPGU-2 Renal Cyst Pseudoenhancement: Impact of Virtual Monochromatic and Ultra-high-resolution Imaging with Photon-counting Detector CT**

##### Participants

Atsushi Nakamoto, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate whether virtual monochromatic and ultra-high-resolution imaging with photon-counting detector CT (PCD-CD) can overcome renal cyst pseudoenhancement.

##### METHODS AND MATERIALS

This retrospective study included 104 renal cysts in 31 patients (20 men and 11 women, age range, 42 to 91 years; mean age, 71.6 years) who underwent abdominal dynamic contrast-enhanced CT with PCD-CT. Cysts less than 3 mm in diameter and greater than 20 mm in diameter were excluded. Unenhanced and portal venous phase images were reconstructed with 512 and 1024 matrices with slice thicknesses of 0.2, 0.4, 1, and 2 mm, respectively. The 0.2-mm-thick images were reconstructed using polychromatic imaging (T3D) because virtual monochromatic imaging is not applicable to the 0.2-mm-thick images. For the other slice thicknesses, 70 keV virtual monochromatic images were reconstructed. In addition, 512-matrix, 1-mm-thick virtual monochromatic images were reconstructed at 50, 60, 80, and 90 keV. CT values were measured by placing regions of interest on the renal cysts and the attenuation increase from unenhanced to portal venous phase was calculated. The attenuation increases in each image were compared and the frequency of pseudoenhancement (an increase of 10 HU or more) was evaluated.

##### RESULTS

There was no significant difference in attenuation increase between the 512 and 1024 matrix images at any slice thickness ( $P > .05$ ). The attenuation increases were significantly higher for the 0.2-mm-thick T3D images and the 2-mm-thick 70 keV images compared to the 0.4-mm and 1-mm-thick 70 keV images ( $P < .001$ ). The attenuation increase was lower at higher keVs, with significant differences among all keVs ( $P < .001$ ). The frequency of pseudoenhancement was lowest for 90 keV images (13/104, 12.5%), followed by 80 keV images and 0.4-mm-thick 70 keV images (18/104, 17.3%). When only cysts with 10 mm or larger in diameter were included, virtual monochromatic images at 70 keV or higher showed no pseudoenhancement.

#### **CONCLUSION**

Virtual monochromatic images with PCD-CT can overcome renal cyst enhancement. Thinner slice thicknesses were useful in reducing pseudoenhancement, although 0.2-mm-thick images had a higher frequency of pseudoenhancement due to their polychromatic nature.

#### **CLINICAL RELEVANCE/APPLICATION**

Virtual monochromatic imaging at 70 keV or higher using photon-counting detector CT shows no pseudoenhancement in renal cysts of 10 mm or larger in diameter and is expected to improve the diagnostic performance of renal masses.

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## Abstract Archives of the RSNA, 2023

M2-SPHN

### Head & Neck Imaging Monday Poster Discussions

#### Sub-Events

#### M2-SPHN-1 The Prevalence of Malleus-tympanum Synostosis on Ultra-high-resolution CT: A Preliminary Study

##### Participants

Ning Xu, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the prevalence of malleus-tympanum synostosis (MTS) in different individuals via 0.1 mm ultra -high-resolution CT (U-HRCT).

##### METHODS AND MATERIALS

This retrospective study evaluated U-HRCT scans with 0.1 mm thickness of 1587 ears from 1122 subjects from October 2020 to March 2022. MTS presented as a bony connection between the malleus and tympanic wall. MTS was detected in subjects with normal ears, subjects with different types of hearing loss (HL), and subjects with various causes of conductive HL. The prevalence of MTS was calculated and statistically compared between subjects with normal ears and with different types of HL, as well as between subjects with various causes of conductive HL. The correlation between MTS and age or gender was calculated using the Mann-Whitney U test.

##### RESULTS

The prevalence of MTS was 2.8% (16/577), 3.4% (12/352), 7.2% (27/374), and 13.7% (39/284) in subjects with normal, mixed HL, sensorineural HL, and conductive HL ears, respectively. MTS was more common in subjects with HL than in subjects with normal ears ( $p < 0.001$ ), and significant differences were shown between mixed and sensorineural HL groups ( $p = 0.023$ ), between mixed and conductive HL groups ( $p < 0.001$ ), and between sensorineural and conductive HL groups ( $p = 0.006$ ). The prevalence of MTS was 83.9% (52/62), 34.8% (23/66), 12.6% (61/483), 7.5% (8/107), and 6.9% (7/102) in subjects with conductive HL with tympanosclerosis, definite middle ear malformations, otitis media, otosclerosis, and middle ear cholesteatoma, respectively. Besides, MTS was found in 18.8% (6/32) of subjects with unexplained conductive HL, 3 of whom were confirmed as having malleus fixation by surgery. No correlation was shown between MTS and age ( $p = 0.41$ ) or gender ( $p = 0.70$ ) in subjects with normal ears.

##### CONCLUSION

MTS is a new sign that can be clearly visualized on an ultra-high-resolution CT with 0.1 mm thickness. The prevalence of MTS was 2.8% and 7.7% in subjects with normal ears and with HL, respectively. It may be asymptomatic, or may be associated with conductive HL.

##### CLINICAL RELEVANCE/APPLICATION

Malleus-tympanum synostosis (MTS) is a new sign that can be clearly visualized on an ultra-high-resolution CT with 0.1 mm thickness. It is not uncommon and may be asymptomatic or may be associated with conductive HL by resulting in malleus fixation. Moreover, MTS may be the cause of some "idiopathic" conductive HL. Otologists can use their understanding of MTS to develop new treatment strategies and improve hearing outcomes.

#### M2-SPHN-2 Comparative Study of the Sensitivity of Ultra-high-resolution CT and High-resolution CT in the Diagnosis of Isolated Fenestral Otosclerosis

##### Participants

Ning Xu, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To compare the sensitivity of ultra-high-resolution computed tomography (U-HRCT) and high-resolution computed tomography (HRCT) in the diagnosis of isolated fenestral otosclerosis (IFO).

##### METHODS AND MATERIALS

Eighty-five patients (85 ears) with both clinical and intraoperative diagnosis of IFO were prospectively included between October 2020 and November 2022. Only U-HRCT (0.1mm thickness) was performed for 20 ears, only HRCT (0.67mm thickness) was performed for 45 ears, and both U-HRCT and HRCT were performed for 20 ears. General radiologists and neuroradiologists who were blinded to the clinical and surgical conditions evaluated the images. The sensitivity of U-HRCT and HRCT to detect IFO by the two groups of radiologists were compared.

##### RESULTS

The diagnostic sensitivity of U-HRCT was 100% (40/40 ears) for neuroradiologists and 87.5% (35/40 ears) for general radiologists, which was significantly higher than that of HRCT (89.2% [58/65 ears] for neuroradiologists; 41.5% [27/65 ears] for general radiologists) ( $P = 0.042$  and  $P = 0.000$ , respectively). When evaluated with HRCT, the sensitivity of general radiologists was

significantly lower compared to neuroradiologists ( $P=0.000$ ), while no difference was shown when general radiologists switched to U-HRCT ( $P=0.152$ ). Among the 20 ears that underwent both examinations, 5 ears with  $<1$  mm lesion involving the fissula ante fenestram were shown on U-HRCT, while the sensitivity of HRCT was 40% (2/5 ears) for neuroradiologists, which was significantly lower than that for neuroradiologists to diagnose lesions  $>1$  mm (93.3%, 14/15 ears,  $P=0.032$ ).

## CONCLUSION

s U-HRCT is more sensitive than HRCT in the diagnosis of IFO, and has a significant advantage in the detection of  $<1$  mm lesions.

## CLINICAL RELEVANCE/APPLICATION

U-HRCT has a high spatial resolution scale, which can significantly improve the delineation of IFO lesions and improve the ability of general radiologists to detect this disease. It has the potential to be used for screening of patients with suspected otosclerosis.

## M2-SPHN-3 Feasibility of the mDIXON Method for Estimation the Parotid Gland Fat Fraction in Sjögren's Syndrome

Participants

Changwei Ding, Shenyang, China (*Presenter*) Nothing to Disclose

## PURPOSE

SS characterized by irreversible varying degrees of fat deposition, the objective of this study is to explore the feasibility of estimating fat fraction (FF) in parotid glands with Sjogren's syndrome using the mDIXON method.

## METHODS AND MATERIALS

Conventional MRI and mDIXON-Quant were performed on 62 parotid glands (case group) in 31 SS patients and 62 parotid glands (control group) in 31 healthy volunteers with age and mean body mass index matching. The FF values of the two groups were compared, and the changes of FF values with different degrees of fat deposition were analyzed.

## RESULTS

The FF value of parotid gland in the case group was significantly higher than that in the control group ( $35.7 \pm 15.7$ ,  $28.3 \pm 16.1$ , respectively,  $P=0.008$ ). The FF value in the case group increased gradually from no significant fat deposition in the early stage ( $32.1 \pm 4.8$ ) to significant fat substitution ( $73.0 \pm 4.9$ ).

## CONCLUSION

s The FF values obtained by the mDIXON method are a new method that can quantitatively assess the extent of SS parotid gland lesions.

## CLINICAL RELEVANCE/APPLICATION

mDIXON provides a simple and easy clinical method for quantitative assessment of the extent of SS parotid gland lesions.

## M2-SPHN-4 Performance of 0.55T MRI for Diffusion Weighted Imaging of Parotid Gland: Comparison with 3T MRI

## PURPOSE

To evaluate and compare the imaging quality of parotid in 0.55T and 3T MRI and to explore the application value of 0.55T in clinical practice.

## METHODS AND MATERIALS

Nine healthy volunteers were prospectively recruited and underwent coronal maxillofacial imaging using 0.55T and 3T MRI respectively. The scanning sequence contained T1/T2 TSE and diffusion sequences. Two different DWI sequences were adopted on 3T, one is conventional single-shot EPI, and the other is RESOLVE; while only a SS-EPI sequence was applied on 0.55T. The parameters were presented in supplementary materials. The signal noise ratio (SNR), contrast to noise ratio (CNR), and quantitative degree of the parotid gland deformation were used to evaluate image quality, as well as subjective scores in six aspects. Two radiologists, with 5 and 15 years of diagnostic experience in head and neck imaging respectively, made subjective scores according to the 5-point method on the images with double-blind. The SNRs, CNRs, degrees of deformation and the stability of ADC value were compared under different field strengths and sequences. Graphpad Prism 8.0 software and 3D slicer was used for statistical analysis and image fusion. The quantitative and quality parameters were analyzed with One-way ANOVA and Kruskal-Wallis One-way ANOVA. The correlation Spearman coefficient was used for the inter-observers consistency analysis. Differences were considered statistically significant at  $P<0.05$ .

## RESULTS

The SNR and CNR of images in 0.55T were lower than those in 3T MRI, however no significant differences were found between 0.55T EPI and 3T RESOLVE ( $P>0.05$ ). The deformation degree was the lowest in 0.55T and significant differences were found between 0.55T EPI and 3T EPI ( $P<0.0001$ ) and 3T RESOLVE with  $b=50$  ( $P<0.05$ ) respectively. The stability of ADC value in 0.55T was also relatively better than in 3T MRI. The subjective scores showed that the clarity of boundary of tissue and image quality achieved the best in 3T RESOLVE. However, the deformation degree was the lowest in 0.55T, and no significant differences were found in the clarity of parotid gland between 0.55T and RESOLVE. Additionally, we found the significantly reduced deformation within basis cranii region using coronal maxillofacial imaging in 0.55 T.

## CONCLUSION

s This study demonstrates that 0.55T can significantly reduce image deformation with comparable image quality with 3T RESOLVE, which will be helpful for patients with high field strength contraindications to achieve the normal diagnostic effect.

## CLINICAL RELEVANCE/APPLICATION

The comparable image quality with 3 T and significant image deformation inhibiting in 0.55 T MRI is able to satisfy the diagnostic demand under certain conditions.

## M2-SPHN-5 Characterization of Intratumoral Heterogeneity by using Diffusion-relaxation Correlation Spectrum

## Imaging (DR-CSI) in HNSCC

### PURPOSE

To determine the feasibility of diffusion-relaxation correlation spectrum imaging (DR-CSI) in the characterization of microstructural tissue compartments in HNSCC.

### METHODS AND MATERIALS

Patients suspected with HNSCC who underwent 3-T MRI and surgical resection were prospectively studied. DR-CSI was applied and imaged for primary HNSCC and metastatic lymph nodes in vivo and were co-registered pathological slides. The DR-CSI spectral signal components volume (VA, VB, VC) was identified in accordance with the pathological findings and compared between benign and malignant primary tumors or lymph nodes. A linear model assessed the correlations between (VA, VB, VC) and each component observed in pathological findings. Strength of correlations was evaluated by using Spearman correlation coefficients.

### RESULTS

Totally 32 subjects (mean age, 45 years  $\pm$  5.6) were evaluated in this study; Basically, three pathological components including epithelial, stroma and vascular areas were accordantly matched with DR-CSI spectral signal components (spectral peaks). Different DR-CSI pattern was observed between HNSCC and benign lesions or metastatic and benign lymph nodes. HNSCC exhibited increased VA (HNSCC vs benign,  $0.41 \pm 0.06$  vs  $0.29 \pm 0.06$ ;  $P < 0.01$ ), decreased VC ( $0.13 \pm 0.08$  vs  $0.27 \pm 0.09$ ,  $P < 0.01$ ). High malignancy suggested higher VA (low- vs high malignancy  $0.36 \pm 0.11$  vs  $0.57 \pm 0.13$ ;  $P < 0.05$ ). In addition, metastatic lymph nodes presented decreased Vc (metastatic vs benign,  $0.14 \pm 0.08$  vs  $0.19 \pm 0.18$ ;  $P = 0.04$ ).and increased VB (mtastastic vs benign,  $0.21 \pm 0.08$  vs  $0.14 \pm 0.18$ ;  $P = 0.051$ ).

### CONCLUSION

s Diffusion-relaxation correlation spectrum imaging is feasible to determine the intra-tumoral heterogeneity of HNSCC. The signal components correlate with pathological compartments. Quantitative VA, VB and VC can be applied to determine malignancy and cervical metastasis.

### CLINICAL RELEVANCE/APPLICATION

Microstructural MRI has the potential to improve diagnosis and characterization intra-tumoral heterogeneity. DR-CSI has been approved to quantitatively determine various components within the tumor, which is a promising approach for identify intra-tumoral heterogeneity.

## M2-SPHN-6 Diagnostic Performance of 3D Dixon T1WI Sequence for Assessing Craniofacial Localized Scleroderma

### PURPOSE

To evaluate the soft tissue lesions in craniofacial localized scleroderma using 3D Dixon T1WI sequence.

### METHODS AND MATERIALS

28 patients who were clinically diagnosed as craniofacial localized scleroderma were retrospectively collected. All patients underwent 3D Dixon T1WI sequence examination. 3D Dixon T1WI sequence included in phase, oppo phase, water, fat images. For the assessments of skin and subcutaneous soft tissue, the facial surface was divided into six subunits, including the forehead, temporal, periocular, cheek, nose, and chin. Radiologists recorded the number of craniofacial localized scleroderma which involved in six subunits on 3D Dixon T1WI sequence and on clinical assessment. The diagnostic performance was evaluated by comparing the number on 3D Dixon T1WI sequence and on clinical assessment. The quantitative assessment by measuring the full thickness soft tissue on the affected side of the most severe axial images (including in phase, oppo phase, water, fat images) and the contralateral normal side.

### RESULTS

28 patients which included 15 males and 13 females were collected in this study. On 3D Dixon T1WI sequence and clinical assessment, 75.0% (21/28) vs 75% (21/28), 35.7% (10/28) vs 35.7% (10/28), 60.7% (17/28) vs 67.8% (19/28), 39.3% (11/28) vs 42.8% (12/28), 57.1% (16/28) vs 60.7% (17/28) and 46.4% (13/28) vs 42.8% (12/28) patients of craniofacial localized scleroderma involved in forehead, temporal, periocular, cheek, nose and chin, respectively. There is no significant difference in evaluation of soft tissue lesions between T1W Dixon images and clinical assessment ( $p=0.743$ ). On 3D Dixon T1WI images, the full thickness of forehead ( $2.80 \pm 1.84$  vs  $4.74 \pm 2.94$ ), temporal ( $4.72 \pm 6.58$  vs  $5.96 \pm 8.24$ ), periocular ( $4.26 \pm 3.66$  vs  $4.71 \pm 6.58$ ), cheek ( $4.99 \pm 7.18$  vs  $7.38 \pm 9.45$ ), nose ( $2.22 \pm 2.11$  vs  $3.06 \pm 2.91$ ), and chin ( $3.04 \pm 4.28$  vs  $6.65 \pm 7.87$ ) on the affected side were significantly lower than the contralateral normal side (all  $p < 0.05$ ).

### CONCLUSION

s The range of lesions evaluated by 3D Dixon T1WI sequence was in consistent with clinic, and could add quantitative information about soft tissue lesions in craniofacial localized scleroderma.

### CLINICAL RELEVANCE/APPLICATION

3D Dixon T1WI sequence could evaluate the soft tissue lesions in craniofacial localized scleroderma and provide preprocedural guidance.

## M2-SPHN-7 Improving Metal Artifact Reduction Methods in Dual-Energy CT for Head and Neck CT Examinations: A Clinical Assessment

### PURPOSE

To evaluate the effectiveness of iterative metal artifact reduction (iMAR) technique in reducing dental metallic artifacts during head and neck CT examinations.

### METHODS AND MATERIALS

Thirty patients with dental prosthesis implants were prospectively collected. Siemens single-source dual-energy CT (SOMATOM Definition Edge CT) was used for examination and the original data were reconstructed respectively in iMAR group (Group A) and

conventional iterative reconstruction group (Group B). The CT and SD values of the high density artifacts, low density artifacts, the surrounding soft tissue areas and the same layer of contralateral artifact-free affected areas in the two groups of images were measured respectively. The difference between the two groups was compared by paired t-test. Two senior radiologists used the 5-component table (1~5 points, non-assessable ~ excellent) method to score the metal artifacts removal ability of the two groups. Mann-Whitney U test was used to compare the subjective scores and the consistency of the scores was analyzed by Kappa test.

## **RESULTS**

There was no significant difference in CT values at the opposite side of the same layer without artifacts ( $P>0.05$ ). The CT values in Group A were significantly reduced in the high density artifact area ( $p<0.05$ ), while significantly increased in the low density artifact area ( $p<0.05$ ), and were closer to the CT values in the corresponding anatomical areas at the opposite side of the same layer. In terms of image noise, the SD values in each measurement area of Group A's images were lower than those of Group B and were significantly lower in high density areas and low density areas ( $p<0.05$ ). In terms of subjective score, the results of the two groups of image evaluation were excellent and consistent (Kappa=0.945,  $p<0.05$ ). The subjective score of Group A was significantly higher than that of the control group, and the subjective score was increased by 2.1 (Group A:  $4.23\pm 0.32$ , Group B:  $2.11\pm 0.51$ ;  $P<0.05$ ).

## **CONCLUSION**

s The iMAR technique can significantly reduce metal artifacts around dental implants, correct CT values of surrounding tissues, help to accurately observe tissue structures around implants, improve image quality, and has great clinical application value.

## **CLINICAL RELEVANCE/APPLICATION**

Compared with conventional iterative reconstruction, it is preferable to use the iMAR technique in head and neck CT examinations as it allows better image quality and helps to accurately observe tissue structures around implants.

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## Abstract Archives of the RSNA, 2023

M2-SPIN

### Imaging Informatics Monday Poster Discussions

#### Sub-Events

#### M2-SPIN-1 Image Perturbation Analysis to Study the Effect of Motion on CT Radiomic Metrics

##### Participants

Hesam Setayesh, Los Angeles, CA (*Presenter*) Nothing to Disclose

Bino Varghese, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the robustness of radiomic metrics in simulated clinically observed ranges of organ motion using an anthropomorphic liver CT phantom with 3D-printed texture inserts.

##### METHODS AND MATERIALS

18 Volumetric CT images of the anthropomorphic liver radiomics phantom with 7 texture inserts were obtained under different imaging conditions varying slice thickness (0.625mm, 1.25mm and 2.5mm), dose (13,86 mGy standard, 40 % dose reduction, and 60 % dose reduction), tube voltage (100 kVp and 120 kVp) and reconstruction algorithms (deep learning image reconstruction algorithm and a hybrid iterative reconstruction algorithm ASiR-V50% one at a time). A circular region of interest (ROI) was manually contoured within a centrally placed texture insert of the phantom. 91 radiomic metrics belonging to 6 different texture families were extracted from the ROI using opensource Pyradiomics software. Subsequently, the same 91 radiomics metrics were extracted using the same ROI co-registered on motion perturbed versions of the original CT images. Specifically, 6 motion conditions: rotation by 5 degrees, rotation by 15 degrees, translation by 2 pixels to the right, translation by 3 pixels to the right, rotation 15 degrees plus translation 2 pixels, and rotation 15 degrees plus translation by 3 pixels were considered. Intraclass correlation (ICC) 2-way-mixed with absolute agreement was used to evaluate radiomics robustness under different imaging and motion conditions.

##### RESULTS

In all imaging conditions, translation by 2 or 3 pixels led to the highest number of radiomic metrics with ICC > 0.8 (indicating high robustness). As opposed to translations, rotation of 15 degrees compared to rotation by 5 degrees showed a significant reduction in robust radiomic metrics, under all imaging conditions ( $p < 0.0001$ ). Rotation followed by translation showed an increase in the number of robust metrics compared to rotation alone, possibly due to the overlap between the modified and the original ROI owing to small movements. Also, despite changes in imaging conditions, the trends in robustness were comparable across the different motion conditions.

##### CONCLUSION

Translation motion amplitudes = 3 times the spatial resolution of the image retained the robustness of radiomic metrics on the CT images of anthropomorphic liver phantom. Different radiomic families showed different associations to the simulated motions. However, across different imaging conditions, the trends in robustness were comparable across the different motion conditions.

##### CLINICAL RELEVANCE/APPLICATION

In a clinical situation, understanding the effect of motion and suppressing its effects may support the development of a robust quantitative approach such as radiomics.

#### M2-SPIN-2 Deep Learning is a Promising Tool for Fully Automatic Malignant Lesions Identification and Segmentation in Whole-body [68Ga]Ga-PSMA PET/CT Scans

##### Participants

Joana Castanheira, MD, Lisbon, Portugal (*Presenter*) Nothing to Disclose

##### PURPOSE

This work aims to assess the feasibility and robustness of deep learning-based fully automatic malignant lesion detection and segmentation on whole-body [68Ga]Ga-PSMA PET/CT scans.

##### METHODS AND MATERIALS

A dataset of 122 whole-body [68Ga]Ga-PSMA-11 PET/CT scans from patients with prostate cancer was used as the training set. These scans were acquired on a Philips Gemini TF16 PET/CT scanner. Two nuclear medicine physicians labeled all lesions suspected of malignancy. Then, a self-adaptive Bayesian classifier was used for semiautomatic lesion segmentation [1]. All segmentations were reviewed and manually rectified if necessary. This set (scans and segmentations) was used to train a fully automatic lesion detection and segmentation 3D U-Net, using the nnU-Net framework [2]. The CT scans were used as a second channel to feed the network. For testing, an independent set containing 39 whole-body [68Ga]Ga-PSMA-11 PET/CT scans from prostate cancer patients was randomly selected from our archives. All these scans were performed on a Philips Vereos Digital PET/CT scanner. The gold standard malignant lesions identification and segmentation of the test set were generated as indicated for the training set. The Dice similarity coefficient was used to measure the voxelwise agreement/overlap between the gold standard segmentations and

the ones obtained with the trained network.

## RESULTS

From the 39 test scans included, 32 scans were identified by the physicians as having malignant lesions, and 7 without. The trained network correctly identified all 32 scans with malignant lesions (sensitivity of 100%). From the 7 scans without malignant lesions, the trained network correctly identified 6 (specificity of 86%). Regarding the quality of the segmentation on the 32 scans, the median Dice coefficient was 0.73 (interquartile range [IQR] 0.53-0.82), the sensitivity was 72% (IQR 0.41-0.86), and the predictive positive value was 90% (IQR 0.72-0.99).

## CONCLUSION

The solution herein described and implemented using deep learning achieved very good results, despite the additional difficulty of segmenting scans acquired on a scanner significantly different from the one used to obtain the train scans. Therefore, fully automatic lesion detection and segmentation on [68Ga]Ga-PSMA-11 PET/CT scans using deep learning may be used to help routine clinical work, especially during disease staging and to assess response to therapy. References [1] Constantino et al. J Digit Imaging 2023; [2] Isensee et al. Nature Methods 2021.

## CLINICAL RELEVANCE/APPLICATION

Deep learning-based fully automatic malignant lesions detection and segmentation on [68Ga]Ga-PSMA PET/CT scans is feasible and appears sufficiently robust to be used as an auxiliary tool in the clinics.

## M2-SPIN-3 The CadAIver: Reproducibility Assessment and Novel Normalization Algorithm of Radiomics Features of Vertebral Bone from Different CT Scanners and Protocols

Participants

Riccardo Levi, Pieve Emanuele, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

1. To quantify the effects of different dose protocols, reconstruction algorithms, fields of view and CT scanners on Radiomics features of the lumbar vertebrae in a cadaveric trunk. 2. To develop a novel normalization algorithm to harmonize Radiomics analyses.

## METHODS AND MATERIALS

We performed a total of 96 CT acquisitions of a cadaveric trunk (80-year old male) on 3 different CT scanners from 2 different vendors, using different kV (80 to 140, with 20 kV steps) and mA (250 to 400, with 50 mA steps). Each acquisition was performed using 2 fields of view (500 and 320 mm) and 2 reconstruction kernels (standard and bone). We also performed a Test-Retest protocol on a single scanner to assess repeatability of features. The lumbar vertebrae were segmented using a convolutional neural network (CNN) with nnU-Net structure and Radiomics features were extracted using pyradiomics library. Intra- and Inter-scanner analyses were assessed using either Analysis of Variance Repeated Measurements (parametric test) or Friedman's Test (non-parametric test) and each radiomics feature was tested using a generalized linear model (GLM) to assess the effects of all the above-mentioned CT acquisition parameters. Moreover, the proposed GLM model was successively employed to standardize radiomics features across different acquisitions, and was compared to the Combat algorithm, using a 10-folds cross-validation (CV) evaluating the R2.

## RESULTS

Variation of KV showed the highest feature modification in intra- and inter-scanner analyses, with the First Order features showing the highest variability (up to 94.4% on Scanner 1). Little or no effect was evident upon mA variation. 100% of shape features on all scanners were found significantly dependent on FOV, and 83% of GLSZM were statistically different between reconstruction kernels. The proposed GLM normalization algorithm obtained a mean R2 across CV higher than 0.90 in 21 Radiomics features (19.6%), whereas Combat normalization algorithm obtained a high R2 value in 1 Radiomics feature (0.90%). Moreover, GLM algorithm was statistically superior in 39 Radiomics features in respect to Combat (which was superior in 16 Radiomics features) in terms of R2.

## CONCLUSION

To our knowledge, this study is the first attempt in describing the effects of CT acquisition parameters on Radiomics features in lumbar vertebrae from cadaveric donor. Current and Voltage affect the Radiomics features in different ways. The developed GLM model was superior to Combat in normalizing radiomics features across all the different CT acquisitions.

## CLINICAL RELEVANCE/APPLICATION

CT radiomics features are to be normalized before multi-scanner studies. The complete dataset and GLM normalization model will be publicly available to foster research in Radiomics.

## M2-SPIN-4 Independent Evaluation of the Winning Kits19 Model for Kidney Tumor Segmentation on a Large External Patient Cohort

## PURPOSE

The fully automatic segmentation of kidney tumors on Computed Tomography (CT) can enable significant advantages in clinical practice including increased accuracy of diagnosis and prognostication of patient outcomes. The Kits19 challenge in 2019 set a baseline for kidney tumor segmentation, with the highest scoring model, nnUNet, receiving a Dice score of 0.85. Herein we seek to evaluate this model on an independent dataset of 694 segmented kidney tumors.

## METHODS AND MATERIALS

The nnUNet model trained on 210 Kits19 cases was evaluated on a separate institution-specific dataset of 694 total segmented kidney tumor cases, acquired from a diverse range of partner sites. A separate nnUNet model was trained on 555 of the institutional cases and evaluated on both 139 held out cases from the same institution as well as the 210 Kits19 cases. Unfortunately, the KITS19 90 test cases were not available to evaluate the model trained on institutional data.

## RESULTS

The nnUNet model trained on the 210 KiTS19 cases received a Dice score of 0.64 when evaluated on the institution specific dataset of 555 cases. The nnUNet trained on the 210 KiTS19 cases also received a Dice score of 0.66 on a held-out test set of 139 institutional cases. In addition, an nnUNet model was trained on these 555 institutional cases and received a Dice score of 0.72 when evaluated on the held-out test set of 139 cases from the same institution. The nnUNet model trained on 555 institutional cases received a Dice score of 0.55 when evaluated on the 210 KiTS19 training cases.

## CONCLUSION

s That the KiTS19 nnUNet model performed significantly worse (0.21 and 0.19 Dice score drops) on the institutional dataset was unexpected, but bears significant implications. Likewise, that the institutional nnUNet model performed significantly worse on the KiTS19 dataset (0.17 Dice score drop) despite being trained on a larger pool of data, reinforces a similar concept. Both models tended to do better on independent data derived from their own respective datasets. This highlights the importance of creating large medical machine learning datasets that incorporate data from a broad range of sources that can capture the data heterogeneity present in distinct patient populations and allow for the creation of generalizable machine learning models.

## CLINICAL RELEVANCE/APPLICATION

These results also highlight the value of federated learning in a healthcare setting, which can allow for the incorporation of diverse datasets into model training, while maintaining the privacy of patient and institutional health data. Furthermore, these results raise the question of what the true state-of-the-art Dice score is for kidney tumor segmentation and demonstrate the importance of independent model evaluation prior to potential clinical deployment.

## M2-SPIN-5 Evaluating the Segment Anything Model for MRI Organ Segmentation Using a Simulated Interactive Setup

### PURPOSE

To evaluate the multi-organ segmentation capabilities of the recently released Segment Anything Model (SAM) as an interactive semi-automated annotation tool for organ segmentation in magnetic resonance (MR) images.

### METHODS AND MATERIALS

This retrospective study used the publicly available multi-organ MRI dataset, AMOS22, which contains 60 MRI volumes from multiple institutions. The 15 target organs are: liver, spleen, right kidney, left kidney, gallbladder, esophagus, stomach, aorta, inferior vena cava, pancreas, right adrenal gland, left adrenal gland, duodenum, bladder, and prostate/uterus. We extracted 2D slices from each 3D MRI volume and resized images to 512 by 512 pixels, resulting in a total number of 3609 2D images. We evaluated the SAM in a simulated interactive annotation setup. The initial prompt given to SAM was the ground truth bounding box (bbox) with added random jitter. SAM then outputs an initial segmentation mask. In subsequent iterations, SAM takes point-based prompts, as well as all previous prompts and the current segmentation mask, to generate the next refined segmentation mask. This procedure was repeated for 10 iterations to produce the final segmentation. The magnitude of random jitter for the initial bbox is a scaling factor that's uniformly drawn between [0.5,2] for our experiment. The magnitude of random jitter for subsequent point prompts is a translation  $0.2 * R_{max}$  pixels, where  $R_{max}$  is the shortest distance between the center and the boundary of a false positive/negative region. The segmentation results of target 15 organs were evaluated against the ground truth masks using the Dice similarity coefficient (DSC) on 2D slices.

### RESULTS

The mean±std DSC for 15 organs after the initial bounding box prompt was  $0.777 \pm 0.049$ . The final mean±std DSC after 10 iterative steps was  $0.901 \pm 0.056$ . The best three organs were the right kidney ( $0.954 \pm 0.034$ ), left kidney ( $0.951 \pm 0.028$ ), and spleen ( $0.949 \pm 0.051$ ). The worst three organs were right adrenal gland ( $0.807 \pm 0.113$ ), prostate/uterus ( $0.819 \pm 0.246$ ), and duodenum ( $0.825 \pm 0.156$ ). The mean DSCs increased monotonically with the number of prompts, implying better segmentation results.

## CONCLUSION

s Experimental results demonstrated that after 10 iterations, the SAM model was able to provide reasonable segmentation results for most of the organs in the MR images.

## CLINICAL RELEVANCE/APPLICATION

The SAM model can potentially reduce radiologists' annotation burden for segmenting MR images to just a few mouse clicks.

## M2-SPIN-6 An Automated Quantification Algorithm for Evaluating Total Metabolic Tumor Volume in Patients with FDG-avid Lymphoma using a Deep-learning Model

### Participants

Lale Kostakoglu, MD, MPH, Charlottesville, VA (*Presenter*) Research Consultant, F. Hoffmann-La Roche Ltd

### PURPOSE

Total metabolic tumor volume (TMTV) holds promise as a method for quantifying tumor burden in patients with 18F-fluorodeoxyglucose (FDG)-avid lymphoma, but methodological limitations mean that it is rarely used in clinical practice. We developed a deep-learning (DL) model for automatic lesion segmentation and TMTV quantification from FDG-positron emission tomography/computed tomography (FDG-PET/CT) scans. We aimed to evaluate the model and identify factors influencing its performance in patients with diffuse large B-cell lymphoma (DLBCL) or follicular lymphoma (FL).

### METHODS AND MATERIALS

The DL algorithm (aTMTV) was trained using retrospective trial data from 836 adults with DLBCL. Model testing was performed using an independent retrospective data set including baseline and post-treatment scans from 166 adults with DLBCL and 201 adults with advanced FL collected from two large phase 3 multicenter trials. FDG-PET/CT scans were assessed by expert readers using semiautomated software (mTMTV) and by aTMTV. Pearson's correlation coefficient (r) was used to evaluate aTMTV performance versus mTMTV. Bias was assessed using the slope and intercept from a weighted Deming regression. Lesion detection performance was assessed by sensitivity (the proportion of mTMTV-detected lesions identified by aTMTV) and positive predictive value (PPV; the proportion of aTMTV-detected lesions identified by mTMTV).

### RESULTS

aTMTV quantification highly correlated with mTMTV in the test set (n = 367; r, 0.96 [95% confidence interval (CI): 0.95, 0.96]) for DLBCL and FL. Only moderate bias was detected between aTMTV and mTMTV (slope, 1.06 [95% CI: 1.02, 1.09]; intercept, -0.27 [95% CI: -0.52, -0.03]; mean difference between methods, 0.10 [standard deviation: 1.15]). Agreement between aTMTV and mTMTV was consistent among patients with different demographics and clinical characteristics, and across scans from different PET/CT scanner manufacturers. Overall mean sensitivity and PPV for lesion detection were both > 0.8. Performance was lower for lesions = 10 mL (mean sensitivity, 0.67; mean PPV, 0.72) than for lesions > 10 mL (mean sensitivity and PPV > 0.95).

## CONCLUSION

The model demonstrated good performance and acceptable bias for TMTV measurement in patients with DLBCL or FL. Good generalizability was observed across patient subpopulations and PET/CT scanner manufacturers. Reduced algorithm performance for small lesions (= 10 mL) may be the result of higher variability among readers in the determination of small lesions.

## CLINICAL RELEVANCE/APPLICATION

With further optimization and validation, this model may provide a novel automated approach for lesion segmentation and TMTV quantification to inform the management of patients with FDG-avid lymphoma.

## M2-SPIN-7 Association of Serum Uric Acid with Visceral, Subcutaneous, Hepatic, Pancreatic, Abdominal Wall Muscle Fat and Bone Marrow Adipose Tissue Quantified by Magnetic Resonance Imaging

Participants

Yuhui Liu, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of our study was to explore the abdominal wall muscle adipose tissue (AMAT) and bone marrow adipose tissue (BMAT) content and ectopic adipose deposition in patients association with Hyperuricemia by MRI fat fraction maps to provide reference for early prevention and disease control according to.

## METHODS AND MATERIALS

A total of 344 participants (160 men and 184 women) who underwent 1.5T or 3.0 T MRI examination of upper abdomen in our hospital from January 2017 to March 2021 were included in our study, including 55 patients in Hyperuricemia group and 189 patients in non-Hyperuricemia group. The MRI images of all patients included the iterative decomposition of water and fat with echo asymmetry at IDEAL-IQ or mDixon Quant sequence, and the image quality met the measurement requirements. The FF and VAT, SAT, AMAT were obtained at the level of the L1 and L2 vertebral bodies by Image J (National Institutes of Health, USA), and the FF and area of BMAT were automatically calculated at the level of the T12 and L1 vertebral bodies by the software where the mean of BMAT were computed. The HFF and PFF were semi-automatically measured by 3D semi-automatic segmentation software (Smart ROI) on the post-processing platform (Intellispace Portal, ISP, Philips, Holland).

## RESULTS

BMI, TG, HFF, VAT area, VAT FF, AMAT area of the Hyperuricemia group were higher than the non-Hyperuricemia group. The difference was statistically significant ( $P < 0.05$ ). However there was no statistically significant difference in SAT area, SAT FF, PFF, AMAT FF and BMAT FF between Hyperuricemia group and the non-Hyperuricemia group ( $P > 0.05$ ) (Table 1) (Fig 1). Continuous SUA was correlated to HFF ( $r = 0.28$ ,  $p < 0.001$ ) and VAT area ( $r = 0.32$ ,  $p < 0.001$ ) and AMAT area ( $r = 0.46$ ,  $p < 0.001$ ) and to a lesser extent to VAT FF ( $r = 0.26$ ,  $p < 0.001$ , compare scatterplots in Fig 2). We found that SAT area, SAT FF, VAT area, VAT FF, HFF, PFF, AMAT area, AMAT FF and BMAT FF were obviously correlated ( $P < 0.05$ ) after adjusting for age, sex and BMI, but the correlation intensity was different (Fig 3).

## CONCLUSION

In this study, we explored the relationship between the occurrence of Hyperuricemia patients and ectopic fat deposition, AMAT and BMAT. We found that in this population-based sample, SUA and hyperuricemia were strongly related to increased storage of HFF, VAT area, VAT FF, AMAT area.

## CLINICAL RELEVANCE/APPLICATION

We found that Hyperuricemia were strongly related to increased storage of HFF, VAT area, VAT FF, AMAT area. by serum uric acid, thus highlighting the different physiological roles of these fat compartments in uric acid metabolism.

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## Abstract Archives of the RSNA, 2023

M2-SPIR

### Interventional Radiology Monday Poster Discussions

#### Sub-Events

#### M2-SPIR-2 Unilateral Lung Disease Model Developed using Interventional Radiology Technique

##### Participants

Hiroshi Kodama, MD, Nishinomiya, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Standard mouse model of pulmonary fibrosis model has been made by administration of Bleomycin intratracheally or intraperitoneally. The problem of this traditional methods is high mortality rate of more than 50% after Bleomycin administration. Our hypothesis was that unilateral lung disease model established using interventional radiology technique can overcome this limitation, and the feasibility and usefulness of unilateral lung disease was assessed.

##### METHODS AND MATERIALS

After 6-week-old C57BL/6 mice were anesthetized, a 1.7Fr. microcatheter was advanced into trachea using otoscope. Then, 1.0mg/kg of Bleomycin was injected into bilateral lung at trachea (n=13) or unilateral lung (n=14) after advancing the microcatheter to left main bronchus under fluoroscopy. Technical success, %decrease of body weight and survival at day 28 were evaluated. Body weight change and survival were compared between bilateral and unilateral lung disease groups using Mann-Whitney test and log-rank test. Lungs were extracted and evaluated on HE or Masson Trichrome stained specimens.

##### RESULTS

In all mice, bleomycin was successfully injected in bilateral or unilateral lung: Technical success rate was 100%. Body weights decreased 75.7%±14.0% in bilateral lung disease group, and it was significantly improved to 94.1%±11.4% in unilateral lung disease group (p=0.03). Overall survival rate at day 28 was 30.8% and 85.7% in bilateral and unilateral lung disease model, respectively. Survival was significantly better in unilateral lung disease model(p=0.01). On histological evaluation, it is confirmed that collagen deposition was only seen in bleomycin injected lung in unilateral lung disease model.

##### CONCLUSION

Establishing both healthy lung and disease lung in the same individual model using interventional radiology technique was feasible and make it possible to achieve less body weight loss and more favorable survival.

##### CLINICAL RELEVANCE/APPLICATION

Interventional radiology technique helps developing new animal model. Unilateral lung disease mouse model may be useful to analyze the treatment effect to both diseased and normal lung in the same individual.

#### M2-SPIR-3 Fully Automated Dynamic Frame Rate Adjustment in Digital Subtraction Angiography

##### PURPOSE

Digital subtraction angiography (DSA) is a commonly used method for visualizing vasculature throughout the human body. Unfortunately, patient motion can generate artifacts, limiting the diagnostic quality of the images. When motion artifacts are present, image quality can be effectively improved by utilizing higher acquisition frame rates. However, this approach increases radiation dose to both the patient and provider. Moreover, frame rate adjustments are currently performed manually and frequently overlooked. There is a critical need to automatically optimize acquisition frame rates to maximize image quality and limit unnecessary radiation. We aim to develop a fully automated method to adjust frame rates on a series-to-series basis in response to motion artifacts.

##### METHODS AND MATERIALS

DSAs of the cerebral, hepatic, and splenic vasculature were retrospectively collected (n=88 patients, 217 series; frame rate range 1-7 frames per second). The degree of motion artifacts in each DSA was visually scored using a five-grade Likert scale. In addition, image histograms were calculated for each DSA, and the relationship between the standard deviation of pixel intensities and the artifact rating was investigated. A Pearson correlation coefficient with a two-sided p-value was used to quantify the relationship, and the processing time required to analyze each DSA image was recorded.

##### RESULTS

The degree of motion artifacts was strongly associated with the standard deviation of pixel intensities in the image histogram (r = 0.78, p<1x10<sup>-5</sup>). The average processing time required to calculate this metric for a DSA image was 0.008 seconds on a middle-entry PC (Intel Core i5 processor, 8GB RAM).

##### CONCLUSION

The standard deviation of pixel intensities in DSA is significantly associated with the degree of motion artifacts and can be

calculated in less than 0.01 seconds. This relationship can be utilized to adjust acquisition frame rates for DSA in a quantifiable, automated, real-time approach.

#### **CLINICAL RELEVANCE/APPLICATION**

Increasing DSA acquisition frame rates is an effective method to improve image quality when motion artifacts are present, but it also increases the radiation dose. In this study, we present a concept to perform fully automated, real-time frame rate optimizations on a series-to-series basis. This approach will improve image quality when patient motion is present while limiting radiation exposure when high frame rates are unnecessary.

#### **M2-SPIR-4 Impact of a Selective Lens Dose Reduction Protocol in 3D Rotational Angiography on Eye Lens Radiation Exposure in Cerebral Angiography: A Randomized Controlled Trial**

Participants

Jong-Tae Yoon, BS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

There is limited research on the radiation exposure to the eye lens during cerebral angiography. A recent study has reported that a simple adjustment of table height during three-dimensional rotational angiography (3D-RA) can significantly reduce the radiation dose to the lens. This study aims to investigate the radiation dose to the eye lens during cerebral angiography and evaluate the effectiveness of a lens dose reduction protocol for 3D-RA in reducing overall lens dose exposure.

#### **METHODS AND MATERIALS**

A randomized, controlled clinical trial was conducted at a tertiary hospital, with patients undergoing diagnostic cerebral angiography for unruptured intracranial aneurysms. The lens dose reduction protocol in 3D-RA involved raising the table to position the patient's eye lens away from the rotation axis. The radiation dose at the eye lens was estimated by measuring the entrance surface air kerma with photoluminescent glass dosimeter (PLD). The lens doses of 3D-RA and overall examination were analyzed and compared between the two groups. Image quality of the 3D-RA was assessed using quantitative and qualitative methods.

#### **RESULTS**

A total of 20 participants (mean age, 58 years  $\pm$  9.4 [SD]; 12 men [60%]) were enrolled and randomly assigned to either the conventional group or the lens dose group. The lens dose in 3D-RA was significantly lower in the lens dose group compared to the conventional group (median of 1.1 mGy vs 4.5 mGy,  $P < .001$ ). The total dose was significantly lower in the lens dose reduction group (median of 7.5 mGy vs 10.2 mGy,  $P = .003$ ). In the conventional group, 3D-RA accounted for 46% of the total lens dose, while in the lens dose group, its proportion decreased to 16%. No significant differences were observed in the image quality between the groups.

#### **CONCLUSION**

The study demonstrated that the lens dose reduction protocol showed significant reduction in the lens dose of the 3D-RA as well as entire cerebral angiography, without compromising image quality.

#### **CLINICAL RELEVANCE/APPLICATION**

Radiation exposure during neurointerventional procedures is one of the significant issues to consider clinically as lenses have a high radiation sensitivity, and frequent radiation exposure can increase the risk of developing cataracts. Therefore, managing radiation exposure is crucial, and the use of techniques to reduce radiation doses in lenses, as presented in this study, can potentially decrease the likelihood of cataract formation in patients.

#### **M2-SPIR-5 Immunologic Stem Markers of Poorly-differentiated Hepatocellular Carcinoma: Potential Targets for Locoregional NK-cell Based Immunotherapy**

Participants

Jason Chiang, MD, PhD, Los Angeles, CA (*Presenter*) Consultant, Intuitive Surgical, Inc; Equipment support, Johnson & Johnson

#### **PURPOSE**

Poorly differentiated hepatocellular carcinoma (HCC) is hypothesized to contain immunologic markers of cancer stem cells that elevate the risk for recurrence or progression after locoregional therapy. Natural killer (NK) cells are uniquely able to target cancer stem cells via the innate immune pathway. The goal of this study was to identify cancer stem cell immunologic markers of poorly- vs well-differentiated hepatocellular carcinomas that would make them susceptible to NK-cell based therapy. HCC cell lines of poor- and well-differentiated HCCs were then incubated with naïve and activated NK cells to validate their cytotoxicity profile.

#### **METHODS AND MATERIALS**

Two HCC tumor cell lines of different grades of differentiation (SNU-423: poorly differentiated; HepG2: well-differentiated) were used to determine immunologic stem cell phenotype and susceptibility to NK cell-mediated cytotoxicity. Flow cytometry was used to evaluate for surface receptor expression of MHC-I, CD-54, CD-44, and PDL-1 after staining with PE-conjugated antibodies. Isotype control antibodies were used to determine non-specific bindings. Freshly isolated NK cells and IL-2 activated NK cells prior to using 4-hr  $^{51}\text{Cr}$  release assay.

#### **RESULTS**

The poorly differentiated HCC (SNU-423) had significantly higher expression percentage of CD44 ( $P < 0.0001$ ) and much lower expression percentage of MHC-I ( $p = 0.028$ ) and CD-54 ( $P = 0.01$ ), compared to the well-differentiated HCC (HepG2). There was no difference in PDL-1 levels ( $p = 0.70$ ) between the two cell lines. Naïve NK cells and activated NK cells both demonstrated significantly higher targeted killing of the poorly differentiated HCC when compared to the well-differentiated HCC (untreated NK in Snu-423 vs HepG2,  $p = 0.013$ , IL2-treated NK in Snu-423 vs HepG2,  $p < 0.001$ ). Morphologically, poorly differentiated HCCs exhibited smaller size and proliferated faster when compared to well differentiated HCCs.

#### **CONCLUSION**

Poorly-differentiated HCCs demonstrated significantly decreased expression of stem cell markers MHC-I, CD-54, and higher expression of CD-44 when compared to well-differentiated HCC. Poorly-differentiated HCCs were subsequently validated to be more

susceptible to NK cell therapy. Additional studies in in-vivo HCC models are required to confirm stem profile of poorly differentiated HCCs and their utility as a biomarker for successful NK cell targeting.

#### **CLINICAL RELEVANCE/APPLICATION**

NK-cell based therapy can potentially be used to augment conventional locoregional therapy options for early- to intermediate-stage HCC. Advances in NK cell activation and expansion will lend itself well to transarterial directed delivery of immunotherapy.

#### **M2-SPIR-6 Evaluating the Potential of ChatGPT's Competency in Interventional Radiology**

Participants

Hossam Zaki, BS, Providence, RI (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This project investigates ChatGPT's proficiency in Interventional Radiology by evaluating its clinical decision making and performance on a standardized exam.

#### **METHODS AND MATERIALS**

We utilized ChatGPT, an LLM by Open AI trained on general data, as well as GlassAI, an LLM by Glass Health trained on medical text. Using the American College of Radiology (ACR) Appropriateness Criteria's patient presentations and criteria, we prompted ChatGPT to rank the 3 best interventional procedures, devices, or venous access areas. GlassAI was prompted to provide the best interventional procedures only. Each output was scored out of 3, where 3 is "usually appropriate", 2 is "may be appropriate", 1 is "usually not appropriate", and 0 is not listed. Partial scores were given for non-specific answers. We also used a Self-Assessment Module for Vascular and Interventional Radiology from the ACR published in 2011 to feed non-image based multiple choice questions into ChatGPT. A 1 was given for a correct answer, while a 0 was given for an incorrect answer. Clinical scenarios and exam questions were passed into each LLM twice, to account for stochasticity. The score for the board exam questions were averaged across both runs. Statistical significance was determined using a two-sided student's T-test.

#### **RESULTS**

ChatGPT achieved a score of 2.38, 2.32, and 3.00 in selecting interventional procedures, devices, and venous access sites, respectively. GlassAI achieved a score of 3.00 in selecting interventional procedures. The difference between the two scores was found to be statistically significant ( $p < 0.05$ ). The average score for the exam was 74.2%.

#### **CONCLUSION**

This study has demonstrated the potential of LLMs as a valuable tool for IR contexts. Compared to the ACR Appropriateness Criteria, LLMs perform well selecting an interventional procedure when prompted with a specific clinical scenario. GlassAI, a medical-specific model, performed better than ChatGPT, a general model. ChatGPT performed well in predicting interventional devices and venous access sites. ChatGPT performed well on the simulated IR exam.

#### **CLINICAL RELEVANCE/APPLICATION**

Throughout the study, LLMs consistently exhibited a strong ability to comprehend complex medical scenarios and provide accurate, relevant predictions in interventional radiology areas. Moreover, the use of ChatGPT in a test setting demonstrated its proficiency in answering a wide range of questions. By integrating the model into the decision-making process, we can enhance the efficacy of diagnostic and therapeutic interventions while reducing the cognitive burden on clinicians.

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## Abstract Archives of the RSNA, 2023

M2-SPMK

### Musculoskeletal Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPMK-1 Thumb Distal Phalangeal Pseudolesion: Imaging Findings and Associations of an Underappreciated Normal Variant that May Mimic Osteolytic Pathology**

##### Participants

Andrew Helming, MD, Portland, OR (*Presenter*) Nothing to Disclose

##### PURPOSE

In daily practice, we often observe a thumb distal phalangeal lucency on routine radiographs which may prompt cross-sectional imaging for further work-up. We hypothesize this represents a "pseudolesion" similar to those at the proximal humerus, radial tuberosity and femoral neck. To our knowledge, this finding has not been described in peer-reviewed literature. We aim to: 1) Describe imaging features of the thumb distal phalangeal pseudolesion (DPPL), 2) record incidence and frequency across age groups, and 3) evaluate associations with underlying diseases.

##### METHODS AND MATERIALS

IRB approved, retrospective review of 450 radiographic exams from 7/1/2021-7/1/2022. Patients divided into 3 age groups: 0-17, mean 12; 18-65, mean 42; 66+, mean 74.5. Each group of 150 cases had 50 hand, wrist, digit exams. Demographics obtained from electronic medical records and cases reviewed on PACS for: DPPL (Likert scale- 0, not present; 1, possible; 2, definite), view-specific conspicuity, location (distal/proximal, radial/ulnar, palmar/dorsal), size, laterality, osteopenia, osteoarthritis (OA) (modified Kellgren-Lawrence), inflammatory arthropathy, periarticular mineralization, and indication.

##### RESULTS

450 patients, 51% female and 49% male, 51% left and 49% right, DPPL present in 23%. Frequency of DPPL varied with age as follows: 68 (45%) seen in >65, 34 (23%) in 18-65, and 3 (2%) in those <18. DPPL located at proximal palmar aspect of thumb distal phalanx in 100%, 97% at ulnar aspect, 3% radial. 2% of patients had inflammatory arthropathy, 21% osteopenia, and 2% peri-articular mineralization. Positive correlations between DPPL presence and patient age, osteopenia, and presence of osteoarthritis, ( $p < 0.001$ ); severity of OA was not correlated. DPPL was not associated with gender or inflammatory arthropathy, and dubiously associated with periarticular mineralization. DPPL frequently seen on frontal and oblique views, infrequently on lateral views. Average size 6.4 x 4.5 mm (CC x TV). DPPL more common on hand and digit radiographs.

##### CONCLUSION

DPPL is common in patients older than 65 and consistently identified at the proximal, palmar-ulnar aspect of the thumb distal phalanx at wrist, hand, and finger/thumb radiography. DPPL is significantly associated with aging, increasing osteopenia, and osteoarthritis, and is unusual in the pediatric population. Anatomically, DPPL may be attributed to radial and ulnar sided basal tubercles bordering a palmar fossa/concavity which is less discrete prior to skeletal maturation.

##### CLINICAL RELEVANCE/APPLICATION

Increasing radiologist awareness of DPPL as a normal variant at the thumb distal phalanx may decrease overcalls of osteolytic bone disease, eliminating unnecessary work-up and alleviating patient anxiety.

#### **M2-SPMK-2 Peripheral Tear of the TFCC: Diagnostic Accuracy of MR Imaging of the Wrist and Diagnostic Performance of the Primary and Secondary Signs**

##### PURPOSE

The aim of the study was to assess the diagnostic performance value of MRI findings in patients with type 1b triangular fibrocartilage complex (TFCC) tear of the wrist.

##### METHODS AND MATERIALS

In this study, a retrospective enrollment of 78 patients was conducted to examine the diagnostic performance of preoperative MRI examinations in patients with type 1b TFCC tear. Of the enrolled patients, 39 were confirmed to have type 1b TFCC tear through arthroscopy and underwent MRI examination within 180 days before surgery. As the control group, 39 patients were randomly selected from 1157 patients who underwent MRI examination for wrist pain during the same period. Both groups underwent a review of 19 MRI findings by two independent observers, and the correlation between each diagnostic finding and type 1b TFCC tear was assessed using a Chi-square test. The 19 MRI findings comprise 8 primary signs of abnormalities in the distal or proximal lamina, alongside 11 secondary signs suggestive of abnormalities in the surrounding structures.

##### RESULTS

The type 1b TFCC tear group exhibited a significantly greater incidence of 7 primary MRI signs, comprising fiber discontinuity, signal alteration, and retraction of both proximal and distal lamina, as well as scarring of the distal lamina, compared to the control group (all  $p < 0.05$ ). Remarkably, the presence of fiber discontinuity and signal alteration of the distal lamina were higher in the type 1b



TFCC tear group (74.3% vs. 38.5%,  $p=0.003$ , and 87.2% vs. 43.6%,  $p<0.001$ , respectively), as detected by both observers. In contrast, none of the 11 secondary MRI signs were statistically significant.

## CONCLUSION

s MRI assessment of fiber discontinuity and signal alteration in the distal lamina through MRI examination may provide predictive markers for type 1b TFCC tear. These findings highlight the potential value of MRI as a diagnostic tool for this particular condition.

## CLINICAL RELEVANCE/APPLICATION

This study holds the potential to identify the diagnostic accuracy of wrist MR imaging, as well as the diagnostic performance of both primary and secondary signs related to type 1b TFCC tear.

## M2-SPMK-3 Wrist Instability after Sectioning the Different Components of the Scafolunate Ligament and DCSS using a Cadaveric Model and Evaluated by 4DCT

Participants

Badr Sellami, MD, Brussel, Belgium (*Presenter*) Nothing to Disclose

## PURPOSE

To study the effect of sectioning the different components of the SL (scafolunate) ligament-DCSS (dorsal scafolunate septum) in a cadaveric model and assessing dynamic effects with 4DCT.

## METHODS AND MATERIALS

Five fresh frozen cadaveric specimens were imaged with 4DCT while placed in a custom-made wooden frame before and after introduction of different SL-DCSS lesions. The lesions were created arthroscopically and consisted of VSL (ventral), DSL (dorsal), VSL+DSL, VSL+DSL+partial DCSS, and VSL+DSL+complete DCSS. With CT, dynamic acquisitions were obtained in flexion, extension (F-E), and radial and ulnar (R-U) deviation. Relevant bony structures were semi-automatically segmented. Based on this X; Y; Z graphs were created to analyze the movement of the bones.

## RESULTS

With VSL sectioning, no SL diastasis occurred. Dorsal tilt increased with VSL sectioning. With DSL sectioning SL diastasis was seen but only in flexion-extension, and not in ulnar-radial deviation. With sectioning of multiple components SL diastasis was observed in all motions. With VSL, DSL, VSL+ DSL tilting in F-E was not concordant with tilting in R-U deviation. When the DCSS was completely sectioned tilting increased significantly in all motions and SL diastasis was most pronounced.

## CONCLUSION

s 1. SL diastasis does not occur with VSL lesions, however with DSL lesions it can also not be shown on R-U deviation 2. Except for the most severe injury of all structures (SL+ DCSS) the motion in R-U deviation is not concordant with F-E as would be expected. We believe that the extrinsic ligaments restrain the expected motion. 3. The more components are injured the more SL diastasis and tilting increases. 4. The DCSS plays a very important stabilizing role, and SL instability is most severe when it is injured.

## CLINICAL RELEVANCE/APPLICATION

Patterns of abnormal scafolunate motion after section of different components can be analyzed on 4D CT, and could predict the underlying injuries. The DCSS (dorsal scafolunate septum) plays an important stabilizing role.

## M2-SPMK-4 Clinical Importance of the Retinacula, Subsheat, Ligament Attachments and Dynamics of the ECU. An US-MRI Study with Anatomical and Histologic Correlation

## PURPOSE

To perform an US-MR anatomical-histological correlation of the extensor carpi ulnaris retinaculæ, subsheat, and their attachments to the TFC and carpal ligaments. To review MR and US imaging in 7 patients with abnormal subsheat and ulnar sided TFC tears.

## METHODS AND MATERIALS

Five cadaver specimens (fresh frozen, Thiel, embalmed) were dissected and sectioned at the level of the ECU. US was performed prior to dissection at 4 levels (cubital groove, styloid process, subsheat, carpal insertion). In the 2 dissected specimens (one nl TFC, one major TFC tear) dynamic clips during pro-supination were obtained. US imaging was obtained in consensus by 2 experienced MSK radiologists with a 24 Mhz ultrasound probe. Seven cases of abnormal ECU subsheat on MRI and US from 3 institutions were retrospectively reviewed.

## RESULTS

At the cubital level the ECU is only covered by a thin superficial retinaculum, there is no tight bony or ligament attachment and mobility in pro-supination is very significant. The subsheat starts at the styloid process level, where it connects to the styloid insertion of the TFC. The subsheat is actually a sling of ligamentous bands in continuity with other tendons and extrinsic carpal ligaments (band of Barfred, radiolunotriquetral, intercarpal ligament) Dynamic studies showed a sudden click in pro-supination in the specimens with a major TFC tear, in contrast to the specimens with a normal TFC. All studied cases with abnormal subsheat showed ulnar sided TFC tears.

## CONCLUSION

s The ECU retinacula and subsheat are complex, and have not been correctly described in previous anatomical and imaging work. This area is best evaluated on 24 Mhz US as are dynamics of the ECU tendon in pro-supination. There is no subsheat nor tight attachment of the ECU at the cubital level, but tight connections to the extrinsic carpal ligaments distally. In the clinical patients, major abnormality of the subsheat on MR or snapping dislocation of the ECU on US, was associated with ulnar sided TFC tears.

## CLINICAL RELEVANCE/APPLICATION

Understanding the anatomy of the subsheat as described in this work is a requisite to correctly interpret US and MR imaging of

this area. Our findings also shed light on the clinical concept of 'ECU dislocation-abnormal ECU motion'. Although only limited clinical cases were studied, our findings suggest that subsheath abnormalities and 'abnormal ECU motion' are associated with ulnar sided TFC tears.

## **M2-SPMK-5 Open Access AI Tools in Clinical Support Roles - An Example of Shoulder Implant Recognition**

### **PURPOSE**

Uptake of novel artificial intelligence methods into clinical tools is slowed down by multiple factors. One is the lack of access to computing facilities. In this study, we test today's open access resources for performing a musculoskeletal 4-class labeling task.

### **METHODS AND MATERIALS**

The tools we chose are Google-Chrome as browser, Google-Drive as online repository, Google-Colab as running environment. The model was implemented in Python, specifically Google-TensorFlow. The code was run on a deliberately unbalanced dataset with X-ray images containing implants from four different shoulder implant manufacturers. We applied a fine tuning on the Google-EfficientNet, the dataset was enlarged for training by data augmentation.

### **RESULTS**

We show that today's available open access resources are suitable for the intended task. Google-EfficientNet can be trained to perform the class labeling. Accuracy and avoidance of overfitting are improved by the data augmentation.

### **CONCLUSION**

We will make the designed tool available as open access tool on github. Remaining issues today are the data safety and data privacy. Future tools will need to address those if sensitive data is supposed to be processed.

### **CLINICAL RELEVANCE/APPLICATION**

Identification of unknown implants is only one of the many clinical applications. The relevance of our work is to demonstrate a pilot that uses remotely open access tools for AI work. In the future, support tools could be designed to assist a radiologist in his daily clinical routine.

## **M2-SPMK-6 Wavelet Decomposition Synthetic Imaging in Metal Artifact Reduction MRI (Magnetic Resonance Imaging) in Patients With Long Bone Tumor Prosthesis**

### **Participants**

Jiwoo Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose  
Joohee Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

To identify the optimal metal artifact reduction sequences (MARS) and to explore solutions to overcome the limitation of existing MARS by using wavelet decomposition.

### **METHODS AND MATERIALS**

We assessed a total of 1348 cases of thigh MRI from patients aged  $\geq 18$  years who underwent 3.0T MRI (Philips Healthcare, Best, the Netherlands) at our institution from January 2016 to April 2022. The inclusion criteria were as follows: (1) Bone resection and tumor prosthesis insertion for tumor involvement of the femur (2) MARS were applied to post-operative follow-up MRI; STIR Metal Artifact Reduction for Orthopedic Implants (O-MAR), mDixon O-MAR, STIR O-MAR XD (3) MARS included the coronal T2FS sequence, which allows for viewing the major axis of a long bone tumor prosthesis in a single image and is deemed the most useful for lesion detection (4) Sufficient image quality for assessment. A total of 61 cases (STIR O-MAR: 15 cases, mDixon O-MAR 17 cases, STIR O-MAR XD 29 cases) with MR images were included in the final analysis. To assess the metal related signal changes that can affect the diagnostic performance, MR images were assessed by the following parameters: the distinction of anatomic structures and image quality. (1) For the distinction of anatomic structures, (1.1) bony cortex on the outer layer of the long bone with the tumor prosthesis could be well observed (1.2) the range of the muscles showing artifacts in the anterior compartment of thigh muscles surrounding the femur, (2) Regarding image quality, (2.1) center signal void area and (2.2) total artifact area including geometric image distortion, spatial blurring and image noise. The scores for the four parameters assessed for each MARS were summed up (4-20 points). The scores of three sequences were evaluated using the one-way ANOVA and post hoc Tukey Honestly Significant Difference (HSD) test. Wavelet decomposition was applied to O-MAR XD images: a total of 101 conventional sequence-MARS pairs.

### **RESULTS**

There were no significant difference in OMAR sequence and mDixon O-MAR sequence ( $P=0.378$ ). However, in subsequent images, wavelet decomposition reduced artifacts caused by blurring, a drawback of OMAR-XD, and there were significantly improved image quality and decreased metal artifact reductions in area ( $P<0.001$ ).

### **CONCLUSION**

OMAR or mDIXON OMAR appeared to be more useful than OMAR-XD for assessing 3.0T MRI images of long bone tumor prostheses. Application of the Wavelet decomposition synthetic imaging would aid diagnosis than OMAR-XD in patients with long bone tumor prosthesis.

### **CLINICAL RELEVANCE/APPLICATION**

Efforts to reduce metal artifacts in MRI have been ongoing, but assessing postoperative magnetic resonance imaging (MRI) of patients with a long bone tumor prosthesis is still challenging.

## **M2-SPMK-7 Development of a Fitted Ultrasound Standoff Pad Device**

### **Participants**

Mario Russo, MEng, Cambridge, MA (*Presenter*) Nothing to Disclose

### **PURPOSE**

Ultrasound (US) examinations are ubiquitous diagnostic assessments, reaching nearly 350 scans per 1,000 person-years in the United States. However, US examinations of superficial structures near curved bony prominences, such as the ankle or wrist, can be challenging, often requiring the use of a standoff pad. Unfortunately, a standard standoff pad can be challenging to use due to its bulky size and instability. This is further exacerbated when dynamic maneuvers or procedures are necessary. To address this issue, we have developed initial prototypes of a custom standoff pad adaptor, the FreePad. This exploratory study aims to compare the FreePad to the standard standoff pad and no pad in selected patients undergoing musculoskeletal ultrasound.

## **METHODS AND MATERIALS**

We used an operator-centered iterative design approach to create the FreePad. The Form 3 3D-printer was utilized throughout this process to create and test consecutive prototypes. This study was granted IRB approval and utilized patient informed consent. Included were 12 patients who presented to the outpatient radiology clinic for musculoskeletal ultrasound with a focus on superficial structures near anatomic areas of bony eminences (elbow, wrist, hand, ankle and foot). Each patient was examined under three conditions: 1) using US gel with no standoff pad, 2) with a standard standoff pad, and 3) with the FreePad. Each condition was evaluated for: a) duration of examination in seconds and, on a scale of 1 to 5, b) ease of use, c) quality of images, d) patient comfort, and e) diagnostic confidence. Three staff radiologists assessed the diagnostic confidence independently. The criteria results were evaluated using paired sample t-tests.

## **RESULTS**

The FreePad was easier to use than both US gel and the standoff pad ( $p=0.03$ ,  $p=0.002$ ). While statistically better than US gel across all other conditions, the FreePad compared to a standoff pad trended towards requiring shorter duration (138 vs 169 sec,  $p=0.09$ ), producing higher quality images (4.5 vs 3.9,  $p=0.08$ ), greater diagnostic confidence (4.4 vs 3.8,  $p=0.08$ ), and increased patient comfort (4.8 vs 4.3,  $p=0.06$ ).

## **CONCLUSION**

Use of the FreePad allows for easier scanning of superficial anatomic regions associated with bony eminences. Utilizing a fitted standoff pad device can improve the diagnostic confidence and quality of US images, while significantly enhancing the ease of clinician imaging.

## **CLINICAL RELEVANCE/APPLICATION**

The significantly improved ease of imaging using the FreePad is of everyday benefit to MSK radiologists' diagnostic practice and holds even greater promise for improving US-guided procedures in challenging anatomy.

## **M2-SPMK-8 The Laundry Dilemma: Long or Short Programme to Get Off Calcium Spots**

Participants

David Macia-Suarez, PhD,MD, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose

## **PURPOSE**

Long-term comparison of two follow up approaches in performing Ultrasound-guided Percutaneous Irrigation of Calcific Tendinopathy (US-PICT) in the shoulder.

## **METHODS AND MATERIALS**

A Cross-sectional study of the evolution of patients undergoing an US-PICT was performed in 2 hospitals, through a Shoulder Pain and Disability Index (SPADI) questionnaire and a clinical survey 5 years after the intervention. The two approaches to assess were: Hospital 1: follow-up by the radiology service a month and a half after the intervention, assessing the need to perform a new US-PICT in case both symptoms and calcification persisted. Hospital 2: the patient was discharged after the intervention, being able to return to the consultation at his own request. In both cases, the same US-PICT (single needle lavage) technique was performed. All patients were informed of their participation in the study and gave their approval through an informed consent document. Authorization was requested and obtained from the regional bioethics committee. At 5 years of the intervention the two approaches were compared using the SPADI questionnaire, a clinical survey and a physical and an US exploration. The SPADI questionnaire consisted of 5 items that assessed pain and 8 items for mobility. The survey consisted of 11 questions that assessed: pain, overall state, mobility and medications compared to before US-PICT. A total of 93 patients were analyzed. 34 from Hospital 1 and 58 from Hospital 2. Statistical analyses were performed using R Statistical Software (v.4.12; Rcore Team 2021), which include a descriptive analysis of the data. Welch test was used in SPADI score means. The Chi-Squared or Fisher test were performed in survey questions.

## **RESULTS**

SPADI Score was statistically significant different in the two centers (Hospital 1:  $2.26 \pm 2.18$ ; Hospital 2:  $4.41 \pm 3.01$ ;  $p$ -value  $<0.001$ ). However, the number of US-PICT was not associated with SPADI Score. Statistically significant differences were found between hospitals in the following aspects of the clinical survey: pain ( $p$ -value = 0.007); mobility compared to healthy ( $p$ -value = 0.001); overall state ( $p$ -value = 0.008). No statistically significant differences were found between the two centers about sex, age, mobility assessment and US features.

## **CONCLUSION**

It seems that closer follow-up of patients (Hospital 1 approach) has better objective (SPADI Score) and subjective (clinical survey) long-term outcomes.

## **CLINICAL RELEVANCE/APPLICATION**

Performing a close and long follow up of patients after US-PICT allows a better outcome and, therefore, a better clinical state.

## **M2-SPMK-9 MRI-guided Retrograde Drilling for Osteochondritis Dissecans of the Talus in Pediatric Patients**

## **PURPOSE**

This study aimed to evaluate the feasibility, effectivity, and safety of MRI-guided percutaneous retrograde drilling in the treatment of osteochondritis dissecans of the talus (OCDT) in pediatric population.

## **METHODS AND MATERIALS**

The retrospective study (2010 - 2019) had 27 consecutive pediatric patients (mean age 13 years) with 30 stable, symptomatic OCDT which were unresponsive to conservative treatment. The OCDT were treated using MRI-guided retrograde drilling. They were graded pre- and post-operatively on a validated 5-grade scale (I - V) based on MRI. The procedure's effectivity was assessed by radiological improvement of the OCDT, and by postprocedural questionnaire that was aimed to evaluate pain (Visual Analogue Scale (VAS) 0 - 10) and performance (scale 0 - 10). Also, an evaluation of procedure-associated symptom alleviation was elicited.

## **RESULTS**

The mean follow-up time was 6.1 (2.4 - 11.4) years. MRI-guided drilling was technically successful in all the cases. No major complications occurred. All the patients were discharged from hospital on the day as the procedure was performed. Mean time interval for follow-up imaging was 4.8 (1 - 12) months. All the OCDT represented grade II - III in pre-operative assessment, and they all remained stable during follow-up. The OCDT grade improved after drilling ( $p = 0.039$ ). Three of grade III OCDT improved to grade I, five of grade III OCDT improved to grade II, and one of grade II OCDT progressed to grade III. The rest of the OCDT remained unchanged. Increased ossification was observed in 39% of the OCDT. The symptoms were significantly alleviated or completely disappeared in 63% of the cases. Preoperative mean VAS and performance was 6.3 (SD 2.0) and 5.2 (SD 2.4), respectively. Both pain (mean change in VAS -3.8, SD 2.6) and performance (mean change 2.6, SD 3.1) were improved significantly ( $p < 0.001$  and  $P = 0.001$ , respectively). Orally administered anti-inflammatory drugs and paracetamol provided satisfactory postprocedural pain relief for 96.7% of the patients.

## **CONCLUSION**

s MRI-guided retrograde drilling of stable OCDT is a feasible, effective, and safe treatment method for pediatric patients.

## **CLINICAL RELEVANCE/APPLICATION**

MRI-guided retrograde drilling of OCDT provides minimally invasive treatment option for patients who are unresponsive to conservative treatment. It is less invasive compared to surgery and is suitable for outpatient care. Additionally, lack of ionizing radiation makes it considerable treatment choice for pediatric patients.

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## Abstract Archives of the RSNA, 2023

M2-SPMS

### Multisystem Monday Poster Discussions

#### Sub-Events

#### M2-SPMS-1 STIR Features of Primary Lower Extremity Lymphedema: A Retrospective Analysis of 228 Patients

##### Participants

MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

##### PURPOSE

The staging of primary lower extremity lymphedema (LEL) is difficult and vital in clinical work. So we investigated the STIR manifestations of primary lower extremity lymphedema (LEL) in different clinical stages.

##### METHODS AND MATERIALS

A retrospective analysis of 228 patients of primary LEL was conducted, all of which underwent MRI examination using a short-time inversion recovery (STIR) sequence. The affected limb MRI manifestation was observed, and patients were divided into stages I, II, and III based on the 2020 International Society of Lymphology (ISL) clinical staging standards. Two radiologists assessed the following characteristics on STIR: the extent of edema, the frequency of MRI manifestations, including dermal thickening (dermal thickness > 2mm), and the morphology of edema in subcutaneous (grid, honeycomb, parallel-lines, banded, crescent, and lymphatic lake). Parallel-lines were thin, 1-2 mm wide, and parallel to the superficial fascia, not forming a network. Grid signs were multiple intertwined lines, up to 3mm wide, with the largest meridian parallel to the superficial fascia and a width-to-length ratio of less than 2/3. Honeycomb signs represented a further thickening of the grid in more than two directions, with a wall thickness greater than 3mm and a width-to-length ratio greater than 2/3. Band sign is an accumulation of fluid on the fascial surface with a strip-like structure observed at the axial level. Crescent sign is a subfascial accumulation observed at the axial level. Lymphatic lake is a large, structureless area of edema located in the subcutaneous soft tissue.

##### RESULTS

The extent of edema was positively correlated with clinical stage, both longitudinally and transversely. When comparing stages, the incidence of dermal thickening in stages II and III were significantly higher than that in stage I. The incidence of parallel-lines in stage I was significantly higher than that in stages II and III. The incidence of grid in stages I and II was significantly higher than that in stage III. The incidence of honeycomb in stages II and III was significantly higher than that in stage I. The incidence of banded sign in stages I and II was significantly higher than that in stage III. The incidence of lymphatic lake and crescent in stage III was significantly higher than that in stages I and II ( $P < 0.05$ ).

##### CONCLUSION

s STIR manifestations of primary LEL in different stages have certain characteristics, Parallel line sign is a characteristic sign of stage I, and crescentic sign and lymphatic lake are characteristic signs of stage III. MRI can be an effective auxiliary tool for evaluating the severity of primary LEL.

##### CLINICAL RELEVANCE/APPLICATION

STIR can sensitively diagnose lymphedema and assist in clinical staging.

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## Abstract Archives of the RSNA, 2023

M2-SPNMMI

### Nuclear Medicine & Molecular Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPNMMI-Virtual Myocardial PET Generated from SPECT-to-PET Translation Model Corrects False High Resting Score in SPECT Due to Photon Attenuation** 1

Participants

Masateru Kawakubo, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Myocardial single photon emission computed tomography (SPECT) is used worldwide for the diagnosis of myocardial ischemia. However, myocardial SPECT with an Anger-type gamma camera has specific artifacts, such as the effect of deep attenuation in the left ventricular inferior wall, that hinder accurate diagnosis. On the other hand, ammonia positron emission tomography (PET) has excellent detector sensitivity and its high-resolution images are considered the gold standard for ischemia diagnosis. We developed an algorithm to generate the virtual PET (vPET) from myocardial SPECT by deep learning network of SPECT-to-PET dataset of the same patient. This research investigates improvement in visual ischemia scoring accuracy of virtual myocardial PET generated by SPECT-to-PET translation (SPT) model.

#### **METHODS AND MATERIALS**

Fifty-four datasets of N-13 ammonia PET and Tc-99m-methoxyisobutylisonitrile SPECT at stress and resting state were retrospectively analyzed. These myocardial base to apical short-axis image dataset from same patient-to-patient were randomly divided into 34 cases of training datasets (2525 images) and 20 cases of test datasets (1762 images). Summed rest scores (SRS) and summed stress score (SSS) derived from vPET with the SPT model, SPECT, and PET in 20 test cases were blindly and independently assessed and compared among them.

#### **RESULTS**

SRS of vPET was not differ from those of PET ( $P > 0.999$ ), but those of SPECT was significantly over-estimated than PET ( $P = 0.002$ ) (vPET vs. SPECT vs. PET =  $0.8 \pm 2.0$  vs.  $1.8 \pm 1.5$  vs.  $0.5 \pm 0.4$ ). There were no differences of SSS among vPET, SPECT, and PET (vPET vs. SPECT vs. PET =  $1.5 \pm 2.2$  vs.  $3.4 \pm 3.0$  vs.  $4.1 \pm 5.6$ ).

#### **CONCLUSION**

Our proposed virtual PET imaging with SPT deep learning model potentially improves visual score based myocardial ischemia diagnosis in SPECT imaging without additional radioisotope injection and the high-cost novel imaging modality. This is the reasonable approach utilizing deep learning because myocardial ischemia diagnosis with standalone SPECT is used worldwide.

#### **CLINICAL RELEVANCE/APPLICATION**

Virtual PET for correcting attenuation artifact in SPECT is applicable as a low-cost and practical clinical tool which provides powerful auxiliary information for myocardial ischemia diagnosis.

#### **M2-SPNMMI-Coronary Artery Bypass Grafting Transiently Improves Myocardial Strain and Myocardial Flow Reserve: An Ammonia PET Study** 2

Participants

Atsushi Yamamoto, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Coronary artery bypass grafting (CABG) is associated with better survival and lower rates of major cardiovascular events in the short and long terms. The patency of bypass grafts has been confirmed using coronary CT angiography; however, the effects of CABG on myocardial strain and microcirculatory functions have not been elucidated. We have made it possible to evaluate left ventricular myocardial strain (LVMS), adapting a feature-tracking technique to electrocardiography-gated high-resolution N-13-ammonia positron emission tomography (NH3-PET). The aim of this study was to evaluate the change of LVMS and myocardial flow reserve (MFR) measured by NH3-PET before and after CABG.

#### **METHODS AND MATERIALS**

Between March 2015 and December 2022, 946 consecutive patients were performed resting and stressed NH3-PET because of known or suspected IHD. Patients who underwent NH3-PET before and after CABG (mean interval, 6 months) were enrolled. Patients with a transplanted heart, congenital heart disease, adenosine ineffectiveness, or poor imaging were excluded. LVMS was assessed by a feature-tracking technique on the NH3-PET cine images of horizontal long-axis slices, and the LVMS ratio (LVMSR) was defined as LVMS at stress divided by that at rest. MFR was calculated using a two-compartment model of the time concentration curve for the first two minutes after ammonia injection. LVMSR and MFR before and after CABG were compared by paired t-test. 11 patients who underwent NH3-PET before and after percutaneous coronary intervention (PCI) were analyzed as a comparison group.

## **RESULTS**

16 patients who underwent CABG were retrospectively analyzed. LVMSR in the CABG group showed significant improvement with invasive treatment ( $0.99 \pm 0.13$  vs.  $1.15 \pm 0.21$ ,  $p=0.0013$ ). Global MFR increased significantly from baseline to post CABG ( $1.49 \pm 0.42$  vs.  $1.91 \pm 0.51$ ,  $p<0.0001$ ). On the other hand, there was no significant difference in LVMSR before and after PCI ( $1.01 \pm 0.14$  vs.  $1.00 \pm 0.11$ ,  $p=0.87$ ). No significant improvements in global MFR ( $1.83 \pm 0.65$  vs.  $2.12 \pm 0.77$ ,  $p=0.16$ ) were observed in the PCI group.

## **CONCLUSION**

s CABG transiently improves myocardial strain and MFR significantly. The effect is more pronounced than PCI.

## **CLINICAL RELEVANCE/APPLICATION**

This method can reproducibly assess local function before and after revascularization. Furthermore, it has the advantage of detecting ischemia-related wall motion abnormalities, whereas previously only ischemia was evaluated.

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## Abstract Archives of the RSNA, 2023

M2-SPNPM

### Noninterpretive Skills (Beyond Imaging) Monday Poster Discussions

#### Sub-Events

#### M2-SPNPM- **Racial and Ethnic Disparities Among Participants in Uterine Leiomyomas Clinical Studies Evaluating Uterine Fibroid Embolization: A Literature Review** 1

##### PURPOSE

Given the existing racial disparities in utilization of uterine fibroid embolization (UFE) amongst Black and Hispanic women in comparison to surgical intervention, the purpose of this study is to assess the extent of racial and ethnic representation in completed clinical trials for UFE in the United States and to identify specific areas for improvement regarding disparities in fibroid research and care.

##### METHODS AND MATERIALS

A search of PubMed, Embase, and the clinicaltrials.gov database was conducted to identify completed studies on UFE in the US, and information on the number of participants and distribution for each racial and ethnic group (based on OMB definition) was collected.

##### RESULTS

: A total of 20 completed studies were identified, 7 reported race characteristics and 6 reported ethnic characteristics. Two studies compared UFE vs. myomectomy and two compared Embosphere® Microspheres and Embosphere®; particles. White participants were overrepresented in UFE, while in myomectomies predominated black participants. Hispanic or Latino participants were particularly underrepresented in the studies.

##### CONCLUSION

s This study demonstrated the need for race and ethnicity reporting in the scientific literature, racial and ethnic minorities are underrepresented in clinical trials for UFE, indicating potential disparities in access to treatment. The lack of diversity in clinical trial participants may limit the generalizability of study results and perpetuate health inequities. Future efforts should focus on increasing diversity and similar representation in clinical trial participation to ensure that all patients have access to safe and effective treatments for uterine fibroids.

##### CLINICAL RELEVANCE/APPLICATION

It has been demonstrated that UFE has numerous benefits when compared to surgical treatment of fibroids, such as shorter hospital stays and quicker recovery times. Despite this, certain minority groups in the US have yet to fully reap these benefits in comparison to their white counterparts. Black and Hispanic women are both more likely to undergo surgical care, such as hysterectomy, for fibroid treatment. These disparities, combined with the greater number and size of fibroids observed in Black women, lead to health equity concerns. Identifying specific pitfalls in equitable clinical trial design for this condition is critical in the setting of known disparities so that we may enact targeted improvement initiatives.

#### M2-SPNPM- **Radiology Practice Size Distribution Pre- and Post-COVID-19 Pandemic** 2

##### PURPOSE

Prior investigations by Rosenkrantz et. al in 2019 have demonstrated a trend of consolidation of radiology groups in the mid-2010s. However, little is known about changes in radiology practice group size and numbers spanning the COVID-19 pandemic. This study seeks to investigate consolidation trends within radiology practice groups before and after the COVID-19 pandemic.

##### METHODS AND MATERIALS

Data on radiologists and their associated practice affiliations were obtained for 2017 and early 2023 from the Physician Compare national database provided by the Centers for Medicare and Medicaid Services. Calculations of unique radiology practice groups and number of unique associated national provider identifier (NPI) numbers associated with each radiology group were performed using R 4.2.2.

##### RESULTS

The number of unique radiologists nationally increased between 2017 and 2023 from 32060 to 34080. Between 2017 and 2023, the number of radiology practices decreased from 3909 to 3455 unique practice entities. The median number of radiologists per practice remained 6 between 2017 and 2023, but the mean practice size increased from 13.9 to 19.0 unique radiologists, indicating a growing skew towards larger groups. The top 10 groups by size increased from including 2411 unique radiologists in 2017 to 3554 unique radiologists in 2023. The top 10 groups by size in 2023 include 3 groups not previously within the top 100 groups by size; the top ranked group by size in 2023 ranked 39th in size in 2017. The number of unique NPI-Practice group pairs has increased from 54,274 in 2017 to 65,664 in 2023; the average radiologist increased billing from under an average of 1.69 to 1.93 distinct practice entities from 2017 to 2023. Analysis by group size demonstrates relative growth in number of radiology practices with >25 radiologists, with a 119% relative increase in number of groups with 100+ radiologists. Geographic analysis demonstrates a relative increase of proportion of groups located within the western census region of approximately 10%, with relative decreases in the



remaining regions.

## CONCLUSION

s Consolidation of radiology practice groups has continued through the COVID-19 pandemic from 2017 to 2023, with fewer unique practices and higher average number of radiologists per practice. The greatest growth is seen among practices with 100+ radiologists, highlighting the high degree of consolidation in recent years among the largest groups in the US. At least some of this consolidation appears to be due to greater number of distinct practice entities under which radiologists are billing.

## CLINICAL RELEVANCE/APPLICATION

Increasing consolidation of radiology practices was seen between 2017 and early 2023, with the largest growth seen in practices with 100 or more radiologists.

## M2-SPNPM- Reducing Energy Consumption in MRI using Shorter Scan Protocols, Optimized Magnet Cooling Patterns and Deep Learning Sequences: How Low Can We Go

Participants

Saif Afat, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

This study aimed to investigate energy consumption in MRI scanners and identify strategies for improving energy efficiency in radiology departments and practices. We focused on musculoskeletal MRI and assessed the potential savings achievable through optimizing protocols, incorporating deep learning (DL) accelerated acquisitions, and optimizing the cooling system.

## METHODS AND MATERIALS

Energy consumption measurements were performed on three MRI scanners (1.5T Aera, 1.5T Sola, 3T Skyra) in practices in Munich, Germany, between December 2022 and March 2023. Two levels of energy reduction measures, eco protocols and DL accelerated sequences, were implemented and compared to baseline. Analysis was conducted in R and Python to evaluate the average, median, and standard deviations of sequence scan times and energy consumption.

## RESULTS

Our findings showed significant energy savings by optimizing protocol settings alone, with knee imaging achieving a 21% energy consumption reduction and 22% time reduction. Implementing DL technologies led to a 37% energy consumption reduction and a 46% time reduction compared to baseline. Optimizing the magnet cooling strategy resulted in a 23.2% reduction during off-cycles.

## CONCLUSION

s Implementing energy-saving strategies, including eco protocols, DL accelerated sequences, and optimized magnet cooling, can significantly reduce energy consumption in MRI scanners without compromising image quality or operational efficiency. Radiology departments and practices should consider adopting these strategies to improve energy efficiency and reduce costs.

## CLINICAL RELEVANCE/APPLICATION

Reducing energy consumption in MRI scanners has environmental, financial, and operational implications for radiology departments and practices. Implementing energy-saving strategies can help address the growing demand for medical devices while reducing energy costs and greenhouse gas emissions.

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## Abstract Archives of the RSNA, 2023

M2-SPNR

### Neuroradiology Monday Poster Discussions

#### Sub-Events

#### **M2-SPNR-1 Multiscale Principal Gradient Alterations in Subcortical-Cortical Connectome as Potential Biomarkers for Memory Impairments in Major Depressive Disorder**

##### Participants

Qian Zhang, Chengdu, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Major depressive disorder (MDD) is associated with functional abnormalities in subcortical networks, which contribute to clinical symptoms and cognitive impairments. This study introduces a new approach, functional gradient mapping, to identify hierarchical organization in subcortical connectivity patterns and evaluate their relationship with cognitive features.

##### METHODS AND MATERIALS

Resting-state fMRI studies were conducted on 145 never-treated first-episode MDD patients and 145 healthy controls (HCs). The voxel-wise gradient distributions of the subcortical-cortical connectome were mapped, and group-averaged gradient values were compared across all subcortical voxels, three main systems (limbic, thalamic, and basal ganglia), structural subregions, and functional subregions related to specific cortical functional networks. The study also assessed the association between significant gradient alterations and neuropsychological functioning.

##### RESULTS

The principal gradient values were organized along a gradual anterior-posterior axis across subcortical structures in MDD patients, which varied across different subcortical systems and subregions relative to HCs. At the system level, principal gradient values were lower in the thalamic and limbic systems but higher in the basal ganglia (BG) striatal system in the MDD group. Within subcortical functional subfields, MDD patients had lower gradient values in all limbic subregions and higher gradient values in thalamic subregions projecting to the frontoparietal network but lower values in other thalamic-subregions. Higher gradient values were observed in BG subregions projecting to FPN and visual networks, but lower gradient values were observed in BG regions projecting to sensorimotor, default mode (DMN), and ventral attention network (VAN). Notably, altered principal gradient values of the thalamic system and the subregion projecting to DMN were positively associated with episodic memory test performance in MDD patients, while the BG region projecting to VAN was negatively linked.

##### CONCLUSION

s Multiscale principal gradient alterations of the subcortical-cortical connectome reflected hierarchical disorganization underlying functional segregation in MDD. The interactive associations of thalamic and BG gradient alterations were implicated in subcortical functional connectivity disturbance and episodic memory impairments in MDD patients, revealing an internally differentiated and clinically relevant pattern of subcortical gradient dysfunction in MDD.

##### CLINICAL RELEVANCE/APPLICATION

These findings enhanced our understanding of MDD-related hierarchical pathology and presented potential intervention biomarkers for memory improvements in MDD.

#### **M2-SPNR-10 Volume Reduction in Hippocampal Subregions is Associated with Cognitive Impairment in Patients with Cerebral Small Vessel Disease**

##### Participants

Na Wang, Jinan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Cerebral small vessel disease (CSVD) is a chronic disease that can lead to mental and psychiatric impairment. As a key brain region for memory and learning, the volume change in the hippocampus may play an important role in cognitive impairment in patients with CSVD, but the specific mechanism is still unknown. The purpose of this article is to compare the volume changes in hippocampal subregions in patients with severe CSVD (CSVD-S), patients with mild CSVD (CSVD-M) and healthy controls (HCs) to investigate the influencing factors of cognitive differences in patients with CSVD.

##### METHODS AND MATERIALS

Sixty-seven CSVD-S patients, 150 CSVD-M patients and 98 healthy controls underwent magnetic resonance imaging (MRI) and cognitive tests. FreeSurfer was used to automatically segment the hippocampus from high-resolution MRI and extract the volume data of 19 subregions. One-way analysis of variance was used to compare the volume differences in hippocampal subregions among the three groups, and the correlation between regions of interest (ROIs) and cognitive test results in the CSVD groups was analyzed. In addition, stepwise regression analysis was performed to correlate the ROIs with multiple risk factors in the CSVD groups.

## RESULTS

We found significant differences in the volumes of the presubiculum-body, head of granule cell and molecular layer of the dentate gyrus (GC-ML-DG-head), fimbria and hippocampus amygdala transition area (HATA) among the three groups ( $p < 0.003$ , Bonferroni correction), and the volumes of the CSVD-S group were significantly smaller than those of the HC group ( $p < 0.003$ ). Bivariate correlation analysis showed that these four subregions were correlated with the Stroop color-word test (SCWT), and the GC-ML-DG-head and fimbria were also correlated with the Montreal cognitive assessment (MoCA) ( $p < 0.013$ ) in the CSVD groups. Influencing factors of the four subregions included age, gender, smoking, hyperlipidemia and hypertension. Mediation analysis showed that the average volume of the 4 ROIs partially mediated the relationship between drinking and SCWT scores.

## CONCLUSION

The volume reduction of some hippocampal subregions can aggravate cognitive impairment in patients with CSVD, and the decreased volume of hippocampal subregions was associated with age, gender, smoking, hyperlipidemia and hypertension. The volume of 4 ROIs mediates cognitive function in CSVD patients with drinking.

## CLINICAL RELEVANCE/APPLICATION

Maintaining good living habits and paying more attention to blood pressure and blood lipids can help to reduce the cognitive impairment caused by CSVD.

## M2-SPNR-11 Regional High Iron Deposition on Brain Quantitative Susceptibility Mapping Correlates with Decreased Cognitive Function in End Stage Renal Disease

Participants  
Yuan Li, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

The end-stage renal disease (ESRD) patients usually have increased brain iron depositions. This study aimed to quantitatively evaluate the brain iron deposition in patients with ESRD by threshold method of quantitative susceptibility mapping (QSM), and to analyze the correlation between the iron deposition and cognitive function.

## METHODS AND MATERIALS

Thirty-four ESRD patients and 45 healthy controls (HCs) were prospectively recruited. All subjects were scanned using a 3T MRI to acquire strategically acquired gradient echo (STAGE) sequence. The mean magnetic sensitivity values (MSV) and volume (MSVM, VM) and high iron region (MSVH, VH) of bilateral caudate nucleus (CN), putamen (PUT), globus pallidus (GP), substantia nigra (SN), red nucleus (RN) and dentate nucleus (DN) in both groups were measured manually (Figure 1). All QSM data was compared between groups using analysis of covariance. Neuropsychological examination results were compared between the two groups by two-sample t tests or Mann-Whitney U tests. Partial correlation analysis was used to assess correlations between the MSVH, VH/VM data and cognitive test scores in the ESRD group, with gender, age and education level as covariates. Multiple comparisons of all statistical values were corrected by false discovery rate (FDR). A statistically significant P-value was set at 0.05.

## RESULTS

Compared with HCs, the MSVM of bilateral PUT, DN and right RN were decreased (Table 1), the VM of all gray matter nuclei were decreased, and the MSVH and VH/VM of bilateral CN, PUT, DN and right SN were increased in ESRD patients ( $P < 0.05$ , FDR corrected)(Figure 2). Patients with ESRD had lower MoCA and DSST scores but higher TMT-A, TMT-B, HAMA, HAMD and BDI-II scores (Table 2). The partial correlation analysis showed that the MSVH of the bilateral RN was negatively correlated with orientation scores (left:  $P = 0.002$ ,  $r = -0.568$ ; right:  $P < 0.001$ ,  $r = -0.651$ )(Figure 3).

## CONCLUSION

The iron deposition of gray matter nuclei increased as well as volume decreased in ESRD patients. The MSV in high iron areas can better assess the distribution of iron and is related to the cognitive dysfunction.

## CLINICAL RELEVANCE/APPLICATION

Previous studies were based on the mean MSV of gray matter nuclei in ESRD patients, but since the distribution of iron is uneven, we further divided the gray matter nuclei into high iron area according to the threshold, which can sensitively reflect the abnormal distribution of brain iron and cognitive impairment.

## M2-SPNR-12 Cerebral Blood Flow Changes in Patients with End Stage Renal Disease: A Study Based on Pseudo-continuous Arterial Spin Labeling

Participants  
Yuan Li, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

Patients with end-stage renal disease (ESRD) lead to cerebral hemodynamic instability. This study aimed to quantitatively evaluate the cerebral blood flow (CBF) alteration in patients with ESRD and to analyze the correlation between the CBF with cognitive and clinical indicators.

## METHODS AND MATERIALS

Thirty-five ESRD patients and 46 healthy controls (HCs) were prospectively recruited. All subjects were scanned using a 3T MRI to acquire pseudo-continuous arterial spin labeling (pCASL) sequence. The relative values of cerebral blood flow (rCBF) of the whole brain was measured using SPM8. All CBF data was compared between groups using analysis of covariance. Neuropsychological examination scores and laboratory indexes were compared between the two groups by two-sample t tests or Mann-Whitney U tests. Partial correlation analysis was used to assess correlations between the CBF data, cognitive test scores and blood biochemical test in the ESRD group, with gender, age and education level as covariates. A statistically significant P-value was set at 0.05.

## RESULTS

Compared with the HCs, the ESRD group exhibited lower rCBF in the bilateral thalamus and putamen (Figure 1, Table 1)( $P < 0.05$ , FDR corrected). There were significant differences in the levels of RBC, HB, Cre, eGFR, UA and HCY between the two groups (all  $P < 0.05$ ). Patients with ESRD had lower MoCA and DSST scores but higher TMT-A, HAMA, HAMD and BDI-II scores (Table 3). The partial correlation analysis showed that the rCBF of the bilateral thalamus were positively correlated with HCY (left:  $P = 0.010$ ,  $r = 0.449$ ; right:  $P = 0.005$ ,  $r = 0.486$ ), the rCBF of the left putamen was negatively correlated with the MoCA scores ( $P = 0.010$ ,  $r = -0.447$ ), the rCBF of the right thalamus was negatively correlated with the orientation scores ( $P = 0.016$ ,  $r = -0.421$ ), the rCBF of the left putamen was negatively correlated with the delayed recall scores ( $P = 0.002$ ,  $r = -0.528$ ), and the right putamen was negatively correlated with the attention scores ( $P = 0.047$ ,  $r = -0.353$ )(Figure 2).

## CONCLUSION

The cerebral blood flow in bilateral putamen and thalamus decreased in patients with ESRD, which correlated with HCY level and neurocognitive scores.

## CLINICAL RELEVANCE/APPLICATION

Patients with ESRD have cerebral hemodynamic imbalances and may suffer from a range of complications. So we used arterial-spin labeling MR imaging to non-invasively and quantitatively evaluate cerebral blood flow changes in patients with ESRD, and analysis the correlation between these changes and cognitive impairment.

## M2-SPNR-13 Visceral Abdominal Adipose Tissue and Insulin Resistance Respectively Influence Alzheimer's Disease Amyloid Pathology and Neurodegeneration in Midlife

Participants

Mahsa Dolatshahi, MD, MPH, Khorram Abad, Iran, Islamic Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Obesity and adiposity at midlife, evidenced by high body mass index (BMI), are increasingly understood as risk factors for Alzheimer's disease (AD). Importantly, visceral fat is known to be associated with insulin resistance and a proinflammatory state, the mechanisms involved in AD pathology. Herein, we aimed to assess the association between brain MRI volumes as well as amyloid and tau uptake with obesity, insulin resistance, and abdominal adipose tissue in the cognitively normal midlife population.

## METHODS AND MATERIALS

A total of 34 middle-aged (age:  $51.27 \pm 6.12$  years, BMI:  $32.28 \pm 6.39$  kg/m<sup>2</sup>), cognitively normal participants, underwent bloodwork, brain, and abdominal MRI, as well as amyloid and tau PET scan. Homeostatic Model Assessment for Insulin Resistance (HOMAIR)  $> 1.9$  was used as a measure of insulin resistance. Visceral and subcutaneous adipose tissue (VAT, SAT) were semi-automatically segmented using VOxel Analysis Suite (Voxa). FreeSurfer 7.1.1 was used for the automatic segmentation of cortical and subcortical brain regions using a probabilistic atlas. Dynamic amyloid imaging was performed with a bolus injection of  $\sim 15$  mCi of [<sup>11</sup>C]PiB, followed by a 60-min scan. A single intravenous bolus of between 7.2-10.8 mCi of AV-1451 was administered. Data from the 30-60 minute, and 80-100 minute post-injection window for PiB and AV-1451 were used for the analysis, respectively. The association of brain volumes and PiB and AV-1451 standardized uptake value ratios (SUVRs) within the default mode network areas with BMI and VAT/SAT ratio were assessed using linear regression models.

## RESULTS

We observed lower right entorhinal white matter volumes in obese participants with insulin resistance compared to metabolically normal non-obese group ( $p=0.004$ ), without any significant difference in PiB or AV-1451 SUVrs. Regression models with sex, age and education as covariates showed a significant positive association between VAT/SAT ratio and left precuneus white matter PiB SUVrs ( $R^2=0.31$ ,  $p=0.005$ ), but no significant associations with AV-1451 SUVrs.

## CONCLUSION

In our midlife obese sample with insulin resistance, there was lower right entorhinal white matter volume, which is involved in relaying information to the hippocampus. We also demonstrated higher early amyloid pathology in AD-signature areas such as the precuneus in mid-life persons with high VAT/SAT ratio, a marker of visceral obesity.

## CLINICAL RELEVANCE/APPLICATION

These findings prompt designing interventions targeted at reducing abdominal visceral fat, obesity, and insulin resistance in midlife to prevent against Alzheimer disease pathology and neurodegeneration.

## M2-SPNR-14 Utility of Quantifying the Glymphatic System Activity using Diffusion Tensor Image Analysis Along the Perivascular Space (DTI-ALPS) in Mild Cognitive Impairment (MCI), Compared to the Cerebrospinal Fluid (CSF) Biomarker

Participants

Hiroto Takahashi, MD, Suita, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Identifying early Alzheimer's disease (AD) would offer better disease management. The cerebrospinal fluid (CSF) biomarker is sensitive to neurodegeneration in dementia. Dysfunction of the glymphatic system has been revealed to be associated with various diseases including AD. We evaluated the activity of the glymphatic system in mild cognitive impairment (MCI) with a diffusion-based technique called diffusion tensor image analysis along the perivascular space (DTI-ALPS) to explore the imaging biomarker for assessing early dementia, while comparing the CSF biomarker level.

## METHODS AND MATERIALS

Sixty-two patients with MCI underwent both CSF measurement and diffusion magnetic resonance imaging at 3T. No hyperintensities in the periventricular white matter were observed in all subjects on T2-weighted images. Based on the CSF p-tau/A $\beta$ 42 ratio value, 33 patients with AD pathology (AD group) were discriminated from 29 patients with non-AD pathology (non-AD group). Diffusivities in the X, Y and Z axes were obtained in the lateral ventricle body plane of all subjects. We assessed the diffusivity along the perivascular spaces, as well as projection fibers and association fibers, respectively in order to acquire the DTI-ALPS index of each hemisphere. The significance of intergroup difference in the DTI-ALPS index was tested using Mann-Whitney's U test. The

performance of the DTI-ALPS index to discriminate the groups was assessed using receiver operating characteristic (ROC) analysis. Correlations between the DTI-ALPS index and each CSF amyloid  $\beta$  (A $\beta$ ) 42, phosphorylated tau (p-tau) and total tau (t-tau) value were assessed in all subjects using Pearson's correlation analysis.

## RESULTS

The DTI-ALPS indices of both hemispheres were higher in the AD group than those of the non-AD group (Right: 1.72/1.59 for AD group/non-AD group; P value was 0.056; Left: 1.61/1.44 for AD group/non-AD group; P value was 0.002, indicating significant intergroup difference). The respective areas under the ROC curve of the DTI-ALPS index of the right/left hemispheres were 0.64/0.73. The DTI-ALPS indices of both hemispheres showed significant correlation with each p-tau value ( $r$ : 0.26/0.28 for right/left) and t-tau value ( $r$ : 0.28/0.31 for right/left), whereas no significant correlation with the CSF A $\beta$  42 value was identified, in all subjects.

## CONCLUSION

Impairment of the glymphatic system was more observed in non-AD pathology than in AD pathology in MCI. The DTI-ALPS index might be useful for discriminating early AD from other dementias as well as for measuring neurodegeneration in MCI.

## CLINICAL RELEVANCE/APPLICATION

Quantifying the activity of the glymphatic system may be a useful biomarker for diagnosing early AD as well as for measuring neurodegeneration in early dementia.

## M2-SPNR-2 Glymphatic System Dysfunction in the Middle-aged and Elderly Chronic Insomnia Patients Evidenced by DTI-ALPS

### PURPOSE

The glymphatic system in the brain, is a highly organized fluid transport pathway for clearing metabolic waste, and this process mainly increases during sleep. Chronic insomnia might result in glymphatic dysfunction and cognitive impairment. The diffusion tensor image analysis along the perivascular space (DTI-ALPS) offers an opportunity for the noninvasive investigation of the glymphatic system in many diseases. Thus, this study focuses on middle-aged and elderly subjects to explore whether DTI-ALPS could be valuable early markers to identify cognitive decline in chronic insomnia, which would be helpful to prevent the progression of cognitive impairment and highlight the importance of early treatment.

### METHODS AND MATERIALS

This study was approved by the institutional ethics committee. We prospectively enrolled 33 patients with chronic insomnia and 20 healthy controls. All participants underwent DTI MRI on a same 3T MRI scanner using 24-channel standard head coil (Ingenia DNA, Philips Medical Systems, Netherlands). DTI was conducted with main parameters as follows: TR/TE = 4472/90 ms, flip angle = 90°, matrix = 240×240, reconstructed voxel size = 2×2×2 mm<sup>3</sup>, 64 noncollinear directions with b value = 1000 s/mm<sup>2</sup>, and acquisition time = 5 minutes. The DTI-ALPS index was calculated from the images (Figure 1). Pearson correlation was used to test the associations between DTI-ALPS with MMSE score. The diagnostic accuracy of DTI-ALPS was evaluated using ROC curve analysis.

### RESULTS

The DTI-ALPS index in chronic insomnia with impaired cognition was significantly lower than that in chronic insomnia with normal cognition and healthy controls (Table 1, Figure 2). Furthermore, the DTI-ALPS index was significantly positively correlated with the MMSE score in chronic insomnia with impaired cognition group ( $r=0.69$ ,  $p=0.002$ , Figure 3). Our results of ROC analysis showed that the DTI-ALPS could distinguish chronic insomnia with impaired cognition group, from normal cognition group with accuracy (area under the curve [AUC]: 0.81, sensitivity: 82.4%, specificity 68.7% (Figure 4).

### CONCLUSION

Our results indicated that non-invasive DTI-ALPS index may be a useful imaging tool to predict cognitive impairment in middle-aged and elderly patients with chronic insomnia. Glymphatic clearance function might play a role in the development of cognitive decline patients in preclinical stage, and it is meaningful to take some measures to prevent disease progression.

### CLINICAL RELEVANCE/APPLICATION

This non-invasive DTI-ALPS index may be a useful imaging marker to predict cognitive impairment in patients with chronic insomnia, and it might be meaningful to use as a reminder to take some measures to prevent disease progression.

## M2-SPNR-3 Evaluate Depression in Parkinson's Disease with a Multi-Flip-Angle and Multi-Echo Gradient Echo Sequence (Multiplex) MRI

### Participants

He Sui, MD, MD, Changchun, China (*Presenter*) Nothing to Disclose

### PURPOSE

Previous multimodal MRI has proven to be a useful imaging approach for both clinical diagnosis and research investigating, however, studies of Parkinson's disease (PD) have focused primarily on motor-related basal ganglia structures and little research has been done on clinical scale indicators. In this experiment, we used multiparametric MRI to detect changes related to non-motor symptoms (NMS) in patients with PD.

### METHODS AND MATERIALS

We included 37 patients with PD diagnosed by two neurologists from August to December 2021 in our hospital in this retrospective study. Hamilton Depression Scale (HAM-D) were used to assess the PD patients. 3D TIWI and Multi-Flip-Angle and Multi-Echo Gradient Echo Sequence (Multiplex) MRI techniques such as T2\*-w, T1-w, PD-mapping and quantitative susceptibility mapping (QSM) were performed using a 3T MR scanner. The regions of interest of the whole brain were depicted according to automatic brain segmentation based on deep learning. The Spearman's rank correlation coefficient was used to analyze the relationship between volume, relaxation value of each brain subregion and NMS related assessment scales

### RESULTS

Among parkinsonian subjects, we found that left paracentral, precuneus on both sides, and right superior temporal gyrus in MTP-QSM, right frontal pole and left lateral occipital gyrus on MTP-T2\* mapping showed correlations with HAMD. Volume of the left superior frontal gyrus, middle frontal gyrus on both sides, left frontal pole, insula on both sides, right middle cingulate gyrus, right entorhinal cortex, right superior temporal gyrus, right middle temporal gyrus and optic chiasm showed negative correlations with HAMD on 3D TIWI images. The indicators in MTP-T1 mapping and PD mapping do not have a clear correlation with HAMD.

## CONCLUSION

There is a certain degree of correlation between Multiplex MRI and some clinical evaluation indicators related to depression of PD, we suggest the fusion of quantitative multiparametric neuroimaging measures as an effective strategy that could generally cope with early diagnosis of PD.

## CLINICAL RELEVANCE/APPLICATION

Quantitative multiparametric neuroimaging measures may serve as an effective strategy for non-invasively characterizing the Parkinson's disease.

## M2-SPNR-4 The Impact of Amyloid Cerebral Small Vascular Disease on Glymphatic Function: A Study Based on Alzheimer's Disease Continuum Participants

### PURPOSE

Glymphatic dysfunction is a crucial pathway for dementia. Alzheimer's Disease (AD) pathologies co-existing with cerebral small vessel disease (CSVD) is the most common pathogenesis for dementia. We hypothesize that AD pathologies and CSVD could be associated with glymphatic dysfunction, contributing to cognitive impairment.

### METHODS AND MATERIALS

Participants completed with amyloid PET, diffusion tensor imaging (DTI) and T2FLAIR sequences were included from the Alzheimer's Disease Neuroimaging Initiative (ADNI). White matter hyperintensities (WMH) as the most common CSVD marker was evaluated from T2FLAIR images and represented the burden of CSVD, amyloid PET was used to assess A $\beta$  aggregation in the brain, and DTI-ALPS calculated from DTI reflected glymphatic function. We used correlation analysis to investigate the relationship between WMH burden/A $\beta$  aggregation and DTI-ALPS and the correlations of DTI-ALPS with cognitive domains. Next, mediation analysis was carried out to explore the mediating effects of DTI-ALPS between WMH burden/ A $\beta$  aggregation and cognitive domains.

### RESULTS

One hundred and thirty-three participants along the AD continuum were included, consisting of 40 CN-, 48 CN+, 26 MCI+, and 19 AD + participants. We found both WMH burden ( $r = -0.432$ ,  $p < 0.001$ ) and whole brain A $\beta$  aggregation ( $r = -0.268$ ,  $p = 0.003$ ) were independently negatively associated with DTI-ALPS. There were no interaction effects of A $\beta$  aggregation and WMH burden on DTI-ALPS ( $\beta = 0.109$ ,  $p = 0.260$ ). DTI-ALPS was positively associated with memory ( $r = 0.470$ ,  $p < 0.001$ ), executive function ( $r = 0.356$ ,  $p < 0.001$ ), visual-spatial function ( $r = 0.241$ ,  $p < 0.040$ ), and language performance ( $r = 0.391$ ,  $p = 0.007$ ). In the mediation analysis, we found that DTI-ALPS mediated the relationship of WMH burden/A $\beta$  with memory, executive and language performance.

### CONCLUSION

Our study provided evidence that both AD pathology (A $\beta$ ) and CSVD were associated with glymphatic dysfunction, which is further related to cognitive impairment.

### CLINICAL RELEVANCE/APPLICATION

Our results may provide a theoretical basis for glymphatic function intervention for treating AD.

## M2-SPNR-5 Discordant Hippocampal Atrophy and Cerebral Hypometabolism in Alzheimer's Disease Subjects with Confirmed $\beta$ amyloid Positivity

### PURPOSE

Hippocampal atrophy on MRI and cerebral hypometabolism on FDG-PET are both widely used biomarkers of Alzheimer's disease (AD). Clinically, hippocampal volumes and FDG-avidity are assessed in comparison to age-matched reference groups, but accuracy of such methods have largely been tested in cohorts without biomarker-confirmed AD. Here, we examined the accuracy of MRI and FDG-PET in amyloid-positive AD, at the single-subject level, and factors that could be associated with structural-metabolic discordance.

### METHODS AND MATERIALS

We included 108 subjects with AD (age 74.5 $\pm$  8.2 years, 59:49 males: females) from the Alzheimer's Disease Neuroimaging Initiative (ADNI), with a positive 18F-florbetapir amyloid PET scan, who underwent FDG-PET and volumetric MRI. 179 amyloid-negative, normal controls (age 75.1 $\pm$  6.9 years, 97:82 males:females) served as the age-matched reference group. Bilateral hippocampal volumes were segmented using Freesurfer v7.1.1, averaged, and normalized by intracranial volume. The same Freesurfer regions were applied to the coregistered FDG-PET and normalized by the pons. A threshold of 1.5 standard deviations below the reference group defined biomarker abnormality (e.g. presence of hippocampal atrophy or cerebral hypometabolism). Two-by-two contingency tables were used to assess concordance/discordance between hippocampal atrophy and hypometabolism. Statistical analyses were performed in STATA 16, and group differences were assessed using the Kruskal-Wallis or Fisher's Exact Tests.

### RESULTS

Hippocampal atrophy correctly classified 40/108 (37%) subjects as AD, whereas precuneus cerebral hypometabolism correctly classified 51/108 (47%) subjects. Structural-metabolic discordance was seen in 47/108 (44%) subjects. Individuals with higher Fazekas scores were less likely to have hippocampal atrophy (OR 0.56,  $p = 0.015$ ) or cerebral hypometabolism (OR 0.62,  $p = 0.04$ ). Older individuals were less likely to have cerebral hypometabolism (OR 0.93,  $p = 0.007$ ). Some subjects without a typical pattern of temporoparietal hypometabolism had significantly decreased FDG avidity in the caudate (5/108) and thalamus (3/108).

### CONCLUSION

Cerebral hypometabolism on FDG-PET and hippocampal atrophy on MRI each detected less than half of the amyloid-confirmed AD

subjects. Discordance was high, suggesting that other factors, including age and microvascular disease, could affect the sensitivity of these biomarkers. Notably, the caudate and thalamus were atypical areas of hypometabolism that warrant further investigation.

#### **CLINICAL RELEVANCE/APPLICATION**

Knowing the limitations of clinically used quantitative AD biomarkers is important for appropriate management.

### **M2-SPNR-6 Defining the Relationship Between Mesial Temporal Atrophy and CSF Biomarkers in Amnesic Mild Cognitive Impairment**

#### **PURPOSE**

The NIA-AA research framework introduced a classification scheme to define and stage the pathologic processes leading to Alzheimer's disease (AD) using three groups of biomarkers: biomarkers of  $\beta$ -amyloid deposition, neurofibrillary tangles deposition, and neurodegeneration. Our aim was to evaluate the differences in mesial temporal atrophy rate among amnesic mild cognitive impairment (MCI) patients with normal CSF biomarkers, CSF biomarkers indicating abnormal  $\beta$ -amyloid deposition (A+), and abnormal CSF biomarkers without  $\beta$ -amyloid deposition.

#### **METHODS AND MATERIALS**

We retrospectively identified 401 elderly patients from the Alzheimer's Disease Neuroimaging Initiative cohort, 243 with a diagnosis of amnesic MCI and 158 cognitively unimpaired (CU). MCI patients were classified into three groups: normal biomarkers (n = 46), Alzheimer's continuum (A+, n = 144), and non-AD pathologic change (all other biomarker profiles, n = 53). Hippocampal (HV) and entorhinal cortex (ERCV) volumes were calculated from brain MRI obtained during the first and second year of study participation. We then evaluated group differences over time using mixed model Analysis of Covariance procedures. Results were considered statistically significant when  $p < 0.05$ .

#### **RESULTS**

HV and ERCV atrophy rates differed among groups of subjects when controlling for age (HV:  $F = 20.45$ ,  $p < 0.001$ ; ERCV:  $F = 11.86$ ,  $p < 0.001$ ). HV atrophy rate was greatest in the MCI A+ group than all other groups. Worse ERCV atrophy rates were observed in the MCI A+ group than CU elderly individuals and MCI subjects with non-AD pathologic change.

#### **CONCLUSION**

Mesial temporal atrophy rate is worse in MCI subjects with abnormal  $\beta$ -amyloid deposition (A+) than other MCI individuals.

#### **CLINICAL RELEVANCE/APPLICATION**

Understanding structural brain differences among patients with different biomarker profiles will enhance the design of clinical trials targeting MCI subjects, especially when MRI markers of neurodegeneration are employed as endpoint.

### **M2-SPNR-7 PET-based A $\beta$ Quantification and Volumetric Comparisons in A $\beta$ classified Patients**

Participants

Priya Santhanam, PhD, Olney, MD (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study aims to identify associations between PET-based quantification of amyloid- $\beta$  (A $\beta$ ) and MR brain volumetrics in patients with or without radiological presence of A $\beta$  plaques.

#### **METHODS AND MATERIALS**

Patients (n=164; mean age=75.1 years) who were clinically identified as having mild cognitive impairment (MCI) and/or Alzheimer's dementia underwent 3T MRI anatomical imaging and PET CT imaging using A $\beta$  binding tracers Amyvid or Vizamy. Neuroradiologist interpretation of PET-imaging allowed patients to be classified as positive (n=89; A $\beta$ +) or negative (n=75; A $\beta$ -) for A $\beta$  presence. NeuroQuant (v3.0) was used to obtain normalized percentile volumes in regions of interest for this patient population (based on previous findings), which were then compared between A $\beta$ + and A $\beta$ - groups. Quantified A $\beta$  tracer in these same regions acquired through newly-available PETQuant (3.0.2) software was also compared between groups. Finally, the statistical association between volumetrics and PET A $\beta$  quantities within regions was assessed via regression modeling.

#### **RESULTS**

PET-based A $\beta$  quantities were significantly higher in A $\beta$ + patients for bilateral amygdala ( $p < 0.001$ ), entorhinal cortex ( $p < 0.001$ ), hippocampus (left:  $p = 0.001$ , right:  $p = 0.002$ ), and parahippocampal regions ( $p < 0.001$ ) as compared to A $\beta$ - patients. Additionally, normalized percentile volumes were significantly lower in the A $\beta$ + group for bilateral amygdala (left:  $p = 0.001$ , right:  $p = 0.005$ ), left hippocampus ( $p = 0.009$ ), and bilateral parahippocampus (left:  $p = 0.003$ , right:  $p = 0.033$ ). A regression model further identified significant associations between A $\beta$  quantity and volumetric percentile in the left entorhinal cortex ( $p = 0.005$ ), bilateral hippocampus (left:  $p = 0.009$ , right:  $p = 0.038$ ), and right parahippocampus ( $p = 0.046$ ).

#### **CONCLUSION**

Decreased volumes and increased A $\beta$  quantities in limbic regions were observed in patients with clinical A $\beta$  positivity. In combination, NeuroQuant and PETQuant metrics provide a useful supplement to radiological examination in patients with MCI or Alzheimer's dementia. Further analysis is needed to determine any predictive value for patient classification and outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

A $\beta$  classification in patients with MCI or Alzheimer's dementia can be further informed by quantified metrics of volume and A $\beta$  tracer quantities in limbic regions.

### **M2-SPNR-8 The Study of Total Load of Imaging Combined with Cognition on Cerebral Small Vessel Disease in High Altitude Areas**

Participants

Hai Hua Bao, Xining, China (*Presenter*) Nothing to Disclose

## PURPOSE

Cerebral small vessel disease (CSVD) is the most common cerebrovascular disease that can result in disability and cognitive decline in older adults. Owing to the unique environmental conditions, research on cerebral small vessel disease in high altitude areas is limited. The purpose of this study was to investigate whether altitude can affect cognitive function in patients with CSVD, and to evaluate the correlation between total imaging load and cognitive scores.

## METHODS AND MATERIALS

A total of 56 patients with CSVD who were admitted to the Department of Neurology of the Affiliated Hospital of Qinghai University were included in the study, according to the altitude, it is divided into middle altitude group (1500-2500 meters, n=30) and high altitude group (2500-4500 meters, n=26). Use Prisma 3.0 T magnetic resonance to perform head T1WI, T2WI, T2Flair, DWI, SWI and MRA scans, evaluate CSVD imaging markers and calculate the total load (0-4 points, the severity of the disease is proportional to the score). After the scan, the Cambridge Automated Neuropsychological Test Battery (CANTAB) was used to evaluate the cognitive abilities of all patients, including motor screening task (MOT), reaction time (RTI), rapid visual information processing (RVP), paired association learning (PAL), delayed matching to sample (DMS), spatial working memory (SWM), psychomotor speed, sustained attention, memory ability, and executive function were assessed separately. Data analysis was performed using SPSS 25.0 software.

## RESULTS

When the total load score was 0 or 1, The high altitude group performed poorly in the DMS test( $P=0.019$ ) and the RIT test( $P=0.024$ ); When the score was 2, there was statistically significant difference between the two groups in DMS ( $P=0.004$ ); when the score was 3 or 4, there was no statistical difference in the test results between the two groups ( $P>0.05$ ). The CSVD total load score was positively correlated with DMSMLAD, DMSMLS, and MOTML ( $r=0.614, 0.727, 0.448$ , all  $P<0.05$ )

## CONCLUSION

s With the increase in altitude, the memory ability and psychomotor speed of CSVD patients decreased more significantly. In addition, with the aggravation of CSVD, memory ability and psychomotor speed will also decrease.

## CLINICAL RELEVANCE/APPLICATION

Cognitive function decline is more serious in patients with cerebral small vessel disease at high altitude, and it is very important to strengthen early diagnosis and clinical intervention for patients in high altitude areas.

## M2-SPNR-9 Brain Cortical Complexity and Subcortical Morphometrics in T2D with Microvascular Complication

### PURPOSE

To explore the relationship between the change of cerebral gray matter volume and cognitive function in type 2 diabetes patients with microvascular complication (T2D-C), and to analyze how the change of cerebral gray matter volume and cognitive function are causal links through mediators.

### METHODS AND MATERIALS

39 normal controls, 39 type 2 diabetes patients without microvascular complication (T2D), and 39 T2D-C patients were recruited for 3D T1weighted imaging (3D T1WI) scanning and neuropsychological scale testing. Voxel-based morphology (VBM) was used to analyze and compare the differences in gray matter volume and neuropsychological scale among the three groups, then the mean gray matter volume of different brain regions between groups was used for partial correlation analysis with the scores of cognitive assessment scales such as Montreal cognitive assessment (MoCA) and biochemical indicators such as HbA1c.

### RESULTS

With  $p<0.05$  as the test level of statistical difference, the brain regions with the statistical difference in gray matter volume among the three groups were located in the calcarine, thalamus, left putamen, and left precentral gyrus. Compared with T2D group, the volume of gray matter in the thalamus and left putamen in T2D-C group decreased. Partial correlation analysis showed that the thalamic gray matter volume and left putamen in T2D-C patients were negatively correlated with fasting blood glucose, positively correlated with HOMA2-%B, and negatively correlated with TMT-A score. Mediation analysis found that the direct effect of fasting blood glucose on TMT-A was not significant, but the indirect effect was significant, that is, the gray matter volume of the left putamen played a complete intermediary role in the relationship between fasting blood glucose and TMT-A.

### CONCLUSION

s In T2D-C patients, there are extensive areas of reduced gray matter, and the change in gray matter volume is related to cognitive decline.

### CLINICAL RELEVANCE/APPLICATION

Early detection of cognitive impairment in T2D patients and targeted intervention can delay the progression of cognitive decline.

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## Abstract Archives of the RSNA, 2023

M2-SPPD

### Pediatric Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPPD-1 Diffusion and Perfusion Properties of Fetal Brain and Placenta in Fetuses Affected by Intrauterine Growth Restriction (IUGR): A Preliminary IVIM MRI Study**

##### Participants

Roberta Ninkova, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the potential use of Intravoxel Incoherent Motion (IVIM) imaging in the study of microperfusion and microstructural characteristics of fetal brain and placenta in Intrauterine Growth Restriction (IUGR) fetuses, comparing IVIM parameters with those of a healthy control group.

##### METHODS AND MATERIALS

112 pregnancies (30 IUGR; 82 normal) were enrolled. MR examinations were performed at 1.5 T, using a DWI sequence with 10 different b-values (0,10,30,50,75,100,200,400,700,1000 s/mm<sup>2</sup>). For each fetus, specific ROIs were manually placed on fetal and maternal sides of each placenta, and for fetal brain on the following areas: centrum semi-ovale (CSO), frontal and occipital white matter (FWM, OWM), basal ganglia (BG), thalamus (TH), cerebellar hemisphere (CH) and pons. Differences of mean values of perfusion fraction (f), diffusion coefficient (D), and pseudo-diffusion coefficient (D\*) and their correlation with Gestational Age (GA) and Birth Weight (BW) were investigated in both IUGR and control group.

##### RESULTS

We found that in the fetal side of placenta, f allowed to discriminate SGA (Small for Gestational Age) from real FGR (Fetal Growth Restriction) ( $p=0.03$ ), with FGR showing lower values. SGA showed intermediate perfusion pattern in terms of f compared to FGR and healthy controls. A significant positive correlation was found between f and BW in fetal side of IUGR group. Concerning the fetal brain, we found higher D values in supratentorial WM areas compared with the other regions (TH, BG, pons, CH), in both normal and IUGR groups. In particular, higher D values in OWM and pons in IUGR fetuses compared to healthy group. A significant negative correlation between D and GA was found for almost all brain areas in the healthy group and conversely not in the IUGR group.

##### CONCLUSION

Complex interactions between placental and fetal environments ensure normal fetal growth. Impairment of the fetoplacental unit may lead to Intrauterine Growth Restriction (IUGR), which is associated with perinatal morbidity and mortality, and long-term complications, like neurodevelopmental delay. In order to this, the development of new non-invasive examinations, such as fetal MRI, may be helpful in detecting fetal abnormalities and understanding their pathogenesis. Specifically, the IVIM model, may be a novel technique to detect microstructural and microperfusion abnormalities of the placenta and fetal brain that occur in IUGR fetuses.

##### CLINICAL RELEVANCE/APPLICATION

Preliminary results show that IVIM parameters may be potential in vivo biomarkers of IUGR severity, improving prenatal and postnatal diagnosis and management of IUGR fetuses.

#### **M2-SPPD-2 Performance Evaluation of Deep Learning-based Bolus-tracking Technology for Pediatric Abdominal Enhanced CT**

##### Participants

Nan Yang, Tianjin, China (*Presenter*) Nothing to Disclose

##### PURPOSE

The process of bolus-tracking scans before CT angiography usually include monitoring location selection and region-of-interest (ROI) placement to generate a time-density curve (TDC) triggering the CT scan. In this study, we aimed to evaluate the performance of an artificial intelligence-based algorithm, SmartPlan, for the bolus-tracking process in pediatric abdominal enhanced CT examination.

##### METHODS AND MATERIALS

226 pediatric abdominal enhanced CT data were prospectively collected. The monitoring locations for placing ROI by experienced technicians for dynamic contrast-enhancement monitoring in bolus-tracking scans and TDC generated in the ROIs were recorded as the control group; The scout scans and time-resolved images were then imported into the SmartPlan software to automatically determine the monitoring location for placing ROI and to generate TDC, and the results were recorded as the experimental group. There are two steps during the SmartPlan process, monitoring section selection and ROI selection. For the monitoring section selection step, we calculated the accuracy of section selection and defined SmartPlan as accurate if the distance between the section selected by SmartPlan and the section selected by technicians was less than 1cm. For the ROI selection, we calculated the

passing ratio of SmartPlan and defined the passing criteria as ROIs were located inner the aortas.

## **RESULTS**

For the monitoring section selection and ROI selection process in SmartPlan, the accuracy of monitoring section selection was 97.35% with a 95% Confidence Interval [95.24%, 99.44%], and the passing ratio of monitoring ROI selection was 0.962 with 95% Confidence Interval [0.919,1]. There was no difference in the peak value of TDC curves between the experimental and control groups (all  $P > 0.05$ ). Time-consuming was found significantly decreased by  $18.18 \pm 1.17$  seconds in the experimental group compared with that in the control group ( $P < 0.05$ )

## **CONCLUSION**

s The AI-based automatic bolus-tracking technique can efficiently provide good performance on bolus-tracking accuracy of pediatric abdominal enhanced CT with experienced technicians.

## **CLINICAL RELEVANCE/APPLICATION**

The AI-based automatic bolus-tracking technique could simplify the CT scan process of pediatric abdominal enhanced CT by fast and acutely automatically triggering CT scans.

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## Abstract Archives of the RSNA, 2023

M2-SPPH

### Physics Monday Poster Discussions

#### Sub-Events

#### M2-SPPH-1 Reliability of CT Numbers on Energy Integrating and Deep Silicon Photon Counting Detector CT with Patient Mispositioning

##### Participants

Aria Salyapongse, BS, Madison, WI (*Presenter*) Nothing to Disclose

##### PURPOSE

In this study we compared the CT number of six clinically relevant materials on an energy-integrating detector (EID) and deep silicon photon-counting (PCD) CT as an effect of mispositioning for different patient sizes.

##### PURPOSE

To investigate the imaging parameters influencing urinary stone detection rate with virtual unenhanced (VUE) images obtained at the excretory phase (EP) in contrast-enhanced dual-energy CT urography (DECTU).

##### METHODS AND MATERIALS

150 urinary stone patients (mean age: 47.51±14.42 years; males vs females: 101 vs 49) who required triphasic DECTU were analyzed. The true unenhanced (TUE) and VUE images at EP (VUE(EP)) were obtained. Per stone detection rates on the above images were recorded. Stone location, size and CT number on the TUE images were recorded and used in univariate and multivariate logistic regression analyses to investigate imaging factors influencing urinary stone detection rate on VUE(EP) images. In addition, five contrast agents were included in the regression analyses. Thresholds for detecting urinary stone on VUE(EP) images were determined using receiver operating characteristics (ROC) analysis.

##### METHODS AND MATERIALS

We performed three sets of dose-matched scans on a patient size-mimicking phantom with five different water-equivalent diameters (WED) (Mercury Phantom, Gammex). The acquisition modes were: (1) 120 kV single-energy (SE) EID CT, (2) 80/140 kV rapid kV-switching dual-energy (DE) EID CT, and (3) 120 kV deep silicon PCD CT at four positions in the bore: (1) isocenter (0 cm), (2) up 4 cm, (3) up 8 cm, (4) and up 12 cm. Average CT number was calculated for air, water, polystyrene, iodine 10 mg/mL, bone, and polyethylene in (1) 120 kV polychromatic EID, (2) 70 keV monochromatic EID, and (3) 70 keV monochromatic deep silicon PCD images. Trends in CT number with WED for each position were assessed by plotting CT numbers against WED. Slopes were compared using t-tests with multiple comparison adjustment to assess whether trends in CT number with WED were decreased for deep silicon PCD CT relative to EID CT. CT number accuracy was assessed by calculating ideal material CT numbers using the U.S. National Institute of Standards and Technology (NIST) XCOM database toolkit.

##### RESULTS

For air, water, iodine, and bone materials, deep silicon PCD CT had the smallest magnitude slope of CT number over WED for all tested positions. Deep silicon PCD CT slopes are flatter compared with SE EID CT and reached statistical significance for iodine ( $p < .001$ ), and bone ( $p < .001$ ) for all positions, and for air ( $p = .008$ ) and water ( $p = .01$ ) at three positions. Deep silicon PCD CT slopes were flatter compared with DE EID CT and reached statistical significance for air ( $p = .005$ ), water ( $p = .04$ ), and bone ( $p < .001$ ) for all positions, and for iodine ( $p = .04$ ) at three positions. The accuracy of deep silicon PCD CT was higher than either SE or DE EID CT for all materials at all positions except for polystyrene at 12 cm, based on relative root mean square error.

##### RESULTS

Three hundred and four stones were detected on TUE images; 217 stones were identified on VUE(EP) images (detection rate, 71.4%). Size (Univariate Multivariate:  $p < 0.001$ ) and CT number (Univariate Multivariate:  $p < 0.001$ ) of the stones were both important factors affecting the detection of stone on the VUE(EP) images (Tab.1). The stone detection rate in the urinary tract was significantly higher than that in the kidney (Univariate Multivariate:  $p < 0.01$ ) (Tab.1 and Fig. 1). However, different contrast agents did not affect the detection rate ( $p = 0.547$ ). The area under ROC curve (AUC) of using size and CT number for detecting stone on the VUE(EP) images was only 0.80 and 0.80, respectively with thresholds for stones with size larger than 3.3 mm and CT number greater than 615 HU being detected. After adding the stone location, the AUC of the three parameters can reach up to 0.88 (Tab.2 and Fig. 2).

##### CONCLUSION

s VUE images at EP in DECTU has a relatively low detection rate for urinary stones. Stone location, size and CT number have significant impact on the stone detection rate using VUE(EP) images.

##### CONCLUSION

s WED contributes more to CT number change than mispositioning. The change in CT number over WED was smallest for deep silicon PCD CT for air, water, and bone at all tested positions. The CT number accuracy was also closest to the ideal CT number on deep silicon PCD CT for all materials at all positions except polystyrene at 12 cm, compared with SE and DE EID CT.

## CLINICAL RELEVANCE/APPLICATION

Accurate and stable CT numbers are important for clinical diagnoses, and use of deep silicon PCD CT provides more stable and accurate CT number over patient size and mispositioning compared with SE and DE EID CT.

## CLINICAL RELEVANCE/APPLICATION

VUE images at EP in DECTU are not suitable for detection of urinary stones. Stone location, size and CT number may have an impact on the stone detection rate.

## M2-SPPH-10 Dual-Energy CT-based Low Energy Virtual Monoenergetic Imaging of the Lower Extremity Runoff in Patients with Diabetes Mellitus: Impact on Image Quality, Vascular Contrast and Diagnostic Accessibility

Participants

Christian Booz, MD, Frankfurt am Main, Germany (*Presenter*) Speaker, Siemens AG

### PURPOSE

To evaluate the impact of low energy virtual monoenergetic imaging (VMI)+ dual-energy CT reconstructions on quantitative and qualitative image quality, vascular contrast and diagnostic assessability of lower extremity arteries in patients with diabetes mellitus.

### METHODS AND MATERIALS

Dual-energy CT angiography scans of lower extremities in patients suffering from diabetes who had undergone clinically indicated dual-energy CT examinations between January 2018 and January 2023 were retrospectively analyzed. Images were reconstructed with standard linear blending (F<sub>0.5</sub>) and low keV VMI+ series were generated from 40 to 100 keV, in an interval of 15 keV. Quantitative analyses included evaluation of vascular CT numbers, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). A total of five CT number measurements per vessel were performed in the superficial and deep femoral artery, the popliteal artery, proximal anterior and posterior tibial artery as well as the fibular artery. Qualitative analyses were performed by three board-certified radiologists independently using five-point scales to evaluate image quality, vascular contrast and diagnostic assessability of lower extremity arteries.

### RESULTS

Our final study cohort consisted of 154 patients (82 males). Mean attenuation, CNR and SNR values were highest in 40 keV VMI+ reconstructions (HU, 1180.41 ± 45.09; SNR, 29.91 ± 0.99; CNR, 28.60 ± 1.03) followed by 55 keV VMI+ reconstructions; all three mean values at these keV levels were significantly higher compared with the remaining VMI+ series and standard F<sub>0.5</sub> images (HU, 251.32 ± 7.13; SNR: 13.22 ± 0.44; CNR: 10.57 ± 0.39) (p<.0001). The qualitative analysis showed highest rating scores for 55 keV VMI+ reconstructions followed by 40 and 70 keV VMI+ series with a significant difference compared to standard F<sub>0.5</sub> images regarding image quality, vascular contrast and diagnostic assessability of lower extremity arteries (p<.0001).

### CONCLUSION

Low keV VMI+ reconstructions at a level of 40-55 keV significantly improve image quality, vascular contrast and the diagnostic assessability of lower extremity arteries in patients with diabetes mellitus compared with standard CT series.

## CLINICAL RELEVANCE/APPLICATION

In patients with diabetes mellitus undergoing dual-energy CT scans of lower extremity arteries, low keV VMI+ CT reconstructions at a level of 40-55 keV should be routinely reconstructed in clinical routine to improve image quality and the diagnostic assessability and to potentially reduce radiation dose and the needed amount of intravenous contrast material in scan protocols in order to protect kidney function.

## M2-SPPH-11 Combining K-edge Filtration and Dual-layer CT for Improved Spectral Performance in Pediatric Diagnostics

### PURPOSE

In pediatric spectral CT, accurate quantitative performance with low radiation doses is imperative. Our study demonstrates the effectiveness of using a combination of a K-edge filter and dual-layer spectral detector to increase the quantification sensitivity of iodine and calcium in pediatric patients.

### METHODS AND MATERIALS

A polychromatic simulation based on a clinical dual-layer spectral CT (Spectral CT 7500, Philips Healthcare) was used to generate incident spectra at tube voltages of 100 and 120 kVp with radiation exposure of 33 mAs. An optimal K-edge filter material and thickness (holmium 0.15 mm) was selected from other potential filters using the Cramer-Rao lower bound of noise in the iodine domain for a single pencil-beam x-ray projection at the central detector. To model the combination of the K-edge filter and dual-layer CT, the input spectra were filtered and linearly scaled to match the patient dose of the non-filtered cases. The spectra were then applied to noiseless photoelectric and Compton scatter basis projections of three pediatric phantoms containing tissue equivalent inserts (iodine 0.5 mg/mL, iodine 2.0 mg/mL, blood, calcium 50 mg/mL). The phantoms ranged in diameter from 10 to 20 cm. Using fan beam geometry, Poisson noise was added, a material decomposition look-up table approach was used, and filtered back projection reconstruction was performed to generate photo/scatter basis images with realistic noise. To estimate spectral sensitivity, noise was measured for each insert in the photoelectric image, and a corresponding noise ratio relative to K-edge filtered simulations was calculated to compare filtered and non-filtered simulations.

### RESULTS

At 100 kVp and across all three phantom sizes, the holmium filter and dual-layer CT combination compared to the non-filtered simulation averaged 11% and 10% improvement in photoelectric noise in iodine 0.5 mg/mL and iodine 2.0 mg/mL inserts, respectively. Average filtered noise improvement at 120 kVp was 3% and 5% for the same rods. For the calcium insert, the maximum relative noise improvement was 17% in the 20 cm phantom at 100 kVp. To match non-filtered patient dose, tube exposure was 93 and 85 mAs for 100 and 120 kVp scans.

## CONCLUSION

s Combined holmium K-edge filtration with dual-layer CT increased iodine and calcium sensitivity in pediatric scans at 100 and 120 kVp with radiation exposures within tube capability. This could lead to increased iodine and calcium quantification accuracy and reduced additional non-contrast scans for pediatric patients.

## CLINICAL RELEVANCE/APPLICATION

The combination of K-edge filtration with dual-layer CT may enhance iodine and calcium quantification accuracy and reduce need for additional non-contrast scans in pediatric diagnostic imaging.

## M2-SPPH-12A Comparative Study of Extracellular Volume Fraction Measured by Spectral CT Between Liver and Pancreas in Patients with Hypertension

### PURPOSE

To investigate the correlation between extracellular volume fraction of liver and pancreas measured by spectral CT iodine maps and hypertension-related indicators and to compare their diagnostic value.

### METHODS AND MATERIALS

166 patients who underwent abdominal spectral CT enhancement scanning were included. They were divided into a normal blood pressure group and a hypertension group according to whether they had hypertension. Then, the hypertension group was further divided into three subgroups according to the systolic and diastolic blood pressure levels. The fECV was calculated by measuring the iodine density (ID) of the liver and abdominal aorta from the iodine maps in equilibrium phase as follows:  $fECV = ID_{\text{hepatic or pancreatic}} \times (100 - Hct) / ID_{\text{abdominal aorta}}$ . One-Way ANOVA analysis was used to compare fECV values among groups. Spearman correlation analysis was used to analyze the correlation between fECV and blood pressure-related indicators, i.e., systolic blood pressure, diastolic blood pressure, pulse pressure. Multiple linear stepwise regression equations were established to obtain the quantitative relationship between fECV and blood pressure-related indicators. ROC curves were used to evaluate the diagnostic performance of hepatic and pancreatic fECV for hypertension.

### RESULTS

The hepatic fECV ( $36.42 \pm 5.20$ ) and pancreatic fECV ( $36.64 \pm 5.46$ ) of patients with hypertension were significantly higher than those patients with normal blood pressure ( $30.17 \pm 4.12$ ,  $33.45 \pm 3.41$ ) and increased with the enhancement of hypertension level. The fECV of liver and pancreas were positively correlated with SBP ( $r=0.57$ ,  $0.42$ ) and DBP ( $r=0.33$ ,  $0.32$ ). Multiple linear regression analysis showed that SBP entered the equation finally ( $\beta=0.105$ , constant= $18.520$ ;  $\beta=0.119$ , constant= $17.528$ ). The AUC for diagnosing hypertension through hepatic fECV was  $0.830$  (SEN  $61.50\%$ , SPE  $88.00\%$ , cut-off value  $34.16\%$ ) and the AUC for diagnosing hypertension through pancreatic fECV was  $0.663$  (SEN  $53.00\%$ , SPE  $94.70\%$ , cut-off value  $37.93\%$ ). Comparing the two AUCs, the accuracy of hepatic fECV was higher than that of pancreatic fECV and the difference was statistically significant ( $P < 0.05$ ).

## CONCLUSION

s The fECV of liver and pancreas measured by spectral CT iodine maps was related to hypertension-related indicators. SBP was an independent risk factor for elevating both hepatic and pancreatic fECV. The hepatic fECV was more helpful for diagnosing hypertension.

## CLINICAL RELEVANCE/APPLICATION

The fECV obtained by dual energy spectral examination is a convenient biomarker to assess the liver and pancreas chronic injury. The fECV derived from spectral CT iodine maps had clinical application values for studying the chronic damage of abdominal organs caused by hypertension.

## M2-SPPH-13A Comparative Study Based on Dual Energy CT and MRI: Grading of Injuries to the Anterior Talofibular Ligament in Ankle

### Participants

Jialiang Guo, Guangzhou, China (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnosis of anterior talofibular ligament (ATFL) injury using ultrafast synchronized KV/mA switching dual energy CT (DECT) and to assess its consistency with MRI grading.

### METHODS AND MATERIALS

Consecutive 41 patients with acute ankle sprain (inversion type) who underwent bilateral ankles scan using DECT (Revolution APEX CT, GE). axial virtual monochromatic image (VMI) at 60 keV with slice thickness of 0.625 mm and material decomposition image (water/HAP) were reconstructed. The MRI (Proton Density Weighted Spectral Attenuated Inversion Recovery, PDW SPAIR) scans were performed on the traumatic ankle joint within two weeks. The width of the injured ATFL was measured on both MRI and VMI images, and the continuity of the ligament and the edema around the ligament were evaluated subjectively. Two radiologists independently evaluated the images and provided grading diagnosis of ATFL injury, and the consistency of DECT and MRI diagnostic grading was assessed using the Kappa test. Paired-sample t-test was used to compare the width of ATFL between DECT and MRI.

### RESULTS

There was no significant difference in the measured widths of ATFL grade I, II, and III injuries measured on DECT and MRI axial PDW SPAIR images (grade I, II, and III, CT:  $2.2 \pm 0.2$ mm,  $3.9 \pm 0.6$ mm,  $5.1 \pm 0.6$ mm; MRI:  $2.3 \pm 0.2$ mm,  $3.9 \pm 0.6$ mm,  $5.1 \pm 0.6$ mm, all  $P > 0.05$ ). The edema within and around the ATFL on the traumatic side can be found in water (HAP) images. In the subjective evaluation of ligament continuity, the agreement between two radiologists is strong ( $K = 0.63$ ). Two radiologists had strong/very strong agreement between the CT diagnostic grading and MRI grading of ATFL injuries ( $K=0.92$ ,  $K=0.78$ ).

## CONCLUSION

s In ankle DECT imaging, grading of ATFL injuries could be performed through the application of VMI image at 60 keV, combined with measurement of the width of ATFL, subjective evaluation of edema within and around the ligament, and ATFL continuity, which has

a good consistency with MRI, providing the possibility of grading ATFL lesions on CT scans.

#### **CLINICAL RELEVANCE/APPLICATION**

Under the condition of VMI imaging at 60 keV, ankle DECT can be used to properly grade ATFL injury by measuring ligament width and subjectively evaluating periligamentous edema and ATFL continuity. This approach showed a good consistency with MRI grading and provided an innovative imaging technique for ankle sprain patients who may not be suitable for MRI examinations.

#### **M2-SPPH-2 Imaging Parameters Affecting Stone Detection using Virtual Unenhanced Images at Excretory Phase in Contrast-enhanced Dual-energy CT Urography**

Participants

Jianying Li, PhD, Beijing, China (*Presenter*) Employee, General Electric Company

#### **M2-SPPH-3 Mobile Photon-counting Detector CT with MD Plus for Neuroimaging of Patients in Intensive Care Unit**

Participants

Junyoung Park, Suwon-Si, Korea, Republic Of (*Presenter*) Employee, Samsung Electronics Co, Ltd

#### **PURPOSE**

The purpose of this study is to evaluate our developed multi-material decomposition method (MD Plus) with mobile PCD-CT for neuroimaging of patients at ICU, and prove the characterization and differentiation of materials between contrast agent and hemorrhage in high-density lesions.

#### **PURPOSE**

To evaluate the performance of self-supervised methods for PCCT image denoising from routine scans, without repeat scans or clean images. These methods include: Noise2Noise (N2N), Noisier2Noise (Nr2N), and Noise2Void (N2V).

#### **METHODS AND MATERIALS**

For clinical images, clean references are difficult to obtain, as noise is always present. Typically, synthetic low-dose images and full-dose images are used as training input and reference, namely Noise2Full-dose (N2Fd), where the inherent noise correlation degrades the result. Alternatively, several self-supervised learning methods have been proposed. N2N is supposed to be equivalent to Noise2Clean (N2C; trained with clean references). For PCCT scans, binomial selection can be used to create the noise independent pairs required in N2N; Nr2N leverages N2Fd which contains residual noise proportional to the synthetic low-dose noise. Thus, it is possible to cancel the residual noise with careful post-processing. To evaluate their performances, we converted clinical images from the KITS21 Challenge to water and Ca density maps and simulated PCCT scans using a 120 kVp spectrum and a realistic energy response. For simplicity, the total counts were used to create a grayscale image. The dataset was split into train (211) / validation (30) / test (59) cases (5 slices from each case). A basic U-Net was trained for 90 epochs, minimizing L2 loss. Dose was split evenly using binomial selection for N2N. N2V was also included in our comparison.

#### **METHODS AND MATERIALS**

For neuroimaging of patients at ICU, the MD Plus was developed and optimized. All CT scans were performed with the FDA 510(k) cleared mobile PCD-CT (OmniTom Elite). For verification of the accuracy of our MD plus algorithm with the mobile PCD-CT, the experiments were conducted using a multi-energy phantom with various exposure conditions and locations of contrast agent. To prove the material characterization of neuroimaging of patients at ICU, our MD plus algorithm was applied to the patients who underwent mobile PCD-CT. The ability of differentiation between iodine and hemorrhage was evaluated.

#### **RESULTS**

All methods reduced the original RMSE of the test set from 27.70 HU. Average RMSE in the test set was 12.37 HU for N2N, which was equivalent to that of N2C (12.38 HU). N2Fd, which violates the independence criterion, had suboptimal results (17.82 HU). Nr2N improved the performance of N2Fd to 13.30 HU. N2V (24.37 HU) had the worst performance since CT images violate its requirement of spatially uncorrelated noise. While Nr2N performed well, we found that the performance relies heavily on the convergence of N2Fd. With a limited amount of training data, the convergence of N2Fd might be incomplete, leading to suboptimal results for Nr2N.

#### **RESULTS**

The results of multi-energy phantom with different exposure showed that there is no critical artifacts on material decomposition maps with various exposure settings. The measured iodine concentrations of each exposure setting were compared to the ground truth. The linear relationships were observed between the measured and true iodine concentrations and the coefficient of determinations ( $R^2$ ) for 5, 10, 15, 20 mA were 0.994, 0.995, 0.996, 0.998 respectively. The results of different contrast demonstrated that the material maps were comparable and the difference ratio was 3.644%. The results of neuro-images of patients at ICU demonstrate the key benefits of our MD plus algorithm with mobile PCD-CT: the regions of intracerebral hemorrhage are clearly visible in material decomposition map. Also, the consistent and repeatable ability to show iodine concentration in material map regardless of different patients was proved.

#### **CONCLUSION**

Among the representative self-supervised learning methods, N2N yields the best performance, approaching that of N2C while only requiring routine scans. Nr2N can effectively improve the performance of N2Fd with proper training and post-processing, but is slightly inferior to N2N. Future work will investigate the applicability of N2N to real data, as well as more sophisticated networks and loss functions.

#### **CONCLUSION**

Our quantitative results of multi-energy phantom verified the accuracy of our MD plus algorithm. In addition, the qualitative results regarding clinical cases of patient at ICU demonstrate that our MD plus algorithm with mobile PCD-CT can separate the contrast agent from the blood accurately. The differentiation of iodine and hemorrhage or acute ischemic stroke can be used in high density lesions after intra-arterial recanalization.

#### **CLINICAL RELEVANCE/APPLICATION**

The accurate results of MD plus algorithm with mobile PCD-CT can lead to simplified clinical imaging protocols and improved workflow for neuroimaging of critical patients with the risks associated with transportation and life-threatening illness.

#### CLINICAL RELEVANCE/APPLICATION

We evaluated representative self-supervised learning methods for PCCT image denoising that can use routine scans to train a denoising network without a clean (noiseless) reference.

#### M2-SPPH-4 Self-Supervised Deep Learning Methods for Photon Counting CT (PCCT) Denoising without Clean References

Participants

Sen Wang, PhD, Stanford, CA (*Presenter*) Research support, General Electric Company

#### M2-SPPH-5 Feasibility and Accuracy in Calcium Quantification of the Turbo Flash Mode on a Clinical Photon Counting Detector CT System: A Phantom Study

Participants

Shan Shui Zhou, Shanghai, China (*Presenter*) Nothing to Disclose

#### PURPOSE

The high-pitch scan mode on a first-generation clinical dual-source photon counting detector (PCD) CT system can be used for energy analysis, which is helpful for calcium quantification. However, its performance has not been validated because the high-pitch scan could not obtain the energy spectrum information by the energy-integrating detector dual-source CT. The purpose of this study is to evaluate the feasibility and accuracy of calcium quantification in the high-pitch scan on PCD-CT.

#### PURPOSE

With the beginning of the photon counting CT (PCCT) era, claims are being made that scanning two contrast agents simultaneously is beneficial in terms of dose. Our aim is to quantify the supposed benefit or the possible harm.

#### METHODS AND MATERIALS

A Gammex™ multi-energy CT phantom with three calcium inserts (50, 100, and 300 mg/ml), with and without the elliptical outer layer, was evaluated using a high-pitch (3.2) and regular (0.8) spiral modes on a PCD-CT. Each scan setting was repeated three times with two tube voltages (120 and 140 kVp) and 4 radiation doses (1, 3, 5, and 10 mGy). Calcium maps were generated by adjusting the specific calcium ratio in post-processing and the mean calcium attenuation (CaCT) across three consecutive slices were recorded. Linear regression and Pearson correlation coefficient was implemented for accessing the correlation between CaCT in all scan settings and calcium concentration. The root-mean-squared-error (RSME) was calculated and compared between the high-pitch and regular spiral scans.

#### METHODS AND MATERIALS

PCCT inherently records spectral information. Moreover, the only clinically approved PCCT system, the Naeotom Alpha, is a dual source CT (DSCT): both x-ray tubes can operate at different kV and can utilize different patient-specific prefilters (PSPs), e.g. tin. With PCCT it becomes possible to distinguish more than two materials. Potential applications focus on using two contrast agents, e.g. X=iodine and Y=hafnium. The simultaneous application of two such agents is claimed to be advantageous, e.g. in a way such that the arterial phase of an abdominal acquisition shows X and the venous phase is enhanced by Y. Is this strategy, WXY, with W being the soft tissue, better than two scans W+WX or WX+WY, assuming no patient motion in-between? Or would even three scans, e.g. W+WX+WXY be optimal? To find out, we conducted a study simulating various patient sizes, tube voltages from 70 to 150 kV, four different PSP thicknesses, and all possible bin settings of a photon counting detector to assess the dose-normalized signal-to-noise-ratio (SNRD) of the resulting virtual non-contrast images, and the contrast agent maps of X and Y. No additional noise reduction strategies were applied in order to obtain a fair comparison. Dose penalty (DP) factors are given by the squared ratio of the SNRD values.

#### RESULTS

With just one agent, X=Iodine, doing WX (single source PCCT) instead of W+WX (two scans) yields DP=2.6. Doing WX+WX (DSCT) instead of W+WX yields DP=1.6. With two agents, X=Iodine, Y=Gadolinium, WXY comes with DP=1.5 when compared to WX+WY and with DP=2.0 when compared to W+WXY. Surprisingly, WXY+WXY, which can be realized by a DSCT scan, is only slightly (DP=1.25) outperformed by W+WXY, which requires two separate scans. By far the best performance is obtained by W+WX+WY and by W+WY+WXY (DP=3.2 if doing WXY instead), which, however, require three scans.

#### RESULTS

For all scan settings, the extremely strong correlations between CaCT and calcium concentration were proven by the statistically significant linear regressions (all R-square  $>$  0.99, p  $<$  0.05) and Pearson correlation coefficients (all r  $>$  0.99). The conversion slope ranged from 0.310 to 0.354 mg/mL/HU for the high-pitch scans and from 0.315 to 0.361 mg/mL/HU for the regular spiral scans. The largest RMSE was witnessed in the high-pitch scans of the large phantom at 140 kVp and 1 mGy. The median [interquartile range] RMSE demonstrated similar calcium quantification abilities between the high-pitch and the regular spiral scans (1.25 [0.81; 2.75] versus 0.90 [0.68; 1.50] mg/mL, p = 0.152).

#### CONCLUSION

s For the task of providing contrast agent maps, simultaneous contrast agents always come with a penalty in the order of 1.5 to 3.2 which means that the 1.5- to 3.2-fold patient dose is necessary. If motion between two non-simultaneous scans could be perfectly corrected for, patient dose and thus patient risk could be drastically reduced. In particular, if an unenhanced scan (W) is performed in addition to the enhanced scan(s).

#### CONCLUSION

s The high-pitch scan mode with full spectral information offers feasible and accurate calcium quantification using the dual-source PCD-CT.

#### CLINICAL RELEVANCE/APPLICATION

Accurate calcium quantification by high-pitch scans on PCD-CT even under ultra-low doses could be promising for bone density screening.

#### **CLINICAL RELEVANCE/APPLICATION**

As long as no motion-compensation between scans can be performed, the currently proposed scan strategies are unavoidable. Once motion can be compensated for, scans should be separated into different contrast enhancement schemes.

#### **M2-SPPH-6 Decomposition of CT Contrast Agents: Single or Multiple Photon Counting CT Scans? Single or Dual Source PCCT?**

Participants

Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

#### **M2-SPPH-7 Assessing the Blood Supply to Lung Parenchyma Surrounding Different Pathological Types of Lung Carcinoma using Iodine Measurement in Dual-energy Spectral Computed Tomography**

##### **PURPOSE**

The purpose of this study was to investigate the blood supply to lung parenchyma surrounding different pathological types of lung carcinoma using iodine concentration (IC) measurement in dual-energy spectral CT (DEsCT).

##### **METHODS AND MATERIALS**

This study included 47 patients with lung carcinoma (squamous carcinoma, n=18; adenocarcinoma, n=17; small cell carcinoma, n=12), who underwent contrast-enhanced DEsCT before treatment. The IC of the tumor, the ipsilateral lung tissues around tumor and contralateral normal lung tissues were measured in the arterial phase (AP) and venous phase (VP). The IC measurements were further normalized by that of the descending aorta to obtain normalized iodine concentration (NIC). All measurements were repeated by the same radiologist after one month. NIC values were statistically compared among patients with squamous carcinoma, adenocarcinoma and small cell carcinoma using the ANOVA test followed by Scheffe post-hoc correction for multiple comparisons.

##### **RESULTS**

There was significant difference in NIC of ipsilateral lung tissues in AP among adenocarcinoma (0.08), squamous carcinoma (0.07) and small cell carcinoma (0.07) patients. Pairwise comparison indicated that there was a statistical difference between adenocarcinoma and squamous cell carcinoma, while there was no statistical difference between other pairs ( $P < 0.05$ ). In all pathological type tumors, the NIC in AP of ipsilateral lung tissues around tumors were lower than the contralateral, however, the difference was not statistically significant ( $P > 0.05$ ).

##### **CONCLUSION**

s The iodine concentration can be quantitatively measured in DEsCT which can be used as an indicator for the blood supply status to lung parenchyma surrounding tumors.

#### **CLINICAL RELEVANCE/APPLICATION**

To investigate the blood supply to lung parenchyma surrounding different pathological types of lung carcinoma using iodine concentration (IC) measurement in dual-energy spectral CT (DEsCT).

#### **M2-SPPH-8 The Accuracy of Monoenergetic Attenuation at High-pitch Scans using A Dual-source Photon-counting Detector CT: A Phantom Study**

Participants

Le Qin, Shanghai, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

High-pitch scans performed on a dual-source photon-counting detector CT (PCD-CT) enable reconstructions of virtual monoenergetic imaging at different keV levels. However, the accuracy of monoenergetic attenuation at high-pitch acquisition remains unknown. Thus, the purpose of this study is to evaluate the monoenergetic accuracy of iodine inserts between the regular spiral scan and the high-pitch scan on a first-generation clinical dual-source PCD-CT.

##### **METHODS AND MATERIALS**

The Gammex<sup>TM</sup> multi-energy CT phantom containing iodine inserts of 2, 5, 10 and 15 mg/mL was scanned on a dual-source PCD-CT, with and without the elliptical outer layer. Two pitch levels (3.2 and 0.8), two tube voltages (120 and 140 kVp) and 4 radiation doses (1, 3, 5 and 10 mGy) were alternated, and each scan setting was repeated three times. The image noise in the background and monoenergetic accuracy of the iodine inserts were evaluated at 40, 70, 100 and 140 keV. The median attenuation errors and absolute attenuation bias were further assessed with linear regression to explore the impact of phantom setup and scan parameters.

##### **RESULTS**

The background noise increased with lower keV level and radiation doses. The noise levels between high-pitch and regular spiral scans were evidently different for the large phantom at 40 and 70 keV, especially when radiation dose decreased. In the small phantom, the median attenuation errors at 1, 3, 5 and 10 mGy were 5.5 (1.8; 10.5) [median, (25th percentile; 75th percentile)], 5.9 (1.3; 10.6), 6.0 (2.1; 10.1) and 5.7 (2.6; 13.6) HU, respectively. Similarly, the errors were 3.3 (-2.5; 13.9), 4.1 (-1.6; 11.7), 4.1 (-1.0; 11.2) and 4.6 (-1.0; 12.9) HU in the large phantom. At the worst-case scenario, the attenuation bias exceeded 10 HU in 14.6% (7 of 48 measurements for 4 inserts, 4 keV levels and 3 scan repeats) and 29.2% (14 of 48) for the small and large phantom setups, respectively. The linear regression revealed comparable monoenergetic accuracy between high-pitch and regular spiral scans ( $p = 0.332$ ). Compared to the 70 keV, images at 40 keV and 140 keV were associated with statistically significant (6.6 HU and 1.6 HU, both  $p < 0.001$ ) higher attenuation bias.

##### **CONCLUSION**

s The high-pitch scans exhibited similar monoenergetic accuracy with the regular spiral scans, although the attenuations at 40 keV



and 140 keV still required careful interpretation.

#### **CLINICAL RELEVANCE/APPLICATION**

The monoenergetic images with high-pitch scans enabled by the dual-source PCD-CT provide accurate attenuation and could be quantitative used in conditions requiring fast acquisition such as pulmonary embolism, chest pain triad and ruptured cerebral aneurysm.

#### **M2-SPPH-9 Comparison of Iodine Quantification between High-pitch and Regular Spiral Scans using a Dual-source Photon-counting Detector CT: A Phantom Study**

Participants

Peng Liu, Shanghai, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

With the advent of the dual source photon-counting detector CT (PCD-CT), material decomposition at high pitch could become a clinical reality and potentially exhibit unprecedented diagnostic value. However, its accuracy has not been validated so far. Thus, the purpose of this study is to investigate the accuracy of iodine quantification in a phantom setup and compare the performance between high-pitch and regular spiral scans based on the first-generation clinical PCD-CT.

#### **METHODS AND MATERIALS**

Four inserts with known iodine concentrations (2, 5, 10 and 15 mg/mL) were placed in the removable head section of a Gammex™ multi-energy CT phantom. The phantom, with and without the elliptical outer layer, was scanned using high-pitch (3.2) and regular (0.8) spiral modes on a dual-source PCD-CT. Two tube voltages (120 and 140 kVp) and 4 radiation doses (1, 3, 5 and 10 mGy) were also alternated, and each scan setting was repeated three times. The mean iodine measurements across three consecutive slices were recorded, and the association between the percentage absolute bias (PAB, normalized to the actual reference) and all scan factors was explored using a linear regression analysis.

#### **RESULTS**

A total of 96 acquisitions were performed with both phantom setups and all variations of scan parameters. In the small phantom, the PAB ranged from 1.8% to 5.9% and 1.5% to 3.2% for high-pitch and regular spiral acquisitions, respectively, across different radiation doses and tube voltages. The bias appeared more pronounced in the large phantom (4.4% to 8.5% for high-pitch and 2.5% to 6.8% for regular spiral). The linear regression analysis revealed that scan modes, tube voltages and radiation doses were all statistically irrelevant ( $P > 0.05$ ) to the iodine measurement bias. Compared to the phantom with the outer layer, the small phantom was significantly associated ( $p < 0.001$ ) with 7.2% fewer PAB.

#### **CONCLUSION**

s Iodine density can be accurately and reliably quantified with the high-pitch scan mode, whose ability of material decomposition was only recently brought by the advent of the dual-source PCD-CT.

#### **CLINICAL RELEVANCE/APPLICATION**

High-pitch scans on PCD-CT ensures accurate iodine quantification even in low radiation doses, thus enabling clinical applications which require fast acquisition such as in pediatrics, pulmonary embolism and acute ischemic stroke.

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## Abstract Archives of the RSNA, 2023

M2-SPRO

### Radiation Oncology Monday Poster Discussions

#### Sub-Events

#### **M2-SPRO-1 A CT-based Radiomics Nomogram for Predicting the Progression-free Survival in Small Cell Lung Cancer: A Multicenter Cohort Study**

#### **PURPOSE**

To develop a radiomics nomogram to estimate progression-free survival (PFS) in patients with small cell lung cancer (SCLC) and assess its incremental value to the clinical risk factors for individual PFS estimation.

#### **METHODS AND MATERIALS**

558 patients with pathologically confirmed SCLC were retrospectively recruited from three medical centers. A radiomics signature was generated by using the Pearson correlation analysis, univariate Cox analysis, and multivariate Cox analysis. Patients were classified into the low-risk or high-risk groups based on the optimal cutoff value of the radiomics signature. Association of the radiomics signature with PFS was evaluated. A radiomics nomogram was developed based on the radiomics signature, then its calibration, discrimination, reclassification, and clinical usefulness were evaluated.

#### **RESULTS**

In total, 6 CT radiomics features were finally selected. The radiomics signature was significantly associated with PFS (hazard ratio [HR]: 4.531, 95% confidence interval [CI]: 3.524-5.825,  $p < 0.001$ ). Incorporating the radiomics signature into the radiomics nomogram resulted in better performance for the estimation of PFS (concordance index [C-index]: 0.799, 95% CI: 0.756-0.841) than with the clinical nomogram (C-index: 0.629, 95% CI: 0.586-0.671), as well as high 6-month and 12-month AUCs of 0.885 and 0.846, respectively. Furthermore, the radiomics nomogram also significantly improved the classification accuracy for PFS outcomes, based on the net reclassification improvement (33.7%, 95% CI: 0.216-0.609,  $p < 0.05$ ) and integrated discrimination improvement (22.7%, 95% CI: 0.168-0.278,  $p < 0.05$ ). Decision curve analysis demonstrated that in terms of clinical usefulness, the radiomics nomogram outperformed the clinical nomogram.

#### **CONCLUSION**

A CT-based radiomics nomogram exhibited a promising performance for predicting PFS in patients with SCLC, which could provide valuable information for individualized treatment.

#### **CLINICAL RELEVANCE/APPLICATION**

providing effective support for the implementation of individualized treatment of SCLC.

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## Abstract Archives of the RSNA, 2023

M2-SPVA

### Vascular Imaging Monday Poster Discussions

#### Sub-Events

#### **M2-SPVA-1 "One-stop" Synchronous Dual Imaging for Coronary Artery and Vein on a Dual-layer Spectral Detector CT with Low Contrast Dose: A Primary Study**

##### Participants

Xun Yue, Chengdu, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To explore the feasibility of simultaneous dual imaging of coronary artery and vein system on a dual-layer Spectral detector computed tomography (SDCT).

##### METHODS AND MATERIALS

60 patients with suspected coronary artery disease were prospectively enrolled to undergo coronary CT angiography with a dual-layer spectral detector CT (Spectral CT 7500, Philips Healthcare). The contrast agent was injected at a rate of 4.5ml/s in 3 phases: 9 ml contrast agent and saline 30%:70% mixture, then 0.8ml/kg of contrast agent and finally 30 ml of saline flush. Automatic bolus tracking was used by defining a ROI in ascending aorta, with the scans initiated 8 seconds after the signal attenuation reached a predetermined threshold of 100 HU. 120 kVp polychromatic images with a model-based iterative reconstruction (IMR) were reconstructed. Four monoenergetic levels of images were reconstructed (40 keV, 50 keV, 60 keV, and 70keV). The CT values, noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) on images of each monoenergetic levels were objectively measured at the coronary sinus(CS), the great cardiac vein(GCV), the middle cardiac vein (MCV) and the anterior inter-ventricular vein(AIV) to filter out the best image for vein display. Subjective indicators (contrast, sharpness, subjective noise, and acceptability) of images at each energy were compared on a 5-point scale. The number, morphology and walking of major branches of coronary arteries and veins were observed on VR and slab-MIP images.

##### RESULTS

The display rate of CS, GCV, MCV, AIV, left anterior descending artery(LAD), and left circumflex artery (LCX) is 100%. It was possible to evaluate at least one main vein with adequate caliber and regular course for cardiac re-synchronization therapy (CRT) in 95% (3/60) of these cases. The objective and subjective noise in 40 keV images were worse than 120kVp ( $P<0.05$ ). There is no statistically significant difference in the image noise between 50keV, 60keV, and 70keV compared to 120kVp ( $P>0.05$ ). The SNR, CNR and CT values of 50keV are higher than those of 60keV and 70keV. The contrast, sharpness, and acceptability of 50keV are also better than 60 and 70keV ( $P<0.05$ ).

##### CONCLUSION

s SDCT provides non-invasive evaluation of the coronary artery and venous system, and 50keV monoenergetic images can provide improved coronary vein image quality.

##### CLINICAL RELEVANCE/APPLICATION

The coronary veins is frequently used as an entry route to the heart and treatment modalities for many cardiac diseases and many procedures. But it is difficult, to evaluate the cardiac vein with single-energy CT due to low attenuation. The monoenergetic reconstruction series from cardiac SDCT can significantly reduce high attenuation artifacts by using higher monoenergetic levels.

#### **M2-SPVA-2 Assessment of Diagnostic Efficacy of Photon Counting CT Virtual Mono-Energetic Imaging for Abdominal Aortic and Pelvic Vascular Imaging in Patients Prior to Transcatheter Aortic Valve Replacement (TAVR)**

##### Participants

Leona Alizadeh, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

Our study aim was to evaluate the diagnostic efficacy of photon counting CT (PCCT) virtual mono-energetic (VMI)+ imaging for low-keV abdominal and pelvic vascular imaging and TAVR planning.

##### METHODS AND MATERIALS

A total of 125 patients (69 male/ 56 female) underwent PCCT imaging pre-TAVR for assessment of the abdominal aorta and pelvic vessels for transfemoral access planning. Virtual mono-energetic images (40 - 120 keV) were generated in 15 keV steps from the spectral post-processing datasets (SPP). For assessment of quantitative image quality, SNR and CNR were calculated from measurements in the infrarenal aorta, common iliac artery, internal iliac artery, external iliac artery, and common femoral artery. Qualitative IQ, diagnostic significance, and vascular contrast were evaluated in a blinded manner by four experienced radiologists, using a 5-point Likert scale with clinically relevant criteria.

##### RESULTS

The highest mean SNR and CNR values of the VMI+ series were found in 40 keV reconstructions (SNR  $32.5 \pm 9.5$  CNR  $33.3 \pm 9.8$ ), followed by the measurements in the 55 keV VMI+ (SNR  $25.0 \pm 8.0$  CNR  $26.3 \pm 7.8$ )( $p < 0.001$ ). SNR and CNR of 40 keV and 55 keV were significantly higher than all other keV levels including standard 120 kV (SNR  $10.7 \pm 3.0$ ; CNR  $26.2 \pm 9.5$ ) ( $p < 0.001$ ). Accordingly, mean HU-values of 40 keV VMI+ reconstructions were significantly higher at  $1401 \pm 18$ , followed by  $748 \pm 14$  for 55 keV reconstructions ( $p < 0.001$ ). The IQ rating using the Likert scale was higher for the virtual mono-energetic images at 55 keV compared to 40 keV ( $4.6 \pm 1.6$  vs.  $3.9 \pm 1.8$ )( $p < 0.001$ ). The qualitative analysis showed highest rating scores for 55 kV VMI+ reconstructions followed by 40 keV and 70 keV VMI+ series with a significant difference compared to standard 120 kV CT images series regarding image quality, vascular contrast and diagnostic assessability for the femoral access planning( $p < 0.001$ ).

#### **CONCLUSION**

s Our findings suggest that PCCT virtual mono-energetic imaging provides higher SNR and CNR values and better IQ than conventional CT imaging for the abdominal aorta and pelvic vessels at 40 keV. However, for qualitative image quality, 55 keV may be preferred.

#### **CLINICAL RELEVANCE/APPLICATION**

Choice of the right VMI+ reconstruction, allows for use of the diagnostic quality reserve for potential reduction in contrast agent and radiation dose. Further, low-keV VMI+ PCCT reconstructions with enhanced diagnostic quality for TAVR procedure planning may improve patient safety.

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## Abstract Archives of the RSNA, 2023

M5A-SPBR

### Breast Imaging Monday Poster Discussions I

#### Sub-Events

#### M5A-SPBR-1 Added Value of Contrast-enhanced Digital Mammography (CEDM) in BI-RADS 3 Lesions

##### PURPOSE

The purpose of our study is to evaluate if our cancer detection rate in our institution for BI-RADS 3 lesions was less than 2%, and to assess if our detection rate could be improved by using contrast-enhanced digital mammography (CEDM).

##### METHODS AND MATERIALS

A total of 473 BI-RADS 3 patients depicted on screening mammogram from 2018 to 2020 were collected from our files. All the patients consented to undergo CEDM and biopsy at their next hospital visit. Contrast enhancement intensity categorized as follows: a) Type -1: negative enhancement, b) Type 0: no enhancement c) Type 1: moderate enhancement, d) Type 2: intense enhancement and/or e) Type BE: background enhancement. Pathology results confirmed 473 lesions in total.

##### RESULTS

18 (3,81%) out of the 473 lesions were diagnosed as malignant. The mean age of the patients was 56,22 years. On the contrary, 455 (96,89%) lesions were benign. The mean age of these patients was 51,04. Using CEDM's technique data a total of 5 (1,95%) out of 256 lesions with Type -1 and Type 0 enhancement were diagnosed as malignant and 251 (98,05%) were benign. Additionally, a total of 13 (5,99%) out of 217 lesions with any type of enhancement were proved as malignant and 204 (94,01%) were proved as benign. Negative or no enhancement of a BI-RADS 3 lesion at CEM technique shows 1,95% possibility to be malignant, which is 1,86% better than digital mammography alone.

##### CONCLUSION

Our study confirms CEDM's added value in BI-RADS 3 lesions evaluation, regarding the positive impact on more accurate staging in the first categorization.

##### CLINICAL RELEVANCE/APPLICATION

The use of CEDM on a BI-RADS 3 lesions could potentially predict more accurately benign entities, based on their type of enhancement, and thus play a key role as first line mammography.

#### M5A-SPBR-2 Diagnostic Accuracy of Thoracic Photon-counting Computed Tomography for Locoregional Staging of Breast Cancer: A Prospective Trial

##### Participants

Jakob Neubauer, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

The aim of this study was to demonstrate the feasibility of complementary locoregional staging of breast cancer in thoracic photon-counting CT (PC-CT) and determine diagnostic performance compared to digital mammography (DM) with MRI as the reference standard.

##### METHODS AND MATERIALS

This prospective clinical cohort study included patients with newly diagnosed breast cancer and indication for CT staging of the thorax over a period of 12 months. Patients underwent contrast-enhanced thoracic PC-CT (NAEOTOM Alpha, Siemens Healthineers) and breast MRI in prone position. PC-CT and DM were rated by two independent radiologists regarding the diameter of the largest mass, infiltration of cutis/pectoral muscle/ thoracic wall, number of masses, adjacent DCIS, tumor conspicuity, and diagnostic confidence in a blinded fashion. Reference standard was generated from a consensus reading of MRI by an independent adjudication committee including all histopathological/clinical data. Statistical analysis comprised calculation of Cohen's kappa, Spearman's rho, and pooled measures of diagnostic accuracy.

##### RESULTS

Among 32 enrolled female subjects (mean age 59 [SD 13.0]) diagnostic accuracy for T-classification (TNM8thEd.) was higher for PC-CT compared to DM (0.94 vs. 0.50;  $p < 0.01$ ) and the number of detected tumor masses were more strongly correlated with the reference standard compared to DM (0.72 vs. 0.50;  $p < 0.01$ ). Furthermore, sensitivity and specificity for DCIS were higher in PC-CT compared to DM (0.83 and 0.99 vs. 0.25 and 0.80;  $p < 0.04$ ). Average kappa values for inter-reader reliability were higher for PC-CT than DM (mean 0.88 vs. 0.54, respectively;  $p = 0.01$ ).

##### CONCLUSION

Locoregional breast cancer staging using contrast-enhanced thoracic PC-CT outperformed digital mammography, with significant improvements in diagnostic accuracy for T-classification, number, and pattern of tumor masses.

## CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced thoracic PC-CT might help provide a more accurate locoregional staging for breast cancer compared to digital mammography.

## M5A-SPBR-3 Contrast Enhanced Mammography: Results after 10 Years of Breast Cancer Screening

### PURPOSE

To evaluate the efficacy of contrast-enhanced mammography (CEM) in detecting breast cancer over a ten-year period in women with intermediate breast cancer risk or dense breasts.

### METHODS AND MATERIALS

We conducted a retrospective analysis of all CEM examinations performed for screening purposes at our institution between 2012 and 2023. Demographic data, breast density scores, background enhancement, and BI-RADS scores were extracted using rule-based natural language processing (NLP) techniques. Biopsies performed following CEM examinations and their respective pathology results were also identified. Positive CEM results were defined as BI-RADS 3-5 or 0, while negative results were BI-RADS 1-2. BI-RADS scores of CEM and low-energy images (equivalent to 2D-mammography) were compared with biopsy results and imaging follow-up.

### RESULTS

A total of 5424 CEM screening examinations were performed between the years 2012 and 2023 in 3484 women. The mean age was 54 years, and 18.2% of women (633/3484) had family history of breast cancer. Dense breasts (BI-RADS density score C-D) were observed in 88.3% (3076/3484) of the women, and 34.2% (1193/3484) had background parenchymal enhancement at CEM. A total of 367 biopsies were performed following CEM examinations, and 42 were malignant. CEM detected all cancer cases: sensitivity 100% (42/42), specificity 79.2% (4297/5424), PPV 3.6% (42/1169), NPV 100% (4297/4297). Eight interval cancers were identified during the first-year of follow-up. Of them six with a BI-RADS 0 score at CEM and supplemental MRI recommendation, and two with BI-RADS 3 scores at CEM and six months follow-up. CEM increased the cancer detection rate beyond 2D mammography, with an incremental cancer detection rate of 4/1000 screens.

### CONCLUSION

s CEM increased breast cancer detection rate compared to 2D mammography in women with dense breasts and intermediate breast cancer risk.

## CLINICAL RELEVANCE/APPLICATION

This ten-year screening cohort supports the implementation of CEM for breast cancer screening in specific populations, including women with intermediate breast cancer risk and dense breasts.

## M5A-SPBR-4 Seeing through Contrast: A Dosimetric Comparison of CEM-guided Biopsy and Other Mammography-guided Procedures

### PURPOSE

This study aims to evaluate the average glandular dose (AGD) of contrast-enhanced mammography (CEM) guidance in comparison with other mammography-guided techniques, including digital stereotactic breast biopsy (SBB) and digital breast tomosynthesis (DBT) guidance. Additionally, we investigate the relationship between AGD and compressed breast thickness (CBT) and estimate the percentage dose due to low-energy (LE) and high-energy (HE) images for routine and interventional CEM.

### METHODS AND MATERIALS

We performed a retrospective analysis of 163 anonymized mammography-guided interventions, comprising 43 contrast-enhanced mammography (CEM)-guided interventions, all conducted using the same upright mammography unit. Our assessment focused on the overall average glandular dose (AGD) per image acquisition and modality, as well as its dependence on breast thickness. Additionally, we evaluated the AGD differences between low-energy (LE) and high-energy (HE) acquisitions for both CEM approaches.

### RESULTS

Our study found that the AGD for a single CEM-guided biopsy acquisition (1.48 mGy) was similar to SBB (1.49 mGy) and a single DBT scout (1.55 mGy). The AGD increased with increasing breast thickness for all modalities, with a lower slope for CEM guidance compared to other modalities. Both SBB and CEM require a similar number of images per procedure, while DBT-guided biopsy requires fewer images and offers a lower AGD range. The AGD from a CEM was similar to SBB, even inferior for higher CBT. AGD proportions between LE and HE images are relatively similar for routine and single CEM-guided biopsy image acquisition, with overall dose increase predominantly attributed to LE images across all breast thicknesses.

### CONCLUSION

s Our findings indicate that the radiation dose from CEM guidance during mammography-guided biopsies is within the range commonly achieved for conventional SBB and lower than the values obtained for standard SBB at higher compressed breast thickness. CEM guidance presents great potential to improve the visibility of suspected findings, suggesting it can be a valuable tool for breast interventionism, not only for RC-only findings but also for other indications where increased visibility is required.

## CLINICAL RELEVANCE/APPLICATION

This study provides important dosimetric information on the safety of CEM-guided biopsy, showing that it is a comparable and effective tool for breast interventionism, with similar radiation dose to other established procedures. Our results highlight the potential benefits of CEM-guidance in improving the visibility of suspected findings and increasing diagnostic accuracy in breast imaging.

## M5A-SPBR-5 Uncovering the Unseen: The Potential of CEM for Invasive Lobular Carcinoma Detection

### PURPOSE

Invasive lobular carcinoma (ILC) can be challenging to detect due to its slow-growing nature and subtle appearance. The aim of this study was to determine the lesion conspicuity using contrast-enhanced mammography (CEM) and compare the diagnostic performance of CEM and MRI. We also assessed the correlation of the overall lesion size on imaging with the final histopathological report.

## **METHODS AND MATERIALS**

We retrospectively selected 94 patients with a histopathological diagnosis of ILC who had undergone preoperative CEM between January 2018 and June 2022 at the Hospital del Mar in Barcelona. We collected data on CEM indication, breast density, background parenchymal enhancement (BPE), multicentricity/multifocality, lesion location, lesion findings on low energy (LE) and recombined (RC) images, lesion conspicuity, and lesion size in LE (mm). We also performed a comparative analysis between CEM and MRI for the 59 cases that had both modalities, and verified the agreement between the measurement of lesions in CEM and the sizes in MRI and the final histologic report.

## **RESULTS**

CEM sensitivity in detecting ILC was 98%, and the lesion conspicuity was high in most cases. CEM was not inferior to MRI for ILC evaluation or tumor size assessment, with a positive correlation between CEM and MRI, CEM and histopathology, and MRI and histopathology. The difference between the mean lesion size for CEM and MRI compared to the mean lesion size reported by histopathology was not statically significant.

## **CONCLUSION**

Despite ongoing debate about ILC's perceived weaker enhancement on CEM compared to invasive ductal carcinoma, our results showed that CEM can be a valuable alternative to MRI for ILC evaluation, providing a safe, immediately available, and rapid assessment of tumor extent.

## **CLINICAL RELEVANCE/APPLICATION**

CEM can be a useful alternative to MRI for the preoperative assessment of patients with ILC. It can also help detect potentially larger tumor sizes than initially expected and aid in making appropriate targeting decisions.

## **M5A-SPBR-6 Interobserver Agreement between Breast Imagers using the First Version of the BI-RADS CEM Lexicon**

Participants  
Calogero Zarcaro, MD, Palermo, Italy (*Presenter*) Nothing to Disclose  
Ambra Santonocito, MD, Torino, Italy (*Presenter*) Nothing to Disclose

## **PURPOSE**

The purpose of this study was to assess the interobserver agreement of the CEM lexicon, which has been introduced as a supplement to the 5th edition of the BI-RADS mammography lexicon.

## **METHODS AND MATERIALS**

IRB-approved single center retrospective study. Three breast imaging fellows reviewed 295 lesions in 246 routine clinical breast CEM according to the fifth edition of the BI-RADS lexicon for Mammography and to the first version of the BI-RADS lexicon for CEM. Readers were blinded to patient outcomes, and evaluated breast and lesion features on low energy images (ACR breast density, type of findings, associated architectural distortion), lesion features in recombined images (enhancement findings, lesion conspicuity, mass shape, mass margin, mass internal pattern of enhancement, non-mass distribution, non-mass internal pattern of enhancement, enhancing asymmetry) and also provided a final BI-RADS assessment for both images (MG BI-RADS and CEM BI-RADS assessment). Interobserver agreement was calculated for each evaluated feature using kappa ( $\kappa$ ) statistics.

## **RESULTS**

Interobserver agreement for ACR breast density was substantial ( $\kappa = 0.622$ ). Interobserver agreement was moderate to substantial for breast density and findings assessment on both low-energy and recombined images, especially for type of findings ( $\kappa = 0.644$ ) and for enhancement findings ( $\kappa = 0.700$ ). Regarding mass enhancement, there was moderate agreement for shape ( $\kappa = 0.571$ ) and substantial agreement for margins ( $\kappa = 0.603$ ) and internal enhancement ( $\kappa = 0.648$ ). For non-mass enhancement, there was moderate agreement on distribution ( $\kappa = 0.445$ ) and internal enhancement ( $\kappa = 0.518$ ). However, agreement was only fair for asymmetric enhancement's descriptors (homogeneous vs heterogeneous,  $\kappa = 0.313$ ) and MG and CEM BI-RADS assessment ( $\kappa = 0.379$  and  $\kappa = 0.375$ , respectively).

## **CONCLUSION**

Moderate and substantial interobserver agreement were demonstrated for breast density and findings assessment on both low-energy and recombined images. There was moderate to substantial agreement on most CEM BI-RADS lesion morphology descriptors, while the agreement was only fair for the descriptors of an enhancing asymmetry.

## **CLINICAL RELEVANCE/APPLICATION**

Most of CEM-BIRADS lexicon features allow for an overall high inter-reader agreement, with a lower agreement regarding the descriptors of an enhancing asymmetry and overall BI-RADS assessment.

## **M5A-SPBR-7 Can Contrast-enhanced Mammography (CEM) Categorize More Accurate B3 Lesions and Reduce Unnecessary Surgical Excisions?**

## **PURPOSE**

a) To evaluate the upgrade rates of B3 lesions to malignancy b) To assess if we can get any benefit using CEM to avoid unnecessary open surgical excisions (OSE).

## **METHODS AND MATERIALS**

This is a retrospective analysis of CEM examinations that performed in our institution from 2012-2015. The analysis included a total of 1092 CEM examinations. Contrast enhancement intensity was categorized in four categories as follows: a) "-1": negative

enhancement, b) "0": no enhancement c) "1": enhancement and d) "BPE": background parenchymal enhancement. In addition to the CEM procedures, 776 core needle biopsies (CNB) were performed. The analysis found that 68 patients returned 71 B3 lesions at the pathology result. As a result, an open surgical excision (OSE) was then performed.

## RESULTS

Out of the 71 B3 lesions, 16 (22.54%) were atypical ductal hyperplasia (ADH), 2 (2.82%) were flat epithelial atypia (FEA), 14 (19.72%) were lobular neoplasia (LN), 1 (1.41%) was phyllodes tumor (PT), 33 (46.48%) were papillary lesions (PL) and 5 (7.04%) were radial scars (RS). Using CEM's results these lesions were categorized as follows: 59 (83.1%) lesions had any type of enhancement either "1" or "BPE" and 12 (16.9%) of the lesions had "0" enhancement. None of the lesions had "-1" enhancement. After OSE, 18 (25.35%) lesions upgraded their histological result to a malignancy from which 6 (33.33%) were first categorized as ADH, 1 (1.85%) as FEA, 7 (38.88%) as LN, 1 (1.85%) as PT and 3 (16.66%) as PL. None of the radial scars upgraded their histological result. From these 18 lesions, 17 (94.44%) had any type of enhancement and 1 (5.56%) had no enhancement on CEM.

## CONCLUSION

The findings of this study support the added value of contrast-enhanced mammography (CEM) in the evaluation of B3 lesions, as it can help to categorize these lesions more accurately. Notably, the absence of enhancement in a B3 lesion on CEM has a high negative predictive value, suggesting that it could be a useful tool for reducing the need for open surgical excisions.

## CLINICAL RELEVANCE/APPLICATION

In our institution, the use of CEM could potentially result in a 16.9% reduction in OSE

### **M5A-SPBR-8 Pectoralis Muscle Invasion by Breast Cancer: Can Digital Breast Tomosynthesis Combined with Contrast-enhanced Mammography Improve Diagnostic Confidence**

#### PURPOSE

Pectoralis muscle invasion (PMI) by breast cancer (BC) cannot be confidently diagnosed by mammography. Breast MRI is more effective but has limitations. We evaluated a combination of contrast-enhanced mammography (CEM) and digital breast tomosynthesis (DBT) under the same compression for diagnostic accuracy and reader confidence in predicting PMI.

#### METHODS AND MATERIALS

Prepectoral cancers (defined as masses adjacent to pectoral muscle with no intervening fat plane) were retrospectively identified in patients with DBT/CEM for BC staging at a single institution. 5 radiologists independently reviewed CEM (low energy (LE) and recombined (RC)) and DBT images of the involved breast in craniocaudal (CC) and mediolateral oblique (MLO) projections, then MRI when available, evaluated predefined radiologic signs of PMI for each image, and graded their diagnostic confidence (Table 1). The ground truth was PMI on surgical pathology (SP). For patients with unavailable SP, or in those post neoadjuvant chemotherapy (NAC) with therapy response and no PMI on SP, radiologists' consensus on muscle and/or fascia enhancement on pre-NAC MRI was used as the ground truth. Measures of diagnostic accuracy, mean radiologist confidence and radiologist agreement for each image type/modality were calculated per radiologic sign, per view and per case.

#### RESULTS

Of 145 patients, 9 had prepectoral masses. PMI was present in 3 and absent in 6 cases, with the ground truth based on SP in 3 and on MRI in 6 cases. The range of accuracies for LE was 0.29-0.62 for CC and 0.56-0.67 for MLO. The accuracy of RC was 0.62 for CC and 0.78 for MLO. For CC views the accuracies of LE, RC, and DBT were 0.5, 0.5-0.62, and 0.29-0.5, respectively, with an overall CC DBT/CEM accuracy of 0.62. For MLO views the accuracies of LE, RC, and DBT were 0.67, 0.56-0.78, and 0.67, respectively, with an overall MLO DBT/CEM accuracy of 0.56. Breast MRI had higher per-case diagnostic accuracy than DBT/CEM (1 vs 0.78) with muscle enhancement as the most accurate MRI sign (1.0), followed by fascia enhancement (0.86). On a scale of 1-3, mean radiologist confidence per case was 1.9 for DBT/CEM (1.8-2.3 for LE, 1.6-2.2 for RC, and 2.1-2.4 for DBT) with poor agreement (-0.14); vs 2.7 for MRI with moderate to substantial agreement (0.56-0.6).

#### CONCLUSION

Breast MRI is superior to DBT/CEM in accuracy and radiologist agreement for PMI. RC images improve the accuracy of non-enhanced images but have the lowest radiologist confidence among all modalities. DBT has lowest accuracy but highest confidence. Absence of SP on treatment-naïve BC and use of MRI as a surrogate limits this study.

#### CLINICAL RELEVANCE/APPLICATION

Although RC images marginally improve the accuracy of DBT/CEM for PMI, breast MRI remains the modality of choice for evaluation of prepectoral BC.

### **M5A-SPBR-9 Can the ROI of Enhancement Predict the Histopathology of a Lesion on CESM**

#### PURPOSE

Contrast-enhanced spectral mammography (CESM) is a rapidly emerging technique for the accurate staging of breast cancer. Can the enhancement levels in CESM be used to predict histology of a lesion?

#### METHODS AND MATERIALS

A retrospective analysis of patients undergoing CESM at St Bartholomew's Hospital, between November 2020 and November 2021, was performed. All lesions confirmed by imaging guided histopathology and had CESM enhancement characteristics analysed. The degree of contrast was quantitatively assessed by measuring the region of interest (ROI) difference between the enhancing lesion and background as a ratio, on both craniocaudal (CC) and mediolateral (ML) views. Statistical analysis was performed to determine whether the percentage signal difference between enhancing lesions and background (%RS) correlated to histopathological results. The %RS calculated for the 3 histological results were compared: invasive and non-invasive cancers and benign lesions.

#### RESULTS

138 lesions were detected, consisting of 73 (52.9%) invasive cancers, 32 (23.2%) non-invasive cancers, and 32 (23.9%) benign lesions. Analysis of enhancement indices showed the following mean %RS: Invasive cancers (ML 1.64%, CC 1.51%), Non-invasive



cancers (ML 0.98%, CC 1.02%), Benign lesions (ML 0.75%, CC 0.68%). The enhancement intensity of invasive cancers was significantly higher than that of non-invasive and benign lesions (in both views  $p < 0.01$ ). After the Bonferroni correction, the distribution of %RS in invasive and non-invasive cancers was statistically significant ( $p < 0.01$ , 95%CI -0.01 to 0.003). Similarly for the invasive lesions and benign lesions ( $p < 0.01$ , 95%CI 0.005 to 0.001), while the difference between non-invasive cancer and benign lesions was non statistically significant ( $p = 0.21$ , 95%CI -0.001 to 0.006).

#### **CONCLUSION**

s There is a correlation between the degree of lesion enhancement in CESM among invasive cancers, non-invasive cancers, and benign lesions. Invasive cancers had the stronger enhancement. There is difference in the enhancement between invasive cancer and non-invasive cancers as well as invasive cancers and benign lesions. There is no difference between the non-invasive cancers and benign lesions.

#### **CLINICAL RELEVANCE/APPLICATION**

Quantitative analysis of enhancement levels in CESM is a feasible in the pre-operative assessment of women with breast cancer and can be used to predict histology of a lesion.

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## Abstract Archives of the RSNA, 2023

M5A-SPCA

### Cardiac Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPCA-1 Improving Dynamic Evaluation of Myocardial Gadolinium Concentration using Elastic Registration for T1 Mapping with Pharmacokinetics Modeling**

##### Participants

Yasutoshi Ohta, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Developing a T1 mapping-based pharmacokinetic method to evaluate myocardial gadolinium concentration over time, and enhancing accuracy by optimizing elastic deformation registration

##### METHODS AND MATERIALS

Thirty-five subjects (66 yrs, IQR 65,76) referred for CMR examination were included in this study. In addition to routine examinations, including cine and LGE, Native T1 and dynamic T1 maps (2, 5, 9, and 15 min after contrast administration) were obtained using the MOLLI sequence. T1 maps were obtained at the base, mid, and apex of the left ventricle, and concentration maps without registration were calculated for each imaging time from the native T1map and the post-contrast T1map. Similarly, the concentration maps with elastic registration (ER) for the native T1 maps were calculated from the post-contrast maps as well. The time after contrast administration was calculated for each image in seconds from DICOM tags. Estimated myocardial concentration maps (mM/l) at each imaging time were generated from the parameters obtained from pharmacokinetic analysis using a two-compartment model for each time series concentration map with and without ER. The model fitting accuracy was evaluated by comparing the residuals with and without ER. Myocardium was extracted from each map, the measured myocardial concentration (MC) and the estimated concentration (EC) at the same post-contrast time of MC, and the mean difference (delta\_mean) and standard deviation (delta\_SD) between the MC and EC were measured. Gadolinium concentration of the blood pool was also evaluated for residuals with and without ER.

##### RESULTS

Analyzable dynamic T1 maps were obtained from all subjects. The fitting residuals in the myocardial contrast medium density analysis improved significantly from 0.746 to 0.822 by applying ER ( $p < 0.001$ ). The fitting residuals for the blood pool improved significantly from 0.848 to 0.875 by applying ER ( $p < 0.001$ ). The delta\_mean with ER was significantly smaller than without ER: 2min; 0.031 vs. 0.026, 5min; -0.026 vs. -0.022, 9min; -0.025 vs. -0.022, 15min; 0.024 vs. 0.019, (without ER vs. with ER, respectively). The delta\_SD was significantly reduced with ER compared to without ER at all imaging times (all; 0.05 vs. 0.03, 2min; 0.05 vs. 0.03, 5min; 0.06 vs. 0.04, 9min; 0.06 vs. 0.04 15min; 0.04 vs. 0.02mM/l) (all,  $p < 0.05$ ).

##### CONCLUSION

Employing elastic deformation registration in dynamic T1 mapping enhanced the accuracy of estimated concentrations derived from myocardial contrast medium pharmacokinetic analysis.

##### CLINICAL RELEVANCE/APPLICATION

The pharmacokinetic approach enables the creation of myocardial gadolinium concentration maps at any given time and the analysis of longitudinal properties such as contrast agent washout in myocardial tissues.

#### **M5A-SPCA-2 Myocardial Tissue Characterization by CMR for the Evaluation of Heart Failure with Preserved Ejection Fraction in Hypertrophic Cardiomyopathy**

##### PURPOSE

This study sought to evaluate the role of myocardial tissue characteristics detected by CMR in the identification of HFpEF in HCM.

##### METHODS AND MATERIALS

In this prospective study, 133 patients with HCM were consecutively enrolled for biomarker testing, echocardiography and CMR including Late gadolinium-enhanced (LGE) imaging and T1 mapping to access tissue characteristics including native T1 values, extracellular volume fraction (ECV) and indexed ECV (iECV).

##### RESULTS

Finally, 75 (56.4%) HCM patients were diagnosed with HFpEF based on the 2019 ESC HFA-PEFF diagnostic algorithm. LGE%, native T1, ECV, and iECV were all significantly greater in HFpEF subjects than in non-HF subjects (all  $p < 0.05$ ). Native T1 value (AUC: 0.723;  $p < 0.001$ ) was a stronger discriminator with the highest sensitivity (80%) than ECV (AUC: 0.622,  $p = 0.016$ ), iECV (AUC: 0.695;  $p < 0.001$ ) and other CMR parameters. In multivariable regression analysis, native T1 (odds ratio [95%confidence interval]: 1.223[1.078-1.388] per 10 ms increased,  $P = 0.002$ ) remained significantly related to the diagnosis of HFpEF-HCM while LGE%, ECV and iECV were not. Native T1, ECV and iECV weakly/moderately correlated with elevated NT-proBNP (? : 0.551, 0.314 and 0.352 respectively; all  $p < 0.05$ ) and lower early diastolic mitral annular velocity (e') (? : -0.381, -0.188 and -0.255 respectively; all

p<0.05).

## CONCLUSION

s Prolonged native T1 and elevated extracellular volume correlated with increased NT-proBNP and impaired diastolic function in HCM patients. Native T1 was a sensitive biomarker that independently associated with the diagnosis of HFpEF-HCM.

## CLINICAL RELEVANCE/APPLICATION

CMR-derived myocardial tissue characteristics, especially native T1 value, could be applied in the clinic even as a supplementary biomarker for discrimination of HFpEF in the HCM cohort. Given that diffuse myocardial remodeling may be a dynamic process, monitoring native T1 might be essential to develop timely interventions to reverse disease progression.

## M5A-SPCA-3 Comparison of Myocardial Lesions by Pharmacokinetic Modeling Concentration Maps Over Time and General One-point LGE

Participants

Yasutoshi Ohta, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the feasibility of detecting myocardial lesions earlier than with conventional LGE timing, as well as to assess the temporal characteristics of these changes, utilizing gadolinium density maps generated from a pharmacokinetic model

## METHODS AND MATERIALS

Thirty-five subjects (66 yrs, IQR 65,76) referred for CMR examination were included in this study. In addition to routine examinations, including cine and 10 minutes LGE, native T1 and dynamic T1 maps (2, 5, 9, and 15 min after contrast administration) were obtained using the modified Look-Locker inversion recovery sequence. Pharmacokinetic analysis of myocardial and blood pool gadolinium concentrations was performed using a two-compartment model, and predicted concentration maps (mmol/l) at 5, 7, 10, 15, 20, 25, and 30 minutes after contrast were generated from calculated parameters. In cases with positive LGE, the gadolinium concentration of the LGE lesion and remote myocardium, extracellular volume fraction ECV (ECVles, ECVremo) was calculated at each time point. The contrast ratio between the lesion and the remote myocardium was measured on the density map and LGE images. Changes in these indices at each time point were compared.

## RESULTS

Hyperenhancement was observed in 20 cases in the LGE image. Lesions were detected at the same sites as LGE in all-time concentration maps. Gadolinium concentrations in the LGE area at each time were 0.48, 0.46, 0.41, 0.34, 0.27, 0.22, and 0.19, showing significant changes, respectively. Contrast concentration in remote myocardium was 0.29, 0.27, 0.24, 0.20, 0.16, 0.13, and 0.11, with significant changes each time. Contrast ratios were 0.25, 0.25, 0.26, 0.35, 0.34, 0.33, and 0.32, with significantly higher values after 15 minutes. The contrast ratio of LGE was 0.61. ECVles increased slightly over time to 43%, 45%, 46%, 47%, 47%, 48%, and 50%, but not significantly. ECVremo was 26%, 27%, 27%, 27%, 28%, 29%, and 29%, with no significant difference.

## CONCLUSION

s Though the gadolinium density map was inferior to LGE in contrast, lesions were detected at the same sites as LGE after 5 min. Lesion ECV could also be measured without significant change after 5-30 min.

## CLINICAL RELEVANCE/APPLICATION

The evaluation with density maps can detect lesions as early as LGE after contrast and may allow evaluation of myocardial characteristics using contrast agent kinetic changes in the lesion.

## M5A-SPCA-4 Evaluation of Myocardial Mass Index Effect on Myocardial Function and Adverse Events in Hypertrophic Cardiomyopathic Patients with Normal Left Ventricular Ejection Fraction and Minimal Fibrosis, by Cardiac MRI Strain Analysis: A Prospective Study

Participants

Sanaz Asadian, MD, Tehran, Iran, Islamic Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

HCM patients are at risk of developing adverse cardiac events, so an effective risk stratification tool is desirable, strain value measurements by cardiac MRI are reproducible and can show subclinical myocardial deformity, which makes them a potential imaging marker to predict patient's outcome. We evaluated the pattern myocardial strain changes based on myocardial mass index by cardiac MRI in a group of HCM patients with normal left ventricular ejection fraction (LVEF) and low fibrosis.

## METHODS AND MATERIALS

We evaluated cardiac magnetic resonance (CMR) and clinical data of 70 cases, including 50 HCM (62% male) and 20 healthy (50% male) subjects. HCM cases inclusion criteria were; normal LVEF with a late gadolinium enhancement (LGE) percentage <10%, exclusion criteria were history of hypertension, valvular heart disease, infiltrative cardiac disorders, ischemic heart disease and renal impairment with estimated glomerular filtration rate (eGFR) less than 30mL/min. follow-up time is set to be 3 years, adverse events are defined as sudden cardiac death, aborted cardiopulmonary resuscitation (CPR), hospitalization because of heart failure or serious arrhythmic events. We clarified between-group differences by ANOVA and post hoc tests. Also Univariate, multivariate Cox regression and Kaplan-Meier analyses revealed the strain pattern differences between patient with favorable and unfavorable prognosis. P value <0.05 was considered significant.

## RESULTS

LV global longitudinal, circumferential, and radial strains (GLS, GCS, and GRS) as well as LV myocardial mass index, were different between the control group and HCM cases (P value < 0.05). Even in HCM patients with normal myocardial mass index strain values were significantly lower than control group. A progressive decline in LVGLS, and LVGCS values were noted along with myocardial mass index increase. LVGLS, LVGCS, and LGE percentage predicted adverse events, and LVGCS was the most potent predictor of

adverse events.

## CONCLUSION

s Increase in Myocardial mass index, independently cause myocardial contraction abnormalities evident by LV strains impairment despite normal EF and minimal myocardial scar index. CMR parameters, especially CMR feature tracking strain values, could predict adverse events in our study population.

## CLINICAL RELEVANCE/APPLICATION

HCM can result in adverse cardiac events, but many patients are living an uneventful life, thus a screening method in HCM could optimize preventive approaches, strain measurement by CMR are potential imaging markers in this regard.

## M5A-SPCA-5 Differentiating Cardiac Amyloidosis from Hypertrophic Cardiomyopathy using Myocardial Atrial Strains Derived from Cardiac MRI

### PURPOSE

Cardiac amyloidosis (CA) is a curable disease for which early diagnosis and treatment are vital. T1 mapping or late gadolinium enhancement (LGE) is a reliable method to differentiate amyloidosis from hypertrophic cardiomyopathy (HCM). However, there are several limitations to its usage, such as additional image acquisition, differences in T1 values due to equipment and facility, and the need for contrast materials for LGE. Recently, myocardial atrial and ventricular strains derived from magnetic resonance imaging (MRI) were developed to assess myocardial dysfunction in each chamber. This study aimed to evaluate the feasibility of using cardiac atrial or ventricular myocardial strains derived from MRI to differentiate CA from HCM.

### METHODS AND MATERIALS

A total of 27 patients with CA and 76 patients with HCM underwent cardiac MRI; of these, 27 were identified with matched left ventricular ejection fraction (LVEF). The left ventricular strain (LVS), left atrial strain (LAS), right ventricular strain (RVS), and right atrial strain (RAS) were calculated from 4-chamber cine MRI images using a dedicated workstation. The diagnostic performance of CA for HCM was compared using receiver operating characteristic analysis.

### RESULTS

LAS (CA:9.7%, HCM: 15%), RVS (CA:13.1%, HCM: 16%), and RAS (CA:10.4%, HCM: 20%) were significantly lower in the CA group than in the HCM group ( $P < 0.05$ ), whereas LVS showed no significant difference between the two groups (CA, 11%; HCM, 12.4%) ( $P = 0.21$ ). The areas under the curves were LVS, 0.60; LAS, 0.74; RVS, 0.68; and RAS, 0.82. The RAS and LAS showed significantly higher diagnostic performance than the LVS ( $P < 0.05$ ).

## CONCLUSION

s Myocardial atrial strain derived from MRI can differentiate CA from HCM with high diagnostic performance. Moreover, it reflects the pathophysiological differences between the two.

## CLINICAL RELEVANCE/APPLICATION

The myocardial atrial strain derived from MRI does not require additional image acquisition or contrast administration. This simple and convenient method could be used to diagnose cardiac amyloidosis.

## M5A-SPCA-6 Multimodal Imaging using FDG PET/MR and Adenosine Stress NH3 PET was Used to Study Patients with Hypertrophic Cardiomyopathy

### PURPOSE

Previous studies of FDG PET in HCM are lacking, but this modality can explain the inflammatory process that precedes myocardial fibrosis. The aim of the study was to compare regional inflammation by FDG uptake, fibrosis by LGE MRI, and microvascular dysfunction by adenosine stress NH3 PET in patients with HCM.

### METHODS AND MATERIALS

Between Jan 2016 and Apr 2018, a total of 25 patients were included in the retrospective study. FDG PET and MRI were simultaneously acquired using an integrated PET/MR scanner, and patients were prepared with a low carbohydrate diet to suppress physiologic myocardial uptake. FDG PET and LGE were analyzed using a 17-segment model, and myocardial flow was analyzed using commercial software (4DM) and compared with FDG PET and LGE.

### RESULTS

Four patients were excluded due to improper physiologic myocardial suppression ( $n=1$ ) or combined ischemic heart disease ( $n=3$ ), leaving 21 patients (16 males, age  $59 \pm 15$  years) in the final analysis. All 21 patients showed abnormal FDG uptake ( $6.8 \pm 3.7$  segments) and 20 patients showed LGE ( $5.7 \pm 3.1$  segments). Mean stress myocardial blood flow was  $1.89 \pm 0.59$  mL/min/g. FDG uptake and LGE were observed in hypertrophic myocardium and, in some patients, in non-hypertrophic myocardium. Hypertrophic myocardium showed decreased stress myocardial flow compared with non-hypertrophic myocardium. Increased FDG uptake was related to LGE ( $\rho = 0.805$ ,  $p < 0.001$ ). Of the total 357 segments analyzed, 83.8% showed matched results (102 segments were both positive and 197 segments were both negative). Increased FDG uptake was also related to decreased stress flow ( $\rho = -0.512$ ,  $p = 0.043$ ).

## CONCLUSION

s The study found that evaluation of HCM with FDG PET/MR and stress NH3 PET was useful in evaluating inflammatory changes, fibrosis, and ischemic severity, to explain pathophysiology and to understand disease status. The study also newly found that FDG PET has a correlation with LGE and ischemia, which are known as poor prognostic factors

## CLINICAL RELEVANCE/APPLICATION

The study also newly found that FDG PET has a correlation with LGE and ischemia, which are known as poor prognostic factors

## M5A-SPCA-7 Imaging Features in Female Patients with Wild-type Transthyretin Amyloidosis Cardiomyopathy

Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

## **PURPOSE**

Wild-type transthyretin amyloid cardiomyopathy (ATTRwt-CM) is significantly male-dominated, but there are also female patients. However, sex-related differences in ATTRwt-CM remain unclear. This study aimed to assess imaging features in female patients with ATTRwt-CM.

## **METHODS AND MATERIALS**

We retrospectively analyzed 106 consecutive patients who were diagnosed with ATTRwt-CM and evaluated sex-related differences in the imaging features including cardiac MRI and 99mTc-labeled pyrophosphate scintigraphy (99mTc-PYP).

## **RESULTS**

Twelve patients (11.3%) were female. These female patients were significantly older at diagnosis ( $75.3 \pm 6.3$  years vs.  $80.6 \pm 4.4$  years;  $p < 0.01$ ). Cardiac MRI-measured left ventricular end-systolic volume was significantly lower ( $44.3 \pm 23.8$  ml vs.  $31.1 \pm 29.3$  ml;  $p < 0.05$ ) and the ejection fraction was significantly higher ( $51.6 \pm 14.1$  % vs.  $62.0 \pm 21.0$  %;  $p < 0.05$ ) in female patients. There was no significant gender difference in left ventricular mass ( $138.4 \pm 48.7$  g vs.  $115.0 \pm 75.7$  g;  $p = 0.26$ ). In T1 mapping, there was no significant difference in native T1 ( $1420.3 \pm 54.0$  ms vs.  $1427.3 \pm 77.5$  ms;  $p = 0.76$ ), but extracellular volume fraction (ECV) was significantly lower ( $56.6 \pm 13.3$  % vs.  $49.4 \pm 15.7$  %;  $p < 0.05$ ) in female patients. No significant difference in myocardial T2 value ( $51.0 \pm 4.5$  ms vs.  $51.0 \pm 3.0$  ms;  $p = 0.97$ ). The mean heart-to-contralateral ratio obtained using 99mTc-PYP was significantly lower in female patients ( $1.95 \pm 0.39$  vs.  $1.63 \pm 0.24$ ;  $p < 0.01$ ).

## **CONCLUSION**

Female patients with ATTRwt-CM were predominantly older and had preserved left ventricular ejection fraction, weaker cardiac uptake of the 99mTc-PYP, and lower ECV value compared with male patients. These imaging features may contribute to the underdiagnosis of ATTRwt-CM in female patients.

## **CLINICAL RELEVANCE/APPLICATION**

Female patients with ATTRwt-CM have different imaging features than the male counterparts, and we need to recognize these imaging features to avoid underdiagnosing it.

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## Abstract Archives of the RSNA, 2023

M5A-SPCH

### Chest Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPCH-1 Multimodal Classification Model for Gram-Positive and Gram-Negative Bacterial Pneumonia using Imaging and Clinical Features: Improving Antibiotic Treatment Decisions**

##### Participants

Ru Wen, Chongqing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aimed to develop and validate a classification model that combines imaging features and clinical characteristics to accurately identify patients with Gram-positive and Gram-negative bacterial pneumonia, assisting clinical physicians in empirical antibiotic treatment.

##### METHODS AND MATERIALS

The study included patients with bacterial pneumonia who sought medical care at a tertiary hospital in China between 2010 and 2020. The patients were randomly divided into a training set and a validation set in an 8:2 ratio. The ResNet-18 model was used as the base model, and 512 features were extracted from the maximum lesion layer as deep features. Spearman correlation and mutual information were employed for dimensionality reduction, and the XGBoost model was utilized to construct the imaging model. The GBM model served as the classifier for establishing the clinical model. A logistic regression algorithm was employed to construct an imaging-clinical fusion model based on the individual scores of the imaging model and the clinical model. The classification performance of the clinical model, imaging model, and fusion model was compared using the DeLong test.

##### RESULTS

This study included data from 2423 patients with bacterial pneumonia. Among them, 563 cases were Gram-positive bacterial pneumonia, and 1860 cases were Gram-negative bacterial pneumonia. The imaging model and clinical model had AUCs of 0.719 and 0.827, respectively, in the test set. The fusion model achieved an AUC of 0.884 (95% CI: 0.868-0.898), sensitivity of 0.772, specificity of 0.822, and accuracy of 0.808 in the test set. The Delong test results demonstrated that the performance of the fusion model was slightly higher than that of the individual imaging or clinical models ( $P < 0.05$ ). Nomogram results of the fusion model showed that clinical scores had the highest weight, and the fusion model exhibited good consistency between predicted probability and expected probability. Decision curve analysis (DCA) confirmed that the fusion model performed well in classifying bacterial pneumonia across most threshold probabilities.

##### CONCLUSION

In this study, we integrated multimodal data including imaging, laboratory tests, and clinical signs to classify gram-positive and gram-negative bacterial pneumonia. Our research demonstrates that the fusion of multiple modalities enhances the classification performance of the model.

##### CLINICAL RELEVANCE/APPLICATION

The fusion model we have developed enables accurate classification of bacterial pneumonia in patients based on CT images, laboratory tests, and clinical signs. It holds significant clinical value in avoiding unnecessary antibiotic usage and provides timely information for guiding clinical decisions and improving patient prognosis.

#### **M5A-SPCH-2 Differentiating Imaging Features of Post Lobectomy Right Middle Lobe Torsion**

##### Participants

Farah Tamizuddin, MD, New York, NY (*Presenter*) Nothing to Disclose

##### PURPOSE

To identify differences in imaging features between patients with confirmed right middle lobe (RML) torsion compared to those with suspected RML torsion who did not have torsion.

##### METHODS AND MATERIALS

This retrospective study entailed a search of radiology reports from April 1, 2014 to April 15, 2021, yielding 52 patients with suspected torsion on imaging but ultimately no lobar torsion and 4 with confirmed torsion. This cohort was supplemented by 2 cases identified prior to the search period for a total of 6 confirmed RML torsion cases. Four thoracic radiologists including an adjudicator evaluated chest radiographs (CXRs) and computed tomography (CT) exams for multiple imaging signs and features. A resident measured the angle between the RML bronchus and bronchus intermedius on coronal reformats of any CTs performed to exclude or confirm torsion for these patients. Fisher exact and Mann-Whitney tests were used to identify any significant differences in imaging features ( $P < .05$ ).

##### RESULTS

A confirmed lobar torsion was seen frequently across the patients with confirmed torsion ( $P < .001$ ) compared to non-torsion patients.

A reversed halo sign was more frequently seen in patients with confirmed torsion ( $P=.001$ ) compared to non-torsion patients (83.3% vs. 0% for 3 readers, including the adjudicator). Torsion patients had a higher percentage of ground-glass opacity (GGO) in the affected lobe compared to non-torsion patients (21.7% vs 13.9% for the adjudicator,  $P=.031$ ). The CT Coronal Bronchial Angle between RML bronchus and bronchus intermedius was larger ( $P=.035$ ) in torsion than non-torsion cases ( $121.3^\circ$  vs  $98.3^\circ$ ). A convex fissure towards the adjacent lobe on CT was more frequent in torsion patients (100% vs 27.3% for the adjudicator,  $P=.009$ ) and increased lobe volume on CT ( $P=.001$ ) occurred more often in confirmed torsion.

## CONCLUSION

s A reversed halo sign, greater proportion of GGO in the affected lobe, larger CT Coronal Bronchial Angle, fissural convexity, and larger lobe volume on CT may aid in early recognition of the rare yet highly significant diagnosis of lobar torsion.

## CLINICAL RELEVANCE/APPLICATION

This paper is clinically relevant because RML torsion is a potentially life-threatening diagnosis and awareness of imaging signs and features associated with this diagnosis can aid radiologists in suggesting RML torsion earlier and more accurately, thus expediting patient care and optimizing patient outcomes.

## M5A-SPCH-3 Frogspawn Sign: Special CT Features for the Diagnosis of Pulmonary Lymphatic Reflux Diseases

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study was to evaluate the value and the morphologic characteristics of the so-called "frogspawn sign" on high-resolution CT as the special CT feature for the diagnosis of pulmonary lymphedema and lymphatic dilatation caused by pulmonary lymphatic reflux diseases (PLRD). This sign has not been reported in the literature by our knowledge.

## METHODS AND MATERIALS

We collected 580 patients with clinical and operative proven PLRD in the study, of which 86 cases had frogspawn sign on HRCT and MSCT lymphography. The imaging features of frogspawn sign were retrospectively reviewed by two chest radiologists who reached decisions by consensus. All patients were followed up for HRCT within 3-6 months.

## RESULTS

The frogspawn sign was seen in 86 (15%) of 580 patients with PLRD, which consisted of diffuse inhomogeneous ground-glass opacity (GGO) with superimposed multiple discontinuous small nodules. The diffuse GGO showed bilateral asymmetrical (100%) and peripheral subpleural or peribronchovascular (14/86, 16%) distribution with predominance in the right middle or lower lung zone. The multiple small nodules appeared round-like or tree-in-bud (22/86, 26%) with 3-6mm in size, central or intrapleural distribution and no continuity or fusion between nodules and nodule-pleura. The spatial distance between the nodules is about 2-4mm. A dynamic changes of this sign was showed in all patients with obvious improvement (32/86, 37%) and aggravation (54/86, 64%) on the follow-up CT.

## CONCLUSION

s The frogspawn sign strongly favors a diagnosis of pulmonary lymphedema and lymphatic dilatation caused by PLRD. This sign is very important for judging the degree of lymphedema and the clinical stage.

## CLINICAL RELEVANCE/APPLICATION

Pulmonary lymphatic reflux abnormalities are rare disorders characterized by developmental malformation of the bronchial-mediastinal lymph trunk and/or thoracic duct outlet anomaly. The frogspawn sign consisted of diffuse inhomogeneous ground-glass opacity (GGO) with superimposed multiple discontinuous small nodules and strongly favors a diagnosis of pulmonary lymphedema and lymphatic dilatation caused by PLRD.

## M5A-SPCH-4 Correlation Between Radiomics Features and Ki-67 Expression in Peripheral Lung Cancers

Participants

Wei Wei, Xianyang, China (*Presenter*) Nothing to Disclose

## PURPOSE

To develop CT image feature-based radiomics signatures to estimate the expression level of Ki-67 in peripheral lung cancers.

## METHODS AND MATERIALS

117 peripheral lung cancer patients who underwent contrast-enhanced CT had confirmed histopathologically and tested for Ki-67 expression into 2 levels: low expression ( $n=63$ ) and high expression ( $n=54$ ). Patients were divided into training ( $n=82$ ) and validation cohorts ( $n=35$ ). The arterial phase images were imported into the ITK-SNAP to manually delineate volume of interest (VOI) of the entire-tumor. Each VOI produced 396 radiomics features including Histogram, GLCM, GLSZM, RLM, Form Factor and Haralick. LASSO regression was used for feature screening to generate a radiomics score. Then multivariate logistic regression analysis (MLRA) was used combining clinical information to screen out independent risk factors for predicting Ki-67 expression level. The predictive accuracy of radiomics signatures was quantified by the area under curve (AUC) of a ROC curve in both cohorts. The calibration degree (CD) of the radiomics was evaluated by Hosmer-Lemeshow test. The clinical usefulness of the radiomics signatures was assessed by decision curve analysis (DCA).

## RESULTS

Seven radiomics features with non-zero coefficients were chosen to build a radiomics model that significantly correlated with Ki-67 expression level with an AUC, sensitivity, specificity and CD of 0.844, 93%, 71% and 0.709 in training cohort; and 0.881, 91%, 75% and 0.950 in validation cohort, respectively. There were no significant differences in gender, age and smoke between the high and low Ki-67 expressions ( $P>0.05$ ). Radiomics signatures were considered to be independent predictor of Ki-67 expression level in peripheral lung cancer, and if the threshold probability was between 0.03 and 0.63, using radiomics signatures to predict Ki-67 expression level added more benefit than treating either all or no patients.

## CONCLUSION

s The CT image feature-based radiomics is helpful to predict the expression of Ki-67 in peripheral lung cancers, providing a non-invasive technique for assessing the invasiveness and prognosis for peripheral lung cancers.

## CLINICAL RELEVANCE/APPLICATION

The radiomics that predict Ki-67 expression level can help understand the proliferation characteristics of tumor cells, and promote early diagnosis and individualized treatment.

## M5A-SPCH-5 Exploring the Biological Significance of a Robust Radiomic Biomarker of Tumor Heterogeneity in Advanced Non-small Cell Lung Cancer Patients Treated with First-line Immunotherapy

Participants

Andrew Chen, BS, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

## PURPOSE

Tumor PD-L1 expression, the accepted predictive biomarker for pembrolizumab (PEMBRO) immunotherapy, is imperfect. We hypothesize that radiomic features, essentially high-throughput descriptors of tumor heterogeneity, can characterize molecular and histopathological tumor subtypes in vivo, and enable precision therapy selection.

## METHODS AND MATERIALS

After IRB approval, a single-center retrospective analysis of pre-treatment CT for stage 4 NSCLC patients (n=342) treated with 1st-line PEMBRO-based therapy Region of interest (ROI) segmentation was performed with ITK-SNAP. Feature extraction on ROIs was performed with the CaPTk toolkit. OPNested Combat mitigated radiomic feature heterogeneity due to differences in contrast enhancement, kernel resolution, and voxel spacing. Clinical variable categories, age, sex, race, ECOG, BMI, smoking status, and tumor histology, were protected during harmonization to prevent removal. Principal component (PC) analysis reduced harmonized feature dimensionality; the first PC was taken as a radiomic signature for histological subtypes (adenocarcinoma, squamous cell, other) and tumor differentiation, using a linear support vector machine (SVM) classifier. For a subset (n=234), a radiomic signature characterized tumor differentiation subtypes (well, moderate, poor). The statistical significance of the radiomic signature's Spearman correlation coefficient (c) for genomic mutational expression categories (negative, positive, unknown) of NSCLC relevant-genes (EGFR, BRAF, ALK, ROS, MET, HER2) and tumor expression of PDL1 was also assessed.

## RESULTS

The radiomic signature performed patient classification of histological subtype with an accuracy of 81.5% (AUC-0.59), and of tumor differentiation subtypes with an accuracy of 82.3% (AUC-0.62). Statistically significant correlations (p<0.05) were found between the radiomic signature and the following genomic mutational expression categories: ALK (c: 0.88), EGFR (c: 0.87) and ROS (c: 0.62).

## CONCLUSION

s The radiomic signature was shown to have correlations with genes relevant to NSCLC tumor progression and was able to identify tumor subtypes based on their molecular and histopathological characteristics, indicating its biological significance. Our future work involves building a multi-omic predictor (combining radiomic, genomic and clinical information) of progression-free survival to study patient response to PEMBRO-based therapy.

## CLINICAL RELEVANCE/APPLICATION

The radiomic signature correlated significantly with NSCLC-related genes and identified tumor sub-types based on molecular and histological characteristics. These results help us better understand the biological meaning of radiomic descriptors.

## M5A-SPCH-6 Lung Cancer Risk Using Never Smokers' Chest X-Rays: Validation of a Deep Learning-based Model

Participants

Anika Walia, Scottsdale, AZ (*Presenter*) Nothing to Disclose

## PURPOSE

Lung cancer is the most common cause of cancer death. In the United States, 10-20% of lung cancers occur in "never-smokers" - those who never smoked cigarettes or smoked fewer than 100 cigarettes in their lifetime. Centers for Medicare and Medicaid Services (CMS) lung cancer screening criteria do not recommend screening never-smokers; however, never-smokers often present with more advanced lung cancer than those who smoke. In this study, we tested whether a deep learning model CXR-Lung-Risk could identify never-smokers at high risk for lung cancer using chest x-rays (CXRs) from the electronic medical record.

## METHODS AND MATERIALS

The CXR-Lung-Risk model was developed using 147,497 CXRs of 40,643 asymptomatic smokers and never-smokers from the Prostate, Lung, Colorectal, and Ovarian (PLCO) cancer screening trial to predict lung-related mortality risk based on a single CXR image as input. In this study, we externally validated the model in a separate cohort of never-smokers having routine outpatient CXR from 2013-2014. The primary outcome was 6-year incident lung cancer, identified using International Classification of Disease (ICD) codes. Continuous CXR-Lung-Risk scores were converted to low, moderate, and high-risk groups based on externally derived risk thresholds.

## RESULTS

Of 24,333 patients (mean age 63.4 ± 8.21 years; 44.3% male; 18,880 (80.5%) White, 1,789 (7.6%) Black, 789 (3.7%) Hispanic) included in the study, 32% (7774/24,333) were deemed high risk by CXR-Lung-Risk. 2.5% of the total cohort (616/ 24,333) developed lung cancer over 6 years of follow-up. CXR-Lung-Risk groups had a graded association with lung cancer risk, with 1.4% (37/2663) in the low-risk group (CXR-Lung-Risk <45), 2.2% (306/13896) in the moderate-risk group (45 < CXR-Lung-Risk < 55), and 3.5% (273/7774) in the high-risk group (CXR-Lung-Risk > 55). After adjusting for age, sex, race, previous lower respiratory tract infection, and prevalent COPD, there was still a 2.1 (95% CI [1.4,3.1]; p<0.001) times greater risk of developing lung cancer in the high-risk group compared to low risk.

## CONCLUSION



s Using routine CXRs from the EMR, CXR-Lung-Risk identified never-smokers at high risk of lung cancer, a group in which lung cancer rates are increasing.

#### **CLINICAL RELEVANCE/APPLICATION**

CXR-Lung-Risk identified never-smokers at high risk of lung cancer, well above the >1.3% 6-year risk threshold where lung cancer screening CT is recommended by National Comprehensive Cancer Network guidelines.

#### **M5A-SPCH-7 Feasibility of Extracellular Volume Fraction Measurement Derived from the Equilibrium Phase Dual-energy CT for Predicting Pathological Grades of Lung Cancer**

Participants

Hiroaki Nagano, MD, PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To assess the diagnostic feasibility of extracellular volume (ECV) fraction measurement using the equilibrium phase dual-energy CT (DECT) for predicting the pathological grade of lung cancer.

#### **METHODS AND MATERIALS**

This study included 110 patients with lung cancer who underwent preoperative DECT examination and surgical resection. These patients were divided into a low-grade group (G1 and G2) and a high-grade group (G3 and G4) based on their histopathological differentiation. Iodine concentration (IC) and effective atomic number (Zeff) were measured using the equilibrium phases DECT, and ECV fraction was calculated based on IC of the lung cancer and the aorta. DECT parameters and ECV fraction were compared between the pathological grade groups using the Mann-Whitney U test. Receiver-operating characteristic (ROC) curve analysis was performed to evaluate the ability of IC, Zeff and ECV fraction to diagnose a high-grade pathological group of lung cancer.

#### **RESULTS**

IC and Zeff during the equilibrium phase and ECV fraction were significantly higher in the low-grade group than in the high-grade group (2.27mg/mL vs. 1.85mg/mL,  $p = 0.006$ ; 8.46 vs. 8.29,  $p = 0.012$ ; 45.2% vs. 35.0%,  $p < 0.001$ ; respectively). The area under the ROC curve values of IC and Zeff during the equilibrium phase and of ECV fraction to differentiate high-grade cancers from low-grade cancers were 0.688 (optimal cutoff, 1.80mg/mL; sensitivity, 60.9%; specificity, 73.6%), 0.672 (optimal cutoff, 8.43; sensitivity, 78.3%; specificity, 51.7%) and 0.750 (optimal cutoff, 30.9%; sensitivity, 47.8%; specificity, 94.3%), respectively.

#### **CONCLUSION**

s IC, Zeff and ECV fraction measurement using DECT can help predict the pathological grade of lung cancers. ECV fraction showed the best diagnostic performance.

#### **CLINICAL RELEVANCE/APPLICATION**

ECV fraction derived from the equilibrium phase dual-energy CT provides useful information to predict the pathological grades of lung cancers.

#### **M5A-SPCH-8 Impact of Duration of Diagnostic Workup on Prognosis for Early Lung Cancer: Validation using the NLST and IASLC Databases**

Participants

Rowena Yip, PhD, MPH, New York, NY (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Impact on prognosis of early stage lung cancer due to time delay for follow-up has been quantified in our previous publication using the I-ELCAP database. Here, our goal is to validate our published findings using two independent databases, the National Lung Screening Trial (NLST) and the International Association for the Study of Lung Cancer (IASLC).

#### **METHODS AND MATERIALS**

Using data collected from the CT arm of the NLST randomized trial (2002-2009) and the IASLC Lung Cancer Staging Project (1999-2010), we determined the size specific 5-year lung cancer (LC)-specific and overall survival rates as surrogates for cure rates. We estimated the change in LC diameter after delays of 90-, 180-, and 365-days using three representative LC volume doubling times (VDTs) of 60(fast), 120(moderate), and 240(slow). We then estimated the decrease in the lung cancer (LC) cure rate resulting from time between CT scans to assess for growth during the diagnostic workup.

#### **RESULTS**

Using the NLST data for a regression model of the 5-year LC survival rates on LC diameter, the estimated LC cure rate of a 4.0 mm LC with fast (60-day) VDT is 97.4%(95% CI: 97.1%-97.8%) initially, but it would decrease to 96.4%(95% CI: 95.9%-96.8%), 94.9%(95% CI: 94.2%-95.6%) and 89.6%(95% CI: 88.2%-89.6%) after delays of 90, 180, and 365 days, respectively. A 20.0 mm LC with the same VDTs has an initial lower LC cure rate of 87.2%(95% CI: 85.5%-88.9%) initially, and decreases more rapidly to 81.9%(95% CI: 79.4%-84.3%), 74.4%(95%CI:70.9%-77.9%) and 47.8%(95% CI: 40.7%-54.8%) after the same delays of 90, 180, and 365 days. Using the IASLC data for a regression model of the 5-year overall survival rates on LC diameter shows a similar trend.

#### **CONCLUSION**

s Although the average tumor size was larger in these two databases, the average change in LC cure rate per unit increase in tumor size was comparable to our previous results. These findings support our earlier research indicating that the interval between scans required to evaluate the growth of lung nodules has a significant impact on prognosis, particularly for fast-growing and larger cancers. To determine the effectiveness of various management protocols, it is essential to quantify the degree of change in prognosis results caused by this delay.

#### **CLINICAL RELEVANCE/APPLICATION**

Timely follow-up is crucial for management of lung nodules. Our study shows that delays in CT scans have a significant impact on prognosis, emphasizing the need to quantify this effect for better management protocols.



## Abstract Archives of the RSNA, 2023

M5A-SPER

### Emergency Radiology Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPER-1 Multicentre Randomised Controlled Trial to Assess the Impact of Online Training on the Diagnostic Performance of Emergency Department Clinicians in Interpreting CT Head Images: The Simulation Training for Emergency Department Imaging 2 (STEDI2) Trial**

#### PURPOSE

Delays in reporting of CT scans can impair patient flow in the Emergency Department (ED). Artificial Intelligence led applications are being evaluated to enable ED physicians to interpret CT Head scans, but their baseline interpretation capability is currently unknown. Here we present preliminary results for a trial to measure the accuracy of ED clinicians in interpreting CT head images, determine the impact of an online training simulation, and estimate potential impacts of clinician-led CT head interpretation on patient flow within the Emergency Department

#### METHODS AND MATERIALS

A multicentre NIHR Portfolio randomised controlled trial (CPMS: 52221, Clinicaltrials.gov: NCT05427838, ISRCTN: 41484, REC reference: 22/HRA/0743) was undertaken across 6 UK hospitals. Emergency medicine clinicians undertook a blinded baseline online assessment of accuracy in interpreting a dataset of 50 CT Head scans. After completing the baseline assessment, participants were offered an online training package on CT head interpretation, then repeated the assessment and recorded interpretation of up to 30 prospective clinical cases with further assessments repeated at 3 and 6 months. Training and assessment were delivered using the online platform [www.raiqc.com](http://www.raiqc.com). The primary outcome was measured changes in reporting accuracy/sensitivity/specificity as calculated in a pooled analysis. Subgroup analyses included diagnostic performance stratified by clinical role, level of seniority, pathological finding. For prospective clinical interpretations times participant and radiology reporting were recorded and compared.

#### RESULTS

From April 2022 until September 2023 206 participants undertook the study. Overall, there was a significant increase in participants' sensitivity (73.3% to 83%) and specificity (65.8% to 89.1%) in detecting the presence of an acute abnormality on the online assessment scans, with a similar increase seen across all pathology subgroups. Overall diagnostic performance for acute abnormality detection remained elevated compared to baseline at six months post training (sensitivity 80.6%, specificity 79.1%).

#### CONCLUSION

Online training can be used to significantly improve ED clinicians' ability to interpret CT Head scans.

#### CLINICAL RELEVANCE/APPLICATION

Our results demonstrate that dedicated online training can significantly improve the image interpretation accuracy of ED clinicians. Provision of a web-based self-directed simulation-based learning platform is a scalable way of delivering this training to departments with a high staff turnover. Further detailed analysis is ongoing and will provide a detailed basis for comparison with other forthcoming interventions such as AI-assisted image interpretation of CT head scans.

#### **M5A-SPER-2 Inter-modality Data Augmentation and Multi-view Reconstructions from CT to Radiography for the Detection of C-Spine Fractures**

#### PURPOSE

Cervical spine fractures are a significant cause of morbidity and mortality worldwide. While ACR appropriateness criteria recommend the use of CT over X-ray, access to imaging can be limited in rural areas. The difference in sensitivity between CT and XR has been shown to be 100% and 63% respectively. Delayed diagnosis of C-spine fractures may lead to adverse outcomes. The goal of this project is to develop a model that can be used in areas where there are significant barriers to acquiring CT C-spines. Our objectives are as follows: To develop a method of reconstructing radiographs from CT to train a convolutional neural network using the reconstructed radiographs to detect C-spine fractures, using single and multiple views To assess the use of reconstructed radiographs as a method of data augmentation To test the model on real radiographs on a model trained on reconstructions.

#### METHODS AND MATERIALS

233 non-contrast CT C-spine studies with fracture labels were collected from a publicly available dataset. The dataset was divided into a training/validation (183) and test set (50). Sagittal, coronal, and oblique Average Intensity Projections (AvIPs) were created at a window width and level of 950/400. The EfficientNet V2-S model with pretrained weights was used as the initial model. A single channel model was trained and tested using sagittal AvIPs. Next, oblique AvIPs were added to the training set and the model re-trained. A multichannel model was trained and tested using sagittal and coronal AvIPs. A training and validation set was created using 5-fold cross validation for training of all models. 188 C-spine radiographs with fracture labels from a publicly available dataset were also used to test the two single channel models. The AUROC was plotted and Youden index used to determine the best threshold for prediction. Accuracy, specificity, and sensitivity were calculated for each model.

#### RESULTS

There is improved AUROC with oblique data augmentation using both AvIPs (from 0.60 to 0.65) and true radiographs (0.77 to 0.70)

There is improved AUROC with oblique data augmentation using both AVIPS (from 0.60 to 0.65) and true radiographs (0.77 to 0.79) as the test set. Sens/Spec of 0.78/0.70 on true radiographs using the augmented model. The multichannel model performed better than the single channel augmented model (AUROC 0.73)

## **CONCLUSION**

s Inter-modality augmentation is possible to create a fair C-spine fracture model using 233 CTs. Multichannel model training can be used to optimize radiograph protocols to detect pathology.

## **CLINICAL RELEVANCE/APPLICATION**

With improvement, an application in rural communities may result in expedited fracture detection. As well, an inter-modality data augmentation technique would assure preservation of labelling and be a valuable tool to enhance datasets.

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## Abstract Archives of the RSNA, 2023

M5A-SPGI

### Gastrointestinal Imaging Monday Poster Discussions I

#### Sub-Events

#### M5A-SPGI-2 Evaluation of Contrast Enhanced Photon Counting Computed Tomography Performed in the Inpatient Setting

##### Participants

Benjamin Steyer, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### PURPOSE

Prior work demonstrating the benefits of photon-counting computed tomography (PCCT) has been performed in controlled research or selective outpatient settings. Given high capital costs of this technology, many scanners will serve general purpose, including application in inpatient settings. Here, we evaluate the performance of a clinical PCCT scanner employed in routine inpatient enhanced abdomen and pelvis imaging and directly compare image quality, image contrast and radiation dose to that of a prior state of the art dual energy CT (DECT) scanner.

##### METHODS AND MATERIALS

In this institutional review board-approved retrospective study, we identified patients (n = 35) who had undergone a routine contrast enhanced CT of the abdomen and pelvis on a clinical PCCT scanner (NAEOTOM Alpha, Siemens Healthineers) and who had also undergone a DECT (SOMATOM Force, Siemens Healthineers) within twelve months. The following patient and scan characteristics were recorded: BMI, radiation dose (CTDIvol) and contrast volume. For quantitative comparison, we calculated contrast to noise ratio (CNR) and signal to noise ratio (SNR) for organ parenchyma as well as the great vessels for both PCCT and DECT exams.

##### RESULTS

Average BMI of patients undergoing contrast enhanced PCCT was 25.9 (range: 17.1 to 54.7). Average time between contrast enhanced PCCT and DECT was 42 days (range: 4 to 204 days). We observed a 9% decrease in scan dose (CTDIvol) in PCCT compared to DECT, 8.7 versus 9.8 mGy respectively (p=0.03). Despite reduced dose, calculated CNR and SNR were significantly increased on PCCT versus DECT across all evaluated anatomic structures with the exception of liver, where no significant difference in SNR was observed.

##### CONCLUSION

Our real-world comparison of inpatient contrast enhanced abdomen and pelvis studies on PCCT and DECT indicates decreased radiation exposure (CTDIvol) can be achieved on clinical PCCT with increased quantitative metrics of image quality (CNR and SNR). Future planned analysis will focus on rigorous comparison of qualitative and quantitative metrics of image quality utilizing direct comparison of spectral data from both PCCT and DECT.

##### CLINICAL RELEVANCE/APPLICATION

In routine inpatient application, PCCT can provide quantitatively improved image quality compared to DECT at a reduced radiation dose.

#### M5A-SPGI-3 Low Dose Whole-liver CT Perfusion in Evaluating Residual Viable Tumor Tissue of Hepatocellular Carcinoma after Transcatheter Arterial Chemoembolization

##### PURPOSE

To investigate the value of low dose whole liver CT perfusion (CTP) in evaluating the hemodynamics of residual viable tumor tissue of hepatocellular carcinoma (HCC) treated with transcatheter arterial chemoembolization (TACE).

##### METHODS AND MATERIALS

HCC patients treated with TACE were prospectively collected. All patients underwent low dose whole liver perfusion CT examination 4-6 weeks after TACE. Thirty HCC cases with residual tumor viable tissue were selected. The hepatic arterial fraction (HAF, %), capillary surface permeability (PS, ml/min/100g), blood volume (BV, ml/100g) and time to peak (TTP, s) of necrotic tissue (T1), residual viable tumor tissue (T2) and background liver tissue (T3) were obtained using liver tumor perfusion software. Univariate Wilcoxon signed rank was used for the comparison of the above parameters between T2 and T1, T3 groups.

##### RESULTS

35 HCC lesions with residual viable tumor tissue were found. The HAF, PS and BV of T2 were higher than those of T1 and T3 (P<0.05); there was no significant difference in TTP between T2 and T1 and T3 (P>0.05).

##### CONCLUSION

Low dose whole liver perfusion CT could reflect the hemodynamics of residual viable tumor tissue of HCC treated with TACE.

## CLINICAL RELEVANCE/APPLICATION

It could provide valuable information for the selection of further treatment protocol for HCC patients.

### M5A-SPGI-4 DECT and MRI Indicators for Assessing Iron Overload and the Effectiveness of Iron Overload Therapy in Patients with Primary and Secondary Hemochromatosis

#### PURPOSE

Evaluation of MRI, CT parameters after chelation and hemoexfusion therapy in patients with iron overload, identification of the prognostic value of CT indicators in the assessment of moderate and severe iron overload.

#### METHODS AND MATERIALS

The design of the study is prospective. The study included the liver scans of 43 patients with hereditary hemochromatosis (HH), secondary transfusion-dependent hemochromatosis (TDH) receiving regular hemotransfusions, iron chelators. We evaluated age, frequency of hemotransfusions, chelating drug used. CT was performed on a Dual Energy computer CT scanner Siemens Somatom Definition 128. 27 patients (62.8%) reached repeated CT. MRI was performed on a Siemens Magnetom Espree high-field scanner with a magnetic field induction of 1.5 T.

#### RESULTS

The median age was 34 y.o. [33.00; 53.50] for HH and 52 y.o [36.00; 62.00] for TDH. After therapy in the general group, T2\* values increased by 26%, LIC decreased by 21.2%, DED (dual energy difference)HU 140 and 80 mean by 17.6%, DER (dual energy ratio) HU 140 and 80 mean by 3%, DEI (dual energy index) HU 140 and 80 mean by 92.8%, 80 max by 3%, DEDHU 140 and 80 max by 19%, DERHU 140 and 80 max by 2.5% after therapy. In patients with HH, liver T2\* increased by 4.6 times, LIC decreased by 5.5 times, DEDHU 140 and 80 mean by 35.1%, DERHU 140 and 80 mean by 7.8%, DEIHU 140 and 80 mean by 93.6%, DEDHU 140 and 80 max by 29.3%, DEIHU 140 and 80 max by 21.6%. In patients with TDH, LIC decreased by 18.9%, DEIHU 140 and 80 mean by 92.2%. A value of 80 mean=85.5, 140 mean=71.5, M0.3 mean=76, DEIHU 140 and 80 mean=0.007996 and DEDHU 140 and 80 mean=18.5 predict the probability of severe iron overload.

#### CONCLUSION

s In patients after chelation therapy and hemoexfusion therapy, MRI and CT indicators decrease. The values of CT 80 mean=85.5, 140 mean=71.5, M0.3 mean=76, DEIHU 140 and 80 mean=0.007996, DEDHU 140 and 80 mean=18.5 can predict LIC values of more than 11 mg/g.

## CLINICAL RELEVANCE/APPLICATION

The threshold of hepatic iron overload which can be diagnosed by measuring CT parameters, mainly with dual-energy scanning, was determined.

### M5A-SPGI-5 Shear Wave Elastography and Attenuation Imaging for the Prediction of Risk of Events in Patients with NAFLD

Participants

Yudai Fujiwara, Yahaba-Cho, Shiwa-Gun, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Common causes of mortality in non-alcoholic fatty liver disease (NAFLD) are cardiovascular events (CVEs), extrahepatic malignancies, and liver-related events (LREs). We aimed to determine the value of fibrosis and steatosis as determined by non-invasive ultrasound-based biomarkers for the prediction of the major events in patients with NAFLD.

#### METHODS AND MATERIALS

During a period 2016-2020, we accumulated a prospective cohort of 279 patients with NAFLD, who underwent shear wave elastography (SWE) together with ultrasound-guided attenuation parameter (UGAP) and liver biopsy within a day, and followed them until December 2022. SWE and UGAP were determined by LOGIQ E9 (GE Healthcare) with a C1-6-D convex probe. The cutoff values of liver stiffness measurements (LSM) by SWE and attenuation coefficient (AC) by UGAP for advanced liver fibrosis stage (F=2) and mild steatosis grade (S=1) were determined by the area under the curve analysis. According to the values, we classified patients into group A (low LSM and low AC), group B (low LSM and high AC), group C (high LSM and high AC), and group D (high LSM and low AC). Cumulative incidence ratio (CIR) of CVE., extrahepatic malignancy or LRE was calculated by Kaplan-Meier analysis and compare among the groups by log-rank test.

#### RESULTS

1) The median LSM values for each stage of liver fibrosis were 6.13 kPa in F0, 6.81 kPa in F1, 8.47 kPa in F3, and 10.23 kPa in F4 ( $p<0.001$ ). The median AC values for each grade of steatosis were 0.42 dB/cm/MHz in S0, 0.55 dB/cm/MHz in S1, 0.68 dB/cm/MHz in S2, and 0.72 dB/cm/MHz in S3, ( $p<0.001$ ). 2) 36 patients experienced one or more events during the observation period with a median of 4.1 years. Diabetes mellitus and AC were found to be independently associated with CIR of CVE (8.76%/5 years among all patients). Similarly, LSM was found to be associated with CIR of LRE (5.01%/5 years). 3) CIR of CVE, extrahepatic malignancy or LRE in groups A, B, C, and D was calculated to be 0.0%, 12.8%, 28.5%, and 46.7%, the values of which were significantly different among the groups ( $p<0.05$ ).

#### CONCLUSION

s A combination of ultrasound-based biomarkers LSM and AC determined by 2D SWE and UGAP may be a help for identifying NAFLD patients at a high risk of subsequent life-threatening events.

## CLINICAL RELEVANCE/APPLICATION

Our prospective cohort study suggested that a combination of SWE and UGAP non-invasively assesses tissue characteristics of NAFLD and contributes to prediction of subsequent major life-threatening events.

### M5A-SPGI-6 Multiparametric Quantitative Ultrasound: Assessment of High-risk Steatohepatitis in Patients with Metabolic Dysfunction-associated Fatty Liver Disease

Participants  
Hong Ding, MD, Shanghai, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Metabolic dysfunction-associated fatty liver disease (MAFLD) affects almost 25% of the adult population worldwide. Early diagnosis and intervention for high-risk steatohepatitis in liver steatosis can prevent disease progression and improve prognosis. Non-invasive detection and quantification are important for the timely management and prevention of the progression of liver steatosis. This study aimed to investigate the clinical value of the predictive model of multiparametric quantitative ultrasound for the non-invasive assessment of high-risk steatohepatitis.

#### **METHODS AND MATERIALS**

The shear wave elastography (SWE), shear wave dispersion (SWD) and attenuation imaging (ATI) examinations were performed on 194 patients with metabolic dysfunction-associated fatty liver disease (MAFLD) who would undergo liver biopsy in Huashan Hospital, Fudan University from June 2021 to September 2022. Based on pathological SAF scoring system, high-risk steatohepatitis is defined as steatohepatitis with greater and clinically significant fibrosis, and a total activity score  $\geq 4$  of steatosis, hepatocyte ballooning and hepatic lobular inflammation. The binary logistic regression was used to identify factors influencing high-risk steatohepatitis. The predictive models were established by using R language. The diagnostic performance for high-risk steatohepatitis was assessed by using the area under curve (AUC), and AUCs were compared by using the Delong test.

#### **RESULTS**

There were 46 cases of high-risk steatohepatitis. Quantitative ultrasound parameters of elastic modulus, dispersion slope and attenuation coefficient, and blood markers including alanine aminotransferase (ALT), aspartate aminotransferase (AST) and high-density lipoprotein cholesterol (HDL-C) were the factors influencing high-risk steatohepatitis (all  $P < 0.05$ ). The AUCs of elastic modulus, dispersion slope, attenuation coefficient, multiparametric ultrasound model, blood markers model and ultrasound combined with blood markers model for diagnosing high-risk steatohepatitis were 0.764, 0.758, 0.634, 0.786, 0.745 and 0.802, respectively. Delong test showed the ultrasound combined with blood markers model had significantly better predictive properties than blood markers model and attenuation coefficient ( $P=0.017$ ,  $P < 0.001$ , respectively).

#### **CONCLUSION**

The combination of multiparametric quantitative ultrasound is useful for the non-invasive diagnosis of high-risk steatohepatitis with positive clinical value.

#### **CLINICAL RELEVANCE/APPLICATION**

This multiparametric quantitative ultrasound is useful for the non-invasive diagnosis of high-risk steatohepatitis.

#### **M5A-SPGI-7 Contrast Enhanced CT Based Radiomics for Predicting Postoperative Re-bleeding in Cirrhotic Patients**

Participants  
Xin Yang, Yangzhou, Jiangsu Province, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To investigate the feasibility of contrast enhanced CT-based radiomics in predicting postoperative esophagogastric variceal re-bleeding (EGVR) after laparoscopic splenectomy and azygoportal disconnection (LSD) in liver cirrhosis patients with portal hypertension.

#### **METHODS AND MATERIALS**

Preoperative contrast-enhanced CT examinations of 182 patients receiving LSD were enrolled. Patients were divided into with and without EGVR groups basing one year follow-up. 145 patients were enrolled randomly into training and validation cohorts in the ratio of 7:3, respectively. 37 patients were used in independent testing group. All radiomic features were extracted from CT images of the portal venous phase. Regions of interest (ROIs) were delineated on liver and spleen at the hilum level, respectively. The liver volumes of interest (VOI) and spleen VOI were automatically extracted. The least absolute shrinkage and selection operator (LASSO) regression was used to obtain optimal features from combined ROIs, as well as combined VOIs features, and incorporated into a logistic regression classifier to construct a model. The EGVR predictive performance of radiomics models was evaluated by the area under receiver-operating characteristic curve (AUC).

#### **RESULTS**

The constructed radiomics models showed good predictive efficacy and outperformed the clinical characteristics models. The best performance of radiomics model was the logistic regression model constructed by 8 features extracted from the ROIs of liver combining with spleen, with AUC of 0.931 and 0.914 for the training and validation group, respectively. An AUC of 0.858 in the independent testing group was obtained.

#### **CONCLUSION**

Contrast enhanced CT-based radiomics model can predict the risk of EGVR after LSD in patient with cirrhotic portal hypertension.

#### **CLINICAL RELEVANCE/APPLICATION**

The rate of esophagogastric vein bleeding in patients with cirrhotic portal hypertension is about 30%, with a 20% increase in mortality after six weeks. A 1 year prospectively study showed that the incidence of EGVR in patients after LSD is 13.4%, which is a lethal complication. Therefore, it is necessary to find a convenient way to predict EGVR, and our study provided a non-invasive way for the prediction of re-bleeding after LSD.

#### **M5A-SPGI-8 Non-invasive Liver Fibrosis Assessment with CT-based Iodine-uptake Parameters and Hepatosplenic Volumetric Indices**

Participants  
Kenichiro Yoshida, Yamaga, Japan (*Presenter*) Nothing to Disclose

## **PURPOSE**

To evaluate the diagnostic performance of iodine uptake parameters and hepatosplenic volumetric indices measured from multiphase hepatic CT to predict liver fibrosis severity in patients who underwent liver resection.

## **METHODS AND MATERIALS**

Ninety-one patients with pathologically proven liver fibrosis who underwent multiphase hepatic CT during the portal-venous phase (PVP) and 3-min delayed phase (DP) were included. The hepatic extracellular volume fraction (ECV) was calculated as  $([1 - \text{hematocrit}] \times [\text{hepatic iodine uptake during DP/aortic iodine uptake during DP}] \times 100)$ . The iodine washout rate (IWR) was calculated as  $([\text{hepatic iodine uptake during PVP} - \text{hepatic iodine uptake during DP}]/\text{hepatic iodine uptake during PVP} \times 100)$ . The liver volume (LV) and spleen volume (SV) normalized to body surface area (LV/BSA and SV/BSA, respectively) were quantified on PVP images using a deep learning algorithm. The correlations between the imaging parameters and the pathologic liver fibrosis stages were assessed using Spearman's correlation coefficient. The areas under the receiver operating characteristic curves (AUCs) to predict liver fibrosis severity were calculated for each imaging parameter. Multivariable logistic regression analysis was performed to identify independent predictors for hepatic cirrhosis, and combined diagnostic performance was assessed.

## **RESULTS**

Patients with F2-4 (n = 37), F3-4 (n =16), and F4 (n = 13) showed higher ECV, lower IWR, and higher SV/BSA than those with F0-1 (n=54), F0-2 (n=75), and F0-3 (n=78), respectively (all p<0.05). The highest correlation with fibrosis stages was attained in IWR (r=-0.593), followed by SV/BSA (r=0.383), ECV (r=0.381), and LV/BSA (r=0.062). The AUC ranges of ECV, IWR, LV/BSA, and SV/BSA for predicting liver fibrosis severity were 0.667-0.717, 0.843-0.882, 0.507-0.560, and 0.685-0.819, respectively. IWR and SV/BSA were independent predictors of cirrhosis, with combined AUCs of 0.881.

## **CONCLUSION**

s IWR and SV/BSA can allow better prediction of liver fibrosis severity compared with ECV and LV/BSA in multiphase hepatic CT.

## **CLINICAL RELEVANCE/APPLICATION**

IWR and SV/BSA may be served as a non-invasive imaging biomarker for predicting liver fibrosis severity on routine multiphase CT.

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## Abstract Archives of the RSNA, 2023

M5A-SPGU

### Genitourinary Imaging Monday Poster Discussions I

#### Sub-Events

#### M5A-SPGU-1 Feasibility Study of Bone Mineral Metabolism in Chronic Kidney Disease Based on Dual-energy CT

##### Participants

Wei Huang, Xi'an, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the accuracy of dual-energy CT (DECT) in assessing bone mineral metabolism in patients with chronic kidney disease (CKD).

##### METHODS AND MATERIALS

The abdominal dual-energy CT images of 53 patients with CKD were retrospectively analyzed, and the images of T12-L4 vertebral bodies were analyzed by decalcification virtual plain scan technology. The images were processed and analyzed using the virtual non-contrast (VNC) software in the Dual-Energy tab of the Syngo Via CT post-processing workstation. The T12 - L4 vertebral body was measured on the median coronal image, the ROI was manually outlined along the outer edge of the vertebral body, and various measurements automatically given by the software were recorded: CT value of calcium (Contrast media, CM), mixed energy image (Mixing ratio of 0.6) CT value (Regular CT value, rCT), calcium concentration (Calcium density, CaD) and fat content percentage (Fat fraction, FF). Pearson correlation analysis was applied to explore the relation between clinical laboratory testing indicators and these parameters.

##### RESULTS

The contrast media, rCT, CaD in the hemodialysis patients were significantly lower than those in early stage CKD ( $p < 0.01$ ). The CM, rCT and CaD values of vertebral body were negatively correlated with Ca ( $r = 0.486, 0.389, 0.598$ , respectively, all  $p < 0.01$ ). There was no correlation between FF and Ca.

##### CONCLUSION

Dual-energy CT VNCA technique may constitute a valid alternative method for quantifying the mineral content and marrow fat composition of bone in the diagnostic assessments of bone mineral metabolism in chronic kidney disease.

##### CLINICAL RELEVANCE/APPLICATION

Using abdominal dual-energy CT images may additionally evaluate bone abnormalities early in CKD patients.

#### M5A-SPGU-2 Development of a Radiomics Model for CT-based Clear Cell Likelihood Score in Small Solid Renal Masses

##### Participants

Taekmin Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To develop an explainable CT radiomics-based model for diagnosing clear cell renal cell carcinoma (ccRCC) among small ( $\leq 4$  cm) solid renal masses.

##### METHODS AND MATERIALS

This retrospective study included 159 patients (50 women; median age 58 years [IQR 50-65 years]) with pathologically confirmed renal solid masses ( $\leq 4$  cm). Two radiologists independently evaluated mass-to-cortex ratio and heterogeneity score (on a 5-point Likert scale) in corticomedullary phases, and evaluated a five-tiered CT score for diagnosing ccRCC. Interpretable radiomics model was constructed using the CT radiomics features which were associated with mass-to-cortex ratio (first-order statistics of the mass and renal cortex) and heterogeneity score (first-order statistics and texture features of the mass). Diagnostic performance of diagnosing ccRCC were compared between five-tiered CT score and radiomics model.

##### RESULTS

The masses comprised 52.8% of ccRCC (84/159) and 47.2% (75/159) of other histologic diagnoses. The mass-to-cortex ratio and heterogeneity score were significantly higher in ccRCC than in other diagnoses ( $0.87 \pm 0.18$  vs.  $0.58 \pm 0.21$  and  $4.1 \pm 0.9$  vs.  $2.5 \pm 1.1$ , respectively,  $P < 0.001$  for both). CT score = 4 achieved an AUC of 0.851 with sensitivity, specificity, and PPV of 72.6%, 80%, and 80.2%, respectively. The radiomics-based mass-to-cortex ratio and radiomics-based heterogeneity score obtained intraclass correlation coefficient of 0.89 (95% CI 0.85-0.92) and 0.82 (95% CI 0.76-0.86) compared with the original values, respectively. Diagnostic performance of radiomics model for identifying ccRCC obtained AUC of 0.913, which was superior to that of CT score (difference between areas 0.06,  $P = 0.02$ ).

##### CONCLUSION

s The CT-based radiomics algorithm, which was constructed using the features correlated with two key parameters, showed good performance of diagnosing ccRCC in small renal masses.

#### **CLINICAL RELEVANCE/APPLICATION**

CT-based clear cell likelihood score (ccLS) could provide lower cost and greater accessibility for patients, but validation for diagnostic performance and inter-reader agreement are needed. We developed a CT radiomics model for identifying ccRCC, which has a potential to easily apply in clinical practice.

#### **M5A-SPGU-3 Succinate Dehydrogenase-deficient Renal Cell Carcinoma: Characterization of Imaging Features for Precision Diagnosis**

Participants

Aditi Chaurasia, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Succinate dehydrogenase-deficient RCC is a rare, newly defined distinct renal cancer subtype under WHO tumor classification, confirmed by immunohistochemistry showing loss of staining of SDHB in tumors. Our aim is to investigate the imaging findings of SDHB-deficient renal tumors to facilitate accurate tumor characterization.

#### **METHODS AND MATERIALS**

The study included 20 SDH-deficient tumors from 16 patients with pathogenic variations in SDHB gene. Cross-sectional and PET imaging scans from this cohort was retrospectively evaluated by two radiologists and one nuclear medicine specialist. Clinical findings such as demographics, family history, extra-renal findings and metastases were recorded. Tumor imaging characteristics on CT and MRI included were laterality, size, homogeneity, morphology, margins, internal content, T1 and T2 signal intensity, enhancement features, and restricted diffusion.

#### **RESULTS**

A total of 16 patients (median age 31 years, IQR 19-41, 8 men) were identified with 68.8% of patients having a known family history of SDHB mutation. 81.3% of lesions were solitary and majority were solid (86.7% on CT, 87.5% on MRI) with well-defined margins in >62.5% of lesions, without evidence of internal fat, calcifications, and vascular invasion. On MRI, 87.5% of lesions had T2 intensity equal or more than cortex but less than CSF, and 100% of lesions demonstrated restricted diffusion. 100% of lesions showed enhancement with degree greater than 75% for most lesions on CT and MRI. On PET, all renal masses showed radiotracer uptake (mean SUVmax 31.9, mean SUVmean 7.1). 43.8% of patients demonstrated extra-renal manifestations and 43.8% distant metastasis.

#### **CONCLUSION**

s SDHB-associated RCC is predominantly noted in young patients with no gender predilection. On imaging, SDH-deficient RCC are frequently unilateral, solitary, and solid with well-defined margins demonstrating avid enhancement with variability in enhancement pattern and showing restricted diffusion.

#### **CLINICAL RELEVANCE/APPLICATION**

The present article is a pilot study to characterize the findings of newly defined SDH-deficient RCC in patients having germline variation in SDHB gene on morphological and PET imaging to aid in early and accurate tumor identification.

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## Abstract Archives of the RSNA, 2023

M5A-SPHN

### Head & Neck Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPHN-1 Intravoxel Incoherent Motion Diffusion-weighted Imaging in Nasopharyngeal Cancer: Comparison between Turbo Spin-echo and Echo-planar Imaging Techniques**

##### Participants

Yuan Liu, Wuhan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To assess the qualitative and quantitative indicators between turbo spin-echo(TSE)-IVIM and echo-planar imaging(EPI)-IVIM in patients with nasopharyngeal cancer.

##### METHODS AND MATERIALS

Thirty patients with nasopharyngeal carcinoma underwent a pre-treatment staging MRI examination (Ingenia 3.0T, Philips Healthcare, the Netherlands). The IVIM images were evaluated subjectively and objectively for anatomical structures (nasopharyngeal lesions, turbinate, spinal cord and temporal pole). Subjective evaluation indicators (five-point scale for susceptibility artifacts, geometric distortion, lesion conspicuity and overall image quality) were compared with Wilcoxon signed rank test. Quantitative indicators were compared with paired t-test of signal-to-noise ratio(SNR), contrast-to-noise ratio (CNR), ADC and IVIM-derived parameters. Bland-Altman and coefficient of variance(CV) was performed to analyse reproducibility and robustness between ADC and IVIM-derived parameters of TSE-IVIM and EPI-IVIM.

##### RESULTS

TSE-IVIM performed significantly better than EPI-IVIM of the qualitative indicators in nasopharyngeal lesions, turbinate and temporal pole (all  $p < 0.001$ ), while no significant difference in spinal cord (table 1). SNR and CNR of TSE-IVIM were significantly lower than EPI-IVIM in spinal cord and temporal lobe, while no significant difference in the nasopharyngeal lesions and turbinate (table 2).  $f$  values of TSE-IVIM showed significant lower than EPI-IVIM in the nasopharyngeal lesions, and ADC and  $D^*$  values of TSE-IVIM showed significant higher than EPI-IVIM in spinal cord (table 3). CV of TSE-IVIM mainly showed lower percentage than EPI-IVIM. Bland-Altman analysis showed wide limits of agreement (LoA) in the nasopharyngeal lesions and turbinate (table 4, figure 1).

##### CONCLUSION

For better image subjective scores and no significant lower SNR and CNR, TSE-IVIM performed better image quality and more stable quantitative indicators in the nasopharyngeal lesions and turbinate area, which were more noticeable for magnetic sensitivity artifacts. For the different  $f$  values and wide LoAs between two sequences in the nasopharyngeal lesions, we recommended to use TSE-IVIM on follow-up of patients with nasopharyngeal lesions.

##### CLINICAL RELEVANCE/APPLICATION

TSE-IVIM provide better image quality and greatly reduce the susceptibility artifacts and geometric distortion in nasopharynx. TSE-IVIM benefit the accuracy and stability for IVIM-derived parameters. We recommend to use TSE-IVIM on follow-up for nasopharyngeal lesions.

#### **M5A-SPHN-2 Feasibility of Using Multi-frequency Magnetic Resonance Elastography for Evaluating the Parotid Glands In Healthy Volunteers**

##### PURPOSE

To assess the feasibility of using multifrequency magnetic resonance elastography (MRE) for evaluating the parotid glands in healthy volunteers.

##### METHODS AND MATERIALS

Six healthy volunteers were divided into two groups. Three volunteers had a passive driver placed on the occiput during scanning (occiput group), while the other three had a passive driver placed on the right face (right face group). Both groups underwent multifrequency MRE (60, 90, 120, and 150 Hz) of parotid gland at 3 Tesla. The image quality of the MRE waveforms, elastograms was evaluated.

##### RESULTS

In the occiput group, the shear wave propagation from the occiput region to the parotid gland was distant, resulting in significant attenuation and interference. The image quality was higher at 60 Hz, but lower at 90 Hz and 120 Hz. Volunteers could not tolerate the scan at 150 Hz and the scan was terminated. In the right face group, the attenuation and interference of the shear wave propagation were smaller. The image quality was high at all frequencies (60, 90, 120, and 150 Hz). However, because the arrival time of the shear wave in the bilateral parotid gland was different, this group was more suitable for observing the right parotid gland.

## CONCLUSION

s The appropriate frequency for the occiput group to evaluate the parotid gland was 60 Hz, while the appropriate frequencies for the right face group were 60 Hz, 90 Hz, 120 Hz, and 150 Hz.

## CLINICAL RELEVANCE/APPLICATION

Multifrequency MRE can be applied to healthy parotid glands, and may be further applied to the study of parotid gland tumors and diffuse lesions such as Sjogren's syndrome in the future.

## M5A-SPHN-3 Validation of a Fluorescent MET-Targeting Probe for Assisting Biopsy in OPMDs

### PURPOSE

The objective of this study is to investigate the use of a topically applied mesenchymal-epithelial transition factor (MET) targeting probe, cMBP-ICG, in conjunction with near-infrared targeted fluorescent imaging (NIRFI) to improve the accuracy of biopsy site selection for oral potentially malignant disorders (OPMDs). This approach aims to reduce the rate of missed detection of intermediate-high grade dysplasia (IHD) and oral squamous cell carcinoma (OSCC).

### METHODS AND MATERIALS

The acute toxicological properties of cMBP-ICG were evaluated in mice. The progression of OPMDs to OSCC was simulated in mice treated with 4-NQO and monitored using MRI and NIRFI. Tongue tissue was evaluated for pathological characteristics and MET expression. The detection rate of IHD was compared between NIRFI-assisted and standard biopsy in mice. An exploratory clinical trial involving six subjects with OPMDs evaluated the consistency between NIRFI-assisted and physician-selected biopsy sites using Cohen's kappa statistic.

### RESULTS

No significant differences were observed in CBC and blood biochemical test results before and after administration of cMBP-ICG. Low-grade dysplasia was present in 62 cases and IHD was present in 34 cases. Carcinoma in situ was present in 21 cases and invasive carcinoma was present in 5 cases. The average signal-to-background ratio and mean fluorescence intensity of neoplasia with higher malignancy than IHD were  $6.3 \pm 2.7$  and  $17.4 \pm 8.9$  arbitrary units, respectively. The mean values of MET-positive area for the four pathological types were  $31.0 \pm 11.9\%$ ,  $57.8 \pm 18.9\%$ ,  $70.4 \pm 13.8\%$ , and  $85.5 \pm 8.4\%$ , respectively. NIRFI-assisted biopsy had a missed detection rate and a detection rate of IHD of  $0.0085 \pm 0.04$  and  $0.66 \pm 0.27$ , respectively, while standard biopsy had a missed detection rate and a detection rate of IHD of  $0.36 \pm 0.2$  and  $0.39 \pm 0.25$ , respectively. There was a statistically significant difference between the two groups ( $P < 0.01$ ). In contrast, there was no statistically significant difference between the two groups in the missed detection rate and detection rate of carcinoma. The OR value related to group assignment was less than 1 for the missed detection rate of IHD and greater than 1 for all detection rates. For the six enrolled patients, NIRFI-assisted biopsy was performed at all sites consistent with experienced clinicians, with a kappa value of 0.39 and a P-value of 0.19.

## CONCLUSION

s Compared to standard biopsy, the use of cMBP-ICG in conjunction with NIRFI may improve the detection of IHD.

## CLINICAL RELEVANCE/APPLICATION

The NIRF probe cMBP-ICG and NIRF imaging system may provide a non-invasive method for biopsy sampling assistance, potentially changing the clinical protocol for OPMDs, and improving the early diagnosis rate of OSCC.

## M5A-SPHN-4 Development and Validation of Deep Learning Based Automated Detection of Cervical Lymphadenopathy in Patients With Lymphoma for Treatment Response Assessment: A Bi-institutional Feasibility Study

Participants  
Ji Su Ko, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

To train and evaluate a deep learning (DL) model for the accurate detection and segmentation of abnormal cervical lymph nodes (LN) on head and neck contrast-enhanced CT scans in patients diagnosed with lymphoma and evaluate the clinical utility of the DL model in response assessment.

### METHODS AND MATERIALS

This retrospective study included patients who underwent CT for abnormal cervical LN and lymphoma assessment between January 2021 and July 2022. Patients were grouped into the development ( $n=76$ ), internal test 1 ( $n=27$ ), internal test 2 ( $n=87$ ), and external test ( $n=26$ ) cohorts. A 3D SegResNet model was used to train the CT images. The volume change rates of cervical LN across longitudinal CT scans were compared among patients with different treatment outcomes (Stable, response, and progression). Dice similarity coefficient (DSC) and Bland-Altman plot were used to assess the model's segmentation performance and reliability, respectively.

### RESULTS

No significant differences in baseline clinical characteristics were found across cohorts (age,  $P=0.55$ ; sex,  $P=0.13$ ; diagnoses,  $P=0.06$ ). The mean DSC was  $0.39 \pm 0.2$  with a precision and recall of 60.9% and 57.0%, respectively. Most LN volumes were within the limits of agreement on the Bland-Altman plot. The volume change rates among the three groups differed significantly (progression ( $n=74$ ), 342.2%; response ( $n=8$ ), -79.2%; stable ( $n=5$ ), -8.1%; all  $P < 0.01$ ).

## CONCLUSION

s Our proposed DL segmentation model is reliable for quantifying the cervical LN burden on CT in patients with heterogeneous lymphoma. Longitudinal changes in cervical LN volume, as predicted by the DL model, are useful for treatment response assessment.

## CLINICAL RELEVANCE/APPLICATION

DL-based auto-segmentation model could effectively detect and quantify cervical LN burden in patients with lymphoma across

DL-based auto segmentation model could effectively detect and quantify cervical LN burden in patients with lymphoma across longitudinal CT scans, which could ultimately improve guidance for treatment response assessment.

### **M5A-SPHN-5 Deep Learning Based Multi-Modal Segmentation of Oropharyngeal Squamous Cell Carcinoma on CT and MRI Using Self-Configuring nnU-Net**

Participants

DONGJUN LEE, MD, Anyang, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate deep learning-based segmentation models for oropharyngeal squamous cell carcinoma (OPSCC) using CT and MRI with nnU-Net.

#### **METHODS AND MATERIALS**

This retrospective study included 91 patients with OPSCC. The patients were grouped into development (n=56), test 1 (n=13), and test 2 (n=22) cohorts. In development cohort, OPSCC was manually segmented on CT, MR, and co-registered CT-MR, which served as ground truth. The multimodal and multichannel input images were then trained using a self-configuring nnU-Net framework. For evaluation metrics, dice similarity coefficient (DSC; 1=perfect and 0=no overlap) and mean Hausdorff distance (HD; near 0=good) were calculated for two test cohorts. Pearson's correlation and Bland-Altman analyses were performed between ground truth and prediction volumes. Kruskal-Wallis tests were performed to compare DSC and HD of the three models.

#### **RESULTS**

All three models achieved robust segmentation performances with DSC of 0.64±0.33 (CT), 0.67±0.27 (MR), and 0.65±0.29 (CT-MR) in test cohort 1 and 0.57±0.31 (CT), 0.77±0.08 (MR), and 0.73±0.18 (CT-MR) in test cohort 2. No significant differences were found in DSC among the models. HD of CT-MR (1.57±1.06 mm) and MR models (1.36±0.61 mm) were significantly lower than that of CT model (3.48±5.0 mm) (P=0.037 and P=0.014, respectively). The correlation coefficients between ground truth and prediction volumes for CT, MR, and CT-MR models were 0.88, 0.93, and 0.9, respectively.

#### **CONCLUSION**

The self-configuring nnU-Net framework yielded a reliable and accurate segmentation of OPSCC on CT and MRI. The multimodal CT-MR model showed promising results for the simultaneous segmentation on CT and MRI.

#### **CLINICAL RELEVANCE/APPLICATION**

The multimodal segmentation models trained with the nnU-Net framework provided reliable and accurate segmentations of OPSCC on both CT and MR, which can be applied to facilitate clinical staging, radiation therapy planning, and treatment response assessment.

### **M5A-SPHN-6 Structure-Preserving Image Quality Improvement of Cone Beam CT Using Deep Learning**

Participants

Won-Jin Yi, PhD, MS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The purpose of this study is to increase the image quality and HU accuracy of CBCTs while preserving anatomical structures. We applied contrastive learning-based GAN for unpaired image translation to the quality improvement of CBCT images.

#### **METHODS AND MATERIALS**

We generate CT-like images from CBCT images using a patchwise contrastive learning-based GAN model. Our model is trained on unpaired CT and CBCT datasets of 30 patients with the novel combination of loss, composed of semantic relation consistency loss, spatially correlative loss, and reconstruction loss. We used a customized feature extractor pretrained on our training dataset to calculate the spatially correlative loss. We evaluate the quality of the images generated by our model in terms of Fréchet inception distance (FID), peak signal-to-noise ratio (PSNR), mean absolute error (MAE), and root mean square error (RMSE). Additionally, the structure preservation performance is assessed by the structure score. Furthermore, we performed the ablation study by progressively adding components of the loss to analyze the impact of the various components on the performance.

#### **RESULTS**

The generated CT-like images by our model are significantly superior to those generated by various baseline models in terms of FID, PSNR, MAE, RMSE, and structure score. The spatially correlative loss and the reconstruction loss in our model provided the complementary benefits of preserving the anatomical structures of the input CBCT images and improving the image quality to be similar to CT images.

#### **CONCLUSION**

The generated CT-like images by our model were significantly superior to those generated by various baseline models in terms of FID, PSNR, MAE, RMSE, and structure score. We demonstrate that our model provides complementary benefits of preserving the anatomy of the input CBCT images and improving the image quality to be similar to those of CT images.

#### **CLINICAL RELEVANCE/APPLICATION**

Cone-beam CT (CBCT) is widely used in dental clinics but exhibits limitations in assessing soft tissue pathology because of its lack of contrast resolution and low Hounsfield Units (HU) quantification accuracy. The proposed method considerably enhanced CBCT's quality and HU accuracy while preserving the anatomical structure. We demonstrated that our framework enables detailed visualization of soft tissues and accurate quantification of HU in CBCT. This work could allow for accurate quantification of HU, suggesting the possibility of using CBCT in more clinical situations.

### **M5A-SPHN-7 Quantitative Pharmacokinetic Parameter Ktrans Map Assists in Regional Segmentation of Nasopharyngeal Carcinoma in Dynamic Contrast-enhanced Magnetic Resonance Imaging (DCE-MRI)**

Participants

## **PURPOSE**

Accurate segmentation of nasopharyngeal carcinoma (NPC) lesion areas from dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) facilitates subsequent diagnostic and prognostic workups. Traditionally, anatomical DCE-MRI-based NPC segmentation using deep learning has achieved fair results but still needs further improvement. Hence, we investigate the incremental benefit of incorporating pharmacokinetic parameter maps into anatomical DCE-MR image segmentation tasks by taking advantage of the hemodynamic contrast between NPC and surrounding tissue.

## **METHODS AND MATERIALS**

In this paper, a pharmacokinetic parameter Ktrans map of NPC is used as prior information and combined with anatomical DCE-MRI data to improve the performance of segmentation models. A novel model, multi-input branch residual U-Net (MBRU-Net), which extracts features from both anatomical DCE-MR images and Ktrans maps and fuses them to improve the segmentation performance, is introduced. The effectiveness of the multibranch network is validated by comparing MBRU-Net with deep residual U-Net (ResU-Net) with DCE-MRI + Ktrans data. Additionally, different models (U-Net, segmentation network (SegNet), recurrent residual U-Net (R2U-Net), and ResU-Net) are trained with DCE-MRI and DCE-MRI + Ktrans data separately and compared to validate the effectiveness of multimodal data using the Dice coefficient (Dice).

## **RESULTS**

Our proposed MBRU-Net achieves the best Dice in this study ( $67.39 \pm 15.79\%$ ), higher than ResU-Net's Dice ( $65.57 \pm 17.52$ ) based on DCE-MRI and Ktrans data. U-Net, SegNet, R2U-Net, and ResU-Net achieve better results in terms of segmenting tumor regions with DCE-MRI + Ktrans data than those of the corresponding models with DCE-MRI data alone, where U-Net has the best performance (DCE-MRI + Ktrans: DCE-MRI =  $66.31 \pm 17.80\%$ :  $61.10 \pm 24.14\%$ ).

## **CONCLUSION**

It is beneficial to add a pharmacokinetic parametric (Ktrans) map as prior information to the conventional anatomical MRI-based segmentation task, and multibranch network structures perform better than single-branch network structures in terms of NPC segmentation.

## **CLINICAL RELEVANCE/APPLICATION**

Ktrans map as a priori information is beneficial for the segmentation of NPC on DCE-MRI, which might facilitate diagnostic and prognostic workup.

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## Abstract Archives of the RSNA, 2023

M5A-SPIN

### Imaging Informatics Monday Poster Discussions I

#### Sub-Events

#### M5A-SPIN-1 Comparison of Human and AI-based Medical and Non-medical Segmentation Algorithms

##### Participants

Matthias Froelich, MD, Mannheim, Germany (*Presenter*) Consultant, Smart Reporting GmbH; Consultant, Guerbet SA

##### PURPOSE

To evaluate the comparative performance of human and AI-based segmentation, especially in the context of novel algorithms, not trained exclusively on (sectional) imaging data.

##### METHODS AND MATERIALS

A challenging CT slice with suboptimal contrast was selected. Manual segmentation was performed by a radiologist using 3D-Slicer. Automated segmentation algorithms (Total Segmentator fast/standard mode, Segment Anything in four settings) were run on the image. No further adjustment of the segmentation was performed. A total of 7 radiologists (3-11 yrs experience), evaluated the segmentations in blinded approach.

##### RESULTS

Human segmentation took 18:23 min, compared to AI-based approaches which took a maximum of 1:12 min. 5 radiologists (62.5%) identified the human segmentation correctly, which was rated best (> 50% very or somewhat closely correct segmentation). For the AI-based approaches, the Total Segmentator Standard Mode was ranked best (at least moderately closely 100%). The results are summarised in the figure attached.

##### CONCLUSION

s AI-based segmentation is significantly faster than human segmentation. In challenging cases with suboptimal contrast, models trained on imaging data exclusively may still be superior to other models.

##### CLINICAL RELEVANCE/APPLICATION

Segmentation is a task that should be performed automatically by AI.

#### M5A-SPIN-2 The Predictive Value of CT Body Composition Indicators Using Fully-Automated AI Tools for Short-term and Long-term Outcomes in Obese Patients Receiving Bariatric Surgery

##### PURPOSE

Computed tomography (CT)-based body composition measures derived from fully automated artificial (AI) intelligence tools are promising for assessing body composition. We aimed to assess the predictive value of CT body composition indicators using fully automated AI tools for short-term and long-term outcomes in obese patients receiving bariatric surgery. Our findings can offer objective recommendations for clinical follow-up, pre- and post-operative interventions.

##### METHODS AND MATERIALS

74 obese patients underwent bariatric surgery were retrospectively analyzed. Patients' skeletal muscle (SMA), subcutaneous fat (SFA) and visceral fat area (VFA) of L3 level were accessed pre- and post-operatively by CT using fully-automated AI segmentation and quantification tools. The clinical variables and perioperative laboratory test data associated with adverse outcomes after surgery were statistically analyzed. %EWL<50% at one year after surgery was considered unsuccessful weight loss. The association of prognostic factors with postoperative complications and body compositions were evaluated by binary univariate and multivariate logistic regression analysis.

##### RESULTS

For obese patients with bariatric surgery, the results of the multivariate model showed that preoperative VFA=284.05 cm<sup>2</sup>(OR: 29.87, 95% CI: 1.42,1386.71, P=0.018) in female patients was an independent risk factor for ICU admission after surgery. Preoperative SFA=748.82 cm<sup>2</sup>(OR: 12.56, 95% CI: 0.81,453.41, P=0.003) in male patients was an independent risk factor for %EWL<50% (unsuccessful weight loss). A sustained decrease in SMA, VFA and SFA was observed during the postoperative period, with the most pronounced drop of approximately 15-50% within 6 months postoperatively (P<0.0001). SFA and VFA continued to decrease long-term after surgery (P<0.0001). SMA was significantly reduced in the short term after surgery and maintained in the long term.

##### CONCLUSION

s CT based body composition using fully automated AI tools can be used to predict short-term and long-term outcomes for obese patients undergoing bariatric surgery. Preoperative VFA in female and preoperative SFA in male are independent risk factors for adverse short-term outcomes. Obese patients can benefit from bariatric surgery, with significant reductions in both muscle and fat

in the short term after surgery. In the long term after surgery, there is a sustained loss in subcutaneous and visceral fat, while skeletal muscle maintained.

#### **CLINICAL RELEVANCE/APPLICATION**

Obese patients can benefit from bariatric surgery. CT based body composition using fully automated AI tools has promising predict value for obese patients undergoing bariatric surgery.

#### **M5A-SPIN-3 Comparative Analysis of Spectral Characteristics of Monoenergetic CT Reconstructions for Different Kidney Stone Types Scanned on Photon-Counting-CT**

Participants

Alexander Hertel, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The aim of this study is to investigate the potential of using the radiomics profile of different monoenergetic reconstructions of photon-counting CT (PCCT) scans to differentiate various types of kidney stones. The study seeks to explore the relationship between radiomics features and the underlying composition of kidney stones, with the ultimate goal of developing a more accurate and non-invasive approach to diagnose and classify kidney stones. The learning objective of this study is to contribute to the development of a more personalized and precise approach to the diagnosis and treatment of kidney stone disease. The learning objective of this study is to contribute to the development of a more personalized and precise approach to the diagnosis and treatment of kidney stone disease.

#### **METHODS AND MATERIALS**

Photon-counting CT (PCCT) is a novel imaging technology that has shown great promise in Radiomics analysis, e.g. due to its high feature stability. In this study, we scanned 150 different types of kidney stones, including Xanthine, Brushite, Carbonateapatite, Cystine, and others, using a PCCT. Monoenergetic reconstructions of the scans were created using the Syngo Via software (version VB60A\_HF02) from Siemens in 30 keV steps from 40 to 190 keV. The stones were semi-automatically segmented using the MITK-Workbench software (v2022.10), and radiomics features were then extracted using a Docker container based on Pyradiomics (Version 3.0.1). Statistical analyses, including cluster analyses and the creation of box plots, were performed using R-Statistics (Version 2023.03.0+386) to explore the potential of radiomics for differentiating between different types of kidney stones.

#### **RESULTS**

In the study it could be shown that especially in the monoenergetic reconstructions with low keV values (40 and 70keV) a differentiation of the different kidney stone types, among other things on the basis of the average HU values, is possible, since these differed significantly depending on the kidney stone type. In contrast, no significant differences were found for the higher keV values.

#### **CONCLUSION**

Radiomics evaluations of monoenergetic reconstructions with low keV values (40 and 70keV) of photon counting CT scans can help differentiate and characterize renal stones noninvasively, potentially optimizing therapy.

#### **CLINICAL RELEVANCE/APPLICATION**

Non invasive differentiation of kidney stones to potentially optimize therapy.

#### **M5A-SPIN-4 Dual-Energy CT-derived Imaging Features: Diagnostic and Prognostic Value of Radiomics Features and Iodine Maps in Patients with Mediastinal Masses**

Participants

Vitali Koch, MD, Frankfurt am Main, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To assess the diagnostic and prognostic value of radiomics features and dual-source dual-energy CT (DECT) based material decomposition in patients with benign and malignant mediastinal masses.

#### **METHODS AND MATERIALS**

This retrospective study included 90 patients (38 males, mean age  $61 \pm 12$  years) with pathologically confirmed mediastinal masses who underwent contrast-enhanced DECT between 10/2014 and 04/2023. All patients were evaluated by two experienced readers regarding conventional radiomics features, as well as DECT-based texture features including attenuation (HU), iodine density (mg/ml), and fat fraction (%). Data comparisons were performed using analysis of variance (ANOVA) and chi-square statistic tests. Cox regression tests and receiver operating characteristic curve analysis were used to predict outcomes and discriminate between benign and malignant mediastinal masses.

#### **RESULTS**

Of the 90 mediastinal masses, 28 (31%) were lymphomas, 6 (7%) were mediastinal tumors, and 9 (10%) were thymic carcinomas. Values differed significantly between benign and malignant mediastinal masses regarding DECT-based texture features ( $p < 0.04$ ) and 30 radiomics features ( $p < 0.03$ ). The area under the curve to differentiate between benign and malignant formations was 0.980 (95% CI, 0.893-1.000;  $p < 0.001$ ) for the combination of DECT imaging parameters and radiomics features, yielding a sensitivity of 100% and specificity of 91%. During a follow-up of 60 months (IQR, 52-60 months), the multiparametric approach including radiomics features, DECT parameters, and clinical parameters showed good prognostic power to predict all-cause mortality (c-index = 0.896 [95% CI, 0.802-0.970],  $p = 0.001$ ).

#### **CONCLUSION**

A multiparametric approach including conventional radiomics features and DECT-based texture features facilitates accurate, non-invasive discrimination between benign and malignant mediastinal masses with high sensitivity and specificity.

#### **CLINICAL RELEVANCE/APPLICATION**

Early detection of malignant masses is of utmost importance to avoid delays in treatment initiation. Combining radiomics features



early detection of malignant masses is of utmost importance to avoid delays in treatment initiation. Combining radiomics features, DECT-derived imaging parameters, and clinical parameters through computational assessment of texture features has the potential to identify masses with an increased risk of malignancy.

## **M5A-SPIN-5 HASKE: A Low-Resource PACS Platform for Improving Diagnostic Imaging Access in Sub-Saharan Africa**

Participants

Udunna Anazodo, PhD, London, ON (*Presenter*) Nothing to Disclose

### **PURPOSE**

The delivery of diagnostic imaging in low-and-middle income countries (LMICs) is challenged by high costs of infrastructure acquisition and shortage of experts, particularly in Sub-Saharan Africa (SSA). One of the main issues accentuating this challenge is the availability of picture archiving and communication systems (PACS) for distribution, archiving and managing of images due to poor availability of quality internet service, high cost of computing infrastructure for hosting and distributing PACS and lack of skilled administrators to effectively maintain the system. Poor access to PACS contributes to poor diagnostic outcomes as the few available radiologists who serve a large population over a vast geographical area, are unable to access images for proper diagnosis. To improve PACS access in resource limited settings, we propose a redistributable PACS platform, HASKE (light in Hausa) accessible to radiologists, physicians, and patients based open-source tools, designed for use in low bandwidth environments and for ease of management.

### **METHODS AND MATERIALS**

HASKE is designed (Figure 1) to provide a low-resource solution for rapid access to images with standard features for 1) onsite and cloud/remote archiving system, 2) integrated zero footprint DICOM viewer, 3) a straightforward DICOM query interface, 4) mobile phone accessibility, and 5) low maintenance requirements for easy management by non-IT health personnel.

### **RESULTS**

The pilot open-source PACS tool is currently in use at three imaging facilities in Nigeria will be scaled up to provide a Health Level 7 (HL7) vendor-neutral PACS platform to ensure ease of integration, especially given the nature of medical device procurement in SSA (third party vs. original equipment manufacturers [OEMs]).

### **CONCLUSION**

The HASKE PACS platform represents a significant step towards improving access to diagnostic imaging in SSA and other resource-limited settings. The platform is designed to overcome prevailing challenges from lost images either through non availability of storage systems or poorly interpreted due to the lack of accessibility to the radiologist. HASKE is designed to help clinicians with limited resources to distribute images better and readily read and share imaging findings to transform disease management in SSA. By utilizing open-source tools, the platform is scalable and affordable, making it accessible to radiologists, physicians, and patients, alike.

### **CLINICAL RELEVANCE/APPLICATION**

While HASKE address the immediate need for diagnostic image data management, it ultimately will enable health equity and inclusion of resource limited settings in imaging data science and artificial intelligence (AI) solutions, where AI is has the greatest potential to improve local health outcomes.

## **M5A-SPIN-6 A Platform for Automatically Extracting Imaging Biomarkers from Ischemic and Hemorrhagic Stroke Patients**

Participants

Rajat Dhar, MD, , (*Presenter*) Nothing to Disclose

### **PURPOSE**

Imaging biomarkers of primary and secondary injury provide critical insights into disease progression and prognosis. Quantifying lesions (infarct or hemorrhage) and associated edema volume can be time-consuming and impractical in large multi-institutional cohorts. We present a cloud-based image repository and computational platform that can archive, analyze, and output multi-dimensional imaging biomarkers from brain CTs of ischemic and hemorrhagic stroke patients.

### **METHODS AND MATERIALS**

The Stroke NeuroImaging Phenotype Repository (SNIPR), based on the XNAT platform, has archived serial imaging from large stroke cohorts from multiple institutions. It allows the implementation of image analysis pipelines wrapped in Docker containers. In this study, we deployed containerized pipelines to analyze lesion and edema volume from both ischemic and hemorrhagic (ICH) stroke cohorts. Scans within each imaging session are first classified (using metadata and a deep learning-based classifier), allowing selection of 'axial brain CT' scans which can be processed (incl. DICOM to NIFTI conversion, brain extraction, and normalization), followed by (U-net-based) segmentation of infarct and hemorrhage lesions as well as peri-hematoma edema (in ICH) and displacement of CSF (for both ischemic stroke and ICH). The ratio of hemispheric CSF volumes was calculated in both groups. Net water uptake (NWU) is calculated in the infarct group as the relative density of infarct vs. Mirrored regions. Resulting segmentation masks are stored, while the biomarker results are stored as CSV files and presented as novel data types that can be viewed on a session, subject, or project level. A superimposed view of the lesion and edema/CSF masks over the NCCT image and a summary of the measurements are also held in a PDF.

### **RESULTS**

The analysis pipelines were implemented on 2649 CT sessions (ischemia:442 and ICH:2207) from three research centers. Axial brain scans could be found in the majority (74%) of sessions. Pipelines were completed in 1407 (71%), with biomarker extraction, including infarct/hemorrhage volumes, CSF ratio, and NWU. The platform can analyze around 1000 images in a week.

### **CONCLUSION**

The study presents a cloud-based image archive and analysis pipeline to calculate biomarkers in axial brain CT. It allows multi-centric collaboration and analyses of thousands of images at a time that would facilitate ongoing stroke research worldwide. The platform will be extended to include more image analysis pipelines useful for stroke research.

## CLINICAL RELEVANCE/APPLICATION

This platform can assist in quantifying infarction, hemorrhage, and edema in large volumes of serial brain CT scans of ischemic and hemorrhagic stroke patients, facilitating stroke research.

## M5A-SPIN-7 Complex Convolutional Neural Networks for Denoising Accelerated Submillimeter Magnetic Susceptibility Brain MRI

Participants

Bryan Quah, MSc, BA, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Magnetic susceptibility-based imaging using submillimeter isotropic 3D echo-planar imaging (3D-EPI) enables the detection of biomarkers for neurological disorders, such as the central vein sign and paramagnetic rim lesions in multiple sclerosis. Recent developments combining 3D-EPI acquisition with CAIPIRINHA undersampling, have shown to significantly reduce scan times. However, this comes at the cost of a reduced signal-to-noise ratio (SNR) which we address here using a complex denoising deep learning method.

## METHODS AND MATERIALS

3T brain MRI scans from 52 adults scanned at three imaging sites were used. T2\*-weighted magnitude and phase images were acquired at 650  $\mu\text{m}$  isotropic using 3D-EPI without parallel imaging (Acquisition Time, AT:  $\sim 6$  minutes), and with parallel imaging using CAIPIRINHA at different acceleration factors: R=2, (AT:  $\sim 4$  minutes), R=3 (AT:  $\sim 3$  minutes) and R=4 (AT:  $\sim 2$  minutes). The subjects were divided into 2 datasets: a training set (N=41) for the network to learn the denoising task and a testing set (N=11) to evaluate the model performance. The training set consists of data acquired without CAIPIRINHA while the testing set consists of data acquired with CAIPIRINHA at the 3 acceleration factors. We developed a 2-dimensional convolutional neural network to denoise the complex valued data created from the magnitude and phase 3D-EPI images. Our developed network extends the convolution and rectified linear unit operations to the complex domain. Peak signal-to-noise ratio (PSNR) and structural similarity index measure (SSIM) were calculated before and after denoising.

## RESULTS

Upon visual inspection, the denoised magnitude and phase images displayed improved image quality while the visibility of brain features and disease-related biomarkers were preserved. The average PSNR values measured across the cohort were increased after denoising at all acceleration factors (+29% for R=2; +34% for R=3; +41% for R=4). Meanwhile, the SSIM values measured remained high for all acceleration factors (mean  $\pm$  SD:  $0.959 \pm 0.014$  for R=2;  $0.951 \pm 0.021$  for R=3;  $0.942 \pm 0.023$  for R=4).

## CONCLUSION

s We developed a complex denoising deep learning approach to efficiently improve the image quality of accelerated submillimeter magnetic susceptibility brain MRI scans. Even at high acceleration factors (R=3), our method was able to restore the significant loss in SNR while maintaining structural details.

## CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the feasibility of efficiently denoising accelerated magnetic susceptibility brain MRI with complex convolutional neural networks. Our proposed method opens the door for ultra-fast submillimeter SWI and QSM imaging in the clinical setting.

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## Abstract Archives of the RSNA, 2023

M5A-SPIR

### Interventional Radiology Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPIR-1 Prediction of Response to Treatment and Outcome of Trans-arterial Chemoembolization in Patients with Hepatocellular Carcinoma Using Artificial Intelligence: A Systematic Review Study**

##### Participants

Pedram Keshavarz, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

This study reviews the efficacy of different AI models for prediction of hepatocellular carcinoma treatment response to transarterial chemoembolization (TACE) including the overall survival (OS).

##### METHODS AND MATERIALS

This systematic review was performed according to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. We conducted a literature search in online databases, including Scopus, Medline (PubMed), Web of Science, Embase, and Google Scholar. The random-effect models were utilized to calculate pool sensitivity, specificity, predictive values, summary receiver operator characteristic (ROC), and area under curve (AUC) based on the "Standards for Reporting Diagnostic accuracy studies" (STARD) guidelines.

##### RESULTS

The systematic review cohort included 21 studies with 4,489 patients. The AI algorithm AUC for predicting HCC response to TACE ranged from 0.32-0.97. Radiomics and non-radiomics feature based models had similar pooled AUCs of 0.76 (95%CI: 0.73-0.79) and 0.75 (95%CI: 0.70-0.80), respectively. Compared to the most widely utilized machine learning methods relying on logistic regression, other AI-based methods such as convolutional neural networks (CNN) and support vector machine (SVM) had AUCs of 0.93 (95%CI 0.84-1.00) and 0.79 (95%CI, 0.77-0.81) respectively. Of all predictive feature models, models combining both CT or MR images with clinical features had higher AUCs of 0.78 (CT+clinical, 95%CI 0.74-0.83) and 0.81 (MR+clinical 95%CI 0.78-0.84) respectively, relative to models based on clinical features alone, AUC 0.67 (95%CI 0.53-0.80).

##### CONCLUSION

AI models showed acceptable performance in prediction of treatment response to TACE and post-TACE OS. CNN method utilizing a combination of cross-sectional images findings and clinical characteristics had superior performance compared to sole clinical features.

##### CLINICAL RELEVANCE/APPLICATION

The prediction of post-TACE, HCC treatment response by AI methods was feasible and significant in all studies. Contributing medical data is vital in improving predictions' confidence and stability, while it can significantly enhance accuracy and reduce the burden on the healthcare systems for investigating all the clinical and radiological features to determine the potential TACE responders. Comprehensive studies are required to introduce a highly accurate and reliable AI prediction model and reduce heterogeneity between outcomes.

#### **M5A-SPIR-2 Predicting Survival of Lung Ablation Patients using Deep Learning-Based Automatic Segmentation and Radiomics Analysis**

##### Participants

Hossam Zaki, BS, Providence, RI (*Presenter*) Nothing to Disclose

##### PURPOSE

To identify radiomic features predictive of survival following image-guided thermal ablation (IGTA) of lung tumors segmented using a deep learning approach.

##### METHODS AND MATERIALS

This HIPAA-compliant study was performed with a waiver for informed consent following institutional review board approval. Between January 1, 2004 and July 14, 2022, adult patients who underwent IGTA for primary and metastatic lung tumors were retrospectively identified. Using pre-procedure CT imaging data, lung zones were automatically segmented using a pre-trained U-Net, which was trained on a large dataset that covers significant visual variability and includes tumors in the segmentation. Following this, we used a U-shaped encoder-decoder transformer architecture (UNETR) to segment lung tumors. The model was trained on lung CT scans with tumor annotations. We then applied the pre-trained model to patients who underwent IGTA. Radiomic features were extracted from the lung segmentations. We utilized features related to the shape of the segmentation, including surface area, volume, and diameter. These radiomic features were then used to predict days-to-death of the patients using a Cox proportional hazards model. Death records were extracted from the electronic medical record and/or obituary data.

##### RESULTS

154 consecutive patients were evaluated (median age, 74.6 years; 46.4% Male). Of these patients, 119 experienced the mortality event, with a mean time to death of 3.6 years (minimum 0.6 years; maximum 14.2 years) following the initial IGTA procedure. Median tumor size was 1.8 cm (minimum 0.6 cm; maximum 5.2 cm), and 138 patients (90%) had primary lung cancer. The initial lung tumor segmentation using UNETR achieved a DICE score of .72, indicating a 72% overlap of the predicted segmentation and the ground-truth. The survivability prediction task using radiomic features achieved a c-index of .69, showing a 69% chance the model will correctly predict which subject has a longer survival time out of a random pair. The most predictive features were flatness and diameter along the row, with a c-index of .57 and .55, respectively. Flatness indicates the elongation of the tumor, while diameter indicates the length in a certain axis, both of which relate to tumor growth patterns.

## CONCLUSION

s Radiomic feature analysis of lung tumors following segmentation by transformer-based UNET may predict long-term survival following image-guided thermal ablation of pulmonary malignancies.

## CLINICAL RELEVANCE/APPLICATION

The incorporation of a survival prediction model based on radiomics features extracted from pre-procedure CT imaging by a deep learning algorithm may allow interventional radiologists to modify treatment approaches to optimize outcomes for patients.

## M5A-SPIR-3 Assessing ChatGPT's Proficiency in Generating Differential Diagnoses Based on Transcribed Vascular and Interventional Radiology Findings

Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the accuracy and reliability of ChatGPT3.5 and ChatGPT4 in producing a differential diagnosis from transcribed radiological findings of specific vascular and interventional radiology (VIR) cases.

## METHODS AND MATERIALS

A sample of 20 cases specific to VIR imaging were evaluated. Cases were selected from a radiology textbook, from which the answers were used as the gold standard. The case images and history were converted into standardized prompts that contained purely descriptive language of the cases and a query for the most likely diagnosis, top three differential diagnoses, and the corresponding explanations and references from the medical literature. These prompts were fed into the ChatGPT3.5 and ChatGPT4 algorithms. Generated responses were analyzed for accuracy by comparison with the original literature and reliability through manual verification of the generated explanations and citations. The top 1 accuracy and the top 3 accuracy were defined as the percentage of generated responses that matched the original diagnosis and the complete differential provided by the original literature. An additional differential diagnosis score was defined as the proportion of differentials that matched the original literature's answers for each case. Comparisons were made between the results of the two algorithms using a one-tailed two proportion z-test method.

## RESULTS

The top 1 accuracy and top 3 accuracy, for ChatGPT3.5 versus ChatGPT4 were 85.0% compared to 85.0% ( $p = 0.5$ ) and 30.0% compared to 15.0% ( $p = 0.13$ ), respectively. The average differential diagnosis score of ChatGPT3.5 versus ChatGPT4 was 60.0% compared to 56.7% ( $p = 0.42$ ). ChatGPT3.5 and ChatGPT4 hallucinated 48.3% versus 13.4% ( $p < 0.00001$ ) of the references provided and generated 1 false statement versus 0 false statements, respectively.

## CONCLUSION

s The two generations of ChatGPT were able to generate a differential diagnosis for prompts containing descriptive radiological findings. The accuracy of top 1 diagnoses matched the expert literature from which the cases originated with reasonable accuracy, with no statistically significant improvement between the 3.5 to the 4th generation algorithm. However, responses from both algorithms matched the top 3 diagnoses from the expert literature a minority of the time. The well-known hallucination effect was encountered more commonly in the generation of citations than the generation of factual statements, which improved with the newest algorithm.

## CLINICAL RELEVANCE/APPLICATION

ChatGPT and Large Language Models (LLM) have a large potential to impact clinical and educational medicine. Knowledge of the accuracy and erroneous possibilities of these algorithms will provide a better understanding of the limitations of these new tools.

## M5A-SPIR-4 Identification of Inferior Vena Cava (IVC) Filters on CT, X-ray and MRI Radiological Reports with a Natural Language Processing (NLP) Based Tool for Management of Clinical Follow Up

Participants

Yifan Wang, MD, MS, New Haven, CT (*Presenter*) Nothing to Disclose

## PURPOSE

Many patients with IVC filters don't get proper follow up and their filters are not removed even when it is not further needed. Many of the patients who are lost to follow up are undergoing other imaging studies in their lifetime with the presence of an IVC filter gets documented in radiological reports. NLP can assist in discovering those patients with IVC filters and help clinicians in monitoring and clinical follow up. The study aims to measure the effectiveness of an NLP solution in discovering IVC filters in radiological reports and explore the role of AI in improving follow up of patients with IVC filters.

## METHODS AND MATERIALS

Radiological reports of CT, X-ray, and MRI studies from a large academic health system generated between 7/1/2021 and 7/31/2021 were selected for analysis. Follow-up was reviewed up to 20 months after the initial report dates. Radiological reports were analyzed for the presence of mention of an IVC filter using an NLP solution. The NLP positive cases were reviewed to measure: the positive agreement rate of the solution in identifying patients with inferior vena cava (IVC) filter using radiological reports, the number of cases identified that were eligible for IVC removal, the number of cases identified that were eligible for IVC removal and not currently scheduled and the number of IVC removal procedures that resulted from the solution case identification.

## RESULTS

NLP solution classified 225 reports as positive for the presence of an IVC filter. The positive agreement rate was 99.56% (224/225). On secondary review by 4 clinicians, 164 unique cases were identified. 51.2% (84/164) filters were not placed by IR, and 20.1% (33/164) filters were non-retrievable type. 4.3% (7/164) identified cases had IVC filter related major complications. In 20 months follow up 57.3% (94/164) of the identified cases were eligible for removal at time of the scan, however only 12.8% (12/94) of the filters removed and 87.2% (82/94) of the cases had not been followed or scheduled. Particularly, 45 filters had been present for at least 5 years and 30 out of these 45 filters were eligible for removal.

## CONCLUSION

The NLP based solution accurately identified patients with IVC filters using the radiological reports. A significant number of the patients that had IVC filters did not have clinical follow up or their filters removed despite eligibility.

## CLINICAL RELEVANCE/APPLICATION

This is the first report to evaluate the efficacy of IVC filter detection using the commercial product AIDOC. Using radiological reports, NLP has the potential to greatly enhance follow-up management for patients with IVC filters, not only at their home institutions but also for those whose filters were discovered incidentally.

## M5A-SPiR-5 Generative Learned Models for Synthesis of Realistic Soft-Tissue Deformable Motion with Controllable Magnitude in Interventional Cone Beam CT

### Participants

Alejandro Siniaga, PhD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; Research Grant, Micro-X Ltd; Research Grant, Izotropic Corporation

### PURPOSE

Cone-beam CT (CBCT) is a ubiquitous tool for guidance in interventional radiology, yet susceptible to motion artifacts from a combination of quasi-periodic motion and aperiodic, local, motion. Deep autofocus showed potential for compensation of deformable motion but requires large and diverse datasets of motion-corrupted CBCT, paired with the source motion, for training. Reliable simulation of complex motion remains an open challenge. This work reports a generative model for simulation of realistic deformable motion with controllable magnitude, via observation of unpaired, motion-corrupted data.

### METHODS AND MATERIALS

The generative model receives a motion-free volume as baseline anatomy, and a random perturbation, to synthesize a random, anatomy-aware 4-dimensional motion field. The model implements a variation of the CycleGAN architecture, with spatial transformers coupling the anatomical context to the spatiotemporal motion field. A customized GAN loss was designed to learn an amplitude control code (ACC) yielding controllable motion magnitude, and it was trained in an unsupervised fashion using solely motion-corrupted CBCT volumes. The model was exercised in a proof-of-concept study with (N=144) simulated CBCT including known motion, providing a controlled validation scenario before extension to clinical data. A test set with 594 motion fields was synthesized (9 anatomies, 6 random perturbations, and 11 amplitude control codes).

## RESULTS

Synthetic motion fields showed magnitude in line with the training set with median amplitude of 26 mm vs 32 mm in training (15 mm vs 17 mm IQR). The spatial distributions of synthetic motion agreed with underlying anatomy, with soft-tissue regions showing large motion distortion with a preference towards anterior parts of the anatomy (median 26 mm) and rigid regions around the spine remaining stationary (median 3.6 mm), in agreement with trends in training data. Variation of the ACC resulted in nearly linear increase in motion amplitude in soft-tissue regions with no significant variation of the spatial distribution. Variation of the random perturbation code resulted in different spatial allocation of motion but no change in magnitude for equivalent control codes.

## CONCLUSION

Random synthetic motion with anatomically realistic spatial distribution, amplitude, and direction was achieved with a learned generative model via observation of motion-corrupted CBCT. The proof-of-concept study opens the way to application of the model in clinical scenarios.

## CLINICAL RELEVANCE/APPLICATION

This work presents an unsupervised motion synthesis model able to generate anatomically-realistic motion vector fields, enabling the generation of large training datasets for development of deep autofocus methods.

## M5A-SPiR-6 Evaluating Artificial Intelligence for the Diagnosis of Acute PE

### Participants

Yifan Wang, MD, MS, New Haven, CT (*Presenter*) Nothing to Disclose

### PURPOSE

Pulmonary embolism (PE) is a severe medical condition, with a high mortality rate if left untreated. A pulmonary embolism response team (PERT) is a multidisciplinary group of providers that provide consultation and care to patients with PE. Artificial Intelligence (AI) has the potential to improve the care provided by a PERT team by notifying members of the team immediately about suspected cases and enabling appropriate therapies to occur in a timely fashion by assisting with the rapid coordination of care amongst a PERT. This study aims to evaluate cases identified by an AI solution across a health system. The health system studied is composed of a main campus (hub) that is capable of performing all current PE therapies and multiple other hospitals (spokes) within the system that can provide limited therapies for PE. This study assesses if AI can correctly identify PE cases of a significant risk stratification and those that may benefit from transfer from a spoke hospital to the hub hospital for additional care.

### METHODS AND MATERIALS

A retrospective cohort of patients at 3 spoke hospitals undergoing computed tomography pulmonary angiography (CTPA) between 01/2019 - 12/2020 was analyzed using an AI solution. A positive finding was defined as the AI solution detecting moderate to large central PE thrombi and a right ventricle to left ventricle (RV/LV) ratio greater than 1.3. CT parameters were obtained from

radiological interpretation and data on clinical PERT activation and interventions at each site were obtained by chart review. Metrics measured included the European Society of Cardiology (ESC) PE risk stratification score, PERT consultation, transfer of patients from a spoke-to-hub, and treatment strategy. The findings were compared to historical averages from the hub/main campus.

## **RESULTS**

A total of 43 cases from 3,787 CTPA scans were identified by the algorithm, of which 92.5% (37/40) were intermediate-high or high-risk PE based on the ESC risk stratification. Comparing spoke hospitals to the hub hospital, 55% (22/40) vs 100% (133/133) of the identified cases had a PERT consultation and 22% (9/40) versus 70% (93/133) of identified cases received an advanced therapy (catheter or surgical therapies, systemic thrombolytics or mechanical support). Only 5% (2/40) of the identified cases resulted in a spoke-to-hub transfer.

## **CONCLUSION**

s The use of AI may help optimize the coordination and care of PERT patients by correctly identifying intermediate and high-risk PE cases, those that may require a PERT consultation, and identifying patients who may benefit from transfer to a hub hospital for advanced therapies.

## **CLINICAL RELEVANCE/APPLICATION**

AI may have the ability to assist in detection of acute PE and coordination of care amongst clinicians across a health system.

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## Abstract Archives of the RSNA, 2023

M5A-SPMK

### Musculoskeletal Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPMK-1 Quantitative Study of Bone Marrow Edema Due to Acute Fractures with Dual-energy Spectral CT Imaging**

##### Participants

Yanan Zhu, Ankang, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the utility of material density and CT attenuation value measurements in dual-energy spectral imaging for differentiating bone marrow edema due to acute bone fractures from the normal bone marrow.

##### METHODS AND MATERIALS

24 patients who presented with acute fractures from November 2017 to March 2018 underwent dual-energy spectral CT imaging on a 16cm wide-detector CT scanner. The virtual monochromatic images and water-calcium material decomposition (MD) images were reconstructed. The monochromatic CT images with color-coded water-calcium MD image overlay were reviewed by two radiologists to identify bone fractures and the associated bone marrow edema. The CT attenuations and water(calcium) concentrations were measured from the CT images and water(calcium) MD images, respectively for bone marrow edema and normal bone marrow. Receiver operator characteristic (ROC) curve analysis was used to determine the diagnostic accuracies of these measurements.

##### RESULTS

The water(calcium) concentrations ( $1040.28 \pm 33.55 \text{ mg/cm}^3$ ) in the areas with bone marrow edema were significantly higher than in the normal bone marrow ( $1011.11 \pm 45.83 \text{ mg/cm}^3$ ) ( $p < 0.001$ ). The CT attenuation values in the 70keV images were  $210.18 \pm 108.63 \text{ HU}$  and  $133.44 \pm 134.06 \text{ HU}$  in the areas with bone marrow edema and with normal bone marrow, respectively ( $p < 0.001$ ). The Area under the curve (AUC) for ROC analysis using the water(calcium) concentration was 0.771, significantly higher than the value of 0.719 using the CT attenuation measurement ( $p < 0.05$ ).

##### CONCLUSION

The measurement parameters, especially the water(calcium) concentration measurement in bone marrow obtained in the dual-energy spectral CT imaging, have high accuracy in differentiating bone marrow edema from normal bone marrow.

##### CLINICAL RELEVANCE/APPLICATION

Dual-energy spectral CT imaging provided a novel and accurate method to quantitatively evaluate the bone marrow edema due to acute bone fractures.

#### **M5A-SPMK-2 The Use of Monochromatic CT Images Overlaid with Water-calcium Material Decomposition Images in Dual-energy Spectral Imaging for Identifying Bone Marrow Edema Due to Acute Bone**

##### Participants

Yanan Zhu, Ankang, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the utility of identifying bone marrow edema due to acute bone fractures using the monochromatic CT images overlaid with color-coded water-calcium material decomposition (MD) images in dual-energy spectral imaging.

##### METHODS AND MATERIALS

24 patients who presented with acute bone fractures underwent dual-energy spectral imaging on a 16cm wide-detector CT scanner from November 2017 to March 2018. The virtual monochromatic images and water-calcium MD image pairs were reconstructed. The monochromatic CT images overlaid with color-coded water-calcium images were reviewed by two radiologists, and the fractures and associated bone marrow edema were identified. The CT attenuations and water(calcium) concentrations of the areas with bone marrow edema and with normal bone marrow were measured from the CT images and water(calcium) MD images, respectively. These values were compared with paired t-test. Kappa values were calculated between the two readers on the identification of the areas with and without bone marrow edema.

##### RESULTS

There was bone marrow edema associated with every bone fracture and the overlay images had higher confidence and clarity to identify the areas of edema than the CT images alone. The Kappa value was 0.878 between the two readers on the identification of the areas with and without bone marrow edema on color-coded water-calcium images. The water(calcium) concentrations ( $1040.28 \pm 33.55 \text{ mg/cm}^3$ ) in the areas with bone marrow edema were significantly higher than in the normal bone marrow area ( $1011.11 \pm 45.83 \text{ mg/cm}^3$ ) ( $p < 0.001$ ). The CT attenuation values in the 70keV images were  $210.18 \pm 108.63 \text{ HU}$  and  $133.44 \pm 134.06 \text{ HU}$  in the areas with and without bone marrow edema, also had a significant difference between the two areas ( $p < 0.001$ ).

## CONCLUSION

s The monochromatic CT images overlaid with color-coded water-calcium images in dual-energy spectral CT imaging on a 16cm wide-detector CT is sensitive and quantitative to identify the bone marrow edema due to acute bone fracture.

## CLINICAL RELEVANCE/APPLICATION

The monochromatic CT images overlaid with water-calcium images in spectral CT can provide an alternative to MRI for detecting the bone marrow edema due to acute bone fractures.

## M5A-SPMK-3 Evaluation of Radiosynoviorthesis as a Palliative Treatment in Advanced Arthropathies

Participants

Marta Gallego Verdejo, MD, Valladolid, Spain (*Presenter*) Nothing to Disclose

## PURPOSE

Radiosynoviorthesis consists of intra-articular injection of radionuclides to achieve a local therapeutic action in patients with chronic or resistant arthropathies in whom other treatments have failed. This study aims to demonstrate the effectiveness of radiosynoviorthesis in treating chronic synovitis at three levels: clinical, functional, and radiological. Additionally, it will study the safety of the technique.

## METHODS AND MATERIALS

It is a descriptive and retrospective study with a multidisciplinary approach (radiology, radiophysics and nuclear medicine). The current sample consists of 15 patients referred for treatment with radiosynoviorthesis from various hospitals between 2019 and 2022. However, we expect to expand to 30 patients in the coming months, when the controls will be carried out. Each patient is evaluated before and after treatment using a pain visual analog scale (VAS) from 0 (no pain) to 10 (maximum pain) and a functionality scale depending on the treated articulation. Immediately after the puncture, scintigraphy is performed to assess the adequate distribution of the radionuclide in the joint. Also, an ultrasound control is performed before and approximately 3 months after radiosynoviorthesis.

## RESULTS

In preliminary results, the mean VAS score lessened from 7.07 before radiosynoviorthesis to 3.47. Similarly, they show an upgrade in the functional scale from 41.47 % to 70.06 % (values expressed as a percentage of the maximum score for each test). In addition, some patients have exhibited an improvement in synovial hyperemia in the ultrasound control, with a reduction in effusion and synovial thickening. Furthermore, it has been confirmed that it is a safe technique, with a low incidence of complications in the treatments performed.

## CONCLUSION

s Radiosynoviorthesis (RSO) is a good treatment for patients with chronic or resistant pathology of the synovial membrane in whom the first lines of treatment have not been effective. It brings improvements at the clinical and functional levels, with a reduction in ultrasound synovitis signs in some patients. It also has a low complication rate, which makes it an effective and safe alternative in the treatment of chronic arthropathies.

## CLINICAL RELEVANCE/APPLICATION

It is a safe procedure that can bring clinical and functional improvement to patients with limiting arthropathies that can substantially improve their quality of life.

## M5A-SPMK-4 Optimizing US-guided Lavage for Rotator Cuff Calcific Tendinitis: The Effect of Corticosteroids Injection Pre vs. Post-procedure

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study is to determine whether the pre or post-procedure injection of corticosteroids during US-guided lavage of rotator cuff calcific tendinitis affects the outcome.

## METHODS AND MATERIALS

At our institution, 124 patients with calcific tendinitis of the rotator cuff were treated with US-guided lavage between 2020 and 2021. In 71 patients, a corticosteroid was injected into the subacromial bursa following the lavage (corticosteroid-after group). The remaining 53 patients (corticosteroid-before group) received the injection before undergoing the procedure. Characteristics of calcification were recorded in terms of number, size, location and type according to Gartner and Hayer's classification. Other variables assessed were calcium extracted, number of adverse events and follow-up. Data were analysed using SPSS 25.0 software, and a p-value < 0.05 was considered statistically significant.

## RESULTS

Both groups showed no significant differences regarding sex ( $p = 0.612$ ) or age ( $p = 0.883$ ). The only reported adverse effect was vasovagal syncope in 7 patients (13.2%) in the corticosteroid-before group and 11 patients (15.5%) in the corticosteroid-after group ( $p = 0.721$ ). The percentage of patients in which a significant amount of calcium was extracted was similar in both groups (54.7% vs 54.9%;  $p = 0.981$ ). The type of calcification was the only factor that showed a statistical association with this outcome (68.5% for type 1 and 2 calcifications; 20% for type 3 calcifications;  $p < 0.01$ ). Finally, the number of patients who required further intervention during follow-up was 23 (43.4%) in the corticosteroid-before group and 41 (57.7%) in the corticosteroid-after group ( $p = 0.943$ ).

## CONCLUSION

s Administration timing of corticosteroid injection before or after calcium deposit removal does not impact treatment outcomes or incidence of adverse effects. Both approaches are equally effective, (however, US guidance should always be recommended to ensure accurate placement and prevent potential complications).



## CLINICAL RELEVANCE/APPLICATION

The order in which this procedure is performed has been arbitrary, with no comprehensive study conducted on the optimal approach. Our study suggests that patients exhibit similar tolerance levels regardless of the treatment sequence.

### M5A-SPMK-5 Intra-articular Injections of the Foot: An Evaluation of Physician Ordering Practices of Ketorolac and Kenalog

#### PURPOSE

Intra-articular steroid injections are widely utilized to provide therapeutic relief and diagnostic evaluation of foot pain. Nonsteroidal anti-inflammatory injectants may offer a safer profile and have been shown to provide similar levels of pain relief as steroids. This study sought to evaluate physician preferences for injection agents for intra-articular foot injections.

#### METHODS AND MATERIALS

An IRB-approved retrospective review was performed using radiology data mining system (Nuance mPower) to identify patients who received intra-articular foot injections from 2011-2023 at a single academic institution. Study participants were eligible if they received an image-guided foot injection and divided into two cohorts: 1) injection with Kenalog and 2) injection with ketorolac. Demographics, BMI, diagnosis, site, agent, pre and post pain scores, treatment history, and ordering provider were recorded. The Visual Analogue Scale was used to collect the pain score. The difference between the pre and post pain scores determined the delta pain score. The Mann-Whitney U test was used to compare the delta pain score between the cohorts. Categorical variables were compared using Pearson's chi-square test.

#### RESULTS

Forty one of the 182 injections were with ketorolac. Eighty four percent of the patients were female and the average age was 65.5 years-old. Fifty percent of patients had a BMI =30. Osteoarthritis was the most common diagnosis for Kenalog and ketorolac injections (95% and 51%, respectively,  $p<0.01$ ) while the tarsometatarsal joints were the most common sites for both cohorts (82% and 37%, respectively,  $p<0.01$ ). Out of the four ordering providers identified, Provider 1 ordered ketorolac for 85% of the injections and Provider 2 ordered Kenalog for 91% of the injections ( $p<0.01$ ). Sixty seven percent of patients who received a kenalog injection and 3% of patients who had ketorolac injections required serial injections ( $p<0.01$ ). Twenty one percent of cohort 1 and 34% of cohort 2 underwent surgery after injections ( $p=0.26$ ). The mean delta scores reported for the Kenalog cohort and ketorolac cohort were -4 and -1, respectively ( $p<0.01$ ).

#### CONCLUSION

s There was a clear preference in the type of agent ordered by each provider without a significant difference in post-injection surgical treatment rates. In recent years, there was an increase in usage of ketorolac and for a wider range of injection sites and diagnoses compared to Kenalog. Future studies could quantitate efficacy of intra-articular injections for foot pain by injectant.

## CLINICAL RELEVANCE/APPLICATION

Ketorolac is a low-cost option for diagnostic and therapeutic intra-articular injections of the foot that offers a safety profile comparable to steroids, without significant differences in outcomes.

### M5A-SPMK-6 Quantitative DWI Assessment of Changes in Graft Maturity at 6 and 12 Months after Anterior Cruciate Ligament Reconstruction and Correlation with Clinical Scores

Participants  
Feiyuan Zhang, Shenzhen, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To quantify the status of graft remodeling using DWI functional MRI at 6 and 12 months after anterior cruciate ligament reconstruction (ACLR) and its correlation with the corresponding clinical function score.

#### METHODS AND MATERIALS

Forty-four patients who underwent ACLR between August 2020 and October 2021 and fifteen volunteers were recruited prospectively. Patients underwent 3.0T conventional MRI and DWI scans in 6 and 12 months after ACLR to measure ADC values of the intra-articular segment graft and its three segments (proximal, middle, and distal). IKDC, Lysholm scores were performed at each time point. Differences between 6 and 12 months postoperatively in ADC changes were compared using the Wilcoxon test. Correlation between ADC values of the intra-articular segment of the graft and clinical scores (IKDC, Lysholm score) in 6 and 12 months was analyzed using the Pearson correlation coefficient.

#### RESULTS

ADC values for the overall intra-articular segment of the ACL graft and its three parts (proximal, middle, and distal) decreased significantly from 6 to 12 months ( $P < 0.05$ ). There was no significant correlation between the ADC values of the grafts and the clinical scores (IKDC, Lysholm scores) at 6 and 12 months postoperatively. The ADC values of the distal segment of the intra-articular segment of the graft were higher than those of the middle and proximal segments at 6 months postoperatively ( $P < 0.05$ ), while the ADC values of the three segments in 12 months were similar.

#### CONCLUSION

s The graft continued to mature from 6 months to 12 months after ACLR. The ADC values measured by the graft decreased but were not consistent with clinical function scores, suggesting that DWI and ADC are a finer reflection of changes in graft maturity than clinical scores.

## CLINICAL RELEVANCE/APPLICATION

DWI can indicate the change of graft maturity and guide the recovery time of ACLR patients after surgery.

### M5A-SPMK-7 Metal Suppression Using a New Generation Low-Field MRI; In Vitro Assessment in a Pig Knee Model

#### PURPOSE

To evaluate the artifact size reduction using a metal artifact correction (SEMAC) sequence at 0.55T and 3T in porcine knee specimens with metal hardware compared to standard sequences. This study aims to assess the feasibility of metal suppression on a novel 0.55T system, to optimize the pulse sequence parameters and to compare them with imaging at 3T as standard of reference.

## **METHODS AND MATERIALS**

Steel and titanium screws with 2.2mm diameter were implanted in 12 porcine knee specimens before imaging at 0.55T (Siemens Free.Max) and 3T (Siemens Vida) MRI using turbo spin echo (TSE), view angle tilting (VAT factor 50 and 100), and combined VAT and SEMAC (VAT100+SEMAC) in proton-density (PD) and T2 short TI inversion recovery (STIR) TSE pulse sequences. Sizes of metal artifacts were measured, and the visualization of the bone and cartilage, cruciate ligaments, joint effusion, and growth plate close to the metal artifact as well as the overall image quality, were assessed using a 5-point Likert scale. Wilcoxon-signed-rank tests were performed to determine the differences in image quality between 0.55T and 3T MRI.

## **RESULTS**

The size of the metal artifacts for titanium was smaller in normal PD ( $p=0.002$ ), PD VAT100 ( $p=0.019$ ), PD VAT100+SEMAC ( $p=0.01$ ), and T2 STIR VAT50 ( $p=0.04$ ) at 0.55T MRI compared to 3T MRI. For stainless steel screws, almost all sequences showed smaller artifact sizes using 0.55T compared to 3T MRI ( $p<0.001$  for PD, PDVAT50/100, PD VAT100+SEMAC, T2 STIR VAT50/100, T2 STIR VAT100+SEMAC), only in T2 STIR no difference could be found. Close to stainless steel screws, the visualization of the growth plate and the bone was significantly better at 0.55T MRI in all sequences ( $p<0.001$ ). Results from PD with VAT100 and PD VAT100+SEMAC showed better visualization of growth plates close to the titanium screws at 0.55T MR compared to 3T MRI. For all other sequences, the visualization of the growth plates did not differ close to titanium screws between both systems. PD VAT100+SEMAC, PDVAT100, and standard T2 STIR FSE sequences showed better image quality at 0.55T compared to 3T MRI. For all other sequences (PD, PDVAT50, T2 STIR 50/100, TS VAT100+SEMAC), the image quality did not differ between field strengths.

## **CONCLUSION**

Our results show that imaging of metal hardware using a novel 0.55T MRI system, in particular, if combined with SEMAC techniques, especially by using factor VAT50, is superior compared to 3T MRI. The visualization of anatomical structures at 0.55T MRI is not inferior compared to 3T MRI.

## **CLINICAL RELEVANCE/APPLICATION**

New generation low-field MRI at 0.55T reduces metal artifacts in musculoskeletal imaging, leading to improved visualization of potential hardware complications and thus enhancing patient care.

## **M5A-SPMK-8 Impact of Weight Loss on Knee Joint Synovitis over 48 months and Mediation by Local Subcutaneous Fat: Data from the Osteoarthritis Initiative**

### **Participants**

Maximilian Loeffler, MD, San Francisco, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

Synovitis and joint effusion are characteristics of the inflammatory phenotype of osteoarthritis (OA). Weight gain promoted the development of synovitis in a previous study. The purpose of this study was to investigate the effect of weight loss on synovitis progression and to assess whether subcutaneous fat (SCF) around the knee mediates the relationship between weight loss and synovitis progression.

## **METHODS AND MATERIALS**

We included 234 overweight and obese participants (BMI  $\geq 25$  kg/m<sup>2</sup>) from the Osteoarthritis Initiative (OAI) with  $>10\%$  weight loss ( $n=117$ ) or stable overweight ( $<\pm 3\%$  change,  $n=117$ ) over 48 months matched for age and sex. Effusion-synovitis and Hoffa-synovitis using the MRI Osteoarthritis Knee Score (MOAKS) as well as SCF were assessed in unenhanced MRI studies at baseline and 48 months. Average joint-adjacent SCF (ajSCF) was calculated as the arithmetic mean of medial, lateral, and anterior SCF measurements. Odds-ratios (ORs) for synovitis progression over 48 months ( $=1$  score increase) were calculated in logistic regression models adjusting for age, sex, baseline BMI, Physical Activity Scale for the Elderly (PASE), and baseline SCF measurements. Mediation of the effect of weight loss on synovitis progression by a pathway through local SCF change was assessed.

## **RESULTS**

The odds for effusion-synovitis progression decreased with weight loss and ajSCF decrease (OR=0.61 and 0.56 per standard deviation [SD] decrease, 95%-confidence interval [CI] 0.44-0.83 and 0.40-0.79,  $p=0.002$  and 0.001, respectively). In contrast, the odds for Hoffa-synovitis progression increased with weight loss and ajSCF decrease (OR=1.47 and 1.48 per SD decrease, CI 1.05-2.04 and 1.02-2.13,  $p=0.024$  and 0.038, respectively). Decrease in ajSCF mediated 39% of the effect of weight loss on effusion-synovitis progression.

## **CONCLUSION**

Effusion-synovitis progression was slowed by weight loss and decrease in local subcutaneous fat. Hoffa-synovitis characterized by fluid in the infrapatellar fat pad increased at the same time, suggesting a decreasing fat pad rather than active synovitis. Decrease in local subcutaneous fat partially mediated the systemic effect of weight loss on synovitis progression.

## **CLINICAL RELEVANCE/APPLICATION**

Local subcutaneous fat around the knee that can be easily measured in unenhanced MRI influences the progression of effusion-synovitis. Signal alterations in Hoffa's fat pad are non-specific for synovitis and should be interpreted with caution, particularly, in patients with weight loss.

## **M5A-SPMK-9 Outcomes and Surgical Revision of Meniscus Allograft Transplant**

### **PURPOSE**

To evaluate factors influencing outcomes of meniscal allograft transplant as measured by both patient reported outcomes and

complications requiring surgical revision of the meniscus.

## **METHODS AND MATERIALS**

Patients undergoing meniscal allograft transplant between 2002 and 2022 at one institution were reviewed. Patient reported outcomes were measured as symptom and function scores via written survey during clinic visits and surgical revision of the meniscus following transplant was recorded. Surgical revision of the transplanted meniscus included meniscectomy, revision transplant, and joint arthroplasty. Univariate and multivariate analyses were performed to evaluate the effect of various prognostic factors on these two outcome measures.

## **RESULTS**

81 patients were evaluated (median age 25 years, interquartile range 18-34, 44 patients were men). Patients showed a mean improvement in symptom score post-transplant of  $1.26 \pm 1.84$  ( $p < 0.001$ ). Patients without associated non-meniscal knee injuries showed a symptom improvement of  $2.26 \pm 1.66$  compared to  $0.83 \pm 1.87$  for those with these injuries ( $p = 0.006$ ). Interval time from meniscectomy to transplant was shown to have a spearman correlation coefficient of  $-0.293$  (95% CI  $-0.500$  to  $-0.051$ ,  $p = 0.017$ ) for symptom score improvement and  $-0.247$  (95% CI  $-0.462$  to  $-0.002$ ,  $p = 0.047$ ) for function score improvement. On multivariate analysis, age  $< 25$  years at the time of meniscectomy was found to be associated with increased need for post-transplant revision surgery (OR 0.18, 95% CI 0.03 - 0.96,  $p = 0.045$ ), as was post-transplant reinjury (OR 10.39, 95% CI 2.52 - 42.92,  $p = 0.001$ ).

## **CONCLUSION**

Meniscal transplant provides symptomatic improvement for patients, which may be limited by the presence of concomitant non-meniscal injuries and increased time between meniscectomy and transplant. Age  $< 25$  years and reinjury are associated with increased likelihood of revision surgery following transplant, likely due to initial traumatic injury or traumatic reinjury.

## **CLINICAL RELEVANCE/APPLICATION**

Meniscal allograft transplant is an increasingly used option for treating meniscal injury to preserve long term function of the knee. Previous studies have varied in choice of outcome measure, failure criteria, and sample size.

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## Abstract Archives of the RSNA, 2023

M5A-SPMS

### Multisystem Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPMS-1 Quantitative Assessment of Activity in Idiopathic Inflammatory Myopathy by Magnetic Resonance Image Complication (MAGiC)**

#### Participants

Zhaorong Tian, MD, Yinchuan, China (*Presenter*) Nothing to Disclose

#### PURPOSE

The study explored the feasibility of using Magnetic resonance image compilation (MAGiC) parameters to quantitatively evaluate changes of thigh muscles in idiopathic inflammatory myopathy (IIM), in order to provide a quantitative index for the evaluation of thigh muscle inflammatory activity in IIM. And to investigate the correlation between thigh muscle T1,T2 values and serum creatinine kinase (CK).

#### METHODS AND MATERIALS

Seventy patients with IIM proven by diagnostic criteria were enrolled in the study along with 30 healthy control subjects. According to clinical findings according to the International Myositis Assessment and Clinical Studies Group (IMACS), the 70 patients were divided into an active group (41 cases) and an inactive group (29 cases). All subjects were scanned using a SIGNATM Architect 3.0T MRI scanner by T1WI, FS-T2WI and MAGiC sequence of the thigh muscle. Two radiologists with 10 years of experience in musculoskeletal system diagnosis measured the T1, T2 values of active group, the inactive group, and the healthy control group thigh muscles on the Magic axial image. The T1,T2 values of thigh muscles in the active, inactive, and healthy groups were compared using one-way analysis of variance (ANOVA). Receiver operating characteristic (ROC) curves were used to analyze the diagnostic efficacy of T1,T2 values for activity of idiopathic inflammatory myopathy. A Spearman correlation coefficient model was used to correlate the mean T1,T2 values of thigh muscle with CK.  $P < 0.05$  was considered statistically significant.

#### RESULTS

The T1 values ( $516.11 \pm 82.42$ )ms in the active group of IIM were lower than those in the inactive group ( $794.24 \pm 84.38$ )ms, lower than those in the healthy control group ( $1184.73 \pm 178.23$ )ms, ( $T = -10.693$ ,  $p < 0.001$ ); T2 values of active groups in IIM ( $93.84 \pm 17.15$ )ms, were higher than inactive groups ( $65.07 \pm 9.7$ )ms, higher than those in the healthy control group ( $45.24 \pm 6.7$ )ms, ( $T = -10.013$ ,  $p < 0.001$ ). The areas under the ROC curves (AUCs) of T1,T2 values between the active and inactive groups of IIM,  $0.921$  (95%CI,  $0.846-0.967$ ),  $0.963$  (95%CI,  $0.912-0.993$ ), respectively. The T1,T2 values of thigh muscles in the IIM were positively correlated with CK, and the correlation coefficients ( $r$ ) were  $0.946$ ,  $0.969$  (all  $p < 0.001$ ), respectively.

#### CONCLUSION

MAGiC parameters can be used to quantitatively assess the activity of IIM, but also be used to demonstrate severity of damaged muscles in IIM, and T2 values can serve as a potential biomarker of disease activity. MAGiC provided imaging bases for the clinical diagnosis of IIM.

#### CLINICAL RELEVANCE/APPLICATION

MAGiC parameters can be used to quantitatively assess the activity and severity of damaged muscles of IIM, provided imaging bases for the clinical diagnosis of IIM.

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## Abstract Archives of the RSNA, 2023

M5A-SPNMMI

### Nuclear Medicine & Molecular Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPNMMI-1 Association Between Severity of Heart Failure<Myocardial Amyloid Deposition on 99mTc pyrophosphate Scintigraph<Echocardiography in Patients with Familial Amyloid Polyneuropathy**

##### Participants

Hiroshi Kanaya, Kumamoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

We investigated the relationship between heart failure severity and myocardial amyloid deposition in patients with familial amyloid polyneuropathy (FAP) using 99mTc-pyrophosphate (PYP) scintigraphy and echocardiography.

##### METHODS AND MATERIALS

Subjects were 71 cases diagnosed with FAP by histopathological diagnosis and genetic testing. Ejection fraction (EF), brain natriuretic peptide (BNP), and cardiac troponin T (TnT) were used as indexes of severity of heart failure. Echocardiography and PYP scintigraphy were performed within 3 months of the blood test. In PYP scintigraphy, the heart to contralateral (H/CL) ratio was calculated in planar image. Pearson's correlation coefficient was calculated for the relationship between the index of the severity of heart failure and the H/CL ratio, also echocardiogram index such as interventricular septum thickness in diastole (IVSTd), posterior wall thickness in diastole (PLVWd) and the ratio of mitral velocity to early diastolic velocity of the mitral annulus (E/e').

##### RESULTS

IVSTd, E/e' and H/CL ratio had significant correlation with EF ( $r=-0.36$ ,  $p<0.01$ ,  $r=-0.34$ ,  $p=0.01$ ,  $r=-0.31$ ,  $p=0.01$ , respectively). IVSTd, PLVWd, E/e' and H/CL ratio showed significant correlation with BNP ( $r=0.47$ ;  $p<0.01$ ,  $r=0.52$ ;  $p<0.01$ ,  $r=0.43$ ;  $p=0.01$ ,  $r=0.39$ ;  $p<0.01$ , respectively). IVSTd and PLVWd had significant correlation with TnT ( $r=-0.3$ ;  $p=0.02$ ,  $r=-0.46$ ;  $p<0.01$ , respectively). In addition, in patients with H/CL ratio  $> 1.3$ , H/CL ratio was not significantly correlated with any heart failure index.

##### CONCLUSION

s Echocardiographic indices, especially IVSTd, may serve as indices of heart failure, whereas H/CL ratio may not.

##### CLINICAL RELEVANCE/APPLICATION

H/CL ratio on PYP scintigraphy is a useful index for the diagnosis of ATTR-CM, but it may not serve as indices of heart failure.

#### **M5A-SPNMMI-2 Diagnostic Potential of TID Ratio in 13N-Ammonia PET Imaging: Differentiating INOCA from Multivessel CAD**

##### Participants

Midori Fukuyama, MD, Osaka, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Adenosine stress 13N-Ammonia PET (Ammonia PET) is a valuable tool for evaluating both myocardial blood flow reserve (MFR) and cardiac function. It is especially useful for diagnosing multivessel coronary artery disease (Multivessel CAD) by measuring MFR. Ischemia with non-obstructive coronary artery disease (INOCA), one of the chronic coronary syndromes, is increasingly recognized as a risk factor for adverse cardiovascular mortality and outcomes. It is difficult to distinguish between INOCA and Multivessel CAD based on MFR alone because MFR is similarly reduced to less than 2.0 in both. Transient ischemic dilatation (TID) ratio is a useful marker of adverse outcomes on myocardial perfusion imaging in severe and extensive CAD. The usefulness of TID during Ammonia PET in INOCA patients has not been reported. We aimed to evaluate the diagnostic potential of TID ratio and other markers in differentiating INOCA from Multivessel CAD using Ammonia PET.

##### METHODS AND MATERIALS

A retrospective analysis was conducted on 86 patients (47 males, 39 females; median age 73) who underwent rest/ adenosine stress-gated Ammonia PET for known or suspected CAD. Using a commercial-used software program, dynamic scanning measured myocardial blood flow (MBF) and MFR. Patients with global MFR $>2.0$  and no evaluation of epicardial coronary artery within three months before or after Ammonia PET were excluded. Seven INOCA patients and 21 Multivessel CAD patients with more than 50% stenosis were included in the final analysis. TID and LV functions were compared between INOCA and Multivessel CAD.

##### RESULTS

No significant differences were detected in rest MBF and MFR between INOCA and Multivessel CAD (1.16 vs. 0.99, 1.52 vs. 1.70, respectively). Although the left ventricular ejection fraction (LVEF) of both INOCA and Multivessel CAD groups were within the normal range, there was a significant difference in rest/ adenosine stress LVEF (78 vs. 65;  $p = 0.008$ , 75 vs. 61;  $p = 0.015$ ). TID was significantly greater in INOCA than in Multivessel CAD (1.29 vs. 1.11;  $p = 0.026$ ). Based on the ROC analysis for identifying INOCA, a TID threshold of 1.22 could predict INOCA (AUC=0.69, sensitivity 95%, specificity 57%, accuracy 85%).

## **CONCLUSION**

s The TID ratio obtained from adenosine stress Ammonia PET was significantly higher in INOCA patients than in Multivessel CAD patients. Patients with global MFR less than 2.0, TID ratio could be a valuable tool to distinguish INOCA from Multivessel CAD.

## **CLINICAL RELEVANCE/APPLICATION**

Transient ischemic dilatation (TID) in rest/ adenosine stress-gated  $^{13}\text{N}$ -Ammonia PET was more significantly observed in Ischemia with non-obstructive coronary artery disease (INOCA) than in Multivessel CAD. TID ratio can assist in distinguishing INOCA from Multivessel CAD.

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## Abstract Archives of the RSNA, 2023

M5A-SPNPM

### Noninterpretive Skills (Beyond Imaging) Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPNPM-1 Flipping Education Right Side Up: A Multiyear Assessment of Flipped Classroom Teaching Versus Traditional Didactic Teaching at Two Academic Institutions**

Participants  
Michelle Ho, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Traditional radiology education consisting of didactic lectures and workstation readout is associated with poor retention of knowledge. Flipped classroom teaching may be more efficient and effective. At our institution (A), flipped classroom teaching has been used consistently for PGY2 residents on one rotation (FR). While on this rotation, residents are assigned daily teaching topics with pre-recorded lectures followed by in-person discussion of related clinical cases. This forces residents to integrate learned concepts and allows faculty to assess areas of weakness. The purpose of this study is to assess the effectiveness of flipped classroom teaching by comparing resident performance on RadExam for FR compared to other core rotations at Institution A, and to resident performance at another similar institution (B), where flipped classroom is not used.

#### **METHODS AND MATERIALS**

RadExam scores from 5 different PGY2 level core rotations (body imaging, emergency, musculoskeletal, neuro, and thoracic) were collected at both institutions from 7/1/2018 to 4/30/2020. At Institution A, the flipped classroom teaching model has been used consistently for one of the above core rotations (FR). The other rotations are referred to as traditional rotations (TR) 1 through 4. The rotation names are anonymized for privacy per data use requirement. Exam scores at institution A were compared using one-way ANOVA. Exam scores between institutions A and B were compared using factorial ANOVA. Survey scores for residents' perception of educational value and efficient use of time for above rotations at institution A were also compared.

#### **RESULTS**

There was significant difference in resident exam scores between rotations at institution A ( $p=0.005$ ) but no difference between the two institutions ( $p=0.7$ ). Residents at institution A performed better on FR than other rotations except for TR4 (Table and Figure). The perceived educational value of FR was higher compared to TR (4.96 vs 4.85,  $p=0.017$ ). No difference was observed in perception of efficient use of time between FR and TR (4.79 vs 4.66,  $p=0.11$ ).

#### **CONCLUSION**

Flipped classroom teaching is at least as effective as traditional teaching model and it is associated with better resident performance on standardized exams at one institution. It is also associated with higher perceived educational value.

#### **CLINICAL RELEVANCE/APPLICATION**

Flipped classroom teaching may increase efficiency in teaching while minimizing interruptions in clinical work, and may improve overall competency of radiology residents and their morale.

#### **M5A-SPNPM-2 Multicriteria Decision Analysis Comparing Gadolinium Based Contrast Agents for Use in Contrast Enhanced Magnetic Resonance Imaging: A Novel Tool in Benefit Risk Assessment**

Participants  
Robert McDonald, MD, PhD, Rochester, MN (*Presenter*) Consultant, General Electric Company; Research Grant, General Electric Company; Consultant, Bracco Group

#### **PURPOSE**

To compare the benefit-risk balance of all currently available FDA-approved GBCAs using a multicriteria decision analysis (MCDA) model to determine if certain agents provide more favorable benefit-risk balance than others in clinical use.

#### **METHODS AND MATERIALS**

An expert panel developed a MCDA model based on two benefits (relaxivity @ 1.5T and pharmacokinetics) and six safety effects (NSF cases, retained Gd in CNS tissues, and rates of physiologic reactions and mild, moderate, and severe hypersensitivity reactions). After scoring, weighted averages of preference scores for the eight criteria were used to give overall preference values for each GBCA in the MCDA model. The usability of the model was tested using 13 diverse clinical scenarios, 5 of which are detailed below.

#### **RESULTS**

For routine adult patients, and those requiring mitigation of hypersensitivity reactions, preference values were driven by hypersensitivity and physiologic reaction rates: gadodiamide=95, gadopentetate=82, gadobutrol=68, gadoterate=48, gadobenate=34, gadoteridol=4. For patients requiring repeated GBCA doses over a longer timeframe in the detection of

subtle/nascent disease preference values were driven by mitigation of Gd tissue retention and relaxivity: gadobenate=73, gadobutrol=55, gadoterate=38, gadodiamide=31, gadoteridol=30, gadopentetate=24. For patients with severely compromised renal function, preference values were driven by mitigation of NSF risk: gadobenate=82, gadoterate=82, gadobutrol=76, gadoteridol=70, gadodiamide=25, gadopentetate=21. For patients requiring hepatobiliary imaging, preference values were driven by pharmacokinetics and relaxivity: gadoxetate=66, gadobenate=44, gadodiamide=35, gadobutrol=29, gadopentetate=29, gadoterate=21, gadoteridol=6.

## CONCLUSION

s The benefit-risk profiles for all FDA-approved GBCAs were found to be comparable and all had favorable benefit-risk ratios in many common clinical scenarios. However, depending on patient-centered characteristics and clinical needs, the relative ranking of these benefit-risk ratios varied. MCDA results provide insights in the identification of clinical scenarios/situations where use of specific GBCAs is warranted due to greater clinical benefits or diminished risks of undesirable effects. These results demonstrate the complexity and multimodal mechanisms underlying the clinical decision making necessary in diagnostic imaging.

## CLINICAL RELEVANCE/APPLICATION

Decision analysis models are commonly used by regulatory agencies to compare benefits and risks of similar prescribed agents. MCDA models are helpful in making patient-centered decisions about GBCA use and can optimize clinical decision making and health care delivery in radiology.

## M5A- SPNPM-3 Impact Analysis of Primary and Secondary Research in Radiology Journals

Participants

Mohamed Ibrahim, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

## PURPOSE

Primary and secondary studies are considered the two major research categories. In this study, we examined the scientific and social media impact of primary and secondary publication types in papers published radiological journals during 2010-2020

## METHODS AND MATERIALS

PubMed publication type tags were used to filter original articles and systematic review and meta-analysis (SR/MA) articles. Clarivate Web of Science was utilized to obtain a list of all radiology journals from the category "Radiology, Nuclear Medicine and Imaging" in Science Citation Index Expanded (SCIE). Automated approach was developed for programmatic extraction of bibliometric and Altmetric yearly citations of each included article using Dimensions API and Altmetric API with Python. Statistical analysis was performed to compare the citation rates between primary and secondary research articles.

## RESULTS

A total of 96,684 published articles from 2010 to 2020 were identified and their meta-data collected. The mean 2-year citation count following publication year was 5.8 for primary research and 10.2 for SR/MA articles ( $p<0.001$ ). Between 2010 and 2020, the mean number of citations per SR/MA article was 51.3 compared to 30.5 per primary research article ( $p<0.001$ ). Mean Altmetric score was 8.2 in SR/MA compared to 3.7 for primary research articles ( $p<0.001$ ).

## CONCLUSION

s Secondary research studies have been increasing in impact in both academia and social media compared to primary research. Our results highlight the importance and impact of systematic reviews and meta-analysis articles as a scientifically influential study type in radiology.

## CLINICAL RELEVANCE/APPLICATION

The study focuses on the impact and influence of different types of research publications in radiology, and highlights the increasing importance of systematic reviews and meta-analyses as influential types of research publications. The findings suggest that prioritizing secondary research studies in future research agendas may be valuable. The study also demonstrates the potential of bibliometric and Altmetric analysis in evaluating the impact of scientific research publications, which can provide valuable insights into the impact of research on both academia and the wider public. Overall, this study has implications for researchers, clinicians, and policymakers in radiology and can inform the development of research strategies and priorities in this area.

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## Abstract Archives of the RSNA, 2023

M5A-SPNR

### Neuroradiology Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPNR-1 Dynamic Functional Connectivity Alterations Associated with Cognitive Impairment in Patients with Type 2 Diabetes**

##### **PURPOSE**

The purpose of this study was to explore the change characteristics and differences of dynamic functional connectivity in type 2 diabetes patients with and without mild cognitive impairment by use of resting state functional magnetic resonance imaging (rs-fMRI).

##### **METHODS AND MATERIALS**

The research consisted of 45 healthy controls (HC) and 102 patients with T2 diabetes (T2). The patients with T2 diabetes were split into two groups based on the presence or absence of mild cognitive impairment, named T2-NC group (n=62) and T2-MCI group (n=40) separately. Thirty-nine components were selected by group independent component analysis (ICA) to construct 7 functional networks. Based on the sliding window method and k-means clustering, changes in dynamic functional connectivity between groups were analyzed and characteristic parameters were compared, while the correlations between characteristic parameters and cognitive performance were evaluated.

##### **RESULTS**

The whole cohort showed four kinds of dFC states: strong local connection state (state 1), extensive interconnection state (state 2), sparse connection state (state 3), and strong connection state (state 4). Compared with the control group, fractional time and mean dwell time of state 2 increased in T2 group, fractional time and mean dwell time decreased in state 4 in T2 group, the number of transitions between state 2 and state 4 reduced in T2 group. The changed dFC characteristics were significantly correlated with cognitive ability. When the statistical efficiency is 0.8 and there are 88 samples in each group, significant differences between T2-NC group and T2-MCI group can be observed.

##### **CONCLUSION**

Our findings indicated that the differences in dFC, which were associated with brain functional impairment due to T2D.

##### **CLINICAL RELEVANCE/APPLICATION**

The differences in dFC might be potential biomarkers for predicting the clinical progression, evaluating the cognitive impairment, and further understanding the pathophysiology of T2D.

#### **M5A-SPNR-10 Temporal and Topological Properties of Dynamic Networks Reflect Disability in Patients with Neuromyelitis Optica Spectrum Disorders**

##### **PURPOSE**

Increasing disability is accrued with each inflammatory attack in neuromyelitis optica spectrum disorders (NMOSD) together with functional network alterations. However, it remains unclear how functional networks relate to clinical disability status in NMOSD. Therefore, our study aims to explore the static strength, time-varying and topological properties within large-scale functional networks, and their associations with disability in NMOSD.

##### **METHODS AND MATERIALS**

A total of 30 NMOSD patients (37.70±11.99 years) and 45 healthy controls (HC, 41.84±11.23 years) were recruited for this retrospective study. All subjects underwent functional MRI and disability assessments. Using independent component analysis, we constructed resting-state networks for subjects, and evaluated between-group differences of static strength, temporal and topological properties of networks using analysis of variance, and their associations with disability by Spearman correlation. Receiver operating characteristic (ROC) curve also was performed to investigate whether abnormal measures could significantly differentiate NMOSD patients from HC.

##### **RESULTS**

Compared to HC, NMOSD patients showed significant alterations in the dynamic networks rather than static ones. Three dynamic states were defined, and State 1 is characterized by overall hypoconnectivity within and between networks. Compared to HC, NMOSD patients showed higher fraction time in State 1 (P<0.001) and more dwell time in it (P<0.001) with lower transitions (P=0.028), and related to higher disability (r=0.421, P=0.029; r=0.461, P=0.031; r=-0.383, P=0.049; respectively). ROC curve analysis indicated the fraction time and dwell time of State 1 could significantly distinguish NMOSD from HC (area under the curve: 0.991-0.996). Moreover, NMOSD patients also exhibited altered small-worldness, decreased degree centrality and clustering coefficients of hub nodes in dynamic networks (P<0.05, false discovery rate corrected). And decreased clustering coefficients of the bilateral precuneus (r=-0.387, P=0.046) and the thalamus (r=0.406, P=0.036) related to clinical disability in NMOSD patients.

##### **CONCLUSION**

s Higher fraction time and more dwell time with less transitions in hypoconnectivity state and decreased clustering coefficients of dynamic networks was observed in NMOSD patients, and associated with higher disability.

#### CLINICAL RELEVANCE/APPLICATION

Our findings indicated altered temporal and topological properties in dynamic networks instead of static ones might better explain disability in NMOSD patients.

### M5A-SPNR- 11 **The Alterations of Glymphatic System Function and Choroid Plexus and Their Correlation with Clinical Features in Relapsing Remitting Multiple Sclerosis Patients**

#### PURPOSE

To investigate the difference in glymphatic system function between relapsing-remitting multiple sclerosis (RRMS) patients versus healthy controls (HCs), and examine the relationship between diffusion along perivascular space (DTI-ALPS) index and choroid plexus (CP) volume or clinical features in RRMS.

#### METHODS AND MATERIALS

The ALPS index, the volume of CP in lateral ventricle and the cortical lesions were derived from magnetic resonance imaging (MRI) in 92 RRMS patients and 40 HCs, 23 of 92 RRMS patients were followed up for an average of 6 months to examine the changes in ALPS index and CP volumes.

#### RESULTS

RRMS patients had lower ALPS-index and higher volume ratio of CP than HCs. Lower ALPS-index was significantly related to higher ratio of CP volume and cortical lesion volume, and longer disease duration. Higher ratio of CP volume was related to higher cortical lesion volume, and lower MoCA scores in MS. But the ALPS index and CP volume didn't have statistical changes after 6 months of follow-up in 23 patients.

#### CONCLUSION

s Our findings demonstrated that the impaired glymphatic system function is involved in the inflammatory processing in MS patients and might help us better understand the pathological mechanism of MS.

#### CLINICAL RELEVANCE/APPLICATION

The DTI-ALPS index may have unique significance for monitoring MS inflammatory reaction.

### M5A-SPNR- 12 **The Diagnostic Value of Dynamic Contrast-enhanced MRI Ktrans in Diagnosing Neuropsychiatric Systemic Lupus Erythematosus**

Participants

Ide Ide, MD, Fukoka, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Neuropsychiatric systemic lupus erythematosus (NPSLE) is a severe complication of SLE that affects nervous system. Brain MRI findings in SLE often show vascular lesions, but approximately 40% of NPSLE patients have normal MRI findings, which makes diagnosis challenging. The blood-brain barrier (BBB) is crucial for brain microenvironment integrity. However, microvascular disease and neuroinflammatory states can compromise the BBB in NPSLE. Dynamic contrast-enhanced (DCE)-MRI is a promising technique to evaluate BBB permeability, using Ktrans as a flow parameter to measure the volume-transfer constant from intravascular to extravascular extracellular space. An increase in Ktrans indicates compromised BBB integrity. The purpose of this study is to determine whether the Ktrans value is useful for differentiating NPSLE from non-NPSLE.

#### METHODS AND MATERIALS

Forty-seven NPSLE and 55 non-NPSLE patients were recruited. Based on the 1999 ACR classifications, NPSLE patients were classified 43 central nervous system lupus (11 diffuse and 32 focal manifestations) and 4 peripheral nervous system (PNS) lupus. DCE-MRI was performed, and the Ktrans map was obtained for all patients. Regions of interest (ROIs) were set in the cerebral cortex, reflecting small vessel disease, as it is a pathological finding of SLE. Manual ROIs were placed on the frontal, temporal, and occipital cortex with reference to T1-weighted images (Figure 1). Subsequently, the Ktrans value was measured, and the average of three points value was used for group comparison using Welch's t-test. ROC analysis was performed to analyze the diagnostic accuracy of the Ktrans map. All statistics were performed with BellCurve for Excel (Social Survey Research Information Co., Ltd.).

#### RESULTS

The mean value of Ktrans (/min) was significantly larger for NPSLE than for non-NPSLE ( $0.88 \pm 0.56$  vs.  $0.26 \pm 0.46$ ,  $p < 0.001$ ) (Figure 2 and 3). The mean value of Ktrans was  $1.10 \pm 0.41$  for diffuse manifestation,  $0.86 \pm 0.59$  for focal manifestation,  $0.42 \pm 0.43$  for PNS lupus, respectively. The mean value of Ktrans of diffuse manifestation of NPSLE was larger than that of focal manifestation, although there were no significant differences between them due to the small sample size. The ROC analysis showed good diagnostic performance (AUC: 0.832, optimal cut-off points: 0.11 (/min), sensitivity: 71%, specificity: 89%).

#### CONCLUSION

s Our study found that Ktrans value from DCE-MRI can differentiate between NPSLE and non-NPSLE, and suggests that BBB disruption may contribute to NP syndrome development in NPSLE.

#### CLINICAL RELEVANCE/APPLICATION

The Ktrans value derived from DCE-MRI can accurately differentiate between NPSLE and non-NPSLE, indicating that this technique may serve as a new biomarker for SLE.

### M5A-SPNR- 13 **Spinal Cord and Brain Atrophy Patterns in NMOSD and MS are Nonrandom and Clinically Relevant**

Participants

Tiantian Hua, Beijing, China (*Presenter*) Nothing to Disclose

## **PURPOSE**

Silent progressive spinal cord and brain atrophies are common findings in neuromyelitis optica spectrum disorder (NMOSD) and multiple sclerosis (MS), but harbor distinct patterns across brain areas leading to inter- and intra-disease heterogeneity, accounting for different physical disability and cognitive decline.

## **METHODS AND MATERIALS**

This cohort study used data retrospectively collected from eight neurological centers. Totally, 209 patients with NMOSD, 304 patients with relapsing-remitting MS (RRMS), and 1160 healthy controls (HC) were studied. Non-negative matrix factorization (NMF) was used to determine the atrophy patterns of these two diseases, respectively. Then, the weightings across atrophy patterns were obtained for each individual using a linear regression model by regarding the individual atrophy profile as dependent variables and the NMF-derived atrophy patterns as independent variables. Next, we associated the individual weighting across each atrophy pattern with cognitive profiles scores and expanded disability status scale (EDSS) scores to explore the contribution of each atrophy pattern to the disease manifestations. An additional longitudinal cohort were conducted to validate the stability and progression of these NMF-derived atrophy patterns.

## **RESULTS**

Three atrophy patterns were observed in NMOSD: (1) Spinal Cord-Deep Grey Matter (SC-DGM) pattern associated with decreased Brief Visuospatial Memory Test (BVMT), and higher EDSS scores; (2) Frontal-Temporal pattern associated with decreased Mini-Mental State Examination (MMSE) and California Verbal Learning Test (CVLT) scores; and (3) Cerebellum-Brainstem pattern associated with decreased EDSS progression scores. Three atrophy patterns were observed in RRMS: (1) DGM pattern associated with decreased Symbol Digit Modalities Test (SDMT), Paced Auditory Serial Addition Test (PASAT), MMSE, Montreal Cognitive Assessment (MoCA), CVLT and BVMT, and higher EDSS scores; (2) Frontal-Temporal pattern associated with decreased MoCA scores; and (3) Occipital pattern associated with decreased EDSS progression scores. Additionally, the longitudinal cohort validate the stability of atrophy patterns, and formed trajectories of atrophy progression in NMOSD and RRMS.

## **CONCLUSION**

s These findings suggested spinal and brain atrophy patterns in NMOSD and RRMS occurred largely in a non-random manner and developed (at least partly) according to distinct anatomical patterns. Additionally, these offered categorical perspectives that may facilitate clinical trials of stratifying participants.

## **CLINICAL RELEVANCE/APPLICATION**

Atrophy patterns showed stronger associations with cognitive impairment, physical disability, and progression.

## **M5A-SPNR-14 Pseudoaneurysm of the Facial Artery after Tonsillectomy Managed with Endovascular Coiling: A Case Report**

Participants

Subash Phuyal SR, MD,MBBS, Kathmandu, Nepal (*Presenter*) Nothing to Disclose

## **PURPOSE**

Introduction: We present a case of pseudoaneurysm of the facial artery after tonsillectomy managed with successful endovascular coiling.

## **METHODS AND MATERIALS**

Presentation of Case: 41-year-old lady presented with a history of throat pain and 3 episodes of hematemesis on the 3rd, 4th, and 7th postoperative days after tonsillectomy and styloidectomy. She had undergone the operation 20 days back. Neurological examination was normal. Contrast-enhanced computed tomography scan of the neck showed - contrast-filled dilatation of a branch of the right facial artery in the right palatine tonsillar fossa within the operative bed - likely pseudoaneurysm which was managed endovascularly. The patient recovered fully after treatment.

## **RESULTS**

Discussion: Tonsillectomy can have various complications among which one is the pseudoaneurysm of the facial artery which can be managed with coiling in the catheterization laboratory.

## **CONCLUSION**

s Conclusion: Pseudoaneurysm of the facial artery is a rare complication of tonsillectomy. Endovascular treatment of a pseudo aneurysm can be done.

## **CLINICAL RELEVANCE/APPLICATION**

Pseudoaneurysm of the facial artery is a rare complication of tonsillectomy. Endovascular treatment of a pseudo aneurysm can be done.

## **M5A-SPNR-2 Abnormal Functional Network Topology in Autism Spectrum Disorder**

## **PURPOSE**

The topological organization of whole-brain (including cerebrum and cerebellum) functional networks in Autistic Spectrum Disorder (ASD) patients remains unclear. Besides, the cerebellum plays an important role in neural activity and interacts with the cerebrum. So, we aimed to investigate the topological architecture of whole-brain functional networks in ASD patients.

## **METHODS AND MATERIALS**

Resting-state functional MRI was obtained on 40 ASD patients and 40 healthy controls. After constructing whole-brain functional networks by thresholding partial correlation matrices of 116 brain regions, we computed the topological properties (small-world, network efficiency, and nodal centrality) with graph theoretical analysis, comparing topological properties between the two groups,

and analyzed the relationships between parameters showing group difference and Autism Diagnostic Observation Schedule (ADOS) scores.

## RESULTS

Small-world architecture was identified for both groups. ASD patients exhibited decreased nodal centrality absolutely in cerebral areas like superior frontal gyrus (dorsolateral), supplementary motor area, anterior cingulate and paracingulate gyri, median cingulate and paracingulate gyri, cuneus, superior occipital gyrus, precentral gyrus, postcentral gyrus, superior parietal gyrus, supramarginal gyrus. However, the increased nodal centrality mainly in cerebellum regions (including Crus I, Lobule III, VI, VIIb of cerebellar hemisphere and Lobule I, II, III, IV, V of vermis).

## CONCLUSION

s Cerebrum and cerebellum showed opposite functional changes in ASD patients. The increased cerebellum function might be compensation for the decreased cerebral function.

## CLINICAL RELEVANCE/APPLICATION

The topological organization of whole-brain analysis was beneficial to understanding the neural mechanism of ASD.

## M5A-SPNR-3 Advanced Imaging in First Episode Psychosis: A Systematic Review

Participants

Riyad Hanafi, La Madeleine, France (*Presenter*) Nothing to Disclose

## PURPOSE

In addition to ruling out numerous neurological conditions that may have psychiatric manifestations, advanced imaging techniques play a role in identifying imaging biomarkers of psychiatric disorders, selecting patients for optimal treatment, and tracking treatment effects. We performed a systematic review of the literature to determine how advanced imaging in FEP can allow for increasing diagnostic specificity and predicting disease's evolution.

## METHODS AND MATERIALS

PubMed searches were conducted on December 9, 2022, using combinations of the following predetermined search terms: "first episode psychosis" and "advanced imaging" or "functional MRI", or "resting state MRI" or "spectroscopy" or "ASL" or "DTI" or "diffusion imaging", with filters Clinical Trial, Meta-Analysis and Randomized Controlled Trial.

## RESULTS

To date, brain imaging studies have shown grey matter deficits, ventricular enlargement and reduced overall brain volume in FEP. Morphology is commonly assessed using T1-weighted volumetric MRI with automated computerized methods. Patients presenting a FEP show a thinning of certain cortical regions notably involved in emotional processing and higher executive functions. Functional MRI (fMRI) is based on the BOLD (Blood Oxygen Level Dependent) contrast, which uses the paramagnetic properties of deoxygenated hemoglobin, during task-activation or resting-state paradigms. Neuronal activity is associated with changes in oxygen consumption and thus in deoxyhemoglobin concentration. Correlations between BOLD signal time series of distant brain regions reflect their functional interactions, allowing for the identification of different functional resting state networks (RSNs).

## CONCLUSION

s In the routine management of a FEP, brain imaging is mainly used to rule out other conditions. In this indication, structural brain MRI is considered the standard examination. In the near future, advanced sequences, particularly functional imaging studies, may allow improved diagnostic specificity, and play a predictive role, in line with the increasing development of personalized medicine.

## CLINICAL RELEVANCE/APPLICATION

Early treatment of first-episode psychosis (FEP) is one of the major factors that impacts long-term prognosis. Better understanding of FEP pathophysiology, proper patient selection for optimal treatment, and adequate prognostication of disease evolution are real challenges for current research. Besides ruling out some neurological conditions that may have psychiatric manifestations, advanced imaging techniques allow for identifying imaging biomarkers of psychiatric disorders.

## M5A-SPNR-4 MRI Volumetric of Limbic System in Burnout Syndrome and Vigilant Attention in a Population with Nocturnal Shifts

## PURPOSE

To determine association between changes in the sleep pattern, burnout syndrome, vigilant attention deficit with structural alterations of the limbic system.

## METHODS AND MATERIALS

39 Volunteer subjects with night shifts underwent a non-contrast brain MRI using a T1 MPRAGE sequence. Brain images were automatically segmented using the VolBrain software. The Maslach Burnout Inventory Index and the test Psychomotor Vigilante Test (PVT) were used to assess the vigilant attention deficit in all patients. The correlation between the volumetric findings with clinical scales were evaluated using Spearman's test. Non-parametric univariate analysis was performed using the Mann-Whitney U test between the volumetric data and burnout syndrome.

## RESULTS

In subjects with burnout syndrome the hippocampal volume was significantly greater than subjects without burnout syndrome ( $p < 0.01$ ). The response time of the PVT test was lower in the subjects with greater volume of the amygdala ( $r = 0.40$ ,  $p = 0.025$ ). Regarding the precision of the test, an inverse correlation was found between the percentage of failed responses with the volume of the hippocampus ( $r = 0.39$ ,  $p = 0.02$ ) and the volume of the amygdala ( $r = 0.49$ ,  $p < 0.01$ ).

## CONCLUSION

s Burnout syndrome is associated with a decrease in the volume of the hippocampus. Vigilant attention deficit is associated with

changes in the volume of the hippocampus and amygdala.

#### **CLINICAL RELEVANCE/APPLICATION**

The clinical relevance of this work is to use artificial intelligence tools to define brain structural changes on MRI associated with burnout syndrome and vigilance attention that are complementary to clinical evaluation and in the future can will have utility as severity criteria or predictors of complications.

#### **M5A-SPNR-5A Multimodal Imaging Study of Adult-onset Neuronal Intranuclear Inclusion Disease**

##### **PURPOSE**

In this study, we propose to apply diffusion kurtosis imaging (DKI) to study the microstructural changes in patients with Neuronal intranuclear inclusion disease (NIID) and the relationship with cognitive dysfunction. We also analyze the changes in brain functional connections, hoping to provide a new imaging perspective on the neuropathological mechanism and early diagnosis of this disease.

##### **METHODS AND MATERIALS**

Our study retrospectively included 12 patients diagnosed with NIID in the Department of Neurology at \*, as well as 20 healthy control subjects matched for age, gender, and education level during the same period. Neuro-psychological assessments, DKI, and RS-fMRI data were collected in our study. Mean kurtosis (MK), axial kurtosis (AK), radial kurtosis (RK), fractional anisotropy (FA), and mean diffusivity (MD) parameters were obtained, and statistical analysis was performed on each DKI parameter of the subjects. We also analyzed the correlation between the DKI parameter values and neuro-psychological scores in brain regions which show significant differences between NIID patients and healthy controls. Finally, based on the ALL 116 template and independent component analysis, we explored changes in brain network functional connectivity in NIID patients.

##### **RESULTS**

Compared with healthy controls, NIID patients have lower MK and RK values in the thalamus, hippocampus, and left caudate in the gray matter, as well as lower AK values in the thalamus, insula, and left calcarine. In the white matter, FA is reduced in the superior frontal gyrus, corona radiata, corpus callosum splenium, inferior frontal gyrus, and temporal gyrus. While MD is increased in the white matter around the ventricles (FWE-corrected,  $p < 0.05$ ). In NIID patients, there is a positive correlation between the AK value of the left caudate and MoCA results ( $r = 0.770$ ,  $P = 0.015$ ), and a negative correlation between the MD value of the white matter around the ventricles and MoCA results ( $r = -0.678$ ,  $P = 0.045$ ). Additionally, functional connections in multiple brain regions of NIID patients are weakened (NBS correction,  $P_{edge} < 0.05$ ,  $P_{cluster} < 0.05$ , 1000 permutations), with decreased functional connections in the precuneus, angular and frontal\_mid regions of the default mode network (uncorrected,  $P < 0.001$ ,  $cluster > 5$ ).

##### **CONCLUSION**

s NIID patients show changes in the microstructure and functional connections of multiple brain regions. These changes might contribute to the pathological physiology of NIID and serve as potential indicators for monitoring the severity and progression of NIID, which has potential clinical value for early diagnosis.

#### **CLINICAL RELEVANCE/APPLICATION**

We hope to provide a new imaging perspective on the neuropathological mechanism and early diagnosis of this disease.

#### **M5A-SPNR-6 Brain Mechanisms Underlying Emotional Response in Social Pain. Football as a Proxy to Study Fanatism: An fMRI Study**

Participants

Francisco Zamorano, Santiago, Chile (*Presenter*) Nothing to Disclose

##### **PURPOSE**

In this study, we aimed to explore the brain mechanisms underlying positive and negative social stimuli in football fanatics during positive and negative social scenarios and deepen the neural substrate of football-related emotional responses as a proxy of fanatism.

##### **METHODS AND MATERIALS**

Forty-three healthy male volunteers who support Chilean football teams were recruited for this fMRI study. Participants were divided into two groups, 22 supporters of the Colo-Colo team and 21 supporters of the Universidad de Chile team. All participants were presented with a compilation of football matches containing 63 goals, and their brain activity was registered in a Siemens 3T SKYRA, during the visual stimulation of score annotations to rivals and from rivals. We also apply a football supporters' fanatism scale (FSFS) in order to determine the fanatism level for each participant.

##### **RESULTS**

The results demonstrate that the brain activity was different when the goals come or go to the most emblematic rival, which we termed the "emotional delta." In the winning scenarios, subcortical activation was observed, specifically in the ventral striatum, caudate, and lentiform nucleus. These areas are important for the reward dopaminergic circuit, inducing pleasure sensations. The mentalizing network was activated for the losing scenario. This mentalizing network strategy could be involved to mitigate the adverse result's pain. Simultaneously, a deactivation was observed at the dACC, which connects the limbic system with the frontal association regions that command normative behavior, decreasing cognitive control and increasing the probability to fall into disruptive or violent behavior. Both, mentalizing network and dACC correlate with FSFS, negatively and positively respectively.

##### **CONCLUSION**

s Football is an excellent social affiliation model, promoting inclusivity, teamwork, community spirit, social change, and personal achievement. Still, the gregarious component could be the reason behind acts of violence and vandalism. Our study provides new inputs for future research on different fanatism expressions, which is crucial for promoting a more equitable and inclusive society.

#### **CLINICAL RELEVANCE/APPLICATION**

Social affiliation is a crucial requirement for complex social phenomena. Fanaticism is extreme or excessive devotion or enthusiasm

towards a particular cause, belief, or opinion. It often involves blind and unquestioning loyalty to a particular ideology or leader, and a refusal to consider other perspectives or opinions. Fanaticism can lead to intolerance, aggression, and even violence toward those who do not share the same beliefs or views. In this sense, our study proposes a new model for studying complex behaviors like fanaticism.

## **M5A-SPNR-7 Comparison of fMRI Language Laterality With and Without Sedation in Pediatric Epilepsy**

### **PURPOSE**

Functional MRI is an essential component of presurgical language mapping. In clinical settings, young children may be sedated for the MRI with the functional stimuli presented passively. Research has found that sedation changes language activation in healthy adults and children. However, there is limited research comparing sedated and unsedated functional MRI in pediatric epilepsy patients. We compared language activation patterns in children with epilepsy who received sedation for functional MRI to the ones who did not.

### **METHODS AND MATERIALS**

We retrospectively identified the patients with focal epilepsy who underwent presurgical functional MRI including Auditory Descriptive Decision Task at our institution from 2014-2022. Patients were divided into sedated and awake groups, based on their sedation status during functional MRI. Auditory Descriptive Decision Task stimuli were presented passively to the sedated group per clinical protocol. We extracted language activation maps contrasted against a control task (reverse speech) in the Frontal and Temporal language regions and calculated separate language laterality indexes for each region. We considered positive laterality indexes as left dominant, negative laterality indexes as right dominant, and absolute laterality indexes less than 0.2 as bilateral. We defined 2 language patterns: typical (i.e., primarily left-sided) and atypical (Fig 1). Typical pattern required at least one left dominant region (either frontal or temporal) and no right dominant region. We then compared the language patterns between the sedated and awake groups.

### **RESULTS**

Seventy patients met the inclusion criteria, 25 sedated, and 45 awake (Fig 2). Using the Auditory Descriptive Decision Task paradigm, when adjusted for age, handedness, gender, and laterality of lesion in a weighted logistic regression model, the odds of the atypical pattern were 13.2 times higher in the sedated group compared to the awake group (CI: 2.55-68.41, p-value <0.01).

### **CONCLUSION**

Sedation may alter language activation patterns in pediatric epilepsy patients. Language patterns on sedated functional MRI with passive tasks may not represent language networks during wakefulness, sedation may differentially suppress some networks, or require a different task or method of analysis to capture the awake language network.

### **CLINICAL RELEVANCE/APPLICATION**

Given the critical surgical implication of these findings, additional studies are needed to better understand how sedation impacts the functional MRI blood oxygenation level-dependent signal. Consistent with current practice, sedated functional MRI should be interpreted with greater caution and requires additional validation as well as research on post-surgical language outcomes.

## **M5A-SPNR-8 The Individual Functional Connectome in Pediatric Epilepsy Patients - Does it Add to Presurgical fMRI Brain Mapping**

### **PURPOSE**

Speech is a complex brain function underlying an extended functional and structural neural network. fMRI as part of presurgical evaluation allows the investigation of language lateralization and organization. Nevertheless, conventional fMRI maps just represent a small aspect of the language network. In children, language networks may differ substantially from their general linear model (GLM) -based activation maps as generated by task-based fMRI post-processing. In this study, functional connectivity analysis (FCA) of task-based language fMRI data was compared to the general linear model-based analysis in children undergoing presurgical evaluation for drug resistant epilepsy.

### **METHODS AND MATERIALS**

9 patients (5 male, 4 female) between 8 and 16 years with lesional (n=6) and mr-negative epilepsy (n=3), underwent presurgical language evaluation by fMRI. All patients were right-handed. An echo planar imaging (EPI) sequence was used to acquire high temporal resolution (TR=1s) functional images at 3 Tesla. Two task-based fMRI paradigms (verb generation and sentence comprehension) were presented. The CONN-toolbox was used for preprocessing of anatomical and functional data and for creating individual functional connectomes. One experienced pediatric neurologist was blinded to the patients history and reviewed conventionally processed as well as connectome language fMRI data and qualitatively described the activation patterns.

### **RESULTS**

Based on GLM-based analysis, 8 out of 9 patients were determined as left-hemispheric language dominant. One patient had a right-hemispheric language dominance in terms of atypical language representation. In the presurgical fMRI activation analysis 3 out of 9 patients showed contralateral activations in the frontal and temporal lobe. In the FCA in 7 out of 9 patients were found significant connectivities to contralateral frontal and temporal lobes at p-uncorrected <0.05. The FCA also demonstrated significant connectivities (p-uncorrected <0.05) to other cortical brain areas in frontal and temporal lobe in all patients, which were not detected in the activation pattern analysis.

### **CONCLUSION**

In this study it was shown that functional connectomes deliver more information about the language network. In the FCA a more extended bilateral functional network was found in most patients as compared to presurgical created activation patterns.

### **CLINICAL RELEVANCE/APPLICATION**

In order to further understand brain plasticity especially in the presence of brain pathologies, the visualization of functional brain networks and its implementation in clinical setting is essential. Further studies have to show how the information from the FCA can be interpreted in prediction of postoperative speech changes.

## **M5A-SPNR-9 Causal Association Between Body Mass Index and Neuroimaging Features in Adults**

Participants

Han Lv, MD, Beijing, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

High body mass index (BMI) is associated with negative brain health; however, its causal association remains unclear. This study evaluated the effect of high BMI on neuroimaging features in different age groups and to validated the causal relationship.

### **METHODS AND MATERIALS**

This real-world study has been performed based on the KaiLuan Study, a multicenter, long-term follow-up, community-based longitudinal cohort in the adult population since 2006. We modeled the trajectories of BMI during follow-up to evaluate cumulative exposure. Multimodality neuroimaging data have been collected by 3.0T MRI since 2020, which were available for volumetric measurements of the brain structure, white matter hyperintensity (WMH), and skeletonized white matter tract at the voxel-wise level. We performed two-sample Mendelian randomization analysis using genetic data from 681,275 individuals to analyze the causal relationship between BMI and neuroimaging features.

### **RESULTS**

In the real-world study, clinical and neuroimaging data were obtained from 1,074 adults (aged 25-83 years). High BMI was found to be associated with a wide range of negative brain health. For adults <45 years, differences in cerebral parenchyma volume between those with BMI > 26.2 kg/m<sup>2</sup> and those with normal BMI corresponded to 12.0 years (95% CI, 3.0 to 20.0) of brain aging. Volumetric results corresponded to -17.9ml (95% CI, -29.8 to -4.5). Differences in WMH were statistically significant for participants >60 years, with 6.0ml (95% CI, 1.5 to 10.5) increased volume. Genetic analysis of 681,275 individuals further indicated causal relationships among high BMI, decreased volume of the cerebral parenchyma and gray matter, and increased fractional anisotropy in projection fibers, further supporting the causal effect of BMI on brain aging and health.

### **CONCLUSION**

s BMI is causally associated with decreased brain volume and disrupted microstructural integrity in projection fibers. Brain aging is prominent in young adults with high BMI.

### **CLINICAL RELEVANCE/APPLICATION**

Controlling BMI has been suggested throughout life, especially for young adults, for protecting brain health.

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## Abstract Archives of the RSNA, 2023

M5A-SPOB

### OB/Gynecology Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPOB-1 Proposed New MRI Scoring System of Rectosigmoid Endometriosis: Concise Qualitative Assessment with Pathologic Correlation to Guide Operative Planning**

##### Participants

Hiroaki Takahashi, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

Rectosigmoid endometriosis (RSE) manifests as a broad-spectrum of MRI findings ranging from serosal surface disease to deep bowel involvement, a spectrum which impacts the surgical strategy. We propose a new MRI scoring system for RSE that is beneficial in operative planning based on pathologic depth of invasion as it pertains to MRI.

##### METHODS AND MATERIALS

Patients with RSE treated by rectosigmoid surgery from May 2018 to June 2022 were retrieved. Types of surgery were classified into (1) partial thickness resection, (2) discoid resection, and (3) segmental resection, including low anterior resection and sigmoidectomy. Depth of bowel involvement was extracted from pathology reports. Each pre-treatment MRI was scored based on the mutual agreement of two abdominal radiologists. MRI score was defined as follows: (1) score 0: no evidence of RSE, (2) score 1: minimal tethering involving the serosal surface of the rectosigmoid colon, (3) score 2: indeterminate thickening and/or soft tissue involving the rectosigmoid colon without mushroom cap or submucosal involvement, and (4) score 3: definite mushroom cap sign or definite MRI evidence of submucosal involvement. The contingency of surgical strategy and pathological results between different MRI scores (MRI score 2 versus score 3) was assessed by Fisher's exact test with Freeman-Halton extension.  $P < 0.05$  was considered statically significant.

##### RESULTS

Among 89 enrolled patients (median age: 37 [22-57] year old), 3, 10, 34, and 42 patients had MRI score 0, 1, 2, and 3, respectively. All patients with MRI score 0 and 1 underwent partial thickness shaving. When comparing MRI score 2 to MRI score 3, there was a significant difference in patients requiring partial thickness shaving (53% [18/34] vs 7% [3/42]), discoid resection (18% [6/34] vs 7% [3/42]), and segmental resection (29% [10/34] vs 86% [36/42]) ( $p < 0.001$ ). The depth of bowel involvement was extracted from pathology reports in 13 patients with MRI score 2, and 33 patients with MRI score 3. A higher proportion of patients demonstrated greater depth of invasion with MRI score of 3 compared to MRI score of 2 with higher rates of submucosal invasion (52% [17/33] vs 15% [2/13]) and lower rates of muscularis propria invasion (48% [16/33] vs 62% [8/13]), serosal invasion (0% vs 8% [1/13]), and no invasion (0% vs 15% [2/13]) ( $p = 0.001$ ).

##### CONCLUSION

Our MRI scoring system for RSE has good correlation with the pathological spectrum of bowel invasion and is helpful in operative planning.

##### CLINICAL RELEVANCE/APPLICATION

Our MRI scoring system for rectosigmoid endometriosis is a concise and qualitative scale based on suspected depth of bowel wall invasion and correlates with pathology to best guide operative planning.

#### **M5A-SPOB-2 Contrast-enhanced 3D T1-weighted Image with Compressed Sensing and Fast 3D Wheel Technique on Women's Pelvic MRI: Utility for Improving Quality and Acquisition Time as Compared with Conventional Contrast-enhanced 3D T1-weighted Image**

##### Participants

Takahiro Ueda, MD, PhD, Toyooka, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the utility of contrast enhanced 3D T1-weighted image with compressed sensing (CS) and wheel encoding order technique (Fast 3D wheel: Fast 3Dw) which is one of the technics for k-space based acceleration technique for improving image quality and acquisition time on women's pelvic MRI as compared with conventional parallel imaging (PI).

##### METHODS AND MATERIALS

24 consecutive female patients with various pelvic diseases underwent contrasted-enhanced 3D T1-weighted image with PI, CS and Fast 3Dw, randomly. Then, all acquisition times were recorded in each patient. For quantitative assessment, SNR of muscle and CR between myometrium and muscle were determined on uterine corpus and cervical level by ROI measurements. For qualitative assessment, two board certified radiologists assessed overall image quality (OIQ), artifact and diagnostic confidence level (DCL) by 5-point scales. Then, each final score was determined as consensus of two readers. To compare the capability for acquisition time reduction, mean acquisition time was compared among all data sets by Tukey's HSD test. To determine quantitative image quality



improvement, SNRs and CRs were compared among all methods by Tukey's HSD test. On qualitative image quality evaluations, inter-observer agreement on each data set was assessed by  $\chi^2$  statistics followed by  $\chi^2$  test. Finally, three indexes among all methods by Wilcoxon signed-rank test.

## RESULTS

Mean acquisition time of CS and Fast 3Dw (CS:  $156.6 \pm 4.8$  sec, Fast 3Dw:  $153.9 \pm 2.7$  sec) were significantly shorter than that of PI (PI:  $313.0 \pm 9.7$  sec,  $p < 0.001$ ). SNR of Fast 3Dw ( $19.3 \pm 0.9$ ) at uterine corpus level were significantly higher than that of PI ( $12.0 \pm 4.2$ ,  $p < 0.05$ ) and CS ( $15.0 \pm 1.4$ ,  $p < 0.05$ ). SNR of Fast 3Dw ( $20.4 \pm 5.5$ ) at uterine cervical level were significantly higher than that of PI ( $15.4 \pm 6.3$ ,  $p < 0.05$ ). There was no significant difference of CR among three methods ( $p > 0.05$ ). All inter-observer agreements were determined as 'moderate' or 'excellent' ( $0.57 < \kappa < 0.83$ ,  $p < 0.0001$ ). OIQs of CS and Fast 3Dw (CS: median 4, IQR 3-4; Fast 3Dw: median 5, IQR 4-5) were significantly higher than that of PI (median 4, IQR 3-4.75,  $p < 0.05$ ). Artifacts of CS and Fast 3Dw (CS: median 2, IQR 2-3; Fast 3Dw: median 1, IQR 1-2) were significantly lower than that of PI (median 2, IQR 1.25-3,  $p < 0.05$ ). There was no significant difference of DCL among three methods ( $p > 0.05$ ).

## CONCLUSION

s CS and Fast 3Dw are considered as useful for image quality improvement with reducing acquisition time on women's pelvic MRI, when compared with conventional PI.

## CLINICAL RELEVANCE/APPLICATION

CS and Fast 3Dw are considered as useful for image quality improvement with reducing acquisition time on women's pelvic MRI, when compared with conventional PI.

## M5A-SPOB-3 Pain-free Survival after Percutaneous Image-guided Cryoablation of Extra Peritoneal Endometriosis

Participants

Milan Najdawi, MD, Montfermeil, France (*Presenter*) Nothing to Disclose

## PURPOSE

To retrospectively evaluate the pain-free survival of percutaneous image-guided cryoablation of symptomatic extraperitoneal endometriosis (EE).

## METHODS AND MATERIALS

From 2017 to 2022, cryoablation of EE was performed in a single institution for 42 consecutive patients (median age: 37 years [interquartile range: 33 - 39.5]) on a total of 47 lesions. Patient and procedural characteristics were reviewed retrospectively. Tolerance and outcomes in terms of pain and patient's satisfaction were evaluated.

## RESULTS

The mean procedure and hospitalization lengths were 73 minutes [48-94] and 1 day [1-1], respectively; including 67% outpatients. The median follow-up was 13.5 months [1.1-37.7] after cryoablation. The median pain-free survival rates were 93.75% [95% CI, 77.25-98.4] at 6 month, and 82.72% [58.8-93.45] after 12 month, respectively. Pain decreased from a median of 8/10 [7-9] on the visual analogue scale to 0/10 [0-1] at the last follow-up ( $P < 0.0001$ ). The median Patient Global Impression of Change score recorded at last follow-up was 1/7 [1 - 2]. Efficacy rate of cryoablation to avoid secondary surgery was 92.8% (39/42) per patient and 93.6% (44/47) per nodule treated. Four patients (9.5%, 4/42) had adverse event in the days following the procedure, one patient (2%) had a severe adverse event.

## CONCLUSION

s Percutaneous cryoablation is safe and effective to significantly reduce pain and obtain local control of extraperitoneal endometriosis.

## CLINICAL RELEVANCE/APPLICATION

Cryoablation provides a minimally invasive alternative to surgery that can achieve local control of the endometriosis and significantly reduce pain. This is important because endometriosis can cause significant pain and can be difficult to treat, often requiring surgery or long-term medical management.

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## Abstract Archives of the RSNA, 2023

M5A-SPPD

### Pediatric Imaging Monday Poster Discussions I

#### Sub-Events

#### M5A-SPPD-1 CT Angiography for Acute Pediatric Gastrointestinal Hemorrhage: A Search for Best Practices

##### PURPOSE

Gastrointestinal bleeding (GIB) in children can be a life-threatening emergency. CT angiogram (CTA) is typically the first-line imaging modality to identify a source and direct further management. When evaluating pediatric patients with GIB; however, no guidelines exist to our knowledge for optimal patient selection and scanning protocols. This project sought to better delineate the best protocols for evaluating GIB in the pediatric patients.

##### METHODS AND MATERIALS

Our work meets criteria for quality improvement and did not constitute human subjects research. We retrospectively reviewed CTA exams performed for GIB at a tertiary care pediatric hospital from 1/23/2018 - 9/6/2022. Exams reported as non-diagnostic were excluded. Patient age and sex were recorded. Number of phases, positive studies, follow-up imaging modality and findings, intervention, and final diagnoses were identified. Phase of CTA with the clearest evidence of GIB was determined in consensus by two pediatric radiologists. Data were evaluated using descriptive statistics.

##### RESULTS

88 CTAs were performed for GIB evaluation in 89 patients [60 males (67%), median age 11.9 years (range 9 months to 28 years)] over the evaluation period. Of 88 exams, 24 (27%) were single-phase, 41 (47%) were dual-phase, 18 (20%) were triple-phase, and 5 (6%) included a fourth phase, 35 (40%) were dual energy, and 2 (2%) were nondiagnostic. Active GIB was identified on 18 exams (20%) with all being most conspicuous during the arterial phase. Further imaging occurred 46 times and included repeat CTA (n=5), Meckel's scan (n=14), tagged red blood cell scan (n=12), and angiography (n=15). 3 patients underwent repeat CTA after an initial negative study; 3 patients were found to be bleeding at subsequent angiography. 8 patients (9%) underwent embolization and 8 (9%) went to surgery. In total 20 (23%) occurrences of GIB were diagnosed in this cohort. Etiologies included vascular malformation, enteroenteric anastomoses, pseudoaneurysm, and a Meckel's diverticulum.

##### CONCLUSION

Among the varied CTA protocols, a majority (77%) of GIB cases were identified in the arterial phase. In this small sample size, bleeding was identified by CTA only in 19% of patients but there was a false negative rate of 18.75%. Further investigation of patient characteristics and a larger cohort may help better define which patients are more likely to have positive findings on imaging.

##### CLINICAL RELEVANCE/APPLICATION

Our data helps to further the clinical data available with regard to the optimal protocoling and patient selection for CT angiography to evaluate for acute gastrointestinal hemorrhage in pediatric patients.

#### M5A-SPPD-2 The Feasibility of Portal Vein Flow Quantitation in Pediatric Patients using 4D MRI

##### Participants

Parmede Vakil, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the feasibility of time-resolved flow-sensitive four-dimensional (4D) Flow MRI for the quantification of portal venous hemodynamics in a clinical pediatric population.

##### METHODS AND MATERIALS

We retrospectively identified patients who received 4D Flow MRI using a 3T scanner at our institution in the past 1 year. Flow was quantified using Arterys Web-based flow analysis software in three pre-defined anatomic regions in the proximal, mid, and distal portal vein. Maximum velocities and flow volumes were tabulated. Inter-observer variability was assessed using Bland-Altman and regression techniques.

##### RESULTS

15 patients (7 male, mean age 9.6 years, range [2, 17]) received 4D Flow MRI as part of the clinical work up of their underlying gastroenterological disease. Portal venous flow averaged 479 mL/min range [180, 1130] across all study participants. On average, portal flow increased from the proximal (453 mL/min) to the mid (480 mL/min) and distal (505 mL/min) portions. Flow rate correlated moderately with age ( $r = 0.5381$ ,  $p = 0.04$ ). Interobserver agreement was excellent with Bland-Altman analysis showing a mean inter-observer difference of 30 mL/min, a 7% difference, which was not significant on 1-tail t-test ( $p = 0.1$ ) or regression analysis ( $r^2 = 0$ ,  $p = 0.87$ ).

##### CONCLUSION

4D Flow MRI assessment of portal venous flow is feasible in a pediatric population with excellent inter-observer agreement and

s 4D Flow MRI assessment of portal venous flow is feasible in a pediatric population with excellent inter-observer agreement and flow measurements that are in line with literature values provided in quantitative portal flow studies in adults. More studies are required to further characterize the clinical utility of this modality.

#### **CLINICAL RELEVANCE/APPLICATION**

4D Flow MRI has the capability of providing both anatomic and functional assessment of portal flow and has been validated against US and 2D Flow MRI in adults; however its feasibility in a pediatric population has not been explored.

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## Abstract Archives of the RSNA, 2023

M5A-SPPH

### Physics Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPPH-1 Carotid Artery Assessment in Dual-Source Photon-Counting CT: Impact of Low Energy Virtual Monoenergetic Imaging on Image Quality, Vascular Contrast and Diagnostic Accessibility**

##### Participants

Christian Booz, MD, Frankfurt am Main, Germany (*Presenter*) Speaker, Siemens AG

##### PURPOSE

Preliminary dual-energy CT studies have shown that low energy virtual monoenergetic imaging (VMI)+ reconstructions can provide superior image quality compared to standard 120 kV CTA series. The purpose of this study is to evaluate the impact of low energy VMI+ reconstructions on quantitative and qualitative image quality, vascular contrast and diagnostic assessability of the carotid artery in patients undergoing photon-counting CTA examinations.

##### METHODS AND MATERIALS

A total of 122 patients (67 male) who had undergone dual-source photon-counting CTA scans of the carotid artery were retrospectively analyzed in this study. Standard 120 kV CT images and low keV VMI+ series from 40 to 100 keV with an interval of 15 keV were reconstructed. Quantitative analyses included evaluation of vascular CT numbers, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). CT number measurements were performed in the common, external and internal carotid artery. Qualitative analyses were performed by three board-certified radiologists independently using five-point scales to evaluate image quality, vascular contrast and diagnostic assessability of the carotid artery.

##### RESULTS

Mean attenuation, CNR and SNR values were highest in 40 keV VMI+ reconstructions (HU, 1362 ± 12; CNR, 33 ± 8; SNR, 34 ± 9) followed by 55 keV VMI+ reconstructions (HU, 737 ± 9; CNR, 24 ± 7; SNR, 26 ± 7); all three mean values at these keV levels were significantly higher compared with the remaining VMI+ series and standard 120 kV CT series (HU, 154 ± 7; CNR, 16 ± 4; SNR, 24 ± 6) (p<.0001). The qualitative analysis showed highest rating scores for 55 keV VMI+ reconstructions followed by 40 keV and 70 keV VMI+ series with a significant difference compared to standard 120 kV CT images series regarding image quality, vascular contrast and diagnostic assessability of the carotid artery (p<.0001).

##### CONCLUSION

Low keV VMI+ reconstructions at a level of 40-55 keV significantly improve image quality, vascular contrast and the diagnostic assessability of the carotid artery compared with standard CT series in photon-counting CTA.

##### CLINICAL RELEVANCE/APPLICATION

In patients undergoing photon-counting CTA scans of the carotid artery, low keV VMI+ reconstructions at a level of 40-55 keV should be routinely reconstructed to improve image quality and the diagnostic assessability and to potentially reduce radiation dose and the needed amount of intravenous contrast material in scan protocols in order to protect kidney function.

#### **M5A-SPPH-10 Assessment of Low-dose Chest CT Protocols Prior to Implementation of Lung Cancer Screening Program**

##### PURPOSE

To evaluate low-dose CT (LDCT) chest protocols prior to implementing a pilot lung cancer screening (LCS) program in the Canadian province of Nova Scotia.

##### METHODS AND MATERIALS

Data were collected from five scanners of a university hospital. Each sample included 20 examinations conducted on average-sized adult patients chosen by image measurement of anterior-posterior (AP) thickness. All scanners were from the same manufacturer installed in 2011-2022. Dose modulation options and iterative reconstruction algorithms were implemented on all machines, and two were dual source (DS) scanners. The volume CT dose index (CTDIvol) and dose-length product (DLP) were collected in each study. The size-specific dose estimate (SSDE) was calculated using the conversion factor for each patient's AP diameter, and the effective dose (ED) was estimated using an anatomy-specific conversion factor for the chest. For quantitative analysis of image quality, CT numbers and image noise in Hounsfield Units (HU) were measured in three regions of interest: tracheal bifurcation, peripheral lung parenchyma, and subcutaneous fat. Signal-to-noise ratio (SNR) values were calculated for each region. Descriptive statistics determined the mean, standard deviation, and median values of obtained data. Protocol differences were determined using a single-factor ANOVA test, with a p-value less than 0.05 denoting statistical significance. The correlation between dose and SNR values was assessed using the Pearson correlation coefficient.

##### RESULTS

The survey included 100 patients with an overall median AP thickness of 25.0 cm demonstrating no significant difference between

patient size in each sample ( $p=0.52$ ). Median values of CTDIvol, DLP, and ED ranged from 2.0 to 4.7 mGy, 72.0 to 164 mGy·cm, and 1.0 to 2.3 mSv respectively. The SSDE varied from 2.5 to 5.8 mGy. Differences between the means of the dose distributions from each scanner were statistically significant with higher doses resulting from both DS scanners. A very weak correlation was found between dose and SNR values with the Pearson correlation coefficients of 0.24, -0.09, and -0.15 for trachea, lung, and fat respectively.

## CONCLUSION

Our study demonstrated up to a 2.3-fold difference in dose resulting from the LDCT examination. Only three of five scanners using this protocol comply with screening requirements. Due to iterative reconstruction, quantitative image quality had a very weak correlation with dose suggesting potential for protocol optimization without degradation of image quality.

## CLINICAL RELEVANCE/APPLICATION

Canada currently has no organized LCS, however, some provinces are implementing pilot studies. It is crucial to assess the radiation dose and image quality of LDCT protocols before using them for screening

### M5A-SPPH-11 **Comparison of Photon-Counting-Detector CT and Energy-Integrated-Detector CT for Evaluating Performance Using Tasks Involving Cerebral Small Vessels**

Participants  
Kazuya Ohashi, PhD, RT, Nagoya, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Detectability index ( $d'$ ) and task transfer function (TTF) are used for evaluating image quality of CT systems. TTF is generally measured using a 30 mm diameter cylindrical phantom. However, it has been reported that this task is not ideal for assessing small vessels, such as those with 1 mm diameter. In this study, we measured TTF using an iodine wire phantom to simulate CT angiography of the cerebral vasculature, and calculated  $d'$  to compare the results of a photon-counting CT system (PCD-CT) and an energy-integrating detector CT system (EID-CT).

## METHODS AND MATERIALS

We used a cylindrical water phantom with a diameter of 210 mm to simulate X-ray absorption in an adult head. A wire phantom with a 1-mm diameter, 100-mm length was placed in the water phantom as an object for in-plane TTF measurement. Custom-made iodine wire phantoms, 1 mm in diameter, manufactured by Kyoto Kagaku (Kyoto, Japan), and made of the same material equivalent to diluted iodine with a concentration of 12 mg/ml to simulate the anterior choroidal artery. We evaluated the image quality of small blood vessels in polyenergetic imaging and spectral imaging using this phantom. All images were acquired at 120 kVp and dual energy mode using a PCD-CT (NAEOTOM Alpha, Siemens Healthineers, Erlangen, Germany) and a second generation dual source EID-CT (SOMATOM Definition Flash, Siemens Healthineers, Erlangen, Germany). Virtual monoenergetic images (40 keV at spectral imaging) and polyenergetic image were generated, and noise and contrast-dependent spatial resolution were assessed with noise power spectral (NPS) and TTF, respectively. We also computed the detectability index ( $d'$ ) of simulated small vessels.

## RESULTS

The NPS at 120 kVp was only slightly different between PCD-CT and EID-CT. At 40 keV, PCD-CT had 29 % less noise. The 50 % TTF was 9 % higher for PCD-CT at 120 kVp and 18 % higher at 40 keV. The  $d'$  of PCD-CT was 63 % higher at 120 kVp and 84 % higher at 40 keV.

## CONCLUSION

The phantom used in this study accurately simulates the adult head with contrasted small vessels, enabling the evaluation of both spectral and polyenergetic images. Our measurements using iodine wire phantoms demonstrated the high performance of PCD-CT in cerebral CT angiography.

## CLINICAL RELEVANCE/APPLICATION

Our proposed method for measuring  $d'$  would be effective for clarifying the image quality of cerebral CT angiography.

### M5A-SPPH-12 **Clinical Usefulness of the Latest 256-detector CT Scanner with 3D Anti-scatter System and Multi-material Artifact Reduction Algorithm to Reduce Pseudoenhancement of Renal Cysts in Abdominal Contrast-enhanced CT**

Participants  
Shingo Harashima, Tokyo, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

The latest 256-detector CT scanner (Revolution CT, GE) has been clinically introduced with a focally aligned detector layout and 3D collimator to use 2D grids to reject scatter in the z-direction and angular plates in the third dimension to reduce scatter as well as multi-material artifact reduction (MMAR) algorithm to reduce heel effect and beam-hardening errors in reconstructed images. We assessed clinical usefulness of Revolution CT with the anti-scatter system and MMAR algorithm to reduce pseudoenhancement of renal cysts in abdominal contrast-enhanced CT (CECT).

## METHODS AND MATERIALS

We included 64 simple renal cysts from 30 patients (16 men; mean age,  $68 \pm 10$  years; mean body mass index [BMI],  $24.9 \pm 4.5$  kg/m<sup>2</sup>) who underwent both the noncontrast CT (NCCT) and CECT at 120 kV with Revolution CT and 76 simple renal cysts from other 30 patients (18 men; mean age,  $65 \pm 12$  years; mean BMI,  $23.2 \pm 3.4$  kg/m<sup>2</sup>) with simple renal cysts who underwent both the NCCT and CECT at 120 kV with a conventional CT scanner (Discovery CT, GE). Each patient underwent helical acquisition of both the NCCT and CECT with iodine load of 600 mgI/kg during the nephrographic phase using our routine parameters including noise index of 10-11 HU (mean CTDIvol:  $6.8 \pm 3.1$  mGy for Revolution CT;  $12.3 \pm 3.0$  mGy, Discovery CT). We reconstructed axial images of slice thickness of 1.25 mm; measured the maximum diameter of the largest cyst on the CECT; and identically placed a region of interest within the cyst to measure the mean CT value on both the NCCT and CECT in each patient. Each renal cyst was classified into one of the following three groups based on the maximum diameter: group A, < 10 mm; group B, = 10 mm to < 20 mm; group C, = 20 mm. Degree of pseudoenhancement of each renal cyst was defined as difference of the mean CT value between

CECT and NCCT. Unpaired t test was used to compare the degree of pseudoenhancement between Revolution CT and Discovery CT in the groups A-C.

## RESULTS

The degree of pseudoenhancement was significantly smaller with Revolution CT than with Discovery CT in the group A ( $0.78 \pm 1.66$  HU [n = 22] vs.  $15.96 \pm 5.95$  HU [n = 28]), the group B ( $1.34 \pm 2.39$  HU [n = 22] vs.  $13.38 \pm 6.47$  HU [n = 26]), and the group C ( $0.39 \pm 1.12$  HU [n = 19] vs.  $6.62 \pm 4.05$  HU [n = 23]) (P < 0.001 for all), as shown in Table. Revolution CT better reduced pseudoenhancement of smaller renal cysts.

## CONCLUSION

s Revolution CT with the anti-scatter system and MMAR algorithm is clinically advantageous for significantly reducing pseudoenhancement of renal cysts in abdominal CECT over a conventional CT scanner.

## CLINICAL RELEVANCE/APPLICATION

Revolution CT with 3D anti-scatter system and MMAR algorithm is clinically useful to reduce pseudoenhancement of renal cysts and thus improve differentiation between renal cysts and solid masses in abdominal CECT.

## M5A-SPPH-13 Phantom Study on Radiomic Features in Ultra-High-Resolution CT Imaging: Matrix Size, Radiation Dose, and Reconstruction Algorithms

Participants

Tomoki Maebayashi, Kobe, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

With the advent of ultra-high-resolution (UHR) CT and photon-counting CT systems, 1024-matrix imaging has achieved clinical viability. These images display enhanced spatial resolution compared to conventional 512-matrix images. However, the impact of matrix size, radiation dose, and reconstruction algorithm on radiomic quantification remains unclear. This phantom study aimed to elucidate the effects of imaging parameters on CT radiomic feature quantification.

## METHODS AND MATERIALS

3D-printed cylindrical plastic phantom (19 mm diameter) designed for radiomic analysis was fabricated. The phantom contained an array of cavities filled with varying contrast agent concentrations, generating spatial variation in CT values (6 distinct types). These cylindrical phantoms were integrated into a 30x20 cm CT evaluation phantom (Kyoto Kagaku) and imaged using an UHR scanner (Aquilion Precision; Canon). Radiomic analysis was conducted in two dimensions by placing 2.0 cm<sup>2</sup> circular ROI for each of the six phantoms, evaluating 118 features classified as first-order (n=19), shape (n=24), and texture (n=75). Two comparative analyses were performed: a) super-high-resolution (SHR) mode (0.25 mm thickness, 1024 matrix) versus normal-resolution (NR) mode (0.5 mm thickness, 512 matrix) images, utilizing hybrid iterative reconstruction; b) SHR mode images with three tube currents (150 mA, 290 mA, 580 mA) and three reconstruction algorithms (deep learning, hybrid iterative, filtered back projection). A linear mixed-effects model assessed imaging parameter effects on features. A P-value less than 0.05 divided by 118 for Bonferroni correction was considered significant.

## RESULTS

In 13 (11.0%) of the 118 features, significant disparities arose between measurements from imaging matrices (1024 versus 512 matrix). Neighborhood Gray-Tone Difference Matrix (NGTDM; 20.0%) was primarily affected, followed by Gray-Level Dependence Matrix (GLDM; 14.3%). Examining 1024 matrix images, 35 features (29.7%) exhibited dose-induced measurement alterations. First-order features (73.7%) were most frequently significantly affected, followed by NGTDM (40.0%). No substantial differences were observed in feature measurements related to reconstruction algorithms.

## CONCLUSION

s Significant discrepancies in feature measurements can be discerned when utilizing UHR CT. Approximately 30% of feature measurements using UHR CT images were notably influenced by dose but not by the reconstruction algorithm.

## CLINICAL RELEVANCE/APPLICATION

Radiomic features derived from CT images using a 1024 matrix deviate from those originating from conventional CT, with measurements dependent on radiation dose while remaining largely unaffected by the reconstruction algorithm.

## M5A-SPPH-2 Dual-Source Photon-Counting CTA of the Thorax: Impact of Low Energy Virtual Monoenergetic Imaging on Image Quality, Vascular Contrast and Diagnostic Accessibility

Participants

Christian Booz, MD, Frankfurt am Main, Germany (*Presenter*) Speaker, Siemens AG

## PURPOSE

Preliminary dual-energy CT studies have shown that low energy virtual monoenergetic imaging (VMI)+ reconstructions can provide superior image quality compared to standard 120 kV CTA series. The purpose of this study is to evaluate the impact of low energy VMI+ reconstructions on quantitative and qualitative image quality, vascular contrast and diagnostic assessability of thoracic arteries in patients undergoing photon-counting CTA examinations.

## METHODS AND MATERIALS

A total of 120 patients (66 male) who had undergone dual-source photon-counting CTA scans of the thorax were retrospectively analyzed in this study. Standard 120 kV CT images and low keV VMI+ series from 40 to 100 keV with an interval of 15 keV were reconstructed. Quantitative analyses included evaluation of vascular CT numbers, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). CT number measurements were performed in the ascending and descending aorta, the aortic arch, the common carotid artery, the subclavian artery and the coronaries. Qualitative analyses were performed by three board-certified radiologists independently using five-point scales to evaluate image quality, vascular contrast and diagnostic assessability of thoracic arteries.

## RESULTS

Mean attenuation, CNR and SNR values were highest in 40 keV VMI+ reconstructions (HU, 1205 ± 11; CNR, 29 ± 7; SNR, 30 ± 9) followed by 55 keV VMI+ reconstructions (HU, 679 ± 8; CNR, 23 ± 6; SNR, 24 ± 7); all three mean values at these keV levels were significantly higher compared with the remaining VMI+ series and standard 120 kV CT series (HU, 169 ± 7; CNR, 19 ± 5; SNR, 27 ± 7) ( $p < .0001$ ). The qualitative analysis showed highest rating scores for 55 keV VMI+ reconstructions followed by 40 keV and 70 keV VMI+ series with a significant difference compared to standard 120 kV CT images regarding image quality, vascular contrast and diagnostic assessability of thoracic arteries ( $p < .0001$ ).

## CONCLUSION

Low keV VMI+ reconstructions at a level of 40-55 keV significantly improve image quality, vascular contrast and the diagnostic assessability of the thoracic arteries compared with standard CT series in photon-counting CTA.

## CLINICAL RELEVANCE/APPLICATION

In patients undergoing photon-counting CTA scans of the thorax, low keV VMI+ reconstructions at a level of 40-55 keV should be routinely reconstructed to improve image quality and the diagnostic assessability and to potentially reduce radiation dose and the needed amount of intravenous contrast material in scan protocols in order to protect kidney function.

## M5A-SPPH-4 Usage of DECT Features and Radiomics for Management of Renal Lesions in Patients with Von Hippel-Lindau

### Participants

Mahshid Golagha, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

Shiva Singh, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Von Hippel-Lindau syndrome (VHL) is a rare genetic condition that increases the risk of cancer, particularly clear cell renal cell carcinoma (ccRCC). Patients with VHL mutation are usually placed under active surveillance until the tumor reaches a size of 3cm, after which surgery is advised. This study aims to investigate the potential use of dual-energy CT (DECT) and radiomics in predicting time to 3cm in patients with VHL, providing a more accurate and efficient method of monitoring ccRCC lesions.

## METHODS AND MATERIALS

This IRB-approved study comprised 71 adult patients (mean age, 44 ± 13 years, 39 males) with histologically proven ccRCCs in patients with VHL germline mutation who underwent contrast-enhanced DECT of the abdomen during their active surveillance period. A total of 134 lesions which were measured >1cm and <2.5 cm on their baseline DECT studies and had a follow-up study reaching 3cm included in our study. We classified the lesions based on their size on baseline images into small (1-1.5cm), medium (1.5-2cm), and large (2-2.5cm). Within each group, we calculated the median time taken for lesions to reach 3cm, enabling us to classify each lesion as either slow-growing or fast-growing. Deidentified low and high kV series of the venous phase of baseline images were imported and processed on the DECT tumor analysis prototype. We semiautomatically segmented all renal lesions to extract DECT and radiomic features. Using a region of interest on the renal cortex, we normalized the iodine concentrations. Data were analyzed with multiple logistic regression and receiver operator characteristic area under the curve (AUC) as the output.

## RESULTS

In each group, there was no difference in the maximum diameter, volume, and whole area of the lesions growing to 3cm slowly or fast ( $p > 0.3$ ). Normalized iodine concentration was significantly higher in lesions that reached 3cm slower than the others ( $p < 0.001$ ). Although the necrotic volume of the lesions was higher in those that reached 3cm faster, but it was not statistically significant. With multiple logistic regression, the combination of iodine concentration and normalized iodine concentration was the best subset in predicting lesions reaching 3cm fast (AUC: 0.72, 95% CI: 0.71-0.74). Radiomics were not able to predict time to 3cm based on baseline DECT studies.

## CONCLUSION

Quantitative iodine parameters of renal lesions derived from the venous phase of DECT studies show potential in predicting the growth of ccRCC lesions and guiding clinical decision-making in patients with VHL.

## CLINICAL RELEVANCE/APPLICATION

Predicting ccRCC lesion growth in patients with VHL improves care quality, prioritizes monitoring for rapidly growing lesions, and helps minimize unnecessary radiation exposure for slower-growing ones.

## M5A-SPPH-5 Evaluation of an Experimental Tantalum Oxide Contrast Material for Material Separation from Iodine and Gadolinium using DECT and PCCT

### Participants

Yuxin Sun, BS, MSc, San Francisco, CA (*Presenter*) Stockholder, Nextrast, Inc

## PURPOSE

To evaluate material separation of an experimental tantalum oxide nanoparticle contrast agent (TaCZ) from iodine and gadolinium, using clinical DECT and a prototype deep silicon PCCT scanner.

## METHODS AND MATERIALS

Vials of the following concentrations of contrast agents: 2.5, 5.0, 10.0 mg iodine/mL (Ultravist, Bayer); 1.2, 1.9, 2.4, 5.8 mg Gd/mL (Multihance, Bracco); 2.0, 2.5, 4.0, 5.0, 6.0, 8.0, 10.0, 12.0 mg Ta/mL (TaCZ, RPI) were scanned in a water-equivalent CT phantom (MECT Phantom, Gammex) on a clinical fast-kV switching DECT scanner (Revolution CT, GE) and a prototype deep silicon PCCT. Paired iodine and water material decomposition (MD) images were generated for both scanners. Also, PCCT bin images were generated (bin A, 44-52 keV; bin B, 52-60 keV; and bin C, 60-80 keV). ROIs were drawn on 10 slices per vial for all image reconstructions to measure average CT attenuation, iodine and water signals. Slopes of iodine versus material concentration graphs were compared for MD images, and higher to lower bin CT number ratios were compared in the bin images.

## RESULTS

The mean attenuation of 5.0 mg/mL iodine and Ta. and Gd (5.8 mg/mL) at 120 kVp was 129. 130. and 175 HU for DECT. and 119.

130, and 229 HU at 70 keV for PCCT, respectively. Slopes of iodine signal versus elemental concentration for DECT and PCCT are 1.06 and 0.93 for iodine; 0.79 and 0.05 for Gd; and 0.10 and -0.04 for Ta, respectively. For MD iodine maps, a larger slope difference is seen for iodine vs. Ta than for iodine vs. Gd, suggesting better spectral separation of iodine from Ta by DECT and possibly PCCT. At DECT, separation of Ta from Gd appears modest (slope  $\beta = 0.68$ ) but poor for PCCT ( $\beta = 0.08$ ) because both materials are correctly classified as non-iodine by 2-MD. However, in PCCT bin images, Gd signal (K-edge 50.2 keV) is optimized between bins A B with an attenuation ratio of  $\sim 1.38$  between those bins, while Ta signal (K-edge 67.4 keV) is optimized between bins B C with a ratio of  $\sim 1.26$ . Attenuation ratios of other materials, including iodine and water are all = 1.0 for these same bin pairs, indicating promising bin-based material separation of Ta and Gd from iodine and other materials.

## CONCLUSION

s Tantalum provides intense enhancement on par with iodine at 120 kVp. Iodine signal is more readily separated from that of Ta than Gd by DECT material decomposition images, and is slightly more readily separated from that of Ta than Gd by PCCT. When using PCCT bin (non-MD) images, both Gd and Ta signals are readily differentiated from that of iodine, from each other, and from other materials.

## CLINICAL RELEVANCE/APPLICATION

Experimental TaCZ contrast gives a strong "color" signal that should be readily separated from iodine signal by both DECT and PCCT, and from Gd for PCCT, and may enable future multi-color contrast discrimination.

## M5A-SPPH-6 Revisiting Noise Variance-mAs Dependence in Photon Counting Detector CT

### PURPOSE

CT noise variance has long been known to be inversely proportional to tube current-time product (mAs), which is essential in clinical CT protocol optimization. With the introduction of photon counting detector CT (PCD-CT), there is an opportunity to provide low-dose CT imaging with high spatial resolution for various clinical tasks. However, the unique technical aspects of PCD-CT, such as pulse pileup and charge-sharing effects, require a new functional dependence on mAs for noise variance.

### METHODS AND MATERIALS

With the introduction of photon counting detectors (PCDs) in CT imaging, the finite deadtime of the detectors causes the statistical distribution of raw counts to deviate from the ideal Poisson distribution, becoming deadtime-dependent. In this study, a modified Poisson distribution of photon counts for non-paralyzable PCDs was used to derive the post-log sinogram projection data variance. To connect the noise variance of a CT image with the variance of the sinogram data, a cascaded systems analysis was introduced. Additionally, for PCD-CTs with pile-up corrections, a similar analysis was conducted to derive the functional dependence of noise variance on both mAs and deadtime  $t$ . The analytical  $s^2(\text{mAs}, t)$  models were validated by comparing them with simulation results and experimental data obtained from a CdTe-based PCD-CT system.

### RESULTS

In PCD-CTs without pile-up corrections, the traditional noise variance of the CT image on mAs is modified by an additional multiplication factor of  $1/(1 + \beta \text{mAs}t)$  with a numerical constant  $\beta$ . On the other hand, for PCD-CTs with pile-up corrections, the classical noise variance of CT image on mAs is modified by an additional additive factor  $\gamma t$ , where  $\gamma$  is another numerical constant. Compared with simulated PCD-CT noise data with and without pileup corrections, the mean percent errors of the theoretical models are 0.53% (95% limits of agreement: [-8.45%, 9.50%]) and 0.44% (95% limits of agreement: [-8.17%, 9.04%]) respectively. Compared with experimental PCD-CT noise data, the mean percent error of the theoretical model is 0.04% (95% limits of agreement: [-1.30%, 1.38%]).

## CONCLUSION

s In the non-paralyzable counting mode of PCD-CTs, such as those in the existing clinical systems, the dependence of CT image noise on mAs is modified as follows: 1) without pile-up correction,  $s^2$  is altered by a multiplicative factor, and 2) with pulse pile-up correction,  $s^2$  is altered by an additive factor.

## CLINICAL RELEVANCE/APPLICATION

The novel noise variance-mAs relationships allow one to predict the CT noise variance at different mA levels accurately and provide the needed scientific foundation for clinical protocol optimization of PCD-CT.

## M5A-SPPH-7 Optimization and Feasibility of Breast Cancer Imaging with Photon-counting CT: A Phantom Study

### Participants

Richard Ahn, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

### PURPOSE

Contrast enhancement is the most sensitive feature of breast malignancy and forms the basis of cancer detection with either breast MRI or contrast-enhanced mammography. Compared to conventional energy-integrating CT, photon-counting CT (PCCT) offers improved spatial resolution, superior iodine conspicuity, and material differentiation capabilities. The purpose of this study was to evaluate the performance of PCCT for breast cancer imaging using an anthropomorphic phantom.

### METHODS AND MATERIALS

A spectral mammography phantom (Sun Nuclear) containing 2 sets of simulated lesions with 0.2, 0.5, 1.0, 2.0 mg/mL iodine was placed on top of an anthropomorphic chest phantom (QRM GmbH, 35 cm X 25 cm). Additional iodine rods (Sun Nuclear) with matched iodine concentrations were placed in the center of the chest phantom. The phantom was imaged on a clinical PCCT scanner (NAEOTOM Alpha, Siemens) using a chest protocol in both standard (144X0.4 mm) and ultra-high resolution (UHR: 120X0.2 mm) modes. Images were reconstructed using a quantitative kernel (Qr40) with quantum iterative reconstruction algorithm at a strength of 3 (QIR-3) with two field of views (FOVs): a large FOV of 420 mm X 420 mm containing both mammography phantom and chest phantom, and a small FOV of 224 mm X 224 mm only containing the mammography phantom. All reconstructions were performed with two matrix sizes of 512 and 1024. Threshold-low images (T3D), virtual monoenergetic images (VMIs) at 50, 60, and 70 keV, and iodine maps were generated. Circular ROI were drawn within the breast lesions and iodine rods. Normalized root mean square error (nRMSE) in CT number was calculated for ROI in the lesions compared to the reference iodine rods. Contrast to noise ratio (CNR) and linearity were measured. Circularity of the breast lesions was measured using a local threshold model and MATLAB.



## RESULTS

CNR was highest at 50 keV for all iodine concentrations and ranged from 8.2 at 2 mg/mL iodine to 1.0 at 0.2 mg/mL. The nRMSE was similar for all configurations and ranged from 0.5-0.7 HU. CT number linearity was excellent for all configurations ( $R^2=1$ ). Circularity of lesions was highest for the large FOV with standard or UHR mode and a 512 matrix size.

## CONCLUSION

s Standard collimation with large FOV and 512 matrix size was optimal for nRMSE, CNR, and circularity measurements. 50 keV VMIs were optimal for breast lesion evaluation due to increased lesion conspicuity and shape fidelity. These phantom results will guide further protocol development to optimize clinical breast imaging on PCCT.

## CLINICAL RELEVANCE/APPLICATION

PCCT has the potential for improved breast cancer locoregional staging due to greater iodine conspicuity in spectrally derived images and improved resolution compared to prior generations of CT scanners.

## M5A-SPPH-8 Simultaneous Iodine and Bismuth Dual-contrast CT Enterography with Clinical Photon-counting CT: A Feasibility Phantom Study using Low-concentration Samples

### Participants

Afrouz Ataei, PhD, Naples, FL (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate whether low-concentration iodine and bismuth samples can be visually differentiated and accurately quantified using clinical dual-source photon-counting CT (PCCT).

## METHODS AND MATERIALS

Four bismuth-barium solutions (0.7, 1.3, 2.5, and 5.1 mg Bi/mL) were prepared by mixing over-the-counter Pepto-Bismol (10.1 mg Bi/mL, Procter Gamble) with a low-density barium sulfate oral suspension (0.1% w/v, NeuLumEX™, E-Z-EM Canada Inc). The 0.7 mg Bi/mL solution corresponded to 30 mL (one dose) of Pepto-Bismol mixed with 500 mL (one bottle) of oral barium suspension. The four bismuth solutions and three iodine rods (1, 2, and 5 mg I/mL, Sun Nuclear) were inserted into three different multi-energy CT phantoms (20, 33, and 40-cm lateral dimension, Sun Nuclear). Each phantom-sample configuration was scanned on a PCCT system (NAEOTOM Alpha, Siemens) at three kV settings (120 kV: [20, 65 keV]; 140 kV: [20, 70 keV]; Sn140 kV: [20, 80 keV], Sn = 0.6-mm tin filter). Radiation dose levels (CTDIvol) were 3, 8, and 12 mGy, respectively. A custom 3-material decomposition method (iodine/bismuth/water) was used to generate iodine, bismuth, and water maps from the PCCT low- and high-energy bin reconstructed images (Qr44, QIR-3, 2.0/1.0 mm slice thickness/increment) for each data acquisition. Volume conservation was incorporated as a physical constraint for the 3-material decomposition method. The mean bismuth and iodine mass concentrations (mg/mL  $\pm$  standard deviation) were measured by placing a circular ROI of  $\sim 2.2$ -cm<sup>2</sup> on each sample. Linear regression analysis was performed to evaluate the correlation between nominal and measured mg/mL values on the iodine and bismuth maps. The root-mean-square-error (RMSE) for iodine, bismuth, and their combination was computed to assess overall quantification accuracy and was compared across all three kV settings and three phantom sizes.

## RESULTS

All iodine and bismuth samples, including those with the lowest concentrations, were clearly differentiated at all kV settings and phantom sizes. The 140 kV setting (with no additional filter) was found to be the optimal kV across the small, medium, and large phantom sizes, with combined RMSE values of 1.45, 1.91, and 2.00 mg/mL, respectively. Both the iodine and bismuth measured mg/mL values were highly linearly correlated with the nominal mg/mL values ( $R^2>0.99$ ) at the optimal 140 kV setting.

## CONCLUSION

s Iodine and bismuth dual-contrast imaging at low-concentration levels can be accurately performed on a clinical PCCT at routine clinical radiation dose levels.

## CLINICAL RELEVANCE/APPLICATION

Simultaneous imaging and visual segmentation of iodine-enhanced small bowel wall and bismuth containing small bowel lumen may allow for improved diagnosis in CT enterography imaging.

## M5A-SPPH-9 Single-energy Low-kV in Energy-integrating Detector CT Versus Low-keV Virtual Monoenergetic Images in Photon-counting Detector CT for Iodine Imaging

### Participants

Hiroki Kawashima, PhD, RT, Kanazawa, Japan (*Presenter*) Kyoto kagaku, Research collaboration

## PURPOSE

To investigate the performance for iodine imaging of low-keV virtual monoenergetic images (VMIs) in photon-counting detector CT (PCD-CT), compared with those of single energy low-kV images in energy-integrating detector CT (EID-CT), using a Fourier-based assessment.

## METHODS AND MATERIALS

A water-bath phantom with a diameter of 300 mm, which contains two rod-shaped phantoms made of diluted iodine (2 and 12 mg/ml), was scanned using a clinical PCD-CT (SIEMENS, NAEOTOM Alpha) and an EID-CT (SIEMENS, SOMATOM Force) at 15 mGy. A low-kV image was obtained with a tube voltage of 90 kV in EID-CT (EID 90 kV). VMIs at 40 and 64 keV were reconstructed from the scan data obtained with a tube voltage of 120 kV in PCD-CT. The energy level of 40 keV is the lowest keV setting, and 64 keV was the energy level that exhibited the closest CT number to that of EID 90 kV. In PCD-CT, a low energy threshold image with a tube voltage of 90 kV (PCD 90 kV) was also obtained for comparison. The iodine contrast (C) and the task transfer function (TTF) were measured with the rod images; the noise power spectrum (NPS) was measured in the water-only region. The system performance function, including the iodine contrast factor (SPFc2) was defined as  $[C^2 \cdot TTF^2(f)]/NPS(f)$ .

## RESULTS

The SPFc2 of VMI 40 keV was notably higher than that of EID 90 kV as the spatial frequency increased. The ratios of SPFc2 of VMI 40 keV to EID 90 kV were approximately 1.50 and 2.81 at 0.1 and 0.5 mm<sup>-1</sup>, respectively. The SPFc2 of VMI 64 keV was comparable to or somewhat lower than that of EID 90 kV. In comparison between the same tube voltage, PCD images were superior to EID images, which was consistent with the theoretical advantages of PCD. The ratios of SPFc2 of PCD 90 kV to EID 90 kV were approximately 1.28 and 1.58 at 0.1 and 0.5 mm<sup>-1</sup>, respectively.

#### **CONCLUSION**

s VMI 40 keV in PCD-CT had a higher performance for iodine imaging than the low tube voltage techniques (EID 90 kV and PCD 90 kV), whereas the performance degradation might be unavoidable when the iodine contrast equalized (EID 90 kV versus VMI 64 keV).

#### **CLINICAL RELEVANCE/APPLICATION**

This study quantitatively demonstrates that PCD-CT has the potential to provide better image quality than EID-CT in a contrast-enhanced CT scan.

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## Abstract Archives of the RSNA, 2023

M5A-SPRO

### Radiation Oncology Monday Poster Discussions I

#### Sub-Events

#### M5A-SPRO-1CT Patterns and Clinical Outcomes of Radiation Pneumonitis in Non-small Cell Lung Cancer Patients

#### PURPOSE

To investigate the CT findings of radiation pneumonitis (RP) in non-small cell lung cancer (NSCLC) patients and their relationship with clinical outcomes.

#### METHODS AND MATERIALS

We assessed CT findings and clinical information of 58 patients with NSCLC who underwent radiotherapy as curative treatment. The CT findings were evaluated for the presence and distribution of the parenchymal abnormalities, which were then classified into three patterns: localized pneumonia (LP), cryptogenic organizing pneumonia (COP), and acute interstitial pneumonia (AIP). Radiation technique, gross tumor volume (GTV), radiation (RT) dose, mean lung dose (MLD), and volume of normal lung receiving 20Gy (V20) were also evaluated. Clinical outcome was evaluated on the basis of Common Terminology Criteria for Adverse Events (CTCAE) grade, corticosteroid treatment, admission, and death. Correlations between imaging findings and clinical outcomes were analyzed.

#### RESULTS

Of the total 58 patients, 47 developed RP. Out of 47 patients, 26(55.3%) had symptoms of grade 2 or less, and 2(4.7%) had symptoms of grade 3 or more. RP related death occurred in 11(19.0%) patients. All patients received radiotherapy using the intensity-modulated radiation therapy technique. The mean, median, and range of the radiation-related factors in all patients are as follows; GTV (134.0, 111.5, 6.9-466.4), RT dose (6010.3, 6600.0, 200.0-7000.0), MLD (1437.6, 1465.9, 364.8-2267.5), V20 (24.9, 25.2, 1.1-443.8). The CT findings of RP were ground-glass opacity with reticulation in 46 (97.8%), consolidation in 40 (85.1%), air-bronchogram in 41 (87.2%), traction bronchiectasis in 28 (59.6%), pleural effusion in 19 (40.4%) and necrosis or cavity formation in 4 (8.5%). The most common pattern of RP was LP (n=20, 42.6%) followed by AIP (n=19, 40.4%) and COP (n=8, 17.0%). GTV, MLD and V20 were significantly different between LP, COP, and AIP patterns ( $p<0.05$ ). The presence of underlying pulmonary fibrosis, AIP pattern and CT extent were higher in the patients with higher CTCAE grade than in patients with lower CTCAE grade ( $p<0.05$ ). RT dose, AIP pattern, CT extent were significantly associated with RP-related death ( $p<0.05$ ).

#### CONCLUSION

s RP could be classified into LP, COP and AIP in NSCLC patients and GTV, MLD and V20 were significantly different in each pattern. The underlying pulmonary fibrosis, AIP pattern and high extent of RP were associated with poor clinical outcomes.

#### CLINICAL RELEVANCE/APPLICATION

In NSCLC patients undergoing radiotherapy, RP pattern could be classified into LP, COP and AIP, and GTV, MLD and V20 were significantly different in each pattern. Patients with underlying pulmonary fibrosis or those planned for high RT should be closely followed up to improve patient outcomes.

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## Abstract Archives of the RSNA, 2023

M5A-SPVA

### Vascular Imaging Monday Poster Discussions I

#### Sub-Events

#### **M5A-SPVA-1 High Resolution MRI Based Radiomics for the Assessment of NIILs after CEA of Patients with Carotid Plaques**

##### **PURPOSE**

This study aimed to assess the occurrence of fresh ipsilateral ischemic lesions in patients with carotid plaques following carotid endarterectomy.

##### **METHODS AND MATERIALS**

We retrospectively collected 115 patients from Renmin Hospital of Wuhan University, all of whom presented with at least 70% carotid luminal stenosis as determined by ultrasound angiography or computerized tomography. Prior to undergoing carotid endarterectomy (CEA), all patients underwent high resolution magnetic resonance imaging (hrMRI) using a 3.0T MR750 system (GE Healthcare, USA) equipped with an 8-channel carotid coil (GE Healthcare, USA). The hrMRI protocol consisted of 2D T1WI FSE, PDWI FSE, and 2D T2WI FSE. The hrMRI images were manually segmented using ITK-SNAP, and radiomics features were extracted using pyradiomics. The occurrence of NIILs was confirmed by DWI following CEA. The patients were randomly divided into training and test groups, and a non-invasive model was built using Lasso and multi-variable logistic regression analysis to predict NIILs.

##### **RESULTS**

Of the total number of patients, 75 were found to have new ipsilateral ischemic lesions (NIILs) following CEA, while 40 did not exhibit any such lesions. Initially, a total of 1175 radiomic features were extracted from T1-weighted images, which were subsequently reduced in dimension to construct a radiomics model to predict NIILs. The area under the curve (AUC) for the radiomics model was 0.864 (95% confidence interval (CI), 0.781-0.947) in the training group and 0.795 (95% CI, 0.646-0.945) in the testing group (Fig. a and b). A clinical model was also built using variables such as sex, age, LDL, HDL, LHR, hypertension, diabetes, IPH (predicted by MRI), and LRNC (predicted by MRI). IPH (OR=42.01) and LRNC (OR=5.11) were incorporated into the clinical model, and a multivariable logistic regression model was constructed by combining radscore, LRNC, and IPH. The model was visualized using a nomogram (Fig. c). The AUC for the combined model was 0.949 (95% CI, 0.906-0.991) in the training group and 0.837 (95% CI, 0.692-0.982) in the testing group. Calibration showed good fitting of the nomogram in both the training and testing groups (Fig. d and e). The nomogram demonstrated the best clinical benefit in the training and testing groups (Fig. f and g).

##### **CONCLUSION**

The findings of this study illustrate that the occurrence of NIILs in patients with carotid plaques after CEA can be predicted non-invasively using a radiomics model and a combined model.

##### **CLINICAL RELEVANCE/APPLICATION**

Compared to traditional hrMRI, the combined model, which incorporates radiomics and clinical variables, not only predicts the occurrence of NIILs but also enables personalized treatment for patients.

#### **M5A-SPVA-2 Imaging of the Aorta in Dual-Source Photon-Counting CT: Impact of Low Energy Virtual Monoenergetic Imaging on Image Quality, Vascular Contrast and Diagnostic Assessability**

##### Participants

Christian Booz, MD, Frankfurt am Main, Germany (*Presenter*) Speaker, Siemens AG

##### **PURPOSE**

Preliminary dual-energy CT studies have shown that low energy virtual monoenergetic imaging (VMI)+ reconstructions can provide superior image quality compared to standard 120 kV CTA series. The purpose of this study is to evaluate the impact of low energy VMI+ reconstructions on quantitative and qualitative image quality, vascular contrast and diagnostic assessability of the aorta in patients undergoing photon-counting CTA examinations.

##### **METHODS AND MATERIALS**

A total of 125 patients (69 male) who had undergone dual-source photon-counting CTA scans of the aorta were retrospectively analyzed in this study. Standard 120 kV CT images and low keV VMI+ series from 40 to 100 keV with an interval of 15 keV were reconstructed. Quantitative analyses included evaluation of vascular CT numbers, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). CT number measurements were performed in the ascending aorta, the aortic arch, the thoracic and infrarenal descending aorta. Qualitative analyses were performed by three board-certified radiologists independently using five-point scales to evaluate image quality, vascular contrast and diagnostic assessability of the aorta.

##### **RESULTS**

Mean attenuation, CNR and SNR values were highest in 40 keV VMI+ reconstructions (HU, 1312 ± 13; CNR, 32 ± 8; SNR, 34 ± 10) followed by 55 keV VMI+ reconstructions (HU, 731 ± 9; CNR, 24 ± 6; SNR, 27 ± 9); all three mean values at these keV levels were

significantly higher compared with the remaining VMI+ series and standard 120 kV CT series (HU,  $160 \pm 8$ ; CNR,  $18 \pm 5$ ; SNR,  $26 \pm 6$ ) ( $p < .0001$ ). The qualitative analysis showed highest rating scores for 55 keV VMI+ reconstructions followed by 40 keV and 70 keV VMI+ series with a significant difference compared to standard 120 kV CT images series regarding image quality, vascular contrast and diagnostic assessability of the aorta ( $p < .0001$ ).

#### **CONCLUSION**

Low keV VMI+ reconstructions at a level of 40-55 keV significantly improve image quality, vascular contrast and the diagnostic assessability of the aorta compared with standard CT series in photon-counting CTA.

#### **CLINICAL RELEVANCE/APPLICATION**

In patients undergoing photon-counting CTA scans of the aorta, low keV VMI+ reconstructions at a level of 40-55 keV should be routinely reconstructed to improve image quality and the diagnostic assessability and to potentially reduce radiation dose and the needed amount of intravenous contrast material in scan protocols in order to protect kidney function.

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## Abstract Archives of the RSNA, 2023

M5B-SPBR

### Breast Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPBR-2 Is Presence of Enhancement on Contrast-enhanced Mammography (CEM) A Diagnostic Biomarker to Determine the Presence of Malignancy in Suspicious Mammographic Calcifications**

Participants  
Leyla Zeitouni, MD, Riyadh, Saudi Arabia (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Aim: Calcifications are a regular finding on screening mammograms and considered a potential early sign of breast cancer. However, the majority of calcifications are benign and stereotactic biopsies could be avoided in a large proportion of cases. We assessed whether the presence of a corresponding enhancement on CEM is diagnostic for the presence of malignancy in mammographic calcifications.

#### **METHODS AND MATERIALS**

Eligible for this retrospective, IRB-approved, single-center study were women recalled due to mammographic BI-RADS 4 calcifications and who received CEM as part of their diagnostic workup between 2020 and 2022 at our institution. CEM protocols followed international recommendations. Two blinded breast fellows (R1, R2) assessed the presence of enhancement corresponding to calcifications on CEM. Reference standard for findings was stereotactic 9G vacuum-assisted breast biopsy or follow up of at least 24 months. For lesions of uncertain malignant potential, surgery was considered. Proportions were compared using the chi-square test.

#### **RESULTS**

69 women with mammographic calcifications (mean age, range) were included. 17 out of 69 cases (25%) were malignant (13 cases were intraductal and 4 were invasive ductal cancers). In the malignant cases, an enhancement was found in 12/17 (71%, R1) and 15/17 (88%, R2) cases. Seven of 52 (13%) [PB1] benign lesions presented enhancement detected by both readers. The higher enhancement rate in malignant compared to benign calcifications was statistically significant ( $p < 0.001$ , respectively). Non enhancing malignant cases were DCIS cases of varying grades. Enhancing benign cases were intraductal papilloma, adenosis and fibrocystic changes with intraductal epithelial proliferation.

#### **CONCLUSION**

Enhancement in CEM is diagnostic for the presence of malignancy in mammographic calcifications. The risk of false negative in the absence of enhancement ranged between 1-3 of 10 malignant cases. Benign calcifications can sometimes show enhancement on CEM.

#### **CLINICAL RELEVANCE/APPLICATION**

CEM identifies pathological enhancement associated with malignant calcification in the majority of the cases, but a significant amount of DCIS may not show enhancement.

#### **M5B-SPBR-3 Performance of Node-RADS Scoring System for a Standardized Assessment of Regional Lymph Nodes in Breast Cancer Patients**

Participants  
Roberto Maroncelli, MD, Guidonia (RM), Italy (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Current cross-sectional imaging modalities exhibit heterogeneous diagnostic performances for the detection of a lymph node invasion (LNI) in breast cancer (BC) patients. Recently, the Node-RADS score was introduced to provide a standardized comprehensive evaluation of LNI, based on a five-item Likert scale accounting for both size and configuration criteria. In the current study, we hypothesized that the Node-RADS score accurately predicts the LNI and tested its diagnostic performance. The secondary objective focuses on assessing the applicability and feasibility of the score among readers.

#### **METHODS AND MATERIALS**

We retrospectively reviewed BC patients treated with mastectomy or QUART and lymph node dissection, from January 2020 to January 2023. Patients receiving preoperative systemic chemotherapy were excluded, therefore we included only patients undergoing lymphadenectomy after sentinel node positivity, who refused neoadjuvant therapy (NT) by self-determination and patients who had contraindications to NT. A logistic regression analysis tested the correlation between the Node-RADS score and LNI both at patient and lymph-node level. The ROC curves and the AUC depicted the overall diagnostic performance. In addition, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for different cut-off values ( $>1$ ,  $>2$ ,  $>3$ ,  $>4$ ).

#### **RESULTS**

Overall, data from 100 patients were collected. Node- RADS assigned on CT scans and CE-MRI images, was found to independently predict the LNI after an adjusted multivariable regression analysis, both at the patient (OR 3.36, 95%CI 1.68-9.40,  $p=0.004$ ) and lymph node (OR 5.18, 95%CI 3.39-8.64,  $p<0.001$ ) levels. Node-RADS exhibited an AUC of 0.85 and 0.90 at the patient and lymph node levels, respectively. With increasing Node-RADS cut-off values, the specificity and PPV increased from 50.0 to 95.3% and from 50.3 to 80.0%, respectively. Conversely, the sensitivity and NPV decreased from 100 to 40.0% and from 100 to 75.3%, respectively. Excellent inter-reader agreement was found in the classification of LN according to the NODE-RADS MRI score.

## CONCLUSION

The current study lays the foundation for the introduction of Node-RADS for the regional lymph-node evaluation in BC patients. Interestingly, the Node-RADS score exhibited a moderate-to-high overall accuracy for the identification of LNI, with the possibility of setting different cut-off values according to specific scenarios.

## CLINICAL RELEVANCE/APPLICATION

Node-RADS has only been validated in prostate and bladder cancer, showing promising results. No previous reports have investigated his role in BC; we want to address this gap. Higher Node-RADS score could be associated with an increased risk of LNI.

## M5B-SPBR-4 Multi-national Validation of A Clinical Image-based AI-risk Model for Individualizing Breast Cancer Screening

### PURPOSE

To investigate the predictive performance of a clinically used image-derived AI-based breast cancer risk model in multiple European screening populations.

### METHODS AND MATERIALS

Four European mammographic screening populations in three countries screened between 2009-2020 for women aged 45-69 was used to perform a nested case-control study. In total, 739 women with incident breast cancers were included together with 7,812 controls matched to cases on year of study-entry. Mammographic features (density, microcalcifications, masses, left-right breast asymmetries of these features) for risk assessment were extracted using AI from full-field digital mammograms. Breast cancer occurrence was assessed after two years of follow-up. Absolute risks of breast cancer were predicted using the risk model from negative mammograms at study-entry. Adjusted Area Under the receiver operating characteristic Curves (aAUC) estimated discriminatory performance and, adjusted risk-ratios estimated the stratification performance of women at high/general risk per the clinical guidelines.

### RESULTS

The overall aAUC of the AI risk model was 0.72 (95%CI 0.70-0.75), range 0.71 (95%CI 0.67-0.75) to 0.74 (95%CI 0.69-0.78) for breast cancers developed in four screening populations. In the 4.6% of women classified at high risk using the NICE guidelines thresholds, cancers were more likely diagnosed after 2 years follow-up, risk-ratio (RR) 6.7 (95%CI 5.6-8.0), compared with the 71% of women classified at general risk by the model. Similar risk-ratios were observed across tertiles of mammographic density. In the high-risk group, 22% of the 2-year future cancers were diagnosed, and 29% of stage 2 and higher cancers,  $p<0.01$ .

## CONCLUSION

The AI risk model showed generalizable discriminatory performances across European populations and, captured ~30% of clinically relevant stage 2 and higher breast cancers in ~5% of high-risk women who were sent home with a negative mammogram. Similar results were seen in fatty and dense breasts. An image-derived AI model is feasible for personalized screening to improve screening outcomes.

## CLINICAL RELEVANCE/APPLICATION

Image-derived AI risk models for breast cancer have shown high discriminatory performances compared with clinical risk models based on family history and lifestyle factors. However, little is known about their generalizability across different screening settings and clinical feasibility.

## M5B-SPBR-5 The Tyrer-Cuzick Risk Model: Is it Effective for All Races?

### PURPOSE

To assess the predictive value of the Tyrer-Cuzick Version 8 (TC8) Risk Model in a diverse group of patients in an urban medical center. TC scores predict a patient's 10 year and lifetime risk of developing breast cancer.

### METHODS AND MATERIALS

A retrospective review of breast imaging patients from multiple clinics within a university hospital system from January 1, 2018-November 1, 2022 was conducted. We collected each patient's most recent lifetime TC8 score, self-reported race and ethnicity (Hispanic/Latina), and cancer status. We excluded patients who did not report race or did not have TC8 scores. The final cohort contained 74,181 total patients. Analyses to explore differences in TC8 scores by race and ethnicity were first conducted on the entire sample, and then on 700 patients with breast cancer. Patients not reporting race or ethnicity were excluded from those analyses. Data was analyzed using two sample unpaired, unequal variance t-tests and  $p<0.05$ .

### RESULTS

In the total sample ( $n=74,181$ ), mean TC8 risk scores were statistically different between all racial groups and the White reference group. The largest differences were between White and Black (2.4 points,  $p<0.0001$ , CI 2.23-2.57) and White and "Other" (2.9 points,  $p<0.0001$ , CI 2.74-3.06). For the breast cancer cohort ( $n=700$ ), Black patients had a mean TC8 score 2.4 points lower than White patients ( $p=0.02$ , CI 0.32-4.4). There was no statistical difference between mean TC8 scores for White vs. Asian or White vs. "Other". Ethnicity did not have a significant impact on TC8 score relationships. For the total group there was a statistical difference between Non-Hispanic (NH)-White and NH-Black (2.7 points,  $p<0.0001$ , CI 2.53-2.87), consistent with the previous race findings. The Hispanic (H)-Black score was statistically higher than H-White score, however the difference was less than one point. For the breast cancer cohort NH-White had a mean TC8 score 2.2 points greater than NH-Black ( $p=0.045$ , CI 0.41-4.3), and there was no statistical difference between H-White and H-Black scores.

## CONCLUSION

s TC8 scores in Black patients were consistently lower suggesting that TC8 may underestimate Black patients' lifetime breast cancer risk.

## CLINICAL RELEVANCE/APPLICATION

The TC8 score is an important tool for predicting breast cancer risk. Currently insurance companies only reimburse MRI screening for patients with TC lifetime risk score >20. It is possible that some of our patients' risk was underestimated. Specifically, in our cohort 468 Black patients had scores between 17-19 narrowly missing the cutoff. If the 2.2-2.7 point difference was considered those patients may have been advised to pursue MRI screening. We hope our results encourage future research on the appropriateness of TC8 cutoffs for Black patients.

## M5B-SPBR-6 Development and Application of a Feature Based Explainable AI Method (XAI) for Trustworthy Breast Cancer Risk Prediction using the Mirai Model

### PURPOSE

The Mirai model (Yala, MIT) is a publicly available deep learning (DL) model predicting 1- to 5-year breast cancer risk from digital mammograms. The model prediction relies on features extracted by an encoder that utilizes a convolutional neural network. We hypothesized that understanding the individual features in terms of their receptive fields offers a route to explainable AI (XAI). The purpose of this study was to retrieve and quantify the features captured in the final layer of the encoder for the short-term risk prediction.

### METHODS AND MATERIALS

The Mirai encoder detects 512 receptive fields in each mammogram and computes one DL feature value for each field. In this study, features were indexed by the order of encoder outputs. Corresponding receptive fields were matched with the annotations in the individual images. Two datasets were used to evaluate localization and discriminatory power of these features for the present lesions: the Cyprus dataset (100 mammograms) with micro-calcification cases and BI-RADS scores, and the CSAW-S dataset (338 mammograms), which is a case collection of malignant masses. Precision scores between the receptive fields and the locations of masses and calcifications were used to identify lesion-specific features with the highest scores. The area under the receiver operating characteristic curve (AUC) for the discriminative power of BI-RADS scores was calculated for the feature values with the highest calcification precision. Other annotated regions studied included the nipple, skin, thick vessels, and axillary lymph nodes.

### RESULTS

A precision score of 0.81 was found between feature (F) 145 and calcification clusters, while the annotated mass regions had a precision score of 0.80 for F 397. The discriminative ability of the calcification-related feature values for the BI-RADS scores resulted in AUCs of 0.91 and 0.88 for distinguishing suspicious (BI-RADS 4,5) cases from normal (BI-RADS 1,2) and benign (BI-RADS 2) cases, respectively. Other potentially relevant regions had the following feature indexes and precision scores: nipple (F 5, 0.31), skin (F 114, 0.60), thick vessels (F 171, 0.21), and axillary lymph nodes (F 166, 0.26).

## CONCLUSION

s This study provides evidence that risk prediction features in the Mirai model focus on early detection of breast lesions in mammograms, despite not being trained with pixel-wise annotation. The findings provide essential insight into the functionality of short-term breast cancer risk prediction models.

## CLINICAL RELEVANCE/APPLICATION

It is possible to extract the main features at the core of a short-term breast cancer risk prediction AI algorithm. Increasing AI trustworthiness should encourage the inclusion of this AI algorithm in the clinical decision-making process.

## M5B-SPBR-7 Mammographic Density Changes after Neoadjuvant Chemotherapy in Triple-negative Breast Cancer: Association with Treatment and Survival Outcome

### PURPOSE

To evaluate the associations between mammographic density changes after neoadjuvant chemotherapy (NAC) and treatment and survival outcomes in triple-negative breast cancer (TNBC).

### METHODS AND MATERIALS

This single center retrospective study evaluated a total of 306 women with TNBC who underwent NAC followed by surgery between 2010 and 2019. Baseline density and density changes after completion of NAC were evaluated both qualitatively and quantitatively. Qualitative breast density (a-d) was evaluated based on the BI-RADS. Quantitative breast density (%) was evaluated using an open-source software (LIBRA) and mediolateral oblique/craniocaudal mammograms of the contralateral breast. Multivariable logistic regression analysis was used to evaluate the association between breast density and pathologic complete response (pCR) according to the menopausal status. Cox proportional hazard regression analysis was used to evaluate the association between breast density and development of (a) contralateral breast cancer and (b) locoregional recurrence and/or distant metastasis.

### RESULTS

Among 306 women, 93 (30%) achieved pCR, and 71 (23%) had contralateral breast density reduction 10% or greater after NAC. For only premenopausal women (n=177), the contralateral breast density reduction 10% or greater was independently associated with pCR (odds ratio, 2.5; P value=.03). On a median follow-up of 54 months, 10 (3%) women developed contralateral breast cancers, and 68 (22%) women developed locoregional recurrences and/or distant metastases. The contralateral breast density reduction 10% or greater was not associated with the development of contralateral breast cancer (Hazard ratio [HR], 1.3; P value =.78) nor the development of locoregional recurrence and/or distant metastasis (HR, 1.1; P value =.79). Family history of breast cancer was independently associated with the development of contralateral breast cancer (HR, 6.2; P value =.005). The presence of lymphovascular invasion (HR, 2.1; P value=.02), invasive cancer 2cm or greater (HR, 3.9; P value <.001), and lymph node metastasis on the surgical specimen (HR, 2.7; P value =.004) were independently associated with the development of locoregional recurrence and/or distant metastasis. Baseline density was not associated with the treatment and survival outcomes.

## CONCLUSION



s For premenopausal women, contralateral breast density reduction 10% or greater after NAC was independently associated with pCR, although it was not translated to improved outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

The contralateral breast density reduction 10% or greater after NAC was associated with achievement of pCR in premenopausal women, however, the density reduction was not translated to improved outcomes.

### **M5B-SPBR-8 Volumetric Parenchymal Pattern Radiomic Analysis in Digital Breast Tomosynthesis for Breast Cancer Risk Estimation**

#### **PURPOSE**

We evaluate the performance of volumetric parenchymal pattern analysis from digital breast tomosynthesis (DBT) versus digital mammography (DM), accounting for conventional risk factors and breast density for breast cancer risk estimation. The rationale is that 3D parenchymal texture analysis with radiomic features may provide information beyond 2D breast density.

#### **METHODS AND MATERIALS**

We performed a retrospective case-control study in women with concurrent DM and DBT screening (Selenia Dimensions, Hologic Inc.) at our institution from 3/2011-12/2014. Cases were diagnosed with breast cancer within 1-year of screening; controls were confirmed negative or benign at 1-year follow-up, matched on race (Black, White, other/unknown) and age (5-year bins). After exclusions for imaging artifacts, craniocaudal (CC) and mediolateral oblique (MLO) views for 187 cases and 737 controls, in six image formats were assessed: 1) raw DM; 2) processed DM; 3) raw DBT central projection; 4) processed DBT central projection; 5) DBT central reconstructed slice; and 6) 3D DBT reconstructed stack. For cases, we analyzed the breast contralateral to cancer diagnosis and the same breast in matched controls. We extracted 487 radiomic features using a lattice-based approach with the Cancer Imaging Phenomics Toolkit, averaging features for each breast over CC and MLO views. We examined 3 lattice window sizes (6.4, 12.8, and 25.6 mm) and 23 image resampling resolutions (0.075 - 2mm). We performed principal component analysis on the resulting 487 features for each combination of window size and resampled resolution and built conditional logistic regression models to assess the association of the first seven principal components with breast cancer, with models adjusting for age, BMI, and Breast Imaging Reporting and Data System (BI-RADS) density. We calculated the model C-statistic at all window sizes and resolutions (i.e., total of 2304 experimental conditions).

#### **RESULTS**

Radiomic features from 3D reconstructed DBT scans had on average higher C-statistics across all experimental conditions. A model using only age, BMI, and BI-RADS density had a C-statistic of 0.61. Models using radiomic features plus age, BMI, and BI-RADS density had mean C-statistic of 0.68 (IQR 0.68, 0.69) for reconstructed DBT scans; for all other image types, the mean C-statistic ranged from 0.64 to 0.66.

#### **CONCLUSION**

s 3D volumetric breast parenchymal patterns from DBT may improve breast cancer risk estimation beyond markers derived from 2D DM and conventional breast density metrics alone.

#### **CLINICAL RELEVANCE/APPLICATION**

Fully-automated, 3D parenchymal pattern radiomic analysis is feasible in DBT, and our preliminary evaluation suggests that it may improve breast cancer risk assessment beyond 2D DM measures.

### **M5B-SPBR-9 Mammographic Density Assessment: Radiologists, Artificial Intelligence-based Computer-assisted Diagnosis, and Automated Volumetric Measurement**

Participants

Su Min Cho, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate breast density assessment using BI-RADS (Breast Imaging Reporting and Data System) breast density category across readers with different levels of experience, artificial intelligence-based computer-assisted diagnosis (AI-CAD) and automated volumetric density measurement program (Volpara®).

#### **METHODS AND MATERIALS**

A total of 1,015 screening mammography were retrospectively reviewed (56 ± 10 years). Density assessment according to BI-RADS category was performed by four readers with two different levels of experience; experts and general radiologists. Agreements between visually assessed BI-RADS category, AI-CAD (Lunit INSIGHT MMG) and Volpara® were evaluated using weighted kappa statistics.

#### **RESULTS**

Inter-reader agreement between expert and general radiologist was substantial ( $k = 0.65$ ) with a matched rate of 72.8%. The agreement was substantial between the expert or general radiologist and Volpara® ( $k = 0.64 - 0.67$ ) with a matched rate of 72.0% but moderate between expert or general radiologist and AI-CAD ( $k = 0.45 - 0.58$ ) with a matched rate of 56.7 - 67.0%. The agreement between Volpara® and AI-CAD was moderate ( $k = 0.53$ ) with a matched rate of 60.8%.

#### **CONCLUSION**

s Density assessment by AI-CAD showed moderate agreement with those of radiologists, while Volpara® showed substantial agreement with radiologists.

#### **CLINICAL RELEVANCE/APPLICATION**

Volpara® presented better agreement with radiologists than AI-CAD with a better matched rate.

## Abstract Archives of the RSNA, 2023

M5B-SPCA

### Cardiac Imaging Monday Poster Discussions II

#### Sub-Events

#### M5B-SPCA-1 Can Cardiac CT Alternate Cardiac MRI for Myocardial ECV Quantification in Cardiac Amyloidosis?

##### Participants

Hidetaka Hayashi, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Myocardial extracellular volume (ECV) on CT, a possible alternative to cardiac MRI, has significant practical clinical advantages. However, the consistency between ECVs quantified via CT and MRI in cardiac amyloidosis (CA) has not been fully investigated. Therefore, the current study investigated the application of CT-ECV in CA with MRI-ECV as the reference standard.

##### METHODS AND MATERIALS

We retrospectively evaluated 31 patients with CA who underwent cardiac CT and MRI. Pearson correlation analysis was performed to investigate correlations between CT-ECV and MRI-ECV at each segment. In addition, correlations between ECV and clinical parameters were assessed.

##### RESULTS

There were no significant differences in terms of the mean global ECVs between CT and MRI ( $51.3\% \pm 10.2\%$  vs  $50.0\% \pm 10.5\%$ ). CT-ECV was strongly correlated with MRI-ECV at the septal ( $r=0.88$ ), lateral ( $r=0.80$ ), and global ( $r=0.87$ ) segments. A strong correlation was also observed at the anterior ( $r=0.77$ ) and inferior ( $r=0.79$ ) segments. In both CT and MRI, the ECV had a weak to strong correlation with high-sensitivity cardiac troponin T level, moderate correlation with global longitudinal strain, and inverse correlation with left ventricular ejection fraction. The septal ECV and global ECV had a slightly higher correlation with the clinical parameters.

##### CONCLUSION

Cardiac CT can quantify myocardial ECV and yields results comparable with those obtained using MRI in patients with CA. A significant correlation was also observed between CT-ECV and clinical parameters.

##### CLINICAL RELEVANCE/APPLICATION

CT-ECV can be used as an imaging biomarker and alternative to MRI-ECV in patients with CA.

#### M5B-SPCA-2 Clinical Utility of 'Faded Edge Sign' on the Post-contrast T1 Mapping for Diagnosis of Cardiac Amyloidosis

##### Participants

Eun Ju Chun, MD, PhD, Seongnam-si, Gyeonggi-do, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the frequency and potential clinical utility of the 'faded edge sign' on the post-contrast T1 mapping to identify cardiac amyloidosis (CA) among patients with left ventricular hypertrophy (LVH).

##### METHODS AND MATERIALS

We retrospectively enrolled 222 patients with pathologically confirmed LVH (56 CA, 116 hypertrophic cardiomyopathies [HCM], 50 hypertensive heart disease[HHD]) who underwent cardiac MR. The 'faded edge sign' was defined as the boundary between the myocardium and the left ventricular (LV) cavity was unclear and the LV myocardium/cavity signal intensity ratio was between 0.8 and 1.2 on the post-contrast T1 mapping. In diagnosing CA among patients with LVH, we compared the diagnostic accuracy of additional faded edge sign compared to the characteristic late gadolinium enhancement (LGE) pattern (global subendocardial enhancement), native T1 values, and extracellular volume (ECV).

##### RESULTS

The faded edge sign was noted in 40 of 56 patients with CA (71.4%) and 5 of 116 patients with HCM (4.3%) and none of the HHD patients. Mean native T1 value and ECV was the highest in CA, followed by HCM and HHD ( $1442 \pm 81$  msec vs.  $1320 \pm 58$  msec vs.  $1230 \pm 32$  msec for native T1 value;  $41 \pm 7\%$  vs.  $29 \pm 7\%$  vs.  $23 \pm 2\%$  for ECV;  $p < 0.05$ ). The sensitivity and specificity of faded edge sign for CA was 71.4% and 97.0%, respectively. For the diagnosis of CA, the diagnostic accuracy of the added faded edge sign for the combination of LGE, ECV, and native T1 (AUC 0.931) was higher than that of the combination of LGE+ECV+native T1 (AUC 0.920) or LGE alone (AUC 0.866).

##### CONCLUSION

The 'faded edge sign' on the post-contrast T1 mapping is a simple observation method that is helpful in increasing the ability for

diagnosis of CA.

#### CLINICAL RELEVANCE/APPLICATION

In addition to LGE, native T1 and ECV, post-contrast T1 mapping was also helpful for the diagnosis of CA.

### M5B-SPCA-3 Prediction of Early Death from Anthracycline-induced Cardiotoxicity using CMR Parameters: An Animal Study

Participants

Nayoung Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

We aimed to compare cardiac magnetic resonance (CMR) parameters between the early death and survival groups of anthracycline-induced cardiotoxicity rat models, and to identify factors that could predict early death.

#### METHODS AND MATERIALS

We generated 38 Sprague-Dawley cardiotoxicity rat models by injecting doxorubicin (1.0 mg/kg) twice weekly for 12 weeks. We conducted CMR biweekly until 12 weeks, including pre-contrast and post-contrast T1 mapping using a saturation recovery Look-Locker sequence and T2 mapping using a spin echo sequence using a 9.4 T Bruker scanner. Biventricular function, left ventricle (LV) mass, native T1, T2, and ECV (extracellular volume fraction) were measured. The CMR parameters and blood troponin I (TnI) were compared between the early death and survival groups using linear mixed regression analysis.

#### RESULTS

Among 38 rats, seven were excluded because of poor image quality or because they died before CMR at two weeks. Seventeen rats died before 12 weeks, so they were assigned to the early death group: 2 rats surviving for 2 weeks, 2 rats for 4 weeks, 3 rats for 6 weeks, and 3 rats for 8 weeks. Fourteen rats survived until the maximum treating period of 12 weeks and were assigned to the survival group. During the treatment, native T1, T2, and ECV increased, and LVEF (left ventricular ejection fraction) decreased in each group. When the two groups were compared, native T1 showed a significant difference at 8th week, with the early death group showing a higher value than survival group (1364.1ms  $\pm$  75.6 vs. 1235.7ms  $\pm$  60.2,  $P = .01$ ). The ECV exhibited significant differences from 6th week (21.7%  $\pm$  2.4 in early death group vs. 18.5%  $\pm$  2.2 in the survival group,  $P = .046$ ) through 8th week (24.5%  $\pm$  2.5 vs. 20.5%  $\pm$  2.3 in survival group;  $P = .022$ ), with the early death group exhibiting significantly higher values. T2 and LVEF showed no significant differences between groups throughout all weeks. TnI levels significantly differed at 8th week (7.5 $\mu$ g/mL vs. 0.02 $\mu$ g/mL,  $P = .002$ ). In the survival group, ECV increased significantly between 4 and 6 weeks ( $P = .044$ ), and LVEF decreased significantly between 8 and 12 weeks ( $P = .001$ ). However, native T1 did not show significant week-by-week differences within the survival group. Within the early death group, LVEF decreased significantly between 2 and 4 weeks ( $P = .04$ ), and native T1 and ECV showed a significant increase between 4 and 6 weeks earlier than the survival group ( $P = .007$  and  $.001$ , respectively).

#### CONCLUSION

We have observed the differences in changing patterns in native T1, ECV, T2, and LVEF over the treatment time between the survival and early death groups.

#### CLINICAL RELEVANCE/APPLICATION

Quantitative measurement of native T1 and ECV with CMR may facilitate the prediction of anthracycline-induced cardiotoxicity.

### M5B-SPCA-5 Diagnostic Yield of Cardiac MRI in Patients with Clinically Suspected Myocarditis after COVID-19 Vaccination

#### PURPOSE

To evaluate cardiac MRI findings in patients with suspected myocarditis following COVID-19 vaccination in relation to clinical presentation and timing of imaging.

#### METHODS AND MATERIALS

Consecutive adult patients who underwent clinically indicated cardiac MRI for evaluation of suspected myocarditis following mRNA-based COVID-19 vaccination at a single center between June 2021-December 2022 were retrospectively evaluated using the revised 2018 Lake Louise Criteria (LLC). Patients were classified into groups based on presence/absence of T1 criteria (late gadolinium enhancement and/or high T1 map values) and T2 criteria (regional T2-hyperintensity and/or high T2 map values). Clinical information including vaccine history and presenting symptoms were extracted from the health record.

#### RESULTS

89 patients were included, 64% male with mean age 34 $\pm$ 13 years; all had received at least one dose of a COVID vaccine (mRNA-1273 in 38% and BNT162b2 in 62%) with median interval between the last dose vaccine dose and cardiac symptoms (chest pain, palpitations or shortness of breath) of 5 days (IQR 1-9). The median interval between last COVID-19 vaccine dose and MRI was 92 days (IQR 31-157). At least one T1 or T2 abnormality on MRI consistent with myocarditis was identified in 42 patients (47%); 25 (28%) met both T1 and T2 criteria on MRI (definite myocarditis); 17 (19%) met T1 criteria but not T2 criteria (possible myocarditis); and 47 (53%) did not meet either T1 or T2 criteria (no myocarditis). None of the patients met T2 criteria but not T1 criteria. The three groups did not differ in age ( $p=0.10$ ), sex ( $p=0.29$ ), vaccine type ( $p=0.24$ ), or left ventricular ejection fraction ( $p=0.53$ ). The interval between last vaccine dose and cardiac MRI was significantly shorter in patients who met both T1 and T2 criteria (28 days, IQR 8-69) compared to those meeting T1 criteria only (110 days, IQR 66-255,  $p<0.001$ ) and those not meeting either T1 or T2 criteria (120 days, IQR 80-252,  $p<0.001$ ). However, the interval between last vaccine dose and MRI did not differ between those meeting T1 criteria only and those not meeting either T1 or T2 criteria ( $p>0.99$ ).

#### CONCLUSION

In a cohort of patients with symptoms concerning for acute myocarditis following COVID-19 vaccination who underwent clinically indicated cardiac MRI, 28% met criteria for definite myocarditis (T1 and T2 abnormal) and 19% met criteria for possible myocarditis (only T1 abnormal). Identification of myocardial edema on cardiac MRI was highly dependent on the timing of imaging after vaccination.

## CLINICAL RELEVANCE/APPLICATION

Cardiac MRI should be performed as soon as possible after symptom onset in patients with suspected acute myocarditis as the likelihood of detecting myocardial edema drops substantially after a few weeks.

## M5B-SPCA-6 Diagnostic Accuracy of Cardiac MRI Versus Nuclear Imaging for Cardiac Amyloidosis: A Systematic Review and Meta-Analysis

Participants

James Roberts, MD,MSc, Vancouver, BC (*Presenter*) Nothing to Disclose

## PURPOSE

There is no consensus regarding the relative diagnostic performance of cardiac MRI and nuclear imaging in cardiac amyloidosis. The purpose of this study was to perform a systematic review and meta-analysis to compare the diagnostic accuracy of cardiac MRI and cardiac nuclear imaging for cardiac amyloidosis.

## METHODS AND MATERIALS

MEDLINE, Ovid Epub, CENTRAL, EMBASE, EMCARE, and Scopus were searched from inception until September 2022. Inclusion criteria included studies that evaluated the diagnostic accuracy of cardiac MRI or cardiac nuclear imaging studies for cardiac amyloidosis in adults. Abstracts and case reports were excluded. Data were independently extracted by two investigators. Summary accuracy metrics were obtained using bivariate random-effects meta-analysis. Meta-regression was used to assess the impact of different covariates. Risk of bias was assessed using the Quality Assessment Tool for Diagnostic Accuracy Studies-2 tool. The study protocol was registered a priori in the International Prospective Register of Systematic Reviews (PROSPERO CRD42022352480).

## RESULTS

Our search strategy yielded 7322 studies. We screened 2785 studies after excluding duplicates and reviewed the full text of 272 studies. Thirty-nine studies were included (3836 patients, 2331 with cardiac amyloid); 18 studies evaluated cardiac MRI (1553 patients, 968 with cardiac amyloidosis) and 24 evaluated cardiac nuclear imaging (2372 patients, 1401 with cardiac amyloidosis). Only 3 evaluated both MRI and nuclear imaging in the same patients. Overall, combined  $^{99m}\text{Tc}$ -scintigraphy bone tracers (including  $^{99m}\text{Tc}$ -DPD,  $^{99m}\text{Tc}$ -PYP, and  $^{99m}\text{Tc}$ -HMDP) had higher specificity than LGE on cardiac MRI (96% vs. 85%,  $p < 0.001$ ), with no difference in sensitivity (95% vs. 91%,  $p = 0.88$ ). When the analysis was restricted to studies with endomyocardial biopsy as the reference standard, there was no difference in specificity between modalities (96% vs. 90%,  $p = 0.56$ ). Covariate analysis demonstrated that sensitivity and specificity for nuclear imaging did not differ significantly by quantitative vs. qualitative evaluation. Thirty-seven studies were at risk of bias. There were insufficient studies to pool data on the diagnostic performance of T1 mapping, ECV and PET.

## CONCLUSION

Nuclear imaging  $^{99m}\text{Tc}$  bone tracers have higher specificity for cardiac amyloidosis than LGE on cardiac MRI, but similar sensitivity. Limitations including risk of bias and few studies with direct comparison necessitate additional study.

## CLINICAL RELEVANCE/APPLICATION

Nuclear imaging  $^{99m}\text{Tc}$  bone tracers are only specific for transthyretin amyloid while MRI detects all types including light chain. Additional studies are needed to determine the relative diagnostic performance in amyloid subtypes.

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## Abstract Archives of the RSNA, 2023

M5B-SPCH

### Chest Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPCH-1 Modeling Risk of Progression to Lung-RADS 4 from a Benign Lung Cancer Screening CT using Imaging and Clinical Data**

##### Participants

Gunvant Chaudhari, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

For patients with benign low-dose chest CTs (LDCTs) with Lung-RADS score = 2, the screening interval is set to one year. To optimize screening intervals, we aim to build a deep learning system to predict risk progression in two years from full volume CT and clinical features.

##### METHODS AND MATERIALS

In this retrospective modeling study, full-volume LDCTs and baseline surveys from the National Lung Screening Trial (NLST) dataset (n=26,722 patients) were accessed to use as training data. A proprietary AI-based system augmented with solid-component segmentations was used to calculate the Lung-RADS 1.1 score for each scan. Baseline LDCTs with Lung-RADS = 2 were selected. For the clinical and demographics data, backward stepwise selection based on p-values was conducted to select the four most predictive features. Then, statistical and deep learning models were trained to predict progression to Lung-RADS 4 in two years. Models were compared based on the AUC-ROC score. To test generalizability, institutional lung screening LDCT and clinical data was collected (n=583 patients). A subset of baseline screenings with corresponding studies in 2 years +/- 4 months were selected. The NLST trained models were evaluated on institutional data.

##### RESULTS

From the NLST dataset, a subset 15,942 baseline LDCT screenings were found to have Lung-RADS = 2, with 1,637 progressing to Lung-RADS 4 (10.3%). Benign Lung-RADS score institutional studies totaled 50 studies, with 7 (14%) progressing to Lung-RADS 4 in two years. After backward stepwise selection on all input features, those that were significantly associated with Lung-RADS 4 progression were average nodule size, largest nodule size, number of nodules, and emphysema diagnosis. Models for predicting progression to Lung-RADS 4 based only on clinical and imaging features had a maximal AUC of 0.667 and 0.750 on the NLST and UCSF holdout data, respectively. Convolutional neural network-based models trained on full volume CTs had an AUC of 0.627 and 0.555 on the NLST and UCSF data, and combined models with clinical features and full-volume CT had a maximal AUC of 0.704 and 0.724.

##### CONCLUSION

This study shows that AI based models can predict future progression to Lung-RADS 4 from clinical features and full-volume CT scan. The full-volume CT based models have limited generalizability to institutional data, likely due to differences in acquisition dates and qualities.

##### CLINICAL RELEVANCE/APPLICATION

Modeling clinical and baseline imaging features that contribute to Lung-RADS 4 progression from a benign baseline LDCT may allow for optimized screening frequency for low-risk patients.

#### **M5B-SPCH-2 AI Assisted Lung Cancer Screening: A Retrospective Multinational Study in the US and Japan**

##### Participants

Atilla Kiraly, PhD, Mountain View, CA (*Presenter*) Former Employee, Siemens AG; Employee, Alphabet Inc

##### PURPOSE

To evaluate the impact of an Artificial Intelligence (AI) assistant for lung cancer screening (LCS) on multinational clinical workflows.

##### METHODS AND MATERIALS

We iteratively developed an AI interface via six user experience reader studies. We then conducted two retrospective randomized multi-reader multi-case studies where 627 (141 cancer positive) cases were each read twice (once with and once without AI assistance) by experienced thoracic radiologists (6 US-based or 6 Japan-based), resulting in a total of 7,524 interpretations. Positive cases were defined as imaging studies within two years before a lung cancer diagnosis. Cases without any subsequent cancer diagnosis for at least two years after the imaging study were defined as negative, and enriched for a spectrum of diverse nodules. The studies measured the readers' level of suspicion (LoS, on a 0-100 scale), country-specific screening system scoring categories, and management recommendations. Evaluation metrics included the area under the receiver operating characteristic curve (AUC) for LoS and sensitivity and specificity for recall recommendations.

##### RESULTS

With AI assistance, the institutional AUC increased 0.20% (70% to 70.2%) (p < 0.001) for the US study and 0.20% (60% to 60.2%)

with AI assistance, the radiologists' AUC increased 2.3% (70% to 72%, p=0.022) for the US study and 2.3% (93% to 96%, p=0.179) for the Japan study. Scoring system specificity for positive screens increased 5.5% (57% to 63%, p<0.001) for the US and 6.7% (23% to 30%, p<0.001) for the Japan study. No significant drop in sensitivity occurred. Specificity increased 5.8% (p<0.001) and 5.4% (p<0.001) in the US-based and Japan-based studies for any actionable recommendations, respectively.

## CONCLUSION

s We demonstrate a rigorous randomized study of an AI assistant into real-world-like clinical workflows. Our PACS-integrated AI interface demonstrated improved LCS specificity in both US and Japan-based reader studies, meriting further study in additional international screening environments.

## CLINICAL RELEVANCE/APPLICATION

We developed a general lung cancer screening AI interface and retrospectively tested it with experienced radiologists on more difficult screening cases under both US-based and Japan-based reading protocols.

### M5B-SPCH-3 Multi-modality Artificial Intelligence Model Based on CT and Haematoxylin and Erosin (HE)-stained Slides Images to Predict PD-L1 Status in NSCLC

## PURPOSE

Programmed death-ligand 1(PD-L1)expression status is the most important biomarker that has been approved in immunotherapy for lung cancer. However, the gold standard of PD-L1 evaluation based on manual assessment by pathologists, which is influenced by the professional knowledge and experience. The aim of this study is to develop and validate a multi-modality artificial intelligence (AI) model to predict the PD-L1 expression status of lung cancer based on eligible computed tomography (CT) images and haematoxylin and eosin (HE)-stained slides.

## METHODS AND MATERIALS

We retrospectively analyzed a PD-L1 expression dataset from 227 consecutive eligible lung cancer patients, including chest CT images and whole slide images (WSI) of haematoxylin and eosin(HE)-stained specimen during the corresponding period. The multi-modality AI model integrates CT radiomics and pathological deep learning based on multi-instance learning. The datasets were divided into training, validation, and testing group in a 4:1:1 ratio (n=151,38,38, respectively). Finally, a separate lung cancer immunotherapy cohort (n=47) was used to evaluate the prognostic value of the multi-modality fusion model.

## RESULTS

The proportion of PD-L1 positive in patients was 55.1%(n=125). The area under the curve (AUC) of fusion model to predict PD-L1 expression status was 0.922, 0.745 and 0.685 in the training, validation and testing group, respectively. The fusion model shows significantly better performance than the single-modality model (AUC=0.781, 0.695, 0.518 for CT radiomics model and AUC=0.93, 0.697, 0.594 for pathological deep learning model in training, validation, testing group, respectively; all p<0.05). Additionally, for the survival cohort, the progression-free survival (PFS) was significantly longer in PD-L1 positive patients predicted by the multi-modality AI model than the negative patients (mean PFS 280 days vs 185 days, p<0.05).

## CONCLUSION

s The multi-modality AI model based on CT and haematoxylin and eosin (HE)-stained slides images can predict the PD-L1 expression status of lung cancer effectively.

## CLINICAL RELEVANCE/APPLICATION

Our AI model can assess the PD-L1 expression status of NSCLC automatically, which can avoid subjective bias in manual evaluation and provide more precise assistance for clinical treatment decisions.

### M5B-SPCH-4 Comparison of Radiologists' Reports and AI for Detecting Ectasia and Aneurysms of the Thoracic Aorta on LDCT for Lung Cancer Screening: A Multicenter, Multivendor Study of 430 Patients

## Participants

Lina Karout, MD, Boston, MA (*Presenter*) Nothing to Disclose

## PURPOSE

We assessed the frequency of inconsistent reporting of thoracic aorta ectasia and aneurysm on unenhanced, low-dose CT for lung cancer screening (LCS) and compared the performance of radiologists' reports with an AI algorithm (AIRC, AI Rad Companion, Siemens) for measuring aortic dimensions.

## METHODS AND MATERIALS

Our IRB-approved and HIPAA-compliant retrospective study included 420 patients (mean age 66±7 years; females: males 157:263) who underwent LCS-LDCT on 10 single and dual-source MDCT scanners at one of the three community and quaternary hospitals. The patients were identified from a commercial radiology report data mining software (mPower, Nuance) with the keywords of "thoracic aorta" "aneurysm" and "ectasia." The negative LDCT-LCS represented consecutive cases over the same period and scanners. We recorded the presence of thoracic aneurysm or ectasia as well as when available the thoracic aorta dimensions from the radiology reports. Separately, thin-section DICOM images (1-1.25mm) were deidentified, exported, and processed with the AIRC to obtain maximum diameter of ascending and descending thoracic aorta. To establish the standard of reference (SOR), a thoracic radiologist independently measured short-axis dimensions of the ascending and descending thoracic aorta. Descriptive statistics and receiver operating characteristics area under the curve were estimated (ROC AUC) with 95% confidence interval.

## RESULTS

Per SOR, 25/420 patients (5.9%) had ascending thoracic aorta aneurysm (≥ 45 mm), 78/420 (18.6%) had aortic ectasia (≥40 <45 mm), and 18/420 (4.3%) had descending thoracic aorta aneurysm (≥35 mm). The respective AUC, sensitivity and specificity of radiology reports were 0.86 (95% CI: 0.75-0.97), 72% and 100% for ascending thoracic aorta aneurysm; 0.66 (95% CI: 0.59-0.74), 35% and 97% for aortic ectasia; and 0.50 (95% CI: 0.36-0.63), 0% and 99% for descending thoracic aneurysm. The corresponding ROC AUCs, sensitivity and specificity for the AI algorithm were 0.99 (95% CI 0.99-1.00), 100% and 99% for ascending thoracic aorta aneurysm; 0.86 (95% CI: 0.81-.091), 82% and 90% for aortic ectasia; and 0.93 (95% CI: 0.87-0.99), 94% and 91% for descending thoracic aneurysm. There was no difference in the performance of AI across different patients'

gender, age groups, as well as scanners and hospitals ( $p>0.1$ ).

## CONCLUSION

s The generalizable AI can improve radiology reporting of ascending and descending thoracic aorta aneurysms on LDCT for lung cancer screening.

## CLINICAL RELEVANCE/APPLICATION

Radiologists' reports on thoracic aorta ectasia and aneurysm are inconsistent on LDCT; AI can help improve and automate aortic dimensions and help improve reporting accuracy.

## M5B-SPCH-5 Clinical and Imaging Factors Associated with Growth of Subsolid Pulmonary Nodule on CT

Participants

Masha Bondarenko, San Francisco, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Growth of part solid nodules are predictive of the nodule becoming cancerous along the adenocarcinoma spectrum. We aimed to investigate the clinical significant features that are predictive for growth of part-solid nodules (PSNs) identified by a commercial algorithm and verified by natural language processing (NLP) of radiology reports.

## METHODS AND MATERIALS

A retrospective study was conducted on patients who underwent chest CT scans between 2015 and 2019 at a single institution. CT scan radiology reports were extracted from mPower to select for patients with subsolid nodules. A commercial algorithm was used on the final dataset to identify nodules with a solid component larger than 6 mm and a non-solid component. The radiology reports were processed using NLP to verify whether the PSNs were growing or not. Clinical and imaging features including age, gender, nodule location, shape, length, margin, lobulation, and pleural traction were evaluated for their predictive value for PSN growth using univariate and multivariate logistic regression analyses.

## RESULTS

A total of 901 PSNs were included in this study, with 148 of those being growing PSNs. On univariate analysis, lobulated margin ( $p<0.01$ ), age ( $p<0.01$ ), and middle lobe ( $p=0.6$ ) were significantly associated with growing PSNs at a significance level of 0.1. On multivariate analysis, middle lobe (Odds Ratio (OR) [95% Confidence Interval (CI)]=0.27 [0.12-0.99],  $p=0.02$ ), age (OR=1.10 [0.98-1.02],  $p<0.001$ ), and lobulated margin (OR=1.53 [2.77-6.50],  $p<0.001$ ) were significant predictors of growing PSNs.

## CONCLUSION

s In patients with PSNs identified by a commercial algorithm and verified by NLP of radiology reports, higher age, no presence in the right middle lobes, and lobulated margin were independent predictors for fast-growing PSNs. These findings could help identify patients who are at high risk of PSN growth and guide appropriate management decisions. The combination of a commercial algorithm and NLP of radiology reports may be a useful tool for identifying PSNs and monitoring their growth.

## CLINICAL RELEVANCE/APPLICATION

By identifying adenocarcinoma spectrum nodules at risk for further growth, clinicians can more precisely identify, monitor, and potentially treat high-risk nodules.

## M5B-SPCH-6 Satellite Modularity as Indicator of Benign Versus Malignant Etiology of Lung Nodules in a Histoplasmosis-endemic Region

## PURPOSE

To evaluate if presence of satellite nodularity can distinguish between benign and malignant lung nodules in histoplasmosis-endemic regions. Additionally, to evaluate any other factors that can add confidence in distinguishing between benign and malignant etiology.

## METHODS AND MATERIALS

An IRB-approved retrospective review was performed of all CT and CTA chest exams from November 2015-2020 containing the phrase "satellite nodule" in the report. Short- and long-axis measurements of both the primary lung nodule and largest satellite nodule were recorded. Data was collected on patient demographics, history of cancer, margins, cavitation, calcification, change in size over time, presence of adjacent bronchovascular bundle nodularity, and tissue diagnosis. Predictive capabilities for demographic and clinical variables were analyzed with logistic regression models to produce odds ratio and area under ROC curve values.

## RESULTS

346 chest CTs were identified, of which 111 were excluded based on primary nodule size outside the range of 0.6 to 3.0 cm ( $n = 46$ ), undecided final pathology ( $n=12$ ), or insufficient follow-up for diagnosis ( $n=53$ ). Benign primary nodule pathology was found in 201 of 235 patients (86%). Bronchovascular bundle nodularity demonstrated the highest odds of benignity (OR 18.4,  $p.01$ ) followed by presence of calcification (OR 10.6,  $pt;.01$ ) as single variables. Spiculated margins (OR 0.06,  $pt;.01$ ) and history of metastatic disease or newly diagnosed cancer (OR 0.15,  $pt;.01$ ) were most associated with malignant diagnosis. Bronchovascular nodularity alone demonstrated poor ability to predict the odds of benignity (AUC 0.66,  $pt;.01$ ) but was increased when combined with margin characteristics (AUC 0.82,  $pt;.01$ ) or patient age (AUC 0.80,  $pt;.01$ ). The multivariable combination of margin characteristics and age demonstrated the largest ability to predict the odds of benignity (AUC 0.84,  $pt;.01$ ).

## CONCLUSION

s Approximately 86% of lung nodules with satellite nodules had benign pathology. Spiculated margins followed by clinical history of either new cancer or known metastatic disease were most associated with malignant diagnosis. Bronchovascular bundle nodularity was most associated with benign etiology, more strongly than presence of calcification. Bronchovascular nodularity combined with smooth primary nodule margins or younger patient age, was an excellent predictor of benign diagnosis, possibly permitting less rigorous follow up imaging or further work up.

## CLINICAL RELEVANCE/APPLICATION

The ability to predict benign etiology of a lung nodule based on the presence of satellite nodularity and bronchovascular bundle nodularity in histoplasmosis endemic regions can direct future follow up recommendations.

## M5B-SPCH-7 Deep Learning Automated Characterization of Lesion Volume and Growth Rates of Histologic Subtypes of Primary Lung Adenocarcinoma

Participants  
Hafsa Babar, MD, San Diego, CA (*Presenter*) Nothing to Disclose

### PURPOSE

CT is the dominant modality for the detection and staging of lung cancer. Nodule size and growth rate are two most predictive imaging biomarkers of likelihood of malignancy. Lesion volume and volume doubling time have been proposed as the most reliable metrics of size and growth rate. Deep learning algorithms allow measurement of both through a combination of automated detection, segmentation, and lesion-level co-registration. We applied these algorithms to measure the growth rates of various histologic subtypes of primary lung adenocarcinoma to determine whether VDTs have discriminative potential in non-invasive nodule assessment.

### METHODS AND MATERIALS

We conducted a retrospective review of biopsy proven lung adenocarcinomas from 2018 to 2021. Clinical and histopathologic data were abstracted from medical records of patients with at least two chest CTs prior to treatment, excluding patients with pulmonary masses (>3 cm) and those with fewer than 14 days between CTs. Images were automatically analyzed using a commercially available DL software (Lung AI, MICA v29.8.2; Arterys, CA) capable of detecting, segmenting, and co-registering pulmonary nodules across multiple CTs. VDTs were calculated for each lesion and stratified across histologic subtypes.

### RESULTS

71 patients with 81 biopsy proven pulmonary adenocarcinoma nodules, satisfied the inclusion criteria [mean age, 68 years (42 females and 29 males)]. Among these, 70 nodules were sub-categorized based on the dominant histopathological pattern: 12 lepidic, 22 acinar, 14 papillary, and 22 solid/micropapillary. Mean nodule size was 16.5 mm (1640 mm<sup>3</sup>) for all lesions. Acinar subtype nodules were the largest on presenting CT (19.3 mm, 2118 mm<sup>3</sup>), followed by lepidic (16.6 mm, 1668 mm<sup>3</sup>), solid/micropapillary (15.7 mm, 1024mm<sup>3</sup>), and papillary (14.4 mm, 1710 mm<sup>3</sup>). The mean overall VDT was 485 days (range: 47 to >1000 days) for all lung adenocarcinomas. Initial VDT was shortest for solid/micropapillary subtypes (210 days), followed by acinar (425 days), papillary (482 days), and lepidic (492 days), (ANOVA: Single Factor, p<0.03). Interestingly, 22/81 (27%) nodules showed volume contraction of at least 50 mm<sup>3</sup> on sequential scans. Amongst these, lepidic (9/22) and acinar (6/22) were the predominant subtypes.

### CONCLUSION

s VDTs varied substantially between histologic subtypes of lung adenocarcinoma. A subset of lesions (mainly lepidic and acinar) contracted between some exams.

## CLINICAL RELEVANCE/APPLICATION

Deep learning algorithms are able to characterize differential growth rates between histological subtypes of primary lung adenocarcinoma, mirroring prior studies with manual linear measurements. They have a potential to non-invasively characterize pulmonary nodules on serial chest CTs.

## M5B-SPCH-8 Prediction of High-grade Histological Subtypes of Stage IA Lung Adenocarcinoma Based on CT Radiomics Model

Participants  
Guojin Zhang, MD, PhD, Sichuan, China (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to investigate the value of CT radiomics model in predicting high-grade histological subtypes of stage IA lung adenocarcinoma (LADC).

### METHODS AND MATERIALS

A total of 236 patients with stage IA LADC were included, who were divided into low-grade group (n=112) and high-grade group (n=124) according to the pathological grading system, and randomly divided into training and validation sets according to a ratio of 7:3. Minimum redundancy maximum relevance and least absolute shrinkage and selection operator regression were used to screen the radiomics features. Multivariate logistic regression was used to screen independent predictors from baseline clinical data and traditional CT signs. The radiomics, clinical, and clinical-radiomics models were established, respectively. Receiver operating characteristic curve curves were used to evaluate the model's predictive performance, decision curve analysis (DCA) to evaluate the model's clinical net benefit, and calibration curves to evaluate the model's goodness of fit.

### RESULTS

Eight radiomics features were significantly correlated with the high-grade group of LADC. The clinical-radiomics model combined with baseline clinical data, traditional CT signs, and radiomic features had the best discriminant ability in predicting high-grade histological subtypes of LADC. In the training and validation sets, the areas under the curve were 0.950 (95% CI, 0.919-0.982) and 0.950 (95% CI, 0.910-0.973), respectively. DCA analysis showed that the clinical-radiomics model had better net clinical benefit.

### CONCLUSION

s Clinical characteristics combined with radiomics features were helpful for preoperative noninvasive prediction of high-grade LADC in stage IA.

## CLINICAL RELEVANCE/APPLICATION

The clinical-radiomics model incorporating the radiomics features and clinical risk factors showed excellent performance in predicting high-grade histological subtypes of stage IA LADC, which may help in clinical decision-making for personalized treatment of lung



adenocarcinoma patients.

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## Abstract Archives of the RSNA, 2023

M5B-SPER

### Emergency Radiology Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPER-1 The Diagnostic Ability of Postmortem CT for the Cause of Natural Death from Out-of-hospital Cardiac Arrest**

##### Participants

Yu Nakaki, Hiroshima, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Postmortem CT (PMCT) can help to identify the cause of death. Its diagnostic ability has been reported, however, its findings depend on the corpse and the methodology applied. PMCT cannot diagnose cardiac disease, e.g. myocardial infarction, lethal arrhythmia, and pulmonary thromboembolism, consequently its ability to determine the cause of natural death, especially from out-of-hospital cardiac arrest (OHCA) may be lower than expected. To reveal the current issue of PMCT, we investigated the ability of PMCT to identify the cause of natural death from OHCA.

##### METHODS AND MATERIALS

Between January 2018 and December 2022, we enrolled 306 patients with OHCA who were taken to our hospital and performed non-contrast PMCT. Excluded were 94 patients with unnatural death and 6 patients younger than 18 years. Included were 206 patients (121 males, 85 females; median age 79 years, range 18-104 years) who died a natural death from OHCA. The median interval from death to PMCT was 2.5 hours (range 1 - 28 hours). All were scanned on a 16-row multi-detector CT scanner. The scan parameters were 120 kVp and automated exposure control; the preset noise was 11 Hounsfield units. All images were consensually interpreted by two board-certified radiologists and categorized into diagnostic (PMCT alone was sufficient to determine the cause of death), suggestive (the cause of death was suggested but additional information was needed), and non-diagnostic (the cause of death could not be determined on PMCT images).

##### RESULTS

Of 206 PMCT images, 46 (22.3%) were diagnostic, 16 (7.8%) were suggestive, and 144 (69.9%) were non-diagnostic. Aortic dissection (n=15), aortic aneurysm rupture (n=12), cardiac rupture (n=8), subarachnoid hemorrhage (n=6), cerebral hemorrhage (n=4) and visceral aneurysm rupture (n=1) were diagnosable. In the suggestive group were malignant tumors (n=7), gastrointestinal bleeding/occlusion/perforation (n=7), and 2 other causes.

##### CONCLUSION

As PMCT images were diagnostic or suggestive in only 62 of 206 cases (30.1%) of natural death from OHCA, the diagnostic ability of PMCT must be improved.

##### CLINICAL RELEVANCE/APPLICATION

The low diagnostic ability of PMCT for identifying the cause of natural death from OHCA may require the development of contrast-enhanced- and dual-energy PMCT.

#### **M5B-SPER-2 T1 and T2 Signal Appearance of Intracranial Hemorrhage in Post-mortem Magnetic Resonance Imaging**

##### PURPOSE

In forensic medicine, age estimation of intracranial hemorrhage can be crucial. Post-mortem MRI (PMMR) can be used as an alternative to autopsy in certain case constellations. In clinical MRI, age estimation of intracranial hemorrhage is based on differing signal behaviors of T1 and T2 over time as hemoglobin passes through different forms before red cell lysis and breakdown into ferritin and hemosiderin. In PMMR, post-mortem phenomena such as putrefaction, autolysis, temperature decrease, and biochemical degradation processes can influence MR signal appearance, particularly at longer post-mortem intervals. So far, it is unknown, if intracranial hemorrhage of different ages appears with the same T1 and T2 signals known in the living and if post-mortem interval alters signal appearance. Therefore, the purpose of this study was to investigate the PMMR T1 and T2 signal behavior of intracranial hemorrhage of different age stages at different post-mortem intervals and to compare it to the known signal behavior in the living.

##### METHODS AND MATERIALS

N=200 forensic cases (110 male, 90 female, mean age 54 years) with intracranial hemorrhage due to traumatic injury or natural causes were investigated. Post-mortem interval (time from death to imaging) ranged from 12 h to 21 days. 3 Tesla T1 and T2 weighted unenhanced PMMR of the head was conducted before the autopsy. Age estimation of intracranial hemorrhage (hyperacute: < 12 h, acute: 12-48 h, early subacute: 2-7 d, late subacute: 8 d - 1 month, and chronic: > 1 month) was performed based on autopsy and histology findings as well as medical records. Two observers blinded for autopsy results and medical records evaluated the T1 and T2 signal appearance of intracranial hemorrhage in PMMR. Hemorrhage signal appearances were assigned to the corresponding age estimations. PMMR results were compared to known clinical MRI signal behavior in living patients.

## **RESULTS**

The following PMMR T1 and T2 signal appearances were observed for different age stages of intracranial hemorrhage: hyperacute: T1 isointense, T2 hyperintense; acute: T1 isointense to hypointense, T2 hypointense; early subacute: T1 hyperintense, T2 hypointense; late subacute: T1 hyperintense, T2 hyperintense; chronic: T1 hypointense, T2 hypointense. The observed signal appearance did not differ from the known signal appearance of living persons. Longer post-mortem intervals of up to 21 days did not significantly alter signal appearance.

## **CONCLUSION**

s In a post-mortem interval of up to 3 weeks, PMMR T1 and T2 signal behavior of intracranial hemorrhage of different age stages are the same as in the living.

## **CLINICAL RELEVANCE/APPLICATION**

T1 and T2 post-mortem MRI of the head can be used as an alternative to autopsy for age estimation of intracranial hemorrhage.

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## Abstract Archives of the RSNA, 2023

M5B-SPGI

### Gastrointestinal Imaging Monday Poster Discussions II

#### Sub-Events

#### M5B-SPGI-1 Gd-EOB-DTPA MRI-based Severity Classification and Prognosis in Fontan-Associated Liver Disease

##### Participants

Atsushi Yamamoto, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Fontan procedure for congenital single ventricle improves prognosis in childhood but is not a curative treatment. The prognosis in the long-term period after Fontan procedure is extremely poor compared to other congenital heart diseases. This is due to liver injury caused by elevated central venous pressure, which is a feature of the Fontan circulation, and is now attracting attention as Fontan-associated liver disease (FALD). FALD frequently progresses to cirrhosis and develops hepatocellular carcinoma (HCC) despite the young age of the patient. Gd-EOB-DTPA MRI is an effective tool for detecting HCC, but the features of FALD have not been studied. We propose an Gd-EOB-DTPA MRI-based severity classification of FALD and its association with prognosis, including the development of HCC.

##### METHODS AND MATERIALS

Data of Gd-EOB-DTPA MRI for 44 patients (mean age, 25 years; female, 22) after Fontan procedure between January 2010 to April 2023 was retrospectively analyzed. The hepatocyte phase image at 15 minutes after Gd-EOB-DTPA injection was scored semi-qualitatively using the following four points. 1) The extent of low-signal reticular shadows extending from the subhepatic capsule with "reverse lobulation": 0, 1 or 2 points. 2) Liver marginal irregularity: 0 or 1 point. 3) Decreased liver-spleen signal ratio: 0 or 1 point. 4) Atrophy of entire liver: 0 or 1 point. Based on the summed scores, patients were classified as Grade-1 (0 or 1 point), 2 (2 points), 3 (3 points), or 4 (4 points or higher). The endpoint was a composite outcome consisting of HCC, intractable ascites, and heart failure (HF) hospitalization. The event-free survival was analyzed by Kaplan-Meier and log-rank test.

##### RESULTS

There were 11 Grade-1 patients, 18 Grade-2 patients, 8 Grade-3 patients, 7 Grade-4 patients. During a mean follow-up period of 60 months, the composite outcome occurred in 11 patients (6 cases of HCC, 3 cases of intractable ascites, and 2 cases of HF hospitalization). Nine of the 11 patients (82%) were in Grade-3 and 4 groups. Kaplan-Meier analysis revealed that patients with Grade-3 and 4 had significantly poorer prognosis than those with Grade-1 and 2 ( $p < 0.0001$ ).

##### CONCLUSION

s Gd-EOB-DTPA MRI could classify the severity and predict prognosis of patients with FALD.

##### CLINICAL RELEVANCE/APPLICATION

This method is not as invasive as liver biopsy and has no sampling errors. It is suitable for surveillance of FALD in young subjects.

#### M5B-SPGI-2 Staging Liver Fibrosis in Volunteers and Patients with Nonalcoholic Fatty Liver Disease with Intrinsic Shear Strain Measurement by 4D Phase-contrast MRI

##### PURPOSE

To investigate the diagnostic performance of intrinsic shear strain induced by pressure pulse and cardiac motion, measured by phase-contrast MRI, for the detection and staging of liver fibrosis in volunteers and patients with nonalcoholic fatty liver disease using liver biopsy as the reference standard.

##### METHODS AND MATERIALS

This prospective cross-sectional study was institutional review board approved. The study included volunteers and patients with nonalcoholic fatty liver disease undergoing 3T MRI with a quantitative 4D phase contrast sequence with retrospective cardiac gating. The 3D displacement field during eight phases of the cardiac cycle were measured. Automated motion processing and masking techniques were used to extract the hepatic octahedral shear strain (OSS). The reference standard was fibrosis staging by liver biopsy. One-way ANOVA and receiver operating characteristic analyses were performed for normal categorized and dichotomized groups based on hepatic fibrosis stages, including F0 versus = F1, = F1 versus = F2, = F2 versus = F3, and = F3 versus F4. The area under the receiver operating characteristic curve (AUC) was reported for each dichotomization of fibrosis stages.

##### RESULTS

The study included 11 volunteers and 24 patients. Mean values of OSS decreased with higher fibrosis stage, with a mean of  $0.15 \pm 0.08$  (standard deviation) for F0,  $0.12 \pm 0.01$  for F1,  $0.07 \pm 0.01$  for F2,  $0.07 \pm 0.02$  for F3, and  $0.05 \pm 0.03$  for F4. The cardiac-induced strain measurements demonstrated high accuracy in discriminating NASH patients, with  $p < 0.01$  and F score 8.35 from one-way ANOVA and the area under ROC curves (AUC) of 0.87 for F0 vs. = F1, 0.96 for = F1 vs. = F2, 0.90 for = F2 vs. = F3, and 0.90 for = F3 vs. F4.

## CONCLUSION

s The study demonstrated a significant decrease in the liver's OSS with increasing fibrosis stage.

## CLINICAL RELEVANCE/APPLICATION

The study found that intrinsic shear strain measured by, standard phase-contrast MRI, without the use of any external actuation, has the potential to be a noninvasive diagnostic tool for detection and staging liver fibrosis.

## M5B-SPGI-3 Depiction of Lymphatic Pathway in Fontan Circulation Using Gd-EOB-DTPA Magnetic Resonance Lymphangiography

### PURPOSE

Although postoperative mortality rates in congenital single ventricle patients after the Fontan procedure have dramatically improved, the long-term mortality rates have remained high compared to those in patients with other types of congenital heart disease. In the Fontan circulation, congestive liver and lymphatic congestion caused by elevated central venous pressure become permanent, resulting in cirrhosis, refractory ascites, and protein-losing enteropathy. These complications are considered poor prognostic factors as Fontan-associated liver disease (FALD). Gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB-DTPA) MRI is expected to detect hepatocellular carcinoma (HCC) that develops in FALD. We attempt to depict abnormal lymphatic pathway in FALD using Gd-EOB-DTPA MRI and propose a classification of their severity.

### METHODS AND MATERIALS

Fifty-two patients (mean age, 25 years) after Fontan procedure who underwent Gd-EOB-DTPA MRI for evaluation of the FALD were enrolled. MR lymphangiography was scanned using three-dimensional heavily T2-weighted imaging with a 3-tesla scanner 10 minutes after Gd-EOB-DTPA administration. This sequence takes advantage of the T2 shortening effect of Gd-EOB-DTPA to suppress the bile duct and vessel's signals, thereby enhancing the lymphatic pathway. Based on the extent of lymphatic tract involvement in the abdomen, patients were classified into the following three categories; Grade 0: no lymphatic pathway, Grade 1: the presence of lymphatic pathway mainly around the bile duct and liver surface, Grade 2: lymphatic pathway extended from the spine to the inferior vena cava periphery. Refractory ascites, protein-losing enteropathy, development of HCC, and hospitalization for heart failure were used as composite outcomes and contrasted with lymphangiographic findings.

### RESULTS

In MR lymphangiography, 20 patients were Grade 0, 17 were Grade 1, and 15 were Grade 2. 16 patients had composite outcomes, including 10 with HCC, 4 with refractory ascites, and 2 with heart failure hospitalization. Grade 0 patients had no events (0/20), whereas Grade 1 and Grade 2 patients had the adverse events in 53% (9/17) and 47% (7/15) of patients, respectively.

### CONCLUSION

s A novel technique, MR lymphangiography with Gd-EOB-DTPA, demonstrates the localization and extent of the abnormal lymphatic pathways in Fontan circulation. The lymphangiographic grade is associated with the adverse events in FALD.

## CLINICAL RELEVANCE/APPLICATION

This MR lymphangiography can be added as one of Gd-EOB-DTPA contrast protocol and does not extend the overall examination time.

## M5B-SPGI-4 A Rules-Based Algorithm for Extracting Structured Clinical Data from Liver CT Free-Text Radiology Reports

### PURPOSE

A large proportion of patients throughout the world have undiagnosed liver disease. Given the abundance of data found in radiology reports, they represent an untapped source to study patients with liver disease. Oftentimes it may be arduous to manually sift through patient-level data. As such, validated methods to study these patients and associated radiology reports are needed. Here we present a rules-based algorithm that determines the presence or absence of liver pathologies from unstructured radiology reports for CT liver scans.

### METHODS AND MATERIALS

Three common diagnosis of liver pathologies were selected for this study, namely focal liver lesions, steatosis and cirrhosis. A data dictionary was created to identify phrases that describe these diagnoses in a radiology report. Data mining and dictionary generation was done by a gastroenterologist treating these liver conditions for more than 20 years at the James A Haley VA Hospital. A random subset of liver CT reports (n = 100) of patients with a liver-related complaint were extracted and split into training and testing sets (65 and 35 patients, respectively). Ground truth values for the presence or absence of three liver pathologies were manually annotated, specifically for focal liver lesions, cirrhosis, and steatosis. A rules-based algorithm was leveraged using the two phase sentence analysis for radiology label extraction (SARLE) method: (1) remove phrases and handle negations and (2) link remaining terms to liver pathologies. The algorithm's performance was assessed using accuracy, sensitivity, and specificity.

### RESULTS

On the test set, the algorithm had an average accuracy across all 3 pathologies of 99.25% (95% CI: 98.76% to 99.65%), sensitivity of 84.21% (68.75% to 93.98%), and specificity of 99.68% (95% CI: 99.25% to 99.89%). Across the 100 patients, the reports of 90 patients were perfectly extracted for all 3 attributes.

### CONCLUSION

s We demonstrate high performance of a rules-based algorithm to extract tabular data information from free text reports of liver CT scans. Our tool performed well in identifying patients with focal liver lesions, steatosis, and cirrhosis, as benchmarked by an expert gastroenterologist.

## CLINICAL RELEVANCE/APPLICATION

This tool may be useful in developing new machine learning approaches to predict outcomes in liver and other abdominal conditions.

Additionally this method may serve as a first step towards identifying the natural language used in radiology reports for future machine learning implementations.

### **M5B-SPGI-5 Staging of Liver Fibrosis Assessed by Quantification of Hepatic Extracellular Volume Obtained by Dual-energy CT Would be Easier-to-Access than Previous**

Participants

Kumi Ozaki, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To assess the validity of 3-min equilibrium-phase CT images compared to 5-min equilibrium-phase images in the quantification of hepatic extracellular volume fraction (ECV) obtained by dual-energy CT.

#### **METHODS AND MATERIALS**

A total of 80 patients (45 men and 35 women, mean age, 69.3 + 10.4 years) who underwent both 3- and 5-min equilibrium-phase CT images to assess the focal liver lesions, that were suspected of hepatic hemangioma or intrahepatic cholangiocarcinoma between January 2020 and July 2022. The iodine densities of the hepatic parenchyma and aorta were measured and ECV was calculated. Comparisons of value of ECV of each phase, and the relation with fibrosis-4 index (Fib4) and albumin-bilirubin (ALBI) grade were then statistically analyzed.

#### **RESULTS**

There was no significant difference in value of ECV of 3- and 5-min equilibrium-phase CT images ( $p = 0.056$ ). ECV of 3- and 5-min showed a strong or moderate correlation with ALBI grade (Spearman's  $\rho$ ; 0.763, 0.724, respectively). The correlation with Fib4 was similar to each ECV (Spearman's  $\rho$ ; 0.537, 0.571, respectively).

#### **CONCLUSION**

s ECV value and the correlation with ALBI grade and Fib4 were not significantly different, and ECV of 3-min equilibrium-phase CT images is clinically acceptable.

#### **CLINICAL RELEVANCE/APPLICATION**

Validity of ECV of 3-min equilibrium-phase CT image can facilitate the prevalence of staging of liver fibrosis assessed by ECV because it can be obtained within routine dynamic contrast examination.

### **M5B-SPGI-6 Establishing the Evaluation Model for Liver Cirrhosis Based on CT Radiomics Characteristics of Different Liver Segments**

#### **PURPOSE**

To evaluate the performance of evaluating liver cirrhosis by radiomics characteristics of different liver segments in contrast-enhanced CT portal vein phase images.

#### **METHODS AND MATERIALS**

154 cases with clinically confirmed liver cirrhosis were included in the study group and 150 cases with normal liver findings in the control group. All patients underwent enhanced liver CT on a GE discovery CT 750 HD. The portal phase CT images were selected for analysis, and two radiologists used a commercial radiomics software (Shukun Radiomics V94) to outline different liver segments on the slice of portal vein left branch into four regions of interest (ROI): S1, S2/3, S4 and S7/8; Intraclass correlation coefficient was calculated to test the inter-group consistency. Patients were randomly divided into training set and testing set at a ratio of 7:3, the radiomics characteristics (first-order features, shape features and texture features) of each ROI were extracted. After dimensionality reduction, the radiomics features with the most predictive performance were selected to establish the evaluation model of liver cirrhosis. The area under curve (AUC) was used to evaluate the performance of the model.

#### **RESULTS**

The two radiologists had good consistency ( $ICC > 0.75$ ). Five, 6, 6 and 6 radiomics features were used for modeling of liver segment S1, S2/3, and S4 and S7/8, respectively. The AUC, accuracy, sensitivity and specificity were 0.948, 0.931, 0.955 and 0.908 in the training set; and 0.928, 0.896, 0.912 and 0.879 in the testing set, respectively for S1; 0.958, 0.924, 0.955 and 0.892 in the training set; and 0.957, 0.881, 0.912 and 0.848 in the testing set, respectively for S2. 0.974, 0.924, 0.940 and 0.908 in the training set; and 0.964, 0.910, 0.941 and 0.879 in the testing set, respectively for S4, and 0.948, 0.908, 0.909 and 0.908 in the training set; and 0.955, 0.910, 0.941 and 0.879 in the testing set, respectively for S7/8

#### **CONCLUSION**

s Good evaluation models of liver cirrhosis may be established using different liver segments, and the model established in the left medial segment gives the highest AUC.

#### **CLINICAL RELEVANCE/APPLICATION**

Good evaluation models of liver cirrhosis may be established using different liver segments, and the model established in the left medial segment gives the highest AUC.

### **M5B-SPGI-7 Prediction of Lymph Node Metastasis of Progressive Gastric Adenocarcinoma Nodes with a Short-Axis Diameter of $\geq 6$ mm**

#### **PURPOSE**

To explore the value of the features of lymph nodes (LN) with a short-axis diameter = 6 mm in prediction of lymph node metastasis (LNM) in advanced gastric adenocarcinoma (GAC) based on dual-energy CT (DECT) radiomics.

#### **METHODS AND MATERIALS**

Data of patients with GAC who underwent radical gastrectomy and LN dissection were retrospectively analyzed. To ensure the

correspondence between imaging and pathology, metastatic LNs were only selected from pN3 patients, nonmetastatic LNs were selected from pN0 patients, and the short-axis diameters of the enrolled LNs were all =6 mm. The traditional features of LNs were recorded, including short-axis diameter, long-axis diameter, long-to-short axis ratio, position, shape, density, edge and the degree of enhancement, and univariate and multivariate logistic regression analyses were used to establish a clinical model. Radiomics features at the maximum level of LNs were extracted in venous phase equivalent 120 kV linear fusion images and iodine maps. Intra-class correlation coefficients and the Boruta algorithm were used to screen significant features, and random forest was used to build a radiomics model. The traditional features with statistical significance in univariate analysis and radiomics scores (Rad-score) were included in multivariate logistic regression analysis to construct a combined model. ROC curve and DeLong test were used to evaluate and compare the diagnostic performance of the models. DCA was used to evaluate the clinical benefits of the models.

## RESULTS

This study included 114 metastatic LNs from 45 pN3 patients and 65 nonmetastatic LNs from 28 pN0 patients. The samples were divided into a training set (n=125) and a validation set (n=54) at a ratio of 7:3. Long-axis diameter and LN shape were independent predictors of LNM and were used to establish the clinical model. 27 screened radiomics features were used to build the radiomics model. LN shape and Rad-score were independent predictors of LNM and were used to construct the combined model. Both the radiomics model (AUC of 0.986 and 0.984) and the combined model (AUC of 0.970 and 0.977) outperformed the clinical model (AUC of 0.772 and 0.820) in predicting LNM in both the training and validation sets. DCA showed superior clinical benefits from the radiomics and combined models.

## CONCLUSION

The models based on LNs DECT radiomics features, or combined traditional features have high diagnostic performance in determining the nature of each LN with a short-axis diameter of =6 mm in advanced GAC.

## CLINICAL RELEVANCE/APPLICATION

The models have important clinical value in the preoperative judgment of N staging, individualized treatment plans and prognosis of patients.

## M5B-SPGI-8 The Spectral Parameters Measured by Fast kVp Switching Dual-Energy CT: The Association with Ki-67 Expression in Hepatocellular Carcinoma

### PURPOSE

To investigate the correlation between spectral parameters obtained from contrast-enhanced spectral CT scanning and Ki-67 expression in hepatocellular carcinoma (HCC).

### METHODS AND MATERIALS

91 HCC patients with hepatitis complicated underwent both pathological examination and two-phase contrast-enhanced CT scanning with spectral imaging mode were included in this study. Then water- and fat-based material decomposition images as well as virtual monochromatic images acquired at energies ranging from 100 to 140 keV were reconstructed. Region of interest (ROI) was placed on the lesion, and water and fat density ( $D_{water}$ ,  $D_{fat}$ ), CT values at monochromatic energy images (HU100-140keV), as well as effective atomic number were measured. The effective atomic number for lesions was normalized by those for aorta to derive normalized atomic number (Neff-Z). Ki-67 expression level was determined by Ki-67 positivity rate according to immunohistochemistry analysis. Pearson coefficient was used to analyze the correlation between spectral parameters and Ki-67 positivity.

### RESULTS

The Neff-Z, HU100-140keV, water and fat density were positively and fairly correlated with the Ki-67 expression, and correlation coefficient  $r$  (P value), were 0.324 (P = 0.002), 0.252-0.358 (P = 0.016-0.001), 0.415 (P <0.001) and 0.293 (P = 0.005), respectively. Particularly,  $D_{water}$  showed strongest correlation with Ki-67 expression. Additionally, the correlation between CT value and Ki-67 was enhanced gradually with the increase of monochromatic energy (100keV to 140keV).

### CONCLUSION

Conclusion: The Neff-Z, HU100-140keV, water and fat density obtained from spectral scanning on dual-energy CT exhibited positive and fair correlation with Ki-67 expression.

### CLINICAL RELEVANCE/APPLICATION

Ki-67 was a significant marker for HCC prognosis and clinical decision, however current method to evaluate Ki-67 always needs surgery, which is detrimental for assessing patients who lost surgery chance. Spectral scanning on Dual energy CT provides a new noninvasive method and various parameters to evaluate Ki-67 (indicative of proliferative activity) expression in HCC, which is valuable for clinical diagnosis and treatment.

## Abstract Archives of the RSNA, 2023

M5B-SPGU

### Genitourinary Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPGU-1 The Additional Value of Pseudocapsule for Clear Cell Likelihood Score v2.0 in Predicting Small Renal Masses: A Multicenter Retrospective Study**

##### Participants

Yuwei Hao, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aims to explore the additional value of pseudocapsule for clear cell likelihood score v2.0 (ccLS v2.0) in diagnosing small renal masses (SRM) and develop a modified clear cell likelihood score (m-ccLS) for predicting malignancy.

##### METHODS AND MATERIALS

In this study, clinical data and MR images of patients with pathologically confirmed solid SRM were retrospectively collected from three academic medical centers between January 1, 2019 and December 31, 2021. All patients were divided into a training group (n = 235), an internal validation group (n = 60), and an external validation group (n = 57). Two junior radiologists independently evaluated whether SRM had pseudocapsule, other MRI features and the ccLS scores according to ccLS v2.0, respectively. Disagreements were resolved by two senior radiologists who reached an agreement. The risk prediction value of pseudocapsules and the ccLS scores in ccRCC and malignant tumors were analyzed using the logistic regression model. M-ccLS was established and calibration curves were drawn to evaluate the consistency of m-ccLS predictions with pathological findings. The diagnostic performance of m-ccLS and ccLS v2.0 was evaluated by drawing ROC and the percentage of ccRCC and malignant tumors in each score was compared using ccLS v2.0 and m-ccLS. The net reclassification index (NRI) and integrated discrimination improvement (IDI) were calculated.

##### RESULTS

352 patients (248 males, 104 females; mean age, 54±12 years) with 358 renal masses were identified. The evaluation results of SRM revealed that pseudocapsule had the additional value for ccLS v2.0 evaluation of ccRCC and malignant tumors ( $P < 0.001$ ). M-ccLS showed a good interobserver agreement in predicting ccRCC and malignant tumors ( $P > 0.05$ ). The diagnostic performance of m-ccLS for ccRCC was comparable to ccLS v2.0 ( $P > 0.05$ ). Compared with ccLS v2.0, the AUC of m-ccLS for diagnosing malignant tumors increased from 0.772 (95%CI: 0.714-0.824), 0.801 (95%CI: 0.680-0.892) and 0.645 (95%CI: 0.507-0.767) to 0.848 (95%CI: 0.796-0.891), 0.887 (95%CI: 0.781-0.953) and 0.716 (95%CI: 0.581-0.827) among three groups, respectively. M-ccLS could achieve the prediction of benign and malignant tumors (the percentage of malignant tumors in m-ccLS 1-5 scores was 19.5%, 31.5%, 72.5%, 91.1%, and 100.0%, respectively). Among three groups, the NRI and IDI of m-ccLS were higher than those of ccLS v2.0.

##### CONCLUSION

Pseudocapsule had the additional value for ccLS v2.0 in the diagnosis of SRM. M-ccLS has great diagnostic performance and improvement for ccRCC and malignant tumors and could predict benign and malignant tumors of SRM.

##### CLINICAL RELEVANCE/APPLICATION

M-ccLS may prove to be a valuable tool for the future non-invasive evaluation of renal tumors.

#### **M5B-SPGU-2 CT-based Potential Predictor for CKD-free Survival after Partial Nephrectomy in Patients with Small RCC**

##### Participants

Seong Min Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate prognostic utility of 3D remaining functional parenchyma (RFP) extracting post-operative kidney CT in predicting chronic kidney disease (CKD)-free survival after partial nephrectomy (PN) in patients with small RCC.

##### METHODS AND MATERIALS

A retrospective analysis was carried out of 331 patients who underwent PN for clear cell RCC (less than 5cm) between September 2006 and September 2020. In order to construct a predictive model for CKD-free survival probability after PN, multivariable Cox regression analysis was carried out adding 3D volume of RFP extracting from the post-operative kidney CT to clinical parameters proven to have an impact on postoperative renal function such as eGFR, age, or perioperative variables.

##### RESULTS

The median age was 53 years, median tumor size was 3.4 cm. A total of 18 patients (5.4%) developed new-onset CKD at a median follow up of 35 months. The CKD-free survival rates at 1, 3, 5 and 7 year were 97.5%, 97.2%, 96.1% and 94.5%, respectively. On



univariable Cox regression analysis, age (hazard ratio 1.097,  $P = 0.0001$ ), Charlson Comorbidity Index (hazard ratio 1.728,  $P = 0.0001$ ), hypertension (hazard ratio 4.792,  $P = 0.0017$ ) and Furhmann\_grade (hazard ratio 2.828,  $P = 0.0086$ ) were independent predictors for new-onset CKD. The C-index for CKD-free survival prediction with clinical parameters along was 0.8358. The addition of 3D RFP improved the C-index to 0.8525 ( $p = 0.0405$ ).

## CONCLUSION

s Addition of 3D RFP values to standard clinical factors improves CKD-free survival prediction after PN in patients with small RCC. Using this model, RFP could be a reliable method for preoperative prediction of prognosis in PN.

## CLINICAL RELEVANCE/APPLICATION

The revised prediction model adding 3D imaging parameters might have an important role in partial nephrectomy decision-making and follow-up plan after surgery in patient with RCC.

## M5B-SPGU-3 Automatic Segmentation of Renal Tumors: A Novel Visualization Approach

### Participants

Sophie Bachanek, Gottingen, Germany (*Presenter*) Nothing to Disclose

Sophie Bachanek, MD, Gottingen, Germany (*Presenter*) Nothing to Disclose

Johannes Uhlig, Goettingen, Germany (*Presenter*) Speaker, Bayer AG; Research Grant, Siemens AG

## PURPOSE

To establish an automatic segmentation algorithm and visualisation method for solid renal tumors that utilizes CT-studies acquired in clinical practice and multireader input.

## METHODS AND MATERIALS

Renal tumor patients diagnosed 2018-2021 were retrospectively assessed. Inclusion criteria were CT-imaging of renal tumors in corticomedullary or nephrogenic contrast media (CM/NG) phase. Patients with cystic or infiltrative renal tumors and age <18 years were excluded. Manual segmentation of the tumors was performed on all axial CT slices and used for training of a convolutional neural network (UNET). In an independent validation dataset, the accuracy of the UNETs predictions of renal tumor contours was compared to manual segmentations (quantified by DICE score).

## RESULTS

$n=394/n=350$  patients in CM/NG phases were included (median age 66 years; 35% female; median tumor diameter 5.4cm). CT-studies from >20 radiological imaging centers were included with different imaging protocols and slice thickness. The UNET was trained on  $n=316$  CM/  $n=294$  NG contrast phase patients ( $n=7019$  /  $n=6859$  CT images). In the independent validation dataset ( $n=78$  /  $n=56$  patients with 1713 / 1298 CT images), the UNET achieved a DICE score of 0.88 and 0.90 for the corticomedullary and nephrogenic CM phase, respectively. The UNET predictions were visualized using a tile-based approach with color-coding and contour-lines that could be overlaid on CT-images to depict varying levels of prediction confidence.

## CONCLUSION

s A UNET yields a robust automatic delineation of renal tumors on CT-images acquired in clinical routine, irrespective of the contrast media phase. Color-coding and contour-lines can be overlaid on original CT-images to provide visual feedback of UNET segmentations and confidence levels.

## CLINICAL RELEVANCE/APPLICATION

Automatic renal tumor segmentation using UNETs robustly performs on heterogeneous clinical CT data. Color-coding provides an explainable approach to model predictions and might improve acceptance in clinical practice.

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## Abstract Archives of the RSNA, 2023

M5B-SPHN

### Head & Neck Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPHN-1 Prediction of Cervical Lymph Node Metastasis in Thyroid Cancer Based on CT Imageomics and Deep Learning**

##### **PURPOSE**

The aim of this study is to explore the feasibility and accuracy of using CT imageomics analysis combined with deep learning technology to predict cervical lymph node metastasis in thyroid cancer patients, and to provide reliable reference for clinical treatment.

##### **METHODS AND MATERIALS**

A retrospective analysis of CT image data was performed on 112 thyroid cancer patients with confirmed cervical lymph node metastasis who underwent surgery in our hospital from April 2021 to March 2023. First, the corresponding lymph nodes that were confirmed by pathology were identified on the CT images, and a convolutional neural network (CNN) was used to perform image segmentation and extract 59 features including morphological, texture, and histogram statistical features. Then, feature selection methods were applied to screen out the features with significant differences in lymph node metastasis. Finally, a logistic regression model was used for prediction modeling and its accuracy and generalization ability were evaluated.

##### **RESULTS**

Through feature selection, we selected four optimal features, including angular second moment, entropy, area, and variance. In the test set, after cross-validation and ROC curve analysis, the logistic regression model had an accuracy of 88.2%, sensitivity of 84.0%, specificity of 92.4%, and AUC of 0.913 for predicting cervical lymph node metastasis in thyroid cancer.

##### **CONCLUSION**

This study demonstrates that CT imageomics and deep learning technology can be used to predict lymph node metastasis in thyroid cancer. The optimal features extracted can effectively distinguish between thyroid cancer patients with and without lymph node metastasis.

##### **CLINICAL RELEVANCE/APPLICATION**

The logistic regression model has high accuracy and generalization ability, and can be used as a reliable clinical decision support tool to help doctors formulate better treatment plans and improve treatment outcomes. In the future, we will further expand the sample size, improve algorithm performance, and develop an automated lymph node metastasis prediction system based on CT imageomics and deep learning technology.

#### **M5B-SPHN-2 Evaluation and Survival Prediction for A Novel Fully Automatic System for Lymph Node Segmentation and Counting in Nasopharyngeal Carcinoma Using Multimodal MRI**

##### **PURPOSE**

The accurate segmentation and counting of lymph nodes (LNs) is essential for the structured reporting and prognostic diagnosis of nasopharyngeal carcinoma. As such, developing a fully automatic system for accurate LNs segmentation and counting in nasopharyngeal carcinoma patients is of great clinical significance for the accurate prognostic analysis of this disease.

##### **METHODS AND MATERIALS**

First, we proposed a multimodal LNs segmentation model based on T1-weighted, contrast-enhanced T1-weighted, and T2-weighted MRI images, which named NPCnet. We then developed a fully automatic algorithm for LNs counting and combined it with the segmentation model to create a comprehensive system called the Fully Automatic Lymph Node Counting System (AMLNC). The accuracy and practical value of our system were evaluated by comparing its performance metrics (Interclass Correlation Coefficient (ICC) and Bland-Altman plot) with those of detailed MRI assessment (gold standard) and automatic counting using manual delineation (MDAC). Finally, we analyzed the relationship between the LNs count and the prognostic outcomes of the patients, such as Overall Survival (OS), Progression-free Survival (PFS), and Distant Metastasis-free Survival (DMFS).

##### **RESULTS**

We retrospectively analyzed the data of 995 patients and divided them into training and validation datasets at a ratio of 7:3 for constructing the segmentation model. The mean DICE similarity coefficient in the validation set of 298 cases was 0.771. We selected 20 cases randomly for manual repeat delineation, and there was no statistically significant difference in the mean DICE between automatic segmentation and manual delineation (0.785 vs 0.806,  $p = 0.068$ ). The median (IQR) LNs counts for the gold standard, AMLNC, and MDAC were 3 (2-4.074), 4 (2-4.581), and 4 (2-5.513), respectively. The ICC showed that the AMLNC had good repeatability (0.778 (Gold vs AMLNC), 0.638 (Gold vs MDAC), and 0.739 (AMLNC vs MDAC)). Furthermore, we selected 40 cases randomly for manual reading repeatedly, and the ICC still showed that the AMLNC system had good repeatability (0.805 (Gold vs AMLNC), 0.663 (Gold vs manual MDAC), and 0.672 (Gold vs Gold repeatedly)). The Bland-Altman plot displayed good agreement between the AMLNC and the gold standard. We divided all patients into low (1-4 positive LNs), moderate (5-9), and high (>9) risk

groups, and the K-M plots showed a great discriminating ability for OS, PFS, and DMFS using AMLNC

## CONCLUSION

s The AMLNC System in this study demonstrates good repeatability and reliability in its results and clinical survival prediction ability

## CLINICAL RELEVANCE/APPLICATION

The AMLNC System can be directly used for structured reporting and survival prognosis analysis of nasopharyngeal carcinoma

## M5B-SPHN-3MRI Radiomics Approach with Deep Transfer Learning for Distinguishing Sinonasal Malignancies: A Preliminary Study Based on Different Machine Learning Algorithms

Participants

Naier Lin, MS, Shanghai, China (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the diagnostic performance of MRI hand-crafted (HC) radiomics features combined with deep transfer learning (DTL) features in distinguishing between sinonasal squamous cell carcinoma (SCC), adenoid cystic carcinoma (ACC) and non-Hodgkin's lymphoma (NHL) .

## METHODS AND MATERIALS

This retrospective analysis consisted of 50 patients with sinonasal SCC, 42 patients with NHL and 40 patients with ACC. Patients were allocated to training and testing cohorts randomly at a ratio of 8:2. HC radiomics features and DTL features were extracted from T2-weighted image (T2WI), apparent diffusion coefficient (ADC) and contrast-enhanced T1-weighted image (CE-T1WI). A ResNet50 convolutional neural network (CNN) pretrained model was used for DTL features extracting. The least absolute shrinkage and selection operator (LASSO) regression was applied for feature selection and radiomic signature (radscore) construction. The classification performance for detection of sinonasal SCC, ACC and NHL was compared between seven machine learning (ML) algorithms.

## RESULTS

The radscore included 24 HC radiomics features and 8 DTL features. Algorithm of SVM showed the best performance with the highest accuracy (92.6%) in the testing cohort. ROC analysis indicated that the macro-average AUC and micro-average AUC values of SVM were 0.98 and 0.99. AUCs for diagnosis of ACC, NHL, SCC were 0.99, 0.97 and 1.00, respectively. Besides, KNN and XGBoost algorithms also provided better results with both the macro-average and micro-average AUC values > 0.90.

## CONCLUSION

s Three-MRI sequence-based HC radiomics features and DTL features combined with SVM model improved differentiation between sinonasal SCC, NHL and ACC.

## CLINICAL RELEVANCE/APPLICATION

The tumor biological behaviors and therapeutic schedules of SCC, ACC and NHL are different. As a noninvasive and convenient method, the MRI radiomics approach with deep transfer learning represented an opportunity to advance precise prediction for the type of sinonasal malignancies preoperatively and assist in making appropriate treatment and improving the prognosis.

## M5B-SPHN-4Radiomics Analysis for the Prediction of Locoregional Recurrence of Locally Advanced Oropharyngeal Cancer and Hypopharyngeal Cancer

## PURPOSE

By radiomic analysis of the postcontrast CT images, this study aimed to predict locoregional recurrence (LR) of locally advanced oropharyngeal cancer (OPC) and hypopharyngeal cancer (HPC), that carry high LR rate >50% and poor overall survival rate <50%.

## METHODS AND MATERIALS

From two independent cohorts, this retrospective study enrolled 194 patients with stage III-IV OPC or HPC according to the 7th edition of the American Joint Committee on Cancer. These patients were randomly split into a training cohort with 153 cases (80%) and a testing cohort with 39 cases (20%). Only the primary tumor mass was segmented manually for the radiomic analysis. Radiomic features were extracted using PyRadiomics, and then the support vector machine (SVM) was used to build the radiomic model with a 5-fold cross-validation process in the training dataset. For each case, a radiomics score was generated to indicate the probability of LR.

## RESULTS

Within a follow-up period of 2 years, there were 94 patients with LR assigned in the progression group and 98 patients without LR assigned in the stable group. There was no significant difference in clinical TNM staging, treatment strategies, and common risk factors between these two groups. For the training dataset, the radiomics model to predict LR showed 83.7% accuracy and 0.832 (95% CI: 0.72, 0.87) area under the ROC curve (AUC). For the test dataset, the accuracy and AUC slightly declined to 79.5% and 0.770 (95% CI: 0.64, 0.80), respectively. The sensitivity/specificity of the training and test dataset for LR prediction were 77.6%/89.6%, and 66.7%/90.5%, respectively.

## CONCLUSION

s The proposed image-based radiomic approach could provide a reliable prediction model of LR in locally advanced OPC and HPC with high accuracy and specificity. Early identification of those prone to post-treatment recurrence would be helpful for appropriate adjustments to treatment strategies and posttreatment surveillance.

## CLINICAL RELEVANCE/APPLICATION

For locally advanced oropharyngeal and hypopharyngeal cancers with high recurrence rates and poor prognoses, we demonstrated that an image-based radiomic model might potentially identify those prone to post-treatment recurrence with high accuracy and high specificity. Pending the future validation in a large cohort, it is expected to provide an opportunity to make appropriate

adjustments to the treatment choices (concurrent chemoradiation therapy vs. surgery with adjuvant treatment), post-treatment imaging interval (6 weeks vs. 12 weeks), chemoradiotherapy treatment protocols, and the patient's rehabilitation plan, psychological support, and social care resource allocation.

## **M5B-SPHN-5 Assessment of a Commercially Available Artificial Intelligence Algorithm for Risk Stratification of Thyroid Nodules: Diagnostic Performance at a Tertiary Academic Center**

### **PURPOSE**

To evaluate the diagnostic performance of a commercially available, artificial intelligence-based software platform for risk stratification of thyroid nodules on ultrasound (US). This tool was recently FDA approved and no external validation studies have been published to date evaluating its clinical performance.

### **METHODS AND MATERIALS**

This retrospective study included all thyroid US examinations containing thyroid nodules over a 1-year period at a large academic medical center. Nodules were included if they had a ground truth diagnosis by: a) surgical pathology, b) fine needle aspiration, or c) three-year follow up US showing stability. The cohort included 650 nodules from 348 patients. An FDA-approved, AI-based software tool (Koios DS Thyroid, Koios Medical) was applied to the images for each nodule. The Koios algorithm generates two primary outputs: 1) ACR TI-RADS nodule descriptors with TI-RADS score and follow up recommendation, and 2) an optional AI adaptor score which can adjust the risk assessment and recommendation based on the overall AI analysis of the images. Four different groups were compared: 1) AI software with AI adaptor enabled, 2) AI software without the AI adaptor, 3) clinical radiology reports (using ACR TI-RADS), and 4) radiology reports combined with AI adaptor score. Diagnostic performance of the final recommendations (FNA or no FNA) was determined based on the ground truth, and comparison between the four groups was made using sensitivity, specificity, and AUROC analysis.

### **RESULTS**

Diagnostic performance of the AI algorithm with the AI adaptor tool enabled was similar to the performance of the clinical radiologists (AUC 0.70 for both). The algorithm + adaptor had improved specificity compared to radiologists (0.63 vs 0.43) but decreased sensitivity (0.69 vs 0.81). Without the AI adaptor enabled, performance of the algorithm was slightly worse (AUC 0.65), while the best performance was seen when the radiology interpretation was combined with the AI adaptor (AUC 0.76). When combined with the AI adaptor, radiologist specificity improved from 0.43 to 0.53, resulting in 17% fewer FNA recommendations, with unchanged sensitivity (0.81).

### **CONCLUSION**

The Koios DS algorithm demonstrated standalone performance similar to that of radiologists, though with lower sensitivity and higher specificity. Performance was best when radiologist interpretations were combined with the AI adaptor component, which led to improved specificity and a reduction in unnecessary FNA recommendations.

### **CLINICAL RELEVANCE/APPLICATION**

AI software can improve thyroid US diagnostic performance and reduce unnecessary procedures. Workflow may also be improved through automated generation of TI-RADS scores, though performance is highest with human input.

## **M5B-SPHN-7 FaBoA: Computed Tomography-based Facial Bone Fracture Analysis Solution**

### **PURPOSE**

Facial bone fractures must be diagnosed and treated as early as possible to avoid complications and sequelae. Computed Tomography (CT) images are essential for accurate diagnosis and treatment planning, but analyzing these images is time-consuming and requires specialized expertise. While many classification and object detection studies have been conducted to address these issues, their limitations have hindered their widespread clinical use. The ability of classification-based studies to pinpoint the exact location of fractures is limited, while object detection-based research is challenging due to the ambiguity of the shape of a fracture. To address these challenges, we propose a deep learning-based facial bone fracture diagnosis system named FaBoA.

### **METHODS AND MATERIALS**

FaBoA was trained on a dataset of 6,294 CT scans with facial bone fractures acquired from January 2009 to March 2020. Experienced expertise manually annotated facial fractures with bounding boxes on all the datasets. Our deep learning model was evaluated on an additional 346 CT scans. We used deep learning-based object detection for the initial detection and class activation-based weakly-supervised segmentation for pixel-wise fine-grained localization.

### **RESULTS**

FaBoA achieved sensitivity and specificity were 100% and 84.2%, respectively, for nasal bone fractures. The sensitivity and specificity of all types of facial bone fractures were 81.3% and 70.5%, respectively. Furthermore, FaBoA can visualize fine-grained 3D fractures using the localization technique.

### **CONCLUSION**

FaBoA is a reliable and accurate CT-based facial bone fracture analysis solution that has the potential to assist radiologists in the diagnosis and treatment of facial bone fractures, leading to better patient outcomes. The combination of object detection and class-activation-based localization enables FaBoA to accurately detect and classify bone fractures with high sensitivity and specificity. In addition, FaBoA includes not only the diagnosis model but also a user-friendly interface that allows doctors to interact with the solution and access the analysis results easily. FaBoA can also be integrated into radiology workflows to enhance efficiency and reduce interpretation variability. The dataset used in this study, which spans over a decade of CT scans with facial bone fractures, provides a representative sample of real-world clinical cases and enhances the generalizability of the FaBoA model.

### **CLINICAL RELEVANCE/APPLICATION**

FaBoA's AI engine and user-friendly interface have the potential to assist in diagnosis, treatment planning, postoperative assessment, and monitoring of facial bone fractures, leading to better patient outcomes and workflow efficiency.

## Abstract Archives of the RSNA, 2023

M5B-SPIN

### Imaging Informatics Monday Poster Discussions II

#### Sub-Events

#### M5B-SPIN-1 Scaling Temporal and Volumetric Datasets for Tumor Localization Without Per-Pixel Annotations

##### Participants

Zongwei Zhou, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

To examine whether AI trained using simple annotation strategies can achieve comparable or superior performance to that trained using per-pixel annotations in the context of computer-aided tumor detection.

##### METHODS AND MATERIALS

Two large-scale datasets were retrospectively collected for this study: SUN-SEG consists of 1,106 colonoscopy video clips for polyp detection, in which 49,136 frames are with polyps and 158,690 frames are without polyps. The video clips were split into training (507), validation (126), and test (473) sets. JHH contains 2,426 subjects collected and annotated at Johns Hopkins University for pancreatic tumor detection, where each subject was scanned by contrast-enhanced CT. We randomly split CT scans into training (1,683), validation (420), and test (323) sets. Tumors in both datasets were annotated on a per-pixel basis. We develop a new annotation strategy, simplifying the tumor annotation process to drag and drop (DragDrop). Furthermore, we designed a watershed-based weakly supervised learning method to leverage the DragDrop annotations and accommodate the high-dimensional temporal and volumetric data. Finally, we assessed Sensitivity, Specificity, Precision, and F1-score for tumor detection at both lesion and patient levels.

##### RESULTS

Given a certain annotation budget, our proposed DragDrop strategy improves the sensitivity, specificity, precision, and F1-score at the lesion-level for polyp detection when compared to per-pixel annotation, with improvements from 68% to 71%, 58% to 67%, 43% to 51%, and 54% to 59%, respectively. The patient-level results improve from 75% to 80%, 69% to 79%, 54% to 64%, and 62% to 66%, respectively. For pancreatic tumor detection, the results improve from 61% to 71%, 33% to 42%, 42% to 57%, and 52% to 61%, respectively. The patient-level results improve from 76% to 88%, 70% to 64%, 75% to 74%, and 61% to 73%, respectively. More importantly, for minority patients aged between 75 to 80 and 80 to 85, who only account for 7% and 3% of the JHH test set, our DragDrop improves lesion-level precision from 42% to 61%, and 45% to 60% and improves lesion-level F1-score from 55% to 72% and 59% to 75%.

##### CONCLUSION

Our proposed strategy reduced 87% and 99% annotation efforts for polyp and pancreatic tumor detection, respectively, and achieved a significantly better tumor detection rate than per-pixel annotations given an annotation budget.

##### CLINICAL RELEVANCE/APPLICATION

Simpler annotations demonstrate their advantages in scaling up datasets for tumor localization in comparison with per-pixel annotations. This not only improves accuracy and generalizability but also allows for better representation of underrepresented groups and identifying rare diseases that may be more prevalent in specific populations.

#### M5B-SPIN-2 Early Prediction of Motor Abnormalities in Very Preterm Infants Using MRI Radiomic Data with a Collaborative Self-Supervised Transformer Model

##### PURPOSE

To develop a collaborative self-supervised learning (Co-SSL) deep learning model for predicting motor abnormalities in preterm infants using MRI radiomic data without large-scale annotated images.

##### METHODS AND MATERIALS

Very preterm infants (gestational age  $\leq 32$  weeks) were enrolled in our institute, and axial T2-weighted MR images were collected on a 3T Philips Ingenia scanner. We processed T2 images using the Developing Human Connectome Project pipeline into 87 regions of interest (ROIs) and the PyRadiomics pipeline to extract 100 radiomic features for each ROI, resulting in a large radiomic feature map ( $87 \times 100$ ) for each subject. We assessed the motor abnormalities using Bayley III Motor score and dichotomized the infants into low-risk (score  $> 85$ ) vs. high-risk (score  $\leq 85$ ) groups. We developed a Co-SSL Transformer model for motor abnormalities prediction. Typical self-supervised learning (SSL) defines a pretext task to pretrain a model without using labels, then fine-tunes the model for the downstream real task. In contrast, our Co-SSL strategy uses two collaborative pretext tasks to jointly pretrain the model. Specifically, we first conducted data augmentation on  $N$  original subjects by randomly masking radiomic features of ROIs from radiomic feature maps, generating  $M$  augmented subjects. We defined two collaborative pretext tasks 1) Reconstruction- to reconstruct the masked radiomic features using the observable ones for all  $M$  subjects, and 2) Discrimination- to cluster  $M$  augmented subjects into  $N$  groups according to  $N$  original subjects. Using these two collaborative tasks, we pretrained a Transformer neural network to learn latent features without human labeling, and then fine-tuned this model for our motor

abnormality prediction. Performance was assessed by 5-fold cross-validation.

## RESULTS

A total of 362 subjects were included in this study, out of which only 318 have Bayley III motor scores at 2 years corrected age. Our Co-SSL Transformer achieved a mean (standard deviation [SD]) accuracy of 76.3 (5.1)% and AUC of 0.73 (0.05), outperforming the supervised Transformer [accuracy = 66.6 (5.3)%, AUC=0.64 (0.05)], SimCLR [accuracy=67.3 (5.2)%, AUC=0.65 (0.07)], and Invariant [accuracy=68.3 (4.4)%, AUC=0.67 (0.08)].

## CONCLUSION

We showed that the proposed model outperformed peer self-supervised ones for early risk stratification of developing motor abnormalities assessed at 2 years corrected age.

## CLINICAL RELEVANCE/APPLICATION

Very preterm infants are especially at increased risk of developing motor abnormalities compared to infants who were term born. Our AI strategy enables the early diagnosis of motor abnormalities using brain MRI radiomics without large-scale annotated datasets.

## M5B-SPIN-3 Quantum Kernel Methods Can Improve Binary Classification of COVID-19 Pneumonia on Chest Radiographs

Participants

John Mayfield, MD, MS, Lithia, FL (*Presenter*) Nothing to Disclose

## PURPOSE

Chest radiography has continued to serve as the workhorse of initial screening and surveillance of patients diagnosed with COVID-19, however, the nonspecific and variable patterns of pneumonia limited diagnostic accuracy as a predictor of disease. Increasingly complex and robust datasets such as COVIDx CXR3 provide enriched training environments for machine learning (ML) models to help clarify diagnosis. However, the stochastic nature of the disease may benefit from emerging technologies that combine ML with quantum computing (QC), known as Quantum machine learning (QML). Here, we evaluate a Quantum Projected Kernel (QPK) method and compare its performance against classical ML methods.

## METHODS AND MATERIALS

8,000 chest radiographs were randomly selected from the COVIDx-CXR3 database and split 80:20 training:validation set as well as a hold-out testing set of 400 cases. The images underwent dimensionality reduction using UMAP and were encoded into a 11-qubit circuit. Google Cirq's Density Matrix simulator was utilized with realistic noise simulation that is based upon Google's Rainbow quantum processor. Kernel density matrices were optimized in a complex Hilbert space to provide greater separation between classes and then subsequently projected into spatial coordinate space. This processed data was then passed through a linear dense classifier layer where accuracy, f1-score, precision, recall, and sensitivity/specificity were calculated for cross-validation and hold-out testing sets.

## RESULTS

The model demonstrated an accuracy of 94% [95% CI: 87-95%] with an AUC of 0.94 [95% CI: 82-95%] and f1-score of 0.92. Performance on the holdout testing set yielded 84% accuracy, AUC of 0.83, with an f1-score of 0.84, precision of 81%, recall of 86%, and sensitivity and specificity of 87% and 81%, respectively.

## CONCLUSION

QPK methods demonstrated promising performance on a diverse database that generalized well to a hold-out testing set. However, further optimization and evaluations are required to assess its performance.

## CLINICAL RELEVANCE/APPLICATION

QML can provide a quantum advantage to the data to potentially improve robustness compared to classical architectures alone. Given the improved accessibility to cloud-based quantum machines, such approaches may increase productivity and reliability of classification strategies, easing the reliance on larger, more complex models.

## M5B-SPIN-4 Joint Self-supervised and Supervised Contrastive Learning for Multimodal Brain MRI at Term: Towards Predicting Motor Impairments in Infants Born Preterm

Participants

Zhiyuan Li, BS, MS, Oxford, OH (*Presenter*) Nothing to Disclose

## PURPOSE

To develop a joint self-supervised and supervised contrastive learning model using multimodal brain MRI at term-equivalent age to predict later motor impairments in infants born preterm.

## METHODS AND MATERIALS

Data acquisition and pre-processing. This IRB approved study involves a multisite cohort of 297 preterm infants born before 33 weeks gestational age. T2-weighted structural MRI (sMRI), diffusion tensor imaging (DTI), resting-state functional MRI (fMRI), and clinical non-imaging data were collected for each subject. We preprocessed each subject using the Developing Human Connectome Project (dHCP) pipeline to segment the whole brain image into 87 regions of interest (ROIs) for the first three modalities. We further extracted radiomic features, structural connectome, and functional connectome from sMRI, DTI, and fMRI, respectively. Individual subjects underwent motor ability assessment using the Bayley-III Motor subtest at 2 years corrected age. We categorized infants into two groups based on their Motor score (range 40-160): high risk of (scores  $\leq$ 85) or low risk of motor impairments (scores  $>$ 85). Joint self-supervised and supervised contrastive learning. Our proposed model is shown in Figure 1. We first designed 5 feature extractors to extract feature embeddings from structural connectome, functional connectome, radiomic features, sMRI images, and clinical non-imaging features, respectively. Next, we pretrained all feature extractors by two pretext contrastive learning tasks, in which the first task was to learn the cross-modality-complementary features by clustering the feature types of an individual patient, and the second task was to learn cross-subject-similarity features by clustering the patient with the same class label.

Finally, we fine-tuned the pre-trained network to solve the real task (i.e., risk stratification of motor impairments) in a supervised manner. We evaluated our model using 10-fold cross-validation.

## RESULTS

Our model achieved an AUC of 0.73, outperforming the Siamese network (AUC=0.65) and Triplet network (AUC=0.68) models. In addition, our model also achieved better prediction performance than the single-modality models, such as the models using DTI (AUC=0.71) or fMRI (AUC=0.70).

## CONCLUSION

We proposed a novel joint self-supervised and supervised contrastive learning model to predict later motor impairments in very preterm infants using multimodal MRI data. The results showed that our proposed model outperformed peer and single modality models, demonstrating the effectiveness of the designed approach.

## CLINICAL RELEVANCE/APPLICATION

The proposed model can facilitate deep learning-based applications for multimodal MRI data.

## M5B-SPIN-5 Towards Patient Consumable Radiology Reports - Improving Content Signal-to-Noise Ratio (SNR) While Converting Medical Jargon to Plain English via GPT-4

### PURPOSE

With the increasing complexity of imaging modalities and the trend toward higher-level structured reporting, radiology reports have become equally as complex and lengthier by default; becoming nearly incomprehensible to the average person (patient). Additionally, there are ongoing efforts to produce patient-consumable radiology reporting. However, we believe that improving radiologist report structure and content is a necessary first step to having consistently structured reports for clinician ease of reading. More concise reports with predictable fields in anatomically oriented top-down logical order more effectively convey meaning. We listed and further removed well-known unnecessary words (noise) common in radiologist reports that do not help convey meaning resulting in an easier-to-read objective report (signal). This was followed by prompting the resultant higher Signal-to-Noise Ratio (SNR) phrases to read in plain English.

### METHODS AND MATERIALS

We first prompted GPT 4.0 (Generative Pretraining Transformer) to common radiologist phraseology that consistently slashed report length in half while maintaining content. Removed commonly used unnecessary words including: there is, of the, within the, visualized, measures, approximately, the patient, at this time. Second, we prompted GPT to convert the higher SNR report text to active voice plain English understanding defined by established doctrine, e.g., SEC (Security and Exchange Commission Rule).

### RESULTS

Report content SNR was doubled (total words cut in half) following the removal of unnecessary words while maintaining meaning for physicians in a more inviting/easier-to-read structured format. Following prompting for improved SNR to read in plain English, the report content was explained in a manner for general public understanding. Example GPT input (37 words): "Nonobstructive renal calculus within the left kidney collecting system measuring approximately 0.4 to 0.5 cm in cross-sectional diameter. This renal calculus was present on prior CT, though it has enlarged compared to the previous study". Example GPT output (17 words): "Enlarged non-obstructive kidney stone in left collecting system measuring 0.4-0.5 cm, previously seen on CT." GPT plain English: This report shows that there is a small stone in your left kidney that is not causing a blockage. The stone is growing and has gotten a bit bigger since your last scan.

### CONCLUSION

We show that GPT-4 can significantly increase the SNR of the radiology report for both physicians and for patients.

### CLINICAL RELEVANCE/APPLICATION

Improving report content SNR leveraging GPT helps referring physicians radiologists report readability further converting to plain English completes radiology's service to our patients.

## M5B-SPIN-6 Quantifying the Technical Challenges and DICOM Metadata Variability in Stroke Machine Learning Data Curation

Participants  
Peter Kamel, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Data curation is a challenging and often rate-limiting task in machine learning algorithm development. This is compounded by heterogeneity of DICOM metadata labeling and storage conventions, which often makes data curation require extensive preprocessing and manual cleaning. The purpose of this study was to quantify the variability in DICOM metadata labeling conventions and analyze the largest factors limiting data curation for the use case of machine learning on stroke CTs and MRIs.

### METHODS AND MATERIALS

We evaluated data curation on a set of stroke MRI-CT pairs consisting of DWI sequences from MRI and associated dual energy CT head with 120 kV and 190 keV virtual monochromatic images. From an initial list of 946 patients, we used DICOM queries to find the studies of interest, identify the b1000 DWI images and thick resolution axial 120 kV and 190 keV images, download the images from the PACS, anonymize them, and convert them to NIFTI file format for machine learning. During each step of the process, errors and limitations of data curation were recorded, characterized, and quantified.

### RESULTS

In the 946 MRI examinations we found 1,122 unique Series Descriptions, of which over 20 were used to identify the DWI sequence, due to varying labeling and storage conventions (Figure 1a). Multiple methods of encoding were used to store the DWI sequence b-value, requiring multiple iterations and regular expression matching to extract the necessary MRI images. Of the initial 946 MRI examination, 24 (2.5%) were missing the appropriate series or unretrievable from the PACS, 2 (0.2%) contained improper or absent

b-value encoding, and 32 (3.4%) contained slice increment, geometric, or orientation inconsistencies that prevented image conversion to NIFTI. Similar challenges were encountered with head CT preprocessing and download which contained 18 unique Series Descriptions for the thick-slice axial images. The final yield of MRI-CT pairs that would be useful for our use case was 815, reflecting an approximately 13.8% data loss from the initial list (Figure 1b).

## **CONCLUSION**

Technical challenges in DICOM metadata variability pose a significant limitation to machine learning dataset curation. Even with extensive manual correcting, a loss of 10-15% can be expected from an initial list to a curated dataset due to technical factors, which do not include scan or clinical limitations on examinations. Such limitations in dataset curation should be considered at the outset of any machine learning project and accounted for during study design.

## **CLINICAL RELEVANCE/APPLICATION**

Machine learning data curation poses significant technical challenges, which need to be accounted for when estimating the yield of an initial data set.

## **M5B-SPIN-7 Mr**

### **PURPOSE**

The purpose of this study is to introduce two approaches that leverage multi-armed bandit algorithms to select the most appropriate participants for each round of training in Federated Learning (FL) for brain tumor segmentation. FL is a machine learning approach that enables collaborative training of a model without sharing data. Developing accurate and reliable machine learning models for brain tumor segmentation in federated settings is crucial, and collaborator selection plays a significant role in achieving this goal. However, choosing the most appropriate collaborators for each round of training in Federated Learning (FL) is a challenge. Hence, Reinforcement Learning (RL) algorithms have potential to tackle this challenge.

### **METHODS AND MATERIALS**

We use RL to evaluate the estimated performance of each collaborator and select the most promising candidates for collaboration. We employ a markov decision process for reward-based selection of collaborators. We measure the estimated performance of each collaborator and the overall performance of the model. Segmentation accuracy and convergence scores are the evaluation metrics used to assess model performances in the OpenFL platform.

### **RESULTS**

The two proposed approaches (epsilon-greedy and upper confidence bound) effectively select the most promising collaborators for each round of training in FL for brain tumor segmentation. The results show that our approach induces participation of the best candidates leading to better segmentation results. The selected collaborators based on the RL approach showed a higher estimated performance than random selection or the batch-wise collaborator selection. Results indicate a positive correlation between selecting the most appropriate collaborators and the overall performance of the model.

## **CONCLUSION**

The proposed multi-armed bandit algorithms effectively select the most promising collaborators for each round of training in FL for brain tumor segmentation. The reward-based selection process encourages the participation of the best candidates, leading to better segmentation results and a generalizable model.

## **CLINICAL RELEVANCE/APPLICATION**

Accurate and reliable machine learning models are essential in clinical settings for early diagnosis and treatment planning. However, after GDPR and HIPAA laws, data privacy concerns limit data sharing, making federated learning a viable approach. This study can lead to better diagnosis and treatment planning for brain tumor patients.

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## Abstract Archives of the RSNA, 2023

M5B-SP1R

### Interventional Radiology Monday Poster Discussions II

#### Sub-Events

#### **M5B-SP1R-1 Prophylactic Internal Iliac Artery Balloon Occlusion in Placenta Accreta Spectrum: Evaluating Efficacy, Risks, and Clinical Implications**

#### **PURPOSE**

This study aimed to assess the efficacy and risks of prophylactic internal iliac artery balloon occlusion (IIABO) in managing placenta accreta spectrum (PAS) disorders and to discuss the clinical implications of this technique.

#### **METHODS AND MATERIALS**

We conducted a retrospective analysis of 623 confirmed PAS cases, including placenta accreta, increta, and percreta, between December 2013 and December 2022. Patients were divided into two groups based on whether they received prophylactic IIABO (Balloon Group, n=310) or not (No Balloon Group, n=313). The diagnosis of PAS was based on ultrasonography and verified by MRI when needed. Clinical management, surgical outcomes, complications, and hospitalization-related outcomes were compared between the groups using independent sample t-test, Mann-Whitney U test, or Fisher's exact test, as appropriate.

#### **RESULTS**

Among 623 confirmed PAS cases, patients were divided into Balloon (n=310) and No Balloon (n=313) groups. The Balloon Group had lower intraoperative bleeding and transfusion, with a significant difference in placenta percreta cases (P=0.03), and shorter operation duration for placenta percreta (P=0.02). No significant differences were observed in demographics, placenta removal, hysterectomy, or obstetric complications between the groups. Balloon Group had higher rates of arterial injury, thrombosis, and lower extremity ischemia (without statistical differences), as well as higher hospitalization costs (P=0.01). Balloon blocking time significantly increased from PA to PI and then to PP (P=0.03).

#### **CONCLUSION**

s Prophylactic IIABO can be beneficial in reducing intraoperative bleeding and operation duration in selected PAS cases, particularly placenta percreta. However, the increased vascular complications and costs must be weighed carefully. Further studies should focus on optimizing patient selection and minimizing complications.

#### **CLINICAL RELEVANCE/APPLICATION**

This study sheds light on the potential benefits and risks of prophylactic internal iliac artery balloon occlusion (IIABO) in managing placenta accreta spectrum (PAS) disorders. While IIABO may be advantageous in specific cases, such as placenta percreta, clinicians must carefully evaluate the associated risks and costs. Future research should focus on refining patient selection and mitigating complications to improve the safety and effectiveness of IIABO in clinical practice.

#### **M5B-SP1R-2 Time-driven Activity-based Cost Analysis of Uterine Artery embolization**

#### **PURPOSE**

Time-driven activity-based costing (TDABC) is the most accurate costing methodology in healthcare. The aim of this study was to increase cost transparency and uncover potential areas for savings in outpatient uterine artery embolization (UAE) for using TDABC methodology.

#### **METHODS AND MATERIALS**

We retrospectively reviewed 109 patients who underwent outpatient UAE for fibroids or adenomyosis at a large urban tertiary academic center between January 2020 and December 2022. A process map defined the steps of UAE during a procedure day. Utilization times were captured from electronic health record timestamps and staff interviews using validated techniques. Capacity cost rates were estimated using a combination of institutional data, regional surveys, and manufacturer proxy prices. Costs were calculated using TDABC methodology for personnel, equipment, and consumables. Consumables were further sub-categorized into standard items, vascular devices (eg, needles, sheaths, catheters, wires), embolic agents (trisacryl gelatin particles and/or gelfoam), medications, and other (eg, contrast, closure devices).

#### **RESULTS**

The mean total cost of UAE was \$4,529 (SD=\$936), the greatest contributor of which was consumables (66%; \$2980 [\$799]), followed by personnel (30%; \$1372 [\$265]) and equipment (4%; \$177 [\$42]). Within consumables, embolic agents accounted for the greatest proportion of costs, accounting for 42% (\$1268 [\$771]), followed by vascular devices (33%; \$980 [\$151]). The cost of embolic agents was highly variable, largely driven by the number of vials (range 1-19) of trisacryl gelatin particles used.

#### **CONCLUSION**

s Consumables accounted for the majority of the total cost of UAE, largely driven by the cost of embolic agents and vascular devices. It is unlikely that improved efficiency in room or personnel time will lead to cost-savings for UAE.

## CLINICAL RELEVANCE/APPLICATION

Understanding true procedural costs and addressing the high cost of consumable equipment in interventional radiology remains an important obstacle in improving the cost-effectiveness of IR procedures.

### M5B-SPIR-4 The Cost of an Interventional Radiology Fellow: Time-driven Activity-based Cost Analysis of Uterine Artery Embolization for Symptomatic Uterine Fibroids

#### PURPOSE

Academic teaching hospitals garner many benefits for undertaking the training of residents and fellows; however, the cost of trainees in the context of clinical care is not well-captured. The aim of this study was to investigate differences in utilization time and total costs between attending alone and attending/fellow cases in patients receiving outpatient uterine artery embolization (UAE) for symptomatic uterine fibroids using time-driven activity-based costing (TDABC) methodology.

#### METHODS AND MATERIALS

We retrospectively reviewed 109 patients who underwent outpatient UAE for fibroids or adenomyosis at a large urban tertiary academic center between January 2020 and December 2022. Using a process map to capture all steps of a single procedure, we gathered utilization times, including pre-procedure care, room time, intra-procedure time, and post-procedure care, from electronic health record timestamps and staff interviews. Capacity cost rates were estimated using validated techniques. Costs were calculated using TDABC methodology for personnel, equipment, and consumables. We analyzed differences in time utilization and costs between procedures performed by an IR attending only (AO) versus an IR attending and IR fellow (AF) using two-sample t-tests, additionally stratifying by time period (July-December vs January-June) to account for trainee experience.

#### RESULTS

Of 109 total cases, 23 (21%) were performed by an attending alone. AO cases had significantly shorter room times (AO vs AF: 141 vs 156 min,  $p=.042$ ) and intra-procedure times (94 vs 110 min,  $p=.009$ ); there were no differences in pre- or post-procedure care times. The mean total cost of AO cases was 12% (\$539) cheaper than AF cases (\$4,103 vs 4,642;  $p=.003$ ). In both AO and AF cases, the greatest contributor of total costs were consumables (70% and 65%, respectively), followed by personnel (27% and 30%). Intra-procedure times were significantly lower for AO cases during July-December (88 vs 114 min,  $p=.024$ ) but not during January-June (99 vs 106 min,  $p=.48$ ).

#### CONCLUSION

The presence of an IR fellow is associated with significantly longer room and intra-procedure times, as well as higher total costs in outpatient UAE. These differences are likely attributable to trainee inexperience during the first half of the fellowship year.

## CLINICAL RELEVANCE/APPLICATION

Cost of procedures varies depending on practice setting, as well as the presence and experience of a clinical trainee. Understanding true costs is important in determining cost-effectiveness of interventional radiology procedures in different environments.

### M5B-SPIR-5 The Evolving Role of IR in the Management of Cholecystitis

#### PURPOSE

(Please review this as an educational exhibit if possible- sorry for the inconvenience!) Teaching Points  
1. Introduce various innovative interventional radiology (IR) management options for cholecystitis and its complications that impact clinical outcomes  
2. Review the success of traditional interventions of cholecystitis by IR  
3. Present a successful example of a standardized multidisciplinary approach for the management of cholecystostomy drains  
4. Demonstrate successful approaches of management of cholecystitis and its complications through the use of novel IR techniques  
5. Review high-impact studies regarding IR management of cholecystitis including new, innovative interventions

#### METHODS AND MATERIALS

Table of Contents  
1. Introduction, including epidemiology of cholecystitis and current traditional surgical management options  
2. Traditional role of IR in the management of non-operative cholecystitis  
3. Review of existing high-impact studies regarding success of percutaneous cholecystostomy drains  
4. Indication, technique, and complications of percutaneous cholecystostomy drain  
5. Standardized management of percutaneous cholecystostomy drains used at our center  
6. Novel roles for IR in management of cholecystitis  
7. Indication, technique, and successful cases of percutaneous stone extraction, electrohydraulic lithotripsy (EHL), and laser lithotripsy  
8. Indication, technique, and successful case of gallbladder cryoablation for chronic cholecystitis  
9. Review of a high-impact studies regarding novel IR techniques: percutaneous cystic duct interventions for non-operative cholecystitis and percutaneous stone extraction  
10. Conclusion and summary

#### RESULTS

-

#### CONCLUSION

s -

## CLINICAL RELEVANCE/APPLICATION

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### M5B-SPIR-6 Prediction of the Benefits of DEB-TACE and Molecular Targeted Sequential Therapy in Advanced Hepatocellular Carcinoma using a Radiological-Clinical Nomogram: A Multi-Institutional Study

#### PURPOSE

To explore the value of a radiological-clinical (Rad-Clinical) model in predicting the clinical efficacy on advanced hepatocellular carcinoma (HCC) after drug eluting beads transcatheter arterial chemoembolization (DEB-TACE), to optimize the targeted sequential treatment.

## METHODS AND MATERIALS

A total of 202 patients with advanced HCC who received DEB-TACE treatment in 17 institutions from June 2018 to December 2022 were retrospectively analyzed (training cohort: n=105; internal validation cohort: n=45; external validation cohort: n=52). Progression-free-survival (PFS) related radiomics were computationally extracted from HCC to build a radiological signature (Rad-signature) with least absolute shrinkage and selection operator regression. A Rad-Clinical model for postoperative PFS was further built according to Rad-signature and clinical variables by Cox regression analysis. It was presented as a nomogram and evaluated by receiver operating characteristic curves, calibration curves, and decision curve analysis. And further evaluate the application value of Rad-Clinical model in clinical stages and targeted sequential therapy.

## RESULTS

Tumor size, Barcelona Clinic Liver Cancer(BCLC) stage, and Radiomics score(Rad-score) were independent risk factors that affect PFS after DEB-TACE treatment for advanced HCC with the Rad-Clinical model being the best model for predicting PFS in these patients (hazard ratio: 2.08; 95% confidence interval: 1.56-2.78;  $P<0.001$ ). Based on this model, low-risk patients had higher PFS than high-risk patients in BCLC-B and C stages ( $P=0.021$ ). Targeted sequential therapy for patients with high and low-risk HCC in BCLC-B stage exhibited significant benefits ( $P=0.018$ ,  $P=0.012$ ), but no significant benefit for patients with high-risk HCC in BCLC-C stage ( $P=0.052$ ).

## CONCLUSION

s The Rad-Clinical model may be favorable for predicting PFS in patients with advanced HCC treated with DEB-TACE and for selecting patients who may benefit from targeted sequential therapy.

## CLINICAL RELEVANCE/APPLICATION

With regard to advanced HCC, we have established several prognostic models or scoring systems to predict survival after TACE . However, the accurate prognosis for HCC patients is not only related to age, lesion size, vascular invasion, treatment methods, lesion number, but also related to the internal features of the lesion .In this study, we investigated the clinical risk factors and CT radiomics features in association with the prognosis of patients with advanced HCC treated with DEB-TACE, and then established and validated a model for predicting postoperative progression-free-survival (PFS). By means of this model, we further identified which patient population could benefit from targeted therapy.

## M5B-SPiR-7 Bacterial Community Analysis of Pyogenic Liver Abscess With or Without Gas Formation by 16S rDNA Sequencing

### PURPOSE

Gas formation is an important feature of pyogenic liver abscess (PLA). The potential relationship between gas formation bacterial composition in PLA remains unclear. The present study attempts to compare bacterial composition between gas-forming PLA (GFPLA) non-gas-forming PLA (non-GFPLA) to identify factors associated with gas formation in PLA .

### METHODS AND MATERIALS

Clinical data from 331 patients with PLA was collected retrospectively, 16S rDNA sequencing was performed to analyze the bacterial composition of pus samples from 60 consecutive PLA patients. Patients were divided into GFPLA non-GFPLA groups according to the presence or absence of gas on computed tomography (CT). Univariate multivariate logistic analyses were used to identify factors associated with gas formation in PLA.

### RESULTS

Rates of extrahepatic migratory infection (EMI), intensive care unit (ICU) admission mortality were significantly higher in the GFPLA group. 16S rDNA sequencing showed no differences in bacterial community richness diversity between the two groups. Linear discriminant analysis effect size (LEfSe) revealed a higher abundance of Enterococcus faecium Enterobacter cloacae in the GFPLA group. However, the presence of Enterococcus faecium Enterobacter cloacae was not associated with the gas formation on multivariate regression analysis. Only the history of digestive system cancer was independently associated with gas formation in PLA .

### CONCLUSION

s No relationship was observed between gas formation bacterial composition in PLA; only the history of digestive system cancer was independently associated with PLA gas formation.

### CLINICAL RELEVANCE/APPLICATION

An increased understanding of the mechanisms underlying PLA gas formation may provide new insights into the clinical phenomenon that patients with gas-forming pyogenic liver abscess (GFPLA) tend to have more severe symptoms increased mortality compared to patients with non-gas-forming PLA (non-GFPLA).

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## Abstract Archives of the RSNA, 2023

M5B-SPMK

### Musculoskeletal Imaging Monday Poster Discussions II

#### Sub-Events

#### M5B-SPMK-1A Preliminary Study of MRI T2 Mapping Imaging of Knee Cartilage in Type 2 Diabetic

##### PURPOSE

To preliminarily explore the effect of type 2 diabetes mellitus (T2DM) on articular cartilage of knee osteoarthritis (OA) based on MRI T2 mapping sequence.

##### METHODS AND MATERIALS

A total of 52 participants were recruited for MRI T2 mapping sequences. The subjects were divided into experimental group and control group. The experimental group was classified as group A of type 2 diabetic osteoarthritis (T2DM OA), with 32 patients and a total of 61 knees; and the control group was classified as group B of non-diabetic osteoarthritis (NDM OA), with 20 persons and a total of 34 knees. Group A was divided into severe group (Ax1) and mild group (Ax2) according to whether there were diabetes-related complications and basal insulin therapy. According to the course of the disease, = 10 years are classified as Ay1 and > 10 years are classified as Ay2 group. Each subject's cartilage was divided into four regions of interest according to the medial and medial femoral condyle and the medial and medial tibial condyle. The cartilage T2 value for each region of interest is defined as the average of the optimal cartilage display level and the most significant lesion level for each region of interest. The optimal cartilage display layer is selected at the middle level of the articular cartilage on this side; and the most significant lesion area level is selected, from the most serious grade of cartilage lesions. The cartilage T2 value of each region of interest is measured twice and averaged calculated.

##### RESULTS

(1) Compared with the NDM OA group, the T2 value of cartilage in the T2DM OA group was generally increased in the early cartilage grading group. (2) The T2 values of knee cartilage in the severe diabetes group were generally greater than those in the mild group, and the T2 values in the medial femoral condyle and the medial tibial condyle were statistically different ( $p < 0.05$ ). (3) When graded according to the course of the disease, the T2 value of cartilage in the Ay2 group was greater than that in the Ay1 group, and the T2 value of the medial tibial condyle cartilage was statistically different ( $p < 0.05$ ).

##### CONCLUSION

The sequence of MRI T2 mapping is able to help assess knee OA by detecting the T2 value of the knee cartilage. Type 2 diabetes has an impact on knee cartilage degeneration, and the course of diabetes and the condition of blood glucose control are correlated with the degree of knee cartilage degeneration.

##### CLINICAL RELEVANCE/APPLICATION

T2 mapping sequence was used to evaluate the quantitative effect of type 2 diabetes on articular cartilage of knee OA, and to provide evidence for early clinical intervention of T2DM OA.

#### M5B-SPMK-2DISH: The Role of Peripheral Involvement

##### Participants

Celia Cantolla, MD, Santander, Spain (*Presenter*) Nothing to Disclose

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

##### PURPOSE

Diffuse idiopathic skeletal hyperostosis (DISH) predominantly affects the axial skeleton. However, it can also affect peripheral joints, even prior to spinal involvement. In this study we aim to assess the frequency, distribution and precocity of lower limb joint involvement in these patients.

##### METHODS AND MATERIALS

We reviewed chest CT scans of 200 patients, from January 1, 2023 to April 31, 2023, dividing them into two groups: first group of 100 patients aged between 50 and 70 years, and second group of 100 patients older than 70 years. We selected patients with DISH following the criteria of Arlet and Mazière. We then reviewed all previous imaging tests (simple x-Ray, CT and MRI) of the lower extremities stored in our PACS for findings characteristic of DISH and their time of onset.

##### RESULTS

We detected 19 DISH patients in the first group (18 men and 1 woman) and 34 in the second (26 men and 8 women). Knee involvement is frequent. Thus, of the 19 patients in the first group, 30% had previous imaging of this joint, and 66% of the cases showed involvement. Of the 34 patients with DISH in the second group, 38% had previous images of the knee, and 53% of them were affected by their disease. In addition, knee involvement was present prior to axial skeletal involvement in 42% of the cases, all of them male. In all patients with knee involvement, the extensor apparatus involvement was in the form of "gull wings".

##### CONCLUSION

s The involvement of the joints of the lower limb joints in DISH disease is frequent and with typical characteristics that allow the diagnosis to be suspected in the absence of imaging studies of the axial skeleton. In a not negligible percentage of cases, peripheral involvement precedes axial involvement, especially in males. Earlier involvement of the axial skeleton is associated with a higher percentage of peripheral joint involvement.

#### **CLINICAL RELEVANCE/APPLICATION**

We should familiarize ourselves with the characteristics of peripheral involvement in DISH that may even precede spinal disease, as early diagnosis is important for treatment and suspicion of complications.

### **M5B-SPMK-3 Opportunistic CT-derived Analysis of Fat and Muscle Tissue Composition Predicts Mortality in Patients with Cardiogenic Shock**

Participants

Babak Salam, Bonn, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Estimation of prognosis in patients presenting with cardiogenic shock (CS) is important to guide clinical decision making. Patients with CS frequently undergo computed tomography (CT) on admission. Aim of this study was to investigate the predictive value of opportunistic CT-derived body composition analysis in CS patients.

#### **METHODS AND MATERIALS**

Amount and density of fat and muscle tissue were quantified from single-slice CT images at the level of the intervertebral disc space L3/L4 in 152 patients with CS. Multivariable Cox regression and Kaplan-Meier survival analyses were performed to determine the predictive value of opportunistically CT-derived parameters of body composition and compare them with established clinical parameters for risk stratification. The primary endpoint was defined as 30-day mortality.

#### **RESULTS**

Within the 30-day follow-up, 90/152 (59.2 %) patients died. On univariable analyses, patient age and lactate as clinical prognosticators, as well as skeletal muscle (SM) area, visceral adipose tissue (VAT) area, area of fat tissue in muscle, and inter-muscle fat fraction as imaging biomarkers, were associated with 30-day mortality. On multivariable analyses, lactate (HR 1.10 (CI:1.04-1.17);  $p=0.002$ ) and patient age (HR 1.04 (CI:1.01-1.07),  $p=0.017$ ), as well as visceral adipose tissue (VAT) area (HR 1.004 (CI:1.002-1.007);  $p=0.001$ ) and skeletal muscle (SM) area (HR 0.987 (CI:0.975-0.999);  $p=0.043$ ) remained as independent predictors of 30-day mortality. Kaplan-Meier survival analyses showed significantly increased 30-day mortality in patients with higher VAT area ( $p=0.015$ ) and lower SM area ( $p=0.035$ ).

#### **CONCLUSION**

s CT-derived VAT and SM area are independent predictors of dismal outcomes in CS-patients and have the potential to become a new imaging biomarker, which is available from clinical CT.

#### **CLINICAL RELEVANCE/APPLICATION**

In this study we propose the use of VAT area and SM area, representing objective measures of patient clinical status, as promising imaging biomarkers for the outcome of patients with CS. The potentially outstanding value of VAT area and SM area is underscored by the fact that, unlike most CS risk scores, they can be rapidly and easily determined using available diagnostic imaging.

### **M5B-SPMK-4 Quantitative Diagnostic Value of CTP on Microcirculatory Perfusion of Lower Extremity Soft Tissues in Diabetic Patients**

#### **PURPOSE**

To quantitatively assess the lower extremity soft tissue perfusion characteristics in patients with unilateral diabetic foot using CTP technique and to initially identify quantitative imaging indicators that can predict lower extremity hemodynamic changes in patients with diabetic foot.

#### **METHODS AND MATERIALS**

A total of 45 patients with unilateral diabetic foot symptoms were included, and the normal side of the limb was included as its own control as the control group and the affected side as the affected foot group. The data were imported into syngo.via workstation for post-processing and analysis to obtain perfusion parameter values, including Blood Flow (BF), Blood Volume (BV), Mean Transit Time (MTT), Time to Peak (TTP), Permeability Surface (PS), and peak residual function of the pulse. Blood Volume (BV), Mean Transit Time (MTT), Time to Peak (TTP), Permeability Surface (PS), Time to Max (T<sub>max</sub>), and permeability (flow extraction, FED)

#### **RESULTS**

There were no statistically significant values of each parameter compared between the two groups of gastrocnemius control and affected foot; there were differences between the BV and FED groups of tibialis anterior control and affected foot groups with perfusion values of BV ( $0.68\pm 0.61$ )/mL and ( $0.44\pm 0.46$ )/mL, respectively, and FED ( $3.56\pm 2.92$ )/(mL/100mL/min) and ( $2.00\pm 2.55$ )/(mL/100mL/min). The differences in BF, BV and FED values were statistically significant between the two groups in the lesser extensor muscles, with perfusion values of BF ( $15.1\pm 17.5$ )/(mL/min) and ( $5.93\pm 5.95$ )/(mL/min), BV ( $1.09\pm 1.27$ )/mL and ( $0.40\pm 0.41$ )/mL, and FED ( $4.67\pm 4.99$ )/(mL/100 mL/min) and ( $1.70\pm 1.89$ )/(mL/100mL/min).

#### **CONCLUSION**

s CTP perfusion imaging of the lower extremity can be used as a reference technique for the initial assessment of the soft tissue perfusion characteristics of the lower extremity in patients with diabetic foot, and some quantitative CTP parameter values of the anterior tibial and lesser adductor muscles can provide some reference basis for the early clinical assessment of the microcirculatory characteristics of the diabetic foot.

#### **CLINICAL RELEVANCE/APPLICATION**

CTP perfusion imaging of the lower extremity can be used as a reference technique for the initial assessment of the soft tissue perfusion characteristics of the lower extremity in patients with diabetic foot.

## **M5B-SPMK-5 The Association Between Change of Muscle Quality and Mortality in Patients with Septic Shock**

Participants

Jiyeon Ha, MD, PhD, (*Presenter*) Nothing to Disclose

### **PURPOSE**

To investigate the prognostic significance of myosteatorsis in septic shock patients undergoing protocolized bundle therapy in the emergency department.

### **METHODS AND MATERIALS**

We conducted a retrospective single center study based on prospectively collected registry of septic shock in adult patients between May 2016 and May 2020. Patients who conducted computed tomography (CT) scan on ED visit day and have prior CT more than 180 days ago were enrolled in this study. Myosteatorsis was defined as sum of low attenuation muscle (LAMA) which represents low quality muscles with fatty infiltration and intermuscular adipose tissue (IMAT) based on CT density of muscle area. Myosteatorsis area difference was calculated between the ED visit day and the prior visit day. An example of body composition measurement is shown in Figure 1. Multivariate logistic regression model was used to evaluate odds ratios (ORs) and 95% confidence intervals (CIs) for 28-day mortality.

### **RESULTS**

Of the 569 enrolled patients, the 28-day survival rate was 40.7% and myosteatorsis area was increased in ED visit day compared with the prior visit day in both non-survival and survival group. But the area was more increased in non-survival group (11.5 cm<sup>2</sup> vs. 22.2 cm<sup>2</sup>,  $p < 0.01$ ). Normal attenuation muscle area was more decreased (-20.0 cm<sup>2</sup> vs. -27.6 cm<sup>2</sup>,  $p < 0.01$ ) and LAMA was more increased (10.9 cm<sup>2</sup> vs. 18.8 cm<sup>2</sup>,  $p < 0.01$ ) in non-survival group. The multivariate analysis showed that the decreased SFA and increased myosteatorsis area were independent risk factor for 28-day mortality of septic shock.

### **CONCLUSION**

s Myosteatorsis area which implies the low quality muscle area was increased in non-survival group of septic shock. Our results revealed the trend of myosteatorsis could be better indicator of septic shock prognosis compared with the single measurement of body composition.

### **CLINICAL RELEVANCE/APPLICATION**

The results of the study suggest that monitoring the trend of myosteatorsis could offer valuable insights into the prognosis of septic shock and guide clinical decision-making to enhance patient management.

## **M5B-SPMK-6 Utilization of AI-aided Osteosarcopenia Measurement on Opportunistic Abdominal CT Scans to Evaluate the Impact of Gastrectomy on Bone Mineral Density**

Participants

Hyunseung Lee, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

Jimi Huh, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

Osteosarcopenia is the co-existence of osteoporosis and sarcopenia, which is closely related with survival outcome in patients with major diseases and elderly patients. In patients treated with gastrectomy, osteoporosis and sarcopenia commonly occurred, but not evaluated routinely in clinical practice. Thus, we applied AI-aided osteosarcopenia measurement methods in opportunistic abdominal CT scans for evaluation of bone mineral density and skeletal muscle area (SMA) in patients treated with gastrectomy.

### **METHODS AND MATERIALS**

In fifty two gastric cancer patients (mean age,  $56.2 \pm 11.3$  years) treated with curative gastrectomy, preoperative and 1-year postoperative abdominal CT scans were analyzed for the SMA and BMD. Deep-learning AI techniques were applied to automatically select the L3 vertebrae level, measure the SMA, and place ROI for trabecular attenuation value. Nutritional risk index (NRI) was also calculated based on laboratory results.

### **RESULTS**

Between preoperative CT and postoperative CT, all patients showed a decrease in the SMA ( $123 \pm 30$  cm<sup>2</sup> vs.  $113 \pm 28$  cm<sup>2</sup>,  $p=0.08$ ) and the trabecular attenuation values ( $137 \pm 31$  HU vs.  $125 \pm 25$  HU,  $p=0.03$ ). The NRI ( $100 \pm 8$  vs.  $92 \pm 12$ ,  $p<0.001$ ), body weight ( $63 \pm 10$  kg vs.  $57 \pm 9$ ,  $p=0.002$ ) and BMI ( $23 \pm 3$  vs.  $21 \pm 3$ ,  $p=0.001$ ) were also decreased. During the 5-year follow-up record, two patients were identified to show osteoporotic vertebral compression fractures. Both patients showed both osteoporosis and sarcopenia.

### **CONCLUSION**

s We found that the significant loss of bone mineral density and skeletal muscle mass occurred in patients treated with gastrectomy through AI-aided measurement techniques on opportunistic CT scans.

### **CLINICAL RELEVANCE/APPLICATION**

AI-aided measurement of bone mineral density and skeletal muscle area simultaneously is greatly helpful to evaluate osteoporosis and sarcopenia in clinical practice using opportunistic CT scans.

## **M5B-SPMK-7 Revolutionizing Bariatric Surgery Outcomes: A Radiomics-Based Model to Unveil the Prognostic Power of Preoperative Skeletal Muscle Analysis on Abdominal CT for Metabolic Syndrome Remission**

### **PURPOSE**

To develop and assess the performance of a CT radiomics-based machine learning predictive model to determine if preoperative skeletal muscle characteristics can predict the remission of metabolic syndrome following bariatric surgery.

### **METHODS AND MATERIALS**

Our study population included 79 morbidly obese patients who underwent bariatric surgery and had abdominal and pelvic CT scans preoperatively and one year postoperatively between January 2019 and October 2020. An experienced musculoskeletal radiologist with eight years of experience, unaware of the patients' clinical information, manually outlined regions of interest encompassing the total abdominal muscle area (including psoas, paraspinal, quadratus lumborum, rectus abdominis, transverse abdominis, and internal and external obliques) on every slice throughout the entire extent of the third lumbar vertebra (L3). We extracted radiomics features from preoperative CT images of skeletal muscle and developed a framework for optimal feature selection. To develop our predictive models, we randomly split the complete dataset into 70% for model development and 30% for model validation. To enhance predictive performance, we employed normalization, standardization, and a random search with 5 repeated 5-fold cross-validation for optimization. We utilized three popular algorithms: logistic regression (LR), random forest (RF), and support vector machine (SVM).

## RESULTS

Feature selection based on absolute correlation (COR) resulted in 43 features with Least Absolute Shrinkage and Selection Operator (LASSO), 35 with Elastic-Net (EN) and 10 with Random Forest (RF). In the cross-validation method, the logistic regression (LR) model achieved the best performance using the COR and RF combination, with train area under the curve (AUC) of 0.774 and test AUC of 0.800. The RF model attained train AUC of 1.000 and test AUC of 0.675 with the COR and RF combination. The SVM model secured train AUC of 0.819 and test AUC of 0.783 using the VIF and RF combination.

## CONCLUSION

In conclusion, our study demonstrates that the CT radiomics-based machine learning predictive models effectively utilize preoperative skeletal muscle analysis to predict the remission of metabolic syndrome after bariatric surgery. Among the models examined, the logistic regression model with the COR and RF combination yielded the best performance.

## CLINICAL RELEVANCE/APPLICATION

This study highlights the potential of radiomics and machine learning approaches in personalized preoperative evaluation and prediction of post-bariatric surgery outcomes, ultimately contributing to the advancement of precision medicine in obesity treatment.

## M5B-SPMK-8 Deep Learning to Quantify Altered Muscle Status and its Association with Survival in Lung Cancer Screening Eligible Individuals

Participants

Johannes Beat Kessler, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

Skeletal muscle (SM) has been described as an important prognostic factor in patients with cancer or cardiovascular disease. However, its prognostic value in asymptomatic screening eligible individuals at increased risk is not routinely determined on performed CT scans due to limited resources. Thus, we used a 3D deep learning model for fully automatic quantification of SM on routine chest CT and explored its association with survival in heavy smokers participating in a lung cancer screening trial.

## METHODS AND MATERIALS

A 3D deep learning model was used to estimate SM volume (SMVol) and SM attenuation (SMHU), a known measure of muscle quality, on non-contrast enhanced lung screening chest CTs of 26,144 participants of the National Lung Screening Trial at baseline and on the 1-year follow-up scan (n=52,228). The primary outcome was all-cause mortality. Secondary outcomes were lung cancer and cardiovascular mortality. The association between SMVol and SMHU and outcomes was assessed via multivariable Cox proportional hazards regression at baseline. In addition, the association between muscle wasting (decrease in SMVol or SMHU [= 20%]) between the baseline and 1-year follow-up scan and mortality was determined.

## RESULTS

A total of 1,839 (7%) deaths occurred over a median follow-up of 6.5 years among the 26,144 participants (age 61.4±5.0 years; 40.9% female). At baseline, multivariable Cox regression revealed an independent association between SMVol, SMHU and all-cause mortality after adjustment for age, sex, BMI, race, pack years, smoking status, prevalent diabetes or hypertension, prior myocardial infarction, prior stroke (SMVol: HR: 0.43, 95% CI [0.21-0.88]; p=0.02; SMHU: HR: 0.62, 95% CI [0.57-0.67]; p<0.001). Individuals with a decrease in SMVol or SMHU >20% within one year had a significantly worse survival than those with stable SM measures (HR adjusted for the same risk factors. SMVol: HR 2.10, 95% CI [1.91-2.31], p<0.001; SMHU: HR 1.78, 95% CI [1.62-1.95], p<0.001). Similar results were obtained for the prediction of lung cancer and cardiovascular mortality.

## CONCLUSION

Altered muscle status is an independent predictor of survival in a high-risk population of heavy smokers participating in a lung cancer screening trial. Deep learning allows for opportunistic assessment of this currently unused but prognostically relevant information with the potential to guide decision-making and improve personalized prevention.

## CLINICAL RELEVANCE/APPLICATION

Deep learning-based opportunistic screening of altered muscle status can identify individuals at increased risk of mortality beyond traditional risk factors in a screening setting. Implementation of such methods may provide a solution to inform risk assessment and improve patient management.

## M5B-SPMK-9 Ability of Radiofrequency Echographic Multi Spectrometry to Identify Bone Fragility in Subjects with Osteogenesis Imperfecta

Participants

Carla Caffarelli, Siena, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

Osteogenesis imperfecta (OI) is a heterogeneous group of heritable bone disease characterized by bone fragility, reduced bone mineral density (BMD), joint laxity, easy bruising, and variable short stature. This study aimed to evaluate the usefulness of the new Radiofrequency Echographic Multi Spectrometry (REMS) technique in the assessment of bone status in subjects with OI.

## **METHODS AND MATERIALS**

In a cohort of 35 subjects ( $39.5 \pm 21.2$  years) with OI and in 30 healthy controls we measured BMD at the lumbar spine (LS-BMD), at femoral neck (FN-BMD) and total hip (TH-BMD) using a dual-energy X-ray absorptiometry device; TBS was calculated using TBS iNsite software. Moreover, REMS scans were also carried out at the same axial sites. Moreover, in OI subjects the presence of prior fractures was reported.

## **RESULTS**

A total of 85.7% of patients presented with a fracture history. The most common fracture sites were extremity long bones (femur, tibia-fibula and radius-ulna) (70.0%) and at vertebral site (54.3%). BMD evaluated by DXA and REMS technique at all measurement sites were all significantly ( $p < 0.01$ ) lower in subjects suffering from OI than in controls. Dividing OI patients on the bases of Silence classification, no differences between the BMD-LS values carried out with the DXA technique between OI type I group and OI Type III and IV group. On the contrary, the OI Type III and IV group presented significantly lower values of both TBS and BMD-LS by REMS with respect to patients OI type I ( $p < 0.05$ ) [figure 1]. TBS value presented significant correlations with both BMD-LS by DXA and BMD-LS by REMS technique, however, the better correlation was observed between TBS values and BMD-LS by REMS.

## **CONCLUSION**

This preliminary study has shown that REMS appears to be an accurate non-ionizing technology able to assess the bone status in subjects with OI. The attractiveness of the use of REMS for bone measurements in OI patients lies in its lack of ionizing radiation, its ease of use and the portability. In fact, the REMS device can be used directly on patient's bed, and this could represent an excellent method for assessing the bone status even in OI subjects with a recent fracture.

## **CLINICAL RELEVANCE/APPLICATION**

This is the first study that has evaluated the usefulness of REMS technology in adult patients with osteogenesis imperfecta. • Finding of a significant correlation between REMS and TBS • REMS could become an important tool able to assess the risk of fragility fractures so helping to overcome the limitations of DXA.

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## Abstract Archives of the RSNA, 2023

M5B-SPMS

### Multisystem Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPMS-1 Detection and Characterization of Urinary Stone Using Virtual Non-contrast Images Derived from Two Dual-energy CT Scanners: A Phantom Study**

#### **PURPOSE**

To assess the feasibility of virtual non-contrast images derived from dual-energy CT (DECT) for urinary stone detection and measurement at different iodine solutions and radiation doses

#### **METHODS AND MATERIALS**

Twenty-four urinary calcified stones (average size: 1.7-5.8mm) were placed in a custom-made cylindrical phantom filled with water and iodine contrast mixture at different degrees of concentration (0, 7, 13, 22, 30 and 57 mg/mL; CT attenuation value: 0, 200, 350, 600, 800 and 1500HU at 120kVp). Thirty-six scans with three radiation doses (CTDIvol) of 5, 10 and 15mGy at the above six iodine concentrations were performed with rapid tube voltage switching DECT (rsDECT) and dual-layer detector-based CT (dIDECT). True non-contrast images (TNC) and virtual non-contrast images (VNC) were reconstructed. Detection rate and measurement of urinary stones were assessed by two radiologists and statistically compared. Stone detection confidence was also assessed using 4-point grading scale (4: detectable; 3: iodine contrast agents and stones are distinguishable; 2: iodine contrast agents and stones are indistinguishable; 1: not detectable). Stones were considered detected only when the score was greater than 2 points. Size (length and width) and CT attenuation value were performed on the coronal image showing the maximal stone diameter.

#### **RESULTS**

Most stones were detected on both TNC and VNC images at different iodine concentrations (rsDECT: 91.7%-100%; dIDECT: 95.8%-100%) with detection confidence greater than 2 except VNC1500HU images (rsDECT: 8.3%-20.8%; dIDECT: 33.3%-45.8%) (Tab.1, Fig. 1). There was no statistically significant difference in stone detection rates among different radiation doses. Stone size and attenuation value on VNC images at different iodine concentrations were significantly lower than those of TNC images except the stone width on rsDECT (Tab.2 and 3). As the radiation dose increased, the measurement difference decreased on the VNC images from rsDECT, while not found on the dIDECT (Fig.2).

#### **CONCLUSION**

s VNC images from the two dual-energy CT enabled reliable detection for urinary stone at moderate iodine concentrations (<30mg/mL) with less dependent on radiation dose. Stone size and CT value measurements were underestimated on VNC images.

#### **CLINICAL RELEVANCE/APPLICATION**

VNC images at different iodine concentrations and radiation doses are feasible to detect and measure urinary stones except higher iodine concentration. It should be noted that stone size and CT value measurements on VNC images were underestimated.

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## Abstract Archives of the RSNA, 2023

M5B-SPNMMI

### Nuclear Medicine & Molecular Imaging Monday Poster Discussions II

#### Sub-Events

#### M5B-SPNMMI-1 **Deep Learning Reconstruction Enables High SNR at Low Counts in SiPM-based PET/CT Imaging**

##### PURPOSE

AiCE-i (Advanced intelligent Clear-IQ Engine-integrated) is an image reconstruction technique designed using deep learning for the Cartesion Prime SiPM-based PET/CT device from Canon. AiCE-i is a denoising reconstruction technique that effectively reduces noise without compromising contrast, leading to stable, high signal-to-noise ratio (SNR) images even with fewer counts contributing to image generation. In this study, we evaluated the relationship between counts and PET image SNR using clinical images with both the conventional method and the new deep learning reconstruction technique.

##### METHODS AND MATERIALS

We analyzed the relationship between liver SNR and counts (True+Scatter) in clinical images of 54 patients who underwent 18F-FDG PET/CT imaging using a SiPM-based PET/CT scanner, Cartesion Prime. The average weight of the patients was 62.5±12.5 kg. All cases underwent at least 4 hours of fasting before PET/CT, and after injection of 233.3±51.1 MBq of 18F-FDG, patients were instructed to rest quietly for 60 minutes. The injected dose per body weight was 3.6±0.3 MBq/kg. Data acquisition started 60±7 minutes after administration, and list-mode acquisition was performed for 5 minutes/bed at the position that included the liver the most (27 cm/bed), followed by 30sec/bed reconstruction from 30 to 300 seconds. The 3D-OSEM method with subset 12, iteration 3, time-of-flight (+), PSF correction (+), and reconstruction using Clear Adaptive Low-Noise Method (CaLM) and AiCE-i were performed. The obtained data were divided into two groups: CaLM and AiCE-i, and statistical analysis was performed using the Kruskal-Wallis test. In the case of significant differences in the multiple comparisons test (Dunn-Bonferroni) for three or more samples, the test was performed. P-values less than 0.05 were considered statistically significant in all analyses.

##### RESULTS

To achieve liver SNR of 10 or higher, which is recommended by the Japanese Society of Nuclear Medicine, a data acquisition time of 120 seconds using CaLM and 30 seconds using AiCE-i was required. In addition, with CaLM, liver SNR increased with increasing counts from 30 to 300 seconds (5.5-16.4,  $r_s=0.98$ ), whereas with AiCE-i, approximately constant liver SNR was obtained from 30 to 300 seconds, which did not correlate with counts (13-16,  $r_s=0.005$ ).

##### CONCLUSION

s Using the deep learning reconstruction technique AiCE-i in SiPM-based PET/CT enables stable high liver SNR even with lower counts contributing to image generation, compared to conventional methods.

##### CLINICAL RELEVANCE/APPLICATION

Deep learning reconstruction in SiPM-based PET/CT improves spatial resolution and contrast, allowing high SNR images at low counts, reducing patient burden and radiation exposure.

#### M5B-SPNMMI-2 **Tolerability of Lutetium-177-PSMA-617 in Men with Prostate Cancer and Baseline Cytopenia**

##### PURPOSE

Results from the VISION trial (NCT03511664) led to the approval of lutetium-177 (177Lu)-PSMA-617 for the treatment of metastatic castration-resistant prostate cancer (mCRPC). This trial excluded patients with baseline cytopenias, thus safety in this frequently encountered patient population is unknown. We aimed to use real-world data to describe the tolerability of radioligand therapy in those with poorer bone marrow reserve.

##### METHODS AND MATERIALS

We retrospectively reviewed the records of all patients, who received a first dose of 177Lu-PSMA-617 at Mayo Clinic in the interval of April 26, 2022, to December 1, 2022. Patients were categorized as having poor marrow reserve on the basis of pre-treatment hematologic parameters, including: (1) an anemia cohort with hemoglobin (Hg) less than 9 g/dL, (2) a thrombocytopenia cohort with platelets (Plt) less than 100 x 10<sup>9</sup>/L, (3) a leukopenia cohort with white blood cell count (WBC) less than 2.5 x 10<sup>9</sup>/L, and (4) a multiple cytopenia cohort. These were exclusionary parameters from the VISION trial. Longitudinal laboratory data and clinical outcomes were collected and analyzed using descriptive statistics.

##### RESULTS

At data cutoff, 273 patients had received one or more doses of 177Lu, including 33 (12%) with at least one baseline cytopenia prior to their first cycle of treatment. In total, there were 25 (76%) patients with anemia, 4 (12%) with thrombocytopenia, 2 (6%) with leukopenia, and 2 (6%) with multiple cytopenias at baseline. The median number of cycles received thus far is 4, including 21 (64%) who are still receiving therapy and 12 (36%) who have permanently discontinued treatment. Median longitudinal changes in blood counts for the anemia cohort are presented in Table 1. Reasons for treatment discontinuation include: toxicity (n=5), disease progression (n=4), or death (n=8). Among the 9 patients who stopped 177Lu for toxicity or disease progression, 5 subsequently also died. Dose reductions or treatment delays for worsening myelosuppression were utilized in 8 (24%) and 8 (24%) patients,

respectively. Transfusions of packed red blood cells or platelets were required for 26 (78%) patients. A total of 16 (48%) received care in the emergency department or were hospitalized.

#### **CONCLUSION**

s Treatment discontinuation for toxicity was rare among men with mCRPC and baseline cytopenias, while receiving <sup>177</sup>Lu; however, these patients have an overall poor prognosis.

#### **CLINICAL RELEVANCE/APPLICATION**

Patients with initial cytopenia have been excluded originally from the Vision trial and in our study, we found that this group of patients can safely receive <sup>177</sup>-PSMA Lutetium.

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## Abstract Archives of the RSNA, 2023

M5B-SPNPM

### Noninterpretive Skills (Beyond Imaging) Monday Poster Discussions II

#### Sub-Events

**M5B-SPNPM-1** **Determining the Utility of Augmented Reality Coupled with Diagnostic Medical Sonography: A Potential Workflow Improvement**

#### PURPOSE

To systematically investigate the advantages and challenges related to the workflow implementation of augmented reality (AR) technology, specifically using the Microsoft HoloLens version 2 (HL2) (MediView LLC), paired with a portable ultrasound (US) equipment system.

#### METHODS AND MATERIALS

After obtaining IRB approval, multiple data collection methods were employed to assess the utility of AR for US applications. A diverse sample of US users, ranging in experience levels, were invited to participate in a video training session, a hands-on demonstration, and remote instruction while wearing the HL2, connected to a portable US system. The duration of participants' tasks was recorded, both with and without the AR platform. Participants' postures and positions were evaluated using the Rapid Upper Limb Assessment (RULA)<sup>1</sup>, which assesses ergonomic risk factors linked to body positioning and muscle usage. Subjects also completed the System Usability Scale (SUS) (IBM, Armonk, New York), a reliable tool for measuring usability consisting of a 10-item questionnaire. Lastly, participants were invited to share qualitative feedback regarding the AR system evaluation.

#### RESULTS

A total of 12 US users provided data during their individual sessions, with and without AR. The time spent on simulated work, both with and without the products, remained consistent, as a group. The RULA scores for the group indicated a lower (better) upper extremity sub-score and a statistically significant lower neck sub-score ( $p < 0.05$ ) when using AR. This suggests a reduced risk of repetitive stress injury when using AR compared to a traditional US examination. Post-test data revealed positive SUS scores, reflecting favorably on both the product and the education and training provided. Participants consistently expressed interest in having access to additional post-processing ultrasound equipment system controls while using the HL2 (i.e., overall gain, power, etc.). Qualitative exit interviews highlighted participants' enthusiasm for incorporating AR systems into their respective clinical workflow.

#### CONCLUSION

s Although larger studies are necessary to validate these initial findings, this cohort identified numerous opportunities for integrating the AR platforms such as the HL2 and portable ultrasound systems. Preliminary evidence suggests that AR usage may offer occupational health benefits when the workflow includes providing ultrasound guidance.

#### CLINICAL RELEVANCE/APPLICATION

Implementation of AR systems for US, have the potential to decrease repetitive stress injuries related to ergonomics in the workplace thereby increasing the productivity and longevity of clinical staff.

**M5B-SPNPM-2** **Online Search Trends Correlation with Imaging Volumes for Screening Mammography and Low-Dose Chest CT: A Multicenter Retrospective Five Year Study of 800,000 Examinations**

Participants  
Emiliano Garza Frias, MD, Monterrey, NL (*Presenter*) Nothing to Disclose

#### PURPOSE

Public awareness of disease and screening programs increases participation in cancer prevention programs. We assessed the correlation between the online search trends and the volume of clinical requests and scheduling for breast and lung cancer screening with mammography and low-dose CT (LDCT) in multicenter settings of a predominantly urban population.

#### METHODS AND MATERIALS

We first obtained the search interest for the terms "lung cancer" and "lung cancer screening," "breast cancer," and "breast cancer screening" from Google Trends data for the entire United States in the last five years (1st Jan 2018 to 31st Dec 2022). Google trends data are displayed as a linear graph on a scale of 0 to 100, where 100 is the peak popularity, and 0 means insufficient data. The weekly trend data were exported to Microsoft Excel. Next, we queried our radiology report search and analytic engine (Nuance mPower) to obtain data on physician orders for mammography and LDCT examinations per week over the same five years. We then performed a Pearson correlation between the weekly Google trends data and the ordered and performed mammography and LDCT.

#### RESULTS

Over the 260-week study duration, 779,366 mammograms and 43,035 LDCT were performed across the 17 sites. There was a significant correlation between the Google trends for "breast cancer screening" and "lung cancer screening" with the corresponding volume of the ordered ( $r=0.48-0.55$ ) and performed ( $r=0.43-0.55$ ) mammograms and LDCT exams. Upon omission of word

"screening," the Google trends for "lung cancer" and "breast cancer" had a much weaker correlation with the volumes of ordered ( $r = -0.07-0.37$ ) and performed ( $r = -0.06-0.23$ ) mammograms and LDCT examinations. Google search spikes during cancer awareness weeks had a stronger correlation with imaging volume surges in breast cancer than for lung cancer.

#### **CONCLUSION**

s Increased interest in "screening" for breast and lung cancer, as reflected in Google trends data, correlates with an increase in the utilization of screening mammography and LDCT.

#### **CLINICAL RELEVANCE/APPLICATION**

Concerted and sustained online efforts aimed at screening awareness can help enhance the utilization of screening exams and help reduce mortality associated with lung and breast cancer.

#### **M5B- SPNPM-3**      **Formal Wellness Training of Academic Radiology Leaders Improves Work-Life Conflict**

Participants

Jay R. Parikh, MD, FRCPC, West University Place, TX (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To investigate the effect of formal leadership training of academic radiology leaders within an academic center on their own burnout and professional fulfillment.

#### **METHODS AND MATERIALS**

The study cohort were academic radiology leaders within one of the largest academic organizations of academic radiologists within the United States. All academic radiology leaders within the organization were electronically mailed a weblink to a confidential IRB-approved survey in April 2021. The survey included validated questions from the Stanford Professional Fulfillment Index (PFI), values alignment, teamwork, overload, and work family conflict. Academic leaders were invited in May 2021 to participate in instructor-led formal training on leading wellness focusing on 5 core leadership skills - emotional intelligence, self-care, resilience support, demonstrating care, and managing burnout. An identical follow-up survey was electronically mailed 6 months after initial training in November 2021.

#### **RESULTS**

The overall response rate of academic radiology leaders was 59 % (19/32). For both measures, there was acceptable internal consistency (Cronbach's  $\alpha = 0.63$  for work exhaustion and  $\alpha = 0.90$  for fulfillment). There was statistically significant improvement in work family conflict (3.32 vs 2.86;  $p=0.04$ ). No statistically significant differences were identified for fulfillment, work exhaustion, alignment, work overload and teamwork scores after training.

#### **CONCLUSION**

s Formal instruction in leading wellness improved work-life conflict for academic radiology leaders. There was no significant change in burnout, fulfillment nor organizational alignment of the leaders.

#### **CLINICAL RELEVANCE/APPLICATION**

Formal instruction in leading wellness raised awareness and improved work-life conflict in academic radiology leaders.

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## Abstract Archives of the RSNA, 2023

M5B-SPNR

### Neuroradiology Monday Poster Discussions II

#### Sub-Events

#### M5B-SPNR-1 Terson Syndrome in Association with Sub-arachnoid Hemorrhage: A Case Report

##### PURPOSE

Introduction: We present a case of Terson Syndrome in a patient with diffuse sub arachnoid hemorrhage

##### METHODS AND MATERIALS

Presentation of Case: 48-year-old lady presented with a history of loss of consciousness. Neurological examination was normal. Fundus examination showed vitreous hemorrhage on both eyes two days after admission. Digital Subtraction Angiography was performed. Aneurysm of the V4 segment of the left vertebral artery was noted. Flow Diverter placement was done. Patient complained of bloaters in eye with loss in visual acuity, ophthalmoscopic examination showed vitreous hemorrhage defined as terson syndrome. The visual acuity gradually improved and was normal after 21 days.

##### RESULTS

Discussion: Terson syndrome can present clinically with loss of visual acuity and bloaters in patient with sub arachnoid hemorrhage.

##### CONCLUSION

s Conclusion: Patient with terson syndrome have improvement in vision gradually within weeks and mostly resolves with fourth to five weeks.

##### CLINICAL RELEVANCE/APPLICATION

Patient with terson syndrome have improvement in vision gradually within weeks and mostly resolves with fourth to five weeks.

#### M5B-SPNR-10 Advanced MRI Techniques in the Diagnosis of Amyotrophic Lateral Sclerosis (ALS): Morphometry, DTI, ASL Perfusion and BOLD Connectivity

##### Participants

Jose Manuel Hidalgo Gomez De Travededo, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

##### PURPOSE

Amyotrophic lateral sclerosis (ALS) is a chronic and progressive neurodegenerative disease characterized by damage to the upper and lower motor neuron, whose diagnosis is currently based on clinical criteria. This study aims to analyze structural and functional MRI parameters in ALS patients to define imaging biomarkers.

##### METHODS AND MATERIALS

An observational cross-sectional study was conducted with a sample of 71 subjects; 34 patients diagnosed with ALS according to El Escorial criteria and 37 age and gender-matched healthy subjects. All participants underwent a basal 3T-MRI including 3D T1WI morphometric sequences, Susceptibility Weighted Imaging (SWI), Diffusion Tensor Imaging (DTI), perfusion Arterial Spin Labeling (ASL) and functional MRI (BOLD), as well as a neuropsychological evaluation. Patients underwent a second MRI and neuropsychological assessment six months later. Post-processing analysis was performed using FreeSurfer, MRTrix, TBSS, BASIL and CONN toolbox software.

##### RESULTS

Morphometric analysis demonstrated greater cortical atrophy in ALS patients, highlighting rolandic regions with left predominance, bilateral amygdala and cerebellum. An association between atrophy and some clinical phenotypes, including cognitive impairment, was found. Greater iron deposition in the rolandic cortex of the patients was quantified by SWI. DTI analysis identified widespread white matter damage in ALS patients, with decreased fractional anisotropy and increased mean diffusivity, in anterior temporal lobe and left frontal lobe. Asymmetric left predominantly disruption of the proximal corticospinal tract (CST), left superior longitudinal fasciculus and frontal aslant tract damage were also notified. Functional connectivity showed foci of motor network impairment in superior and middle frontal gyri and left fusiform gyrus. At six-month reassessment, patients showed an asymmetric progression of the atrophy in rolandic cortex, predominantly right, and cingulate gyrus; further disruption of white matter tracts in frontal and temporal lobes, corpus callosum and CST; and small areas of increased connectivity in motor network and DMN.

##### CONCLUSION

s Advanced MRI techniques permit the identification of structural and functional damage in the brain of ALS patients and demonstrate progression of the atrophy over time. Involvement of motor and extra-motor areas was objectified, supporting the relationship between this condition and the group of frontotemporal dementias.

##### CLINICAL RELEVANCE/APPLICATION

ALS is a rare and fatal disease whose diagnosis, based on clinical parameters, is often delayed. Imaging biomarkers through

advanced MRI techniques could improve diagnostic accuracy and positively impact healthcare practice.

## **M5B-SPNR-11 Prediction of Conversion to Parkinson's Disease in Individuals with Prodromal Symptoms through a Machine Learning Model using MRI**

### **PURPOSE**

Prodromal Parkinson's disease (PD) is the phase during which progressive neurodegenerative pathology is initiated, but motor features necessary for the diagnosis of PD are not yet manifested. Such preclinical nature of prodromal PD leads to the notion that prodromal PD could be considered as being somewhere in between healthy and PD. In this study, we tested the notion by classifying individuals with prodromal PD into those close to healthy and PD respectively and checking plausibility of such distinction.

### **METHODS AND MATERIALS**

From the Parkinson's Progression Markers Initiative (<https://www.ppmi-info.org/>), 75 healthy individuals (59.9±11.3 years, 26 women), 132 individuals with PD (60.7±9.2 years, 44 women), and 66 individuals with prodromal PD (62.3±7.6 years, 31 women) for whom structural and diffusion-weighted MRI data were available at the baseline were included. A machine learning model for distinguishing healthy and PD was constructed using the random forests method based on brain structural features in terms of cortical thickness in 62 grey matter regions and fractional anisotropy in 48 white matter regions. The constructed model was externally tested for additional individuals (83 healthy individuals and 130 individuals with PD). Individuals with prodromal PD were divided into healthy-like and PD-like ones by making predictions with the model, while development of PD at follow-ups was assessed for them.

### **RESULTS**

For individuals with prodromal PD, motor symptoms as assessed with the Unified Parkinson's Disease Rating Scale Part III was significantly lower than individual with PD. In classifying healthy and PD, the machine learning model showed adequately high performance in cross-validation (accuracy = 91.3%) and external validation (accuracy = 93.8% for healthy individuals and 86.7% for individuals with PD). When the model was applied to individuals with prodromal PD, 40 were classified as PD-like ones while the other 26 were classified as healthy-like ones. Of 26 individuals with prodromal PD who were classified as PD-like ones, 8 (30.8%) converted to PD, while none of those who were classified as healthy-like ones were found to develop PD later ( $p = 0.018$  in Fisher's exact test).

### **CONCLUSION**

The externally validated machine learning model for classifying healthy and PD could be used to distinguish healthy-like and PD-like ones among individuals with prodromal PD. Occurrence of all PD converters in PD-like ones suggests that individuals with prodromal PD could be differently positioned on the course of PD development according to their individual risks.

### **CLINICAL RELEVANCE/APPLICATION**

Distinguishing PD-like ones from healthy-like ones among individuals with prodromal PD may help to assess the risk of developing PD.

## **M5B-SPNR-12 Quantitative Parameter Mapping of Brain Structure and Components in Parkinson's Disease and Progressive Supranuclear Palsy**

Participants

Yuki Matsumoto, PhD, Tokushima, Japan (*Presenter*) Nothing to Disclose

### **PURPOSE**

Our aim was to simultaneously evaluate changes in brain structure and components, depending on the level of dopamine receptor cells, in Parkinson's disease (PD) and progressive supranuclear palsy (PSP) using the quantitative parameter mapping (QPM) technique. Additionally, we investigated whether there were differences in the quantitative values of proton density, T1, T2\*, and quantitative susceptibility mapping (QSM) between PD and PSP patients.

### **METHODS AND MATERIALS**

A total of 44 patients with PD and PSP Richardson syndrome (PSP-RS), all of whom provided informed consent, underwent a 3T MRI brain scan (FUJIFILM Healthcare Corporation) and ioflupane [<sup>123</sup>I] SPECT (DaTscan, SIEMENS Healthcare). In this study, the quantitative values of proton density, T1, T2\*, and QSM images were generated. Additionally a synthetic T1-weighted (T1w) image was computed from the T1 map. FreeSurfer was used to estimate the brain volume, cortical thickness, and local gyrification index (LGI) in each region from the synthetic T1w data of these patients. Furthermore, regions of the left and right substantia nigra and red nucleus were determined by drawing a region of interest (ROI) for each patient. The parcellated results were then compared to the average specific binding ratio (SBR) adjusted by age, or the asymmetry index (AI) in the striatum using Pearson correlation coefficients ( $r$ ). Subsequently, the mean proton density, T1, T2\*, and QSM values of each brain region were measured using the parcellated results so as to investigate the relationship between the average SBR and the mean quantitative values. Finally, the standardized mean difference (SMD) was calculated. For SMD calculations, patients with a SBR<4.5 were included to determine differences between PD and PSP patients.

### **RESULTS**

We observed significant positive or negative correlations between the average SBR, cortical thickness, segmented volume, and mean quantitative values (refer to figure). Notably, the right amygdala exhibited the strongest correlation ( $r=0.54$ ), with a volume decrease observed depending on the average SBR. Our results were consistent with previous findings in cases when the correlation was strong.

### **CONCLUSION**

Our findings suggested that QPM can simultaneously evaluate changes in brain structure and components related to dopamine receptor cell levels. Moreover, QPM may prove to be a valuable tool for differentiating between PD from PSP in future research.

### **CLINICAL RELEVANCE/APPLICATION**

QPM has the ability to simultaneously detect changes in brain structure and components based on dopamine receptor cell levels, all

within a short scan time. This makes it a valuable tool that may have clinical applications.

### **M5B-SPNR- 13 Cortical and Subcortical Morphological Alterations in Parkinson's Disease Patients with Depression**

Participants  
Mingrui Qu, Dalian, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

We aimed to explore the alteration pattern of cortical thickness and subcortical volume in Parkinson's disease (PD) with depression and their correlation with the severity of the depressive symptom.

#### **METHODS AND MATERIALS**

PD patients with depression (PDD) (n=42), PD patients without depression (PDND) (n=26) and healthy controls (HC) (n=33) were studied. All subjects underwent a 3D-T1 sequence. FreeSurfer was used to derive measures of cortical thickness and deep grey matter nuclei volume. The FreeSurfer's QDEC was used for cortical thickness analysis and correlation analysis. Multiple comparisons were corrected with Monte Carlo Simulations set at  $P < 0.05$ . ANOVA was applied to compare the subcortical grey matter nuclei volume differences. Age, gender and education were included as covariates.

#### **RESULTS**

The demographic and clinical data are summarized in Table 1. PDD group showed decreased cortical thickness compared to HC in the bilateral superior frontal gyrus, left middle temporal gyrus, right superior temporal gyrus, right insula, and right bankssts. A lower cortical thickness was observed in PDND group compared to HC in the left superior frontal gyrus, right rostral anterior cingulate and right superior temporal gyrus. PDD group only showed decreased cortical thickness in the right superior temporal gyrus compared to PDND group (Figure 1, Table 2). Cortical thinning correlated with higher HAMD scores in the middle temporal gyrus (Figure 2). In subcortical nuclei, PDD group showed significantly reduced volumes in bilateral hippocampus ( $p < 0.001$ ), bilateral amygdala ( $p = 0.008$ ), left thalamus ( $p < 0.001$ ) and right nucleus accumbens ( $p < 0.001$ ) compared to HC. PDD group showed significantly reduced volumes in left thalamus ( $p = 0.008$ ) and right nucleus accumbens ( $p = 0.001$ ) compared to PDND group. However, the volume of bilateral caudate and putamen ( $p < 0.01$ ) increased significantly compared with HC in the two PD groups (Figure 3).

#### **CONCLUSION**

s Depression has an impact on subcortical nuclei volume and cortical thickness in PD patients. Alterations were found in the frontotemporal regions, thalamus, nucleus accumbens and limbic brain region. Interestingly, this study indicated the volumes of bilateral putamen and caudate increased in the PD group; the effect may be due to a compensatory response to impaired cerebral function in early PD.

#### **CLINICAL RELEVANCE/APPLICATION**

We explored the alteration pattern of cortical thickness and subcortical nuclei volumes in PDD. Our study implies the distinct effects of the frontotemporal regions, thalamus, nucleus accumbens and limbic brain region on emotional regulation in PD patients. Our results may guide the discovery of neuroimaging markers and underlying mechanisms related to emotional disorders in PD.

### **M5B-SPNR- 14 Advanced MRI Neuroimaging Biomarkers in Alzheimer's Disease and Their Association with Liquid Biopsy**

Participants  
Jose Manuel Hidalgo Gomez De Travecedo, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Alzheimer's disease (AD) is the most frequent cause of age-related dementia, but it is only suspected when clinical cognitive decline appears and, by then, neural damage is already irreversible. The aim of this study is to define MRI biomarkers to improve diagnostic accuracy and to investigate their relationship with the recently described technique of liquid biopsy (LB).

#### **METHODS AND MATERIALS**

An observational cross-sectional study was conducted with a sample of 150 subjects; 59 patients diagnosed with "dementia due to probable AD" according to NIA-AA criteria and 91 age- and gender-matched healthy subjects. Both groups were drawn from the cohort of a previous neuroepigenetic investigation (iBEAS) carried out in our institution. Participants underwent a 3T MRI including T1WI morphometric sequences, diffusion tensor imaging (DTI) and Arterial Spin Labeling (ASL) perfusion assessment. Post-processing analysis was performed using FreeSurfer, TBSS and BASIL software. iBEAS group had previously identified in LB a series of differentially methylated genes in patients with AD that were proposed as potential biomarkers. In the current project, its association with the alterations detected in MRI was investigated.

#### **RESULTS**

Morphometric analysis showed a marked cortical atrophy in AD patients, highlighting gray matter loss in medial temporal lobe and thalamus. In addition, certain relationships were demonstrated between clinical and epidemiological variables such as age, sex, time of evolution and score on the Mini Mental State Evaluation and atrophy. DTI revealed damage in corpus callosum and fornix, fronto-parieto-temporal deep white matter and parahippocampal gyri. ASL showed hypoperfusion in dorsolateral prefrontal cortex, inferior parietal and temporal lobe and posterior cingulate/precuneus. In the analysis of the results of the liquid biopsy, patients with differentially methylated ISR-2 and TREM-2 genes presented foci of cortical atrophy in the left frontal, right temporal, and bilateral parietal lobes; and in the lower region of the left cerebellar hemisphere respectively. DTI analysis showed greater disruption of white matter tracts in patients with differentially methylated APOE E4, IRS-2 and TREM-2.

#### **CONCLUSION**

s Advanced MRI permits the identification of structural and perfusion brain damage in AD. The association between differential methylation of some genes studied by LB and the pattern of brain atrophy could open the door to the development of new biomarkers of the disease.

#### **CLINICAL RELEVANCE/APPLICATION**

AD is a frequent condition whose current diagnosis is mainly clinical and in most cases delayed. Advanced MRI biomarkers and liquid



biopsy could improve diagnostic accuracy and positively impact healthcare practice.

## **M5B-SPNR-2 Assessment of MRI Vulnerability of the Magnetically Programmable Shunt Valve**

### **PURPOSE**

Hydrocephalus is a condition characterized by accumulation of cerebrospinal fluid (CSF) within the cerebral ventricles which, if left untreated, may exert pressure on the brain, potentially causing brain damage and death. Surgical treatment with a ventricular shunt for drainage of excess CSF is the standard of practice for diagnosed patients. Modern shunts typically contain a programmable valve which controls CSF drainage rate based on symptomatic response. Magnetically programmable valves are important clinically because they allow for noninvasive changes to shunt settings. However, there is concern for unintended changes in setting due to external magnetic sources, such as 3T magnetic resonance imaging (MRI). We aimed to systematically evaluate the resistance of this valve to changes in setting within the MRI environment in a single-center cohort.

### **METHODS AND MATERIALS**

Patients who underwent shunt placement for hydrocephalus between 2016 and 2019 at a single institution were retrospectively included. Demographics, shunt type, shunt valve settings, and dates of shunt valve radiograph and MRI imaging were abstracted from the electronic medical record. Patients were included if they received a Codman Certas shunt and had received an MRI at any point following surgery.

### **RESULTS**

Forty-two patients who received an MRI after shunt placement were included for review of pre- and post-MRI shunt valve radiograph. Average age was 60.7 years (range: 18-85) and 24 patients (57%) were female. One patient (2.4%) with normal pressure hydrocephalus, who resided at a skilled nursing facility, experienced an unintentional change in their shunt valve setting. Four days following 3T MRI for suspicion of stroke, the patient presented to the emergency department (ED) for postural headaches and projectile emesis, symptoms consistent with over-drainage. Shunt valve radiograph demonstrated a decrease in valve setting compared to most recent radiograph prior to MRI. Between MRI and ED presentation, the patient had not seen another neurosurgical provider. After resetting the valve to the appropriate setting, symptoms resolved.

### **CONCLUSION**

In a single-center retrospective cohort of hydrocephalus patients with programmable valves, only 1 of 42 patients had a change in their shunt dial settings potentially related to 3T MRI. Even given the low frequency of this event, shunt valve radiography before and after receiving an MRI is important to ensure that dial setting remain unchanged. Future prospective studies should investigate these effects further as additional advances in MRI-compatible programmable valve technology emerge.

### **CLINICAL RELEVANCE/APPLICATION**

While changes were seen at a low rate (~2%), diligent surveillance of shunt settings after MRI is important.

## **M5B-SPNR-3 The Accero-Rex-Stent - A Giant Stent For Giant Aneurysms**

Participants  
Hermann Kraehling, MD, Muenster, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

Until now, the treatment of giant fusiform aneurysms of the posterior circulation has been a disease that is difficult or impossible to treat, mostly due to the lack of availability of a large-format stent. In this multicentre study, we report on the world's first five clinical deployments of the Accero-Rex-Stents (Acandis) for the treatment of fusiform giant aneurysms.

### **METHODS AND MATERIALS**

The Accero-Rex-Stents are self-expanding, braided, fully radiopaque Nitinol stents. They are available in three different sizes (diameter 7 - 10 mm, length 30 - 60 mm) and intended for implantation in vessels with diameters of 5.5 - 10 mm. The stents were implanted in aneurysm of the posterior circulation.

### **RESULTS**

Five patients with large fusiform aneurysms of the posterior circulation were treated endovascularly using the Accero-Rex-Stents. There were no major technical complications peri- and post-intervention and the implanted stents showed proper contrast perfusion in all follow-up examinations. A significant remodelling and reduction in the size of the stent-covered aneurysms was already seen in the short-term post-interventional course, no major clinical complications occurred.

### **CONCLUSION**

The Accero-Rex-Stents were used safely in five patients for the treatment of fusiform aneurysms of the posterior circulation without any technical complications. The treatment options of giant fusiform aneurysms are extended by the Accero-Rex-Stents.

### **CLINICAL RELEVANCE/APPLICATION**

The treatment options of giant fusiform aneurysms are extended by the Accero-Rex-Stents.

## **M5B-SPNR-4 Determining the Functional Outcome of Patients Presenting with a Large Volume Stroke without Endovascular Intervention to a Level 1 Stroke Center: Single Center Retrospective Review**

### **PURPOSE**

Several lines of evidence demonstrate the effectiveness of endovascular treatment (EVT) for large volume stroke (LVS) as defined by low Alberta Stroke Program Early CT Score (ASPECTS) of less than 6 in decreasing severe disability and death. Despite this, there remains hesitancy to offer EVT in these cases. The modified Rankin Score (mRS) is a validated 7 point scale used to measure degree of disability. We aim to determine the clinical outcome of patients with a LVS who do not undergo EVT utilizing the mRS.

### **METHODS AND MATERIALS**

2485 CT angiograms of head and neck. and CT Head examinations performed between 2018-2021 were obtained from the picture

Time of angiograms or those and nearly one of those examinations performed between 2000-2005 were obtained from the picture archiving and communication system (PACS). Cases presenting with ASPECTS<6 as assigned by a neuroradiologist were identified. Functional outcomes was obtained utilizing the mRS for those patients who did not undergo EVT. Premorbid mRS as defined by degree of disability prior to the acute presenting event and outcome mRS as defined by degree of disability on discharge were collected. All patients with a documented outcome mRS were included in the analysis. Patients were excluded if presenting ASPECTS was >=6, if stroke symptoms were attributable to etiology other than large vessel or tandem occlusion, if metastatic lesions were noted on presentation, if the patient underwent EVT or if the studies had been duplicated. As a further subgroup analysis cases excluded who underwent EVT were also analyzed.

## RESULTS

From the 2485 examinations, 62 had a baseline ASPECTS<6; 34 cases met exclusion criteria. 28 cases were available for analysis [premorbid mRS (n): 0=(11), 1=(3), 3=(4), 4=(6), 5=(2), ?=(2); age range: 28-93; 10 male, 18 female]. All patients progressed from premorbid mRS to an outcome mRS of 5 (n=6/28, 21%) or 6 (n=22/28, 79%). Subgroup analysis of cases which underwent EVT identified 12 cases [premorbid mRS (n): 0 =(7), 1=(2), 3=(3); age range: 45-90; 9 male, 3 female]. 1/11 cases were technically unsuccessful. Of the 10 successful cases, 6 had outcome mRS of 0-3 (60%) and 4 had outcome mRS of 5-6 (40%). 5/10 (50%) of cases returned to premorbid mRS.

## CONCLUSION

s Patients presenting with a large volume stroke will progress to being bedridden or dead irrespective of premorbid functional status without endovascular intervention. Although our analysis of cases who underwent EVT is underpowered, it corroborates current evidence demonstrating that patients presenting with a LVS can have good outcomes and return to premorbid baseline in technically successful cases.

## CLINICAL RELEVANCE/APPLICATION

To better understand the clinical ramifications of not offering endovascular treatment in the setting of large volume stroke.

## M5B-SPNR-5A Systematic Search and Analysis of Diagnostic Reference Levels (DRLs) in Interventional Neuroradiology (INR)

### PURPOSE

The purpose of this study was to identify whether DRLs for diagnostic and interventional neuroradiology have been previously published and whether any guidelines specify optimal or maximum safe doses for various INR procedures. DRLs are crucial in standardizing practice and may potentially reduce radiation doses during such interventions. In general, INR procedures tend to be associated with high radiation doses both to the patient and operators.

### METHODS AND MATERIALS

An extensive electronic search of the literature was performed using 3 different databases, namely Scopus, Web of Science, and PubMed, without language restrictions. Four main keywords were identified for this search as follows: Dose Area Product (DAP), Fluoroscopy Time (FT), Cumulative Air Kerma (CAK) and Diagnostic Reference Levels (DRLs). The keywords and various synonyms were integrated using the Boolean operators "OR" and "AND". A reference management software was used to import the search results from the 3 databases and the results were scanned for duplicates. Strict inclusion and exclusion criteria were developed, and the abstracts were scanned to check whether the studies met the inclusion criteria. All exclusion and inclusion decisions were documented via the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA).

### RESULTS

The included studies were categorised into 4 main groups: - namely 'Cerebral Angiography', 'Aneurysm Coiling', 'Stroke (Thrombectomy)' and 'AVM/AVF Embolization'. The 3rd Quartile Values for DAP, Air Kerma, Fluoroscopy Time and Image Frames from each of the included studies recorded and tabulated for the 4 categories. Analysis of these values were then performed and screened for significant differences. The authors also sought to identify potential reasons for such discrepancies within the included studies.

### CONCLUSION

s To date, few studies have published data regarding DRLs in INR procedures. Guidelines are necessary both for quality control and to reduce procedural radiation doses to "as low as reasonably achievable" as per the "ALARA" principle. This analysis has gathered all the available literature on the matter and may help in future development of standard acceptable doses in INR.

### CLINICAL RELEVANCE/APPLICATION

Identification and analysis of DRLs in INR procedures is essential for subsequent development of recommended radiation doses. Adherence to such recommendations may reduce radiation exposure to "as low as reasonably achievable".

## M5B-SPNR-7 Selective Aberrant Alterations in Structural-functional Coupling of Large-scale Brain Networks with Progressive Supranuclear Palsy

### PURPOSE

We combined functional and structural connectivity to investigate both global and modular-specific topology changes in the brain following progressive supranuclear palsy (PSP). We also hypothesized that the disruption of connections may lead to structural-functional (S-F) connectivity alterations.

### METHODS AND MATERIALS

In our study, 51 PSP and 101 healthy control (HC) subjects were enrolled. These participants underwent 3D-T1WI, rs-fMRI, DTI and neuropsychological assessment. Furthermore, two weighted adjacency matrices, representing the structural and functional connectome, were created using the same cortical parcellation. S-F coupling was determined to use the spearman rank correlation. Then, the intramodular and intermodular connectivity strengths were computed and the graph-theoretic method was used to calculate network topology metric. Finally, we make correlations between clinical scales and S-F coupling.

### RESULTS

For structural connectivity network (SCN). compared with HCs. the intramodular structural connectome of PSP in subcortical cortex

(SC) decreased significantly. The intermodular SCN between SC and the sensorimotor network (SMN) decreased, while the connections between SC and limbic network increased (FDR  $q < 0.001$ ). The characteristic path length ( $L_p$ ) was significantly increased. At the nodal level, these alterations were in SMN, dorsal attention network (DAN), ventral attention network (VAN), frontoparietal network, default mode network (DMN) and SC. For functional connectivity network (FCN), the intramodular functional connectome of PSP in DMN decreased significantly. As the intermodular FCN, DAN-DMN, DAN-SMN, DAN-VAN and DAN-VN decreased (FDR  $q < 0.001$ ). At the global level, the normalized clustering coefficient ( $\gamma$ ), small worldness ( $s$ ) and  $L_p$  were significantly increased and normalized characteristic path length ( $L_p$ ) was decreased. Both PSP and HC groups showed significant correlations in regional S-F connectivity ( $P < 0.05$ ). Besides, we compared regional S-F coupling between PSP and HC by two-sample T-test. We found that PSP increased significantly in visual network (VN), VAN and DMN. Finally, there is no association between S-F coupling and clinical variables.

## CONCLUSION

The S-F coupling features in PSP are aberrant. These results could contribute to better comprehending the relationships between structural and functional underlying the motor impairments in PSP.

## CLINICAL RELEVANCE/APPLICATION

Our study discovered increased S-F coupling in PSP, which would indicate the additional breakdown of coherence between brain function and structural connections after brain damage. These findings suggest that functional reorganization occurs along indirect anatomical pathways in PSP.

## M5B-SPNR-8 Development and Validation of a Deep Learning-based Automatic Brainstem Segmentation and Multi-class Classification Algorithm for Parkinsonian Syndromes using 3D T1-Weighted Images

Participants

Seongken Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To develop and validate a deep learning-based automatic brainstem segmentation and multi-class classification algorithm for parkinsonian syndromes.

## METHODS AND MATERIALS

The model was developed using 3D T1-weighted brain MR images from subjects that were either cognitively normal or had progressive supranuclear palsy, multiple system atrophy of the cerebellar variant, or Parkinson's disease. We used 2D U-NET for architecture and a multi-view ensemble strategy. The final output was inferred using ensemble probabilities. To assess our segmentation performance using Dice similarity coefficient (DSC), we compared segmentation masks with manual labels in both training and external datasets. We evaluated classification performance based on the regional volumetric measurements obtained from segmentation. The multi-class performance was evaluated using five-fold cross-validation. Three classification models based on support vector machine (SVM), random forest, and XGBoost were trained. We adopted the area under the receiver operating characteristic curve (AUROC) as a representative value of classification performance.

## RESULTS

In total, 300, 513, 82 eligible patients were recruited as training, internal, and external dataset, respectively. Our model achieved DSC scores of 0.969 and 0.996 in the training and external datasets, respectively, when compared to the manually labeled ground truth masks for the brainstem region. The multi-class classification algorithm using SVM showed higher differentiation performance than the two other approaches. The AUROCs for SVM were  $0.937 \pm 0.022$  ( $\pm$  standard deviation) and 0.914 for internal and external validation, respectively.

## CONCLUSION

We developed and validated a deep learning model using 3D T1-weighted brain MR images which may allow for fast and accurate differentiation of parkinsonian syndromes.

## CLINICAL RELEVANCE/APPLICATION

Considering the widespread availability of T1-weighted brain MRI, this automated brainstem segmentation algorithm might be a promising and widely applicable method for the differentiation of parkinsonian syndromes in the clinical practice.

## M5B-SPNR-9 Alterations in T1, Proton Density and T2\* Properties of Deep Brain Nuclei in Parkinson's Disease Patients Measured by Synthetic MRI

## PURPOSE

Combined application of T1, proton density and T2\* map for the differential diagnosis of Parkinson disease (PD) from health controls with the Strategically Acquired Gradient Echo (STAGE) technique.

## METHODS AND MATERIALS

41 PD patients and 38 volunteers as the control group were prospectively enrolled. Brain MRI examinations, including STAGE, were performed at 3T (Ingenia CX, Philips Healthcare, the Netherlands). T1, proton density and T2\* maps were obtained after post-processing. The nuclei included in this study were caudate nucleus (CN), putamen (PUT), globus pallidus (GP), thalamus (THU), red nucleus (RN), black nucleus (SN) and dentate nucleus (DN). The regions of interest (ROIs) to cover these structures were manually drawn on T1, proton density and T2\* maps by two researchers using SPIN (Signal Processing in NMR, SpinTech, Inc., Bingham Farms, MI, United States), and the mean value within each ROI was measured and recorded. Statistical analysis was performed using SPSS20.0 software, and the normal distribution was tested in each group. Data in accordance with normal distribution were expressed as means  $\pm$  standard deviation, while the others expressed by median (upper and lower quartiles). Independent sample t-test or Mann-Whitney U test (not in accordance with normal distribution) were used to compare the mean values of T1, proton density and T2\* between PD and control group in both hemispheres, and the differences between the left and right were tested by independent sample t-test or Mann-Whitney U test. A P-value  $< 0.05$  was considered statistically significant.

## RESULTS

Compared to the control group, the T1 values of the CN, GP, DN and the proton density values of the CN, PUT, THU, DN were

Compared to the control group, the T1 values of the CN, GP, RN and the proton density values of the CN, PUT, THU, RN were significantly reduced in the PD group, while the T1 values of the DN was increased. ( $P < 0.05$ ) (Table 4-5, Figure 1-2). Meanwhile the T2\* value of the SN was significantly reduced and the THU was increased in PD patients. ( $P < 0.05$ ) (Table 6, Figure 3). In control group, the T1 values of the right THU and DN and the proton density value of the right DN were significantly lower than when compared to their counterparts in the left. There was no difference in the T1 proton density and T2\* values between the affected side and the healthy side in the PD group. ( $P < 0.05$ ) (Table 1-3, 7-9)

#### **CONCLUSION**

In summary, we found the alterations of T1, proton density and T2\* values may reflect the microstructural changes of deep brain nuclei.

#### **CLINICAL RELEVANCE/APPLICATION**

Combined application of T1, proton density and T2\* map for the differential diagnosis of Parkinson disease (PD) from health controls is potentially promising and valuable methods in clinical application.

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## Abstract Archives of the RSNA, 2023

M5B-SPOB

### OB/Gynecology Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPOB-1 Automatic Detection and Segmentation of Ovarian Epithelial Tumor using a Multitask Model in CT Images**

##### Participants

Jing Ren, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

It is of great importance to identify the location and boundary of the ovarian tumors on medical images. The study aimed to develop and validate a multitask model utilizing the 3D nnU-Net framework in multicentric datasets, which can simultaneously complete the tasks of ovarian tumor detection and segmentation.

##### METHODS AND MATERIALS

Multiphase contrast-enhanced CT images from 748 patients who were histologically diagnosed with ovarian epithelial tumors between January 2016 and September 2022 were obtained from two medical centers. The internal dataset from center A consisted of a training set (n=405) and a testing set (n=135), and the external dataset contained 208 patients from center B. The manual annotations of the primary ovarian tumors by two professional radiologists were served as the ground truth of the datasets. The multitask model utilizing the 3D nnU-Net framework was trained for 500 epochs with a loss function that combined binary cross entropy loss and Dice loss. The training procedure involved the 5-fold cross-validation method, and the ensemble prediction was utilized. The segmentation performance was evaluated using the Dice similarity coefficients (DSCs), 95% Hausdorff distance (HD95), and Average Surface Distance (ASD). To evaluate the detection performance of the model, the recall and precision metrics were calculated.

##### RESULTS

The proposed multitask model exhibited good segmentation performance both in the internal and external testing sets, with average DSCs of 91.2% and 85.1%, respectively. The HD95 and ASD of the model were  $17.79 \pm 35.24$  and  $2.86 \pm 7.27$  in the internal testing set, and  $20.99 \pm 31.41$  and  $4.73 \pm 11.73$  in the external testing set. For the task of ovarian tumor detection, the model showed good performance (recall = 95.3% and precision = 72.9%) in the internal dataset, and promising result (recall = 88.7% and precision = 63.4%) in the external dataset.

##### CONCLUSION

The proposed multitask model shows promising in the automatic detection and segmentation of ovarian epithelial tumors.

##### CLINICAL RELEVANCE/APPLICATION

Our proposed multitask model can automatically and accurately complete the tasks of ovarian tumor detection and segmentation, thus avoiding time-consuming and labor-intensive manual operations.

#### **M5B-SPOB-2 Don't Forget about the Teens! Does Adenomyosis Also Affect Young Girls**

##### Participants

Ana Luiza Di Mango, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the difference in prevalence and pattern of adenomyosis between adolescents and reproductive-age adults patients.

##### METHODS AND MATERIALS

In a retrospective study, we evaluated the findings of dedicated pelvic magnetic resonance imaging (MRI) with a medical request of endometriosis/pelvic pain in 192 female patients, of which 96 were adolescents (aged between 11-19 years) and others 96 were reproductive-age adults. Two radiologists independently evaluated the exams. Adenomyosis was defined as the ectopic presence of endometrium as a punctuate high-intensity T2-weighted signal in the junctional zone (JZ) seen in MRI.

##### RESULTS

The prevalence of adenomyosis in adolescents patients was 8.3% (n=8) and in adult patients was 23% (n=22). Superficial adenomyosis was the most prevalent pattern in adolescent patients, with seven cases (87.5%), while only one case (12.5%) had deep adenomyosis with uterine cavity distortion. In adult patients, the most prevalent pattern of adenomyosis involvement was also superficial (n=11, 50%), followed by deep adenomyosis with uterine cavity distortion (n=8, 36.4%) and deep involvement without cavity distortion (n=3, 13.6%).

##### CONCLUSION

Adenomyosis, like in adults patients, is one of the manifestations of endometriosis in adolescents patients, with a difference in

prevalence of 14.7% in our study. The most common pattern of involvement in both groups was superficial.

#### **CLINICAL RELEVANCE/APPLICATION**

The presence of pelvic pain and/or hypermenorrhea in adolescents patients should raise the suspicion of endometriosis, which despite being more common in adult patients, also affects the first group. Early suspicion and diagnosis of adenomyosis can reduce long-term morbidity.

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## Abstract Archives of the RSNA, 2023

M5B-SPPD

### Pediatric Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPPD-1 Clinical Value of Virtual Unenhanced CT Images for Children with Hepatic Tumors: CT Measurement and Lesion Detection**

##### **PURPOSE**

To access the feasibility of multi-material decomposition based virtual unenhanced images (VUE) replacing true non-contrast (TNC) images in the CT follow-up of children with hepatic tumor

##### **METHODS AND MATERIALS**

This study retrospectively collected 24 children with hepatic tumor who received conventional non-contrast CT scan and sequential dual phase contrast-enhanced spectral CT scans. VUEs were generated at artery phase [VUE(A)] and portal vein phase [VUE(PV)]. Regions of interest were placed on liver parenchyma and tumor site, CT values were measured. The consistency of CT measurement on two-group images were assessed by Pearson analysis and Bland-Altman method. The detection rate of liver tumor lesions was also evaluated with pathologic examination and CT follow-up as standard reference.

##### **RESULTS**

The 24 children contained 10 with hepatoblastoma, 6 with hemangioma, 5 with focal nodular hyperplasia, 2 with hepatic metastases from neuroblastoma and 1 with lymphomatosis. Including 12 showing hypovascular and 12 cases showing hypervascular. The CT<sub>liver</sub> among three-group images shown no statistical difference (both  $P > 0.05$ ), while CT<sub>tumor</sub> were higher in VUEs than TNC ( $P < 0.05$ ). The CT<sub>liver</sub> and CT<sub>tumor</sub> between VUE(A) and VUE(PV) images exhibited strong positive correlation ( $r_{liver} = 0.878$ ,  $r_{tumor} = 0.972$ ,  $p < 0.001$ ). The CT<sub>liver</sub> showed strong correlations between TNC and VUEs [ $r_{VUE(A)} = 0.787$ ,  $r_{VUE(PV)} = 0.802$ ,  $p < 0.001$ ]. For CT<sub>tumor</sub>, VUE(PV) showed moderate correlation [ $r_{VUE(PV)} = 0.497$ ,  $p = 0.014$ ] while VUE(A) showed no correlation ( $r_{VUE(A)} = 0.394$ ,  $p = 0.057$ ) with TNC, however for hypervascular tumors the CT<sub>tumor</sub> had strong correlation between VUE(A) and TNC ( $r = 0.749$ ,  $p = 0.005$ ). Bland-Altman analysis displayed that the VUE(A) had 6 cases and VUE(PV) had 7 cases where the CT<sub>tumor</sub> bias to TNC larger than 10 HU, therein most had hypervascular lesions. For lesion detection, there were total of 111 lesions, TNC, VUE(A) and VUE(PV) had detection rates of 68.47%, 57.66% and 83.78%, respectively.

##### **CONCLUSION**

For CT follow-up of children with hepatic tumor, VUE(PV) could replace TNC, VUE(PV) had good correlation with TNC in CT<sub>liver</sub> and CT<sub>tumor</sub>, and VUE(PV) improved tumor lesion display and internal structure announcement.

##### **CLINICAL RELEVANCE/APPLICATION**

Patients with hepatic tumors need long-term CT follow-up, but children are sensitive to X-ray exposure, excessive radiation may affect growth and development. The CT values measured on the VUE(PV) generated from the enhanced spectral CT data are correlated with that on TNC, and VUE(PV) can improve the lesion detection, so VUE(PV) could replace TNC and reduce the radiation dose of one unenhanced CT scan in the follow-up of children with hepatic tumors.

#### **M5B-SPPD-2A Comparative Analysis of Clinical and MRI Characteristics of Atypical Teratoid Rhabdoid Tumors and Medulloblastomas of the Posterior Fossa in Pediatric Patients**

##### **PURPOSE**

Atypical teratoid rhabdoid tumor (AT/RT) typically presents at a younger age and had a poorer prognosis compared to medulloblastoma. Notwithstanding, these two neoplasms share a considerable degree of neuroimaging overlap and are nearly indistinguishable on MRI. The aim of our study was to discriminate between AT/RT and medulloblastoma through retrospective analysis of their clinical and MRI features, with the ultimate goal of improving treatment strategies and prognostic assessment.

##### **METHODS AND MATERIALS**

Between 2005 and 2022, a total of 16 patients with histopathologically confirmed AT/RT and 58 patients diagnosed with medulloblastoma were retrospectively enrolled from our institution. We evaluated their clinical data and MRI findings, including lesion signals, intratumoral morphologies, and peritumoral/distal involvement.

##### **RESULTS**

The age of children diagnosed with AT/RT was younger than that of children with medulloblastoma ( $2.8 \pm 4.9$  [0-17] vs.  $6.6 \pm 4.0$  [0-18],  $P < 0.001$ ), and the overall survival rate was lower (21.4% vs. 66.7%,  $P = 0.005$ ). With regards to lesion signals on MRI, AT/RT exhibited a lower ADC<sub>min</sub> (cutoff value =  $544.7 \times 10^{-6}$  mm<sup>2</sup>/s, area under the curve [AUC] = 0.845,  $P < 0.001$ ), a lower ADC ratio (cutoff value = 0.705, AUC = 0.860,  $P < 0.001$ ), and a higher DWI ratio (cutoff value = 1.595, AUC = 0.802,  $P < 0.001$ ) than medulloblastoma. In respect to the intratumoral morphologies, the manifestation of the "tumor central vein sign" was found to be predominantly limited to medulloblastoma while being absent in cases of AT/RT (24/58 [41.4%] vs 1/16 [6.3%],  $P = 0.008$ ). For the peritumoral invasion detected on T2WI, AT/RT demonstrated a greater propensity for invasion of the brainstem ( $P < 0.001$ ) and middle cerebellar peduncle ( $P < 0.001$ ) compared to medulloblastoma.

## **CONCLUSION**

s MRI findings that include a lower ADC value, greater peritumoral invasion, and the absence of a "tumor central vein sign" have shown promise in distinguishing AT/RT from medulloblastoma. These discernible MRI features, coupled with the comparatively younger age of AT/RT patients, may account for the inferior prognoses observed in this patient population.

## **CLINICAL RELEVANCE/APPLICATION**

AT/RT can be distinguished from medulloblastoma based on specific MRI findings, such as a lower ADC value, greater peritumoral invasion, and the absence of the "tumor central vein sign." A combination of these MRI features and the patient's age can improve the accuracy of a pretreatment diagnosis of AT/RT versus medulloblastoma. This improved diagnostic accuracy can help guide treatment strategies and aid in prognostic assessment.

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## Abstract Archives of the RSNA, 2023

M5B-SPPH

### Physics Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPPH-1 Feasibility Study of Coronary CT Angiography in Patients with Different Heart Rates under Free Breathing State**

#### **PURPOSE**

To explore the diagnostic value of different heart rates for patients with coronary CT angiography (CCTA) under free-breathing scanning in coronary heart disease.

#### **METHODS AND MATERIALS**

Forty-five patients with suspected coronary atherosclerotic heart disease undergoing CCTA examination were collected in our hospital. According to the real-time monitoring of the heart rate of the scanned patients, they are divided into 3 groups, group A: low heart rate group (heart rate =69 beats/min), group B: medium heart rate group (heart rate 70~80 beats/min), group C: high heart rate group (heart rate =81 times/min), 15 cases in each group. All patients used 256-slice wide-body detector CT (Revolution CT, GE Healthcare) for prospective ECG-gated coronary scans. Transfer the reconstructed image to GE AW 4.7 workstation. Two physicians with experience in cardiovascular CT diagnosis used the blind method to score subjectively and objectively the original images of the three groups of coronary artery imaging, and compared the radiometric measurements of each group. The subjective evaluation adopts the coronary segmentation method of the American Heart Association (AHA), and each segment is scored in 4 grades. Objective image quality evaluation places region of interest on the muscles of the anterior chest wall, the aortic root, the main left coronary artery, the proximal left anterior descending artery, the proximal left circumflex artery, and the root of the right coronary artery. Calculate the signal-to-noise ratio and contrast-to-noise ratio. SPSS 23.0 software was used, and one-way ANOVA analysis was used for comparison among multiple groups.

#### **RESULTS**

The subjective RCA scores of the three groups of image quality were  $3.36 \pm 0.61$ ,  $3.02 \pm 0.69$ ,  $2.90 \pm 0.64$ , respectively; LAD were  $3.35 \pm 0.60$ ,  $3.02 \pm 0.69$ ,  $2.92 \pm 0.62$ ; LCX was  $3.30 \pm 0.59$ ,  $2.97 \pm 0.55$ ,  $2.62 \pm 0.75$ , the difference was statistically significant ( $p$  were 0.000, 0.006, 0.001). The effective radiation dose ED of the three groups of patients was  $9.40 \pm 1.38$ ,  $7.39 \pm 0.96$ ,  $6.28 \pm 1.38$ , and the difference was statistically significant ( $p=0.000$ ).

#### **CONCLUSION**

Heart rate is an important factor affecting the quality of patients' coronary CTA images. Although the image quality of patients with different heart rates under free breathing decreases slightly with the increase of heart rate, it can meet the needs of diagnosis and also reduce the radiation dose received by patients with high heart rates.

#### **CLINICAL RELEVANCE/APPLICATION**

Although the image quality of patients with different heart rates under free breathing decreases slightly with the increase of heart rate, it can meet the needs of diagnosis and also reduce the radiation dose received by patients with high heart rates.

#### **M5B-SPPH-10 CT Number Reliability on Energy Integrating and Deep Silicon Photon Counting Detector CT with Patient Size**

#### Participants

Aria Salyapongse, BS, Madison, WI (*Presenter*) Nothing to Disclose

#### **PURPOSE**

In this study we compared the CT number of six clinically relevant materials on an energy-integrating detector (EID) and a prototype deep silicon photon-counting detector (PCD) CT as an effect of patient size.

#### **METHODS AND MATERIALS**

We performed three sets of dose-matched scans on a patient size-mimicking phantom (Mercury Phantom, Gammex), (1) 120 kV single-energy (SE) EID CT, (2) 80/140 kV rapid kV-switching dual-energy (DE) EID CT, and (3) 120 kV deep silicon PCD CT. Average CT number was calculated for air, water, polystyrene, iodine 10 mg/mL, bone, and polyethylene in (1) 120 kV polychromatic EID, (2) 70 keV monochromatic EID, and (3) 70 keV monochromatic deep silicon PCD image volumes. Trends in CT number with patient size were assessed by plotting CT numbers against phantom water equivalent diameter (WED). Slopes were compared using t-tests with multiple comparison adjustment to assess whether trends in CT number with WED were decreased for deep silicon PCD CT relative to EID CT. CT number accuracy was assessed by calculating ideal material CT numbers using the U.S. National Institute of Standards and Technology (NIST) XCOM database toolkit.

#### **RESULTS**

For all tested materials, deep silicon PCD CT had the smallest magnitude slope of CT number over WED. Deep silicon PCD CT slopes compared with SE EID CT and DE EID CT reached statistical significance for air ( $p = .03$ ,  $p = .007$ ), water ( $p = .02$ ,  $p = .03$ ), iodine

10 mg/mL ( $p < .001$ ,  $p = .04$ ), and bone ( $p < .001$ ,  $p < .001$ ). The accuracy of deep silicon PCD CT was higher than either SE or DE EID CT for all materials based on relative root mean square error. All materials except air had negative slopes for CT number with WED. The slopes for iodine and bone were smallest for deep silicon PCD CT, then DE EID CT, followed by SE EID CT: 20.3, 34.7, 81.5 HU/cm for iodine and 46.9, 113.1, and 186.6 HU/cm for bone, respectively.

## CONCLUSION

The change in CT number over WED was smallest for deep silicon PCD CT for air, water, iodine 10 mg/mL, and bone. The CT number accuracy was closest to the ideal CT number on deep silicon PCD CT for all materials compared with SE and DE EID CT.

## CLINICAL RELEVANCE/APPLICATION

Myriad characterizations in clinical radiology rely on accurate and stable CT numbers, use of deep silicon PCD CT could provide more consistent and accurate CT number over patient size and therefore better classification of tissue in clinical radiology.

## M5B-SPPH- 11 Assessing the Efficacy of Multiple Additive Processing in Contrast Enhancement Boost CT Technique for the Diagnosis of Hypervascular Hepatocellular Carcinoma

Participants

Shinji Yabe, MD, PhD, Kobe, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

For accurate diagnosis of hepatocellular carcinoma (HCC) in contrast-enhanced CT (CE-CT), providing better tumor-to-liver contrast is desirable. Recently, it has been demonstrated that a post-processing technique (CE-boost; Canon Medical Systems) can enhance the degree of contrast in CE-CT and facilitate HCC detection. In this technique, an iodine image can be obtained by subtracting the precontrast from the contrast phase image and is added to the contrast phase image with a non-rigid registration and denoising procedure. Despite the potential for further contrast enhancement via an additional additive process, the efficacy of this process remains unexplored. This study aimed to investigate the usefulness of the CE-boost technique with multiple additive processing for the evaluation of hypervascular HCC.

## METHODS AND MATERIALS

This retrospective study included 21 patients (age,  $74 \pm 8$  years; 13 men) with 31 hypervascular HCCs who underwent multiphase CE-CT. In this study, the late arterial phase (LAP) and portal venous phase (PVP) images were used to evaluate hypervascular HCCs. In the LAP, three types of CE-boost images were created by one to three times additive processing (LAP A1, LAP A2, and LAP A3, respectively). Similarly, three types of CE-boost images were created in the PVP (PVP A1, PVP A2, and PVP A3). Tumor-to-liver contrast-to-noise ratios (CNRs) were calculated in the LAP and PVP and were compared among CE-CT and CE-boost images using the Wilcoxon signed-rank test with Bonferroni correction. Also, the presence or absence of artifacts caused by the CE-boost technique was evaluated using a 3-point scale (1= non-diagnostic, 2= slight artifact, and 3= almost no artifact).

## RESULTS

The mean size of lesions was  $18.8 \pm 15.5$  mm (range, 8-93 mm). The tumor-to-liver CNR was significantly higher in CE-boost (LAP A3) images ( $7.0 \pm 3.9$ ) than in LAP ( $2.9 \pm 1.9$ ), CE-boost (LAP A1) ( $4.3 \pm 2.5$ ), and CE-boost (LAP A2) images ( $5.8 \pm 3.9$ ) (P<0.01 for all). On the other hand, there were no significant differences in tumor-to-liver CNR among CE-CT and CE-boost images in the PVP (P<0.99 for all). Artifacts due to the CE-boost technique were not noticeable in all CE-boost images and were rated 3.

## CONCLUSION

The CE-boost technique with multiple additive processing can increase the conspicuity of arterial phase hyperenhancement of hypervascular HCC by improving the tumor-to-liver CNR. In contrast, improvements in tumor-to-liver CNR were not observed in the PVP for washout assessment of hypervascular HCC.

## CLINICAL RELEVANCE/APPLICATION

CE-boost with multiple additive processing can improve the degree of contrast effect of CE-CT effectively. This technique is especially beneficial in the detection of focal liver lesions that show arterial phase hyperenhancement.

## M5B-SPPH- 12 Low-dose Cerebral Perfusion CT Reconstruction Based on Voxel-level TAC Correction (VTC)

## PURPOSE

To propose a low-dose cerebral perfusion CT (PCT) image reconstruction method and promote the application of PCT imaging in clinical cerebrovascular diseases (CVD) diagnosis.

## METHODS AND MATERIALS

A regularized least-squares method with high interpretability based on voxel-level time-attenuation curve (TAC) correction (VTC) is proposed in this study for low-dose PCT image reconstruction. The theory of third-order Hermite interpolation (THI) is applied to voxel-level TAC correction during dynamic images reconstruction. Clinical PCT imaging data is involved for the evaluation of the proposed VTC method, with peak signal-to-noise ratio (PSNR) and structural similarity (SSIM) being the quantitative indexes for imaging performance measurements. Based on the reconstructed PCT images, hemodynamic maps, including cerebral blood flow (CBF), cerebral blood volume (CBV) and mean transition time (MTT), are calculated to validate its ability to restore hemodynamic parameters.

## RESULTS

Indicated by the PSNR and SSIM values of the low-dose PCT images reconstructed by different methods, the proposed VTC method for low-dose PCT imaging has better performance than several state-of-the-art dynamic CT imaging methods, including the PICCS, ndiNLM, PIDT and NL-T-RPCA methods. Meanwhile, VTC provides the most accurate hemodynamic maps (CBF, CBV and MTT) among all the compared methods.

## CONCLUSION

The proposed VTC method is capable to reconstruct PCT image with satisfactory image quality under a low-dose PCT scan protocol.

## CLINICAL RELEVANCE/APPLICATION

The VTC method remarkably reduced the necessary radiational dose for PCT scan. This meaningful for promoting the application of PCT technique in the clinical diagnosis of CVD.

## M5B-SPPH- Photo-realistic Virtual Endoscopy Images for CT Colonography

13

### PURPOSE

Algorithms introducing photo-realism to the volume rendering (VR) have been investigated since early 2010s; as a result, some applications for photo-realistic VR (PRVR) have been clinically available. However, there are no applications for photo-realistic virtual endoscopy (PRVE) used for the CT colonography (CTC). An image-based deep-learning technique was proposed for CTC; however, CT-number information is ignored in it and it focused on a different reality. The purpose of this study was to investigate methodologies to achieve the PRVE for CTC and compare images between PRVE and a conventional VE.

### METHODS AND MATERIALS

To achieve photo-realistic rendering in VE, the rendering calculation of PRVR was modified to suit to a typical viewing field of VE. Unlike the conventional VR for CT, the photo-realistic rendering reflects the CT-number gradient with small fractions in the shading. Thus, the PRVE improves spatial resolution and is less sensitive to the image noise similarly to PRVR. Exploiting this feature, we reconstructed CT images with a high-resolution kernel to improve shape reproducibility of lesions. For the conventional VE (VEc), a standard kernel for abdomen was used. The following parameters were not altered from routine ones: a slice thickness of 1.0 mm, a table position increment of 0.5 mm, and a CT dose index of  $\sim 3.8$  mGy. The averaged rendering time per frame (RT) was measured for consecutive 100 renderings. One radiologist visually evaluated the superiority of PRVE over VEc using a five-point scale (1: worse, 2: somewhat worse, 3: equal, 4: somewhat better, 5: better) for image sharpness, artifact, lesion conspicuity, and gross morphology of ten clinical cases.

### RESULTS

The RTs of PRVE and VEc were 0.032 and 0.015 s, respectively. The average scores of visual comparisons for image sharpness, artifact, lesion conspicuity, and gross morphology were 5.0, 3.8, 4.1, and 5.0, respectively. The lesions were rendered more clearly with PRVE than with VEc, thanks to the photo-reality enhanced by the high-resolution kernel. Since the CT-number is reflected in the shading more in PRVE than in VEc, residual stools with tagging were able to be easily recognized in the PRVE images.

### CONCLUSION

s The PRVE for CTC exhibited high-quality VE images with better visual evaluations compared to the conventional VE. The PRVE would be effective visualization method for CTC.

## CLINICAL RELEVANCE/APPLICATION

The PRVE can render lesions in CTC more clearly compared to the VEc. Moreover, it was effective in the fecal tagging because the CT number is more reflected in the PRVE rendering than in VEc rendering.

## M5B-SPPH-2 Advancing Optimization Strategies for Oncological Abdominal CT Scanning: The i-Violin EU Project Approach Applied to Photon Counting CT

Participants

Gizem Yegin, MSc, Leuven, Belgium (*Presenter*) Nothing to Disclose

### PURPOSE

To propose CT optimization curves to improve oncological imaging of chest-abdomen CT as worked out in the i-violin EU4Health supported multicenter project for CT Guideline development.

### METHODS AND MATERIALS

An anthropomorphic abdominal phantom with an extension ring (PTW, Germany) and a length of 17cm was scanned on a Siemens Naeotom Alpha photon-counting CT scanner (Siemens-healthineers, Germany). The phantom contains an in-house designed cylindrical insert placed in the center of it. The first half of the insert contains a collection of low-contrast spheres with sizes of 4, 6, and 8mm diameter (15 of each size) while the second half was background only to provide signal-free segments. CT acquisitions were performed with a large range of scanning parameters and reconstruction settings: tube voltage, CTDI, bowtie filter, reconstruction kernel, iterative reconstruction strength, field of view, matrix size, and slice thickness. An anthropomorphic channelized Hotelling model observer was used to predict the human detectability of the spherical targets. From the percentages of correctly detected spheres of the 3 diameters, the threshold diameter (Dtr) at 62.5% correct was determined via logistic regression (GraphPad Prism, USA), and the 95% CI were estimated via bootstrapping. Optimization curves were realized with all Dtr values for specific parameters, each obtained from all scans with these parameter values.

### RESULTS

The results of most CT scan parameter combinations were as expected. As an example, a doubled CTDI value corresponds to a significantly lower Dtr ( $p < 0.001$ ). The results allow to compare the relative impact of the CTDI to other parameters. The switch to a smaller field of view, different slice thickness, bowtie filter, and iterative reconstruction strength did not lead to a significantly different low-contrast image quality ( $p > 0.07$ ). The change to 1024x1024 matrix size from 512x512 gave a significant performance increase ( $p = 0.001$ ). Interestingly, despite the use of the same CTDI, for the phantom with an extension ring, the 120 kVp scan outperformed the 90 kVp scan, while this effect was inverted without the ring.

### CONCLUSION

s From this systematic task-based comparison focused on soft tissue performance, it becomes possible to assess the effects of various parameters quantitatively. When completed with reference levels typically used by multiple centers, this approach may facilitate the development of practical guidelines to optimize CT scan protocols.

## CLINICAL RELEVANCE/APPLICATION

Quantitative and graphical representations of the Dtr values for the different conditions provide a fast approach to measures and parameter settings that would lead to improved soft tissue detection thresholds in abdominal oncological CT.

## **M5B-SPPH-3 Evaluation of Low-contrast Detectability of Abdominal Protocols in Clinical Photon-counting CT**

### **PURPOSE**

Accurate and clear representation of anatomy is essential in the assessment of pathology in clinical computed tomography (CT). With the introduction of photon-counting CT (PCCT) and more advanced iterative reconstruction (IR) algorithms into clinical practice, there is potential to improve low-contrast detectability in clinical CT protocols. Therefore, this work aimed to assess IR image quality to optimize low-contrast detectability and reduce radiation dose in a clinical abdominal CT protocol.

### **METHODS AND MATERIALS**

Data were acquired on a clinical PCCT scanner, Siemens NAEOTOM Alpha. Low contrast detectability was investigated in the CTP 515 low contrast module of the Catphan 600 phantom, which was surrounded by a fat ring to simulate an abdomen and resulted in a water equivalent diameter of 298-mm. Supra-slice contrast rods with a nominal 1.0 % contrast and diameters of 4, 6 and 9 mm were used. A factory abdominal protocol was adjusted to acquire virtual monoenergetic images (VMI) with four tube voltages and two quantum IR (QIR) strengths. VMI were produced at the mean energy of the applied spectrum. The noise power spectrum and task transfer function of each scan protocol was quantified; and detectability index and accuracy for each protocol was also determined using model (in-house non-prewhitening matched filter, NPW) and human observers (in-house 4-alternative forced choice, 4-AFC, scoring with standard deviation, SD), respectively.

### **RESULTS**

Preliminary studies with a NPW model observer show that lower doses can be achieved without sacrificing low-contrast detectability of various target sizes when QIR strength is increased in clinical abdominal protocols. For a 6-mm 1% contrast target, detectability may be matched, regardless of tube potential setting, between a protocol using a CT DIvol of 10 mGy and QIR 2; and another protocol using CT DIvol of 5 mGy and QIR 4. Additionally, 4-AFC human observer studies confirm that detectability is relatively unchanged with different tube potential settings when VMI energy levels are selected to match the mean energy of the applied spectrum. For a 6-mm 1% contrast target imaged with a CT DIvol of 10 mGy and QIR 4, tube potential settings of 70, 90, 120, and 140 kVp yielded 4-AFC detective accuracy scores of  $68.3 \pm 2.6\%$ ,  $65.1 \pm 2.7\%$ ,  $63.7 \pm 2.7\%$  and  $60.6 \pm 2.7\%$ , respectively.

### **CONCLUSION**

Lower doses can be achieved without sacrificing diagnostic capability and low-contrast detectability in clinical PCCT abdominal protocols when QIR strength is increased and appropriate VMI energies are selected.

### **CLINICAL RELEVANCE/APPLICATION**

Comparing various settings in clinical abdominal protocols, this work investigates avenues for optimizing low-contrast detectability in PCCT while also reducing radiation doses.

## **M5B-SPPH-4 Contrast-enhancement Boost Technique on Abdominal-enhanced CT Improves Image Quality of Adamkiewicz Artery**

Participants  
Huiqing Zhou, Jinan, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To evaluate the contrast-enhancement boost (CE-Boost) technique on improvement of the image quality of adamkiewicz artery.

### **METHODS AND MATERIALS**

109 patients who underwent abdominal-enhanced CT in Aquilion ONE Genesis were retrospectively collected. Images of arterial phase were postprocessed with CE-Boost technique. The arterial phase images (group A) and CE-Boost images (group B) were transferred to vitrea workstation to evaluate the objective and subjective image quality. The CT value and image noise (SD) of descending aorta and erector spinae muscle were measured, and signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. Subjective image quality was analyzed by using a five-point scale to score image quality of adamkiewicz artery.

### **RESULTS**

The CT value, SNR, CNR of descending aorta in group A and group B were  $406.2 \pm 104.9$  HU,  $46.1 \pm 13.9$ ,  $46.8 \pm 18.7$  and  $588.9 \pm 157.2$  HU,  $104.6 \pm 48.4$ ,  $120.6 \pm 52.2$ , respectively (all  $P < 0.01$ ). In group A, adamkiewicz artery were observed in 82 patients and observation rate was 75.2% (82/109). In group B, adamkiewicz artery were observed in 97 patients and observation rate was 88.9% (97/109). The image scores of group A (82 cases) and group B (97 cases) were 2 (1.5, 3) and 3 (2, 4), respectively ( $P < 0.01$ ).

### **CONCLUSION**

CE-Boost technique can improve the image quality of adamkiewicz artery.

### **CLINICAL RELEVANCE/APPLICATION**

CE-Boost technology can improve the visualization of adamkiewicz artery, which is beneficial for understanding spinal cord blood supply and improving the therapeutic effect of diseases of the thoracic aorta and abdominal aorta.

## **M5B-SPPH-5 Comparison of Imaging Methods for Ultra-high-resolution CT to Delineate Very Small Vessels: Low Tube Voltage Imaging vs. Small Focal Spot Imaging**

### **PURPOSE**

Imaging techniques with high contrast and spatial resolution are necessary to delineate such as Adamkiewicz. Low-tube-voltage imaging is effective in achieving high contrast, and small-focus imaging is effective in achieving high spatial resolution. Low-tube-voltage imaging requires the use of a large tube current, whereas small-focus imaging is limited by the tube current, which makes it difficult to achieve both low-tube-voltage and small-focus imaging. This study aimed to clarify whether low-tube-voltage imaging or small-focus imaging is superior for delineating blood vessels smaller than 1 mm.

### **METHODS AND MATERIALS**

In this study, we used an ultra-high-resolution CT (Aquilion Precision, Canon, Japan) to scan simulated vessel phantoms (DSA2, Kyoto Kagaku, Japan) with diameters of 1, 0.75, 0.5, and 0.25 mm as well as deep learning reconstruction. The imaging conditions were 80 kVp, large focus (0.8 mm × 1.3 mm) and CTDIvol 16.4 mGy for low-tube-voltage imaging and 120 kVp, small focus (0.4 mm × 0.5 mm) and CTDIvol 16 mGy and 29.6 mGy for small-focus imaging. The simulated vessel phantom was filled with a diluted contrast medium to achieve a contrast of approximately 500 HU (high contrast) and 300 HU (low contrast) against the background at 120 kVp. The peak CT values of the simulated vessels and SD of the background were measured for image evaluation, and the signal-to-noise ratio (SNR) was calculated.

## RESULTS

The SNR of the 1 mm simulated vessel with high contrast dilution contrast media was  $27.75 \pm 0.43$  at low kVp;  $17.74 \pm 0.35$  at small focus 16 mGy;  $22.78 \pm 0.29$  at 29.6 mGy; and  $19.96 \pm 0.45$ ,  $13.16 \pm 0.36$ , and  $22.83 \pm 0.43$  at 0.75 mm, respectively. The values were  $9.07 \pm 0.27$ ,  $7.78 \pm 0.15$  and  $10.75 \pm 0.32$  for 0.5 mm and  $5.52 \pm 0.12$ ,  $6.16 \pm 0.14$ , and  $6.96 \pm 0.13$  for 0.25 mm, respectively. The SNRs of 1 mm simulated vessels with low-contrast diluent were  $19.18 \pm 0.41$  for low kVp;  $12.82 \pm 0.28$  for small focus 16 mGy;  $16.21 \pm 0.27$  for 29.6 mGy; and  $13.3 \pm 0.31$ ,  $8.9 \pm 0.19$ , and  $12.45 \pm 0.26$  for 0.75 mm, respectively. The values were  $7.66 \pm 0.28$ ,  $6.8 \pm 0.23$ , and  $8.41 \pm 0.27$  for 0.5 mm and  $5.52 \pm 0.12$ ,  $6.16 \pm 0.14$ , and  $6.96 \pm 0.13$  for 0.25 mm, respectively.

## CONCLUSION

In microvascular imaging, low-tube-voltage imaging is effective when a sufficient contrast cannot be obtained, whereas small-focus imaging is effective when a large imaging dose is required.

## CLINICAL RELEVANCE/APPLICATION

In ultra-high-resolution CT, if the patient is large, rapid injection of a high-density contrast agent and small-focus imaging at 120 kVp can be used to ensure depiction of very small vessels, although the dose will increase. If the patient is small, Low-tube-voltage imaging can be used to ensure the depiction of very small vessels without increased invasiveness of rapid injection of high-density contrast medium.

## M5B-SPPH-6 Radiology Professional Preferences for CT Radiation Dose and Image Quality Monitoring

### PURPOSE

Existing radiation dose monitoring systems (RDMSs) primarily focus on radiation dose. The purpose of this work was to assess how image quality metrics can be incorporated into these systems taking into consideration the preference of different radiology professionals.

### METHODS AND MATERIALS

A new RDMS was designed to incorporate image quality assessment alongside radiation dose for clinical performance monitoring in CT. The study investigated how such data should be visualized for effective utilization by radiology professionals. To achieve this, a set of key questions was formulated and answered using various charts, illustrating trends, variations, outliers, comparisons, and inconsistencies in radiation dose and image quality data as oriented by the question. Fifteen such charts were then systematically evaluated by 12 experienced radiology professionals of four radiologists, four technologists/radiographers, and four medical physicists, with a combined professional experience of over 130 years. A Likert scale (very useful = 10, useful = 8, moderately useful = 6, slightly useful = 4, and not useful = 0) was used to assess the usefulness of the charts. To provide additional insights on potential improvements, free-text fields were also enabled. The data were analyzed in terms of average score and deviation per group as well as their individual insights.

### RESULTS

The system interface overall received an overall average score of 7.8 out of 10.0. Among the 15 charts, the one comparing scanner radiation output with literature and regulatory standards (i.e., diagnostic reference level and achievable dose across patient body habitus), showed the highest variation in scores among professional subgroups. In contrast, the chart representing scanners workload received similar scores across the subgroups. Specific visualizations resonated differently with each professional group, leading to 58 unique suggestions to better inform performance monitoring.

### CONCLUSION

The study highlighted the importance of including image quality in performance monitoring, regardless of the professional subgroups' preferences. However, we found strong differences across radiology professionals as to what they wish to see visualized.

### CLINICAL RELEVANCE/APPLICATION

A comprehensive monitoring system that integrates radiation dose with image quality assessment should be tailored to different radiology professionals' roles and responsibilities for best clinical practice in radiology.

## M5B-SPPH-7 Impact of X-Ray Tube on Image Quality and Conspicuity of Pancreatic Ductal Adenocarcinoma in Pancreatic Protocol Dual-Energy CT

Participants

Tetsuro Kaga, MD, PhD, Gifu, Japan (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the image quality and conspicuity of pancreatic ductal adenocarcinoma (PDAC) in dual-energy pancreatic protocol CT between two x-ray tubes mounted in Revolution CT Apex.

### METHODS AND MATERIALS

Between January 2019 and March 2022, 80 patients underwent dual-energy pancreatic protocol CT using either Performix HDw (old x-ray tube; Group A, n = 41) or Quantix 160 (new x-ray tube; Group B, n = 39) mounted in Revolution CT Apex, respectively. All data were reconstructed at 70- and 40-keV and with medium-strength level of deep-learning image reconstruction. The two groups were compared in terms of CT dose-index volume (CTDIvol), CT numbers of the abdominal aorta, pancreas and PDAC, background noise, and qualitative scores for image noise, overall image quality, and conspicuity of PDAC.

## RESULTS

The CTDI<sub>vol</sub> was lower in Group B than in Group A (9.2 mGy vs. 7.9 mGy;  $P < .001$ ). The median CT numbers of all anatomical structures at 70- and 40-keV were comparable between two groups ( $P = .06-.78$ ). The background noise at 70- (14 HU vs. 12 HU;  $P = .046$ ) and 40-keV (30 HU vs. 26 HU;  $P < .001$ ) were lower in Group B than in Group A. Qualitative scores for image noise and overall image quality at 70- and 40-keV and conspicuity of PDAC at 40-keV were higher in Group B than in Group A ( $P < .001-.045$ ).

## CONCLUSION

In dual-energy pancreatic protocol CT, Revolution CT Apex with Quantix 160 improved qualitative image quality and reduced radiation dose.

## CLINICAL RELEVANCE/APPLICATION

Even when using the same Revolution CT Apex, the latest x-ray tube of Quantix 160 has clinical impact on the image quality and conspicuity of PDAC.

## M5B-SPPH-8 New Generation Wide Detector Spectral CT: What is the Optimal Monochromatic Energy Level for Diagnosing Iliac Vein Compression Syndrome

### PURPOSE

To determine the optimal monochromatic energy level for iliac vein compression syndrome (IVCS) assessment in dual-energy spectral CT imaging and demonstrate its advantages by comparing with the 120kVp-like images.

### METHODS AND MATERIALS

18 patients (56% female, 51±15y) with suspected IVCS underwent CT venography with spectral imaging mode on a new generation wide detector CT (Revolution CT, GE Healthcare). Scans started at 130s after 85-95 ml (370mgI/ml) was injected at 4.0ml/s speed followed by 40 ml saline. Monochromatic images (every 5 keV from 40 to 70 keV) and 120kVp-like images at 1.25mm were reconstructed and independently assessed by two radiologists both quantitatively and qualitatively. CT attenuation and standard deviation (SD) were measured in regions of interest (40±2mm<sup>2</sup>) in the following locations: bilateral common iliac artery and vein, psoas muscle and subcutaneous fat. The SD value for subcutaneous fat was used to represent image noise and to calculate contrast-to-noise ratio (CNR) for the arteries and veins. The data were analyzed using SPSS 22.0.

### RESULTS

CT attenuation and CNR values increased monotonically as energy level decreased with the monochromatic images at 40keV having the highest CT attenuation and CNR vein (6.26±1.08), CNR artery (7.32±1.45). However, the image noise at 40keV was also the highest (Fig1), shifting the highest subjective image quality score to 55keV (4.82±0.49,  $p < 0.05$ ). Reader 1 chose 55 keV in 61% cases, 50 in 33%, 60 in 6%. Reader 2 selected 55 keV in 50% cases, 50 in 33%, 60 in 17%. The monochromatic images improved both the quantitative and qualitative image quality over the 120kVp-like images (all  $p < 0.001$ ).

### CONCLUSION

Low energy (50-55keV) monochromatic images in spectral CT improves image quality for IVCS compared with 120kVp-like images.

### CLINICAL RELEVANCE/APPLICATION

Spectral CT images at the optimal energy level may be used to improve image quality for the assessment of iliac vein compression syndrome.

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## Abstract Archives of the RSNA, 2023

M5B-SPRO

### Radiation Oncology Monday Poster Discussions II

#### Sub-Events

#### M5B-SPRO-1 Prediction of EGFR Mutations in Non-small Cell Lung Cancer Based on Hybrid Radiomics

##### PURPOSE

This study aimed to predict EGFR gene mutations in non-small cell lung cancer patients based on deep learning and radiomics using CT and clinical characteristics.

##### METHODS AND MATERIALS

A total of 1,917 patients with non-small cell lung cancer were selected as the final study population, who underwent contrast-enhanced CT scans and EGFR gene testing before treatment. Clinical characteristics included gender, family history, height, and weight. The region of interest was segmented from CT images to extract radiomics features and obtain tumor images. The tumor images were used as input data for a CNN model to extract 512 image features, and combined with radiomics features and clinical data to predict EGFR gene mutations. The generalization performance of the model was evaluated using external institutional data.

##### RESULTS

AUROC was used as the performance evaluation metric. The model using tumor images and radiomics features as input data showed an AUROC of 0.67. The model using tumor images, radiomics features, and clinical data showed an AUROC of 0.72.

##### CONCLUSION

This study provides a convenient and non-invasive method for predicting EGFR gene mutations. EGFR gene mutations play a very important role as one of the factors that increase the risk of recurrence in non-small cell lung cancer patients, and can also be used to determine treatment strategies. Therefore, further research is needed to improve the accuracy of the model and address issues related to data collection in the future.

##### CLINICAL RELEVANCE/APPLICATION

EGFR gene mutation is the most commonly observed gene mutation in non-small cell lung cancer patients. EGFR is a signal transduction protein that regulates cell growth and division. When the DNA sequence inside the gene is mutated, the signal transduction pathway works abnormally, causing cancer cells to rapidly proliferate or form tumors. Existing gene mutation tests can only observe a part of the tumor, not the entire tumor, and thus cannot determine the heterogeneity of the entire tumor. In addition, there are technical difficulties and high costs associated with conventional methods, so a non-invasive and convenient test method must be developed to overcome these limitations.

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## Abstract Archives of the RSNA, 2023

M5B-SPVA

### Vascular Imaging Monday Poster Discussions II

#### Sub-Events

#### **M5B-SPVA-1 Benefit of Photon-counting CT for Lower Extremity CTA Compared to Conventional Energy-integrating Detector CT**

##### Participants

Safa Hoodeshenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the impact of photon-counting detector (PCD) CT on radiologist confidence and visualization of below-knee arteries at lower extremity CT angiography (CTA) compared to conventional energy-integrating detector (EID) CT.

##### METHODS AND MATERIALS

Patients who underwent clinically-indicated lower extremity CTA performed on a commercial PCD CT system (NAETOM Alpha, Siemens), as well as a prior or subsequent lower extremity CTA performed with EID CT were included. PCD-CTA included 0.6 mm slices with sharp kernel (Bv68), whereas EID CTA included 2 mm slices using routine kernel (Bv44), per clinical protocols. Two radiologists independently reviewed the anonymized and randomized CTA exams in separate reading sessions, with each patient's images appearing once per reading session. Readers estimated maximum stenosis grade for each of 7 below-knee arterial segments (popliteal to dorsalis pedis and plantar arteries), noting confidence in stenosis grading (0-100%). Visualization of small vessels was evaluated by counting the number of fibular perforators and grading visualization of fibular perforators, dorsalis pedis and plantar arteries on a 5-point Likert scale (1=worst, 5=best). Image quality metrics (i.e., sharpness, enhancement, and overall image quality) were assessed per patient.

##### RESULTS

25 patients (mean age  $68 \pm 10$  years; M: F=18: 7) underwent CTA runoff using PCD-CT (mean contrast volume:  $120 \pm 14$  cc) and EID-CT (mean contrast volume:  $114 \pm 16$  cc). For both readers, confidence in stenosis grading was significantly higher in PCD-CT for all evaluated arterial segments (e.g., popliteal artery  $92.9 \pm 6$  vs.  $77.3 \pm 14.7$ ;  $p < 0.001$ ; dorsalis pedis artery  $90.6 \pm 6.4$  vs.  $67 \pm 19.5$ ;  $p < 0.001$ ). The number of visualized fibular perforators was significantly higher with PCD-CT ( $8.1 \pm 3$  vs.  $5.4 \pm 2$ ;  $p < 0.001$ ). Visualization of small vessels was rated significantly higher with PCD-CT for all the evaluated small vessels (e.g., plantar arteries:  $4.5 \pm 0.8$  vs.  $3.1 \pm 0.8$ ,  $p < 0.001$ ; fibular perforators,  $p < 0.001$ ; dorsalis pedis,  $p < 0.001$ ). PCD-CT had significantly greater arterial sharpness ( $4.7 \pm 0.5$  vs.  $2.7 \pm 0.9$ ;  $p < 0.001$ ), arterial enhancement ( $4.3 \pm 0.6$  vs.  $3.4 \pm 0.7$ ;  $P < 0.001$ ), and overall image quality ( $4.6 \pm 0.6$  vs.  $3.3 \pm 0.8$ ;  $P < 0.001$ ).

##### CONCLUSION

Lower extremity CTA runoff with PCD-CT and 0.6 mm slices resulted in significantly increased reader confidence in small vessel stenosis grading, a higher number and improved visualization of small arteries, and greater arterial sharpness and enhancement.

##### CLINICAL RELEVANCE/APPLICATION

Thin-slice PCD-CT improved visualization of small calcified below-the-knee vessels, with greater reader confidence and higher number of visualized small vessels.

#### **M5B-SPVA-2 Short Segment Linear Flaps" of the Abdominal Aorta are Not Dissections: Discovery of their Origin via Retrospective Imaging Review**

##### Participants

Amar Shah, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### PURPOSE

Linear filling defects of the abdominal aorta are often referred to as focal aortic dissection or flaps in radiology reports, triggering concern amongst clinicians for acute aortic syndrome. However, these "flaps" are highly unlikely to represent true intimal dissection flaps given their short segment and often incidental discovery. This retrospective study aims to determine the etiology of linear filling defects of the abdominal aorta utilizing prior contrast-enhanced (CE) imaging.

##### METHODS AND MATERIALS

An IRB-approved, HIPAA compliant retrospective study was performed. Abdomen/pelvis CT reports finalized Jan 2021 through Dec 2022 from two sites of an academic medical center were queried for the terms "focal dissection," "dissection flap," "linear filling defect," and "linear flap". Duplicate patients were removed. Exclusions based on reports were vessel other than abdominal aorta, thoracoabdominal dissection, no prior CE imaging, and less than 6 months between exams. On imaging review, cases with no change in appearance between exams were excluded. Cases were excluded if medical record review indicated femoral catheter access between imaging exam dates. Imaging review of more recent exam included presence of flap, flap calcification, and qualitative assessment of aortic caliber at the level of flap. Prior exam assessment included evaluation of aortic caliber and aortic



findings at the location of subsequent flap.

## **RESULTS**

Report query yielded 865 reports and 702 unique patients. After initial exclusion, the imaging of 70 patients was reviewed, of which 40 were excluded for lack of change in imaging appearance of the linear filling defect. 10 patients were excluded for femoral access, yielding a final population of 20 patients. There was a median of 70 months between imaging exams (range 14-230). All aortas were atherosclerotic and 75% (n=15) were ectatic or aneurysmal at the level of flap; on the older exam only 5 aortas were ectatic or aneurysmal. Of 20 cases, mural thrombus or partially ulcerated mural thrombus was present at the flap site in 17, thrombosed PAU in 1, and no corresponding findings in 2.

## **CONCLUSION**

s Short segment linear filling defects within the abdominal aorta correspond to sites of prior mural thrombus. Mural thrombus has ulcerated or resorbed, leaving behind the luminal surface of the thrombus. Therefore, short segmental filling defects within the abdominal aorta should not be referred to as a dissection flap but rather a remnant of ulcerated and resorbed mural thrombus.

## **CLINICAL RELEVANCE/APPLICATION**

Linear filling defects of the abdominal aorta are often reported as focal dissections, but this incorrectly describes their pathophysiology. These filling defects are the remnant surface of ulcerated/resorbed mural thrombus.

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## Abstract Archives of the RSNA, 2023

R2-SPBR

### Breast Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPBR-1 The Value of Dual-Energy CT Quantitative Parameters in Predicting the Nature of Breast Space-Occupying Lesions

Participants  
Minghui Wei, Nanning, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the value of parameter of dual energy CT in predicting breast space occupation lesions.

#### METHODS AND MATERIALS

66 patients with breast space occupation lesions confirmed by pathology who tested by enhancing arterial and venous dual energy CT scan of breast in our hospital from Jan 2023 to Mar 2023 were collected, which were 42 cases of invasion breast cancer and 24 cases of fibroadenoma. To obtain the iodine map, use the virtual plain scan program. Then, use the single energy spectrum program to obtain the energy spectrum curve of the lesion. Record the CT value of the lesion at both 40 keV and 70 keV. Finally, calculate the slope of the energy spectrum curve ( $\alpha = (CT_{40keV} - CT_{70keV}) / (70 - 40)$ ). The study utilized the rank sum test to compare quantitative parameters on two-phase images between benign and malignant groups, and also used the Spearman rank sum test to analyze the correlation between quantitative parameters and breast space-occupying lesions.

#### RESULTS

During the arterial phase, the IC of the lesions in the malignant and benign groups were 0.700 (0.4, 0.9) and 0.100 (-0.3, 0.5 mg/mL), and the  $\alpha$  values were 0.995 (0.5, 1.4) and 0.330 (-0.4, 0.9). During the venous phase, the IC of the lesions in the malignant and benign groups were 1.800 (1.4, 2.6) and 1.000 (0.3, 1.6) mg/mL, respectively. Additionally, the  $\alpha$  values were 3.265 (2.6, 4.6) and 1.415 (0.3, 3.0) for the malignant and benign groups, respectively. In both arterial and venous phases, there were significant statistical variations in IC and  $\alpha$  values between the two types of pathological lesions ( $P < 0.05$ ). The IC and  $\alpha$  values of arterial and venous phase lesions exhibit weak to moderate correlation with the pathological types of breast space-occupying lesions.

#### CONCLUSION

The dual-energy CT iodine map and the slope of the energy spectrum curve are effective in distinguishing between benign and malignant breast space-occupying lesions. They also show a strong correlation with pathological types and provide quantitative information for differential diagnosis. These methods offer a valuable means of analysis for breast space-occupying lesions of different pathological types.

#### CLINICAL RELEVANCE/APPLICATION

The dual-energy CT iodine map and the slope of the energy spectrum curve are effective in distinguishing between benign and malignant breast space-occupying lesions.

#### R2-SPBR-2 Multiparametric MRI Assessment of Primary Tumor for Predicting Axillary Tumor Burden in Women with Invasive Breast Cancer

Participants  
Jin You Kim, MD, PhD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

To assess whether multiparametric MRI features of a primary tumor are associated with axillary lymph node tumor burden in women with invasive breast cancer.

#### METHODS AND MATERIALS

This retrospective study evaluated women with invasive breast cancer who underwent 3-T multiparametric breast MRI including diffusion-weighted imaging (DWI) between 2019 and 2020. Two radiologists independently evaluated peritumoral edema and intratumoral necrosis on T2-weighted imaging (T2WI) and measured the mean, minimum, and maximum apparent diffusion coefficient (ADC) values by manually placing regions of interest within the breast tumors. Quantitative kinetic features of breast cancer assessed with computer-aided diagnosis (CAD) and clinical-pathologic characteristics were analyzed. Uni- and multivariable logistic regression was performed to identify predictors of axillary lymph node metastasis or high axillary nodal burden ( $\geq 3$  positive nodes).

#### RESULTS

A total of 242 women (mean age, 54.4 years; age range, 29-86 years) were evaluated. Eighty-three (34.3%) had axillary lymph node metastasis and 39 (16.1%) had high axillary nodal burden by surgical pathologic analysis. On multivariate analysis, predictors of axillary lymph node metastasis were peritumoral edema (Odds ratio [OR]: 4.54; 95% confidence interval [CI]: 2.32, 8.87;  $P <$

.001), maximum ADC value ( $= 1.207 \times 10^{-3} \text{mm}^2/\text{s}$ ) (OR: 2.60; 95% CI: 1.33, 5.10;  $P = .005$ ), lymphovascular invasion (OR: 5.20; 95% CI: 2.61, 10.35;  $P < .001$ ), and larger tumor size ( $> 2\text{cm}$ ) (OR: 3.17; 95% CI: 1.59, 6.29;  $P < .001$ ). Predictors of high axillary nodal burden were peritumoral edema (OR: 7.39; 95% CI: 2.72, 20.02;  $P = .001$ ), maximum ADC value ( $= 1.045 \times 10^{-3} \text{mm}^2/\text{s}$ ) (OR: 9.74; 95% CI: 3.26, 29.07;  $P < .001$ ), lymphovascular invasion (OR: 8.38; 95% CI: 2.95, 23.75;  $P = .001$ ), and larger tumor size ( $> 2\text{cm}$ ) (OR: 6.08; 95% CI: 1.77, 20.91;  $P = .004$ ). CAD-derived kinetic features of breast cancer did not associate with axillary nodal status. In the subgroup analysis of 192 early-stage breast cancer patients, peritumoral edema (OR: 17.12; 95% CI: 2.02, 144.90;  $P = .009$ ) and lymphovascular invasion (OR: 4.65; 95% CI: 1.01, 21.51;  $P = .049$ ) maintained significance for predicting high axillary nodal burden.

## CONCLUSION

s Peritumoral edema on T2WI and maximum ADC value of breast cancer on DWI could be helpful for predicting axillary lymph node tumor burden in women with invasive breast cancer.

## CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI assessment of primary tumor using T2WI and DWI might have predictive value for assessing axillary tumor burden in women with invasive breast cancer.

## R2-SPBR-3 A Radiomic-Clinical Model of Contrast-Enhanced Mammography for Biopsy Outcome Prediction on BI-RADS 4A/4B Patients

### PURPOSE

In the US over 1 million biopsies are performed annually, with 9.6% diagnostic exams given BI-RADS =4A, most of which are rated as BI-RADS 4A/B. Contrast enhanced mammography (CEM) may improve lesion classification. BI-RADS 4A and 4B patients are particularly challenging for biopsy outcome prediction. The goal of the study is to build machine learning quantitative analysis of CEM to improve breast biopsy outcome prediction.

### METHODS AND MATERIALS

With HIPAA-compliance and IRB-approval, 292 patients (aged 30-86) with 332 included BI-RADS =4A lesions (78 cancers (49 IDC, 14 ILC, 15 DCIS) and 254 benign) underwent pre-biopsy CEM. An experienced radiologist produced Initial BI-RADS based on mammography, tomosynthesis and/or ultrasound, and then CEM-adjusted BI-RADS after CEM interpretation. Logistic regression models for outcome prediction were built using radiomic features of segmented lesions in CEM and four CEM-assessed qualitative clinical descriptors (enhancement, strength of enhancement, kinetics, and background parenchymal enhancement). The area under the receiver operating characteristic curve (AUC) measured model performance. PPV conditioned at 100% sensitivity assessed performance on BI-RADS 4A/B lesions.

### RESULTS

AUC for radiomics was 0.87, clinical descriptors 0.89, and combination 0.92. PPV3 for clinical BI-RADS 4A lesions is 6.9% and model 17.6%. PPV3 of CEM BI-RADS 4A is 5.1% and model 9.1%. PPV3 of clinical BI-RADS 4B is 15.3% and model 25.0%. PPV3 of CEM BI-RADS 4B is 35.9% and model 45.7%. Compared to the radiologist, the model increased 153% (or 63%) and 78% (or 30%) of the PPV for initial clinical BI-RADS 4A (or 4B) patients and CEM-adjusted 4A (or 4B) patients.

## CONCLUSION

s Machine learning models of tumor radiomics and clinical descriptors of CEM can substantially increase biopsy outcome prediction accuracy, particularly for the 4A and 4B patients. For 4B patients, the collaboration of radiologists (producing CEM BI-RADS) and our model can largely reduce false positives with a PPV of 45.7%.

## CLINICAL RELEVANCE/APPLICATION

Machine learning analysis and radiologists' clinical assessment of CEM can improve biopsy outcome prediction and their collaboration can gain the highest benefits for the 4A/4B patients.

## R2-SPBR-4 Kinetic Features on DCE-MRI Rather than Glycolytic Phenotype on 18F-FDG PET/CT Predict Recurrence Free Survival in Patients with ER-positive/HER2-negative Early Breast Cancer

### PURPOSE

Estrogen receptor (ER)-positive/human epidermal growth factor receptor 2 (HER2)-negative subtype of breast cancer is known to show low F-18 fluorodeoxyglucose ([18F]FDG) uptake on positron emission tomography/computed tomography (PET/CT). The purpose of this study was to evaluate prognostic value of preoperative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) compared to [18F]FDG PET/CT in patients with ER-positive/HER2-negative early breast cancer.

### METHODS AND MATERIALS

We analyzed data from 145 consecutive women with breast cancer who underwent [18F]FDG PET/CT for initial staging and subsequent surgery between 2008 and 2015. Among them, a total of 118 patients had preoperative DCE-MRI. The clinicopathological variables, computer-aided diagnosis (CAD)-generated kinetic features, apparent diffusion coefficient, and maximum standardized uptake value (SUVmax) were assessed for the risks of recurrence. Hazard ratios (HRs) were estimated from Cox proportional hazards regressions. Recurrence free survival (RFS) curves were estimated using the Kaplan-Meier method and differences in each risk layer were assessed using the log-rank test.

### RESULTS

During the follow up ( $82.25 \pm 22.91$  months), 16 (11.0%) patients experienced recurrence. Peak enhancement (PE)  $>210\%$  (HR 10.70; 95% CI: 1.36-84.51;  $p=0.025$ ), Ki-67  $>6\%$  (HR 5.06; 95% CI: 1.15-22.27;  $p=0.032$ ) and SUVmax  $>6.75$  (HR 4.50; 95% CI: 1.64-12.39;  $p=0.004$ ) were significant factors for RFS on the univariate analysis. On the multivariate analysis, PE  $>210\%$  (HR 9.23; 95% CI: 1.16-73.29;  $p=0.036$ ) was the only significant prognostic factor. On the Kaplan-Meier survival analysis, patients with tumors showing PE  $>210\%$  at preoperative MRI had a significantly poorer 5-year RFS compared to those with PE  $\leq 210\%$  (83.7% and 98.1%, respectively,  $p=0.010$ ).

## CONCLUSION

s In patients with early-stage ER-positive/HER2-negative breast cancer, high PE at preoperative DCE-MRI was more effective than [18F]FDG uptake on PET/CT for predicting RFS.

#### **CLINICAL RELEVANCE/APPLICATION**

CAD-generated kinetic information that can be obtained automatically from preoperative breast MRI in routine clinical practice could help stratify which early-stage ER-positive HER2-negative breast cancer to treated with adjuvant chemotherapy.

### **R2-SPBR-5 An Innovative Technique using Discrete Multi-Wavelength Near Infra-Red Spectroscopy Diffuse Optical Imaging to Differentiate Breast Lesions in Fast Scans: A Feasibility Study**

Participants

Min Jung Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To investigate the potential role of newly developed diffuse optical spectroscopic imaging (DOSI) device using discrete multi-wavelength near-infrared spectrum (DMW-NIRS) in fast scans to differentiate breast lesions.

#### **METHODS AND MATERIALS**

The protocol for DOSI using DMW-NIRS in fast scans was approved by the Institutional Review Boards of Severance Hospital; all participants provided informed consent. A total of 62 consecutive women (range, 29-80 years; mean, 49.9 years) with 62 breast lesions (37 malignant, 25 benign) that were biopsied under US guidance were included. A handheld probe consisting of 5 pairs of light-emitting diodes and photodiodes was used, with the lesion location marked according to conventional US findings. Light absorption and scattering were measured with 8 NIR wavelengths. Lesion to normal ratios (L/Ns) of quantitative chromophores (HbO<sub>2</sub>, HHb, THC, StO<sub>2</sub>, Water, Lipid, and TOI) that were calculated in comparison to the contralateral normal breast tissue were assessed. L/Ns of chromophores were compared between the malignancy and benign. Diagnostic performance was calculated for each L/N of chromophores. Subgroup analysis was performed for Breast Imaging Reporting And Data System (BI-RADS) category 4A lesions.

#### **RESULTS**

All L/Ns of chromophores showed significant differences between malignant and benign groups (all  $p < 0.05$ ). Area under receiver operating characteristic curve (AUROC)s of L/Ns of chromophores ranged 0.710-0.901 (all  $p < 0.05$ ), with TOIL/N showing the highest AUROC (0.901; 95% CI: 0.825-0.976). Accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of TOIL/N were 83.9%, 86.5%, 80.0%, 86.5%, and 80.0%, respectively. In subgroup analysis for BI-RADS category 4A lesions, all L/Ns of chromophores, except for Lipid, showed significant differences between malignant and benign groups ( $p < 0.05$ ). AUROC of L/Ns of chromophores ranged 0.710-0.902 (all  $p$  except for Lipid  $< 0.05$ ), and TOIL/N showed the highest AUROC (0.902; 95% CI: 0.788-1.000). Accuracy, sensitivity, specificity, PPV, and NPV of TOIL/N were 90.6%, 100.0%, 82.4%, 83.3%, and 100.0%, respectively.

#### **CONCLUSION**

s L/Ns of chromophores measured by the newly developed DOSI using DMW-NIRS in fast scans showed promise as an adjunct to BI-RADS categorization for distinguishing breast cancers from benign lesions. This new technique also demonstrated similar performance even in subgroup that included only low suspicious lesions.

#### **CLINICAL RELEVANCE/APPLICATION**

New DOSI technique using DMW-NIRS could be a quick, safe, and noninvasive supplemental method to increase diagnostic accuracy. However, it is essential to validate our results with larger patient cohort.

### **R2-SPBR-6 Comparison of Radiomics-Based Machine-Learning Classifiers for Pretreatment Prediction of Pathologic Complete Response to Neoadjuvant Therapy in Breast Cancer**

#### **PURPOSE**

In recent years, machine learning (ML) classifiers have gradually been used to establish high-performance predictive models for pathological complete response (pCR) in breast cancer after neoadjuvant therapy (NAT). However, few studies have compared the effectiveness of different ML classifiers. This study investigated the ability of radiomics models based on pre- and post-contrast first-phase T1 weighted images (T1WI) to predict breast cancer pCR after NAT and compared the performance of different ML classifiers.

#### **METHODS AND MATERIALS**

In this retrospective study, 300 patients from the Duke-Breast-Cancer-MRI dataset who underwent neoadjuvant therapy (NAT) were included, including pCR ( $n=76$ ) and non-pCR ( $n=224$ ) cases. These patients were randomly divided into training and validation groups at a ratio of 8:2. Radiomics features were extracted from pre- and post-contrast first-phase T1WI images of each patient. The radiomics model was built using features selected through the Spearman correlation analysis and the LASSO algorithm after normalization. SVM, RF, extraTrees, DT, KNN, XGBoost, LightGBM were used as classifiers. ROC curves were used to assess the predictive performance of the radiomics models.

#### **RESULTS**

Out of the seven classifiers used, the LightGBM classifier performed best in predicting breast cancer pCR, with an AUC of 0.813 in the validation group (95% CI: 0.697-0.928, accuracy 78.3%, sensitivity 46.7%, specificity 100.0%). During subgroup analysis, RF achieved the highest AUC in pCR prediction in luminal breast cancers (0.859, 95% CI: 0.710-1.000, accuracy 85.9%, sensitivity 68.8%, and specificity 83.3%), and DT yielded the highest AUC in pCR prediction in triple negative (TN) breast cancers (0.909, 95% CI: 0.790-1.000, accuracy 88.2%, specificity 81.8%, accuracy 100%).

#### **CONCLUSION**

s Overall, the LightGBM-based radiomics model demonstrated superior performance in predicting breast cancer pCR, while RF and DT displayed promising results in predicting pCR for luminal and TN breast cancers, respectively, during subgroup analysis.

## CLINICAL RELEVANCE/APPLICATION

pCR after neoadjuvant therapy (NAT) in breast cancer strongly correlates with overall survival. Over the past few years, the value of radiomics in predicting pCR in breast cancer has attracted significant attention, and machine learning algorithms have become a research hotspot. It is widely acknowledged that high-performance machine learning algorithms are essential for establishing radiomics models. Therefore, in our study, we extracted radiomics features based on pre- and first post-contrast T1WI and used seven machine learning classifiers to build prediction models, respectively, and compared their prediction performance.

## R2-SPBR-7 Evaluating Mammography Positioning Quality on Digital Screening Mammograms in Large Urban Health Systems - Same as Film?

Participants

Laurie Margolies, MD, New York, NY (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

### PURPOSE

Mammography positioning quality (MPQ) is critical to detection of breast cancer. Approximately 90% of poor-quality screening mammography images are due to poor positioning. The most common errors on film screen mammography (FSM) reported in the medical literature are inadequate pectoralis major muscle, sagging and poor visualization of posterior tissue. Understanding how positioning errors present themselves on digital mammograms can help tailor quality improvement initiatives. The purpose of this study was to examine MPQ, as defined by American College of Radiology (ACR) criteria, of digital screening mammograms at two US health systems.

### METHODS AND MATERIALS

Data from two US health systems was collected as part of an international multi-center mammography positioning quality research collaboration (MAMMO.IQ Study). MPQ errors, including exaggeration, portion cut off, posterior tissue missing, nipple not in profile, too high on image receptor (IR), inadequate pectoralis length, sagging, and posterior nipple line (PNL) length difference, were evaluated using artificial intelligence MPQ algorithms applied to screening mammograms acquired between December 2019 and April 2021; associated proportions and rankings of the positioning errors were computed. A total of 221,427 and 318,929 digital mammography images were processed from two health systems. The study was approved by research ethics at the participating sites.

### RESULTS

175,591 and 290,503 MPQ errors were identified respectively at the centers. The rank order of the eight MPQ errors was nearly identical for the two centers (Wilcoxon Rank Sum Test,  $p=0.645$ ). The three most common MPQ errors, PNL on CC view not within 1 cm of that on MLO view, inadequate pectoralis major muscle, and excessive exaggeration on CC view, accounted for 66% and 72.0% of all MPQ errors at the centers respectively; only inadequate pectoralis major muscle is amongst the reported most common errors on FSM. The two least common errors, breast positioned too high on IR and sagging, accounted for 10.4% and 7.0% of all MPQ errors at the centers respectively.

### CONCLUSION

s MPQ errors on digital mammograms were similarly distributed at the centers, but did not align with the pre-digital era reported findings on film screen mammograms.

## CLINICAL RELEVANCE/APPLICATION

Knowledge of common MPQ errors can inform technologist teaching efforts. MPQ errors may be affected by equipment used. MPQ assessments may be more reliable by AI than by humans.

## R2-SPBR-8 Using Artificial Intelligence to Triage Screening Mammograms after Breast-conserving Therapy

Participants

Jeaneun Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate the clinical usefulness of artificial intelligence (AI) for triaging of screening mammograms after Breast-conserving therapy (BCT).

### METHODS AND MATERIALS

The consecutive mammograms from January to May 2021, conducted in patients who underwent BCT were included. Mammograms were analyzed by dividing into ipsilateral and contralateral breast. Triage was performed in the following three methods. One method was to classify exams as no recall (BI-RADS C1, C2) and recall (C0, C3, C4 or C5) based on the original report by expert radiologists. The commercially available AI for mammography was used for the others. If AI did not detect any abnormality, it was assigned as a no recall, and otherwise as a recall (Standalone AI-triage). For cases classified as recall by AI, one radiologist classified them as recall or no recall in consideration of mammography findings (Decision referral AI-triage). We analyzed cancer detection rate (CDR), recall rate and sensitivity for each method.

### RESULTS

A total of 1190 patients (mean age 56.6 years) were included in the study, with 1221 cases of the ipsilateral and 1135 cases of contralateral breast. In ipsilateral breast, the CDR, recall rate and sensitivity of the original report were 6.5/1000, 3.4%, and 80%. Standalone AI-triage was able to reduce the workload by 77%, while maintaining the same level of CDR and sensitivity. Decision referral AI-triage lowered the recall rate to 2.8%. The CDR, recall rate and sensitivity of the original report were 1.7/1000, 1.9%, and 66.7% in contralateral breast. About 90% of workload could be reduced in standalone AI-triage. In decision referral AI-triage, the CDR, recall rate and sensitivity for were 2.5/1000, 2.0% and 100%.

### CONCLUSION

s AI-based triage can contribute to reducing the radiologist's workload without harming sensitivity in the screening mammograms of BCT patients. However, sufficient experience of radiologists is essential to interpret false-positive results, especially in ipsilateral breast after BCT.

## **CLINICAL RELEVANCE/APPLICATION**

The population undergoing screening after surgery is accumulating, as the number of breast cancer patients increases worldwide. Also, the personal history of breast cancer itself is a sustained long-term risk for future breast cancer. This study investigated the clinical usefulness of AI-based triage to maintain quality even in the screening of patients who underwent BCT, while reducing the radiologist's workload.

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## Abstract Archives of the RSNA, 2023

R2-SPCA

### Cardiac Imaging Thursday Poster Discussions

#### Sub-Events

#### **R2-SPCA-1 Impact of Diabetes Mellitus on Left Ventricular Deformation in Restrictive Cardiomyopathy Patients Assessed by Cardiac Magnetic Resonance Imaging**

##### Participants

Yue Gao, MD, Chengdu, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Diabetes mellitus (DM) is considered a major risk factor for cardiovascular events and increases the risk of worse long-term outcomes in patients with restrictive cardiomyopathy (RCM). We aimed to investigate the impact of comorbid DM on LV deformation in RCM individuals.

##### METHODS AND MATERIALS

Seventy-four RCM patients without DM [RCM (DM-)], 33 with DM [RCM (DM+)], and 75 age- and sex-matched controls who underwent CMR scanning were included. We exclude patients with congenital heart disease and heart failure secondary to other cardiomyopathies or diseases. LV geometry, function, and LV global strains, including peak strain in the radial, circumferential, and longitudinal directions were measured. We evaluated the type of LGE in each RCM patient, which was divided into no-LGE (type 1), local LGE (type 2), and diffuse LGE (type 3). The determinants of reduced LV myocardial strain for all RCM patients were assessed using multivariable linear regression analyses.

##### RESULTS

Compared with normal controls, both RCM (DM-) and RCM (DM+) patients exhibited increased LV end-diastolic and end-systolic volume index and decreased LV ejection fraction. LV global strains progressively declined from the normal controls to two RCM groups. RCM subgroup analysis showed that LV global longitudinal PS was worse in RCM (DM+) group than in RCM (DM-) group ( $p = 0.014$ ). DM was an independent determinant of reduced LV global longitudinal PS in patients with RCM ( $\beta = -0.208$ ,  $p = 0.018$ ). The LGE type was independently associated with a decreased global longitudinal PS ( $\beta = 0.411$ ,  $p < 0.01$ ) in RCM patients.

##### CONCLUSION

DM has an additive deleterious effect on LV function and deformation in RCM patients. The LGE type and DM were found to be associated with reduced LV global longitudinal strain.

##### CLINICAL RELEVANCE/APPLICATION

Diabetes mellitus can aggravate the left ventricular global strain damage in patients with restrictive cardiomyopathy without heart failure, so the control of diabetes mellitus should be strengthened

#### **R2-SPCA-2 Could Coronary Artery Calcium Score be a Reliable Predictor of Coronary Artery Stenosis in Women?**

##### Participants

Yuval Liberman, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### PURPOSE

Coronary Artery Calcium Score (CACS) has been widely used to predict coronary artery disease (CAD) risk in both men and women. However, due to physiological differences between these two groups, more studies are needed to assess CACS thresholds for suspected CAD in women. This study aims to evaluate the predictability of CACS for determining CAD with  $\geq 50\%$  stenosis in women and to explore the impact of age and CACS threshold selection on its predictive performance.

##### METHODS AND MATERIALS

The study was approved by the hospital IRB. We reviewed all female patients who underwent CCTA for coronary artery disease (CAD) assessment (including CACS) between 01/01/2006 - 12/31/22 in tertiary medical center. CACS was assessed according to Agatston score. SCAS was identified qualitatively on CCTA as  $\geq 50\%$  stenosis using multiplanar curved reconstructions. Correlation between CACS and SCAS was assessed with Pearson correlation. Various CACS cutoff values were used to check the sensitivity and specificity of CACS as predictor for SCAS. Age information was used for multivariate analysis of the accuracy of CACS in predicting SCAS.

##### RESULTS

1378 consecutive female patients ( $62.4 \pm 11.7$  y.o average, min 21, max 93) were included. Average CACS was 194.1 (min 0, max 4130). 381 of the patients had SCAS (27%). Continuous CACS demonstrated a correlation of 0.501 with SCAS. CACS threshold of 100 provided sensitivity of 68.9% and specificity of 88.8%. Increasing the threshold to 400 and 1000 resulted in higher sensitivity (87.3% and 94.8%, respectively) but lower specificity (81.3% and 76.3%, respectively). Optimal performance was achieved with a CACS threshold of 77, providing a sensitivity of 65.5% and specificity of 90.1%. Taking into consideration age and pre/post

menopausal age did not statistically improve the results

## CONCLUSION

s Our study demonstrates the potential of CACS as a non-invasive tool for predicting  $\geq 50\%$  coronary stenosis in women. Optimal performance is achieved with a CACS threshold of 77. Further research is needed to identify additional factors that can enhance the predictability of CACS for stenosis in women.

## CLINICAL RELEVANCE/APPLICATION

Utilizing CACS in women more accurately.

### R2-SPCA-3 Coronary Artery Calcium Score (CACS) vs. CAD-RADS Predictability of Positive Cardiac Catheterization in Pre-Solid Organ Transplant Patients: A Comparative Analysis

Participants

Yuval Liberman, MD, Boston, MA (*Presenter*) Nothing to Disclose

## PURPOSE

The accurate prediction of significant coronary artery stenosis (SCAS) is crucial in the pre-solid organ transplant evaluation process. This study aims to compare the predictability of Coronary Artery Calcium Score (CACS) and CCTA in determining the presence of SCAS ( $\geq 50\%$ ) in pre-solid organ transplant patients, as detected by cardiac catheterization (Cath).

## METHODS AND MATERIALS

This study was IRB approved. All pre-solid organ transplant patients who underwent CCTA for coronary artery disease (CAD) assessment (including CACS) and were sent to Cath between 01/01/2018 - 12/31/22 were reviewed. CACS was assessed according to Agatston score. SCAS was identified as  $\geq 50\%$  stenosis on CCTA. Similarly, Cath was identified as positive if there was a finding of  $\geq 50\%$  stenosis. Correlation between CACS and Cath was assessed, as well as between CCTA and Cath. CCTA and Various CACS cutoff values were used to create predictors for a positive Cath, which were checked for their sensitivity and specificity.

## RESULTS

We analyzed data from 72 pre-solid organ transplant patients who underwent CCTA, CACS, and cardiac catheterization (57 males and 15 females). These patients had an average CACS of 709 (min 0, max 7675) and average CCTA of 2.2. The patients had an average age of  $58.2 \pm 9.8$  (min 37, max 71). Our results showed that CACS had a correlation of 0.35 with positive Cath, while CCTA demonstrated a correlation of 0.31. Using CCTA as a binary predictor of positive Cath resulted in a sensitivity of 46% and specificity of 100%. In contrast, CACS yielded a maximum sensitivity of 83.3% (specificity of 68.3%, threshold 2920) and a maximum specificity of 83.3% (sensitivity of 42%, threshold 45).

## CONCLUSION

s The findings suggest that CACS is a better screening tool for eliminating patients without significant stenosis due to its higher specificity, whereas CCTA serves as a better diagnostic tool due to its higher sensitivity. However, it should be noted that both tools demonstrated only moderate correlations with positive catheterization findings, indicating the need for further research to optimize their performance in this patient population.

## CLINICAL RELEVANCE/APPLICATION

how predictive is calcium score in comparison to ccta of stenosis identified in cath (the gold standard)

### R2-SPCA-4 Improving Spatial Resolution at Coronary CT Angiography on Photon-counting Detector CT: A Structured Phantom Study

Participants

Zhou Yu, Vernon Hills, IL (*Presenter*) Employee, Canon Medical Systems Corporation  
Keiichi Nomura, PhD, Kashiwa, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

The photon-counting detector CT (PCD-CT) features a semiconductor detector. Due to electrical noise cancellation, its high-density detector element yields high-resolution- and low-noise images. We developed a photon-counting detector CT scanner whose detector is made of CdZnTe. Here we evaluate the spatial resolution of PCD-CT using a structured phantom that simulates coronary CT angiographs (CCTA).

## METHODS AND MATERIALS

Our structured phantom for CCTA (Fig.1) uses a 3D printer (KEYENCE Agilista-3200). The vessels were filled with iodine contrast medium diluted to 20 mgI/ml; one simulated coronary artery harbored 70% of one simulated stenotic lesion, another a stent graft (Medtronic, BeStent, 3.0 mm  $\times$  15 mm). We scanned the phantom on a prototype PCD-CT scanner (Canon Medical Systems) in high-resolution mode. The detector element density was approximately three times that of a conventional CT system. The slice thickness was about 0.2 mm, the tube voltage was 120 kV, and the tube current was 250 mA. For comparison, a conventional energy integrating detector CT (EID-CT; Aquilion ONE GENESIS, Canon Medical Systems) was used; the structured phantom was scanned with a scan protocol that resulted in similar radiation exposure. All images were reconstructed with hybrid iterative reconstruction. To evaluate the image quality of the phantom we measured the noise power spectrum (NPS) as a metric of the noise characteristics and the task-based modulation transfer function (MTF) as a metric of the spatial resolution.

## RESULTS

The radiation doses (CTDIvol) were approximately 9.5 mGy. The image noise on PCD-CT scans was almost twice as high as on EID-CT scans (SD: 26.8 v.s. 13.8 HU, Fig. 2 left); the spatial resolution was higher with PCD-CT (10%MTF: 1.05 v.s. 0.75 cy/mm, Fig. 2 right) than EID-CT. Comparison of the images shown in Figs. 3 and 4 confirmed the high spatial resolution on PCD-CT images.

## CONCLUSION

s The high-resolution mode on our PCD-CT scanner yields images of fine structures. It is suitable for examining fine structures



because it significantly improves spatial resolution, its cost is increased noise.

#### **CLINICAL RELEVANCE/APPLICATION**

The high-resolution mode of PCD-CT may facilitate a more precise stenosis evaluation and the assessment of the patency of coronary stent grafts at CCTA.

### **R2-SPCA-5 Comparative Study of One-stop CTA Scan Delay Protocol in TAVI/TAVR Patients**

#### **PURPOSE**

To compare the effect of preoperative CTA examination using bolus testing or bolus tracking delay protocol on image quality in patients with transcatheter aortic valve implantation (TAVI)/transcatheter aortic valve replacement (TAVR).

#### **METHODS AND MATERIALS**

A total of 43 patients with TAVI/TAVR in our hospital were randomly divided into two groups, and performed preoperative one-stop CTA examination using bolus testing and bolus tracking, respectively. After scanning, the CT value and SD value of the aortic root sinus (C1), the proximal left and right coronary arteries (C2, C3), the ascending aorta (A1), the abdominal aorta on the renal artery level (A2), the left and right femoral arteries (A3, A4), and the paraspinal muscles of the same layer were measured, and the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the corresponding parts were then calculated. All the parameters were compared both in subjective and objective aspects.

#### **RESULTS**

There was no significant difference in image quality between the two groups in the aortic root sinus (C1), the proximal left and right coronary arteries (C2, C3), and the ascending aorta (A1) ( $P > 0.05$ ). Significant differences were detected in the abdominal aorta at the renal artery level (A2) and the left and right femoral artery levels (A3, A4) ( $P < 0.05$ ) in terms of image quality.

#### **CONCLUSION**

Compared with bolus tracking, the preoperative one-stop CTA examination using bolus testing in TAVI/TAVR patients showed better image quality in the aortic artery below the renal artery level and the femoral artery.

#### **CLINICAL RELEVANCE/APPLICATION**

the preoperative one-stop CTA examination using bolus testing in TAVI/TAVR patients showed better image quality in the aortic artery below the renal artery level and the femoral artery.

### **R2-SPCA-6 Deep Learning Image Reconstruction Algorithm and Second-generation Motion Correction Algorithm Improve Dosage Saving and Diagnostic Performance of Coronary CT Angiography with Patients after Percutaneous Coronary**

#### **PURPOSE**

To investigate the image quality and diagnostic value of low-dose coronary CT angiography (CCTA) with deep learning image reconstruction algorithm (DLIR) and second-generation motion correction algorithm (SSF2) compared with conventional-dose CCTA with high-definition (HD) mode assisted by adaptive statistical iterative reconstruction Veo algorithm (ASIR-V) and first-generation motion correction algorithm (SSF) in coronary in-stent restenosis (ISR).

#### **METHODS AND MATERIALS**

A total of 105 patients after Percutaneous coronary intervention (PCI) who received CCTA and invasive coronary angiography (ICA) were prospectively collected and randomly divided into two groups: 60 patients in 100kVp low-dose group (LD group) reconstructed with high-grade DLIR (DLIR-H) and second-generation motion correction algorithm (SSF2), and 45 patients in 120kVp conventional-dose group reconstructed with high-definition mode (HD group) assisted by ASIR-V 50% and first-generation motion correction algorithm (SSF1). Radiation dose and contrast media dose, objective image quality including CT value, image noise (SD), signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) for vessels, as well as subjective image quality parameters with Likert 5-level scoring method were assessed. Moreover, based on the ICA results, we compared the diagnostic performance of these two groups at patient level and stent level.

#### **RESULTS**

With 58.2% radiation dose reduction and 22.5% contrast media reduction, 100kVp LD group assisted with DLIR and SSF2 could achieved even better objective and subjective image quality scores than the 120kVp HD group assisted with HD mode assisted with ASIR-V 50% and SSF. To be specific, SD in AO, LM, LAD, LCX and RCA in LD group was significantly lower than those in HD group (all  $p < 0.05$ ). SNR and CNR in all vessels in LD group were significantly higher than those in HD group (all  $p < 0.05$ ). The subjective image quality scores of the LD group were better than those of the HD group (all  $P < 0.001$ ). The sensitivity, specificity and accuracy of LD group and HD group for diagnosing coronary ISR were 100.0%, 92.1%, 94.2% and 100.0%, 77.9% and 83.8%, respectively, and the number of false positive cases in the DLIR group decreased by 19.2%.

#### **CONCLUSION**

Compared with conventional-dose CCTA with HD mode assisted by ASIR-V and SSF1, 58.2% dose reduction and 22.5% contrast media reduction CCTA with DLIR and SSF2 could further improve the image quality and diagnostic performance in coronary ISR.

#### **CLINICAL RELEVANCE/APPLICATION**

It can effectively reduce the radiation dose while improving the quality of CCTA images, and has a high diagnostic efficiency for ISR, which has good clinical application value.

## Abstract Archives of the RSNA, 2023

R2-SPCH

### Chest Imaging Thursday Poster Discussions

#### Sub-Events

#### **R2-SPCH-1 AI-based Diagnosis of Incidental Pulmonary Embolism (PE) on Contrast-enhanced CT Images: A Multi-center Study**

##### Participants

Roshan Fahimi, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

##### PURPOSE

Unsuspected, incidental PE on routine, contrast-enhanced chest CT can be overlooked and missed. We performed a standalone, multicenter, external validation study of an AI algorithm for detecting incidental PE on routine contrast-enhanced chest CT.

##### METHODS AND MATERIALS

Our IRB approved study included 432 patients from four hospitals (two quaternary and two community hospitals) with a mean age of  $56 \pm 12$  years and a female-to-male ratio of 248:184. We used a radiology reports database search engine (Nuance mPower) to identify routine contrast-enhanced CT examinations with and without incidental PE. CT images with section thickness  $<1.5$  mm were deidentified and exported from Visage PACS. All CT exams were processed with an AI algorithm (Cina, Compose, Avicenna Inc.) for triage (CE and FDA cleared) and detection of incidental PE on routine contrast enhanced chest CT. We assessed the model performance the area under the curve (AUC) of the receiver operating characteristic (ROC) curve and calculated sensitivity and specificity with SPSS (IBM).

##### RESULTS

The AI algorithm had an overall AUC of 0.86 (95%CI 0.94-0.78) and accuracy of 0.88 for diagnosing incidental PE on routine chest CT. When stratified by sex, the AUC was 0.83 (95%CI 0.95-0.71) for females and 0.92 (95%CI 0.99-0.83) for males. There were no significant inter-institutional variations in model performance across the four sites ( $p>0.1$ ). When stratified by age, the AUC was 0.85 (95%CI 0.98-0.72) for patients  $\leq 60$  years and 0.89 (95%CI 0.98-0.80) for  $> 60$  years, with specificities of 0.91 and 0.93 and sensitivities of 0.80 and 0.87. There were no significant differences among scanners from two main vendors in terms of model AUC, sensitivity, and specificity (GE: 0.85 [95%CI 0.70-0.99], 0.75, 0.96; Siemens: 0.88 [95%CI 0.78-0.98], 0.85, 0.92) ( $p>0.1$ ).

##### CONCLUSION

The assessed AI algorithm was generalizable across different imaging sites, patients gender, age, and scanner vendors for detection of incidental PE on routine contrast-enhanced chest CT.

##### CLINICAL RELEVANCE/APPLICATION

The assessed AI algorithm can help detect incidental PE on routine contrast-enhanced chest CT examination.

#### **R2-SPCH-2 Three-dimensional Growth Mapping in Subacute Type B Aortic Dissection Predicts Long-term Outcomes**

##### Participants

Prabhvir Marway, BA, MBChir, Ann Arbor, MI, MI (*Presenter*) Nothing to Disclose

##### PURPOSE

Aneurysmal degeneration of the false lumen (FL) is a common complication of Type B aortic dissection (TBAD) often requiring surgical repair. Prophylactic endovascular repair (TEVAR) can prevent FL aneurysm, but early identification of high-risk patients is challenging. Subacute FL growth may predict late adverse events (LAE) but detecting small changes (1-3 mm) is hampered by measurement error. Vascular deformation mapping (VDM) is an emerging CT analysis technique that provides highly accurate 3D maps of aortic growth using routine clinical CTs. We hypothesized that early identification of FL growth by VDM within 3 months post-TBAD can more accurately identify patients at risk of LAE versus standard CT measurements.

##### METHODS AND MATERIALS

We performed a retrospective study (2005-2018) of adult patients with acute, uncomplicated TBAD, with high-quality CT angiograms (CTA) pre-discharge and at 1-3 months post-discharge. Exclusions included: Prior repair of the descending aorta; poor FL enhancement OR complete FL thrombosis. VDM analysis used a multi-step deformable image registration process after semi-automated segmentation. Quantitative growth data from the descending thoracic aorta was extracted from VDM, and 90th percentile radial values were used for analysis. Standard CT measures were collected by expert raters: maximal diameter; proximal tear size; tear distance from the left subclavian artery (LSC). LAE were defined as aneurysmal growth of the dissected aorta  $>55$ mm, rupture, and surgical repair of TBAD.

##### RESULTS

Among the 33 patients analyzed, 22 (66%) had LAE. There was no significant difference in follow-up period ( $6.3 \pm 2.7$  vs.  $6.3 \pm 4.0$

years,  $p = 0.99$ ), or time between scans ( $45 \pm 17$  vs.  $46 \pm 29$  days,  $p = 0.88$ ). Based on clinically reported measurements (chart review), there were no significant predictors of LAE by anatomic metrics: maximal diameter ( $42.8 \pm 7.4$  vs.  $39.4 \pm 6.2$ mm,  $p = 0.20$ ), change in maximal TBAD diameter by clinical measurements between scans ( $3.3 \pm 4.2$  vs.  $2.2 \pm 5.3$ mm,  $p = 0.54$ ), and LSC to proximal tear distance ( $51.8 \pm 62.9$  vs.  $41.6 \pm 76.8$ mm,  $p = 0.70$ ). However, VDM identified higher growth in the LAE group compared to the no AE group ( $3.7 \pm 2.8$ mm vs  $1.0 \pm 0.8$ mm,  $p = 0.006$ ). Most (68%) patients in the LAE group had a maximum baseline diameter of = 40mm, compared to 45% in the no AE group ( $p = 0.20$ ).

## CONCLUSION

s 3D growth mapping (VDM) using routine CTA images can detect subacute FL growth that is largely missed by clinical CT diameter measurements. Small growth (>2 mm) 1-3 months post-TBAD can identify patients at high risk of late adverse events.

## CLINICAL RELEVANCE/APPLICATION

Even small aortic growth (>2 mm) can be mapped over a short CT interval using an image analysis technique called VDM, identifying TBAD patients at high risk of late adverse events.

## R2-SPCH-3 A Preliminary Study on the Reduction of Radiation Dose in CT Pulmonary Arterial Imaging with the Combination of the Dual-energy Spectral and ASIR-V Presets for Scan Technique

### PURPOSE

To explore the feasibility of reducing radiation dose in dual-energy spectral CT pulmonary artery imaging by using the ASIR-V presets for scan option.

### METHODS AND MATERIALS

44 patients for dual-energy spectral CT pulmonary artery imaging (CTPA) were prospectively divided into 2 groups. Group A (n=18) used the spectral CT imaging mode without the ASIR-V preset (0%), while Group B (n=26) used the spectral CT imaging mode with ASIR-V 50% preset for scanning. Both groups used a contrast agent with iodine concentration of 350mg/ml, with a dosage of 15-20ml and a flow rate of 4-4.5ml/s. Images at the 60keV were reconstructed by default using ASIR-V at 50% for reconstruction and used for analysis. Using the independent samples t-test to compare pulmonary CT value and image background noise, the signal-to-noise ratio (SNR), contrast to noise ratio (CNR), Volume CT dose index (CTDIvol), Dose length product (DLP) and the effective dose and effective dose (ED) between group A and group B. Two senior physicians evaluated the subjective image quality for the two groups, and the Mann-Whitney U test was used to compare the differences in subjective scores between the two groups.

### RESULTS

There was no difference in the gender, age, height, weight and BMI of the two groups ( $P > 0.05$ , table 1). There was no significant difference for the CT values and the SD values of the 60keV monochromatic images between the two groups ( $P > 0.05$ , table 2). However, the CTDI, DLP and ED values in group A were significantly higher than those of group B, with statistically significant difference ( $P < 0.05$ , table 2). For the subjective evaluation: the image noise of group A was higher, and the score was slightly lower than in group B, but the difference was not statistically significant.

## CONCLUSION

s Dual-energy spectral CT with ASIR-V preset for scan can achieve image quality comparable to that of the routine spectral imaging protocol in CTPA with the added benefit of reducing dose requirement.

## CLINICAL RELEVANCE/APPLICATION

The use of energy spectrum combined with Pre-ASIR-V iterative reconstruction technology can reduce the radiation dose received by every CTPA patient and ensure the safety of patients.

## R2-SPCH-4 Real-world Performance of an AI-based Algorithm for Pulmonary Embolism Detection at Several Emergency Departments

Participants

Sarah Quenet, MD, La Ciotat, France (*Presenter*) Employee, Avicenna.ai

### PURPOSE

The integration of artificial intelligence (AI) in clinical routine allows accurate diagnosis and may ultimately improve patients' outcome of life-threatening conditions such as pulmonary embolism (PE). However, the accuracy needs to be constantly evaluated. This study aims to analyze the real-world performance of an FDA-cleared and CE-marked AI-based software designed to detect PE on chest computed tomography angiograms (CTAs) at a large emergency teleradiology network.

### METHODS AND MATERIALS

CTAs from patients admitted to several emergency departments (ED) from June 2022 to March 2023 and received by a teleradiology company (Telediag, Lyon, France) for clinical interpretation were retrospectively analyzed. CINA-PE v1.0.3 (Avicenna.AI, La Ciotat, France), an AI-powered algorithm designed to flag acute suspected PEs up to the segmental level, was already integrated into the clinical workflow. Only the scans automatically processed by the device were included in the study. A board-certified senior thoracic radiologist, not blinded to any clinical information, randomly reviewed 5% of the CTAs and their radiological reports, as part of the company's quality control program. The AI-device results were compared to the expert's interpretation, defined as the ground truth. The sensitivity, specificity, PPV and NPV were calculated. Furthermore, the potential causes of false positives (FP) and false negatives (FN) were analyzed.

### RESULTS

A total of 295 scans (mean age:  $66.9$  yo  $\pm 18.5$  [SD]; 47.1% male) from 58 ED were reviewed. Among the 34 exams identified as positive for PE by the expert, the device correctly identified 29, yielding a sensitivity of 85.3% [95% CI: 68.9% - 95.1%]. Similarly, 250 out of 261 were correctly identified as negative for PE (specificity of 95.8% [95% CI: 92.6% - 97.9%]). The PPV and NPV were 72.5% and 98.1%, respectively. All the missed PEs (5 FN) were located at the segmental level. The 11 FP had confounding conditions such as bronchiolitis (n=3), pulmonary edema (n=1), lymphadenopathy (n=1), fibrosis (n=1), vena cava artifacts (n=1), overlapping pulmonary vein and artery (n=1), pleuritis (n=1) and unknown (n=2). In addition, the dataset included 2 PEs at the

subsegmental level that were considered as negative cases because the algorithm is not intended to detect them.

## CONCLUSION

s The AI-based algorithm, tested on real-world data from several ED, demonstrated high accuracy for PE detection. These results suggest that the integration of AI into daily practice may help optimize the clinical workflow providing a faster and accurate diagnosis.

## CLINICAL RELEVANCE/APPLICATION

This study provides insight into the high performance of an AI-based algorithm in real clinical routine, tested on heterogeneous data from several clinical sites.

## R2-SPCH-5 Unenhanced MR Angiography and V/Q Scan for the Detection of Pulmonary Embolism: Systematic Review and Meta-analysis

Participants  
Stephan Altmayer, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Our purpose was to conduct an updated meta-analysis to compare the diagnostic performance of unenhanced magnetic resonance angiography (MRA) and ventilation/perfusion (V/Q) scintigraphy in the diagnosis of acute pulmonary embolism (PE).

## METHODS AND MATERIALS

Systematic searches of PubMed, Embase, Scopus, BVS, Web of Science, and Cochrane databases were conducted through April 2023. The inclusion criteria of our study required the evaluation of the performance of unenhanced MRA and V/Q scintigraphy for the detection of acute pulmonary embolism using computed tomography pulmonary angiography (CTPA) as the reference standard. We excluded studies in which CTPA was performed more than 30 days after the MRA or V/Q scan.

## RESULTS

A total of 1695 studies were identified through systematic searches, with seven studies meeting inclusion criteria. The results showed that unenhanced MRA had a pooled sensitivity of 0.87 (95% CI 0.82 - 0.91) and specificity of 0.96 (95% CI 0.93 - 0.98), with no statistically significant heterogeneity. The pooled summary receiver operating characteristic (SROC) curve for unenhanced MRA yielded an AUC of 0.92 (95% CI 0.85 - 0.96). On the other hand, V/Q scanning had a pooled sensitivity of 0.81 (95% CI 0.76 - 0.85) and specificity of 0.84 (95% CI 0.74 - 0.91), with statistically significant heterogeneity for both sensitivity and specificity. The selected studies were assessed using the revised QUADAS-2 tool, and all studies were considered to have a relatively low risk of bias.

## CONCLUSION

s Unenhanced MRA has a comparable if not superior diagnostic accuracy compared to V/Q perfusion scan for the detection of pulmonary embolism.

## CLINICAL RELEVANCE/APPLICATION

Unenhanced MRA for at least similar if not superior diagnostic performance compared to V/Q scan without the need for contrast agents, exposure to radiation, and contraindication in patients with known lung parenchymal abnormality.

## R2-SPCH-6 CT-defined Low-skeletal Muscle Mass and Muscle Density are Related with Mortality in Acute Pulmonary Embolism: A Multicenter Analysis

## PURPOSE

Computed tomography (CT) defined muscle mass can be used as a surrogate parameter for sarcopenia. The present study used thoracic CT to assess pectoralis muscle area and density as an imaging biomarker for prognosis of 30-day mortality in patients with acute pulmonary embolism (PE)

## METHODS AND MATERIALS

The clinical database was retrospectively screened for patients with thoracic CT in 3 centers. Pectoralis musculature was measured on axial slices of the thoracic CT at the level of T4 of contrast enhanced pulmonary angiography CT. Skeletal muscle area (SMA), skeletal muscle index (SMI), muscle density and gauge were calculated.

## RESULTS

Overall, 981 patients (440 female, 44.9%) with a mean age of  $63.5 \pm 15.9$  years were included into the study and 144 patients (14.6%) died within the 30-days period. Every pectoral muscle value was higher in survivors compared to non-survivors (exemplarily for SMI  $9.9 \pm 3.5$  cm<sup>2</sup>/m<sup>2</sup> versus  $7.8 \pm 2.6$  cm<sup>2</sup>/m<sup>2</sup>,  $p < 0.001$ ). Moreover, 91 patients were defined as hemodynamically instable (9.3%). Comparable, every pectoral muscle parameter was higher in patients with hemodynamically stable course compared to instable course. Different muscle variables are related to 30-day mortality: SMA, OR = 0.94 (95%CI = (0.92; 0.96),  $p < 0.001$ ); SMI, OR = 0.78 (95%CI = (0.72; 0.84),  $p < 0.001$ ); muscle density, OR = 0.96 (95%CI = (0.94; 0.97),  $p < 0.001$ ); muscle gauge OR = 0.96 (95%CI = (0.94; 0.99),  $p < 0.001$ ). SMI and muscle density were independently associated with 30-days mortality: SMI, OR = 0.81 (95%CI = (0.75; 0.88),  $p < 0.001$ ); muscle density: OR = 0.96 (95%CI = (0.95; 0.98),  $p < 0.001$ ).

## CONCLUSION

s Parameters of the pectoralis musculature are associated with 30-day mortality in patients with acute PE. These findings should lead to an independent validation study and ultimately to the inclusion into clinical routine as a prognostic factor.

## CLINICAL RELEVANCE/APPLICATION

Pectoralis muscle is a potential important imaging biomarker, which can be easily quantified in clinical routine. There was an association with 30-day mortality in patients with acute PE.

## R2-SPCH-7 PURPOSE

## Improved Quantification and Prognostication of Lung Disease on CT in Pulmonary Hypertension by Combining the Strengths of Deep Learning and Radiologists: A Retrospective Multicentre Study with External Validation

Gold standard for Computed Tomography (CT) lung disease quantification is visual assessment by specialist radiologists. Due to overlapping characteristics, distinguishing between Idiopathic Pulmonary Arterial Hypertension (IPAH) and PH associated with Lung Disease (PH-LD) is challenging in patients with 'mild' lung disease. A new IPAH lung disease sub-phenotype has been recently identified. Accurate diagnosis is vital, as therapeutic agents are only indicated in IPAH. CT imaging is routinely performed, but its prognostic impact is not well understood. This retrospective multicentre study deploys an artificial intelligence (AI) model to quantify the prognostic value of CT lung parenchymal patterns in a combined approach with radiological reporting.

### METHODS AND MATERIALS

521 consecutive IPAH and PH-CLD patients with incident CT imaging between 2001-19 were included from the ASPIRE registry. A DenseNet121 and nnU-net AI model with AUC 0.94 on external testing quantified the percentage of normal lung, ground glass, ground glass with reticulation (GGR), emphysema, honeycombing and fibrosis. Fibrosis severity was scored by sub-specialist radiologists. Multivariate cox regression adjusting for age, sex, WHO function class, pulmonary vascular resistance (PVR) and diffusing capacity of carbon monoxide (DLCO) was performed. Findings were externally validated in 246 patients.

### RESULTS

AI quantified fibrosis was a significant predictor independent of age, sex, WHO FC, PVR and DLCO in the internal (HR 1.01 per one percentage point,  $p=0.043$ ) and external (HR 1.03,  $p=0.006$ ) cohorts. In sub-group of patients scored by radiologists as having 'no' fibrosis, AI identified minor (1%) fibrosis, which was of prognostic (HR 1.03,  $p=0.004$ ) significance. Adding AI quantified fibrosis to a predictive model of radiologically scored disease and patient demographics significantly improved its predictive strength (c-index 0.763 vs 0.742,  $p=0.038$ ).

### CONCLUSION

AI quantified parenchymal patterns are prognostic markers for survival, independent of age, sex, WHO function class, disease severity (PVR) and DLCO. This is the largest AI study in this domain and first with external validation (246 patients, 33 centres, 37 scanners). AI is sensitive to minor lung disease, and when used in combination with radiological reporting, provides additional predictive value. These findings have implications for phenotyping, radiological reporting, and therapeutic decisions.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates the strength of combining radiological reporting and automated quantitative AI models together to improve patient outcomes. This approach will aid in identifying PH phenotypes and identify new phenotypes based on lung disease severity.

## R2-SPCH-8 Artificial Intelligence Algorithms for Incidental Pulmonary Embolism Detection: A Systematic Review and Meta-analysis

### PURPOSE

In patients with suspected pulmonary embolism (PE) who undergo chest CT angiogram (CTA), the efficacy of artificial intelligence (AI) algorithms for PE detection has been well established. However, less is known about the use of AI algorithms for detection of incidental PE on imaging ordered for reasons other than suspected PE. The purpose of this study is to evaluate the use of AI algorithms for detection of incidental PE.

### METHODS AND MATERIALS

We performed a comprehensive literature search using PubMed, Embase, and Web of Science databases from inception to 2/25/2023, for all studies that assess an AI algorithm for detection of incidental PE. Pooled sensitivity, specificity, and the corresponding 95% CI were calculated using the random effect model. Heterogeneity was assessed using the Higgins I<sup>2</sup> index.

### RESULTS

A total of four studies, including 19,440 CT scans were included in the analysis. The pooled sensitivity of the artificial intelligence algorithms for the detection of incidental PE was 0.839 (95% CI:0.637-0.939, I<sup>2</sup>: 88.23%) and the pooled specificity was 0.999 (95% CI: 0.996-1.000, I<sup>2</sup>: 82.51%).

### CONCLUSION

Our meta-analysis demonstrated that AI algorithms can detect incidental PEs on CT scans with good sensitivity and excellent specificity. Such algorithms can potentially be used as screening tools or second readers for detection of PEs on non-CTA imaging. Further large-scale studies are necessary to validate our findings.

### CLINICAL RELEVANCE/APPLICATION

More hospitals are now implementing artificial intelligence and deep learning algorithms to their imaging protocols. It is important to present the overall usefulness of such algorithms as we have done in this study.

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## Abstract Archives of the RSNA, 2023

R2-SPER

### Emergency Radiology Thursday Poster Discussions

#### Sub-Events

#### R2-SPER-1 Dual-Energy CT for Suspected Scaphoid Fractures: Evaluation of a Clinical Implementation

##### Participants

Felix Muller, MD, Herlev, Denmark (*Presenter*) Employee, Siemens AG

##### PURPOSE

In December 2020 we changed the workup of patients with radiographically occult but clinically suspected scaphoid fractures from MRI to dual-energy CT (DECT) using virtual non-calcium images (VNCA). Previous studies have shown similar diagnostic accuracy for MRI and DECT, but we still wanted to investigate if this would lead to overlooked injuries. We also tested a previously proposed threshold level for detection of traumatic bone marrow edema on VNCA images.

##### METHODS AND MATERIALS

Patients were eligible for inclusion if they had received a DECT scan of the wrist with a clinical suspicion of a scaphoid fracture after a radiograph during the first 6 month of implementation. We excluded patients with known scaphoid or other fractures. All patients were scanned on a second or third generation dual-source CT scanner with a tube voltage combination of 80 kV / 140kV or 80kV / 150kV with use of tin filtration. VNCA images were available to the reading on-call radiologists. Definite or possible radius or scaphoid fractures as noted in the radiological report were recorded. We then audited the electronic health record and PACS for any follow up visit or radiological imaging of the wrist for a period of 12 months after the trauma for identification of scaphoid fractures, other fractures or soft tissue injury. Patient with scaphoid or radius fractures were selected for quantitative image analysis compared to patients without as a control group. Areas in the VNCA image above -40HU were color-coded for the automatic detection of fracture associated bone marrow edema.

##### RESULTS

Of 322 identified patients 87 were excluded. Of the 235 included patients (214 adults, 21 Children) 8.5% (20/235) had a scaphoid, 17% (40/235) a radius, and 19.1% (45/235) other fractures. We found no patients with overlooked scaphoid fractures during the follow-up period. Three patients presented with a new wrist trauma and were diagnosed with an avulsion from the scaphoid, a radius fracture and a scapholunate dissociation. Two patients were diagnosed with ulnar collateral ligament injury on clinical follow-up examination. VNCA cutoff of -40HU had a sensitivity and specificity of 100% (95% CI 83%-100%) and 96% (95% CI 79%-100%) for radius fracture and 100% (95% CI 59%-100%) and 92% (95% CI 78%-98%) for scaphoid fracture detection.

##### CONCLUSION

We find no evidence that a DECT based scaphoid fracture workup leads to overlooked scaphoid fracture. VNCA values above -40HU were highly sensitive and specific for the detection of fracture associated bone marrow edema.

##### CLINICAL RELEVANCE/APPLICATION

Implementation of DECT based scaphoid fracture detection is safe and quantitative assessment of virtual non-calcium images can assist radiologists in the detection of radiographically occult fractures.

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## Abstract Archives of the RSNA, 2023

R2-SPGI

### Gastrointestinal Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPGI-1 Comparison of Split Bolus Dual Energy CT and Multiphase Dual Energy CT in Assessing Vascular Invasion in Patients with Biliary Malignancies: A Randomized Study

#### PURPOSE

To compare image quality, definition of vascular invasion and radiation dose of split bolus dual energy CT (DECT) with multiphase DECT in biliary malignancies.

#### METHODS AND MATERIALS

This prospective single centre approved study included 88 patients of gallbladder cancer and hilar cholangiocarcinoma randomized into two groups and scanned on rapid-switching DECT scanner. Patients in group 1 (n=43, mean age: 54.6 years, 12 men) were scanned with multiphase protocol (MPP; arterial, venous, delayed phases in DECT) and those in group 2 (n=45, mean age: 52.6 years, 20 men) with split bolus protocol (SBP; split-bolus, delayed phases in DECT). For both groups, virtual monoenergetic images (VMI) were generated at 50 and 70 keV. Mean attenuation, contrast to noise ratio (CNR) and signal to noise ratio (SNR) of tumor, liver and hepatic vessels were assessed in each phase and VMI and were compared between the two groups along with dose length product and volumetric CT dose index. Two readers independently assessed subjective image quality and vascular invasion (5 point Likert scale) in each phase (MPP and SBP) and inter-reader agreement was compared within groups. Mann Whitney U-test and kappa statistics were used for comparison and  $p < .05$  was considered significant.

#### RESULTS

Arterial phase of group 1 had significantly higher attenuation, CNR and SNR of arteries compared to SBP (for both 50 and 70 keV) of group 2 ( $p < .001$ ). However, venous phase of group 1 had significantly poorer attenuation, CNR and SNR for arteries compared to SBP (both VMI) ( $p < .001$ ). Quantitative parameters for veins and tumor between venous phase (group 1) and SBP (group 2) were comparable. Good-to-strong inter-reader agreement ( $k=0.45$  to  $0.75$ ) for image quality for both protocols was observed. For hepatic arterial invasion, SBP had significantly higher inter-reader agreement ( $k=0.71$ ) compared to arterial phase of MPP ( $p < .001$ ). For arterial invasion, 32% and 24% of images of group 1 could not be assessed by reader 1 and 2 respectively, compared to 8% and 6%, respectively in group 2 ( $p < .001$ ). Venous invasion was comparable between the two readers. 50 and 70 KeV VMI were comparable for staging of vascular invasion for both readers. MPP had 37% higher radiation dose than SBP ( $p < .001$ ).

#### CONCLUSION

Image quality of SBP is non-inferior to MPP for biliary malignancies. However, SBP showed significantly better inter-observer agreement for arterial invasion indicating better assessment of vascular involvement with significantly lower radiation dose.

#### CLINICAL RELEVANCE/APPLICATION

Biliary malignancies are better defined in venous phase in which arteries are indistinct, making arterial invasion assessment tough. SBP overcomes this by clearly depicting arteries and tumor in same phase for confident assessment.

#### R2-SPGI-3 Sarcopenia During Neoadjuvant Chemotherapy and its Effect on Survival in Gastroesophageal Adenocarcinomas

#### Participants

Clarissa Hosse, Berlin, Germany (*Presenter*) Nothing to Disclose

#### PURPOSE

Gastroesophageal adenocarcinomas are one of the most prevalent types of cancer worldwide and their incidence has been increasing over the last few decades. Despite advances in treatment, the survival rate remains low, with less than 30% of patients surviving beyond five years. Patients suffer from dysphagia, weight loss and often present with sarcopenia, a progressive muscle loss associated with both age and cancer. Sarcopenia has been gaining attention as a prognostic factor in cancer, mainly focusing on surgical patients. Its prognostic power for patients who receive multimodal treatment, however, remains unclear. This study aimed to investigate the effect of changes in muscle mass on patients with gastroesophageal adenocarcinomas who received neoadjuvant chemotherapy before surgical resection. The study focused on overall survival (OS), disease-free survival (DFS), and length of stay (LOS) after curative resection as the endpoints.

#### METHODS AND MATERIALS

We collected retrospective data from 146 patients treated between 2010 and 2020. We used a fully automatic "AI body composition analysis software" to measure the lumbar skeletal muscle index (LSMI) on CT scans taken before and after neoadjuvant chemotherapy to evaluate sarcopenia. We defined sarcopenia as  $LSMI < 38.5 \text{ cm}^2/\text{m}^2$  (female) and  $< 52.4 \text{ cm}^2/\text{m}^2$  (male). The primary outcome was OS, and the secondary outcomes were DFS and LOS after curative resection. We conducted Kaplan-Meier analyses for survival and tested with Log-Rank.

#### RESULTS

The median OS was 82.13 months (95% CI [64.22 - 10.05]), with 32 recorded deaths (21.9%). The median skeletal muscle loss during neoadjuvant chemotherapy was 2.79%. Although any loss of skeletal muscle during neoadjuvant chemotherapy indicated worse OS, it did not reach statistical significance ( $p = 0.068$ ). LSMI-loss significantly correlated with worse DFS ( $p = 0.028$ ) with a mean of 77.06 months (95% CI [63.03 - 91.09]) without and 47.40 months (95% CI [37.92 - 56.89]) with loss of skeletal muscle mass. It also correlated with LOS ( $p = 0.026$ ) with a median of 12 days (95% CI [11.19 - 12.81]) without and 14 days (95% CI [12.86 - 15.14]) with loss of skeletal muscle mass.

## CONCLUSION

Patients with gastroesophageal adenocarcinomas undergoing neoadjuvant chemotherapy before surgery are at risk of skeletal muscle loss associated with adverse outcomes. While further studies are needed, loss of skeletal muscle mass during treatment, rather than sarcopenia at any timepoint, has the potential to become a prognostic marker and target for interventions.

## CLINICAL RELEVANCE/APPLICATION

Using AI body composition analysis techniques to find individual prognostic markers for patients with cancer

### R2-SPGI-4 Assessment of Predictive Efficacy of Microvascular Invasion in Hepatocellular Carcinoma Based on Preoperative Clinical Variables and Radiological Findings

#### PURPOSE

Microvascular invasion (MVI) is one of the most important risk factors for poor prognosis in hepatocellular carcinoma (HCC) patients, but there remains a lack of reliable and effective noninvasive preoperative prediction methods. Therefore, we aimed to analyze preoperative clinical data and MRI features in HCC patients and construct a clinical-radiological model to predict MVI in HCC.

#### METHODS AND MATERIALS

One hundred and sixty-one patients with pathologically confirmed HCC in our hospital were retrospectively recruited from January 2017 to May 2022 and randomly divided into training and validation sets at a ratio of 7:3 (training set: validation set = 112:49). The patients' preoperative clinical data and MRI features were collected. Independent predictors of MVI were explored by univariable and multivariable logistic regression analysis in the training set. The best variables combination was enrolled into the clinical-radiological model for predicting MVI by the Akaike Information Criterion (AIC). Furthermore, the model was validated in the validation set, and the performance of the model was evaluated by the area under the receiver operating characteristic curve (AUC).

#### RESULTS

Univariable logistic regression analysis showed that elevated alpha fetoprotein (AFP) levels, maximum tumor diameter, non-smooth tumor margin, arterial hyperenhancement, nonperipheral washout, peritumoral arterial enhancement, peritumoral hypointensity on hepatobiliary phase, mosaic sign, intratumoral hemorrhage and intratumoral necrosis were predictors of MVI ( $P < 0.05$ ). Multivariable logistic regression analysis revealed non-smooth tumor margin (OR = 4.036, 95%CI = 1.419-12.25,  $P = 0.01$ ) and peritumoral hypointensity on hepatobiliary phase (OR = 3.217, 95%CI = 1.102-10.038,  $P = 0.036$ ) were independent predictors of MVI. Finally, non-smooth tumor margin, peritumoral hypointensity on hepatobiliary phase, AFP > 400 ng/mL, peritumoral arterial enhancement, and intratumoral necrosis were included into the clinical-radiological model for predicting MVI. The AUC (95% CI) of the model were 0.824 (0.748-0.900) on the training set and 0.754 (0.619-0.890) on the validation set.

## CONCLUSION

The clinical-radiological model based on preoperative clinical data and imaging features showed a good predictive performance for MVI.

## CLINICAL RELEVANCE/APPLICATION

We hope to provide non-invasive imaging biomarkers for the prediction of MVI for hepatocellular carcinoma through the clinical-radiological model based on preoperative clinical data and imaging features.

### R2-SPGI-5 A Fusion Model of Clinical-radiological-radiomics to Predict Microvascular Invasion of Hepatocellular Carcinoma

#### PURPOSE

To construct a fusion model of clinical-radiological-radiomics in predicting MVI of HCC, and find its independent risk factors.

#### METHODS AND MATERIALS

The radiomics score of the optimal model was classified into binary data named radiomics signatures (Radiomics signature, RS) based on the appropriate cut-offs corresponding to maximal Youden index, and the variables in the clinical-radiological model and RS were included into a multivariable logistic regression analysis to construct a clinical-radiological-radiomics fusion model, which was visualized by a nomogram. The performance of the fusion model was evaluated by using receiver operating characteristic analysis, calibration curves, HL goodness-of-fit test and decision curves. Furthermore, univariable and multivariable logistic regression analysis for the included variables were used to find independent risk factors for MVI.

#### RESULTS

The AUC (95% CI) for the fusion model was 0.875 (0.81-0.941) and 0.82 (0.704-0.936) on the training and validation sets, respectively, which was higher than that of the clinical-radiological model (DeLong test,  $P = 0.040$  for the training set and  $P = 0.036$  for the validation set). The calibration curve showed a good agreement for the fusion model (HL goodness-of-fit test  $P$ -value > 0.05), and the decision curves indicated that the model had good clinical application value. Multivariable logistic regression analysis showed that RS and peritumoral hypointensity on hepatobiliary phase were independent risk factors for MVI, with odds ratio of 7.111 and 2.986 respectively.

## CONCLUSION

The clinical-radiological-radiomics fusion model can provide individualized risk assessment of MVI in HCC patients and help to develop individualized preoperative treatment strategies; RS and peritumoral hypointensity on hepatobiliary phase were independent



risk factors for MVI.

#### **CLINICAL RELEVANCE/APPLICATION**

We hope to provide non-invasive imaging biomarkers and provide individualized risk assessment for the prediction of MVI for hepatocellular carcinoma through the clinical-radiological-radiomics fusion model.

#### **R2-SPGI-6 CT Radiomics to Predict Prognosis of Gastric Cancer Treated with PD-1/PD-L1 Inhibitor Therapy**

##### **PURPOSE**

To develop and validate personalized radiomics prediction models and assess their predictive efficacy.

##### **METHODS AND MATERIALS**

293 gastric adenocarcinoma patients treated with PD-1/PD-L1 inhibitor therapy at our institution were retrospectively collected and randomized divided into a training set of 206 patients and a validation set of 87 patients. All patients had baseline CT enhanced images and complete follow-up information. Overall survival (OS) and progression free survival (PFS) was regarded as endpoint events, and radiomics features were extracted and screened based on the region of interest (ROI) of tumor and peritumor. Then, LASSO-COX was applied to establish the tumor, peritumor and tumor+peritumor radiomics signature. In training set, the multivariate COX regression was used to constructed the clinical model and the radiomics models, and their prognostic predictive performance were assessed. The risk of patients was stratified using the median predictive value of the optimal radiomics prediction model. Kaplan Meier analysis and Log rank test were used to estimate and compare OS and PFS between low-risk and high-risk patients.

##### **RESULTS**

206 patients had a median OS of 11.0 (6.8-16.9) months and a median PFS of 7.5 (4.1-13.5) months in training set. A tumor+peritumor radiomics model based on distant metastasis, tumor location, CA125, CA199 and tumor+peritumor radiomics signature was developed to predict OS in gastric cancer patients receiving PD-1/PD-L1 inhibitor therapy, and the radiomics model for predicting PFS included age, the thickest diameter of tumor, CA125 and tumor+peritumor radiomics signature. The radiomics model had a good performance in predicting OS and PFS, with a C-index of 0.746 (95% CI: 0.720, 0.772) and 0.726 (95%CI:0.705, 0.746). The patients in high-risk group had a worse prognosis. Time-dependent ROC curves showed the area under the curve (AUC) for predicting 1-year and 2-year OS were 0.828 and 0.873 and AUC for predicting 0.5-year and 1-year PFS were 0.686 and 0.762. Calibration curves showed a high agreement in predicting OS and PFS. DCA showed the tumor+peritumor radiomics model achieve clinical benefit within a large threshold, particularly in predicting the 1-year OS and 0.5-year PFS (threshold probability >20%) for gastric patients receiving PD-1/PD-L1 inhibitor therapy.

##### **CONCLUSION**

The radiomics model based on CT enhanced images had an excellent performance in predicting prognosis of gastric cancer treated with PD-1/PD-L1 inhibitor therapy.

#### **CLINICAL RELEVANCE/APPLICATION**

The radiomics prediction model had a significant clinical application value and is expected to directly screen the clinical benefit populations.

#### **R2-SPGI-7 Evaluation of Programmed Cell Death Ligand 1 Expression in Gastric Cancer by Enhanced CT Parameters**

##### **PURPOSE**

We aimed to explore the correlation between enhanced CT imaging features and programmed cell death ligand-1(PD-L1) expression status in gastric cancer and to evaluate the predictive value of imaging parameters for immunotherapy biomarkers.

##### **METHODS AND MATERIALS**

Patients with gastric adenocarcinoma who underwent abdominal CT three stage enhanced scan and PD-L1 immunohistochemical testing before treatment were retrospectively examined. All diagnoses were confirmed by pathology. According to the expression status of PD-L1, they were divided into positive group(CPS $\geq$ 5) and negative group(CPS<5). Baseline CT imaging features were collected. CT value were collected in the unenhanced(U), arterial(A), venous(V), and delayed(D)phases to further calculate the arterial attenuation and venous attenuation with arterial enhancement fraction(AEF). Diagnostic performances of the different variables were evaluated using receiver operating characteristic(ROC) curve.

##### **RESULTS**

A total of 67patients with gastric adenocarcinoma were included in the study. On abdominal enhancement CT images, the probability of maximum lymph node short diameter>1cm and peak of lesion enhancement occurring in the arterial phase were statistically significant between the two group(p<0.05); Moreover, the AEF was significantly higher in the positive group than in the negative group(p<0.05). And the ROC curve analysis showed that the AEF exhibited a high evaluation efficacy [AUC: 0.724(95%CI: 0.602~0.826)]. The combined model had the best diagnostic efficacy[AUC: 0.786(95%CI: 0.669~0.877), sensitivity: 58.33%; specificity: 88.37%].

##### **CONCLUSION**

There is a correlation between CT imaging features and PD-L1 expression status in gastric cancer, and AEF may help to assess high PD-L1 expression and help to select patients suitable for immunotherapy.

#### **CLINICAL RELEVANCE/APPLICATION**

To explore the value of CT imaging features in evaluating biomarkers for immunotherapy of gastric.

#### **R2-SPGI-8 MRI-traceable Nanoparticles for Integrin Targeted Liver Fibrosis Detection**

Participants

Qihui Hu JR, MD, Hangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To timely detection and intervention of liver fibrosis are crucial for preventing the progression of the liver disease, we designed an integrin  $\beta 3$  targeted nano-platform (cRGD-PLGA/IONP) based on iron oxide nanoparticles (IONPs) for the detection and grading of liver fibrosis.

## METHODS AND MATERIALS

Preparation of cRGD-PLGA/IONP. The PLGA microcapsules were prepared by the double emulsion process, where superparamagnetic IONPs were introduced into the reaction. cRGD-PLGA/IONP were subsequently characterized by a series of methods. Animal models. C57BL/6 mice received an intraperitoneal injection of 20% CCl<sub>4</sub> (1  $\mu$ g/g) twice weekly for 0, 3, 7, or 11 weeks. MRI protocol. C57BL/6 mice were imaged on a 3.0 T MRI system with animal coils. MR imaging (Discovery 750w, GE Healthcare) was performed at different time points after cRGD-PLGA/IONP, IONP and PBS i.v. injection. Scanning with T2WI and T2 mapping sequences. The T2 and R2 values in various areas of the mice livers at different time points after cRGD-PLGA/IOFA administration were measured and calculated to assess the contrast enhancement.

## RESULTS

Liver fibrosis induction. Immunofluorescence and Sirius staining confirmed the increased protein expression of integrin  $\beta 3$  subunit in aHSCs and the fibrogenic marker  $\alpha$ -SMA with the time of CCl<sub>4</sub> administration, which indicates the animal model was established successfully (Figure 1). cRGD-PLGA/IONP for MRI detection of liver fibrosis. cRGD-PLGA/IONP group demonstrated a contrast enhancement in R2 to 33.9 s<sup>-1</sup> ( $R_2 \sim 4.7$  s<sup>-1</sup>, an approximate 16.2% increase in the liver area) in the early-stage fibrotic liver (Ishak 1). Compared with the control group (Ishak 0), the significantly increased signal ( $R_2$ ) of mice (Ishak 3 and Ishak 5) injected with cRGD-PLGA/IONP were 12.4 (42.5%) and 37.4 (127.9%), and the R2 values were nearly 1.4 and 2.3 times than that of the control group, respectively. (Figure 2a, b). The Fe concentration in mice liver of cRGD-PLGA/IONP group was measured by the inductively coupled plasma-mass spectroscopy. Figure 2c showed that the levels of Fe content in the mice liver were basically consistent with the changes in MRI liver signal values. In contrast, the IONP group did not result in significant signal enhancement at different time points. These results illustrated that cRGD-PLGA/IONP was a highly efficient MRI agent for liver fibrosis diagnosis.

## CONCLUSION

In conclusion, cRGD-PLGA/IONP could perform MRI visualization detection and grading.

## CLINICAL RELEVANCE/APPLICATION

Liver fibrosis is the critical stage in developing chronic liver disease (CLD), from simple and reversible injury to irreversible cirrhosis. A novel contrast agent-enhanced MRI detection is a potential new method for diagnosing liver fibrosis.

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## Abstract Archives of the RSNA, 2023

R2-SPGU

### Genitourinary Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPGU-1 Development and Validation of a Predictive Model Based on Clinical and mpMRI Findings to Reduce Additional Systematic Prostate Biopsy

##### PURPOSE

To develop and validate a predictive model based on clinical features and multiparametric magnetic resonance imaging (mpMRI) to reduce unnecessary systematic biopsies (SB) in biopsy-naïve patients with suspected prostate cancer (PCa).

##### METHODS AND MATERIALS

274 patients who underwent combined cognitive MRI-targeted biopsy (MRTB) with SB were retrospectively enrolled, and temporally be split into development (n = 201) and validation cohorts (n = 73). Multivariable logistic regression analyses were used to determine independent predictors of clinically significant PCa (csPCa) on cognitive MRTB, and the clinical, MRI and combined models were established respectively. Area under the receiver operating characteristic curve (AUC), calibration plots and decision curve analyses were assessed.

##### RESULTS

Prostate imaging data and reporting system (PI-RADS) score, index lesion (IL) on the peripheral zone, age and prostate specific antigen density (PSAD) were independently predictors and included in the combined model. The combined model achieved the best discrimination (AUC: 0.88) as compared to both MRI model incorporated by PI-RADS score, IL level and zone (AUC: 0.86), and clinical model incorporated by age and PSAD (AUC: 0.70). The combined model also showed good calibration and enabled great net benefit on internal and external validation. Applying the combined model as a reference for performing MRTB alone with a cutoff of 60% would reduce 43.8% of additional SB, whilst missing 2.9% csPCa.

##### CONCLUSION

s The combined model based on clinical and mpMRI findings improved csPCa prediction and might be useful in making a decision about which patient could safely avoid unnecessary SB in addition to MRTB in biopsy-naïve patients.

##### CLINICAL RELEVANCE/APPLICATION

• Age, PSAD, PI-RADS score and index lesion on the peripheral zone were independently predictors of detecting csPCa by cognitive MRTB. • The combined model that incorporated clinical and mpMRI findings achieved best discrimination in predicting csPCa, with satisfactory calibration and net benefit in biopsy naïve patients. • Using the combined model with a cutoff of 60% as an indication of performing MRTB alone would reduce 43.8% of unnecessary SBs, whilst missing 2.9% csPCa.

#### R2-SPGU-2 Readout Segmented Diffusion Weighted Imaging Sequence of Clinical Application in Prostate Cancer and Benign Prostatic Hyperplasia in High b Value

##### Participants

Yang Yang, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the readout segmented diffusion weighted imaging sequence (Rs-EPI) ultra high b value used in the diagnosis of prostate cancer and benign prostatic hyperplasia.

##### METHODS AND MATERIALS

37 patients with prostate disease who underwent MR diffusion weighted imaging were enrolled in this study. MR diffusion weighted images were acquired before surgery or biopsy. All data were collected on a MAGNETOM Skyra 3.0T MR scanner (Siemens AG, Erlangen, Germany) with the b value of 0,1000,2000,3000 s/mm<sup>2</sup>. The patients were identified with either prostate cancer (15 cases) or prostate hyperplasia (22 cases) according to pathological results. All images were analyzed by two experienced radiologists blinded to the final result, the signal strength were measured in DWI at the region with higher signal than that in background. The efficacy of parameters for differentiation of prostate cancer was investigated using receiver operating characteristic (ROC) curve.

##### RESULTS

For all the 15 cases of prostate cancer, the signal strength values were significantly higher than those in prostate hyperplasia patients. Overall DW-MRI sensitivity and specificity for tumor detection were 80% and 63.6% with the b value of 1000 s/mm<sup>2</sup>; and they were 93.3% and 68.2% with the b value of 2000s/mm<sup>2</sup>, and 93.3% and 72.7% with the b value of 3000 s/mm<sup>2</sup>. Both the sensitivity and specificity were higher by using ultra-high b value as 3000 s/mm<sup>2</sup>.

##### CONCLUSION

s Rs-EPI with ultra high b value (1000,2000,3000 s/mm<sup>2</sup>) with satisfactory sensitivity and specificity can be used as an important

auxiliary method in the diagnosis of prostate cancer and prostate hyperplasia.

**CLINICAL RELEVANCE/APPLICATION**

Rs-EPI with ultra high b value (1000,2000,3000 s/mm<sup>2</sup>) with satisfactory sensitivity and specificity can be used as an important auxiliary method in the diagnosis of prostate cancer and prostate hyperplasia.

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## Abstract Archives of the RSNA, 2023

R2-SPHN

### Head & Neck Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPHN-1 **Ultrasound Radiomics Models Based on Multimodal Imaging Feature Fusion of Papillary Thyroid Carcinoma for Predicting Central Lymph Node Metastasis**

##### PURPOSE

This retrospective study aimed to establish ultrasound radiomics models to predict central lymph node metastasis (CLNM) based on preoperative multimodal ultrasound imaging features fusion of primary papillary thyroid carcinoma (PTC).

##### METHODS AND MATERIALS

In total, 498 cases of unifocal PTC were randomly divided into two sets which comprised 348 cases (training set) and 150 cases (testing set). In addition, the independent testing set contained 120 cases of PTC at different times. The presence or absence of CLNM in all the studied cases was confirmed with postoperative pathology. The following steps were used to build models: the regions of interest were segmented in multimodal ultrasound images which contained PTC primary tumors, multimodal (grayscale, color Doppler, strain elastography) ultrasound image features were then extracted by the deep learning residual neural network with 50-layer (ResNet50) network, followed by feature selection and fusion; subsequently, classification was performed using three classical classifiers—adaptive boosting (AB), linear discriminant analysis (LDA), and support vector machine (SVM). Model performances were analyzed in terms of areas under curve (AUC), accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

##### RESULTS

The unimodal (grayscale) models (Unimodal-AB, Unimodal-LDA, and Unimodal-SVM) yielded AUCs equal to 0.764, 0.816, and 0.877 (testing set) and 0.724, 0.754, and 0.806 (independent testing set). The multimodal models (Multimodal-AB, Multimodal-LDA, and Multimodal-SVM) yielded AUCs equal to 0.852, 0.865, and 0.910 (testing set) and 0.743, 0.762, and 0.851 (independent testing set). The Multimodal-SVM model achieved the best predictive performance than the other five models ( $P < 0.05$ ) in the testing and the independent testing sets. When the Multimodal-SVM model was applied to the cN0 subgroup cases ( $n = 396$ ) in the main cohort (training and testing sets), the prediction model achieved an AUC of 0.920; in the cN0 subgroup cases ( $n = 100$ ) in the validation cohort (independent testing set), it achieved an AUC of 0.828.

##### CONCLUSION

The ultrasound radiomics model only based on the multimodal ultrasound image of PTC primary tumors have high clinical value in predicting CLNM and can provide a reference for treatment decisions.

##### CLINICAL RELEVANCE/APPLICATION

The ultrasound radiomics model only based on the multimodal ultrasound image of PTC primary tumors have high clinical value in predicting CLNM and can provide a reference for treatment decisions.

#### R2-SPHN-2 **The Effects of Improved Position on Image Quality of CT Scanning of Thyroid**

##### PURPOSE

In this study, we explore the effect of the Improved Swimmer's position on computed tomography (CT) image quality of thyroid, on the radiation dose to patients and the detection rate of thyroid micronodules on CT, using GE Revolution Energy Spectrum CT.

##### METHODS AND MATERIALS

Thyroid examinations with spectral CT were compared for Traditional position group (TDN); Swimmer's position group (SWIM) and Improved Swimmer's position group (I-SWIM). We used subjective grades and objective SNRs and CNRs indicators to assess image quality. Potential confounders, such as Body Mass Index (BMI) and the effective diameter of the neck, were assessed. Patients' radiation exposure was measured by the volume CT dose index (CTDIvol), dose-length product (DLP), and the effective dose of the neck (EDN) and thyroid (EDT). We also evaluate the micronodules detection rate on CT images.

##### RESULTS

Subjective and objective evaluation of thyroid CT image quality were significantly improved in the I-SWIM group compared with SWIM group and TDN group ( $p < 0.001$ ). Although there was no statistically significant difference ( $p = 0.109$ ) in BMI, effective neck diameter and radiation dose received between the groups ( $P > 0.05$ ), there was no significant increase in radiation exposure in the modified swimming position group. There was a significant promotion in micronodules detection of thyroid in the I-SWIM group versus SWIM group and TDN group ( $p < 0.001$ ).

##### CONCLUSION

Based on spectral CT, I-SWIM position improved the image quality of thyroid CT without increasing the radiation exposure of the patients, and increased the detection rate of thyroid micronodules on CT.

## CLINICAL RELEVANCE/APPLICATION

Based on spectral CT, I-SWIM position improved the image quality of thyroid CT without increasing the radiation exposure of the patients, and increased the detection rate of thyroid micronodules on CT.

### R2-SPHN-3 Medium-Term Study Results of Ultrasound-Guided Radiofrequency Ablation for Thyroid Follicular Neoplasm with Low SUV in PET/CT

#### PURPOSE

To evaluate the long-term results of radiofrequency ablation (RFA) of thyroid nodule with cytology of follicular neoplasm with low standard uptake value (SUV) in a positron emission tomography (PET/CT) study.

#### METHODS AND MATERIALS

From January 2018 to January 2021, 40 patients were diagnosed with follicular neoplasm. All patients received ultrasound, fine needle aspiration (FNA) or core needle biopsy (CNB) prior to the treatment. A PET/CT scan was performed in 33 patients prior to treatment. Under local anesthesia, RFA was performed with the use of an RF generator and an 18-gauge internally cooled electrode. Volume changes in nodules on follow-up ultrasonography (US), changes in symptomatic and cosmetic scores, and complications arising during or after RFA were evaluated. Six to twelve months after RFA, all patients received FNA to reevaluate the neoplasm status.

#### RESULTS

Significant volume reductions during follow-up between values prior to RFA and 6 months after RFA ( $7.31 \pm 12.83 \text{ cm}^3$ ,  $p < 0.001$ ) were demonstrated. The respective mean volume reduction ratios at the 6-month and final follow-up were 71.5% and 81.45%. The mean follow-up time was  $2.38 \pm 0.9$  years. One patient presented with vocal cord palsy and another patient presented with ptosis, both of whom recovered after RFA. No post-procedural hypothyroidism occurred in the RFA patients. Pre-RFA thyroglobulin level was significantly positively correlated with the SUVmax value of PET/CT ( $p = 0.001$ ).

#### CONCLUSION

RFA is a safe and effective treatment for patients with low-risk follicular neoplasm (SUVmax value  $\leq 5$ ) in long-term follow-up. It is a viable alternative treatment for patients not suitable or willing to undergo surgery.

## CLINICAL RELEVANCE/APPLICATION

RFA is a safe and effective treatment option for patients with thyroid follicular neoplasm, specifically those with low SUVmax on PET/CT studies. This treatment can provide significant volume reductions in the nodule and improve symptomatic and cosmetic scores. Additionally, RFA may be a viable alternative to surgery for patients who are not suitable or willing to undergo surgery. Clinicians could consider using RFA as a treatment option in patients with low-risk follicular neoplasm, as it has been demonstrated to have minimal complications and no post-procedural hypothyroidism. Furthermore, clinicians could consider performing PET/CT studies in patients with thyroid nodules to assess their SUVmax value, as it can be a useful predictor of the malignancy rate of thyroid nodule.

### R2-SPHN-4 The Value of Radiomics Models Based on DWI and ADC for Predicting Benign and Malignant Thyroid Nodules

Participants  
Qian Yang, Shenzhen, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the value of radiomics features extracted from DWI and ADC in differentiating benign and malignant thyroid nodules.

#### METHODS AND MATERIALS

The clinical and imaging data of 140 thyroid patients with 148 pathology-confirmed thyroid nodules in our hospital were analyzed retrospectively, including 50 benign nodules and 98 malignant nodules. All patients underwent thyroid magnetic resonance DWI examination. Based on the delineated region of interest (ROI), radiomics features were extracted from DWI and ADC images. Student-t test, the Least Absolute Shrinkage and Selection Operator (LASSO) algorithm and correlation analysis were sequentially used for feature selection. Four classifiers of k-nearest neighbor (KNN), support vector machine (SVM), random forest (RF) and logistic regression (LR) were used for modeling (DWI model, ADC model and combined model). The receiver operating characteristic (ROC) analysis with area under curve (AUC) was used to evaluate the efficacy of radiomics model in predicting benign and malignant thyroid nodules.

#### RESULTS

After feature selection, 10 DWI features and 18 ADC features were used to build models. Among the three radiomics models built with the same classifiers, combined model outperformed either DWI model or ADC model for all classifiers, except for RF models in which ADC model (AUC=0.825) outperformed combined model (AUC=0.809). Among the combined models, LR model (AUC=0.885) was superior to the other three models (SVM: AUC=0.867; KNN: AUC=0.846; RF: AUC=0.809).

#### CONCLUSION

The radiomics model based on DWI and ADC image is helpful to differentiate benign and malignant thyroid nodules.

## CLINICAL RELEVANCE/APPLICATION

The results of this study will help the diagnosis of benign and malignant thyroid nodules and provide clinical assistance.

### R2-SPHN-5 Development and Validation of Radiomics Model Based on Ultrasound Images to Predict Malignancy in Bethesda Category III and IV Thyroid Nodules

#### PURPOSE

This study aimed to predict malignancy in thyroid nodules with initial fine-needle aspiration (FNA) results of Bethesda category III

and IV using a machine learning algorithm.

## **METHODS AND MATERIALS**

A total of 266 thyroid nodules (= 1 cm) were included from January 2017 to May 2022 retrospectively. The initial FNA results were Bethesda category III or IV and subsequent pathological diagnoses were obtained. All subjects were divided into a training set and a test set randomly at a ratio of 7:3. One senior and one junior radiologist independently and blindly reviewed the images of the test set and evaluate the nodule features based on the American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TI-RADS). For each nodule, two grayscale ultrasonography images including one transverse and one longitudinal were selected and segmented. Then radiomics features were extracted and selected using a machine learning algorithm to develop a radiomics model. Univariate and multivariate logistic regression analyses were used to select clinical independent predictors which were used to develop the clinical-radiomics combined model. The receiver operating characteristic (ROC) curves of the radiomics model and combined model were plotted. The AUCs were calculated and compared using DeLong's test.

## **RESULTS**

Among the final set, 226 cases were Bethesda III nodules with a malignant rate of 39.4%; 40 cases were Bethesda IV nodules with a malignant rate of 50.0%. The variables included in the clinical-radiomics combined model were nodule size, suspected cervical lymph node metastasis and radiomics probability. In both the training and test sets, the AUC of the combined model was higher than that of the radiomics model (training, 0.823 vs 0.751,  $P = 0.003$ ; test, 0.800 vs 0.749,  $P = 0.040$ ). In the test set, the AUC of the combined model was significantly higher than that of the junior radiologist (0.800 vs 0.658,  $P = 0.029$ ) and no significant difference compared to senior radiologist (0.800 vs 0.760,  $P = 0.550$ ). Moreover, the specificity of the combined model (66.7%) was higher than that of the junior radiologist (44.4%) and senior radiologist (62.2%). There was no significant difference between the AUC of the radiomics model and two radiologists ( $P > 0.05$ ).

## **CONCLUSION**

The radiomics model and clinical-radiomics combined model based on grayscale ultrasound images can effectively predict malignancy in Bethesda category III and IV thyroid nodules. The diagnostic performance of the combined model is comparable to that of the senior radiologist and better than that of the junior radiologist.

## **CLINICAL RELEVANCE/APPLICATION**

Machine learning algorithm may help in more accurate identification of malignancy in Bethesda category III and IV thyroid nodules for further evaluation.

## **R2-SPHN-6 "Unlocking the Secrets of F-18-FDG PET/CT Thyroid Incidentalomas". A Comprehensive Analysis of Ultrasound and Pathology in a Leading Mexico City Hospital**

### **PURPOSE**

Study the prevalence of focal and diffuse thyroid incidentalomas detected by 18-FDG PET/CT. Investigate the relation between SUVmax, ultrasound features, and histopathology to estimate the risk of malignancy in these patients. Estimate a cut-off point of SUVmax to suspect malignancy.

### **METHODS AND MATERIALS**

We retrospectively reviewed the reports of 3958 patients in whom 18-FDG-PET/CT scans were performed. Studies in which the presence of thyroid incidentaloma were analyzed. SUVmax and Total lesion glycolysis (3D slicer) values were obtained prospectively. Ultrasound was also prospectively reviewed if available, Fine Needle Aspiration (FNA) and histopathology data were collected. Statistical analysis was made with SPSS 25.

### **RESULTS**

The prevalence of thyroid incidentaloma in FDG-PET/CT was 3.2% (130 patients), 98 (2.53%) had focal uptake, and 32 (0.82%) diffuse uptake. 43 patients with focal uptake underwent further workup. The prevalence of focal uptakes was higher in women than in men (33.7% vs 66.3%, OR 1.54, CI 95% 1.0132 - 2.3644). Nodules were classified as benign (N=14) and malignant (N=14) by pathology. The median SUVmax of focal uptakes was 4.50 (1.66-56.24). Malignant lesions had higher SUVmax than Benign (8.25 vs 4.49,  $p = 0.049$ ). In ultrasound analysis (n=43), nodules with the following features had higher SUVmax and malignancy rates: Hypoechoic ( $p = 0.004$ , SUVmax: 7.28), taller-than-wide ( $p = 0.003$ , SUVmax: 8.84), lobulated or irregular margins ( $p = 0.000008$ , SUVmax: 8.84), punctate echogenic foci ( $p = 0.039$ , SUVmax: 10.23) and presence of adenopathy ( $p = 0.037$ , SUVmax: 12.16). A significant difference in SUVmax values among ATA classification was found ( $H = 19.27$ ,  $df = 4$ ,  $p = 0.0007$ ). Benign nodules had lower SUVmax values (2.46, 1.86-3.05), while high suspicion nodules had higher SUVmax values (11.62, 4.46-56.24). A cut-off value of 4.880 g/ml SUVmax was used to determine malignancy with a sensitivity of 81% and specificity of 77%.

### **CONCLUSION**

Higher SUVmax in PET/CT were consistent with ultrasound features of suspicion and the rate of malignancy. SUVmax values are significantly different among nodules classified according to the ATA guidelines, with benign and low suspicion nodules having lower SUVmax values and high suspicion nodules having higher SUVmax values. A cut-off value of 4.880 g/ml has good sensitivity, and specificity (81% and 77%, respectively). This suggests that SUVmax may be a useful metric for distinguishing between benign and malignant lesions in PET-CT imaging.

### **CLINICAL RELEVANCE/APPLICATION**

Up to 3% of PET-CT scans showed a thyroid incidentaloma. It is important to determine which nodules are more likely to be malignant. This study shows SUVmax has a good correlation with ultrasound and pathology for determining malignancy.

## **R2-SPHN-7 Preoperative Localization of Previously Occult Parathyroid Adenomas using Dynamic, Contrast Enhanced Parathyroid MR Imaging**

Participants  
Jacob Musiol, MD, San Antonio, TX (Presenter) Nothing to Disclose

### **PURPOSE**

Common techniques for preoperative localization of parathyroid adenomas include nuclear medicine parathyroid sestamibi scans with

Common techniques for preoperative localization of parathyroid adenomas include nuclear medicine parathyroid sestamibi scans with or without SPECT or SPECT-CT, ultrasound, and 4D parathyroid CT with differing levels of success. While not widely utilized, dynamic contrast enhanced parathyroid MRI has also been previously shown to demonstrate parathyroid adenomas with increased sensitivity and specificity when compared to dynamic parathyroid CT. Our interest in dynamic parathyroid MRI began when a patient presented with clinical hyperparathyroidism but occult prior imaging. We tailored a protocol on our clinical use 3 Tesla Siemens magnet using previously published parameters. We subsequently scanned six patients for evaluation of parathyroid adenoma.

## **METHODS AND MATERIALS**

Our patient selection included six patients imaged over 18 months with biochemical hyperparathyroidism and elevated serum parathyroid hormone values, but negative prior imaging. Using a clinical Siemens 3T magnet, we performed T1 axial, T2 axial, T2 fat saturated coronal, T1 coronal, T1 axial VIBE pre contrast, and T1 axial VIBE post contrast dynamic sequences. After the administration of gadolinium-based contrast, 11 axial dynamic contrast series were obtained at 11.5 second intervals for a total imaging sequence time of 2 minutes 7 seconds. Additional T1 VIBE post contrast subtraction images were created. All images were submitted to the AGFA PACS, and clinical interpretation was performed by a board certified neuroradiologist.

## **RESULTS**

We utilized our protocol to image six patients, all with positive findings on MRI. The lesions identified as positive demonstrated T2 hyperintensity and intense arterial enhancement within the first 30 seconds of contrast injection, followed by delayed washout. The patients were taken to surgery with accurate surgical localization. All six had pathology-proven parathyroid adenomas. The smallest lesion measured 6 mm and the largest lesion measured 14 mm.

## **CONCLUSION**

While not widely utilized, dynamic parathyroid MR imaging is a helpful resource for localizing parathyroid adenomas with high sensitivity and specificity. While other modalities such as nuclear medicine parathyroid sestamibi scans or 4D parathyroid CT are more widely available, implementing this dynamic post contrast technique in clinical practice can assist surgeons in preoperative localization, as well as decrease the incidence of exploratory surgery of the neck.

## **CLINICAL RELEVANCE/APPLICATION**

Dynamic parathyroid MRI can be readily and easily integrated into routine outpatient imaging protocols for evaluation of parathyroid adenoma. Utilization can improve preoperative surgical localization and improve patient outcomes.

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## Abstract Archives of the RSNA, 2023

R2-SPIN

### Imaging Informatics Thursday Poster Discussions

#### Sub-Events

#### **R2-SPIN-1 Prediction on Lateral Cephalograms of Post Orthognathic Surgery using Graph Convolutional Neural Network and Diffusion Model**

##### Participants

JiHeon Jeong, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To generate lateral cephalogram of post orthognathic surgery based on pre-operation lateral cephalogram using a graph convolutional neural net (GCN) and a diffusion model

##### METHODS AND MATERIALS

Among a dataset from nine university hospitals with different types of cephalography machines and radiation exposure protocols, 800 pairs of pre- (T0) and post- (T1) surgery with 12-bit deep grayscale images were selected and registered based on the sella and nasion points. And the dataset was divided into a training set of 700 pairs and a test set of 100 pairs. Landmarks were measured on each image at 41 points using a pre-trained model with an average error of  $0.80 \pm 0.79$  mm. First, a model was trained to predict the movement predictions of each landmark in T1 image by embedding the T0 image and its landmarks using CNN and graph GCN, respectively. To generate T1 images, we used various prompts, including the movement of landmarks based on surgical planning. To ensure more realistic and detailed generation quality using various prompts, an autoencoder using not only a labeled dataset of T0 and T1 but also an unlabeled cephalogram dataset was trained. A diffusion model for image generation in the encoding space was trained with various prompts as conditioning factors. Specifically, T0, and T0's landmarks, and movement predictions were used as prompts.

##### RESULTS

The distances between the landmark points on the images generated by the diffusion model and the T1 images were measured for 100 test images, both with and without various prompts. The diffusion model without prompts had an average error of approximately  $2.33\text{mm} \pm 6.16\text{mm}$  across 30 landmark points, while the diffusion model with prompts had an average error of  $1.76\text{mm} \pm 1.45\text{mm}$ , which was statistically significant based on paired t-test results ( $p < 0.001$ ).

##### CONCLUSION

A diffusion model was trained to generate T1 cephalogram based on T0 images of orthognathic surgery using graph CNN and diffusion model, which lead to better prediction of post-operational cephalogram.

##### CLINICAL RELEVANCE/APPLICATION

This generative model could be used to predict surgical result based on surgery planning and pre-operative cephalogram with landmarks. Therefore, based on this, among various surgical planning options of orthognathic surgery, better outcome could be selected.

#### **R2-SPIN-2 Artificial Intelligence (AI) Software for Automated Fracture Detection in Emergency Department: 2-month Experience**

##### Participants

Francesco Pucciarelli, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

Computer-aided detection tools are routinely used in clinical practice. In recent years, artificial intelligence (AI) is playing an increasing role in medical imaging, aiming at speeding up the workflow and improving human diagnostic performances. The purpose of this study is to evaluate the reliability of an AI software trained to detect fractures on radiographs and to compare its accuracy to radiologists.

##### METHODS AND MATERIALS

This retrospective study included radiographs of patients admitted for trauma to the emergency department of our hospital from May 19 2022 to July 19 2022. Radiographs of each patient were analyzed for the presence of fracture by both radiologists and AI software. For discordant cases a radiologist with 25 years of experience in emergency radiology was considered the ground truth and, when available, CT. Statistical analysis was performed with a dedicated software and accuracy of both radiologist and AI software was collected.

##### RESULTS

Final population consisted of 981 patients, comprising 1360 anatomical districts and 3367 X-ray projections. Concordance between radiologists and AI software was 88.8% (871/981) and discordance was 11.2% (110/981). In discordant cases false positive (FP)

were 30 for radiologists vs 76 for AI software; true negative (TN) were 76 vs 30, respectively; true positive (TP) were 3 vs 1 respectively; false negative (FN) were 1 vs 3 respectively. Accuracy was 0.96 for radiologists and 0.91 for AI software (sensitivity 0.99 vs 0.99 and specificity 0.96 vs 0.91 respectively). Positive predictive value (PPV) was 0.92 for radiologist vs 0.81 for AI software; negative predictive value (NPV) was equal (0.99). FP for AI software were mainly due to image artifacts, external devices, and immature bone in pediatric patients.

## CONCLUSION

Radiologists and AI software showed the same sensitivity on fracture detection with a slightly higher specificity for radiologists. NPV was equal. We can conclude that the use of AI software has shown good reliability in ruling out fractures on radiographs.

## CLINICAL RELEVANCE/APPLICATION

This AI software could be applied to clinical routine to improve the radiologist's confidence in ruling out fractures in the emergency department.

## R2-SPIN-3 Using Deep Learning to Augment Radiologist Interpretation of Brain MRIs for Alzheimer's Disease

### PURPOSE

Modern machine learning approaches are being developed to assist radiologists in evaluating MRIs for Alzheimer's disease (AD) detection. We sought to determine if a deep learning model can augment neuroradiologist evaluations of MRIs for AD assessment.

### METHODS AND MATERIALS

We developed a multimodal deep learning framework for dementia assessment that combines MRIs and non-imaging data including demographics, past medical history, neuropsychological testing, and functional assessments [1]. The model was trained on 4,822 participants from the National Alzheimer's Coordinating Center dataset. A subset of cases clinically diagnosed with dementia (n=50) was evaluated by seven neuroradiologists who were asked to differentiate between persons with AD and those with non-Alzheimer's dementia (nADD) using MRI scans and demographic information. We evaluated the model performance against the radiologist assessments and constructed a consensus opinion from the expert ratings and model predictions. [1] Qiu et. al., Nat Commun. 2022 Jun 20;13(1):3404. doi: 10.1038/s41467-022-31037-5

### RESULTS

Our results showed that combining the radiologist assessments with predictions from our model yielded greater accuracy, sensitivity, specificity, and Matthews correlation coefficient (MCC) in differentiating persons with AD from those with nADD than the assessments made by the neuroradiologists alone. The consensus methods used in this study resulted in an improvement in accuracy from 58% to 64%, in sensitivity from 58% to 64%, in specificity from 60% to 72%, and an increase in the MCC from 0.16 to 0.28.

## CONCLUSION

Incorporating machine learning model assessments into the consensus radiologist interpretation improved the reliability of AD diagnosis based on brain MRIs, age, and gender.

## CLINICAL RELEVANCE/APPLICATION

AI-augmented radiologist assessment can improve the diagnostic accuracy of AD diagnosis, leading to more precise and timely treatment, potentially improving patient outcomes.

## R2-SPIN-4 Joint Generative and Mixture Data Augmentation for Metastatic Focal Liver Lesion Classification in Abdominal CT Images

### PURPOSE

Generative data augmentation (DA) using generative adversarial network (GAN) has been successful in improving the learning efficiency of medical image analysis tasks where training data is limited. However, it is prone to mode collapse, where the GAN generates a limited variety of patterns due to inadequate learning of the training data pattern. To overcome this limitation, we propose a novel data augmentation approach that combines generative DA with MixUp-based mixture DA to diversify the pattern of synthetic data. We evaluate the effectiveness of this approach on the classification of metastatic focal liver lesions (FLLs) in abdominal CT images.

### METHODS AND MATERIALS

Our dataset consists of CT scans from 502 colorectal cancer patients, including 1,290 FLL images with 676 cysts, 130 hemangiomas, and 484 metastases. First, we generated synthetic images by training a StyleGAN model on real training images. We then created new training images by performing MixUp-based linear combinations between synthetic and real training images. The VGG-16 network is then trained using these training images to classify FLLs. To validate the effectiveness of our approach, we compared the accuracy, sensitivity, and specificity of classification results, and analyzed the t-SNE feature distribution to determine whether our approach mitigates mode collapse in generative DA.

### RESULTS

Generative DA achieved a marginal improvement over the affine DA-based baseline, with 73.2% accuracy compared to 72.3%. Our proposed method achieved 80.8% accuracy and demonstrated a significant enhancement in the sensitivity of cyst and metastasis. In the t-SNE feature distribution, synthetic images generated by generative DA were concentrated around specific locations due to mode collapse, while training images of our method were distributed across the entire class. This outcome confirms that our method can mitigate mode collapse by diversifying the pattern of synthetic images.

## CONCLUSION

We proposed a novel DA method that combines generative DA with mixture DA to address mode collapse, a major limitation in generative DA. We confirmed that our method diversifies the pattern of synthetic images created by generative DA, mitigating the mode collapse phenomenon and enhancing classification performance in the classification of FLLs in CT images. (This work was supported by the National Research Foundation of Korea Grant funded by the Korea government (No. RS-2023-00207947))

## CLINICAL RELEVANCE/APPLICATION

Our approach can be applied to a wide range of medical image analysis tasks in which training data is scarce or mode collapse arises during generative DA.

### R2-SPIN-5 Development of Accurate Automated Organ Segmentation in Pediatric CT Scans: Impacts of Model Pretraining

Participants

Panagiotis Korfiatis, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

## PURPOSE

To develop a deep learning-based segmentation model for pediatric patients with CT imaging.

## METHODS AND MATERIALS

This study utilized two publicly available datasets: a pediatric dataset with imaging of 359 patients ranging from 5 days to 16 years old, with varying imaging parameters, and a dataset of adult patients consisting of 1204 scans, with annotations of 104 structures. The pediatric dataset comprised 29 organs. In this study we focused on 20 organs. The nnUNet model was trained utilizing the following approach: First, a model was trained using the adult dataset. Then, the weights of the adult model were used to initialize the weights of the pediatric model. The training/validation dataset was comprised of 325 scans, while 34 patients were used for testing. The default nnUNet augmentations were applied in this model excluding mirroring. Finally, the ensemble of the five models from the 5-fold training process was obtained as the final model (Figure 1, supplement).

## RESULTS

Training the model with weight initialization led to performance improvements especially in smaller structures (Figure 1, supplement). The performance of the pretrained nnUNet ranges from 0.57 to 0.97 with the performance of the model being better in larger structures. Smaller structures like the adrenal glands and more complex anatomical structures like the small intestine benefit when pretrained models are utilized.

## CONCLUSION

Leveraging pretrained models to facilitate model training for populations where large datasets that are not widely available can further improve segmentation performance. More advanced training techniques like self-supervised training or data-centric training should also be investigated.

## CLINICAL RELEVANCE/APPLICATION

Image segmentation is the fundamental step in many downstream clinical applications such as quantification and treatment planning, and less attention has been given to solving this problem in pediatric populations.

### R2-SPIN-6 Detection of Progression to Clinically Significant Prostate Cancer Using End-to-End Deep Learning in Sequential MRI

Participants

Christian Roest, MSc, GRONINGEN, Netherlands (*Presenter*) Grant, Siemens AG

## PURPOSE

Reading sequential prostate MRI is a difficult task for radiologists. Deep learning (DL) may help detect progression. We explored end-to-end deep learning to compare two sequential MRI scans in detecting progression to clinically significant prostate cancer.

## METHODS AND MATERIALS

This retrospective study included 714 patients with at least two consecutive biparametric MRI scans of the prostate between 2014 and 2021 (875 follow-up scans). We recorded all PIRADS reported prostate cancer lesions. PI-RADS=3 lesions received MRI-targeted biopsy, and lesions with histopathological grade of ISUP=2 were considered clinically significant (csPCa). All patients were negative for csPCa at the first MRI. Three separate end-to-end DL segmentation approaches were subsequently tested to detect csPCa: 1) a single, current MRI model; 2) a sequential model comparing prior and current MRI 3) model 2 extended with clinical parameters (PSA, PSA density, age, prostate volume). Maximum detected per lesion likelihood in the heatmap was considered the patient-level likelihood for csPCa progression. Receiver-operating characteristic (ROC) curve analysis was used to compare the three DL models at patient level. Lesion level performance was evaluated using free-ROC (FROC) analysis by comparing the area-under-the-FROC-curve (AUFROC) between 0.1 and 2.5 false-positives per patient. Explainable AI was used to create saliency maps, ranking the importance assigned by the model to information in the sequential MRI input. Differences in AUROC and AUFROC were evaluated using DeLong's and bootstrap tests, respectively.

## RESULTS

The sequential model outperformed the single-scan baseline at lesion-level (AUFROC: 1.45 [1.29–1.61] vs 1.56 [CI 1.40–1.72],  $p < 0.05$ ) and patient-level (AUROC: 72.9% [CI 68.7–77.2%] vs 75.7% [CI 71.6–79.9%],  $p = 0.008$ ). Including differential clinical parameters further improved patient-level performance to 76.1% AUROC (CI 71.6–80.6%). Saliency maps showed significantly higher importance for temporal high b-value sequences, compared to T2W and ADC ( $p < 0.0001$ ).

## CONCLUSION

Our proposed end-to-end deep learning model can accurately detect progression to csPCa using sequential MRI.

## CLINICAL RELEVANCE/APPLICATION

Active surveillance is crucial in prostate MRI, and an accurate artificial intelligence tool for detecting progression to clinically significant disease may help to prevent unnecessary biopsies.

## Abstract Archives of the RSNA, 2023

R2-SPIR

### Interventional Radiology Thursday Poster Discussions

#### Sub-Events

#### R2-SPIR-1 **STING Pathway Activation and Antitumor Immunity Induction by an Injectable Hydrogel Loaded Lysed OK-432 and DOX for Incomplete Radiofrequency Ablated Liver Cancer**

##### PURPOSE

To investigate the efficacy and mechanism of an injectable hydrogel loaded lysed OK-432 and doxorubicin for incomplete radiofrequency ablated (inRFA) liver cancer.

##### METHODS AND MATERIALS

RADA16-I (R) peptide was dissolved in a mixture of doxorubicin (D) and lyOK-432 (O) to develop a ROD hydrogel. The characteristics of ROD hydrogel were evaluated. Tumor necrosis and mice survival were measured after different treatments. Immune cells and cytokines were measured, and the cGAS/STING/IFN-I signaling pathway in dendritic cells (DC) was evaluated in vitro and in vivo.

##### RESULTS

LyOK-432 was more effective than OK-432 in promoting DC maturation and activating the IFN-I pathway. ROD was an injectable hydrogel for the effective loading of doxorubicin and lyOK-432, and presented controlled-release property. ROD treatment achieved the highest tumor necrosis rate ( $P < 0.001$ ) and significantly longer survival time ( $P < 0.001$ ) than other therapies. The ROD group also displayed the highest rates of DCs, CD4+ T cells and CD8+ T cells ( $P < 0.001$ ), the lowest level of Treg cells ( $P < 0.001$ ), and significantly higher expression levels of IFN- $\gamma$  and TNF- $\alpha$  ( $P < 0.001$ ) than the other groups. Moreover, the expression levels of pSTING, pIRF3, and IFN- $\beta$  in DCs were obviously higher after treatment with lyOK-432 combined with doxorubicin than after monotherapy. The surviving mice in the ROD group showed inhibition of rechallenged subcutaneous tumor growth.

##### CONCLUSION

The novel ROD peptide hydrogel was effective for the treatment of liver cancer previously treated with inRFA.

##### CLINICAL RELEVANCE/APPLICATION

This modality probably leads to a progression in the eradication of larger liver cancer in clinical practice.

#### R2-SPIR-2 **GNMT and MMP12 Expression Determines Transarterial Chemoembolization in Hepatocellular Carcinoma**

##### PURPOSE

Transarterial chemoembolization (TACE) is a first-line treatment for patients with intermediate hepatocellular carcinoma (HCC). It is crucial to accurately identify patients who are effective for TACE and explore their related mechanisms. Our purpose is to determine the key molecular characteristics and related pathways that affect TACE efficacy.

##### METHODS AND MATERIALS

Based on microarray datasets and high-throughput sequencing dataset, a TACE-effectiveness model was constructed using logistic regression. Based on external data validation, its accuracy was verified by Kaplan-Meier survival analysis, Principal Component Analysis (PCA), and immunohistochemistry was used to verify the expression level of signature genes. Kyoto Encyclopedia of Genes and Genomes (KEGG) analysis and Cibersort x were used to investigate related mechanisms.

##### RESULTS

Three independent cohorts were used, among which GSE104580 was randomly divided into a training set and a validation set at a ratio of 6:4. TACE-effectiveness model was constructed including GNMT and MMP12 through the training set. Our model can effectively distinguish TACE efficient and inefficient patients in the validation set and GSE14520. The OS and DFS of TACE efficient patients were significantly higher than those of TACE inefficient patients. Immunohistochemistry results showed that GNMT was highly expressed in TACE efficient patients, while MMP12 was lowly expressed in TACE efficient patients ( $p < 0.05$ ). MMP12 and GNMT may determine the TACE effectiveness by affecting the metabolic pathway and HIF-1 $\alpha$  signaling pathway.

##### CONCLUSION

Our research provides a model that can accurately evaluate the effectiveness of TACE, and MMP12 and GNMT may determine the TACE effectiveness by affecting the metabolic pathway and HIF-1 $\alpha$  signaling pathway.

##### CLINICAL RELEVANCE/APPLICATION

Our study provides a basis for individualized accurate medical care for patients with HCC, and provides a novel idea and direction for exploring the mechanism of TACE.

## **R2-SPIR-3 Transarterial Chemoembolization Combined With Apatinib Plus PD-1 Inhibitors for Hepatocellular Carcinoma With Portal Vein Tumor Thrombus: A Multicenter Retrospective Study**

### **PURPOSE**

The aim of this study was to compare transarterial chemoembolization (TACE) combined with apatinib and PD-1 inhibitor (TACE-AP) with TACE combined with apatinib alone (TACE-A) in the treatment of hepatocellular carcinoma (HCC) with portal vein tumor thrombus (PVTT) and to explore the prognostic factors affecting the survival of patients.

### **METHODS AND MATERIALS**

This retrospective study analyzed data of patients with HCC with PVTT who were treated with TACE-AP or TACE-A between January 2018 and June 2021. The primary end points of the study were progression-free survival (PFS) and overall survival (OS), and the secondary end points were objective response rate (ORR) and adverse events (AEs). Propensity score matching (PSM) and inverse probability weighting (IPTW) analyses were used to reduce patient selection bias, and Cox regression analysis was used to analyze prognostic factors affecting patient survival.

### **RESULTS**

Sixty-nine and 40 patients were included in the TACE-A and TACE-AP groups, respectively. After PSM and IPTW analyses, the median PFS and median OS in the TACE-AP group were significantly higher than those in the TACE-A group (PFS: after PSM, 6.9 vs 4.0 months,  $P < 0.001$ , after IPTW, 6.5 vs 5.1 months,  $P < 0.001$ ; OS: after PSM, 14.6 vs 8.5 months  $P < 0.001$ , after IPTW, 16.1 vs 10.5 months,  $P < 0.001$ ). After PSM and IPTW analyses, the tumor ORR in the TACE-AP group was significantly higher than that in the TACE-A group (PSM, 53.6% vs 17.9%,  $P = 0.005$ ; IPTW, 52.5% vs 28.6%,  $P = 0.013$ ). All treatment-related AEs were observed to be tolerated. Multivariate Cox regression analysis showed that the main prognostic factors affecting the survival of patients were tumor number, PVTT type, alpha-fetoprotein, and treatment mode.

### **CONCLUSION**

In the treatment of patients with HCC with PVTT, TACE-AP significantly improved PFS, OS, and ORR, and the AEs were safe and controllable.

### **CLINICAL RELEVANCE/APPLICATION**

The study's findings may have clinical relevance in the treatment of HCC patients with PVTT, as it suggests a potential treatment option that could improve patient outcomes. Clinicians treating HCC patients with PVTT may consider the use of TACE-AP, as it may lead to better survival rates and improved objective response rates. Additionally, the findings may inform future research on potential treatment strategies for HCC patients with PVTT, and the prognostic factors identified in the study may aid in patient selection and treatment planning.

## **R2-SPIR-4 Efficacy, Mechanism Safety of Melatonin-loaded on Thermosensitive Nanogels for Rabbit VX2 Tumor Embolization: A Novel Design**

### **PURPOSE**

To explore the efficacy, mechanism and safety of melatonin loaded on p(N-isopropyl-acrylamide-co-butyl methacrylate) (PIB-M) in the treatment of rabbit VX2 tumors.

### **METHODS AND MATERIALS**

In this study, PIB-M was used for tumor embolism. Two types of human hepatoma cell lines (HepG2 and LM3 cells) were used to explore the mechanism by which melatonin prevents the growth and metastasis of cancer cells in vitro. High-performance liquid chromatography was used for pharmacokinetic analysis. A VX2 rabbit tumor model was used to evaluate the efficacy, mechanism and safety of PIB-M in vivo.

### **RESULTS**

We found that under hypoxic condition, melatonin could inhibit tumor cell proliferation and migration by targeting hypoxia inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ) and vascular endothelial growth factor A (VEGF-A) in vitro. The results of pharmacokinetics in vivo showed that a high concentration of melatonin in the PIB-M group could be maintained in tumor tissue for 72 hours after embolization. In vivo, PIB-M inhibited tumor growth and metastasis in rabbit VX2 tumors by targeting related angiogenic proteins and vascular permeability proteins. The liver and kidney functions were most damaged on the first day but recovered to normal on the seventh day after embolization in the PIB-M group.

### **CONCLUSION**

PIB-M can effectively inhibit the growth and metastasis of tumor after treatment, and it is safe. This novel method may open avenues for reduced tumor growth and metastasis after embolism, which may be used for treatment for other solid tumors and clinical translation.

### **CLINICAL RELEVANCE/APPLICATION**

The conclusion of this study may provide a theoretical basis for the use of melatonin in interventional therapy for liver cancer.

## **R2-SPIR-5 Impact of Acute Kidney Injury After Radiofrequency Ablation for Patients with T1a Renal Cell Carcinoma**

### **PURPOSE**

To investigate the association between acute kidney injury (AKI) and renal function 1 year after RFA, and whether this relationship is affected by the duration of AKI.

### **METHODS AND MATERIALS**

We analyzed the data of 393 patients treated by RFA for a single T1aN0M0 renal cell carcinoma. Three outcomes of interest have been defined as follows: (1) recovery of at least 90% of baseline function 1 year after RFA, (2) percentage change of 1-year renal function compared with baseline function, and (3) chronic kidney disease upstaging. AKI was defined according to the RIFLE

criteria. The association between AKI and each endpoint of interest was investigated using a regression model after adjusting for common predictors of renal function.

## RESULTS

Total 58 patients (14%) experienced AKI after RFA. The rate of patients recovering 90% of baseline function was lower in the AKI group (20% vs. 51%), while the proportion of patients who had CKD upstaging was significantly higher (40% vs 19%;  $P < 0.0001$ ). At multivariable analysis, AKI was associated with worse renal function 1 year after RFA, regardless of the outcome of interest (all  $p < 0.0001$ ). Longer AKI increases the risk of functional deterioration, especially after the 3rd day of injury. The risk of CKD upstaging for an average patient who had 1-3 versus = 4th day of AKI was 26% (95% CI: 20-32%) versus 67% (95% CI: 45-68%; absolute risk increase of 11%; 95% CI: 7-22%).

## CONCLUSION

s AKI negatively affects long-term functional recovery after RFA.

## CLINICAL RELEVANCE/APPLICATION

Monitoring of renal function after RFA for RCC is important for patient management. Through this study, it can be helpful for patient management by identifying the correlation between AKI and changes in renal function after RFA for RCC.

## R2-SPIR-6 Impact of Clinical Evident Portal Hypertension on Hepatocellular Carcinoma with Transarterial Chemoembolization (CHANCE-CHESS 2301): A Multicenter Cohort Study

Participants

Zhicheng Jin, MD, Nanjing, China (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the impact of clinically evident portal hypertension (CEPH) on the prognosis of hepatocellular carcinoma (HCC) patients treated with transarterial chemoembolization (TACE).

## METHODS AND MATERIALS

A total of 1614 consecutive HCC patients treated with TACE were retrospectively collected from 10 tertiary centers between June 2006 and December 2019. CEPH was defined when at least one following factor was present: 1) esophageal/gastric varices on upper endoscopy or CT imaging, 2) ascites requiring diuretic treatment, 3) splenomegaly (largest diameter on CT  $> 12$  cm) with a low platelet count ( $< 100,000/\text{mm}^3$ ). Overall survival (OS) as the study endpoint was analyzed by Kaplan-Meier and Cox regression. Propensity score matching analysis was used to match patients for predetermined prognostic factors. During the following up, portal hypertension-related adverse events were described.

## RESULTS

Among 1614 patients, 504 (31.2%) were affected by CEPH. Most patients were male (1339, 83.0%) with predominantly etiology of HBV (1167, 72.3%). Before matching, the median OS in CEPH group was 24.5 months (95% confidence interval [CI]: 21.7-28.8) versus 27.3 months (95%CI: 24.9-31.4) (adjusted hazard ratio [HR], 1.22,  $p = 0.011$ ). After matching, 413 pairs were included. The median OS was also significantly lower in CEPH group (23.4 months [95%CI: 21.6-28.8] vs. 31.7 months [95%CI: 28.0-39.3]; adjusted HR, 1.24,  $p = 0.022$ ). Subgroup analysis showed that CEPH group had a trend that persisted on lower OS compared to non-CEPH group. Patients with  $\geq 2$  CEPH factors had a significantly worse prognosis than patients with 0 or 1 CEPH factor ( $p < 0.001$ ). Among them, 25.2%, 5.8%, and 5% of patients developed ascites progression/occurrence, hepatic encephalopathy, and esophageal/gastric variceal bleeding, respectively.

## CONCLUSION

s The presence of CEPH, especially  $\geq 2$  CEPH risk factors, was significantly associated with poor outcomes and should be taken into consideration when managing HCC patients who underwent TACE.

## CLINICAL RELEVANCE/APPLICATION

The large-sample, real-world study highlights the importance of portal hypertension management by identifying morbidity rate and prognostic impact on clinical decision-making and trial design in HCC patients treated with TACE.

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## Abstract Archives of the RSNA, 2023

R2-SPMK

### Musculoskeletal Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPMK-1 **Assessing the Efficacy of Radiofrequency Ablation and Kyphoplasty for Alleviating Painful Spine Metastases: A Study Using VAS Pain Scale**

##### PURPOSE

To determine the efficacy of pain improvement of radiofrequency ablation (RFA) in conjunction with kyphoplasty in treatment of patients with painful metastatic neoplastic disease to the spine.

##### METHODS AND MATERIALS

Between 3/2019 and 8/2022, a total of 59 kyphoplasty/RFA procedures were performed. The median age of the cohort was 65 years old (range, 41-86) with male-to-female ratio of 0.97. The primary neoplastic disease was as follows: multiple myeloma (n=17, 28.8%), breast cancer (n=15, 25.4%), lung cancer (n=7, 11.9%), prostate cancer (n=6, 10.2%), lymphoma and colorectal cancer (each n=3, 5.1%), urothelial carcinoma (n=2, 3.4%), thyroid cancer, pancreas adenocarcinoma, renal cell carcinoma, and metastatic adenoid cystic carcinoma (each n=1, 3.3%). Pain relief was evaluated by the visual analogue scale (VAS) score before and within 3-months after the procedure. The highest documented VAS pre- and post-procedure was recorded. A P value < 0.05 was considered statistically significant.

##### RESULTS

Technical success was achieved in all patients. The median follow-up was 15 days (IQR, 14-52.5) after the procedure. The median VAS score decreased from 10 (IQR, 8-10) to 2 (IQR, 2-3) within 3 months after procedure ( $p < 0.001$ ). There were no major complications.

##### CONCLUSION

s RFA in conjunction with kyphoplasty is safe and provides meaningful clinical improvement in VAS pain scores when measured within 3 months of the procedure.

##### CLINICAL RELEVANCE/APPLICATION

MSK Interventional Radiology - Palliative Spine Intervention

#### R2-SPMK-2 **Accuracy of GE Revolution CT and Philips iQon CT Energy Spectrum Scanning in Measuring Lumbar Bone Density**

##### PURPOSE

In this study, the European spine phantom (ESP) was used to investigate the accuracy of GE Revolution CT and Philips iQon CT in measuring human lumbar vertebra bone density

##### METHODS AND MATERIALS

The ESP (QRM GmbH, Moehrendorf, Germany) used in this study consists of epoxy resin and three hydroxyapatite (HAP) at densities of 50 mg/cm<sup>3</sup> (osteoporosis), 102 mg/cm<sup>3</sup> (osteopenia) and 197 mg/cm<sup>3</sup> (normal), They were labeled as the first, second, and third lumbar vertebrae (L1), respectively. The energy spectrum scanning of the body mold was performed by Revolution CT and iQon CT. The scanning parameters of Revolution CT were 140/80kVp instantaneous switching of high and low voltage, tube current was 230mA, tube speed was 0.8s /r, and pitch was fixed at 0.984:1. iQon CT scanning parameters: tube voltage 120kVp, tube current: automatic milliampere technology, tube speed 0.75 s/r, pitch 0.801:1. The BMD values of ESP L1-3 vertebra were measured, and the linear regression equations between the two CT measurements and the real values were calculated. The differences between the two linear regressions were analyzed by MedCalc.

##### RESULTS

There was no significant difference between the measured values and the real values between the two machines ( $P > 0.05$ ). The linear regression equation of Revolution CT was  $y = 1.0365x - 2.593$ , and the linear regression equation of iQon CT was  $y = 1.0193x - 1.528$ . There was no significant difference in slope and intercept ( $P > 0.05$ ).

##### CONCLUSION

s Under the optimal scanning parameters of Revolution CT and iQon CT, the two machines can measure lumbar bone density with good consistency.

##### CLINICAL RELEVANCE/APPLICATION

iQon CT, like Revolution CT, can also accurately measure lumbar bone density.

#### R2-SPMK-3 **Preoperative Imaging Features of Bone Cement Leakage After Percutaneous Vertebroplasty in**

## Kummell's Disease

### PURPOSE

To investigate the preoperative imaging features of bone cement leakage after percutaneous vertebroplasty for Kummell's disease.

### METHODS AND MATERIALS

The clinical, imaging, treatment and follow-up data of patients with Kummell's disease vertebral compression fracture and percutaneous bone cement filled vertebroplasty from January 2016 to January 2022 were analyzed retrospectively. According to whether there was bone cement leakage in postoperative follow-up, they were divided into two groups. The continuous variable data were compared by independent sample t-test or Mann-Whitney U nonparametric rank sum test, and the classified variable data were compared by chi square or Fisher exact chi square; Finally, binary logistic regression was used to explore the independent risk factors of bone cement leakage.

### RESULTS

A total of 67 cases were included (mean age  $69.63 \pm 9.11$  years, 13 males and 54 females). The injured vertebrae of Kummell's disease were mainly in the thoracolumbar (T5, T6, T7 and T10 were all 1, T8:3, T11:8, T12:19, L1:16, L2:12, L3:1 and L4:4). 38 cases (57%) of bone cement leakage occurred within one month after follow-up, including 24 cases (63%) of intervertebral disc leakage, 11 cases (29%) of soft tissue leakage, 1 case (2.6%) of intravascular leakage, 1 case of intraspinal leakage and 1 case (2.6%) of mixed leakage. The following signs were statistically different between the leakage group and the non leakage group: the degree of X-ray vertebral compression ( $\chi^2=6.278, P=0.043$ ), CT Intravertebral Vacuum Clefts ( $\chi^2=4.899, P=0.025$ ), vertebral cortical discontinuity ( $\chi^2=4.540, P=0.030$ ). Binary logistic regression showed that CT Intravertebral Vacuum Clefts was an independent predictor of bone cement leakage (Odds ratio,  $OR=3.069, P=0.029$ ).

### CONCLUSION

The Intravertebral Vacuum Clefts is related to the leakage of bone cement after percutaneous vertebroplasty, which can be used to guide the choice of treatment before operation.

### CLINICAL RELEVANCE/APPLICATION

The Intravertebral Vacuum Clefts is related to the leakage of bone cement after percutaneous vertebroplasty, which can be used to guide the choice of treatment before operation. The Intravertebral Vacuum Clefts is the preoperative imaging features of bone cement leakage after percutaneous vertebroplasty for Kummell's disease.

## R2-SPMK-4 Trabecular Bone Score as an Assessment Tool to Identify the Risk of Vertebral Fractures in SAPHO Syndrome

### PURPOSE

To investigate the clinical utility of TBS evaluation for vertebral fracture (VF) risk assessment in SAPHO patients compared with BMD assessment.

### METHODS AND MATERIALS

Seventy SAPHO patients [mean age 50.1 (10.7) years, 81% women] were enrolled in this cross-sectional study. TBS and BMD were assessed using dual-energy X-ray absorptiometry. VF of spine were evaluated using whole-spine CT. We compared BMD and TBS results regarding to the presence/absence of VF.

### RESULTS

Patients with VF had significantly lower BMD, T-score and Z-score of lumbar spine (LS) and TBS values and more frequently presented median-high fracture risk in TBS and abnormal BMD at the three evaluated sites than without. Univariate logistic regression analyses identified lower TBS value ( $<1.23$ ), abnormal BMD of the LS, femoral neck (FN) and total hip (TH) were associated with VF [odds ratio (95% CI): 22.9 (6.1, 85.7), 7.6 (2.4, 23.5), 7.6 (2.4, 23.5), and 10.1 (3.0, 33.8), respectively]. For predicting VF in SAPHO patients. TBS showed the greatest AUC in the ROC curve, with a value of 0.920 compared with 0.777, 0.690 and 0.652 for LS, FN and TH BMD, respectively.

### CONCLUSION

TBS has a better discriminatory value than BMD for prediction of VF in SAPHO patients.

### CLINICAL RELEVANCE/APPLICATION

TBS may, therefore, be a useful clinical tool to identify the risk of VF in SAPHO patients.

## R2-SPMK-5 Deep Learning Reconstructed T2-weighted Dixon Imaging of the Spine: Impact on Acquisition Time and Image Quality

### Participants

Thierno Diallo, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

Zeynep Berkarda, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the image quality and impact on acquisition time of a novel deep learning based T2 Dixon sequence (T2DL) of the spine.

### METHODS AND MATERIALS

This prospective, single center study included  $n=44$  consecutive patients with a clinical indication for lumbar MRI at our university radiology department between September 2022 and March 2023. MRI examinations were performed on 1.5-T and 3-T scanners using dedicated spine coils (MAGNETOM Aera and Vida; Siemens Healthcare, Erlangen, Germany). The MR study protocol consisted of our standard clinical protocol, including a T2 standard Dixon sequence (T2std) and the additional T2DL. T2DL acquisition used a conventional sampling pattern with a higher parallel acceleration factor. The individual contrasts acquired for Dixon water-fat separation were then reconstructed using a dedicated research application. After reconstruction of the contrast images from k-



space data, a conventional water-fat separation was performed to provide derived water images. Two readers with 6 and 4 years of experience in interpreting MSK imaging, respectively, analyzed the images in a randomized fashion. Overall image quality (OIQ), banding artifacts, artifacts, sharpness, noise, and diagnostic confidence were analyzed using a 5-point Likert scale (from 1 = non-diagnostic to 5 = excellent image quality).

## RESULTS

Forty-four patients (median age 61,5 years, [IQR: 35.3,67.5], male sex: 39%) were prospectively included. 31 examinations were performed on 1.5-T and 13 examinations on 3-T-scanners. A sequence was successfully acquired in all patients. The total acquisition time of T2DL was 93 seconds at 1.5-T and 86 seconds at 3-T, compared to 235 seconds, and 257 seconds, respectively for T2std (reduction of acquisition time: 60.4% at 1.5-T, and 66.5% at 3-T;  $p < 0.01$ ). OIQ was rated equal for both sequences (mean T2DL 4.66,  $\pm 0.61$ , and T2std 4.61  $\pm 0.72$ ;  $p = 0.59$ ). T2DL showed reduced noise levels compared to T2std (4.93,  $\pm 0.26$  versus 3.84,  $\pm 0.37$ ;  $p < 0.01$ ). In addition, sharpness was rated to be higher in T2DL (4.84,  $\pm 0.37$  versus 3.95,  $\pm 0.53$ ;  $p = 0.01$ ). Although T2DL displayed significantly more banding artifacts (4.25,  $\pm 0.92$  versus 4.91,  $\pm 0.29$ ;  $p < 0.01$ ), no impact on readers diagnostic confidence between sequences was noted (T2std: 4.7,  $\pm 0.63$ , and T2DL: 4.8,  $\pm 0.48$ ;  $p = 0.61$ ). Inter-reader agreement ranged from fair (? for noise: 0.3) to substantial (? for OIQ: 0.8).

## CONCLUSION

s T2DL is feasible with image quality comparable to the reference standard while substantially reducing the acquisition time.

## CLINICAL RELEVANCE/APPLICATION

T2DL may replace standard imaging, while significantly reducing time and cost in MRI of the spine. Further interchangeability analyses seem reasonable to assess the diagnostic performance of the new sequence.

## R2-SPMK-6 Diagnostic Delay in Patients with Osteoid Osteoma

### Participants

Florian Gassert, MD, BSc, Muenchen, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the diagnostic delay in patients with osteoid osteoma and to analyze influencing factors.

## METHODS AND MATERIALS

All patients treated for osteoid osteoma at our tertiary referral center between December 1997 and February 2021 were retrospectively identified (n=302). The diagnosis was verified by an expert panel of radiologists and orthopedic surgeons. Exclusion criteria were post-interventional recurrence, missing data on symptom onset, and if no pretherapeutic CT images were available. Clinical parameters were retrieved from the local clinical information system. CT and MR images were assessed by a senior specialist in musculoskeletal radiology.

## RESULTS

After all exclusions, we studied 162 patients (mean age, 24  $\pm$  11 years, 115 men). The average diagnostic delay was 419  $\pm$  485 days (median: 275 days; range: 21 - 4503 days). Gender, patient age, presence of nocturnal pain, positive Aspirin test, extent of bone sclerosis, and location of the tumor within bone and relative to joints did not influence diagnostic delay ( $p > .05$ ). It was, however, positively correlated with nidus size ( $r = 0.26$ ;  $p < .001$ ), and shorter with affection of long tubular bones compared to all other sites ( $p=.04$ ). If osteoid osteoma was included in the initial differential diagnoses, diagnostic delay was also shorter ( $p = .007$ ).

## CONCLUSION

s The diagnostic delay in patients with osteoid osteoma is independent from demographics, clinical parameters and most imaging parameters.

## CLINICAL RELEVANCE/APPLICATION

A long average delay of more than one year suggests low awareness of the disease among physicians. Patients with unclear imaging findings should thus be referred to a specialized musculoskeletal center or an expert in the field should be consulted timely.

## R2-SPMK-7 Differentiation of Bone Metastases from Benign Red Marrow Depositions: Concerns of Conventional MR Imaging

### Participants

Jisu Lim, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To differentiate bone metastases (BMs) from benign red marrow depositions (BRMs) by qualitative and quantitative analyses of T1-weighted imaging (T1w) and fat-suppressed T2-weighted imaging (T2 FS) and to compare the diagnostic performance of normal muscle and normal bone marrow as internal standards on T2 FS in differentiating BMs and BRMs

## METHODS AND MATERIALS

Seventy-five lesions, including 38 BMs and 37 BRMs, were assessed with T1w and T2 FS. Two radiologists independently evaluated MR images by qualitative (signal intensity [SI] of lesions compared to that of normal muscle [NM] or normal bone marrow [NBM]) and quantitative (parameters of the ROIs in the lesions, including T1 ratio [ratio of T1 SI of lesion to that of NM], T2FMu ratio [ratio of T2 FS SI of lesion to that of NM], and T2FMa ratio [ratio of T2 FS SI of lesion to that of NBM]) analyses. Qualitative and quantitative characteristics of BMs and BRMs were compared. To evaluate the diagnostic utilities of quantitative parameters, ROC curves were analyzed.

## RESULTS

Hyperintensity relative to NM or NBM on T2 FS was more frequent in BMs than in BRMs (100% vs 59.5%~78.4%, respectively;  $p=0.001$ ) but also was present in more than half of BRMs. All quantitative parameters showed a significant difference between BMs

and BRMs (T1 ratio, 1.075 vs. 1.227 [p=0.002]; T2FMu ratio, 2.094 vs. 1.282 [p<0.001]; T2FMa ratio, 3.232 vs. 1.810 [p<0.001]). The ROC AUCs of T2FMu and T2FMa ratios were clinically useful (0.781 and 0.841, respectively) and didn't demonstrate statistically significant differences.

## CONCLUSION

s The quantitative analysis of T2 FS can be useful in differentiating BMs from BRMs, regardless of whether the reference was NM or NBM.

## CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of conventional T2 FS without additional scanning could be used to differentiate bone metastases from benign red marrow depositions, regardless of whether the comparison reference was normal muscle or normal bone marrow.

## R2-SPMK-8 Can Material Density Imaging Improve Detection of Healthy-appearing Bone Metastases at Contrast-enhanced Dual-energy CT?

Participants

Hitoshi Takeuchi, MD, Fuchu, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Because CT is an imaging modality of choice for oncologic assessment but not sufficiently sensitive to detect bone metastases, sensitive detection of bone metastases by material density imaging is expected at body contrast-enhanced dual-energy CT (ceDECT). We assessed usefulness of water/hydroxyapatite (W/H-DI) and iodine/water density imaging (I/W-DI) to improve detection of healthy-appearing bone metastases at body ceDECT.

## METHODS AND MATERIALS

From September 2022 through March 2023, two experienced radiologists by consensus included 41 bone metastases that appeared healthy without definite sclerotic/lytic changes or mass formation on virtual monochromatic imaging (VMI) at 70 keV but were diagnosed by MRI, bone scintigraphy/SPECT, and/or FDG-PET/CT from four patients who underwent body ceDECT during the venous phase using a 256-detector DECT scanner (Revolution CT, GE). We reconstructed VMI at 70 keV, W/H-DI, and I/W-DI of slice thickness of 1.25 mm with a deep-learning reconstruction algorithm (TrueFidelity, GE) to place regions of interest within each healthy-appearing bone metastasis and its corresponding non-metastatic area with anatomical symmetry (for a vertebral metastasis, a non-metastatic area in only a little more cranial/caudal vertebra) as reference to measure mean CT value, W/H density, and I/W density, respectively. Paired t test was used to compare the mean CT value, W/H density, and I/W density between the healthy-appearing bone metastases and the reference areas. Receiver operating characteristic (ROC) analysis was adopted to assess diagnostic performance of these parameters to detect healthy-appearing bone metastases.

## RESULTS

W/H density was significantly higher ( $985.3 \pm 10.9$  mg/mL vs.  $962.9 \pm 10.6$  mg/mL;  $P < 0.001$ ) and I/W density was significantly lower in the metastases than in the reference areas ( $3.4 \pm 1.4$  mg/mL vs.  $3.8 \pm 1.3$  mg/mL;  $P < 0.001$ ), whereas CT value at 70 keV was comparable ( $151.3 \pm 62.8$  HU vs.  $149.1 \pm 60.7$  HU;  $P = 0.429$ ). Area under the ROC curve improved from CT value at 70 keV (0.513) to I/W density (0.595) to W/H density (0.951).

## CONCLUSION

s Material density imaging, particularly W/H-DI, can improve detection of healthy-appearing bone metastases at body ceDECT.

## CLINICAL RELEVANCE/APPLICATION

As a comprehensive oncologic study, ceDECT with improved detectability of bone metastases by W/H-DI can reduce radiation exposure and/or medical cost and improve patient management by omitting unnecessary further examinations.

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## Abstract Archives of the RSNA, 2023

R2-SPNMMI

### Nuclear Medicine & Molecular Imaging Thursday Poster Discussions

#### Sub-Events

#### **R2-SPNMMI- Functional Imaging Metrics in Patients with Metastatic Paraganglioma/pheochromocytoma Treated with Lu-177-dotatate: A Single-center Experience**<sup>1</sup>

Participants

Ridvan Demirci, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Paragangliomas and pheochromocytomas are rare neuroendocrine tumors for which there is no standard of care for patients that develop metastatic disease. Radioligand therapy in neuroendocrine tumors shows promising results in disease control with minimal adverse events. This study describes our observations of changes in functional imaging metrics relative to time to progression (TTP) with Lu-177-dotatate treatment in patients with metastatic paraganglioma/pheochromocytoma (mPara/Pheo).

#### **METHODS AND MATERIALS**

Of nine patients with mPara/Pheo treated with four cycles of Lu-177-dotatate, eight patients had both pre-and post-treatment dotatate PET and were included in the image analysis. Total tumor volume (mL, TV) was determined by thresholding all tumor sites with uptake above blood pool activity measured from the left ventricle. SUV<sub>mean</sub> of the TV and ratio of SUV<sub>mean</sub> TV to liver (SUV<sub>mean</sub> T:L ratio) were also measured, and changes between these parameters on pre and post imaging were calculated. Progression was defined as presence of new lesions on post-treatment dotatate PET or by RECIST in those with RECIST measurable disease. TTP was calculated from the date of the 1st cycle.

#### **RESULTS**

Median age in the cohort was 52 [range 33 to 83], 4 female, with 0 - 1 lines of prior therapy. Median TTP for all patients was 19 [range 4 to 26]. Patients were then divided into two groups, those with progressive disease (N=2, PD) and those with stable disease or partial response (N=6, SD), on initial re-staging scans after the 4th cycle. Median values of TTP were 5 months [range 4 to 6] and 20.5 months [range 13 to 26], respectively. In the two patients in the PD group, TV increased by 103% and 235% from the pre-treatment scan and SUV<sub>mean</sub> T:L ratio decreased by 8% and 35%. Median change in TV in the SD group was -7.5% [range -43% to +25%]. Two had increased TV, and the remaining four had decreased TV in their post-treatment scans compared to pre-treatment scans. Median SUV<sub>mean</sub> T:L ratio change was -14.5% [range -52% to +53%].

#### **CONCLUSION**

Functional imaging metrics, particularly tumor volume, may have predictive power for clinical outcomes in metastatic paraganglioma/pheochromocytoma. Further studies with a larger patient population and correlation with other clinical and biochemical parameters are needed to confirm these results.

#### **CLINICAL RELEVANCE/APPLICATION**

Functional imaging metrics may serve as an independent biomarker of response in patients with metastatic paraganglioma/pheochromocytoma.

#### **R2-SPNMMI- The Usefulness of FDG-PET Indexes Including Heterogeneity Parameters in the Prediction of Initial Chemo-radiotherapeutic Effect in Oropharyngeal Cancer**<sup>2</sup>

#### **PURPOSE**

FDG-PET parameters were useful for prediction for the treatment response in various tumors. However, few reports have been analyzed regarding predictivity of FDG-PET indexes particularly heterogeneity indexes for the initial treatment response to chemoradiotherapy in oropharyngeal cancers. The study was done to analyze the predictive capability of various FDG-PET indexes, including heterogeneity parameters such as Entropy, Kurtosis and Skewness for the initial treatment response to chemoradiotherapy.

#### **METHODS AND MATERIALS**

Sixty-six patients with oropharyngeal cancer were analyzed. Forty patients showed CMR after the initial chemo-radiotherapy. Average age was 63.4, the gender ratio was male 51 and female 15. The case number of each stage were 12 in stage II, 39 in stage III and 15 in stage IV respectively. After the initial therapy, complete remission (CMR) was 48 and partial remission (PMR) was 18 cases based on PERCIST criteria using FDG-PET. The group comparison was done between CMR and PMR group regarding SUV<sub>max</sub>, SUV<sub>peak</sub>, metabolic tumor volume (MTV) and total lesion glycolysis (TLG). In addition, the values of heterogeneity indexes such as Entropy, Kurtosis and Skewness were also compared. Then under the best cut-off level, the value of positive predictive values (PPV) for CMR were compared among these parameters.

#### **RESULTS**

Both MTV and TLG values showed significantly lower values in CMR group compared with those in PMR group (9.1 vs. 18.7ml, and

71.9 vs. 157.5g). Other parameters did not show any statistical significance. In the cases with lower TLG (<70g) at baseline, the rate of CMR cases was 100%. Similarly, the cases with lower MTV (<10ml) at base line showed CMR response in 90%. The value of PPV (%) in CMR to the chemo-radiotherapy under the best cut-off values were 100% in TLG, 90% in MTV, 85.7% in SUVmax, 80% in SUVpeak, 69.2% in Entropy, 76.9% in Kurtosis, and 63.6% in Skewness.

#### **CONCLUSION**

s In the prediction of therapeutic response for oropharyngeal cancer, both TLG and MTV were excellent parameters. Among, heterogeneity indexes, Kurtosis seemed to be promising parameter for predicting chemo-radio therapeutic response.

#### **CLINICAL RELEVANCE/APPLICATION**

In the prediction of chemoradiotherapy for oropharyngeal cancer, the heterogenetic index in particular kurtosis preferably checked in addition to TLG and MTV.

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## Abstract Archives of the RSNA, 2023

R2-SPNPM

### Noninterpretive Skills (Beyond Imaging) Thursday Poster Discussions

#### Sub-Events

#### R2-SPNPM-1 Prevalence and Impact of Workplace Sexual Harassment Among Medical Sonographers in the United States

Participants  
Sue Yi, PhD,BS, Verona, WI (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the prevalence and impact of workplace sexual harassment experienced by sonographers in the USA with a national survey including both quantitative and qualitative data.

#### METHODS AND MATERIALS

A survey was adapted from multiple existing well validated instruments and distributed anonymously to a convenience sample of medical sonographers via email contacts and sonographer-specific social media pages. Survey data were analyzed to determine respondent demographics, the prevalence of sexual harassment in the last two years, the type and severity of harassment experienced, demographics of perpetrators, personal and institutional responses to such experiences, and the impact of sexual harassment on sonographer physical and mental health and job satisfaction.

#### RESULTS

220 sonographers (82.7% female) participated in the survey. The majority (45%) were aged between 18 and 34 years, and 81% identified as white. The majority (87%) reported experiencing at least one incident of harassment within the last two years. Female respondents experienced higher harassment rates (76%) compared to male respondents (50%,  $p=0.02$ ). The most common forms of harassment were verbal, including suggestive or sexist jokes (69%) and offensive sexist remarks (61%). Perpetrators were predominantly male (78%) and most commonly patients (89%) or their friends/family members (46%). The majority of respondents either ignored the harassing behavior (70%) or treated it like a joke (50%), with only a minority (12%) officially reporting incidents. Of those who reported, 44% were unsatisfied with their institution's response. Among respondents, 34% reported negative impacts of workplace sexual harassment, such as anxiety, depression, sleep loss, or adverse workplace consequences.

#### CONCLUSION

Sexual harassment experienced by sonographers in the workplace is commonplace, and often leads to negative health and career outcomes. Female sonographers are significantly more likely to experience harassment compared to male sonographers, and in a profession where 90% of sonographers are female, it is critical to find systemic methods to prevent harassment behavior and support victims of sexual harassment in the workplace.

#### CLINICAL RELEVANCE/APPLICATION

Sexual harassment is prevalent among sonographers, harming their physical and mental health. Strong institutional policies are critical to curb harassment and lessen its impact.

#### R2-SPNPM-2 The Shift From Hospital Based Imaging To The Office Setting: A Medicare Analysis from 2013 to 2020

Participants  
Aditya Khurana, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate trends in productivity for diagnostic radiologists serving the Medicare population, by practice setting.

#### METHODS AND MATERIALS

All imaging interpretation claims from 2013 to 2020 were extracted from the CMS POSPUF Database for Medicare Part B, a national social insurance program providing health insurance for outpatient services for Americans over 65 yrs and disabled. Claims data were merged with CMS data files to determine the year specific total professional component (wRVU) value for each procedure. These values were aggregated for each individual radiologist and stratified by "Place of Service." "Place of service" has two possible values: "Facility" includes hospital affiliated sites, emergency room, or ambulatory surgery center, while "Non-facility" includes private offices and urgent care facilities. Market share of services was defined as the proportion of wRVUs from a given setting divided by wRVUs performed in both settings. Claims were assigned to a US Census region.

#### RESULTS

In 2013, there were 52,179,386 total imaging wRVUs, 63,276,990 (+21.3%) in 2019, and 53,907,670 (-14.8%) in 2020. Facility (hospital) settings accounted for 42,607,520 wRVUs in 2013, 48,578,010 (+14.0%) in 2019, and 40,957,510 (-15.7%) in 2020. Facility market was 81.7% in 2013, 76.8% in 2019, and 76.0% in 2020. Non-facility (office) services accounted for 9,571,866 wRVUs in 2013, 14,698,980 in 2019 (+53.6%), and 12,950,160 (-11.9%). Non-facility market share was 18.3% in 2013, 23.2% in

2019, and 24.0% in 2020. By US region, 2020 total outpatient imaging wRVUs and CAGRs were: South 4,928,295 (+28.1% from 2013), Northeast 3,228,274 (+44.2%), West 2,791,136 (+31.9%), and Midwest 2,002,454 (+46.1%). 2020 wRVU market share of non-facility services by US region was: Northeast 30.5% (+8.7% from 2013), West 29.1% (+3.4%), South 23.6% (+5.5%), and Midwest 15.5% (+4.5%).

## **CONCLUSION**

s In the Medicare population, the rate of growth of office based imaging wRVUs outpaced growth of hospital settings by 39.4% from 2013 to 2020. Office market share grew by 5.7% nationally, and by 3.4% - 8.7% across US regions. These findings document a shift toward office settings, which are often less subject to peer review, validation, or regulation than are hospital settings. This shift follows several legislative, regulatory and payer efforts to steer patients toward lower cost settings. Further research is advised to ensure appropriate imaging utilization and consistent high quality patient care is provided in non-facility settings.

## **CLINICAL RELEVANCE/APPLICATION**

Outpatient imaging services for the US Medicare population have shifted from hospital based to office settings, which are often less expensive, yet also less regulated.

## **R2-SPNPM-3 The ACR Learning Network Mammography Positioning Improvement Collaborative: Facilitating Local Performance Improvement through Shared Learning**

Participants

Sarah Pittman, MD, FRCPC, Stanford, CA (*Presenter*) Nothing to Disclose

## **PURPOSE**

To establish and maintain consistent excellent performance in mammography positioning at multiple sites simultaneously by utilizing a structured quality improvement (QI) program within a learning network framework that enables participating sites to develop and implement locally-successful strategies while sharing with and learning from other sites.

## **METHODS AND MATERIALS**

The Mammography Positioning Improvement Collaborative is led by a physician leader and administrative leader, supported by learning facilitators and an advisory committee comprised of national experts and thought leaders. Sites enter the collaborative by first participating in a structured QI training and project execution program. Sites were selected on the basis of strength of local leadership support, intra-organizational relationships, access to data and analytic support, and experience with QI initiatives. During the QI program, participating sites went through a process of organizing their teams, developing goals, gathering data, evaluating their current state, understanding root causes of problems, and developing and testing solutions. A common process map and an image quality scoring system were established. The impact of the interventions implemented at each site was assessed by tracking the percentage of screening mammograms meeting overall passing criteria over time.

## **RESULTS**

Six organizations were selected to participate in the first cohort of the collaborative, beginning with participation in the QI program. Run charts from the six sites show that interventions developed and implemented at each site during the program resulted in improvement in the percentage of screening mammograms meeting overall passing criteria, with five of six sites meeting or exceeding the target mean performance of 85% by the end of the QI program. Anticipated variability in progress is observed between sites.

## **CONCLUSION**

s Using a structured QI program within a learning network framework, five of six sites participating in the first cohort of the Mammography Positioning Improvement Collaborative increased the percentage of screening mammograms meeting overall passing criteria from a collaborative mean of 59% to greater than 85%.

## **CLINICAL RELEVANCE/APPLICATION**

Suboptimal mammography positioning can lead to undetected breast cancer on mammograms. A structured QI program within a learning network framework can facilitate improvement in mammography positioning at multiple sites simultaneously.

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## Abstract Archives of the RSNA, 2023

R2-SPNR

### Neuroradiology Thursday Poster Discussions

#### Sub-Events

#### R2-SPNR-1 **White Matter Lesion Asymmetry: An Indicator of Amyloid PET Positivity in Mild Cognitive Impairment Patients**

Participants

Hye Weon Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

Assessing amyloid-positivity in mild cognitive impairment (MCI) patients is crucial as it may indicate a higher risk of developing dementia. This study aims to investigate whether the asymmetry of white matter lesions (WML) on T2-fluid attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI), assessed through artificial intelligence (AI) based hyperintensity segmentation, could potentially serve as an indicator for amyloid positron emission tomography (PET) positivity in patients with MCI.

#### METHODS AND MATERIALS

In this retrospective cohort study, MCI patients who visited a clinical site in South Korea were enrolled. The participants underwent a comprehensive evaluation, including clinical and neuropsychological assessments, brain MRI, and [18F]-Flutemetamol amyloid PET. Our study utilized in-house AI based software for segmenting and separating WML into left and right hemispheres. Using the processed segmentation, we measured individual WML differences through volumetric assessment.

#### RESULTS

A total of 122 subjects were enrolled in the study, with 53 in the amyloid-negative group and 69 in the amyloid-positive group based on amyloid-PET positivity. The two groups were comparable, with no significant differences in age ( $p=0.189$ ), sex ( $p=0.057$ ), education years ( $p=0.411$ ), and MMSE scores ( $p=0.861$ ). However, the amyloid-positive group showed a significantly higher frequency of having an e4 allele of APOE genotype ( $p=0.033$ ) and Clinical Dementia Rating scale ( $p=0.024$ ). The average WML volume differences between hemispheres were significant in the amyloid-negative group ( $p=0.02$ ) but not in the amyloid-positive group ( $p=0.2$ ). Both groups had a larger WML volume in the right hemisphere, which did not differ significantly between the groups.

#### CONCLUSION

Our study results indicate that it is crucial to evaluate the asymmetry of WML rather than the total hyperintensity lesion load in MCI patients, especially in those without amyloid pathology. Therefore, WML asymmetry could be a potential indicator of amyloid positivity in MCI patients.

#### CLINICAL RELEVANCE/APPLICATION

The WML asymmetry could be utilized as an indicator for amyloid PET positivity in MCI patients.

#### R2-SPNR-10 **Impact of an AI Software on the Diagnostic Performance of Radiologists for the Detection of Cerebral Aneurysms on Time of Flight MR-Angiography**

#### PURPOSE

To evaluate the impact of an AI based software trained to detect cerebral aneurysms on Time-of-Flight MR-Angiographies on the diagnostic performance and reading times of multiple readers with different amounts of experience in diagnostic neuroimaging.

#### METHODS AND MATERIALS

A dataset of 186 MRI studies was evaluated by the different readers for the presence and localization of cerebral aneurysms. First, the reading was done with the support of an AI based software. After a washout period of six weeks, the reading was repeated without the support of the AI software. To document the findings and to measure the reading times, a standardized report was used. The results were compared to the consensus reading of two neuroradiological specialists as a reference standard and sensitivity on patient level and lesion level, specificity on patient level, and false positives per case were calculated.

#### RESULTS

According to the reference standard, there were 54 aneurysms present in the dataset. Six readers took part in the reading with no experience (three medical students), two years experience (resident in neuroradiology), six years experience (fellow neurointerventional radiologist) and twelve years experience (neuroradiology specialist), respectively. Sensitivities on lesion level ranged from 66.7% - 87.0% with AI and 57.7% - 87.0% without AI, sensitivities on patient level ranged from 63.4% - 81.8% with AI and 52.3% - 75.0% without AI. Specificities ranged from 93.7% - 97.2% with AI and 89.4% - 98.6% without AI. False positive findings per case ranged from 0.03 - 0.12 with AI and 0.02 - 0.17 without AI. The differences in diagnostic performance did not reach the level of statistical significance. 4 out of 6 readers showed significantly shorter reading times with the use of AI, while the remaining two readers showed a significant increase in reading times.

#### CONCLUSION

s In our retrospective study, we found equivocal results for the diagnostic performance of six different readers for the detection of cerebral aneurysms with and without the use of an AI software. Although we found a tendency towards a better diagnostic performance, these differences were not statistically significant. The majority of readers showed a significant decrease of reading times, but the radiologist and one medical student showed a significant increase of reading times.

#### **CLINICAL RELEVANCE/APPLICATION**

AI softwares for the detection of pathologies in neuroimaging are increasingly used in the clinical routine. There is a chance that the use of the softwares may improve readers' performances, but radiologists must be aware that with the use of additional softwares, there is a risk of slowing down established workflows without a significant increase in diagnostic performance.

### **R2-SPNR-11 Sensitivity and Specificity of Ischemia Detection on Brain MRIs using a Commercially Available Deep Learning Algorithm in Patients with Suspected Stroke from a Non-comprehensive Stroke Center**

#### **PURPOSE**

Several deep learning artificial intelligence (AI) products exist to detect intracerebral pathology in magnetic resonance imaging (MRI). We set out to estimate the ability of a commercially available CE-approved AI product to detect acute brain ischemia on MRI, compared to an experienced Neuroradiologist.

#### **METHODS AND MATERIALS**

We retrospectively included patients from January 2020 based on the following criteria: Age = 18 years, brain MRI due to suspicion of stroke, with onset of symptoms within four weeks prior to the scan. The Neuroradiologist reinterpreted the MRI scans and subclassified ischemic lesions, serving as the reference test. Scans were excluded if artifacts hampered interpretation, or if sequences were missing. The patients were scanned by one of four different MRI models from the same vendor. The first 3/4 of the patients were included consecutively and the remaining patients were included in an enriched manner to increase the size of subgroups of less frequent ischemic lesions. The index test was a CE-approved AI product.

#### **RESULTS**

The final analysis cohort comprised 995 patients (mean age 69 years, 53% female). A case-based analysis for detecting acute or subacute ischemic lesions showed a sensitivity of 89% (95% CI: 85%-91%) and specificity of 90% (95% CI: 87%-92%). In the consecutive cohort only, consisting of 767 patients, we found a sensitivity of 86% (95% CI: 80-90%) and a specificity of 90% (95% CI: 87-92%). The consecutive and enriched cohorts did not differ significantly in sensitivity, nor was there a significant difference in sensitivity or specificity based on sex or age. However, specificity was significantly reduced in cases with DWI artifacts as opposed to those without (77% vs. 91%,  $p < 0.01$ ). Sensitivity increased significantly with lesion size, for fragmented lesions, and for lesions with signs of hemorrhagic transformation. Furthermore, sensitivity varied with the radiological age of the ischemic lesions. For lesions located in multiple anatomical subgroups, sensitivity was 97% (95%CI 94%-99%), while it was 82% (95%CI 77%-87%) for lesions located within one anatomical subgroup, which was significantly different ( $p < 0.001$ ).

#### **CONCLUSION**

s The AI product exhibits high sensitivity and specificity in detecting acute ischemic lesions on MRI compared to an experienced Neuroradiologist at our non-comprehensive stroke center. However, upon clinical application of this AI tool, awareness of the reduced sensitivity for detecting smaller ischemic lesions is required.

#### **CLINICAL RELEVANCE/APPLICATION**

Validating AI products that analyze brain scans is essential before clinical application as they can impact patient diagnostics. AI models often decrease accuracy in clinical settings, highlighting the need for validation studies.

### **R2-SPNR-12 Diagnostic Performance of ChatGPT from Patient History and Imaging Findings in Neuroradiology**

#### **PURPOSE**

To evaluate the diagnostic performance and utility of Generative Pre-trained Transformer (GPT)-4 based ChatGPT in neuroradiology.

#### **METHODS AND MATERIALS**

We collected 80 consecutive "Case of the Week" cases in the American Journal of Neuroradiology between October 2021 and April 2023. ChatGPT was provided with patient history and imaging findings for each case and asked to provide a diagnosis. The generated diagnoses were compared with the ground truth to evaluate ChatGPT's diagnostic accuracy rate. Each case was categorized by anatomical location (brain, spine, and head neck). Brain cases were further divided into two groups: the central nervous system (CNS) tumor group and the non-CNS tumor group. The Fisher's exact tests were conducted to compare the diagnostic accuracy rates among the three anatomical locations, as well as between the CNS tumor and the non-CNS tumor groups.

#### **RESULTS**

ChatGPT's overall diagnostic accuracy rate was 43% (34/80). When categorized by anatomical location, the diagnostic accuracy rates were 40% (24/60) in brain cases, 60% (6/10) in spine cases, and 40% (4/10) in head neck cases. There was no significant difference in the diagnostic accuracy rates among the three anatomical locations ( $p = 0.56$ ). When comparing the CNS tumor and non-CNS tumor groups, the diagnostic accuracy rates were 8% (1/13) in the CNS tumor group, and 49% (23/47) in the non-CNS tumor group. The diagnostic accuracy rate was significantly lower for the CNS tumor group compared to the non-CNS tumor groups ( $p < 0.01$ ).

#### **CONCLUSION**

s This study demonstrates the potential of ChatGPT's diagnostic performance and utility in neuroradiology. ChatGPT can be used without considering anatomical locations in neuroradiology. ChatGPT's diagnostic accuracy may vary depending on the etiology of the diseases, and its diagnostic accuracy is significantly lower in CNS tumors compared to other diseases. Radiologists should understand the potential advantages and limitations of ChatGPT as a diagnostic tool and decision support system.

#### **CLINICAL RELEVANCE/APPLICATION**

The integration of ChatGPT into neuroradiology practice has the potential to revolutionize the field. improve diagnostic accuracy.



The integration of enhanced image reconstruction, provides not only the potential to revolutionize the field, improve diagnostic accuracy, and ultimately improve patient outcomes.

## **R2-SPNR-13 Improved Differentiation of Cavernous Malformation and Acute intraparenchymal Hemorrhage on CT using AI Algorithm**

Participants

Hwangseon Ju, Gyeonggi-Do, Seongnam-Si, Bundang-Gu,, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

The aim of this study was to evaluate the utility of an artificial intelligence (AI) algorithm in differentiating between cavernous malformation (CM) and acute intraparenchymal hemorrhage (AIH) on brain computed tomography (CT) images, as the differentiation between these two conditions can be challenging on brain CT and may lead to unnecessary additional studies in clinical practice.

### **METHODS AND MATERIALS**

A retrospective, multi-reader, randomized study was conducted to validate the performance of the AI algorithm (SK Inc. CC Medical Insight + Brain Hemorrhage), a commercial software product, in differentiating AIH from CM on brain CT images. CT images of CM and AIH smaller than 3 cm were collected from the electronic database search. The diagnostic performance of the AI algorithm for differentiating CM and AIH was evaluated using the area under the receiver operating characteristics curve (AUC). Six blinded reviewers, including two neuroradiologists, two radiology residents, and two emergency department physicians, evaluated CT images from 288 patients (CM, n = 173; AIH, n = 115) with and without AI assistance, and the diagnostic performance was compared.

### **RESULTS**

The overall AUCs for AI standalone performance in the dataset were 0.93 and 0.92 for slice-wise and patient-wise analyses, respectively. The best diagnostic performance was achieved with a cut-off level of 97.75 % and 97.95 %, sensitivity of 97.1 % and 94.2 %, and specificity of 73.0 % and 73.0 % in slice-wise and patient-wise analyses, respectively. Brain CT interpretation by the reviewers with AI assistance resulted in significantly higher diagnostic accuracy than that without AI assistance (86.92 % vs. 79.86 %,  $p < 0.0001$ ). Radiology residents and emergency department physicians showed significant improvement in the diagnostic accuracy for brain CT interpretation with AI assistance compared to that without AI assistance (84.21 % vs 75.35 %, 80.73 % vs. 72.57 %; respectively, all  $p < 0.05$ ). Neuroradiologists showed a trend of higher diagnostic accuracy with AI assistance in the brain CT interpretation, but with no statistically significant difference (95.83 % vs. 91.67 %).

### **CONCLUSION**

The use of AI algorithm can enhance the differentiation of AIH from CM in brain CT interpretation for non-experts in neuroradiology.

### **CLINICAL RELEVANCE/APPLICATION**

The AI algorithm can aid in the proper diagnosis and management of patients who present with a hyperdense lesion on brain CT in clinical practice.

## **R2-SPNR-14 Battle of the Brains: Exploring the Accuracy of Artificial Intelligence in Detecting Brain Bleeds on CT Scans**

Participants

Victor Tang, MBBS, BSc, Melbourne, Australia (*Presenter*) Nothing to Disclose

### **PURPOSE**

Artificial intelligence (AI) has the potential to improve the accuracy and speed of diagnosis of acute intracranial haemorrhage (ICH) which can enhance daily radiology practice and reduce diagnostic errors. As the number of commercial AI algorithms increase, radiology departments are met with a choice of which companies to partner with. This study aimed to compare the performance of two different AI algorithms in detection of ICH on CT scans.

### **METHODS AND MATERIALS**

All technically adequate non-contrast CT brain studies collected over one month were second-read independently by a neuroradiologist to establish a ground truth for the presence of ICH. Two AI algorithms (1 and 2) were then utilized to review these CT studies and assess them for the presence of ICH. The outputs of the AI algorithms were then compared to the ground truth in order to evaluate their diagnostic accuracy and to compare their performance. Repeat CT brains performed on the same patient were included within the study.

### **RESULTS**

A total of 1241 brain CT scans were performed within the study period, with 1058 scans marked as negative and 183 scans marked as positive for ICH (14% incidence) by the neuroradiologist. The sensitivity and specificity for Algorithm 1 was 86.3% and 97.2%, respectively. Stratifying by location (emergency [ED], inpatient [IP], outpatient [OP]), the sensitivity was 82.6% (ED), 91.1% (IP), 53.8% (OP), the specificity was 97.1% (ED), 97.3% (IP), 91.7% (OP). The sensitivity and specificity for Algorithm 2 was 88.5% and 96.7%, respectively. Stratifying by location, the sensitivity was 87.0% (ED), 91.1% (IP), 69.2% (OP), the specificity was 96.7% (All), 97.2% (ED), 96.0% (IP), 94.4% (OP). Statistical analysis of the data was conducted using a McNemar test. No statistically significant differences between the two algorithms were found at a significance level of 0.05; all cases P-value: 0.913, ED P-value: 1, IP P-value: 0.458, OP P-value: 0.453

### **CONCLUSION**

Both algorithms demonstrate high diagnostic accuracy with no significant difference. The drop in OP sensitivity could be due to the low sample size (power = .80). AI 2 did provide a differential output for ICH subtypes, however this was not evaluated in this study. Nonetheless, other features of the AI, such as detection of pathologies other than ICH, user interface and cost, will carry more weight in determining which AI solutions to integrate into the departmental workflow.

### **CLINICAL RELEVANCE/APPLICATION**

The growing number of commercial AI algorithms presents radiology departments with an opportunity of selecting a partner

The growing number of commercial radiomics products, regulatory requirements, and opportunities for creating a profitable company, in order to enhance daily practice and reduce diagnostic errors.

## **R2-SPNR-2 Automatic Brain MRI Segmentation Quality Control for More Reliable Study Outcomes**

### **PURPOSE**

Large-scale (>10,000) retrospective observational studies of quantitative regional brain volume assessment from magnetic resonance imaging (MRI) require automated segmentations (SEG). Segmentation errors on standard clinical data are frequent and hamper results. We seek to mitigate this with automated reliability quantification.

### **METHODS AND MATERIALS**

All 35,818 consecutive 3D T1 brain MRI scans acquired for clinical purposes on 24,261 patients in 11 hospitals in the Capital Region of Denmark during 2019 and 2020 were harvested after regulatory waiving of consent. All MRIs were processed and segmented in anatomical brain regions using FAST-AID Brain [DOI:10.48550/arXiv.2208.14360]. A random subset of 4,887 MRIs was manually categorized by a neurologist as with no, minor, and major SEG failure. We fine-tuned a pre-trained 3D residual convolutional neural network (3DResNet) [DOI:10.1038/s41467-019-13163-9] on 3,910 brain MRIs excluding minor SEG failure to predict the SEG failure probability. We compared various scan exclusion (SE) methods, including no SE, manual SE based on major SEG failure (MM1), and manual SE based on any SEG failure (MM2). To examine the automatic approach, we excluded equally many scans with the highest predicted SEG failure probability matching MM1 and MM2, resulting in AM1 and AM2, respectively. We assessed male-female separation using Cohen's d (CD) across age groups for intracranial volume (ICV), hippocampus, cerebellum, and ventricles and computed the minimum sample size per group (MSS) to obtain a power of 0.8 with an alpha of 0.05.

### **RESULTS**

On the test set containing no and major SEG failures, we achieved a ROC-AUC of 0.98 and a PR-AUC of 0.99, with a specificity of 0.93 and an accuracy of 0.94 at the 95% sensitivity level. For ICV, both manual and automatic SE methods showed similar separation, with a higher CD for most age groups compared to no SE. Both approaches resulted in a larger average CD for all examined brain regions. The required MSS was significantly reduced, up to five times, compared to no SE.

### **CONCLUSION**

Employing a machine learning-based approach for predicting SEG failure probability effectively improves the power of retrospective clinical studies focusing on quantitative regional brain volume assessment. The automatic SE method led to a larger average CD for all examined brain regions and substantially reduced the required MSS, ultimately contributing to more reliable conclusions and improved power in retrospective observational studies.

### **CLINICAL RELEVANCE/APPLICATION**

Accurate and reliable quantitative regional brain volumes from MRI are critical for large-scale retrospective observational studies of neurological disorders. We automate quality assurance to increase power and insight.

## **R2-SPNR-3 Advancing the Use of IA in Clinical Practice: Preliminary Outcomes of a Retrospective Clinical Validation Analysis of an AI Volumetric Segmentation Model**

Participants  
Rafael Loureiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **PURPOSE**

The use of Artificial Intelligence (AI) in radiology presents a potential remedy to the escalating volume of medical exams and the insufficient number of specialists. Nonetheless, most AI applications in radiology have not undergone rigorous clinical validation trials. Such validation is essential to reveal any unforeseen downstream implications of implementing AI models in clinical practice, including sociodemographical factors that could affect the model's performance. Additionally, most volumetric brain segmentation tools were originally designed for Magnetic Resonance Imaging (MRI), which is more expensive, time-consuming, and limited in availability compared to Computed Tomography (CT). To tackle such challenges, we evaluated the reliability and accuracy of an AI model in the volumetric segmentation of the intracranial region and lateral ventricles task, using a retrospective dataset comprised of real-world head CT exams stored in our institution's PACS.

### **METHODS AND MATERIALS**

The model is based on an efficient, lightweight U-Net architecture and performs concurrent segmentation in head 3D images of brain and lateral ventricles. For model development, 559 real-world CT images from neonates to adults were used and included typical and atypical cases besides different scanner models, and acquisition settings. For retrospective clinical validation, 167 anonymized exams from February 2021 were chosen. Intracranial and ventricular ground-truth (GT) binary masks were generated using simpleITK and 3D Slicer, respectively and were approved by board-certified neuroradiologists with at least 6 years of experience. Both generation and validation of GT masks were done remotely by using a 3D Slicer Docker web application and a dashboard based on Trame framework. Project approved by the institutional Ethics Committee.

### **RESULTS**

Comparison between GT and AI model's masks showed positive results with a mean Hausdorff distance metric and a mean Jaccard similarity index of 10,11 and 0,97, for the intracranial masks, and 13,20 and 0,65 for the ventricle masks, respectively. Intracranial volumes were more homogenous than the ventricles volumes.

### **CONCLUSION**

The proposed model demonstrated favorable outcomes by using a pipeline that does not require software installation or data download. Future efforts will focus on advancing the model to a prospective stage by conducting external clinical validation using multicentric real-world data.

### **CLINICAL RELEVANCE/APPLICATION**

The model can accurately and efficiently segment CT exams, according to clinical retrospective results. In the future, it might help diagnose patients with greater precision and effectiveness, especially in resource-limited settings.

## **R2-SPNR-4 An Experimental Study of Newborn Pigs Based on MRI Histological Analysis: Pathological Control for Predicting Brain Edema Gradation in HIE**

### **PURPOSE**

Hypoxic-ischemic encephalopathy is one of the causes of death and severe disability in clinical children. Cerebral edema is the main pathological change affecting the clinical prognosis of HIE. Because the pathology of HIE cannot be obtained, clinical experience is commonly used to determine. Noninvasive and rapid prediction of the degree of cerebral edema is essential for clinical decision-making. To solve the clinical problem, we performed pathological studies by simulating clinical children through HIE animals. According to the pathological changes of brain tissue, the MRI images were divided into mild edema group and severe edema group, so that the microscopic pathological changes corresponded to the abnormal signals of macroscopic images. Then the microscopic pathological changes were associated with the omics model, and finally the omics model with pathological validation was realized to predict the HIE brain edema grade.

### **METHODS AND MATERIALS**

The HIE model was established by sealing both common carotid arteries and hypoxia in 54 newborn Yorkshire breeding pigs. T2WI and DWI scans were performed at 1 h, 3 h, 6 h, 9 h, 12 h, 16 h, 22 h, and 24 h. At the end of scanning at each time point, a group of neonatal pigs were taken for pathological examination of brain tissue. It provides a biological basis for omics research and explores the biological significance of image-omics. Each sequence manually delineated ROI in the region of interest to extract omics features, and three methods of dimensionality reduction screening features were used to establish the model. The combination of sequences and classifiers with better efficacy was assessed with ROC curves, K-Fold cross-validation, etc.

### **RESULTS**

Based on the sequence DWI, T2WI, ADC and their combination, the classifiers with better model efficacy were LR, LR, KNN and SVM, and the AUCs were 0.89, 0.86, 0.80 and 0.84, respectively. LR model has the best performance among different classifiers. In the combined sequence and classifier power: the LR classifier training set AUC was 0.88; the validation set AUC was 0.89. Logistic regression classifiers based on DWI images had the best predictive model diagnostic efficacy. Gray level dependent matrix class features and homogeneity class features were found to have more important potential for differentiating brain edema.

### **CONCLUSION**

s 1. The logistic regression model based on DWI sequences was effective in identifying HIE brain edema in neonatal pigs. 2. The gray-scale dependent matrix and homogeneity correlation features have the potential to be used as imaging biomarkers to reflect the degree of HIE edema.

### **CLINICAL RELEVANCE/APPLICATION**

To provide a non-invasive histological prediction model with pathobiological significance for children with clinical HIE.

## **R2-SPNR-5 Deep Learning-based CT to MRI Image Synthesis with Contrastive Loss**

### **Participants**

Seungyu Kim, Yongin-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

Magnetic Resonance Imaging (MRI) is an essential imaging modality in clinical radiology. However, conventional Positron Emission Tomography (PET) quantitative analysis requires MR images, and it is challenging to utilize PET images alone. Recently, deep learning-based generative models have been widely applied in the medical field, yet attempts to synthesize MRI images from CT scans, which possess higher resolution, are scarce. Moreover, as PET-CT devices are more commonly used than PET-MRI, patients often require multiple scans, leading to increased time and cost. In this study, we introduce a deep learning model utilizing contrastive loss to obtain MRI images from CT scans and demonstrate the feasibility of replacing conventional MRI with synthesized MRI for PET quantitative analysis with 18F-Fluorbetaben (FBB) PET imaging.

### **METHODS AND MATERIALS**

We used data from 150 patients with brain CT and T1 MRI scans. Among them, 114 were used for training and the remaining 36 for validation. The CT and MRI scans were co-registered using SPM12 and subsequently used for image translation training. We employed a 2D-based Generative Adversarial Network (GAN) model, utilizing four models: pix2pix, cycle-GAN, Dual Contrastive Learning GAN (DCLGAN) and Contrastive Unpaired Translation (CUT). We extracted slices from CT scans, trained the deep learning models to synthesize MRI slices from 256x256 CT slices, and combined the synthesized slices to generate MRI images.

### **RESULTS**

We assessed the performance using the Peak Signal-to-Noise Ratio (PSNR), Root Mean Square Error (RMSE), and Structural Similarity Index Measure (SSIM). DCLGAN showed the best performance with a PSNR of 24.13, RMSE of 0.1038, and SSIM of 0.8590. Qualitative evaluation also revealed that DCLGAN accurately predicted structures like basal ganglia and cerebellum, challenging to discern in CT scans. Moreover, we retrospectively compared SUVR evaluation using original MRI and synthesized MRI from 142 patients' FBB-PET scans, obtaining an Intraclass Correlation Coefficient (ICC) of 0.9561, indicating a strong correlation between them.

### **CONCLUSION**

s Our deep learning model demonstrates the ability to generate high-quality MRI images from CT scans, capturing intricate structures that are difficult to identify in CT images. This research highlights the potential of our approach as a valuable tool when MRI is inaccessible, ensuring continued advancements in medical imaging analysis.

### **CLINICAL RELEVANCE/APPLICATION**

Our deep learning model generates high-quality MRI images from CT scans, providing a time- and cost-effective alternative for clinical quantitative analysis, such as SUVR, when MRI is inaccessible.

## **R2-SPNR-7 Improved Multimodal Diagnosis of Alzheimer's Disease through MRI and PET Image Fusion**

### **PURPOSE**

Alzheimer's Disease (AD) is a degenerative neurological disorder commonly seen in the ageing population and there is currently no universally accepted atomic diagnostic technique. Previous studies have shown that multimodal analysis can be of great benefit in the diagnosis of AD. In this work, we present two novel multimodal diagnostic models for early detection of AD that utilize fused images from Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET): the 2D dynamic image analysis model and the 3D image analysis model. These models have the potential to improve diagnostic accuracy and facilitate early detection of AD, allowing for timely interventions and better patient outcomes.

### **METHODS AND MATERIALS**

Our study utilized a dataset of 394 paired MRI and PET scans from the Alzheimer's Disease Neuroimaging Initiative (ADNI), which included 120 AD, 154 MCI, and 120 Normal Control (NC) scans. We performed multimodal fusion of paired images to create 3D images containing structural and functional information about the brain. We trained two deep learning models for AD diagnosis: a traditional 3D ResNet-18 model and a novel 2D dynamic image analysis model.

### **RESULTS**

Based on our experiments, we found that both models performed similarly well in more challenging tasks such as differentiating between AD and MCI (85.75% for the 2D model vs 85.66% for the 3D model) and distinguishing between AD, MCI, and NC (86.88% for the 2D model vs 86.20% for the 3D model). However, the 3D image analysis model showed higher accuracy in relatively simpler tasks such as distinguishing between AD and NC (96.11% for the 3D model vs 99.44% for the 2D model) and between MCI and NC (93.47% for the 3D model vs 98.80% for the 2D model).

### **CONCLUSION**

In this study, we have developed two advanced multimodal diagnostic models that offer efficient and accurate early Computer Aided Diagnosis (CAD) of AD and have experimentally demonstrated their effectiveness. Our models outperform existing multimodal diagnostic models using PET images and MRI images as input, in terms of decision-based fusion and image fusion. The proposed models have the potential to assist in early detection and diagnosis of AD, ultimately improving patient outcomes.

### **CLINICAL RELEVANCE/APPLICATION**

Our models have significant clinical relevance as they can aid in the early detection and diagnosis of AD, leading to improved patient outcomes. Although the 2D and 3D models perform similarly in some tasks, we recommend the 2D model due to its faster processing time. Our automated approaches have the potential to enhance healthcare professionals' performance and save costs.

## **R2-SPNR-8 Improved Neurovascular Imaging using Advanced Intelligent Clear-IQ Engine (AiCE)**

### **PURPOSE**

To evaluate the effects of deep-learning image reconstruction on image quality and diagnostic confidence of ultra-high-resolution computed tomography (UHRCT).

### **METHODS AND MATERIALS**

In this single-center study, 100 consecutive patients with acute neurological symptoms underwent CT imaging including cranial computed tomography (CCT) and computed tomography angiography (CTA) using an ultra-high resolution CT scanner. CTA images were reconstructed with normal resolution mode (NR-CTA, matrix 512 x 512, slice thickness 0.5 mm) and ultra-high resolution mode (UHR-CTA, matrix 1024 x 1024, slice thickness 0.25 mm) using iterative reconstruction. Additionally, a deep-learning reconstruction algorithm (advanced intelligent clear-IQ engine, AiCE); specifically trained for ultra-high resolution CT-angiography of the brain was utilized to generate a further UHR-CTA datasets (DL-UHR-CTA, matrix 1024 x 1024, slice thickness 0.25 mm). Image quality for all three reconstructions was evaluated visually by two blinded radiologists using a 4-point Likert-scale. Therefore, general (overall image quality, contrast in general, artifacts, diagnostic confidence and image noise) and vessel specific (assessability of proximal, intermediate and subcortical vessels as well as perforators) criteria were assessed. The quantitative features including slope, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), noise, entropy and co-occurrence matrix (COOC) were examined and compared using an in-house tool.

### **RESULTS**

Qualitative analysis revealed highest scores for DL-UHR-CTA, followed by UHR-CTA and NR-CTA, whereas DL-UHR-CTA yielded excellent results for all qualitative parameters and was significantly superior to UHR-CTA and NR-CTA (all  $p < 0.001$ ). The quantitative analysis was in line with the qualitative findings with significantly superior results for DL-UHR-CTA (slope:  $p < 0.01$ , SNR/CNR:  $p = 0.004$ , entropy  $p < 0.01$ , COOC:  $p < 0.01$ ).

### **CONCLUSION**

Deep-Learning image reconstruction significantly improves image quality of ultra-high resolution neurovascular CT-angiography allowing for higher diagnostic confidence, potentially improving the detection of subtle but oftentimes-significant pathologies.

### **CLINICAL RELEVANCE/APPLICATION**

Deep-learning image reconstruction improves the quality of UHR-CTA images, leading to higher diagnostic confidence and potentially aiding in the detection of subtle but clinically significant pathologies.

## **R2-SPNR-9 Prediction Model of Vascular Cognitive Impairment Based on MRI White Matter Hyperintensities Radiomics Features in the Elderly Patients with CSVD**

Participants  
Wei Wang, Xuzhou, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To establish a prediction model of vascular cognitive impairment (VCI) based on white matter hyperintensities (WMH) radiomics feature, in order to guide people at risk of VCI to carry out early intervention and delay the occurrence of VCI or dementia.

## **METHODS AND MATERIALS**

MRI data of 57 patients with VCI and 169 patients with no cognitive impairment (NCI) were retrospectively analyzed. Patients were randomly divided into training set (n=159) and test set (n=67) in a ratio of 7:3. The images were standardized and WMHs were segmented automatically by using the lesion prediction algorithm in the SPM software package. Two radiologists determined whether there was any error, and if there was any error, ITK-SNAP software was imported for manual delineation. Then features were extracted from the segmented WMHs to select the best image morphological features to build the model. Clinical data and conventional MRI signs were incorporated into the study to build a clinical model, and then the radiomics model was combined with clinical model. The receiver operating characteristic (ROC) curve was plotted and the decision curve analysis (DCA) was performed to evaluate the diagnostic efficacy and clinical application value of each model.

## **RESULTS**

8 radiomics features were extracted from WMH, and the WMH radiomics model, clinical model and combined model were established respectively. The area under the ROC curve (AUC) of the training sets of the three models were as follows: WMH radiomics model was 0.74(95%CI: 0.66-0.83), clinical model was 0.88(95%CI: 0.81-0.94), combined model was 0.90 (95%CI: 0.84-0.96), The AUC in the test set was 0.75(95%CI:0.62-0.87), 0.81(95%CI: 0.68-0.95) and 0.85 (95%CI: 0.74-0.96), respectively. The combined model has better diagnostic efficacy and a higher clinical net return as assessed by DCA.

## **CONCLUSION**

s The diagnostic efficacy of WMH radiomics combined with clinical model was better than that of WMH radiomics or clinical model. It could provide more sensitive and reliable markers for the early prediction and diagnosis of VCI.

## **CLINICAL RELEVANCE/APPLICATION**

The model combined WMH radiomics and clinical data had potential clinical application and could provide more sensitive and reliable markers for the early prediction and diagnosis of VCI.

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## Abstract Archives of the RSNA, 2023

R2-SPPD

### Pediatric Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPPD-1 Absorbed Doses in Ovaries During Pediatric Hip Radiography: To Stop Routine Gonadal Shielding and Move Forward

#### Participants

Kosuke Matsubara, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

The National Council on Radiation Protection and Measurements (NCRP) stated that discontinuing routine use of gonad shield is based on our best scientific understanding. To provide data that contributes to our scientific understanding, we evaluated the difference in ovarian dose between the presence and absence of gonad shield and the difference in ovarian dose depending on the shield size and the depth of the positions of the ovaries.

#### METHODS AND MATERIALS

Twenty-five sensitivity-corrected fluorescent glass dosimeters were placed on the cross section at the level of the femoral head of a 1-year-old pediatric phantom to measure absorbed doses with and without a 2-mm-thick lead gonad shield. They were arranged within a depth of 3-9 cm from the body surface and 0-3 cm to the left and right of the body midline. The imaging conditions were as follows: a tube voltage of 50 kV, tube current-time product of 6.3 mAs, a field size of 7×10 cm, and the source-to-image receptor distance of 100 cm. The ovaries were assumed to be 6 cm depth from the body surface and 1.5 cm to the left and right of the body midline. In the Monte Carlo simulation, a voxel phantom was built from CT images of the 1-year-old pediatric phantom, and the absorbed doses in the ovaries were calculated when changing the area covered by the shield to large, medium, and small and when changing the depth of the ovaries to 3-9 cm.

#### RESULTS

Although the gonad shield blocks almost 100% of the primary X-rays, significant values of absorbed doses were observed in the area covered by the shield. There was a tendency for the dose reduction rate to decrease from 75.5-81.6% to 52.8-66.7% at positions covered by the shield with increasing depth from the body surface from 3 to 9 cm. The dose reduction rate ranged from 2.3% to 23.1% at positions not covered by the shield. The average dose reduction rates obtained from measurements and simulations at the assumed positions of the ovaries were 66.2% for measurements and 72.7% for simulations. In the simulation, the dose reduction rate was 80.0-80.1% when the ovaries were completely covered by the shield (large size), but it was 72.4-73.1% and 53.6-55.3% when the ovaries were partially uncovered (medium size) and completely uncovered (small size), respectively.

#### CONCLUSION

When using a gonadal shield, ovarian dose is affected by how deep the ovaries are located from the body surface and whether the locations of ovaries are covered by the shield. Ovarian doses were far below the thresholds for temporary and permanent infertility even without shielding.

#### CLINICAL RELEVANCE/APPLICATION

This study reveals that gonadal shielding does not eliminate a significant number of scattered X-rays produced in the unshielded irradiated areas, supporting the abolition of gonadal shielding in medical practice.

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## Abstract Archives of the RSNA, 2023

R2-SPPH

### Physics Thursday Poster Discussions

#### Sub-Events

#### R2-SPPH-1 Skin Dose Estimation Reduces Need for Patient Follow-up

##### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

##### PURPOSE

Determine how reference point air kerma and estimated skin dose are related. Further, determine how use of estimated skin dose could impact patient follow-up.

##### METHODS AND MATERIALS

Reference point air kerma ( $K_{air}$ ) and other demographic information was recorded from 629 patients (669 cases) with  $K_{air}$  above 2Gy. An in-house skin dose ( $D_{skin}$ ) estimation system (DIT Platform) was applied to each case. Dose differences between  $K_{air}$  and  $D_{skin}$  were recorded and summary statistics calculated. Trends against demographics were investigated. Percentage of cases brought below accepted dose thresholds related to skin damage and patient follow-up were determined.

##### RESULTS

Median  $D_{skin}$  estimates were 39.6% lower than  $K_{air}$  [24.9% 25th percentile, 51.1% 75th percentile]. Least squares linear trendline set  $D_{skin}$  as 63.2% of  $K_{air}$  with a  $R^2$  of 0.9. No trend was seen between patient weight and any dose metric. Similarly, difference between  $D_{skin}$  and  $K_{air}$  were not dependent on patient weight. 82.6% of  $K_{air}$  cases between 2 and 3 Gy fell below the erythema limit (2Gy). 40.7% of  $K_{air}$  cases between 3-4 Gy cases, 17.1% of  $K_{air}$  cases between 4-5Gy cases, and 5.6% of  $K_{air}$  cases between 5-6 Gy cases had  $D_{skin} < 2$  Gy. 91.7% of  $K_{air}$  cases between 5-6 Gy cases fell below 5 Gy which is a patient follow-up threshold suggested by several professional societies.

##### CONCLUSION

$K_{air}$  substantially overestimates  $D_{skin}$  in clinical cases. The estimates reduced the number of patients needing follow-up due to possible tissue reactions. When discussing possible skin reactions with patients and physicians the improved estimate reduced the need to discuss more severe skin reactions.

##### CLINICAL RELEVANCE/APPLICATION

The use of skin dose estimation software can decrease the need for patient follow-up and reduce the kinds of possible skin reactions that need to be discussed with patients and referring physicians.

#### R2-SPPH-10 Experimental Study of using Low-Dose CT Scan with Novel Deep Learning and Conventional Iterative Reconstruction for Image quality: A Phantom Study

##### PURPOSE

To investigate effect between low-dose CT scan combined with DLIR and conventional ASiR-V for image resolution and noise using Japanese Industry Standards Phantom (JIS Phantom) on GE Revolution APEX.

##### METHODS AND MATERIALS

No GSI scanning experiments were performed on JIS phantom based on GE APEX. The image spatial/density resolution parts of the phantom were selected for the comparative study of different reconstruction algorithms. The scan tube voltage was 120kV, the speed was 0.5s, the detector width was 80mm, the helical pitch was 0.992, and the layer thickness was 0.625mm. For control group (A), 11.5 (CTDIvol,mGy) was used as the conventional dose scan with 30%ASiR-V reconstruction; For low dose group (B), 4.22 (CTDIvol,mGy) was used. Reconstruction was performed using with different ASiR-V weights (30%,90%) and different DLIR levels (L, M, H). For the image spatial resolution/density resolution parts of the body model, AdvancedWorkstation 4.7(GE Healthcare) were used for objective assessment (SD) and subjective scoring (5-point scale for noise and resolution, respectively, with 1 being the worst, 5 being the best, and 3 or more being used for diagnosis) with  $P < 0.05$  considered as statistically significant difference.

##### RESULTS

The SD of the control group A (ASiR-V30%) with conventional dose was  $(14.98 \pm 1.48)$  HU, and the subjective scores of image spatial/density resolution parts were 3 and 3, respectively, and the noise was 2. The SD of the different groups were  $(25.21 \pm 2.42, 13.76 \pm 1.36)$  HU for ASiR-V 30%, 90% ,and  $(21.33 \pm 2.05, 17.74 \pm 1.81$  and  $13.84 \pm 1.57)$  HU for DLIR L, M, H, respectively, with significant differences between the groups ( $p < 0.05$ ). The image spatial resolution score of (2,1) for ASiR-V, and (2, 2 and 3) for DLIR; The image density resolution score of (1,1) for ASiR-V, and (2, 2 and 3) for DLIR; The subjective scores of noise of (2,3) for ASiR-V, (2, 3 and 4) for DLIR. From the subjective results, the image resolution decreased with increasing weight of ASiR-V but increased with increasing DLIR level in low-dose scans. Subjective and objective assessments both showed that noise decreased with increasing weight of ASiR-V or DLIR level, but the noise reduction effect of DLIR was more significant than that of ASiR-V.

## CONCLUSION

The application of DLIR in the non-spectral scan of Revolution APEX was able to improve the image quality (noise and resolution) of the low dose scan to achieve the image quality of the conventional dose scan.

## CLINICAL RELEVANCE/APPLICATION

The images reconstructed with new DLIR algorithm are more advantageous than those obtained by conventional ASIR and FBP. Especially for those low-dose scanning, DLIR can offer good image quality while reducing radiation dose, providing a broader application scenario for low-dose scanning.

## R2-SPPH-11 Image Quality Assessment of Deep Learning Image Reconstruction Combined with Low Radiation Dose in Abdominal CT: A Phantom Study

### PURPOSE

To compare the image quality of deep learning image reconstruction (DLIR) at low and ultra-low dose with filtered back projection (FBP) at clinical dose in abdominal CT.

### METHODS AND MATERIALS

Ten consecutive scans of Catphan 500/600 phantom were performed on Revolution Apex CT using a clinical dose (20.7mGy), low dose (12.29 mGy), ultra-low dose (6.19 mGy). The acquired images were reconstructed with FBP in the clinical dose group, and reconstructed with medium, high strength DLIR algorithms (DLIR-M, DLIR-H) in the ultra-low dose and low-dose groups. The noise (SD), contrast noise ratio (CNR), low density insert diameter, spatial resolution line pair, noise power spectrum (NPS) and task transfer function (TTF) were measured. Image quality was assessed independently by two radiologists using a 5-point scale. One-way analysis of variance and K-W test were used for statistics. Kappa test was used to assess consistency.

### RESULTS

The values of SD and CNR of DLIR-H images in low-dose and ultra-low dose groups were better than FBP images in the clinical dose group (all  $P < 0.01$ ). Low density inserts diameter and the number of spatial resolution line pair of DLIR-H images in the low-dose group were equivalent to those of FBP images ( $P > 0.05$ ) in the clinical dose group. Compared to the FBP images of the clinical dose group, the image texture of DLIR-M and DLIR-H in the low-dose group and ultra-low dose group were almost unchanged, and the NPS noise of the DLIR-H group in the low-dose group was the lowest (FBP of the clinical dose group:  $f_{peak} = 0.28 \pm 0.01 \text{ mm}^{-1}$ ,  $f_{ave} = 0.32 \text{ mm}^{-1}$ ,  $NPS_{noise} = 4.44 \pm 0.05 \text{ HU}$ ; DLIR(M,H) of the low-dose group:  $f_{peak} = 0.28 \pm 0.01 \text{ mm}^{-1}$ ,  $f_{ave} = 0.29 \text{ mm}^{-1}$ ,  $NPS_{noise} = 3.88 \pm 0.04 \text{ HU}$ ; DLIR(M,H) of the ultra-low dose group:  $f_{peak} = 0.27 \text{ mm}^{-1}$ ,  $f_{ave} = 0.29 \text{ mm}^{-1}$ ,  $NPS_{noise} = 5 \text{ HU}$ ); The TTF10% of low contrast target in low-dose and ultra-low dose groups were higher than that of FBP the clinical dose group, while TTF50% were lower in both groups. The subjective score of image quality of DLIR in the ultra-low dose and low-dose groups were not statistically different from that of FBP images in the clinical group ( $P > 0.05$ ). The subjective scores of the two doctors showed good consistency (Kappa = 0.72).

## CONCLUSION

The DLIR algorithm hardly impacts the image texture, especially the contrast and spatial resolution of the low-dose group are comparable or even better than those of the clinical dose FBP image, and the potential reduction of radiation dose can reach 40%~70%, which provides theoretical basis and scanning parameter selection for clinical abdominal CT imaging.

## CLINICAL RELEVANCE/APPLICATION

Low-dose DLIR can reduce radiation dose and provide theoretical basis and scan parameter selection for clinical abdominal CT imaging.

## R2-SPPH-12 Improving Head CT Image Quality under Low-Dose Scanning Conditions using Deep Learning Image Reconstruction Algorithms

Participants  
Chunyu Chen, Guangzhou, China (Presenter) Nothing to Disclose

### PURPOSE

To explore the potential of deep learning image reconstruction (DLIR) algorithm for improving image quality under low dose scanning conditions

### METHODS AND MATERIALS

22 inpatients requiring cranial CT reexamination who underwent routine low-dose brain CT scan (120kV200mA) were recruited. All images were reconstructed using filtered backprojection (FBP), ASIR-V at 50% strength (50%ASIR-V), DLIR at low, medium, and high level (DLIR-L, DLIR-M, DLIR-H). The CT values and noise (SD, standard deviation of CT values) of the gray matter (GM) and white matter (WM) at the basal ganglia and centrum semiovale levels were measured at different algorithm groups. The signal-to-noise ratio (SNR) of GM and WM, contrast-to-noise ratio (CNR) between GM and WM, and artifact index (AI) at posterior fossa were calculated. Two radiologists individually performed subjective evaluation of image noise, lesion clarity, overall image quality, and image artifacts using 1-5 scoring system. The consistency between two radiologists was analyzed. The objective and subjective measurements were compared at four algorithm groups.

### RESULTS

There were no significant differences in the CT values among the different algorithm groups (all  $p > 0.05$ ). In the DLIR groups, as the level of DLIR increased, the SD of GM and WM in the basal ganglia and centrum semiovale, as well as AI, gradually decreased, and while the SNR and CNR gradually increased, compared to FBP and 50% ASIR-V. There were significant statistical differences among the five algorithm groups, with the best performance observed in DLIR-H. (FBP vs DLIR-H, in basal ganglia, SDGM:  $9.45 \pm 2.41$ ,  $3.56 \pm 0.90$ ; SNRGM:  $4.42 \pm 1.27$ ,  $11.47 \pm 2.79$ ; CNR:  $1.23 \pm 0.51$ ,  $2.89 \pm 1.12$  AI:  $9.79 \pm 3.69$ ,  $7.22 \pm 2.30$ ; all  $p < 0.01$ ). The subjective evaluation scores in terms of image noise, overall image quality clarity of the lesion, and image artifacts gradually in DLIR (M, H) were higher compare with FBP and 50%ASIR-V, with a significant statistical difference among five algorithm groups (Radiologist1, FBP vs DLIR-H, image noise:  $2.09 \pm 0.53$ ,  $4.14 \pm 0.35$ ; over image quality:  $2.18 \pm 0.40$ ,  $4.00 \pm 0.00$ ; clarity of the lesion:  $2.55 \pm 0.67$ ,  $4.00 \pm 0.31$ ; Image artifacts:  $2.18 \pm 0.59$ ,  $4.05 \pm 0.49$ ; all  $p < 0.01$ ). Two radiologists showed a good consistency



(ICC:0.48-0.75,  $p < 0.01$ ).

## CONCLUSION

Under low-dose scanning conditions, compared with FBP and 50% ASIR-V, the deep learning optimization scheme has better performance in reducing image noise and artifacts, and subjectively evaluates DLIR-M and DLIR-H as the best post-processing image quality.

## CLINICAL RELEVANCE/APPLICATION

Compared with FBP and 50% ASIR-V, deep learning image reconstruction algorithms can better improve the quality of head CT images.

## R2-SPPH-2 Impact of Model Shape on Peak Skin Dose Estimates

Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

## PURPOSE

To determine the impact of patient model shape on peak skin dose calculation

## METHODS AND MATERIALS

100 different human models randomly selected from the Civilian American and European Surface Anthropometry Resource dataset were used as input to a previously validated peak skin dose estimation system. Models were scaled to be the same approximate height as the default stylized phantom. Other Patient dimensions were scaled accordingly. The original phantom had craniocaudal, mediolateral, and anteroposterior dimensions of 173 cm, 39 cm, and 20 cm. The scaled patient models had dimensions of 173 cm,  $89 \pm 7.6$  cm, and  $34.5 \pm 3.4$  cm, respectively. Two positions were chosen for the phantoms: 1) patient models most posterior point aligned with default model's most posterior point and 2) patient model center of mass aligned with default model's center of mass. Beam data from 111 scans with reference point air kerma greater than 2 Gy ( $3.3 \text{ Gy} \pm 2 \text{ Gy}$ ) were applied to each patient model. Summary statistics and skin dose maps were calculated.

## RESULTS

When the posterior of the patient models was aligned with the default model the peak skin dose was  $16\% \pm 0.3\%$  larger than using the default model. When the patient model center of mass was aligned with the default model center of mass the peak skin dose was  $19\% \pm 0.3\%$  larger than the default model.

## CONCLUSION

Patient model substantially impacts final peak skin dose estimates. future work is will refine the existing meshes to better represent a realistic patient on the table.

## CLINICAL RELEVANCE/APPLICATION

Dose estimation software should implement an array of patient models to better approximate the patient on the table to improve peak skin dose estimation.

## R2-SPPH-3 Fetal Organ Dose Estimates from the Exposure of Pregnant Women in Fluoroscopy Procedures

Participants

Seth Streitmatter, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the dependence of fetal organ dose on gestational age (GA), beam size and angulation in common fluoroscopy procedures and interventions a pregnant patient may undergo.

## METHODS AND MATERIALS

Hybrid computational phantoms of pregnant woman at four GAs (10w, 20w, 30w, 38w) were used to assess fetal organ doses by simulating common beam quality (70 kVp, 6.83 mm Al), field size (19 x 19 cm) and projections (LAO 25 CAU 25, LAO 25 CRA 25) used in interventional cardiac procedures. The beam geometry data created for the adult female phantom using NCIRF (National Cancer Institute dosimetry system for Radiography and Fluoroscopy), was translated for dose calculations in MCNP6, a general-purpose Monte Carlo code, and fetal organ doses were assessed.

## RESULTS

The major organs that the ICRP has assigned tissue weighting factors to were assessed. As the GA increases and the fetus gets closer to the treatment field, the brain (and other fetal organs that are inferior with respect to the mother's thorax) doses decreases (up to 0.39x), while organs that are superior or distributed throughout the fetus (e.g., bone, skin) show increased dose (up to 4.25x). More dramatically, dose increases as the beam becomes more caudally angulated and the fetus is closer to the beam or partially in it; all fetal organ doses were significantly higher for the LAO 25 CAU 25 scenario (up to 5.19x). Bone shows the largest relative increase in dose for GA 10w - 38w in both scenarios. Figure 1 illustrates the dependence of the doses on GA and beam angulation, normalized to organ dose to dose area product (DAP),  $\text{mGy}/\text{mGy}\cdot\text{cm}^2$ .

## CONCLUSION

For fluoroscopy cases, specifically cardiac/thoracic interventions, differences in GA and beam angulation can have a dramatic effect on fetal organ doses. Using the methods described here provides a higher level of accuracy for fetal organ dose estimates and the interplay between different potential exposure scenarios for pregnant patients than using the older, simple geometric phantoms and the uterus as a surrogate for fetal dose.

## CLINICAL RELEVANCE/APPLICATION

Examinations that involve an unpredictable duration of fluoroscopy have "substantial risk" potential. The capability to compute more accurate fetal organ doses can provide the patient with more relevant fetal risk assessment.

## **R2-SPPH-4 Evaluation of Different Peak Skin Dose Calculators Using an OSL Dosimeter Array in a Hybrid CT/Angiography Suite**

### **PURPOSE**

Fluoroscopically-guided interventional (FGI) procedures can result in high skin doses, potentially in the range where effects such as erythema could occur. Thus, it may be necessary to accurately determine the peak skin dose (PSD) so physicians can predict possible effects and inform the patient. The accuracy of three PSD calculators was evaluated using direct entrance skin dose measurements from optically stimulated luminescent dosimeters (OSLDs).

### **METHODS AND MATERIALS**

An array of 286 OSLDs was used to measure entrance skin dose on patients (n=12) undergoing FGI procedures. A previously validated method was used to separate the OSLD dose into CT and fluoroscopy skin dose for patients who were scanned with CT during their procedure. The OSLD with the highest fluoroscopy skin dose was used as the measured PSD. Additionally, an in-house PSD calculator was used to determine the PSD based on information from each patient's RDSR and room-specific correction factors. The PSD values reported from an independent commercial dose tracking software were recorded for each patient. The PSD values from a vendor/system-specific dose tracking software were recorded for each patient.

### **RESULTS**

The measured fluoroscopy PSD ranged from 189 mGy to 8,095 mGy for the 12 patients. The results show good agreement between the measured PSD and the PSD from the in-house PSD calculator. The mean percent error was -2% with mean absolute percent error of 10%. There was no statistical difference between the two PSD values ( $p = 0.445$ ). The independent commercial dose tracking software had a mean percent error of -16% with a mean absolute percent error of 21%. There was no statistical difference between the two PSD values ( $p = 0.054$ ). The vendor/system-specific dose tracking software showed the worst agreement between the measured PSD and displayed PSD. The mean percent error was -37% with a mean absolute percent error of 37%. There is a statistically significant difference between the measured PSD and the displayed PSD ( $p = 0.005$ ).

### **CONCLUSION**

The in-house PSD calculator that considers parameters from each patient exam and used room-specific correction factors had the best agreement with the measured PSD. The in-house PSD can provide physicians with a relatively more accurate PSD compared to the commercial and vendor dose tracking software.

### **CLINICAL RELEVANCE/APPLICATION**

Providing interventional radiologists with an accurate PSD estimation can help them better predict possible skin effects and potentially reduce effects by modifying exam parameters.

## **R2-SPPH-5 The Feasibility of High-Pitch Spectral CT Monochromatic Imaging in Combination with ASIR-V Technology: A Phantom Study**

### **PURPOSE**

To analyse the influence of high-pitch spectral CT monochromatic imaging in combination with pro-adaptive statistical iterative reconstruction-V(ASIR-V) technology on image quality and radiation dose.

### **METHODS AND MATERIALS**

A chest phantom was scanned on a revolution energy spectrum CT scanner separately using 0.5s rotation time, 0.992 helical pitch and 0.5s rotation time, 1.531 helical pitch. 70KeV monochromatic images were separately reconstructed at slice thickness of 5mm, meanwhile, the 40% pro-ASIR-V was applied to 70 keV high-pitch monochromatic image. Images of lung window and mediastinal window were separately reconstructed by standard algorithm and sharp algorithm. A total of three sets of images were obtained: routine-pitch/0%ASIR-V group, high-pitch/0%ASIR-V group and high-pitch/40%ASIR-V group. The CT dose index volume (CTDIvol), dose-length product (DLP) and effective dose (ED) were recorded. Standard deviation (SD) of pulmonary parenchyma, soft tissues of chest wall and heart were measured. Subjective image quality of lung window and mediastinal window were assessed by two radiologists in a double blinded and randomized manner using five-point scale (from 5=good image quality, almost no artifacts, clear anatomic details, easy to distinguish to 1=poor image quality, obvious artifacts, indistinct anatomic details, unable to distinguish). The differences between groups for MSD, radiation dose and mean subjective score were done with one-way ANOVA. The interobserver variation between two radiologists were assessed by the kappa statistic.  $P < 0.05$  was considered statistically significant.

### **RESULTS**

There was moderate agreement between the two radiologists in rating of subjective image quality ( $K=0.571$ ). Results indicated that the image quality of high-pitch spectral CT monochromatic imaging in combination with 40% pro-ASIR-V were better than routine-pitch or high-pitch in combination with 0%ASIR-V. Effective doses of the routine-pitch group and high-pitch group were 6.84mSv and 5.31mSv. The radiation dose reduction for high-pitch group was 22.37% in comparison with routine-pitch group.

### **CONCLUSION**

The use of high-pitch spectral CT monochromatic imaging in combination with pro-ASIR-V resulted in wonderful diagnostic images with lower radiation dose.

### **CLINICAL RELEVANCE/APPLICATION**

High-pitch spectral CT monochromatic imaging in combination with ASIR-V may acquire high image quality and low radiation dose.

## **R2-SPPH-6 The Impact of Different Noise Index (NI) on Image Quality of Three-low" Chest CTA**

### **PURPOSE**

To investigate the effect of low tube voltage, low contrast agent dosage and low contrast agent flow rate combined with different NI on the image quality of chest CTA.

### **METHODS AND MATERIALS**

This study was randomly divided into two groups: group A (n=20) and group B (n=20). Patients in group A were performed prospective "three-low" chest CTA with following parameters: 100kVp, contrast volume 45ml, contrast flow rate 3.0ml/s, and NI = 12, 14, 16, 18 for subgroup A1, A2, A3 and A4. Group B was control group with routine scanning parameters: 120kVp, contrast volume 60ml, contrast flow rate 4.0ml/s, NI=10. The other scanning sets were same. CT values and SD of the ascending aorta, aortic arch, descending aorta and the same layer of chest wall fat were measured. Then the CNR were calculated. The effective dose (ED = DLP \* 0.014) were also recorded. The subjective image quality of five groups were scored independently by two senior radiologists according to the 5-point system (Five points is the highest and one point is the lowest). More than three points meet the diagnostic criteria.

## RESULTS

The CT values of experimental group A1, A2, A3, A4 and control group B were  $346.1 \pm 22.1$ ,  $340.7 \pm 13.9$ ,  $344.0 \pm 14.8$ ,  $342.7 \pm 11.8$  and  $406.5 \pm 8.1$  HU, respectively. There were statistical significance between groups A and B ( $P < 0.05$ ) and no statistical significance between group A ( $P > 0.05$ ). The CNR of experimental group A1, A2, A3, A4 and control group B were  $12.9 \pm 2.5$ ,  $15.3 \pm 2.8$ ,  $17.9 \pm 4.1$ ,  $20.0 \pm 2.9$  and  $9.99 \pm 0.99$ , respectively. There was statistical significance between groups ( $P < 0.05$ ). The CNR of experimental group A1, A2, A3, A4 and control group B were  $42.2 \pm 8.3$ ,  $36.1 \pm 5.9$ ,  $32.3 \pm 3.5$ ,  $24.9 \pm 2.8$  and  $53.3 \pm 6.2$ , respectively. There was statistical significance between groups ( $F = 69.6$ ,  $P < 0.05$ ). The effective dose (ED) were  $2.5 \pm 0.24$ ,  $1.41 \pm 0.26$ ,  $1.15 \pm 0.4$ ,  $0.93 \pm 0.08$  and  $5.0 \pm 0.32$ , respectively. The effective dose of each group was statistically significant ( $F = 1076$ ,  $P < 0.01$ ). In subjective statistics, the image scores of experimental group A1, A2, A3, A4 and control group B were  $5.0 \pm 0$ ,  $4.98 \pm 0.14$ ,  $4.17 \pm 0.38$ ,  $3.61 \pm 0.49$  and  $2.63 \pm 0.49$ , respectively. The result from two senior radiologists were high consistency ( $\kappa = 0.65$ ). Only the subjective score of B4 did not meet the diagnostic requirements, and the lowest radiation dose of B3 group was about 77% lower than that of the control group.

## CONCLUSION

Three low combined with high NI index can reduce the risk of contrast injection and the radiation dose of patients at the same time.

## CLINICAL RELEVANCE/APPLICATION

To reduce the risk of contrast injection and the radiation dose of patients

## R2-SPPH-7 A Study Related to the Optimal Phase Selection of Virtual Scanning of Spectral Enhanced CT Instead of Conventional Scanning

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the optimal phase selection of virtual non-contrast (VNC) technique instead of conventional true non-contrast (TNC) for spectral enhanced CT scanning.

## METHODS AND MATERIALS

Fifty-seven patients with energy-spectrum-enhanced CT scans of the abdomen were collected, 23 males and 24 females with a mean age of  $55 \pm 12$  years. A spectral CT (Revolution, GE Healthcare, USA) scanner was used, with conventional (non-energy spectral) scanning mode for conventional scanning and gemstone spectral imaging (GSI) abdominal scanning mode for enhanced scanning. The CT scan used spectral mode. The CT values and SD values of the water were measured, and the signal-to-noise ratio (SNR) was calculated. The virtual scanning images were obtained by virtual non-contrast (VNC) technique, and the CT values and SD values of the liver in each phase, and the signal-to-noise ratio (SNR) was calculated. All statistical tests were performed using SPSS version 26.0, and one-way ANOVA was used to compare the differences between CT values, signal-to-noise ratio (SNR), and CT Dose Index (CTDI) of the liver after virtual scanning of the three phases of the spectral enhanced scanning images. For all tests, the level of statistical significance was set at  $P < 0.05$ .

## RESULTS

The SD and SNR of the liver after virtual scanning processing of the three phases of the spectral enhanced scanning were statistically significant ( $P < 0.05$ ) compared with those of the conventional scanning. The differences were statistically significant ( $P < 0.05$ ) when comparing the SD values and SNR of the liver between the virtual scanning of the three phases of spectral enhanced scanning. There were significant differences ( $P < 0.05$ ) in the SD values and SNR of the liver between the virtual scanning of the arterial phase and the virtual scanning of the venous and delayed phases, and there were no significant differences ( $P > 0.05$ ) in the SD values and SNR of the liver of the virtual scanning of the venous and delayed phases.

## CONCLUSION

The image quality of spectral CT virtual scanning was higher than conventional true scanning, the lowest CT Dose Index (CTDI) was in the delayed phase, while the virtual scanning image quality in the delayed phase was better than the virtual scanning image quality in the arterial phase, and they are no difference significantly between the image quality in the portal phase and delayed phase.

## CLINICAL RELEVANCE/APPLICATION

Spectral CT abdominal enhancement virtual scanning allows for the selection of delayed-period virtual scanning images instead of true scanning, this can reduce the number of scans, decrease radiation dose, and improve image quality.

## R2-SPPH-8 Silver (Ag) X-ray Spectrum Modulation Filter vs. Copper (Cu) X-ray Spectrum Modulation Filter: Capability of Low-Dose CT for Lung Cancer Screening at In Vitro and In Vivo Studies

Participants

Yoshiharu Ohno, MD, PhD, (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, Daiichi Sankyo Co, Ltd; Research Grant, Ministry of Education, Culture, Sports, Science and Technology

## PURPOSE

To compare the capability of low-dose CT for lung cancer screening between newly developed silver (Ag) and traditionally applied

To compare the efficacy of low-dose CT for lung cancer screening between newly developed silver (Ag) and traditional copper (Cu) x-ray beam spectral modulation filters at in vitro and in vivo studies.

## **METHODS AND MATERIALS**

A chest CT phantom including simulated ground-glass and part-solid nodules was scanned with a 320-detector row CT with Ag and Cu filters at 0.6, 1.6 and 2.5 mGys and reconstructed with hybrid-type iterative reconstruction (IR) method at in vitro study. Then, 95 patients who underwent low-dose CT lung cancer screening with Ag and Cu filters at same radiation dose level (i.e. 1.6mGy) as well as standard-dose CT examination within 3 months were retrospectively included to in vivo study. At in vivo study, the same reconstruction method was applied. At in vitro study, SNR at each nodule were determined by region of interest (ROI) measurements at all protocols. At each simulated nodule, the probability of nodule was assessed with 5-point visual score by two board-certified chest radiologists. All final scores were determined as consensus of two readers. At in vivo study, SNR of normal lung parenchyma was also determined by ROI measurement at each low-dose CT. Then, the probability of nodule equal to or more than 4 mm in long-axis diameter was also assessed with 5-point scale by same board-certified chest radiologists. Student's t-test was performed to compare SNR of CT data between Ag and Cu filters at in vitro and in vivo studies. At in vitro study, ROC analyses were performed to compare nodule detection capability between Ag and Cu filters on each radiation dose data. At in vivo study, JAFROC analysis was performed to compare nodule detection capability between Ag and Cu filters. Finally, averaged sensitivity (SE) and false-positive/case (FP/case) were compared by McNemar's test and Wilcoxon's signed rank test.

## **RESULTS**

At in vitro studies, SNR and AUC of Ag filter were significantly higher than those of Cu filter at each radiation dose ( $p < 0.05$ ). At in vivo study, SNR of Ag filter was significantly higher than that of Cu filter ( $p < 0.05$ ). There were no significant differences of averaged figure of merit (FOM) and FP/case of between Ag (FOM=0.92, FP/case=0.24/case) and Cu (FOM=0.91,  $p > 0.05$ ; FP/case=0.24/case,  $p > 0.05$ ) filters. However, averaged sensitivity of low-dose CT with Ag filter (SE=0.88) was significantly higher than that with Cu filter (SE=0.79,  $p < 0.001$ ).

## **CONCLUSION**

s Ag filter can significantly improve image quality and nodule detection capability than Cu filter on low-dose CT screening at in vitro and in vivo studies.

## **CLINICAL RELEVANCE/APPLICATION**

Ag filter can significantly improve image quality and nodule detection capability than Cu filter on low-dose CT screening at in vitro and in vivo studies.

## **R2-SPPH-9 Effects of Different Tube Voltages and Different Levels of Hybrid Iterative Reconstruction on the Detection and Characterization of Pulmonary Nodules in Ultra-low-dose Chest CT**

Participants

Yue Yao, Xi'an, China (*Presenter*) Nothing to Disclose

## **PURPOSE**

To explore the effects of different tube voltages combined with adaptive statistical iterative reconstruction (ASIR-V) algorithms on the detection and characterization of pulmonary nodules by an artificial intelligence software in ultra-low dose chest CT

## **METHODS AND MATERIALS**

An anthropomorphic thorax phantom containing 12 spherical simulated nodules served as the reference standard (Diameter: 12, 10, 8, 5 mm; CT value: -800, -630, 100 HU) was scanned at different dose levels with combinations of kVp and tube current: Group A (70kV/30mA:0.11mSv, 100kV/10mA:0.10mSv), Group B (70kV/100mA:0.34mSv, 100kV/30mA:0.32mSv), and Group C (70kV/150mA:0.53, 100kV/50mA:0.51mSv). Scans were repeated 5 times. Four different weights of ASIR-V (0%=FBP, 30%, 50%, 70%) were used to generate images. All images were automatically analyzed using a commercially available artificial intelligence software (Intelligent 4D Imaging System for Chest CT 5.5, YITU Healthcare) and long diameter, short diameter, location and nature of each nodule, and CT and SD values of muscle under each group of conditions were obtained. The detection rate (DR), deformation coefficient (DC) and size measurement deviation percentage (SP) of pulmonary nodules were calculated and compared between groups. The image quality and noise of each group were compared.

## **RESULTS**

Under the same ASIR-V weight, the image noise of 70kV was in general lower than that of 100kV group; and noise gradually decreased with the increase of reconstruction weight. Under the same dose level, there was no significant difference in DR of nodules between different kV ( $p > 0.05$ ); and DR values in the 70kV group were slightly higher than 100kV at 50%ASIR-V and 70%ASIR-V in Group A, 50%ASIR-V in Group B and 70%ASIR-V in Group C. Higher percentages ASIR-V and 100kV in general had better (lower) DC and SP.

## **CONCLUSION**

s Detection rates were similar between 70kV and 100kV scans. 70kV had better noise performance under the same ASIR-V percentage, while 100kV and higher ASIR-V percentages were better in preserving the forms of nodules.

## **CLINICAL RELEVANCE/APPLICATION**

Under ultra-low radiation dose chest CT, High weight IR is better to balance between nodule detection rate and shape deformation.

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## Abstract Archives of the RSNA, 2023

R2-SPRO

### Radiation Oncology Thursday Poster Discussions

#### Sub-Events

#### R2-SPRO-1 Auto-contouring of Brain Metastases for Stereotactic Radiosurgery

#### PURPOSE

Brain metastases (BMs) are a common complication of cancer and the most common type of brain tumor. Stereotactic radiosurgery (SRS) is a well-established treatment option which allows for the delivery of highly focused radiation allowing for improved sparing of healthy brain tissue when compared to whole-brain radiotherapy leading to better cognitive outcomes after treatment. Highly focused treatments such as SRS require very precise BMs identification and definition. In this study, we train and evaluate the nnUNet's ability to automatically identify and contour BMs for use in radiotherapy planning and treatment assessment.

#### METHODS AND MATERIALS

Post-contrast T1-weighted (T1w+C) MR scans and planning records from 784 SRS patients previously treated at our institution using Gamma Knife SRS were used in this study. Physician-drawn BMs contours were extracted for each patient treatment. T1w+C scans were acquired on the same day of treatment using Philips Ingenia 1.5T scanner using an axial 3D fast spin echo sequence using 1mm slice spacing and  $0.449 \times 0.449 - 1 \times 1$  pixel spacing. This dataset was split into training ( $n=759$ ) and final testing ( $n=25$ ) cohorts. We then trained the nnUNet (Isensee, F., et al. Nature methods, 2021) on 2 NVIDIA TITAN RTX 24GB GPU using 5-fold cross validation with 1000 epochs in each fold. The nnUNet is a self-configuring model that has demonstrated high performance in various automatic contouring tasks. Auto-contouring performance was evaluated using Dice similarity coefficient (DSC) and voxel-wise precision and recall.

#### RESULTS

The 25 test cases had 78 BMs defined by the treating physician at the time of treatment (average volume of  $9.91 \pm 15.28$  cm<sup>3</sup>). 75.6% (59/78) of BMs (average volume of  $8.89 \pm 12.07$  cm<sup>3</sup>) were detected by the trained model resulting in an average DSC of 0.84 ( $\pm 0.11$ ), and voxel-wise precision and recall of 0.87 and 0.85, respectively. The nnUNet did not detect 19 physician-defined BMs (24.4%) (average volume  $1.82 \pm 5.74$  cm<sup>3</sup>) and identified 43 BMs which were not defined at the time of treatment (average volume  $0.98 \pm 3.22$  cm<sup>3</sup>).

#### CONCLUSION

Overall, the trained model shows promise in automatically detecting and contouring BMs. However, the current approach is less accurate in identifying smaller BM volumes. Further work is needed to improve automatic identification and contouring performance for these smaller lesions.

#### CLINICAL RELEVANCE/APPLICATION

Accurate detection and definition of brain metastasis volumes through automated solutions could help standardization of delivered treatments across radiation oncology practices. Furthermore, automation of this process could improve treatment assessment on post-treatment imaging.

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## Abstract Archives of the RSNA, 2023

R2-SPVA

### Vascular Imaging Thursday Poster Discussions

#### Sub-Events

#### R2-SPVA-1 Evaluation and Comparison of CT Angiography Image Quality Acquired with Single-Energy Metal Artifact Reduction Algorithm and Deep Learning Reconstruction in Patients after Endovascular Aortic Repair

#### PURPOSE

To assess and compare the image quality of hybrid iterative reconstruction (HIR), deep learning reconstruction (DLR), combination of HIR and single-energy metal artifact reduction (SEMAR) algorithm (HIR+SEMAR), and combination of DLR and SEMAR algorithm (DLR+SEMAR) for computed tomography angiography (CTA) examinations in patients after abdominal aortic (AA) endovascular aortic repair (EVAR).

#### METHODS AND MATERIALS

CTA images of 27 patients (mean age  $\pm$  standard deviation, 68.7  $\pm$  8.8 years, 23 male) were reconstructed using HIR, DLR, HIR+SEMAR, and DLR+SEMAR. CT attenuation, image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were measured in muscle, liver, AA distant to stents (region 1 of interest, ROI 1), AA near stents and artifacts (ROI 2), AA near stents but not artifacts (ROI 3), mural thrombus with artifacts, and mural thrombus without artifacts. Data were expressed as median (interquartile distribution) for non-normally distributed data. The subjective visual scores (1 for worst -5 for best) of images were obtained for the following: overall image quality and visibility of surrounding organs, vessels outside the scaffold, and stent thrombosis. These parameters were compared among above four methods.

#### RESULTS

HIR+SEMAR or DLR+SEMAR provided higher Hounsfield unit (HU) values in images with artifacts, while there is no statistically significant attenuation in images without artifacts among four methods. The image noise in HU of images with artifacts was significantly lower in HIR+SEMAR or DLR+SEMAR than in HIR and DLR ( $p < 0.001$ ), while the image noise in HU of images without artifacts was significantly lower in the DLR or DLR+SEMAR group than in the HIR and HIR+SEMAR groups ( $p < 0.0001$ ). For images with stents, SNR and CNR were significantly higher in the HIR+SEMAR [6.110 (4.5, 7.9)] or DLR+SEMAR [6.010 (4.7, 10.5)] group than in the HIR [3.080 (1.9, 4.0)] and DLR [2.860 (1.8, 4.6)] groups (SNR of ROI 2, respectively,  $p < 0.001$ ). But the SNR of liver and muscle were significantly higher in the DLR or DLR+SEMAR group than in the HIR and HIR+SEMAR groups ( $p < 0.0001$ ). The subjective visual scores in the DLR+SEMAR were the highest compared those in the images reconstructed with HIR, DLR and HIR+SEMAR ( $p < 0.0001$ ).

#### CONCLUSION

Compared to HIR, DLR, and HIR+SEMAR, DLR+SEMAR provides superior image quality in terms of quantitative and qualitative parameters, not only markedly reducing metal artifacts but also improving reliably attenuation of soft tissues.

#### CLINICAL RELEVANCE/APPLICATION

The combination of DLR and SEMAR algorithm technique significantly improving CTA image quality not only in the images with metal artifacts but also in those without metal artifacts in patients after EVAR, beneficial for postoperative surveillance.

#### R2-SPVA-2 Ultra-High-Resolution Photon-Counting Detector CT Angiography of the Lower Limbs

#### Participants

Dirk Graafen, MD, PhD, Mainz, Germany (*Presenter*) Nothing to Disclose

#### PURPOSE

Peripheral arterial disease frequently affects the lower limbs, and heavy calcifications may reduce the accuracy of CT-angiography. Photon-counting detector (PCD) CT offers improved image quality for CT angiography, recently demonstrated for coronary artery evaluation. However, no previous study investigated the potential of PCD-CT angiography for the assessment of the lower limbs. Therefore, the aim of this study was to identify the optimal reconstruction parameters for ultra-high-resolution (UHR) PCD-CT angiography of the lower limbs in a phantom and patient study.

#### METHODS AND MATERIALS

Silicone pipes with five different inner diameters (1 to 5 mm) were filled with different iodine concentrations (0, 4.63, 9.25, 18.5, and 37.0 mg I/cm<sup>3</sup>) and scanned in a water container using six different radiation doses (CTDI = 1, 2, 3, 4, 10, and 30 mGy). Virtual monoenergetic images at 55 keV were reconstructed with 0.4 mm isotropic resolution using the quantitative kernels with all ten available sharpness levels (Qr36 to Qr76) combined with the three highest levels of Quantum iterative reconstruction (QIR-2 to QIR-4). Noise levels and sharpness (maximal slope values at the pipe walls) were determined for all reconstructions. Additionally, clinical CT angiographies of 20 patients were reconstructed with a normal (Qr-44), sharp (Qr-60), and ultra-sharp (Qr-72) kernel at QIR2-4. Three raters performed a qualitative analysis of these images with a 5-point Likert scale assessing noise, delineation of plaques and vessel walls, and overall image quality.

## **RESULTS**

Increase kernel sharpness led to higher image noise, e.g., for 4 mGy CTDI and QIR-2, noise level was 11 HU for Qr36, 45 HU for Qr60, and 141 HU for Qr76. Maximum slope values increase relevantly until a sharpness level of 60, while higher sharpness levels only yield small additional improvements. QIR clearly decreases noise with higher levels without reducing the maximum slope. Qualitative analysis of the clinical images confirmed these findings. Worse noise scores were given for higher sharpness levels, while no improvement in the delineation of plaques and vessel walls was found between the sharp and ultra-sharp kernel. The sharp kernel (Qr-60) with the highest QIR level (QIR-4) yielded the best overall quality.

## **CONCLUSION**

s Reconstruction kernels with optimized sharpness level in combination with the highest QIR level yield the best image quality for UHR-PCD-CT angiography of the lower limbs, which is Qr60 for 0.4 mm isotropic voxels with edge lengths of 0.4 mm.

## **CLINICAL RELEVANCE/APPLICATION**

Using UHR-PCD-CT angiography with optimized reconstruction parameters might improve diagnostic accuracy and confidence in peripheral artery disease of the lower limbs.

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## Abstract Archives of the RSNA, 2023

R5A-SPBR

### Breast Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPBR-1 Optimizing Double Reading in Screening Mammography through Pairing Strategies Explored by Modelled Radiologists' Assessments**

##### **PURPOSE**

Radiologists' performance characteristics vary, yet the pairing of radiologists for the double reading of screening mammography is done randomly or out of convenience. No attempts have been made to prospectively optimise the pairing of radiologists for improved screening performance. We aim to investigate whether the optimal set of pairs of radiologists can be achieved by using modelled radiologist performance characteristics for pairing.

##### **METHODS AND MATERIALS**

Our retrospective study was performed with datasets from breast cancer screening programs in Sweden (2008-2015), England (2012-2014), and Norway (2004-2018). Logistic regression models with reader and case effects, for positive and negative screening examinations separately, were used to model radiologists' screening assessments. Screening programs with different pairing strategies, including the pairing of readers with 1) opposite or 2) similar true-positive rates (TPR) and/or false-positive rates (FPR), were simulated. Group performances of the different pairing strategies were compared against those of the random pairing strategies, with positive assessments defined by either reader flagging a case as abnormal. Bootstrap resampling (n=1,000) was used to obtain 95% confidence intervals.

##### **RESULTS**

The final study sample consisted of 3,191,955 screening examinations, 936,621 from Sweden, 435,281 from England, and 1,820,053 from Norway. The logistic-regression models adequately predicted individual (Pearson correlations > 0.95) reader performance. Within the simulations, pairing similar readers reduced what they were similar in and pairing opposite readers increased what they were opposite in. The pairing strategies involving readers with similar FPR resulted in significantly lower FPR outcomes (Sweden: 4.50%, England: 5.51%, Norway: 8.03%), compared to the random pairing strategies (Sweden: 4.74%, England: 5.76%, Norway: 8.30%), while the TPR did not change significantly. All other pairing strategies performed equally or worse than random pairing.

##### **CONCLUSION**

There was no pairing strategy that increased TPR and at the same time decreased FPR. However, according to our pairing rule, pairing readers with similar FPR performance characteristics may result in a reduced FPR with no significant reduction in TPR. Pairing readers with similar FPR characteristics may be helpful to reduce the number of examinations sent to consensus or arbitration. Additional studies are needed to explore the effect of consensus and arbitration.

##### **CLINICAL RELEVANCE/APPLICATION**

Pairing readers with similar FPR might result in reduced FPR while not significantly reducing TPR, potentially reducing workload. Future studies are needed to explore what happens after consensus/arbitration.

#### **R5A-SPBR-2 Comparison of Contrast-Enhanced Spectral Mammography and Digital Mammography in Detecting Breast Cancer: A Systematic Review and Meta-Analysis**

##### Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **PURPOSE**

To evaluate and compare the diagnostic accuracy of digital mammography (DM) and contrast-enhanced spectral mammography (CESM) in breast cancer detection, through a systematic review and meta-analysis.

##### **METHODS AND MATERIALS**

A comprehensive literature search was conducted using PubMed, Web of Science, Scopus, and Google Scholar up to February 15, 2023. Bivariate modeling was employed to obtain pooled diagnostic accuracy metrics (sensitivity, specificity, DOR, PPV, and NPV) of CESM and DM. Summary ROC curves were used for comparison.

##### **RESULTS**

The systematic review incorporated twenty-four studies based on our eligibility criteria. However, we excluded four studies from the meta-analysis due to incomplete contingency tables. The meta-analysis ultimately included twenty studies, consisting of 3830 breast lesions. Among these, 17 studies focused on diagnostic purposes, two were dedicated to screening and one study aimed at preoperative assessment. For breast cancer detection, CESM demonstrated significantly higher sensitivity (0.948, 95% CI: 0.917-0.968) and better specificity (0.732, 95% CI: 0.626-0.816) than DM (sensitivity: 0.815, 95% CI: 0.731-0.877; specificity: 0.576, 95% CI: 0.415-0.723). The diagnostic odds ratio for CESM (50.4, 95% CI: 35.5-69.5) was notably superior to DM (6.12, 95% CI: 3.4-10.2).



## CONCLUSION

s CESM exhibits superior diagnostic performance compared to DM in breast cancer detection. Clinicians should consider CESM as an alternative or complementary imaging modality to DM.

## CLINICAL RELEVANCE/APPLICATION

CESM offers improved diagnostic accuracy in breast cancer diagnosis of patients retrieved from screening, making it a valuable alternative or complement to DM in specific clinical situations, including dense breast tissue and inconclusive imaging cases, while considering its drawbacks.

### **R5A-SPBR-3 Long-term Effects of a Breast Cancer Screening Programme on Breast Cancer Incidence and Mortality: Results from a Cohort of 2.6 Million Women**

Participants

Amanda Dibden, London, United Kingdom (*Presenter*) Nothing to Disclose

Robert A. Smith, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

## PURPOSE

Population-wide mammography screening programmes have been in operation for over 30 years with the aim of reducing breast cancer mortality by diagnosing cancers at an early stage when treatment is more likely to be effective. Whilst there have been many studies assessing the short to medium term effectiveness of these programmes, there have been few assessing long-term effectiveness. The objective of this study was to assess whether the national programme in England and Wales was achieving its aim to reduce mortality, with long-term follow-up for estimation of overdiagnosis associated with routine mammography screening

## METHODS AND MATERIALS

An established cohort of 2,669,328 women aged 49 to 64 years at study entry and resident in England and Wales was studied. All women were as yet uninvited to screening upon study entry, with screening status changing on invitation and attendance. Women were followed for invasive and ductal carcinoma in situ breast cancer diagnosis and breast cancer death, with a maximum follow-up of nearly 33 years. Poisson regression was used to assess the effect of invitation and attendance to screening on breast cancer incidence and mortality, and overdiagnosis in relation to the NHS Breast Screening Programme in England and Wales.

## RESULTS

Invitation to screening was associated with a 28% reduction in breast cancer mortality after adjustment for age and time (RR: 0.72; 95% CI: 0.71 - 0.74). The reduction in mortality associated with screening attendance was slightly greater at 29% after adjustment for age, time and self-selection bias (RR: 0.71; 95% CI: 0.68 - 0.73). There was a 4% excess of breast cancer diagnoses associated with being screened (RR: 1.04; 95% CI: 1.02 - 1.07) after adjustment and with at least 10 years follow-up post-screening.

## CONCLUSION

s These results suggest that screening continues to be effective in reducing mortality from breast cancer many years after the cessation of screening and that the level of overdiagnosis associated with long-term screening is low. Work is ongoing to assess the association between screening for breast cancer and death from other causes than breast cancer.

## CLINICAL RELEVANCE/APPLICATION

There is ongoing debate as to whether breast cancer screening causes more harm than good, the main harm being overdiagnosis. This study demonstrates the long-term benefit of screening with a minimal amount of overdiagnosis.

### **R5A-SPBR-4 Opening Doors to Early Detection: The Critical Relationship between Readability and Breast Cancer Screening Attendance**

Participants

Sonali Sharma, Vancouver, BC (*Presenter*) Nothing to Disclose

## PURPOSE

Low health literacy remains a barrier to accessing effective care. The AMA and NIH recommend that health information be written at the sixth and eighth grade reading levels. This study aimed to evaluate the readability, quality, and accuracy of online health information for breast imaging and screening in Canada and ACR Breast Imaging Centers of Excellence websites in the USA, and to examine the relationship between readability and screening attendance.

## METHODS AND MATERIALS

Breast imaging websites in Canadian provinces and territories, and ACR Breast Imaging Centers of Excellence websites in the USA were searched. Readability was assessed using Flesch-Kincaid Reading Ease Index, Flesch-Kincaid Grade Level, and Gunning-Fog Score. The DISCERN instrument measured the quality and accuracy of the online health information. Breast cancer screening attendance rates in the US and Canada and the relationship between website readability was examined.

## RESULTS

Of the 500 websites analyzed, mean readability scores corresponded to a 12th-grade reading level. The websites were considered below-average quality with a DISCERN score of 41.05. A negative correlation was found between website readability and screening attendance, indicating that as readability increased, attendance decreased.

## CONCLUSION

s Online health information regarding breast imaging and screening programs in Canada and ACR Breast Imaging Centers of Excellence websites in the USA is written at a level far greater than most adults' reading level and at below-average quality. The negative correlation between readability and screening attendance emphasizes the need for improved readability and quality of websites, potentially leading to higher screening program attendance and better patient outcomes.

## CLINICAL RELEVANCE/APPLICATION

Low health literacy and readability contribute to reduced screening participation, crucial for early breast cancer detection. By prioritizing high-quality and easily understandable patient materials, healthcare providers and organizations can potentially mitigate low screening attendance, improving patient outcomes and healthcare cost-effectiveness.

### **R5A-SPBR-5 Optimizing Lesion Detection in Digital Breast Tomosynthesis: A Phantom Study Investigating Angular Range Across Varied Breast Density and Thickness**

Participants

Hee Jeong Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To determine the optimal angular range (AR) for digital breast tomosynthesis (DBT) systems that provides the highest detectability of breast lesions across various breast densities and thicknesses.

#### **METHODS AND MATERIALS**

The Modular DBT phantom (Model 165SI; Gammex Inc, WI, USA) composed of tissue-equivalent adipose and glandular modules and a module embedded with test objects of speckles, masses, and fibers was used to generate ten modular combinations simulating different breast thicknesses and densities, as well as different lesion locations. A prototype DBT system (KERI, Gyeonggi-do, Korea) with a W/Al target/filter combination operating at ARs of  $\pm 7.5^\circ$  ( $AR\pm 7.5^\circ$ ),  $12.5^\circ$  ( $AR\pm 12.5^\circ$ ),  $\pm 19^\circ$  ( $AR\pm 19^\circ$ ), and  $\pm 25^\circ$  ( $AR\pm 25^\circ$ ) was used to acquire 11 low-dose projection images of each combination. Image datasets were acquired three times under the same conditions. Three blinded radiologists independently assessed lesion detectability on the reconstructed images according to the 2018 ACR Digital Mammography Quality Control Manual. Their scores were averaged and compared using linear mixed models with combination and reader as random intercepts.

#### **RESULTS**

The  $AR\pm 12.5^\circ$  provided the highest overall lesion detectability across all breast combinations. Speckles were best detected with  $AR\pm 7.5^\circ$  or  $AR\pm 12.5^\circ$  in all breast combinations, with no significant difference between them. However, speckle detectability was significantly lower when using the  $AR\pm 19^\circ$  or  $AR\pm 25^\circ$  ( $P = .014$  for thin fatty,  $0.026$  for thick fatty, and  $< .001$  for dense breasts). The optimal AR for mass detection was  $AR\pm 19^\circ$  for thin breasts and  $AR\pm 25^\circ$  for thick breasts. Specifically, for thin fatty breasts,  $AR\pm 19^\circ$  significantly outperformed the other ranges ( $P = .042$ ), while for thick dense breasts,  $AR\pm 25^\circ$  significantly outperformed the others ( $P = .025$ ). Although the optimal AR for fiber detectability varied among the breast combinations,  $AR\pm 25^\circ$  provided the lowest detectability among the four ARs in all combinations ( $P = .013$  for thin fatty,  $.026$  for thin dense and thick fatty,  $.004$  for thick dense breasts).

#### **CONCLUSION**

The optimal AR for overall lesion detectability was the  $AR\pm 12.5^\circ$  in all breast densities and thicknesses. However, for speckle and mass detection, narrower and wider ARs may be necessary, respectively.

#### **CLINICAL RELEVANCE/APPLICATION**

While current DBT systems generally employ a single AR, using various ARs may enhance the lesion detectability for patients with different breast densities and thicknesses, as well as different lesion types of interest.

### **R5A-SPBR-6 Diagnosis of Lesions Presenting as Architectural Distortion on DBT: Malignancy Rate Related to Accompanied Features, Ultrasound Findings, and BI-RADS Density**

Participants

Jiejie Zhou, PhD, MD, Wenzhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Accurate diagnosis of architectural distortion (AD) on DBT is challenging, and usually ultrasound (US) is performed to provide additional information. This study aims to: (1) compare the diagnosis in cases associated with nodular density and microcalcifications; (2) compare the diagnosis in cases with and without corresponding suspicious findings on US; (3) evaluate the malignancy rate in cases with different BI-RADS density backgrounds.

#### **METHODS AND MATERIALS**

A total of 471 cases were included, 265 malignant and 206 benign, which were all pathologically confirmed. The DBT images were reviewed to identify the suspicious areas showing architectural distortion, and to determine whether the lesion was accompanied by nodular density or microcalcifications. The US reports were reviewed to determine whether there were suspicious findings corresponding to the detected AD. The malignancy rate in each DBT BI-RADS category, with or without accompanied nodule density, microcalcifications, US findings, and in different density backgrounds were analyzed.

#### **RESULTS**

Malignant rate in DBT BI-RADS 5, 4C, 4B, 4A, and 2-3 groups were 100%, 86%, 57%, 37%, and 19%, respectively (Table 1). For cases accompanied by nodular density, microcalcifications, and without any features, the malignancy rate was 91%, 69% and 38%, respectively. Of 471 cases, 315 showed the corresponding abnormality on US, and the malignancy rate was 72%. In 156 cases without corresponding US findings, the malignancy rate was much lower at 24% ( $P < 0.00001$ , Table 2). The malignancy rate in patients who had BI-RADS density category A+B was significantly higher (48/64, 75%) than in those who had category C+D (217/407, 53%,  $p=0.0011$ ). When using DBT BI-RADS =4A as the cutoff, 252/265 (95%) malignancies were correctly diagnosed by DBT, and 13 cases were misdiagnosed; but 9 of them could be correctly diagnosed by the supplement US. In the benign group, 54/206 (26%) were correctly diagnosed as DBT BI-RADS 2 or 3. When US was considered, 35 false positive lesions showed US BI-RADS 2-3 and they might be spared of biopsy.

#### **CONCLUSION**

AD lesions on DBT accompanied by nodule density had a higher malignant rate than those with microcalcifications, and the malignant rate was the lowest for those without any accompanied features. Cases with corresponding US abnormalities had a much higher malignancy rate than those without. Lastly, AD detected in fatty breasts had a higher malignancy rate, presumably due to the more clearly revealed features in a clean background.

## CLINICAL RELEVANCE/APPLICATION

Diagnosis of lesions presenting as architectural distortion on DBT can be improved with more understanding of associated features and tissue backgrounds, as well as the corresponding findings by using the supplementary ultrasound.

### R5A-SPBR-7 Diagnosis of Architectural Distortion on Digital Breast Tomosynthesis Using Radiomics and Deep Learning

Participants

Yang Zhang, PhD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

## PURPOSE

The objective of this study is to develop diagnostic models for patients showing architectural distortion in Digital Breast Tomosynthesis (DBT) images using two Artificial Intelligence (AI) techniques: radiomics and deep learning.

## METHODS AND MATERIALS

A retrospective review identified a total of 506 cases. The initial 298 cases were utilized for training, while the remaining 208 cases were allocated for independent testing. The training set includes 175 malignant and 123 benign cases. The architectural distortion areas on craniocaudal (CC) and mediolateral oblique (MLO) views were manually defined as for radiomics analysis. Features were extracted using PyRadiomics, followed by the application of the support vector machine (SVM) to select significant features and construct the classification model. Deep learning employed the ResNet50 algorithm, producing binary outputs for malignancy and benignity. The Gradient-weighted Class Activation Mapping (Grad-CAM) method was used to identify suspicious regions. Malignancy probabilities were utilized to create ROC curves. The model was further applied to a testing dataset consisting of 208 cases, including 122 malignant cases and 96 benign cases for independent testing.

## RESULTS

The radiomics model, created using combined CC+MLO features, resulted in an AUC of 0.82, sensitivity of 0.78, specificity of 0.68, and accuracy of 0.74. Using only CC features, the AUC was 0.77. The deep-learning model generated an AUC of 0.61, significantly lower than all radiomics models ( $p < 0.01$ ), likely due to the utilization of the entire image as input. The Grad-CAM method effectively localized architectural distortion areas. In the testing dataset, the radiomics model, built using combined CC+MLO features, yielded an AUC of 0.8, sensitivity of 0.82, specificity of 0.76, and accuracy of 0.74. When only CC features were used, the AUC was 0.74. The deep-learning model generated an AUC of 0.57.

## CONCLUSION

Radiomics models demonstrate satisfactory diagnostic accuracy, and high specificity within the benign group can help prevent unnecessary biopsies. Deep learning can be employed to localize architectural distortion areas, potentially offering an automated method for ROI delineation. The validation results on the testing dataset further confirm the reliability of the radiomics model in real-world scenarios.

## CLINICAL RELEVANCE/APPLICATION

This study demonstrates the promising potential of radiomics models in accurately diagnosing architectural distortion in DBT. Additionally, the study suggests that deep learning can effectively localize areas of architectural distortion, which could aid in the development of a fully automated computer-aided diagnosis system for breast cancer.

### R5A-SPBR-8 How Long Does It Take to Read a Mammogram? Investigating the Reading Time of Digital Breast Tomosynthesis Compared to 2D Mammography

## PURPOSE

Digital breast tomosynthesis (DBT) can increase cancer detection and reduce recall rates compared to 2D full-field digital mammography (FFDM) alone. We analysed DBT reading times in a national screening program, compared to FFDM, to investigate the impact of DBT implementation on reading times in double reading, high-volume breast screening programmes.

## METHODS AND MATERIALS

Reading time data were recorded as part of the PROSPECTS Trial, a prospective randomised trial comparing DBT plus FFDM or synthetic 2D mammography (S2D) to FFDM alone, in the UK National Health Service (NHS) breast screening programme, from January 2019 to February 2023. The time to report DBT+FFDM or DBT+S2D and FFDM alone was calculated per case and reading times were compared between modalities. Reporting times were also compared between readers from different professional groups - radiologists and radiographers (i.e. technologists); and with years of DBT reading. The effect of experience using DBT in the screening setting on reporting time was investigated.

## RESULTS

Following exclusions, 48 readers reported 1,242 FFDM clinics (34,210 FFDM cases) and 973 DBT clinics (13,983 DBT cases). DBT reading time was doubled compared to FFDM ( $2.09 \pm 0.64$  minutes vs.  $0.98 \pm 0.30$  minutes, respectively;  $p < .001$ ), and DBT+S2D reading was longer than DBT+FFDM ( $2.24 \pm 0.62$  minutes vs.  $2.04 \pm 0.46$  minutes, respectively;  $p = .006$ ). No significant difference was identified in reporting time between radiologists and radiographer readers ( $2.06 \pm 0.71$  minutes vs.  $2.14 \pm 0.46$  minutes, respectively;  $p = .71$ ). Readers with five or more years of experience reading DBT were quicker at reading DBT than those with less than five years' experience ( $1.86 \pm 0.56$  minutes vs.  $2.37 \pm 0.65$  minutes;  $p = .008$ ), and DBT reading time significantly improved after 6-months of accrued screening experience ( $p = .01$ ).

## CONCLUSION

DBT reading required greater time compared to FFDM, yet relatively short exposure with DBT in the screening setting (6-months) improved reporting time.

## CLINICAL RELEVANCE/APPLICATION

In double reading, high-volume breast screening programmes, caution needs to be exercised when considering DBT as a standard screening tool to prevent overwhelming screening workloads in high-volume screening programmes.



## Abstract Archives of the RSNA, 2023

R5A-SPCA

### Cardiac Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPCA-1 Ultra-High Spatial Resolution of Photon Counting Detector Coronary CT Angiographies Minimize Overestimation Bias Compared to Invasive Reference**

Participants  
Moritz Halfmann, MD, Mainz, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Ultra-high resolution coronary CT angiographies (UHR-CCTA) from Photon counting detector (PCD)-CT have recently been proven feasible in a patient population. However, data comparing it to quantitative coronary angiography as the clinical reference standard for stenosis assessment, is still missing. Therefore, it was the aim of the study to compare stenosis measurements of UHR-CCTA to QCA.

#### **METHODS AND MATERIALS**

For this retrospective study, the institutional database was searched for patients who had undergone UHR-CCTA for the assessment of coronary artery disease (CAD) and had a clinically indicated coronary angiography within 30 days from CCTA. Exclusion criteria were the chronic total occlusion (CTO) of a coronary artery as well as the presence of coronary stents prior to CCTA. This resulted in a total of 39 patients with 83 coronary stenoses. CCTA images were reconstructed with slice thicknesses of 0.6, 0.4 and 0.2 (UHR) mm using the vascular reconstruction kernels Bv44 (0.6/0.4mm) or Bv64 (0.2mm). Stenoses were assessed on all slice thicknesses by two cardiovascular radiologists and on QCA by two cardiologists. Measurements were compared using univariate analysis of variance with post-hoc testing and Bland-Altman plots.

#### **RESULTS**

Mean degrees of coronary stenosis continuously decreased with decreasing slice thicknesses ( $61.3 \pm 13.7\%$  vs.  $53.8 \pm 15.4\%$  vs.  $46.4 \pm 14.8\%$ , all  $p=0.001$ ). Both the 0.6 and the 0.4mm reconstructions showed significant differences between UHR-CCTA and QCA ( $44.1 \pm 15.1\%$ ,  $p<0.001$  and  $p=0.004$  respectively), while the 0.2mm reconstructions did not ( $p=0.428$ ). Bland Altman analysis revealed significant bias between 0.6mm (mean bias 17.6, limits of agreement -14.6 to 48.8) and 0.4mm (9.8, -24.0 to 43.6) reconstructions and QCA, respectively. UHR-CCTA reconstructions did not show a significant bias (2.1, -27.2 to 31.4) but the spread was broader than for QCA.

#### **CONCLUSION**

UHR-CCTA reconstructions minimized overestimation bias of coronary stenosis measurements in comparison to the clinical reference standard of QCA.

#### **CLINICAL RELEVANCE/APPLICATION**

Reduced overestimation bias from UHR-CCTA reconstructions can obviate the need for unnecessary referral for follow-up imaging including invasive coronary angiography.

#### **R5A-SPCA-2 Deep learning-based Acceleration of Compressed Sensing for Non-contrast-enhanced Coronary MR Angiography in Patients with Suspected Coronary Artery Disease**

#### **PURPOSE**

The clinical application of coronary MR angiography (MRA) remains limited due to its long acquisition time and often unsatisfactory image quality. A compressed sensing artificial intelligence (CSAI) framework was recently introduced to overcome these limitations, but its feasibility in coronary MRA is unknown. Therefore, this study aims to evaluate the diagnostic performance of non-contrast-enhanced coronary MRA with CSAI in patients with suspected coronary artery disease (CAD).

#### **METHODS AND MATERIALS**

64 consecutive patients (mean age  $\pm$  standard deviation [SD]:  $59 \pm 10$  years, 48.4% females) with suspected CAD were enrolled in this study. The 3.0-T balanced steady-state free precession sequence were performed. Three observers evaluated the image quality for 15 coronary segments of the right and left coronary arteries using a 5-point scoring system (1=not visible; 5=excellent). Image scores  $\geq 3$  were considered diagnostic. Furthermore, detection of CAD with  $\geq 50\%$  stenosis was evaluated in comparison to reference standard coronary computed tomography angiography (CTA). Mean acquisition times for CSAI-based coronary MRA were measured. For each patient, vessel and segment, sensitivity, specificity, and diagnostic accuracy of CSAI-based coronary MRA for detecting CAD with  $\geq 50\%$  stenosis according to coronary CTA were calculated. Intra-class correlation coefficients (ICCs) were used to assess the interobserver agreement.

#### **RESULTS**

The mean MR acquisition time  $\pm$ SD was  $8.1 \pm 2.4$  min. Twenty-five (39.1%) patients had CAD with  $\geq 50\%$  stenosis on coronary CTA and 29 (45.3%) patients on MRA. A total of 885 segments on the CTA images and 818/885 (92.4%) coronary MRA segments were

diagnostic (Image score =3). The sensitivity, specificity, and diagnostic accuracy were as follows: per patient (92.0%, 84.6%, and 87.5%), per vessel (82.9%, 93.4%, and 91.1%), and per segment (77.6%, 98.2%, and 96.6%), respectively. The ICCs for image quality and stenosis assessment were 0.76-0.99, 0.66-1.00, respectively.

## CONCLUSION

The image quality and diagnostic performance of coronary MRA with CSAI may show good results in comparison to coronary CTA in patients with suspected CAD.

## CLINICAL RELEVANCE/APPLICATION

The non-invasive and radiation-free CSAI framework could be a promising tool for rapid screening and comprehensive examination of the coronary vasculature in patients with suspected CAD.

## R5A-SPCA-3 Virtual Monoenergetic Reconstructions from Photon-Counting Detector CT Influence Coronary Stenosis Quantification: Comparison Between Coronary CT, Coronary and Invasive Coronary Angiography

Participants

Elias Wolf, Mainz, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the influence of virtual monoenergetic image (VMI) reconstructions on the accuracy of coronary artery stenosis measurements on a clinical dual-source photon-counting detector computed tomography (PCD-CT) system in a dynamic phantom, and in a patient cohort with invasive correlation.

## METHODS AND MATERIALS

A rod phantom with two custom-built vessels (4mm diameter) and two different stenoses grades (50% and 25%) was mounted into an anthropomorphic thorax phantom and heartbeats were simulated with 10 different beats per minute (bpm), between 50 bpm and 80 bpm. In addition, 33 patients (26 (78.8%) male, mean age  $71.3 \pm 9.0$  years) who underwent coronary CT angiography (CCTA) and invasive coronary angiography as part of their clinical work-up for suspected coronary artery disease were retrospectively identified from the clinical database. A total of 9 different VMI levels from 40-140 keV were reconstructed with a slice thickness of 0.4 mm, Qr40 Kernel, and QIR strength level of 3 on a PCD-CT system. Reconstruction parameters for the phantom were matched with those of the clinical patient cohort. Percent diameter stenosis (PDS) measurements were compared to either the manufacturers data sheet (phantom) or quantitative coronary angiography (QCA) measurements (clinical cohort) as a ground truth.

## RESULTS

Variation of VMI reconstructions lead to significantly different stenosis measurements in the phantom and patients (e.g., mean PDS in patients:  $68.3\% \pm 9.6$  at 40 keV vs  $53.0\% \pm 9.7$  at 140 keV,  $p < 0.0001$ ). Across the entire range of artificial heart ranges, the phantom study indicated 100 keV (bias: -0.4%, limit of agreement (LoA): -4.5/3.7) for the 50% and 90 keV (bias: 1.4%, LoA, -1.9/4.8) for the 25% stenosis as an ideal VMI level with the least deviation to the reference stenoses. The tissue quality of the plaque (calcified, mixed, or soft) determined the ideal VMI level in the study group. For the in-vivo comparison to QCA as reference, 100 keV (bias: 17.2%, LoA, -1.2/35.7) for calcified, 140 keV (bias: 5.0%, LoA, -24.5/34.4) for mixed and 40 keV (bias: -0.5%, LoA, -21.5/20.5) for soft plaques led to the best agreements.

## CONCLUSION

VMI reconstructions have the potential to improve the accuracy of coronary CT angiography (CCTA) for the quantification of different stenoses types.

## CLINICAL RELEVANCE/APPLICATION

VMI reconstructions can help overcome current limitations of CCTA due to calcium blooming thereby help reduce bias in stenosis quantification compared to QCA.

## R5A-SPCA-4 Diagnostic Performance of Detecting Specific Ischemia in Patients with Intermediate Coronary Stenosis: CT-derived Fractional Flow Reserve versus CT Myocardial Perfusion Imaging

Participants

Zhao-Qian Wang, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the diagnostic accuracy of CTFFR with myocardial perfusion imaging (CTMPI) for detecting the specific ischemia of intermediate coronary stenosis (50% - 70%), using FFR as reference standard

## METHODS AND MATERIALS

Between April 2019 and March 2022, the intermediate coronary arteries stenosis confirmed by ICA quantitative analysis and FFR were prospectively enrolled. All participants underwent coronary computed tomography angiography (CCTA) + CTMPI and ICA + FFR within 10 days. CTFFR and  $\Delta$ CTFFR (the difference between proximal and distal of stenosis) value of coronary artery stenosis was calculated. Myocardial blood flow (MBF) and relative MBF (rMBF) were measured. FFR = 0.80 was used as the reference standard for myocardial ischemia, and ROC curve was used to assess the diagnostic performance of CTFFR,  $\Delta$ CTFFR, CTMPI (MBF) and CTMPI (rMBF) for detecting the specific ischemia of intermediate coronary artery stenosis.

## RESULTS

A total of 37 coronary arteries (27 left anterior descending, 5 left circumflex and 5 right coronary arteries) in 35 patients had intermediate stenosis ( $65.20\% \pm 8.40\%$ ). Among them, the FFR = 0.80 was 29, and the FFR > 0.80 was 8. On a per-vessel basis, the sensitivity, specificity, NPV, PPV and accuracy of CTFFR for detecting specific ischemia of intermediate coronary artery stenosis were 89.66%, 87.50%, 70.00%, 96.30% and 89.19%. The optimal cut-off value of  $\Delta$ CTFFR was 0.04. The sensitivity, specificity, NPV, PPV and accuracy of  $\Delta$ CTFFR were 96.55%, 62.5%, 83.33%, 90.32% and 89.19%, respectively. The optimal cut-off value of MBF was 115.15 mL·100 mL<sup>-1</sup>·min<sup>-1</sup>. The sensitivity, specificity, NPV, PPV and accuracy of CTMPI (MBF) were 75.86%,

75.00%, 46.15%, 91.67% and 75.68%, respectively. The optimal cut-off value of rMBF was 0.736. The sensitivity, specificity, NPV, PPV and accuracy of CTMPI (rMBF) were 96.55%, 75.00%, 85.71%, 93.33% and 91.89%, respectively.

## CONCLUSION

The diagnostic performance of CTFFR and CTMPI for detecting specific ischemia in patients with intermediate coronary stenosis is comparable. For investigating specific ischemia in patients with intermediate coronary stenosis from CCTA, CTFFR should be the preferred method because of its unique advantage, and CTMPI can be chosen if CTFFR is not applicable for various reasons.

## CLINICAL RELEVANCE/APPLICATION

diagnostic performance of CTFFR and CTMPI for detecting specific ischemia in patients with intermediate coronary stenosis

### R5A-SPCA-5 Diagnostic Accuracy of CTFFR in Detecting Hemodynamic Significance of Coronary Stenosis and its Incremental Value to CCTA

Participants

Zhao-Qian Wang, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the diagnostic performance of fractional flow reserve derived from coronary computed tomography angiography (CTFFR) based on machine learning to detect the hemodynamic significance of coronary stenosis, using fractional flow reserve (FFR) as reference standard.

## METHODS AND MATERIALS

From April 2019 to January 2022, patients with suspected coronary heart disease who underwent coronary artery CT angiography (CCTA) and ICA+FFR within 14 days were enrolled retrospectively. FFR = 0.80 was used as the diagnostic criterion of myocardial ischemia to evaluate the diagnostic performance of CTFFR, ?CTFFR (the difference between proximal and distal of stenosis) and combined with CCTA to evaluate specific ischemia of coronary stenosis.

## RESULTS

The 77 stenosis of 77 coronary arteries in 64 patients, 50 had FFR = 0.80 and 27 had FFR > 0.80. Taking FFR = 0.80 as a positive event, the area under the curve (AUC) of specific stenosis ischemia detected by CCTA, CTFFR, ?CTFFR, CCTA + CTFFR and CCTA + ?CTFFR were 0.694, 0.766, 0.791, 0.806 and 0.836, respectively. (1) The diagnostic performance of CTFFR or ?CTFFR for detecting specific stenosis ischemia was slightly higher than that of CCTA, but the difference was not statistically significant ( $P > 0.05$ ). On a per-vessel basis, the sensitivity, specificity, NPV, PPV and accuracy of CTFFR and ?CTFFR were 94.00%, 59.26%, 84.21%, 81.03%, 81.82% and 86.00%, 59.26%, 69.57%, 79.63% and 76.62%, respectively. CTFFR or ?CTFFR correctly diagnosed 5 (31.25%) of the 16 false positive CCTA stenosis. (2) The diagnostic performance of CCTA + CTFFR or CCTA + ?CTFFR was higher than CCTA ( $P = 0.008, P = 0.002$ ). On a per-vessel basis, the sensitivity, specificity, NPV, PPV and accuracy of CCTA + CTFFR were 92.00%, 66.67%, 81.82%, 83.64% and 83.12% respectively. The sensitivity, specificity, NPV, PPV and accuracy of CCTA + ?CTFFR were 88.00%, 66.67%, 75.00%, 83.02% and 80.52%, respectively. (3) There are 15 stenosis in gray area (0.75 - 0.80) of FFR. Two stenosis of CTFFR was higher than 0.80 and the five stenosis of CTFFR was less than 0.75. Eight stenosis of CTFFR was between 0.75 and 0.80. Two stenosis of ?CTFFR was less than 0.05, and thirteen stenosis of ?CTFFR was higher than 0.05.

## CONCLUSION

The specificity in CTFFR is better than CCTA and it can reduce the false positive cases of CCTA by about 1/3. The diagnostic performance of ?CTFFR is comparable to CTFFR. The addition of CTFFR or ?CTFFR has incremental value in the specificity of CCTA alone in the diagnosis of specific stenosis ischemia, but the high false positive rate caused by its moderate specificity (66.67%) may still have some limitations in avoiding ICA including FFR

## CLINICAL RELEVANCE/APPLICATION

detecting hemodynamic significance of coronary stenosis

### R5A-SPCA-6 Quantification and Detection of Calcium Using Multimodal Fusion Approach

Participants

Paddy Raghav, MS, Seattle, WA (*Presenter*) Nothing to Disclose

## PURPOSE

Calcium detection and quantification from computed tomography (CT) scans of the heart is an important tool for the early diagnosis of coronary artery disease (CAD). However, manual identification of calcium can be time-consuming and subject to inter- and intra-observer variability. The majority of current clinical solutions to identify and quantify coronary artery calcium score are semi-automatic and are developed for unenhanced ECG-gated Cardiac CT scan. The proposed method uses a multimodal fusion-based approach, is automatic and precisely quantifies and classifies calcium in different arteries.

## METHODS AND MATERIALS

We developed a multimodal fusion-based approach that utilizes both Cardiac CT and Chest CT. The core of it is an in-house developed segmentation model that segments heart and calcium. One major challenge we faced was due to the variability in scan resolution, orientation, and heart size across different patients. To address this, we normalized the scans to fit a scaled coordinate system. To detect calcium deposits, an intensity threshold was applied to filter out the areas of the scan with higher calcium density, followed by connected-components labeling to identify the connected regions of calcium. To classify calcium deposits based on their location within the heart, a likelihood model based on spatial features and location was built. This helped to determine the probability that a given calcium deposit belongs to a specific region of the heart.

## RESULTS

The solution was tested on 200 cardiac patients and 1000 chest patients. The Pearson correlation coefficient between the reference actual and the computed predictive scores on the test set show a high level of correlation (0.84;  $p < 0.001$ ) and high limits of agreement in Bland-Altman plot. The proposed method correctly classifies the risk group in 75.2% of the cases and classifies the subjects in the same group. For the presence/absence of coronary artery calcifications, the deep learning model

achieved a sensitivity of 90 % and a specificity of 94 %.

#### **CONCLUSION**

s Fully automated deep learning-based calcium quantification on cardiac-CTs shows good correlation compared to reference standards. Automating this process may reduce evaluation time and potentially optimize clinical calcium scoring.

#### **CLINICAL RELEVANCE/APPLICATION**

AI-powered calcium detection has the potential to improve the accuracy, efficiency, and consistency of heart disease diagnosis, ultimately leading to better patient outcomes. By analyzing data from multiple imaging modalities, AI algorithms can identify patterns and correlations that may be missed by a single imaging modality. This can help clinicians to identify patients at high risk for future cardiovascular events and take preventative measures to reduce that risk.

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## Abstract Archives of the RSNA, 2023

R5A-SPCH

### Chest Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPCH-1 Positional Effects on Cardiopulmonary Function Measured by 4D-Flow and 3D-cine MRI with Blanket-Like Coil**

##### Participants

Ryogo Enoki, RT, Suita Osaka, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Hemodynamic changes caused by positional changes are known in patients with heart failure or pregnant women, but clinically applicable noninvasive testing methods have not been well established. This study aims to assess the feasibility of assessing cardiac function and collecting normal values for pulmonary blood flow measurements by changing body position.

##### METHODS AND MATERIALS

CMR imaging was performed on 10 healthy volunteers who gave consent for imaging using a 3T MRI and a blanket-like coil; 3D cine was performed using the Hyperkat acceleration in the horizontal section, and 4D flow using Hyperkat was performed to measure the flow of the mediastinal region. These images were taken in the supine, right lateral recumbent, and left lateral recumbent positions. A questionnaire was obtained from the participants regarding imaging in different positions. The left and right ventricular volume parameters (end-diastolic volume, end-systolic volume, and ejection fraction) were then calculated from the 3D cine. 4D flow data were used to measure the flow volume (ml/heartbeat) of the Aorta, main pulmonary artery (PA), right PA, left PA, SVC, and IVC, respectively. Differences in each flow volume between body positions were compared.

##### RESULTS

Positional changes did not significantly alter right or left ventricular volumetric parameters. Flow volume did not change with position in Aorta (74 ml, 76 ml, 75 ml) and main PA (81 ml, 71 ml, 83 ml). Right PA (36 ml, 42 ml, 27 ml) increased in the right lateral position and significantly decreased in the left lateral position compared with the supine position ( $P=0.09$ ,  $0.02$ , respectively). Left PA (32 ml, 21 ml, 44 ml) significantly decreased in the right lateral position and significantly increased in the left lateral position ( $p=0.02$ ,  $0.01$ , respectively). Blood flow in SVC (21 ml, 24 ml, 19 ml) and IVC (42 ml, 33 ml, 39 ml) was not significantly different by position. The proportion of right/left distribution of pulmonary flow was 0.53 in the supine position, 0.67 in the right recumbent position, and 0.39 in the left recumbent position, showing significant differences between positions ( $p<0.01$ ). The total imaging time for cine and 4D flow was approximately 30 minutes, including positional changes.

##### CONCLUSION

4D flow and cine imaging with a blanket-like coil had clinically applicable imaging times. Cardiac function in healthy volunteers did not differ by positioning, but the left or right pulmonary blood flow increased on the gravity side.

##### CLINICAL RELEVANCE/APPLICATION

The measurement of hemodynamic changes due to positional differences can be performed noninvasively, enabling the evaluation of pathological conditions such as heart failure patients.

#### **R5A-SPCH-2 Radiologist and Surgical Agreement in Classification of Chronic Thromboembolic Pulmonary Hypertension (CTEPH)**

##### Participants

Lewis Hahn, MD, San Diego, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

Determine agreement between radiologists (rads) and surgeons in localizing level of disease in CTEPH and determine factors that affect agreement.

##### METHODS AND MATERIALS

6 rads (3 local and 3 external) localized CTEPH level on CTPA on consecutive patients who underwent pulmonary thromboendarterectomy (PTE) surgery at a leading CTEPH surgical center from 1/7/21-10/22/22. Rads graded the level of most proximal disease in the left and right PAs using a locally developed surgical level classification: level 1= disease in main PA; level 2= disease distal to level 1 to segmental ostia; level 3=segmental disease; level 4=subsegmental disease; level 0=no disease. 10 cases were used for training. The time between CTPA and surgery, minimum slice thickness of CTPA, and number of positive CTEPH cases each radiologist read/year was recorded. Excluded patients (number in parenthesis) included those w/o CTPA study (30), time between CTPA and surgery was >180 days (110), slice thickness was >3mm (2), study was not CTPA protocol (4), path diagnosis of PA sarcoma (4), presence of acute PE (4), patients <18 y/o (3). Surgical notes were reviewed to determine surgical level of disease. Weighted kappa and multivariate analysis were performed.

##### RESULTS

330 patients had PTE over 22 months. After 157 exclusions +10 training cases, rads reviewed 163 CTPAs. Agreement was substantial ( $\kappa=0.62-0.77$ ) between all rads except for moderate agreement between rads 2 and 4 and rads 4 and 5. Agreement between reader 1 and surgical level was substantial ( $\kappa=0.724$ ) and moderate for readers 2-6 ( $\kappa$  range 0.49-0.58). Agreement was significantly better with less time between CTPA and PTE ( $p=0.006$ ) with  $<50\%$  agreement when CTPA  $>118$  days old. Agreement between rads and surgery for proximal (level 1+2) disease did not change with slice thickness. There was a significant drop with distal (level 3+4) disease in studies with slice thickness  $\geq 1\text{mm}$  ( $\kappa$  range 0.06-0.327) vs thickness  $<1\text{mm}$  ( $\kappa$  range 0.34-0.6) ( $p=0.03$ ). No difference was seen between rads agreement and CTEPH level or laterality. Reader experience was marginally correlated with surgical agreement.

## CONCLUSION

Using this CTEPH surgical classification system, agreement between rads was substantial and was moderate to substantial between rads and surgeons. Slice thickness  $<1\text{mm}$  must be used to accurately localize segmental and subsegmental disease. Agreement decreased as time between CTPA and surgery increased.

## CLINICAL RELEVANCE/APPLICATION

There is a high level of agreement between rads and surgeons for grading CTEPH. Slice thickness  $<1\text{mm}$  should be used as experienced surgeons can treat distal disease. Given evolution of disease, patients with studies  $>4$  months old could undergo repeat CTPA prior to PTE to more accurately localize disease for surgeons.

## R5A-SPCH-3 Monitoring Changes in Lung Perfusion of Patients with Acute Pulmonary Embolism under Therapy Using Free Breathing Arterial-spin Labeling (ASL-)MRI: Preliminary Results of an Ongoing Study

### PURPOSE

Organ perfusion can be imaged non-invasively with ASL-MRI. The aim of this study was to evaluate changes of lung perfusion in patients with acute pulmonary embolism (PE) under therapy using ASL-MRI.

### METHODS AND MATERIALS

Between 11/2020 and 12/2022, 15 patients (median/min/max 55/24/90 y/o, 9f) with PE before and after treatment initiation (min/max/mean/median 5/243/165/174 days in-between) were examined by ASL-MRI under free breathing in a prospective study. The study was approved by the local ethic committee and all patients gave written informed consent. Initially, patients were treated with heparin ( $n=9$ ), alteplase and heparin ( $n=1$ ) or oral anticoagulation ( $n=5$ ). One patient additionally underwent catheter-directed embolectomy. After the initial therapy patients were treated with Rivaroxaban ( $n=5$ ), Apixaban ( $n=8$ ) or low molecular weight heparin ( $n=2$ ). The examinations were performed on a 1.5T MRI. Pulmonary perfusion was assessed using free-breathing ECG-triggered pseudo-continuous ASL-MRI. The pulmonary trunk was labeled during systole, and images were acquired during diastole of the subsequent cardiac cycle. Additionally, multisection coronal, balanced steady-state-free-precession imaging was carried out. The proportion of perfusion deficit caused by pulmonary embolism was categorized for each lung lobe: I) 0-25 %, II) 26-50 %, III) 51-75 %, IV)  $>75$  %

### RESULTS

Before treatment, perfusion deficits caused by PE were found in all patients in 59 lobes: I)  $n=5$ , II)  $n=10$ , III)  $n=17$ , IV)  $n=27$ . At follow-up imaging, perfusion deficits were found in 25 lobes of 8 patients: I)  $n=7$ , II)  $n=8$ , III)  $n=6$ , IV)  $n=4$ . Improved lung perfusion was seen in all patients. Perfusion deficits resolved completely in 7/15 patients.

### CONCLUSION

This is the first study using ASL-MRI to evaluate changes of lung perfusion during and after therapy of patients with PE. After therapy, improvements of lung perfusion were seen in all patients. However, in some patients, persistent perfusion deficits could be observed.

### CLINICAL RELEVANCE/APPLICATION

The clinical relevance of these findings needs to be evaluated in future studies. Nonetheless, ASL-MRI might be useful to monitor non-invasively the treatment effects in patients with PE.

## R5A-SPCH-4 Assessment of Missed Incidental Pulmonary Embolisms on Chest CT with an AI-algorithm

### Participants

Vera Inka Josephin Graeve, MD, Gerlafingen, Switzerland (*Presenter*) Nothing to Disclose

Tician Schnitzler, MD, Aarau, Switzerland (*Presenter*) Nothing to Disclose

### PURPOSE

Pulmonary embolism (PE) is the third most frequent cause of cardiovascular related death and occurs in 1 of 1000 patients in the European population. In symptomatic patients a CT angiography reveals a detection rate of more than 95%, while the diagnostic performance for occlusions of pulmonary arteries massively decreases in CT scans, performed due to other reasons than suspected PE. A recent study estimates, that radiologists diagnose nearly as much of those incidental pulmonary embolisms (iPE) than they miss. The aim of this study was a retrospective assessment of iPE missed by radiologists on chest CT with an artificial intelligence (AI) algorithm including prevalence, anatomic distribution pattern and daytime of diagnosis of the CT scans.

### METHODS AND MATERIALS

This IRB approved, retrospective single center study included 1965 chest CT scans acquired during venous or arterial contrast, performed due to other reasons than suspected PE, analyzed by an FDA-approved AI algorithm for diagnosing iPE (Aidoc Medical). The appearance of iPEs, their location and the studytime were retrieved from the radiological reports and compared to all positive findings of the AI algorithm, verified by an experienced radiologist, serving as the gold standard. For statistical analysis SPSS was used (Version 28, 2021).

### RESULTS

Of the 1966 cases 63 suspicious iPEs were displayed by the AI of which 42 were true iPEs (Sensitivity 95%, Specificity 99%). Prevalence of iPE was 2,4%, while half of the positive cases were missed by radiologists (PPV: 66%; NPV: 99%). In nearly 76%

(16/21) the retrospectively identified missed iPEs were allocated in the right lower lobe, while the non-missed iPEs showed a nonspecific distribution affecting all lung segments. Most of the reports which missed an iPE were generated between 1:00 and 5:00pm (57%).

## CONCLUSION

s Nearly 50% of cases with iPE were missed by radiologists, which indicates the need for a robust AI solution. Secondly, this study can pave the way for a better understanding of iPEs with regard to their anatomic distribution pattern and different external influences in order to prevent future misdiagnosis.

## CLINICAL RELEVANCE/APPLICATION

This study illustrates the poor diagnostic performance of radiologists diagnosing iPEs, focussing on their anatomic distribution and additional external influences that may cause misdiagnosis.

## R5A-SPCH-5 Effects of Model-based Iterative Reconstruction Algorithm and Contrast Enhancement Boost Postprocessing Technique on the Pulmonary CT Angiography: A Evaluation of Image Quality for Obese Patients

### PURPOSE

To evaluate whether model-based iterative reconstruction [forward projected model-based IR solution (FIRST)] algorithm and contrast-enhancement-boost (CE-Boost) technique can improve the image quality in pulmonary CT angiography (CTA) for obese patients.

### METHODS AND MATERIALS

This prospective study was conducted on 100 consecutive patients who underwent pulmonary CTA for suspected pulmonary embolism (PE). Patients whose body mass index (BMI) exceeded 25 (group 1) were performed with conventional hybrid iterative reconstruction [adaptive iterative dose reduction 3D (AIDR 3D)], FIRST, and CE-Boost. Non-obese patients (BMI<25, group 2) was subjected to AIDR 3D, considering as reference standard. CT numbers, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and image noise were quantitatively assessed by pulmonary arteries. Two chest radiologists independently reviewed the CT images (5, best; 1, worst) by four subjective characteristics including noise, visibility of pulmonary artery, overall image quality and diagnostic confidence. The Mann-Whitney U test and Independent Samples t-test were used for statistical analysis.

### RESULTS

Group 1 FIRST images had significantly lower image noise compared with group 2 AIDR 3D images ( $p<0.05$ ), while group 1 CE-Boost and AIDR 3D images were inferior to group 2 AIDR 3D images regarding to image noise. Both CE-Boost images and FIRST images showed higher SNR and CNR than group 2 AIDR 3D images (all  $p<0.05$ ). When compared with group 2 AIDR 3D, group 1 AIDR 3D exhibits lower subjective scores, whereas group 1 FIRST and CE-Boost had markedly higher scores (all  $p<0.05$ ). A major increase in diagnostic confidence was observed after the addition of FIRST or CE-Boost (all  $p<0.05$ ).

## CONCLUSION

s The postprocessing technique CE-Boost and FIRST reconstruction algorithm can both improve overall image quality and diagnostic confidence of pulmonary CTA in obese patients.

## CLINICAL RELEVANCE/APPLICATION

High-quality pulmonary CTA image provided by CE-Boost or FIRST enables a better visualization of the main pulmonary artery and its branch vessels. This may enable early diagnosis of PE and reduce exposure dose in obese patients.

## R5A-SPCH-6 Efficacy of Lung Dynamic CT Perfusion in Patients with Pulmonary Hypertension

Participants

Takuya Yokota, Bunkyo Hongo 3-1-3, Japan (*Presenter*) Nothing to Disclose

### PURPOSE

We developed lung dynamic CT perfusion (LCTP) that can evaluate absolute lung blood flow. The purpose of this study was to investigate the incremental diagnostic value of LCTP over CT pulmonary angiography (CTPA) for detecting perfusion defect with perfusion scintigraphy.

### METHODS AND MATERIALS

This retrospective single-center study included 23 patients (mean age, 61 years  $\pm$  16 [SD]; 15 women) who were suspected of pulmonary hypertension underwent LCTP and perfusion scintigraphy from January 2021 to March 2023. LCTP data was obtained by electrocardiogram-gated axial scan targeted at systolic phase using a 320-row CT. The acquisition was performed separately in the upper and the lower lung fields, and these data were combined for analysis. Deconvolution method was used to calculate the blood flow of the lungs using a workstation. The phase in which the pulmonary artery was most contrasted during LCTP scan was selected to reconstruct CTPA. Six regions of interest were placed in each lobe to calculate quantitative perfusion ratio. Diagnostic performance of CTPA and CTPA plus quantitative perfusion ratio was compared to detect perfusion defect with perfusion scintigraphy. The analysis was performed for each lobe (right upper, right middle, right lower, left upper, left lingula, and left lower lobe).

### RESULTS

Of the 138 lobes, 86 lobes (62%) showed perfusion defects on scintigraphy. Adding LCTP to CTPA increased sensitivity from 29.1% (95% CI: 20, 40%) to 95.3% (95% CI: 89, 99%;  $p<0.001$ ) and accuracy from 54.3% (95% CI: 46, 63%) to 92.7% (95% CI: 87, 96%;  $p<0.001$ ) while maintaining specificity (96.2% [95% CI: 87, 100%] vs. 88% [95% CI: 77, 96%];  $p=0.13$ ). The area under the receiver operating characteristics curve increased from 0.63 (95% CI: 0.57, 0.68) to 0.96 (95% CI: 0.94, 0.99;  $p<0.001$ ) when LCTP was included. The mean radiation dose and contrast medium amount was 5.1 mSv  $\pm$  1.3 and 78 ml  $\pm$  15, respectively.

## CONCLUSION

s Adding LCTP to CTPA improves the diagnostic performance to detect perfusion defect in perfusion scintigraphy by increasing

sensitivity.

#### **CLINICAL RELEVANCE/APPLICATION**

Quantitative evaluation of pulmonary blood flow using dynamic lung CT perfusion enables accurate diagnosis compared to CT pulmonary angiography alone with acceptable radiation and contrast medium dose.

#### **R5A-SPCH-7 The Effects of Age on Lung Structure Parameters in Healthy People by Low-dose Computed Tomography**

Participants

Anqi Liu, MD, Beijing, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This article mainly focuses on the associations of lung structure parameters in healthy people with age. We quantified these changes by indicators derived from LDCT such as lung volumes, pulmonary vascular volumes and fractal dimensions, artery diameters, etc.

#### **METHODS AND MATERIALS**

1500 participants aged 20-69 years (mean age, 45±14 years; 51.4% men) with normal chest imaging manifestations were included in this study. The MPAd (main pulmonary artery diameter) at the bifurcation of the pulmonary artery and the AAd (ascending aorta diameter) at the same level in cross section were measured. We calculated the ratio PA by dividing MPAd by AAd. The lung volumes and pulmonary vascular volumes (small, middle, large vessels/arteries/veins) were computed by 3-dimensional(3D) reconstructions using LDCT images of the study population, and vessel fractal dimensions, normalized lung volumes (divided by body surface area) and normalized pulmonary vascular volumes (divided by total lung volume) were calculated.

#### **RESULTS**

We chose the young group (20-44-year-old group) as a reference, the MPAd of middle-aged group (45-59-year-old group,  $\beta=1.040$ ,  $p<0.001$ ) and old group (60-69-year-old group,  $\beta=1.778$ ,  $p<0.001$ ) increased compared to the young group after being adjusted for bias, so did AAd. Increasing total and right lung volumes were associated with age-based groups, the same phenomenon was observed when normalized by BSA, but the left lung volume ( $\beta=0.036$ ,  $p=0.215$ ) and normalized left lung volume ( $\beta=0.010$ ,  $p=0.546$ ) did not show statistically significant increase between the old and young groups. We found statistical differences ( $P<0.05$ ) of vascular volumes between the 3 age-based groups, but there was no association of vascular volumes in the 3 groups after adjustment. The normalized pulmonary vascular volumes except normalized pulmonary large artery and venous volumes presented lower levels comparing the middle-aged and old groups with young group. Vessel fractal dimensions have no associations with age. The 90th percentile cutoff values of MPAd were 27.63, 28.80 and 29.60mm, AAd were 32.28, 37.11 and 40.06mm, ratio PA were 0.97, 0.90, 0.86 for young group, middle-aged group and old group respectively.

#### **CONCLUSION**

s MPAd, AAd, total and right lung volumes increased when compared the old and middle-aged people to young people, while the normalized pulmonary vascular volumes except normalized pulmonary large artery and venous volumes presented lower levels comparing the old and middle-aged people with young people.

#### **CLINICAL RELEVANCE/APPLICATION**

Changes in LDCT-related lung structure parameters with age may provide normal reference values for healthy people in different age stage, which can also be potential markers of lung aging.

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## Abstract Archives of the RSNA, 2023

R5A-SPER

### Emergency Radiology Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPER-1 Necessity of Whole Body CT in Trauma Patients After Vehicle Accidents - Predictive Parameters for a Negative CT Examination**

#### Participants

Daniel Ginzburg, Bonn, Germany (*Presenter*) Nothing to Disclose

#### PURPOSE

To rule out serious findings in trauma patients, immediate CT imaging poses a major aspect in the Advanced Trauma Life Support scheme. In order to assess the necessity for whole body CT in patients after a vehicle accident a detailed analysis of this patient group is required. We aimed to identify patients after vehicle accidents that do not benefit from CT imaging in regard to the chest and abdomen.

#### METHODS AND MATERIALS

In this retrospective study, all patients that received a trauma CT in our emergency department after vehicle accidents between 03/2017 and 08/2019 were evaluated regarding trauma mechanisms as well as initial clinical assessment including the extended Focused assessment with sonography for Trauma (eFAST). Inclusion criteria were: vehicle accident, CT scan of the chest and abdomen and GCS = 13.

#### RESULTS

348/2525 patients (13.8 %) met the inclusion criteria. 151/348 patients (43.4 %) had an unremarkable physical examination according the ATLS scheme and a negative eFAST exam. 90/151 patients (59.6 %) had no injuries on CT, while the remaining 61 patients (40.4%) had only minor to moderate trunk injuries (Abbreviated injury scale - AIS < 3) not necessarily requiring CT evaluation (e.g. non-dislocated rib or sternal fractures). None of these patients required surgery, and apart from adjusted pain treatment, no changes were made to the therapeutic regimen based on the CT results. Of 197/348 (56.6%) patients with abnormal findings on physical examination and/or eFAST, 75 (38.1%) had severe trunk injuries (AIS = 3) requiring immediate clinical intervention on subsequent CT; 103 patients (52.3%) had mild/medium injuries (AIS < 3) and 19 patients (9.6%) had no trauma-related injuries.

#### CONCLUSION

While CT examinations remain an essential diagnostic pillar for the assessment of severely injured trauma patients, the indication for performing such examinations in patients with a GCS = 13 without abnormalities on physical examination or eFAST could be approached in a more individualized way. These patients rarely benefit from a trauma CT scan in terms of adjusting their treatment regimen.

#### CLINICAL RELEVANCE/APPLICATION

With vehicle accidents being one of the most frequent causes of death especially in younger patients below the age of 45 the correct diagnostics and treatment of this patient group is of major clinical significance.

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## Abstract Archives of the RSNA, 2023

R5A-SPGI

### Gastrointestinal Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPGI-1 Pancreatic Volume Changes in Patients with Immunotherapy-induced Acute Pancreatitis and Diabetes Mellitus Type 3c**

##### Participants

Hiroaki Takahashi, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

Immune check-point inhibitors (ICI) therapy causes immune-related pancreatic injury (irPI) resulting in acute pancreatitis (AP) or glandular dysfunction including insulin-requiring diabetes mellitus type 3c (DM-3c). We investigated the chronological pancreatic volume changes in patients with ICI-associated AP and DM-3c.

##### METHODS AND MATERIALS

Patients treated with ICI therapy (pembrolizumab, ipilimumab or nivolumab) who developed ICI-associated AP or DM-3c from 2015 to 2019 at 3 centers in our network were included. CT or PET/CT examinations in each of following periods were reviewed: (1) Pre-treatment scans (prior to ICI administration), (2) pre-diagnostic scans (after ICI administration and prior to irPI diagnosis), (3) early post-diagnostic scans (0-90 days after irPI diagnosis), (4) midterm post-diagnostic scans (91-360 days after irPI diagnosis), and (5) late post-diagnostic scans (>360 days after irPI diagnosis). Each exam was anonymized and segmented by an experienced abdominal radiologist. The mean pancreatic volume was used as the representative value if multiple examinations were performed in each period. Normalized pancreatic volume (NPV) is calculated by the ratio of pancreatic volume in each period to that in the pre-diagnostic scan. Mann-Whitney U test was used to compute NPV statistical differences with  $P < 0.05$  considered statically significant.

##### RESULTS

Among 30 enrolled patients (12 males, 18 females, mean age: 63 [37-90] year-old), 21 patients developed AP and 9 patients developed DM-3c. No patient had concurrent AP and DM-3c diagnosis. The median duration from ICI administration to irPI diagnosis was 131 days (12-715 days) in patients with AP and 146 days (28-685 days) in patients with DM-3c. NPV (pre-treatment; pre-diagnostic; early post-diagnostic; midterm post-diagnostic; late post-diagnostic) was 1.05 (n=14, p=0.53); 1 (n = 21); 1.22 (n=19, p=0.41); 0.71 (n=12, p=0.04); 0.53 (n=5, p=0.14) in patients with AP and 0.80 (n=7, p=0.20); 1 (n=9); 0.71 (n=8, p=0.01); 0.62 (n=8, p < 0.001); 0.73 (n=5, p=0.01) in patients with DM-3c.

##### CONCLUSION

The pancreas shows increase in volume after ICI administration in patients with AP and DM-3c, but at different timing. Increase is seen prior to DM-3c diagnosis, and within 0-90 days after AP diagnosis. Pancreas volume decreases in 91- days after the diagnosis of DM-3c or AP and persists after 1 year. The degree of pancreatic atrophy is more severe in AP than DM-3c.

##### CLINICAL RELEVANCE/APPLICATION

CT pancreatic volumetry is a useful tool to assess irPI. Pancreatic volume loss could suggest previous irPI events. Pancreatic volume increase could suggest the future risk of ICI-associated DM-3c and recent AP events.

#### **R5A-SPGI-2 Time Dependency and Risk Factors of Splanchnic Vein Thrombosis Development in the Early Phase of Acute Pancreatitis: A Systematic Review and Meta-analysis**

##### PURPOSE

Splanchnic vein thrombosis (SVT) is a local complication of acute pancreatitis (AP) that may lead to subsequent complications such as portal hypertension, gastrointestinal bleeding, and mesenteric ischemia. Our aim was to analyze the temporal progression and contributing risk factors of SVT occurrence during the early phase of AP.

##### METHODS AND MATERIALS

We conducted a systematic search in four medical databases (Embase, MEDLINE via PubMed, Scopus, and CENTRAL) on October 27, 2022. Inclusion criteria were studies using appropriate radiological modalities to identify SVT in adult patients with AP, present data on early phase AP, and offer accurate information on the imaging timing. Exclusion criteria were studies with patients having malignant disease or recent surgical history. We used a random effects model, we calculated SVT-affected patient proportions, with 95% confidence intervals (CI), and conducted subgroup analyses. The study protocol was prospectively registered in the PROSPERO database.

##### RESULTS

Our analysis included 14 studies encompassing 1,951 patients. We found that the proportion of patients who developed SVT during the early phase of AP (within 12 days post-symptom onset) was 0.13 (CI 0.08-0.22). SVT incidence was lowest at 0.05 (CI 0.02-0.15) within 0-3 days, increasing almost five-fold to 0.23 (CI 0.1-0.46) between 3-11 days. Factors influencing SVT occurrence

included etiology (alcoholic 0.31 (CI 0.13-0.58), biliary 0.12 (CI 0.04-0.3),  $p=0.03$ ), and pancreatic necrosis (absent 0.09 (CI 0.06-0.15), under 50% 0.29 (CI 0.22-0.37), over 50% 0.46 (CI 0.36-0.56),  $p=0.01$ ). The proportions of distinct venous combinations affected by thrombosis included splenic vein (SV) 0.48 (CI 0.35-0.61), portal vein (PV) 0.28 (CI 0.18-0.42), superior mesenteric vein (SMV) 0.14 (CI 0.08-0.25), SV and PV 0.09 (CI 0.05-0.19), SV and SMV 0.06 (CI 0.02-0.14), PV and SMV 0.13 (CI 0.06-0.27), all three veins 0.1 (CI 0.05-0.19),  $p=0.01$ .

## CONCLUSION

One in six patients develops SVT in the early phase of AP. Alcoholic etiology and pancreatic necrosis increase the risk of SVT. In addition, this risk seems to increase with the duration of AP. The affected veins, in descending order, are the SV, PV, SMV, and combinations thereof.

## CLINICAL RELEVANCE/APPLICATION

Imaging should target high-risk patients and take into account the time-dependent nature of SVT incidence. Furthermore, when reporting, radiologists should have an increased suspicion of SVT if they observe pancreatic necrosis.

## R5A-SPGI-4 Preoperative Assessment of Peripheral Vascular Invasion of Pancreatic Ductal Adenocarcinoma Based on High-resolution MRI

### Participants

Xiaoqi Zhou, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

Preoperative imaging determination of vascular invasion is important for surgical resectability of pancreatic ductal adenocarcinoma (PDAC). The purpose of this study is to compare diagnostic accuracy of PDAC vascular invasion between high-resolution MRI (HR-MRI), conventional MRI (non-HR-MRI) and CT, and clarify the applicable diagnostic criteria for MRI and CT.

## METHODS AND MATERIALS

Pathologically proved PDAC with preoperative HR-MRI (79 cases, 58 with CT) and non-HR-MRI (77 cases, 59 with CT) from 2014 to 2022 were retrospectively collected. Vascular invasion was confirmed by surgical exploration and pathology. The degree of tumor-vascular contact, vessel narrowing and contour irregularity were reviewed respectively. Diagnostic criteria 1 (C1) is the presence of all three characteristics, and criteria 2 (C2) if any one of them is present. The diagnosis efficacy of different examination methods and different criteria was evaluated and compared.

## RESULTS

HR-MRI showed satisfying performance in assessing vascular invasion (AUC: 0.87-0.92), especially better sensitivity (0.79-0.86 vs 0.40-0.79) compared with non-HR-MRI and CT. HR-MRI was superior to non-HR-MRI, but evenly matched to C2 assessed CT. C2 was superior to C1 in CT evaluation (0.85 vs 0.79,  $P=0.03$ ). C1 was superior to C2 in venous assessment by HR-MRI (0.90 vs 0.87,  $P=0.04$ ) and arterial assessment by non-HR-MRI (0.69 vs 0.68,  $P=0.04$ ). Combining C1 assessed HR-MRI and C2 assessed CT yielded the best performance, significantly better than CT alone (0.96 vs 0.86,  $P=0.04$ ).

## CONCLUSION

HR-MRI can provide more accurate assessment of PDAC vascular invasion than conventional MRI. C1 may be more applicable to MRI assessment, while C2 may be more applicable to CT. The combination of HR-MRI and CT outperformed CT alone and should be the recommended preoperative examination option.

## CLINICAL RELEVANCE/APPLICATION

HR-MRI provides vital information for the assessment of PDAC vascular invasion and may contribute to the operative decision making. Combined C1 assessed HR-MRI and C2 assessed CT showed the best efficacy and is the preferred preoperative examination option for PDAC.

## R5A-SPGI-5 Multivariate Quantitative Ultrasound Approach for the Assessment of Hepatic Steatosis in Chronic Liver Disease

## PURPOSE

There is a need for a non-invasive, widely available, and highly accurate tool for assessing hepatic steatosis considering the global increase in the incidence of non-alcoholic fatty liver disease. This study focused on the acoustic properties of the integrated backscatter coefficient (IBSC) and signal-to-noise ratio (SNR) in addition to the ultrasound-guided attenuation parameter (UGAP). We attempted to construct a highly accurate model for the prediction of  $\geq 5\%$  steatosis in chronic liver disease (CLD) using a multivariate quantitative ultrasound approach.

## METHODS AND MATERIALS

This prospective multicenter study enrolled 582 patients with CLD between February 2020 and April 2021, who were grouped into steatosis ( $n=364$ ) and non-steatosis ( $n=218$ ) groups using magnetic resonance imaging proton density fat fraction (MRI-PDFF) values as a reference. Four models were created to compute the prediction equation for steatosis: Model 1 (UGAP alone), Model 2 (UGAP + IBSC), Model 3 (UGAP + SNR), and Model 4 (UGAP + IBSC + SNR). Receiver operating characteristic (ROC) analysis, category-free net reclassification improvement (cf-NRI), and integrated discrimination improvement (IDI) were used to examine the optimal model.

## RESULTS

The areas under the ROC curve for steatosis diagnosis in Models 1, 2, 3, and 4 were 0.923, 0.931, 0.953, and 0.959, respectively. Internal validation using the bootstrap method yielded a C-index of 0.923, 0.930, 0.952, and 0.958, respectively; Models 3 and 4 demonstrated statistically significant discriminative power over the other models ( $p<0.001$ ) (95% confidence interval: 0.431-0.753,  $p<0.001$ ). The cf-NRI and IDI were 0.592 (95% confidence interval: 0.431-0.753,  $p<0.001$ ) and 0.019 (95% confidence interval: 0.005-0.031,  $p<0.01$ ), indicating higher discriminative performance of Model 4 compared to Model 3.

## CONCLUSION

s The multivariate quantitative ultrasound approach focused on the acoustic properties of UGAP, IBSC, and SNR is a promising method for assessing  $\approx 5\%$  steatosis in CLD.

#### CLINICAL RELEVANCE/APPLICATION

We developed a predictive formula using multiple quantitative ultrasound parameters to diagnose  $\approx 5\%$  steatosis in CLD with high discrimination and calibration power. The three quantitative ultrasound parameters, namely ultrasound-guided attenuation parameter, integrated backscatter coefficient, and signal-to-noise ratio, strongly correlated with steatosis in CLD. The procedure also demonstrated the potential to diagnose and quantify hepatic steatosis, with an AUROC of 0.959 (95% confidence interval: 0.944, 0.973) using the multiple quantitative ultrasound model.

#### R5A-SPGI-6 Diagnostic Accuracy of Computed Tomography (CT) for Detection of Hepatic Steatosis: A Systematic Review and Meta-analysis

Participants

Maryam Haghshomar, MD, MA, Chicago, IL (*Presenter*) Nothing to Disclose

#### PURPOSE

CT is a widely accessible imaging method and has an important role for opportunistic diagnosis of fatty liver. Its accuracy and performance however have been inconsistent in various studies and no clear criteria have been established by the societies. Our objective is to conduct a comprehensive review and meta-analysis to assess the diagnostic accuracy of CT in detection of steatosis.

#### METHODS AND MATERIALS

We searched through PUBMED, Embase, and Scopus databases between September 1977 to March 2023. We included studies evaluating diagnostic accuracy, such as sensitivity or specificity, cross-tabulations, or correlations of noncontrast CT (NCCT), contrast-enhanced (CECT), and dual-energy CT (DECT) in detecting fatty liver using either biopsy, proton-density fat fraction, or standard imaging as the reference standard.

#### RESULTS

Thirty-six (4432 participants) studies were included. CT is a reliable method for detecting mild and moderate/severe fatty liver, with sensitivity/specificity of 80.2%/90% for NCCT, 82.3%/96.1%, for CECT, and 83.2%/90% for DECT. Additionally, the area under the curve of diagnostic accuracy for NCCT, CECT, and DECT were 0.891, 0.901, and 0.917, respectively. Stratifying by multiple clinically relevant characteristics did not eliminate the statistical heterogeneity. The heterogeneity was most prominent for DECT and CECT. The threshold range for diagnosing fatty liver was a liver attenuation  $< 38.5$ -58 HU, a liver minus spleen attenuation of  $< -19$  to  $-10.1$  HU, and a liver-to-spleen attenuation ratio  $< 0.89$  to 1.2.

#### CONCLUSION

s NCCT, CECT, and DECT are reliable methods for screening fatty liver in clinical settings. They can detect mild/moderate to severe fatty liver with high reliability and accuracy. It is important to remain cautious when interpreting these findings as there was significant heterogeneity observed, particularly for DECT and CECT.

#### CLINICAL RELEVANCE/APPLICATION

CT is a major modality for opportunistic detection of hepatic steatosis. Results of this meta-analysis explores the performance of CT for this task and discuss the threshold values for diagnosis of steatosis.

#### R5A-SPGI-7 The Application Value of FLIS Combined with T2\* Mapping in Preoperative Liver Function Assessment of sHCC

#### PURPOSE

Using the 15 minutes indocyanine green retention rate (ICG R-15) as the reference standard, the diagnostic value of FLIS combined with T2\* mapping for preoperative assessment of liver reserve function in sHCC were compared with T1 mapping.

#### METHODS AND MATERIALS

A retrospective analysis was conducted on 60 patients with sHCC who had preoperative imaging findings from July 2020 to March 2023. All patients underwent Gd-EOB-DTPA-enhanced MRI, including pre-injection (T1-pre) mapping, post-injection (T1-post) 20 min mapping, and T2\* mapping. The ROIs were selected at the same location and measurements were taken to calculate R2\* values, pre-injection (T1-pre), post-injection (T1-20 min) T1 relaxation times and calculated the T1 relaxation time reduction rate (T1-pre - T1-20 min/ T1-pre). Three features of the hepatobiliary phase were assessed: normal liver parenchyma, biliary system and portal vein signal intensity, and FLIS was calculated. All patients underwent a ICG retention test and were divided into three groups (29 patients in group 1  $< 10\%$ , 19 patients in group 2 10%-20% and 12 patients in group 3  $\approx 20\%$ ). The differences between the normal liver R2\* values, FLIS and T1 relaxation time reduction rates between the three groups were statistically analysed.

#### RESULTS

he reduction rates of T1 relaxation time, R2\* values, FLIS between the 3 groups were (76.56 $\pm$ 1.00)%, (62.12 $\pm$  (1.25)%, (53.19 $\pm$ 2.25)% vs (39.75 $\pm$ 2.57) Hz, (45.39 $\pm$ 1.83) Hz, (55.41 $\pm$ 2.34) Hz vs (4.90 $\pm$ 0.90), (3.68 $\pm$ 0.82) (1.58 $\pm$ 0.79), the differences were statistically significant (P $<$ 0.01), R2\* values were negatively correlated with liver function grade, FLIS and T1 relaxation time reduction rate were positively correlated with liver function grade, Spearman's correlation coefficient Rs were -0.921, 0.821, 0.981. The area under the R2\* value, FLIS and T1 relaxation time reduction rate ROC were 0.883, 0.825 and 0.914 between group 1 and 2, and 0.867, 0.8 and 0.869 between groups 2 and 3. The T1 relaxation time reduction rate was the most efficient diagnostic between the 3 groups, followed by R2\* value and FLIS respectively, and the combined diagnostic efficacy of the two increased (0.945, 0.935).

#### CONCLUSION

s The FLIS and T2\* mapping can accurately assess the liver reserve function of patients with sHCC preoperatively, and their combined diagnostic efficacy is higher than the T1 relaxation time reduction rate.

#### CLINICAL RELEVANCE/APPLICATION



The combined diagnostic efficacy of FLIS and T2\* mapping is higher than the T1 relaxation time reduction rate. And it can shorten scanning time.

## **R5A-SPGI-8 Quantitative liver function analysis using T1 mapping on gadoxetic acid-enhanced MR imaging; the application of Dixon-based fat correction in look-locker inversion recovery sequence**

Participants

Ye Rin Hwang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

To investigate the role of T1 map-derived quantitative imaging parameters for the assessment of liver function, and the impact of fat correction of T1 mapping on gadoxetic acid-enhanced MR imaging

### **METHODS AND MATERIALS**

A total of 228 patients with normal liver, chronic liver disease and liver cirrhosis who underwent 3T gadoxetic acid-enhanced MR including Dixon-based fat corrected look-locker inversion recovery (LLIR) sequence were included. Two readers measured pre- and postcontrast T1 relaxation times (preT1 and postT1) on conventional and water map T1 in two sessions with 2-week interval. The averaged preT1, postT1 values, changes between pre- and postcontrast T1 liver ( $\Delta T1$ ), and adjusted postcontrast T1 liver ( $\text{postcontrast T1}_{\text{liver}} - \text{T1}_{\text{spleen}} / \text{T1}_{\text{spleen}}$ ) for both conventional T1 and water map T1, were analyzed for assessment of clinical indices of liver function and hepatic enhancement grade on hepatobiliary phase (HBP). Liver fat fraction (FF) was calculated on MR-based proton density fat fraction (PDFF) map and correlation of T1 map-derived parameters with fat fraction were assessed. With the FF cut-off 6.4%, T1 map-derived parameters were compared between fatty liver and non-fatty liver groups. Multivariate linear regression (MLR) analyses were performed to determine significant variables for T1 value. Reproducibility of T1 values were also assessed.

### **RESULTS**

The inter-reader and intra-reader reproducibility showed near-perfect agreement (ICC 0.929-0.999). 68 subjects were included in fatty liver (FL) group (29.8%, 68/228; mean FF for FL group  $10.77\% \pm 4.92$  vs. non-fatty liver (NFL) group  $2.75\% \pm 1.33$ ). The water map preT1 was lower than preT1 in FL group, and showed significant difference between FL group and NFL group ( $669.4 \pm 274.21$  vs.  $760.67 \pm 207.05$ ,  $p = 0.015$ ). The correlation of preT1 ( $r = 0.232$ ,  $p = 0.0005$ ) and  $\Delta T1$  ( $r = 0.263$ ,  $p = 0.0001$ ) with FF were significant, however water map preT1 ( $r = -0.109$ ,  $p = 0.106$ ) and water map  $\Delta T1$  ( $r = 0.039$ ,  $p = 0.569$ ) showed no correlation with FF. With MLR analysis, albumin, total bilirubin, HBP enhancement grade, FF and R2\* value were significantly associated with T1 map-derived parameters (preT1, postT1,  $\Delta T1$ , and adjusted postT1). For the same T1 map-derived parameters measured on water map, the effect of FF was eliminated while HBP enhancement grade, albumin, and R2\* value were persistently significant factors.

### **CONCLUSION**

T1 mapping on water map using Dixon-based fat corrected LLIR sequence can estimate liver function effectively free from the influence of hepatic steatosis.

### **CLINICAL RELEVANCE/APPLICATION**

With the fat corrected water map T1, T1 mapping of liver can be a useful and noninvasive imaging biomarker for the assessment of liver function regardless of hepatic steatosis.

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## Abstract Archives of the RSNA, 2023

R5A-SPGU

### Genitourinary Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPGU-1 Comparing the Diagnostic Performance of Biparametric with Multiparametric MRI using PI-RADS version 2.1 for Clinically Significant Prostate Cancer**

##### **PURPOSE**

To compare the diagnostic performance of multiparametric MRI (mpMRI) with biparametric MRI (bpMRI) for clinically significant prostate cancer (csPCa) based on the Prostate Imaging Reporting and Data System (PI-RADS) version 2.1.

##### **METHODS AND MATERIALS**

1939 patients underwent prostate MRI from January 2019 to December 2021. This study finally enrolled 597 patients with 616 lesions who underwent mp-MRI (T2WI, DWI and DCE) before MRI/transrectal ultrasound fusion-targeted biopsy. All lesions were classified as 249 lesions in peripheral zone (PZ) with 81 csPCa and 367 lesions in transition zone (TZ) with 67 csPCa. We scored the lesions on the image according to the site of targeted biopsy using the PI-RADS v2.1 standard with blinding to PSA value and pathology results. There were four weeks in between reading sessions for bpMRI and mpMRI. On bpMRI, the overall category of lesions in PZ was determined solely based on the DWI category. The overall category of lesion in TZ was the same between bpMRI and mpMRI. A Student's t-test and a Mann-Whitney U test were employed to compare continuous variables. When using a cutoff of PI-RADS category =4, the ROC curves for bpMRI and mpMRI in the diagnosis of csPCa were drawn to calculate AUC values.

##### **RESULTS**

Patients with csPCa had higher PSA levels and PSAD values, but lower prostate volumes, and being older, compared to those with non-csPCa ( $P < 0.001$ ). The AUCs of bpMRI and mpMRI in PZ for the diagnosis of csPCa were 0.901 and 0.891, respectively ( $P > 0.05$ ). However, mpMRI had higher sensitivity (93.8%) but lower specificity (76.2%) compared to bpMRI (sensitivity: 74.1%; specificity: 89.9%). The same trend was observed in PZ+TZ lesions. In PZ, significantly fewer lesions were assigned to category 3 in mpMRI than in bpMRI due to some lesions with category 3 in bpMRI were up-scored to category 4 in mpMRI. For PZ, if biopsy had been performed in patients with PI-RADS categories 4 and 5, mpMRI detected 39 additional patients who needed biopsy compared to bpMRI and identified 16 cases of csPCa.

##### **CONCLUSION**

Both bpMRI and mpMRI using PI-RADS v2.1 exhibited similar diagnostic performance in diagnosing csPCa, yet mpMRI might decrease the probability of missing csPCa cases.

##### **CLINICAL RELEVANCE/APPLICATION**

Compared to mpMRI, bpMRI offers several advantages including contrast-free imaging, shorter scanning time, and lower costs. However, the application value of bpMRI in diverse clinical scenarios needs to be further researched. Our study demonstrated that mpMRI had the advantage of reducing the probability of missing csPCa cases.

#### **R5A-SPGU-2 Combined Real-time Elastography and Contrast-enhanced Ultrasound for the Detection of Clinically Significant Prostate Cancer**

##### Participants

Yunkai Zhu, Shanghai, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

To investigate the diagnostic performance of combined real-time elastography (RTE) and contrast enhanced ultrasound (CEUS) for the detection of clinically significant prostate cancer (csPCa).

##### **METHODS AND MATERIALS**

This prospective study was approved by the local ethics committee. Between November 2019 and December 2022, 286 patients scheduled for prostate biopsy underwent RTE and CEUS evaluation before biopsy procedure. Men with suspicious lesions on RTE (defined as reproducible stiffness lesion) or CEUS (defined as increased focal contrast enhancement) underwent targeted biopsy (TB) in conjunction with systematic biopsy (SB). Men with negative RTE and CEUS underwent SB alone. The primary outcome was the detection of csPCa (Grade Group = 2) in correlation with the biopsy results.

##### **RESULTS**

Among the 286 patients (median age, 67 years) enrolled in this study, mpUS identified suspicious lesion(s) in 204 patients. The biopsy histopathology confirmed the diagnosis of prostate cancer in 146 patients, including 110 patients with csPCa. The csPCa detection rate was 28% (80/286) for CEUS-TB, 26% (74/286) for RTE-TB and 25% (72/286) for SB ( $P = 0.73$ ). The combination of CEUS-TB and RTE-TB could achieve a csPCa detection rate of 34% (101/286), significant higher than that of SB ( $P = 0.02$ )

##### **CONCLUSION**

Combined CEUS-TB and RTE-TB could achieve a csPCa detection rate of 34% (101/286), significant higher than that of SB ( $P = 0.02$ )

s Combined CEUS-IB and RTE-IB could achieved significantly higher csPCa detection rate than SB alone.

**CLINICAL RELEVANCE/APPLICATION**

Combined CEUS-TB and RTE-TB could improve csPCa detection than either individual US and SB alone.

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## Abstract Archives of the RSNA, 2023

R5A-SPHN

### Head & Neck Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPHN-1 The Added Values of Dynamic Contrast-enhanced Ultrasound in Diagnosis of Small Thyroid Nodules (= 10mm)**

##### Participants

Yun-Lin Huang, MD, Shanghai, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the potential added values of dynamic contrast-enhanced ultrasound (DCE-US) for the diagnosis of small solid thyroid nodules.

##### METHODS AND MATERIALS

This bi-center prospective study was approved by the institutional review board and it was performed between January 2020 and October 2020. B-mode ultrasound and contrast-enhanced ultrasound (CEUS) images were obtained for solid thyroid nodules (= 1.0 cm) confirmed by pathological results. The CEUS time-intensity curves (TICs) of thyroid nodules and surrounding parenchyma were created by VueBox® software (Bracco, Italy). The quantitative parameters of CEUS were analyzed after curve fitting. The weighted kappa statistic (?) was performed to assess the interobserver agreement and consistency between the diagnosis of CEUS and DCE-US. The diagnostic performance of CEUS and DCE-US was evaluated and compared.

##### RESULTS

Totally, 79 thyroid nodules in 79 consecutive patients (55 women; median age: 41 years) were enrolled; 70.9 % (56/79) were malignant and 29.1 % (23/79) were benign nodules. Hypoenhancement during the arterial phase of CEUS was associated with malignant nodules ( $P < 0.001$ ), with an AUC of 0.705, sensitivity of 71.4 %, and specificity of 69.6 %. The peak enhancement (PE), wash-in rate (WiR), and wash-out rate (WoR) of quantitative parameters of DCE-US in malignancies were significantly lower than those in benign nodules ( $P < 0.05$ ). For detecting malignant small solid thyroid nodules (= 1.0 cm), the AUCs of PE, WiR, and WoR were 0.642 (sensitivity 65.2 %, specificity 67.9 %), 0.643 (sensitivity 43.5 %, specificity 91.1 %), and 0.667 (sensitivity 69.6 %, specificity 69.6 %), respectively. Comparing the quantitative parameters between small solid thyroid nodules and surrounding normal thyroid parenchyma, the PE, wash-in area under the curve, WiR, wash-in perfusion index, wash-out AUC, wash-in and wash-out AUC, and WoR of the nodules were significantly lower than those of normal thyroid tissue ( $P < 0.05$ ). A total of 20.3 % (16/79) nodules showed isoenhancement during the arterial phase of CEUS, and the median PE ratio of surrounding tissue and thyroid nodules was 1.70 (IQR 1.33 - 1.89).

##### CONCLUSION

s DCE-US using VueBox® perfusion analysis could provide added values for differential diagnosis of small solid thyroid nodules. VueBox® is a helpful tool for the evaluation of dynamic microvascularization of lesions.

##### CLINICAL RELEVANCE/APPLICATION

This bi-center prospective study highlights the practicality of DCE-US using VueBox® perfusion analysis for the evaluation of dynamic microvascularization of thyroid nodules and differential diagnosis of small solid thyroid nodules.

#### **R5A-SPHN-2 The Value of Deep Learning Reconstruction Algorithms Combined with Organ Dose Modulation Techniques to Improve Thyroid CT Scan Image Quality and Reduce Radiation Dose**

##### Participants

Lv Ren-feng LV, Dalian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Study the deep learning reconstruction (DLIR) algorithm combined with organ dose modulation(ODM) technology to improve the quality of thyroid CT scan images and reduce the radiation dose value.

##### METHODS AND MATERIALS

Using APEX CT, 36 patients with thyroid examination in our hospital were scanned and divided into non-ODM (N-ODM) and ODM groups according to whether the ODM technique was used or not, with 18 cases in each group. According to the different reconstruction algorithms, the two groups respectively reconstructed 2.5 mm images using adaptive statistical iterative reconstruction (ASIR-V, 30%) and deep learning reconstruction (DLIR). Scan start position is 14cm below the plane of the thyroid cartilage, the ODM area contains a fixed length of 5 cm of the thyroid. At the level of maximum thyroid display in the transectional position, the CT values and noise (SD) of the thyroid and muscle in the same layer were recorded, the contrast noise ratio (CNR) and radiation dose (ED) were calculated, the image quality was evaluated subjectively by two imaging physicians using a 5-point scale.

##### RESULTS

There was no statistical difference in CT values of thyroid and muscle tissue in the four groups ( $P > 0.05$ ). The SD, CNR and image quality subjective scores of the N-ODM-DLIR and ODM-DLIR groups were better than the N-ODM-ASIR and ODM-ASIR groups (all  $P < 0.05$ ), the overall image noise of DLIR group is significantly better than that of ASIR group, which can provide a clear image of the neck hierarchy. The radiation dose reduction was about 23% in the ODM group compared to the N-ODM group ( $2.20 \pm 0.07$  vs.  $2.89 \pm 0.04$ ,  $t = 35.04$ ,  $P < 0.05$ ).

## CONCLUSION

s In thyroid CT scans, using the DLIR reconstruction algorithm can significantly improve the image quality, combined with the ODM technique effectively reduces the radiation dose.

## CLINICAL RELEVANCE/APPLICATION

During thyroid scan, because the thickness of the X-axis of the human neck and shoulder is much greater than the Y-axis, the adaptive statistical iterative reconstruction algorithm can not improve the noise of the lower neck scan image well, while the DLIR algorithm can effectively suppress the noise. The thyroid is a highly sensitive tissue organ, ODM technology can conduct low-dose imaging of thyroid area in the process of scanning, combined with DLIR algorithm can improve the image quality.

## R5A-SPHN-3 Value of Radiomics Model Based on T1-weighted, T2-weighted, and Enhanced T1-weighted MRI in Differentiating Benign and Malignant Thyroid Nodules

Participants

Pin He, Shenzhen, China (*Presenter*) Nothing to Disclose

## PURPOSE

To explore the application value of radiomics model based on T1-weighted, T2-weighted and enhanced T1-weighted MRI (T1WI, T2WI, and enhanced T1WI) in differentiating benign and malignant Thyroid Nodules.

## METHODS AND MATERIALS

The clinical and MR imaging data of 127 patients with 135 thyroid nodules (benign: malignant = 37: 98) confirmed by pathology from January 2019 to December 2022 were retrospectively collected and analyzed in our hospital. These patients were randomly divided into a training group and test group according to 7:3 ratio. All patients underwent T1WI, T2WI and enhanced-T1WI before operation. Based on the manually segmented entire thyroid lesions as the regions of interest (ROI), radiomics features were extracted from T1WI, T2WI, and enhanced-T1WI, respectively. Student-t test, the Least Absolute Shrinkage and Selection Operator (LASSO) algorithm and correlation analysis were sequentially used for feature selection. Four classifiers, i.e., k-nearest neighbor (KNN), support vector machine (SVM), random forest (RF) and logistic regression (LR) were used for building three models (T1WI model, T2WI model, enhanced-T1WI model and combined model). The effectiveness of the model in differentiating benign and malignant thyroid nodules was validated by a receiver operating characteristic (ROC) curve.

## RESULTS

After feature selection, 7, 10 and 5 features from T1WI, T2WI, and enhanced-T1WI were selected to build models. Among the four radiomics models built with the same classifier, LR classifier-based model outperforms other three classifiers-based T1WI model, T2WI model, enhanced T1WI model and combined model. In the test group, LR-based T2WI radiomics model achieved an AUC of 79.1% with the sensitivity and specificity of 76.3% and 98.6%, respectively. Combined model achieved an AUC of 79.7% with the sensitivity and specificity of 79.8% and 89.8%, respectively.

## CONCLUSION

s Radiomics method based on T2WI has certain significance on the malignancy differentiation of thyroid nodules.

## CLINICAL RELEVANCE/APPLICATION

Different benign and malignant Thyroid Nodules require different treatment strategies and have a different prognosis; thus, the noninvasive differentiation of thyroid Nodules before surgery is of great importance. Radiomics models based on structural MRI has good performance in differentiating malignant and benign thyroid nodules, especially radiomics model based on T2WI.

## R5A-SPHN-4 Evaluation of Ultrasound Characteristics of Two Topical Hemostatic Agents after Thyroid Surgery

Participants

Vincenzo Dolcetti, Rome, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of the study is to describe the ultrasound appearance of topical hemostatics after thyroidectomy, in order to recognize their main features to avoid diagnostic errors and pitfalls.

## METHODS AND MATERIALS

We enrolled 84 patients who underwent hemithyroidectomy or total thyroidectomy and treated with two types of topical hemostats, 49 with an absorbable hemostat of oxidized regenerated cellulose (Oxitemp®) and 35 with a fibrin glue-based hemostat (Tisseel®). All patients were examined with B-mode ultrasound to evaluate post-surgical changes and the presence or absence of residual swab at the level of the thyroid lodge in each patient. A regression analysis was performed for positive cases correlating the size of the residual swab with the time elapsed since surgery

## RESULTS

In 39 patients of the first group (approximately 80%) was detected a haemostatic residue which could potentially be confused with a native gland residue, or with cancer recurrence in oncological patients. No residue was detected in patients in the second group. The main ultrasound characteristics of the swab were analyzed and arranged according to predefined patterns, providing suggestions to recognize it and avoid wrong diagnoses. A part of the group of patients with tampon residue was re-evaluated after 6-12 months, ensuring that the swab remained for months after the maximum resorption time declared by the manufacturer. The regression analysis showed a weak not statistically significant correlation between time elapsed from surgery and the size of the residue.

## CONCLUSION

s Since the two materials showed the same efficacy in post surgical hemostasis, the fibrin glue pad is more favorable in the ultrasound follow-up because it creates reduced surgical outcomes.

## CLINICAL RELEVANCE/APPLICATION

It is important to know and recognize the ultrasound characteristics of oxidized cellulose based hemostats in order to reduce the number of diagnostic errors and the inappropriate diagnostic investigations.

## R5A-SPHN-5 To Explore the Application Value of Spectral CT in the Identification of Benign and Malignant Thyroid Nodules

### PURPOSE

To explore the value of spectral CT in the differential diagnosis of benign and malignant thyroid nodules through the analysis of spectral CT data and the pathological results.

### METHODS AND MATERIALS

Retrospective analysis was performed on 31 patients with pathological confirmation of surgery and enhanced thyroid spectrum CT examination in our hospital from May 2022 to March 2023, with a total of 37 nodules. According to the pathological results, the nodules were divided into two groups, there were 13 nodules in the benign group and 24 nodules in the malignant group. The iodine concentration (IC) in the arterial and venous phases of nodules and that in the artery of the same layer were measured on the iodine concentration diagram, and the standardized iodine concentration (NIC) was calculated,  $NIC = \text{nodule IC} / \text{IC in the artery of the same layer}$ , using GSI viewer software. In addition, the effective atomic number (Z) of the nodules at the arterial and venous stages was measured on the 45 keV single energy map. Independent sample t-tests were performed for the obtained energy spectrum parameters IC, NIC, and Z, Draw the subject's operating characteristic curve (ROI) and calculate the area under the curve (AUC).

### RESULTS

The IC of malignant nodules in arterial and venous stages was  $25.99 \pm 15.19$ ,  $20.95 \pm 6.92$ , lower than that of benign nodules  $42.65 \pm 10.13$ ,  $32.17 \pm 13.17$ , which were statistically significant ( $P < 0.05$ ). The NIC and Z values of benign and malignant nodules in arterial phase were not significant ( $P > 0.05$ ), while the NIC and Z values of venous phase were  $0.94 \pm 0.26$  and  $0.62 \pm 0.16$ , and Z values were  $9.21 \pm 0.51$  and  $8.84 \pm 0.26$ , which were statistically significant ( $P < 0.05$ ). The area under the receiver operating characteristic curve (AUC) of IC, NIC and Z-value in arterial and venous phases were 0.859, 0.782, 0.853, 0.736, respectively, and the corresponding cutoff values were 34.92, 25.09, 0.72, 9.00, respectively.

## CONCLUSION

s The IC value, NIC value and Z value of kinetic and venous stage of spectral CT have good clinical value in the differential diagnosis of benign and malignant thyroid nodules, and can effectively identify benign and malignant thyroid nodules.

## CLINICAL RELEVANCE/APPLICATION

An effective method to distinguish benign and malignant thyroid gland can be provided by using CT enhancement of thyroid spectrum and quantitative parameter analysis.

## R5A-SPHN-6 Utility of Repeat FNA for Benign Thyroid Nodules

### PURPOSE

For a large portion of patients with suspicious thyroid nodules, fine-needle aspiration (FNA) yields a benign diagnosis. There is a paucity of data to help determine which of these patients require a repeat FNA. The primary aim of this study is to evaluate the incidence of malignancy from repeat FNA of thyroid nodules in patients with initially benign pathology. Additionally, we assess if there are any demographic indicators or image features that may predict a need for repeat biopsy.

### METHODS AND MATERIALS

We retroactively identified patients who underwent more than one thyroid FNA at our institution between May 2010 and September 2022. From this cohort, we found 383 patients who underwent a total of 791 biopsies. Of these, 110 nodules had a cytopathologic diagnosis of Benign Follicular Nodule (BFN) based on the Bethesda System at the time of initial FNA. 38 of the 110 had a corresponding second biopsy of the same nodule on a later date. Demographic variables and pertinent risk factors were recorded. Associated TI-RADS descriptors, TI-RADS score, and size of the nodules were documented for each biopsy when available.

### RESULTS

Of the 38 biopsies that were initially benign and underwent repeat biopsy, 36 were confirmed as benign (94.7%) on repeat biopsy. One nodule had a non-diagnostic sample on repeat biopsy and was lost to follow-up (2.6%). Only one nodule was ultimately diagnosed as malignant (2.6%). The mean age (SD) at time of first biopsy was 51.2 (16.1) years. Initial cytopathology from repeat FNA identified 30 BFN (79%), 6 atypical follicular cells of undetermined significance (AFCUS) (15.8%), 1 follicular neoplasm (2.6%) and 1 nondiagnostic (2.6%). Of the six biopsies that were classified as AFCUS, three underwent Afirma genomic sequencing and were determined to be benign (50%). One of the three AFCUS nodules that did not undergo Afirma was surgically removed and identified as a micropapillary thyroid carcinoma. The nodule that was classified as a follicular neoplasm on repeat FNA was diagnosed as an adenomatous hyperplastic nodule on surgical pathologic examination. The mean time (SD) between first and second FNA was 69.6 (40.6) months. Mean increase in nodule size was 0.46 cm between initial and repeat biopsy.

## CONCLUSION

s In this retrospective study of patients who underwent a repeat FNA of thyroid nodule initially categorized as benign on initial FNA, only 1 of 38 patients (2.6%) was found to have malignant pathology on final diagnosis. The single nodule with initial benign cytology subsequently found to be malignant had no interval increase in size.

## CLINICAL RELEVANCE/APPLICATION

Our data suggest a low risk of malignancy for thyroid nodules biopsied based on TI-RADS recommendations, suggesting that re-

biopsy of nodules with benign cytology is likely unnecessary.

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## Abstract Archives of the RSNA, 2023

R5A-SPIN

### Imaging Informatics Thursday Poster Discussions I

#### Sub-Events

#### R5A-SPIN-1 A New Automatic AI Tool for MR Urography Functional Analysis in Children

##### PURPOSE

Magnetic resonance urography (MRU) is a technique used to evaluate urinary tract abnormalities in children, with the advantage of being noninvasive and allowing both morphologic and functional assessments. Currently, MRU analysis is usually performed with semiautomated software that typically requires manual segmentation of the kidney and pelvis and other time-consuming interactions. In recent years, artificial intelligence (AI) techniques have been used in various domains to solve segmentation, classification, diagnosis tasks. In this work, we propose a deep learning-based approach to automate the functional analysis of the MRU. The proposed approach is integrated into a commercial web viewer (DicomVision) so that it can be used easily included into the clinical routine.

##### METHODS AND MATERIALS

The developed pipeline first employs an Attention U-Net for automatic segmentation of the kidneys and pelvis on morphological MR and then an image registration process to align the segmentations on functional MR. Morphological and functional MR scans are navigable and analyzable on the web viewer along with the automatic segmentations provided by the pipeline. The web viewer allows the automatic segmentations to be edited manually if necessary. Finally, functional analysis is automatically performed by considering the entire 3D anatomy of the kidneys and pelvis, thus assessing the functioning of the renal system in its entirety. The results produced by the analysis, that include excretion curves and split renal functions (with volumetric, area under the curve (AUC), and Rutland Patlack methods) together with derived parameters, are presented in an automatically generated report within the web viewer.

##### RESULTS

The automatic segmentation of morphological MR has been tested on 107 patients using cross validation, achieving a Dice Score of  $0.87 \pm 0.15$  and  $0.91 \pm 0.11$  for left and right kidney, and a Dice Score of  $0.75 \pm 0.24$  and  $0.71 \pm 0.25$  for the left and right pelvis respectively. The registration process, used to align the morphologic segmentations on functional MRU scans, produced functional segmentations that did not require manual retouching in 74% of cases.

##### CONCLUSION

Our analyses demonstrate that the automated web viewer enables rapid and comprehensive analysis of children's MRUs. In particular, the use of such software reduces the time required for segmentation and enables functional analysis on the entire 3D anatomical structure of the kidneys and pelvis.

##### CLINICAL RELEVANCE/APPLICATION

This AI tool for MRU performs faster and better for functional evaluation of SRF and opens the door assessment of new quantitative parameters for obstructive and non-obstructive pathologies which can be useful for surgical planning.

#### R5A-SPIN-2 Generative Adversarial Networks for Brain MRI Synthesis: Impact of Training Set Size on Clinical Applications

##### Participants

Gian Marco Conte, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

To test the impact of training set size on generative adversarial networks (GANs) trained to synthesize brain MRI sequences.

##### METHODS AND MATERIALS

We previously trained two GANs to generate pre-contrast T1 from post-contrast T1 (T1 model) and FLAIR from T2 (FLAIR model) sequences (baseline models). The reference models were trained on 135 from the BraTS 2017 dataset. Here, we trained the same models using 1251 subjects from the BraTS 2021 dataset using the same architecture and hyperparameters from the original model: a batch size of 1, learning rate  $2 \times 10^{-4}$ , Adam optimizer, cross-entropy, and L1 loss. We trained two versions of the updated models: one stopped at an early checkpoint (early models) and one after 50 epochs (late models). We tested all models on a dataset of newly diagnosed 487 IDH-wt gliomas (Fig.1 A, B). The generated T1 and FLAIR sequences were compared with the original MRIs using the structural similarity index (SSI) and mean squared error (MSE). To assess the practical impact of using synthetic data, we simulated scenarios where either the T1, FLAIR, or both were missing and used their synthetic version as inputs of a segmentation model (HD-GLIO) with the original post-contrast T1 and T2. We compared the segmentations obtained in all scenarios using the dice similarity coefficient (DSC) for the contrast-enhancing area, non-enhancing area, and the whole lesion (Fig. 1B, C). We used Friedman and Dunn's test to compare the DSC scores and correct for multiple comparisons.

##### RESULTS

The median SSI on the test set for the generated T1 were .957, .947, and .947 and the median MSE were .006, .014, and .008 for



the baseline, early, and late models. For the generated FLAIR, the median SSI were .924, .908, and .915 and the median MSE were .016, .016, and .019 for the baseline, early, and late models. The range DSC on the test set for the baseline, early and late models were .655 - .953, .420 - .952, and .610 - .952 (Fig. 1D). Overall, the baseline and late models did not show any statistically significant differences in DSC, but both performed significantly better than the early models.

## CONCLUSION

s Generative models trained on a relatively small cohort performed similarly to those trained on a cohort 10 times larger. Overall, synthesizing FLAIR is more challenging than T1; consequently, segmentation of the contrast-enhancing areas is more robust to the use of synthetic data.

## CLINICAL RELEVANCE/APPLICATION

Incomplete MRI exams reduce the possibility of applying AI models in practice. We show that GANs can generate missing MRIs with relatively low data, making them a viable option for rare diseases or institutions with limited computing resources.

## R5A-SPIN-3 Clinical Validation Study of Machine Learning Algorithms for Liver Transplant Planning Including Vessel Segmentation

### PURPOSE

Accurate volumetric measurements have been shown to improve the outcome of liver transplant operations for both donor and recipient. [1] Preparation involves the segmentation of the donor liver in order to ensure acceptable tissue volume to support a good outcome for both the donor and the recipient. Ideally, vasculature would be excluded from these measurements however this process can take up to 1 hour for a highly trained specialist. A reliable, automated machine learning model was developed in order to significantly reduce the time required for generating this vital data.

### METHODS AND MATERIALS

Materials: 35 retrospective liver donor venous phase CT images were collected from historical records in order to train the initial model. Three rounds of evaluation were performed by three separate readers with 10 patients each round. Between rounds the model was re-trained with all previous results. The final model had a total training set of 64 images. Methods: A 3D CNN (NVIDIA Clara segresnet [2, 4-5]) was trained using 44 retrospective cases. Training labels for the right lobe, left lobe and vessels were extracted from venous phase CT images using the EDDA [3] software package by an expert analyst. The model performance was compared to segmentations performed by two readers, one novice to liver segmentation and the other a highly trained specialist in liver segmentation. All 3 results were uploaded to an XNAT [6] server for review. Clinicians performed a blinded review of all 3 segmentations for quality using the OHIF plugin [7].

### RESULTS

The final model was trained using a total of 44 retrospective and 20 prospective clinical cases showing mean dice scores of 0.96 for the right lobe, 0.930 for the left lobe, and 0.725 for the vessels. Three metrics commonly used in liver transplant planning including graft weight to recipient weight ratio (GWRW), future liver remnant (FLR), and graft volume to standard liver volume ratio (GVSTL) were calculated and compared between the ML result and the expert assuming the right lobe as the graft. The median difference between the expert and ML for GWRW was 2% with a mean of 4.5%  $\pm$  0.1%, for FLR the median difference was 7% with an average of 12%  $\pm$  0.2%, and for GVSTL the median difference was 6% with an average of 8%  $\pm$  0.2%.

## CONCLUSION

s The presented machine learning model for liver donor segmentation was able to efficiently provide accurate estimates for liver volumetrics in order to support surgical planning.

## CLINICAL RELEVANCE/APPLICATION

Accurate volumetrics are critical for predicting outcome in liver donor transplant cases. A CNN was trained to quickly and automatically segment the right and left lobes excluding vessels for liver donor transplant surgery planning.

## R5A-SPIN-4 Evaluating ChatGPT as an Adjunct for Radiologic Decision-Making

### PURPOSE

To evaluate ChatGPT's capacity for clinical decision support in radiology via the identification of appropriate imaging services for two important clinical presentations: breast cancer screening and breast pain.

### METHODS AND MATERIALS

We compared ChatGPT's responses to the American College of Radiology (ACR) Appropriateness Criteria for breast pain and breast cancer screening. Our prompt formats included an open-ended (OE) format, where ChatGPT was asked to provide the single most appropriate imaging procedure, and a select all that apply (SATA) format, where ChatGPT was given a list of imaging modalities to assess. Scoring criteria evaluated whether proposed imaging modalities were in accordance with ACR guidelines. Three replicate entries were conducted for each prompt, and the average of these was used to determine final scores.

### RESULTS

ChatGPT achieved an average OE score of 1.83 (out of 2) and a SATA average percentage correct of 88.9% for breast cancer screening prompts, and an average OE score of 1.125 (out of 2) and a SATA average percentage correct of 58.3% for breast pain prompts.

## CONCLUSION

s ChatGPT achieves moderate accuracy in identifying appropriateness of common imaging modalities for breast cancer screening and breast pain. Our results demonstrate the feasibility of using ChatGPT for radiologic decision making.

## CLINICAL RELEVANCE/APPLICATION

Our pilot study of the use of ChatGPT in radiology demonstrates the potential to improve clinical workflows and responsible use of radiology services. Potential use cases include triage and imaging resource allocation.

## **R5A-SPIN-5 Modified Turing Test Unveiled: AI-Generated Radiology Editorials Compete with Human Expertise**

Participants

Burak Ozkara, MD, Houston, TX (*Presenter*) Nothing to Disclose

### **PURPOSE**

The aim of this study was to assess the performance of AI-generated editorials in comparison to human-written editorials in the field of radiology, examining various dimensions including ease of comprehension, English proficiency, technical knowledge and expertise, persuasiveness and convincingness of arguments, and consistency of content.

### **METHODS AND MATERIALS**

16 human-written editorials were collected from eight radiology journals, including AJNR, Radiology, AJR, Academic Radiology, Journal of Neurointerventional Surgery, Stroke, JACR, and Clinical Neuroradiology, with two editorials authored by the same person from each journal. GPT-4.0 was used to generate corresponding AI-written editorials based on the topics provided. A total of 32 editorials were reviewed by five different reviewers, four of whom were editorial board members of AJNR, and one was an editor at The Neuroradiology Journal. The reviewers scored the texts using a 1-5 scale for the aforementioned dimensions. They were blinded to the origin of the texts, and the AI-generated and human-written editorials were presented in separate batches, ensuring that the counterparts were not assessed within the same batch. The Mann-Whitney U test was employed to compare the performance of the texts, and Fleiss's kappa was used to assess inter-rater reliability.

### **RESULTS**

The analysis revealed no statistically significant differences between AI-generated and human-written editorials in any of the assessed dimensions. In terms of ease of comprehension, English proficiency, technical knowledge and expertise, persuasiveness and convincingness of arguments, and consistency of content, AI-generated texts performed similarly to human-written texts. Fleiss's kappa results indicated low inter-rater agreement in scoring the editorials based on the provided scoring criteria. Reviewers' accuracies in identifying AI-generated vs. human-written texts were 14/32, 27/32, 25/32, 30/32, and 7/32, respectively.

### **CONCLUSION**

s AI-generated editorials, as exemplified by GPT-4.0, demonstrate comparable performance to human-written editorials. Reviewers had a hard time differentiating the texts highlighting the challenge faced by even expert reviewers in differentiating the editorials. These findings suggest that AI-generated texts may be on par with human-written texts in terms of the evaluated qualities.

### **CLINICAL RELEVANCE/APPLICATION**

The use of AI-generated content in radiology journals could potentially augment editorial writing, enhance the efficiency of content generation, and contribute to the growing body of literature in the field. Further research and development of AI systems may lead to improved capabilities and applications within the radiology community and beyond.

## **R5A-SPIN-6 Data Mining with Natural Language Processing on Radiology Chest X-Ray Reports**

Participants

Michael Welsh, BS, Philadelphia, PA (*Presenter*) Nothing to Disclose

### **PURPOSE**

Radiology reports are a rich source of diagnostic information. Structured reports particularly lend themselves to data mining and artificial intelligence (AI). However, even structured reporting templates demonstrate inconsistent formatting and large variability in terminology, which hinders large-scale text analysis. We developed an AI system, based on natural language processing (NLP) methods, that extracts the fields from reports and can be used to identify relevant features on an image, such as an endotracheal tube.

### **METHODS AND MATERIALS**

In this retrospective, IRB-approved study, 1492 pediatric chest radiographs with corresponding radiology reports were obtained at our institution from 2014 to 2019. Two pediatric radiologists labeled the 1492 images based on the presence/absence of metallic hardware, endotracheal tubes, tracheostomy tubes, and the number of lines and tubes, documented in the database software REDCap. Patient demographics were directly extracted from the DICOM header information. The labeled images were then used to train an AI system (train/valid/test splits of 60%/20%/20%), using NLP and supervised machine learning algorithms (scikit-learn v1.1.3) to automatically parse text data and predict the presence of hardware.

### **RESULTS**

The AI system was able to determine the presence of metallic hardware, tubes, and the number of lines and tubes using only a few sections of the report (notably the "history", "impression", and "finding" sections). The balanced accuracy of the system is more than 90% (type-I error of 5% and power of 80%) in most classification tasks by using the appropriate fields.

### **CONCLUSION**

s We utilized NLP to reliably and automatically label images for the presence of lines and tubes, using radiology reports. The proposed system can be adapted for other external devices and has significant utility for identifying objects on the image, with important implications for image quality and patient safety.

### **CLINICAL RELEVANCE/APPLICATION**

The proposed system uses radiology reports to identify labeled structures on clinical images. This reduces time-consuming annotation efforts for radiology research and accelerates AI development.

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## Abstract Archives of the RSNA, 2023

R5A-SP1R

### Interventional Radiology Thursday Poster Discussions I

#### Sub-Events

#### R5A-SP1R-1 Intra-arterial CT Perfusion is Feasible During Liver-directed Therapy Procedures

##### Participants

Rajesh P. Shah, MD, (*Presenter*) Research support, Merit Medical Systems, Inc; Consultant, Intuitive Surgical, Inc; Consultant, F. Hoffmann-La Roche Ltd; Research support, Lucence Health; Consultant, Histosonics, Inc; Consultant, Artio Medical, Inc

##### PURPOSE

To determine feasibility and baseline statistics of intra-arterial CT perfusion during Interventional Radiology (IR) liver-directed therapy procedures.

##### METHODS AND MATERIALS

This was a prospective observational study approved by the local institutional review board. Nine patients undergoing intra-arterial therapy (IAT) for hepatocellular carcinoma (HCC) without treatment in the prior year were enrolled. Subjects underwent injection of a 50% dilution of Iohexol 300 mgI/mL from either the celiac artery at 3 mL/sec for a total volume of 24 mL for conventional hepatic arterial anatomy, or from the superior mesenteric artery (SMA) for replaced anatomy at a rate of 5 mL/sec for a total volume of 40 mL to account for flow into mesenteric vessels. Perfusion scanning was performed continuously for 11 sec, then every 2 sec to a total scan time of 40 sec to capture arterial, portal venous, and washout phases at 100 kV and 60 mA. Radiation dose was recorded. A region of interest (ROI) was drawn on the common hepatic artery, portal vein, spleen (celiac injection) or small bowel (SMA injection), and non-tumor liver by a single Radiologist. Arterial blood flow (AF), portal venous blood flow (PVF), and perfusion index (PI) were calculated from an ROI drawn on a single index tumor 1.5 cm or larger in size without prior treatment. Descriptive statistics were calculated. The Wilcoxon Rank-Sum test was used to determine the significance of peripheral vs. central tumor and any prior treatment (more than 1 year prior) on perfusion values. Analysis of Variance was used to determine impact of tumor segment on perfusion values. A p-value < 0.05 was considered significant. A Pearson Correlation coefficient was calculated to determine impact of tumor size.

##### RESULTS

All 9 patients successfully underwent perfusion CT. Celiac artery injection occurred in 7 patients, while 2 patients had injection via SMA. Median (IQR) radiation dose was 525.3 (524.4-528.6) mGy·cm. Mean (Range) index tumor diameter was 2.46 (1.5-4.5) cm. Index tumors were distributed in segments 2, 5, 7, and 8 (2 subjects each) as well as segment 4 tumor in 1 subject. Three tumors were central while 6 were peripheral. Median (IQR) AF, PVF, and PI were 509.9 (389.6-524), 291.1 (71-859.4), 58.3 (41.9-87.6) mL/min/100 mL, respectively. Treatment more than 1 year prior, tumor segment, and peripheral location of tumor were not significant for perfusion values ( $p > 0.05$ ). Higher AF was strongly correlated with larger tumor ( $r = 0.6$ ).

##### CONCLUSION

s Intra-arterial perfusion CT is feasible during IAT for HCC. A wide range of AF and PVF is seen in HCC and these values can provide a baseline for evaluating dosing of IAT such as radioembolization.

##### CLINICAL RELEVANCE/APPLICATION

CT perfusion of HCC is feasible and may help better personalize IR treatments.

#### R5A-SP1R-2 A Surprising Effect of Metformin Plus Transarterial Chemoembolization on Hepatocellular Carcinoma Patients with Type II Diabetes

##### PURPOSE

Diabetes is common in the patients with hepatocellular carcinoma (HCC) and can lead to poor prognosis for these patients. Metformin is a hypoglycemic drug with anti-tumor effects. Whether metformin can have a positive effect on HCC patients receiving interventional embolization (transarterial chemoembolization, TACE) is still unclear. The study was conducted to explore the effect of metformin plus TACE on HCC patients with type II diabetes.

##### METHODS AND MATERIALS

From January 2014 to June 2021, 385 consecutive HCC patients with type II diabetes from three medical centers were retrospectively reviewed. All of them received TACE, and 216 patients received metformin. Propensity Score Matching (PSM) was used to reduce selective bias. Competing risk model was used to reduce the influence of deaths caused by other factors (not cancer) on the results.

##### RESULTS

The median overall survival (mOS) (35 months, 95%CI: 28-44 months vs 20 months, 95%CI: 16-24 months;  $P < 0.001$ ) and median progression-free survival (mPFS) (11 months, 95%CI: 10-14 months vs 8 months, 95%CI: 6-11 months;  $P < 0.001$ ) for patients with metformin were longer than those without metformin before PSM. Similar results were presented after PSM. The multivariate

regression analysis presented that metformin could reduce mortality risk of patients (HR: 0.56, 95%CI: 0.44-0.71;  $P < 0.001$ ) and tumor progression risk (HR: 0.67, 95%CI: 0.53-0.84;  $P < 0.001$ ) before PSM. The subgroup analysis showed that patients with BCLC stage A, BCLC stage B, BCLC stage C, Child-Pugh A and Child-Pugh B who received metformin could receive survival benefits from metformin. After excluding the influence of deaths caused by other factors (such as heart disease, diabetes, etc), metformin could still reduce mortality risk of patients and tumor progression risk. The adverse events evaluation was based on the NCI-CTCAE 5.0. The results showed metformin did not increase severe adverse events (grade III or grade IV).

## CONCLUSION

s Metformin might bring survival benefits for HCC patients with type II diabetes who received TACE. Metformin could achieve the effect of "killing two birds with one stone" for these patients.

## CLINICAL RELEVANCE/APPLICATION

Metformin has been proved to have anti-cancer effects in preliminary studies. However, there are few clinical studies on metformin against cancer. We included 385 patients from three medical centers to conduct the study to explore the effect of metformin on hepatocellular carcinoma patients with TACE. Our results presented metformin could prolong the survival of patients, which could provide new evidence for clinical decision for HCC patients with type II diabetes.

## R5A-SPiR-3 Relaxin Synergizes with Transarterial Chemoembolization in Immunity for Treating Rabbit VX2 Liver Cancer

### PURPOSE

To investigate the effect of relaxin on the TGF- $\beta$ /Smad2 pathway and immune cells in the tumor microenvironment, and the therapeutic effect of liver cancer after combined with transarterial chemoembolization (TACE).

### METHODS AND MATERIALS

HepG2 cells were adopted to evaluate the protein expression of TGF- $\beta$ , Smad2/pSmad2, and HIF-1 $\alpha$  after relaxin administration by western blotting and immunofluorescence staining. The expression of TGF- $\beta$  and HIF-1 $\alpha$  was also evaluated in the rabbit VX2 liver cancer model after treatment with relaxin combined with TACE (RLX+TACE), TACE, and normal saline, respectively. PD-L1 protein and immune cells of CD8+ T, Treg, and MDSCs were measured by immunohistochemical or immunofluorescent staining. A TGF- $\beta$  inhibitor (1D11) and dexamethasone were used to further clarify the role of immunity. The tumor-killing effect and survival time of rabbits were evaluated.

### RESULTS

Relaxin inhibited the TGF- $\beta$ /Smad2 pathway in vitro. Relaxin significantly suppressed the expression of TGF- $\beta$ , HIF-1 $\alpha$ , and PD-L1 in tumor tissues in the RLX+TACE group compared to TACE alone ( $p=0.011$ ,  $<0.001$ ,  $<0.001$ , respectively). The density of CD8+ T cells was significantly increased ( $p < 0.001$ ), while that of Treg cells and MDSCs were significantly decreased ( $p < 0.001$  and  $< 0.001$ , respectively) in the combination group. The management of 1D11 and dexamethasone improved and inhibited immune cells in tumor tissues, respectively. RLX+TACE treatment achieved a significantly higher tumor necrosis rate and prolonged rabbit survival time ( $p=0.004$  and  $<0.001$ , respectively).

### CONCLUSION

s RLX+TACE improved the therapeutic efficacy in liver cancer by mitigating the immunosuppressive tumor microenvironment.

### CLINICAL RELEVANCE/APPLICATION

This combination treatment provided a novel strategy for mitigating the tumor immunological microenvironment after TACE, and also effectively improving the treatment efficacy of TACE for clinical practice.

## R5A-SPiR-4 Management of Hepatocellular Carcinoma with Portal Vein Tumor Thrombus, Transcatheter Arterial Chemoembolization with Tyrosine Kinase Inhibitors, PD-1 Inhibitors, and Iodine-125 Seed Implantation

### PURPOSE

To retrospectively investigate the safety and efficacy of transcatheter arterial chemoembolization (TACE) with tyrosine kinase inhibitors (TKIs), PD-1 inhibitors, and iodine-125 seed implantation in the treatment of hepatocellular carcinoma (HCC) with portal vein tumor thrombus (PVTT).

### METHODS AND MATERIALS

A retrospective study was conducted on 62 HCC patients with PVTT from Jan 2018 and Aug 2021, who were classified into two groups. In group A, TACE with TKIs, PD-1 inhibitors, and iodine-125 seed implantation was performed, and in group B, TACE with TKIs, PD-1 inhibitors without iodine-125 seed implantation was performed. The blood count, biochemical indexes, coagulation function, complete response, partial response, stable disease, progressive disease, objective response rate, disease control rate were compared three, six and twelve months after the combination treatment. Overall survival and progression-free survival were compared in two groups.

### RESULTS

Overall survival, progression-free survival and disease control rate in group A were significantly greater than those in group B (median overall survival: 19.8 months vs 12.3 months,  $p=0.04$ , median progression-free survival: 11.57 months vs 5.13 months,  $p=0.01$ , disease control rate: 84.2% vs 58.3%,  $p=0.023$  at six months, and 50.0% vs 20.8%,  $p=0.022$  at twelve months). The univariable and multivariable analysis showed that the age, extrahepatic metastasis and treatment method were associated with the survival of those patients.

### CONCLUSION

s TACE with TKIs, ICI, and iodine-125 seed implantation seems to be safe, and effective in the treatment of HCC with PVTT. The age, extrahepatic metastasis and treatment method could be the prognostic factors.

### CLINICAL RELEVANCE/APPLICATION

First: Transcatheter arterial chemoembolization (TACE), TKIs, and PD-1 inhibitors, with iodine-125 seed implantation was found to be safe and effective as treatment for hepatocellular carcinoma with portal vein tumor thrombus. Second: TACE with TKIs, PD-1, and iodine-125 seed implantation showed association with a higher median overall survival, progression-free survival, and disease control rate than the treatment without iodine-125 seed implantation. Third: Age and extrahepatic metastasis showed association with poor prognosis and survival, but combining TACE, TKIs, and PD-1 inhibitors with iodine-125 seed implantation showed potential as a therapeutic regimen for patients with HCC and PVTT.

### **R5A-SPIR-5 Development of PLGA-loaded Ticagrelor Magnetic Microspheres: Towards Prevention of Post PCI Thrombosis**

#### **PURPOSE**

After percutaneous coronary intervention (PCI), dual antiplatelet therapy (DAPT) was required to prevent thrombosis. Systemic DAPT may increase the bleeding risk, especially in populations at high risk of bleeding. Moreover, patients who require non-cardiac surgery during DAPT, have to make decision between postpone surgery and discontinue medication. The aim of this study was to develop PLGA-Fe<sub>3</sub>O<sub>4</sub>-Ticagrelor microspheres (PFTm), which were local infused to aortic wall for local antiplatelet therapy.

#### **METHODS AND MATERIALS**

We designed and prepared PLGA loaded with ticagrelor magnetic microspheres by improved emulsified solvent evaporation method. For in vitro study, the morphology, relaxation rate, drug release rate, encapsulation efficiency, and biocompatibility of PFTm were evaluated. For animal experiment, twenty Japanese rabbits were divided into four groups, including local PFTm therapy group, systemic PFTm therapy group, non-therapy control group, and healthy control group. The last two groups shared one group of animals. The first three groups underwent balloon injury for the abdominal aorta. The first group received balloon PFTm infusion immediately after the injury, while the second group received intravenous PFTm. The other two groups did not receive treatment. MR T2WI was performed pre-operation and post-operation at day0, day2 and day3 to detect PFTm distribution. Then, the targeted aorta was harvest for pathological.

#### **RESULTS**

The characterization of PFTm showed that it was spherical. The size of the PFTm was  $930.5 \pm 134$  nm, with SPAN=0.35. The overall size of the PFTm was uniform. The drug encapsulation efficiency of the PFTm was  $82\% \pm 2\%$ , the release rate of ticagrelor from the microspheres reached 90% within 96 hours. The  $r_2$  of the PFTm was  $332.0 \text{ mm}^{-1} \text{ s}^{-1}$ . The PFTm were nontoxic for the cells by CCK-8. Twenty rabbits (3~4kg) were used. All rabbits were successfully established aorta injury model, in which the first two animals in the local PFTm therapy group were found intramural hematoma during PFTm infusion, resulting in animal death. The results of animal experiments showed that PFTm was infused into aortic wall with no thrombus detected in the local PFTm therapy group. The thrombosis area in the systemic PFTm therapy group was significantly smaller than that in the non-therapy control group ( $0.37 \pm 0.04 \text{ mm}^2$  vs  $0.58 \pm 0.03 \text{ mm}^2$ ,  $P < 0.0001$ ).

#### **CONCLUSION**

s PFTm was successfully developed, which can effectively inhibit thrombosis. This study provides a new concept of local infusion for prevention of thrombosis after PCI.

#### **CLINICAL RELEVANCE/APPLICATION**

The study validated new concept for local antiplatelet therapy after PCI, which may decrease systemic risk of bleeding and provide chance for non-cardiac surgery during anticoagulation therapy.

### **R5A-SPIR-6 Single vs Double Lumen Ports Placements: Infection and Complication Rates**

#### **PURPOSE**

Port-a-cath (subcutaneous port) placements are implanted intravascular ports that allow for easy venous access. With the rise in port placements performed by Interventional Radiologists (IR), it is important to determine whether there are differences in infection and complication rates between double and single lumen ports.

#### **METHODS AND MATERIALS**

We retrospectively analyzed 1582 port placements and removals during a 2-year period (April 2019-March 2021) at the University of Miami(UM) Health System. Patients were grouped by single and double lumen port subgroups and information on infection (bacteremia/port site infection), malfunctions (fibrin sheath, thrombosis, catheter malposition, extravasation), wound dehiscence, and hematoma rates were collected. Chi-square and Fisher t-test analyses were performed on the data in IBM SPSS 2022.

#### **RESULTS**

On average, patient age was 58.7 years, BMI 27 kg/m<sup>2</sup>, with 616 port placements in males (38.9%) and 966 in females (61.1%). We identified 684 single lumen (43.2%) and 898 double lumen port placements (56.8%). Double lumen ports sustained bacteremia at a significantly higher rate than single lumen ports (3.5% vs 1.2%,  $p = 0.005$ ), with the most common causes of bacteremia being *S. Aureus* (65%), *E. Faecalis* (16.1%), and *E. Coli* (12.9%). Moreover, double lumen ports experienced significantly higher rates of fibrin sheath (2.5% vs 0.4%,  $p = 0.002$ ), catheter tip malposition (1.3% vs 0%,  $p = 0.002$ ), and thrombosis (1.2% vs 0%,  $p = 0.007$ ) compared to single lumen ports. Furthermore, double lumen ports encountered more wound dehiscence ( $n = 8$  vs 2), port site infections ( $n = 12$  vs 5), extravasation ( $n = 4$  vs 1), and hematoma ( $n = 4$  vs 1) compared to single lumen ports, although these differences were not statistically significant.

#### **CONCLUSION**

s This study found significantly higher rates of infectious complications and malfunctions of double lumen ports compared to single lumen ports, suggesting that structural differences inherent to double lumen ports may be conducive to bacterial growth and catheter malfunction.

#### **CLINICAL RELEVANCE/APPLICATION**

These results indicate that oncologists and their IR colleagues may consider placing single lumen ports if clinically feasible, however future studies are still needed to determine clinical significance. Limitations of this study include retrospective nature and potential loss of patient follow-up.



## Abstract Archives of the RSNA, 2023

R5A-SPMK

### Musculoskeletal Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPMK-1 Dual Energy CT-derived Effective Atomic Number and Electron Density for Differentiation of Bone Tumors: Initial Experience**

##### Participants

Tomohito Hasegawa, Kagoshima, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine whether dual-energy CT parameters including electron density (ED) and effective atomic number (Zeff) could be quantitative imaging markers for differentiating benign from malignant bone tumors.

##### METHODS AND MATERIALS

Fifty-eight patients (34 males and 24 females, age range from 9 to 86 years) with histopathologically proven osteolytic bone tumor who underwent spectral detector CT scan were included in this retrospective study. Images of the conventional CT value (CTconv, HU), electron density relative to water (ED, %), and Zeff (AU) were obtained. Regions-of-interest were manually placed on the largest cross-section of tumor avoiding calcification to obtain the mean parametric values. Histopathologically, the tumors were divided into two groups: benign and intermediate malignant tumor (n=14), malignant tumor (n=44). Mann-Whitney U test was used to compare the DECT parameters between two groups. ROC curve analysis was used to assess the discriminative abilities of the DECT parameters.

##### RESULTS

The mean Zeff of benign and intermediate malignant tumors was significantly higher than that of malignant tumors ( $7.47\pm 0.11$  vs  $7.38\pm 0.12$ ,  $p=0.011$ ), whereas the mean CTconv and ED showed no significant difference between the two groups ( $44.28\pm 7.00$  vs  $41.89\pm 11.92$ ,  $p=0.490$  and  $103.54\%\pm 0.66$  vs  $103.60\%\pm 0.92$ ,  $p=0.637$ ). The AUC for Zeff was 0.727, with a sensitivity of 72.73%, specificity of 64.29% and accuracy of 70.69% (cut off,  $< 7.44$ ).

##### CONCLUSION

The mean Zeff may be helpful in differentiating benign and intermediate malignant bone tumors from malignant tumors. Their difference in Zeff may reflect differences in elemental composition which are inaccessible with conventional CT.

##### CLINICAL RELEVANCE/APPLICATION

The mean Zeff may be helpful in differentiating benign and intermediate malignant bone tumors from malignant tumors.

#### **R5A-SPMK-2 A New Approach to Detect Rib Metastases Using Deep Learning with Hounsfield Unit-augmentation**

##### PURPOSE

With the recent developments of cancer treatments, the number of patients with bone metastases is increasing. CT can well define cortical destruction in bone metastases due to its high spatial resolution. However, detection of bone metastases on CT is challenging for radiologist because of the three types of metastases (osteoblastic, osteolytic, and mixed) to evaluate. Hounsfield Unit (HU)-augmentation, using multiple HU windows in the HU normalization is available for deep learning (DL) algorithm. Thus, HU-augmentation using the appropriate CT values for the three types of bone metastases has the potential to improve detection accuracy. This study aimed to investigate whether the accuracy of the DL algorithm for detecting rib metastases on CT can be improved by HU-augmentation method.

##### METHODS AND MATERIALS

All images of bone metastases were obtained retrospectively from the clinical databases of a single institution between April 2011 and September 2019. Delayed phase axial images of contrast-enhanced CT with soft tissue kernel reconstruction were used. Both training and validation datasets, ground truth labels were established using bounding boxes by two radiologists. After manually extracting thoracic region from the torso CT, faster region-based convolutional neural network is utilized for rib metastasis detection. HU augmentation was performed with three HU windows; osteoblastic (WW 700 HU/WL 450 HU), osteolytic (WW 900 HU/WL 200 HU), and mixed (WW 1300 HU/WL 80 HU), in both training and testing phase. Training and evaluation of DL were performed by 5-fold cross validation. The mean Average Precision (mAP), F-measure, precision, and recall were calculated and compared with and without HU-augmentation.

##### RESULTS

A total of 4218 positive slice images in 159 patients with rib metastases (mean age,  $62\pm 11$  years; 78 male) were used for model development and test. Primary lesion of 159 patients were following; 47 were breast, 46 were lungs, 17 were prostate, and 49 were other origins. The mAP and F-measure with HU-augmentation were 0.609 and 0.591, compared with 0.553 and 0.571 without HU-augmentation. The precision and recall with HU-augmentation were 0.741 and 0.492, compared with 0.667 and 0.503 without HU-augmentation.

## CONCLUSION

s HU-augmentation improved DL algorithm to detect rib metastases on CT.

## CLINICAL RELEVANCE/APPLICATION

This study reveals that HU-augmentation using the appropriate CT values for the three types of bone metastases (osteoblastic, osteolytic, and mixed) improves the detection accuracy of rib metastases.

## R5A-SPMK-3 Retrospective Validation of the Birmingham Atypical Cartilage Tumor Imaging Protocol (BACTIP) in a Single US Tertiary Care Center

Participants

Sonja Oppen, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study is to retrospectively validate the Birmingham Atypical Cartilage Tumor Imaging Protocol (BACTIP) in a US tertiary care center. This study will provide the necessary groundwork for prospective validation in real-time patients.

## METHODS AND MATERIALS

Institutional review board approval was obtained. A keyword search within our institutional PACS for the words chondroid, enchondroma and chondrosarcoma in the text of MRI reports from 2014 - 2022. Lesions in the proximal humerus, distal femur, and proximal tibia of adults were included in the study. Lesions were categorized into 1 of 7 BACTIP categories based on size and presence/absence of endosteal scalloping. Rate of malignancy for each BACTIP category was calculated and based on follow up protocol, evaluation of delayed diagnosis was recorded.

## RESULTS

The PACS keyword search resulted in 305 patients that met inclusion criteria. Preliminary results are below: Of these 305 MRI exams, 75% had no additional MRI exams and clinically presumed benign enchondromas. The remaining 25% of patients had 1 or more follow up MRI exam(s). The length of time between MRI exams varied widely from 2 months to 8 years. BACTIP Type IA (47% of lesions, 2% biopsy rate), IB (20%, 3%), IC (10%, 18%), IIA (6%, 0%), IIB (4%, 28%), IIC (11%, 32%), and III (2%, 100%), respectively. Biopsy rate increased with BACTIP category. Type IA and IB lesions had a malignancy rate of 0%. Malignancy rate for type IC was 33%, and 50% for IIB. Type IIC lesions had a 50% malignancy rate. Type III has a biopsy rate of 100% and malignancy rate of 75%. Malignancy rate increased with BACTIP category.

## CONCLUSION

s Retrospective validation of the BACTIP in a single US tertiary care center showed similar results to those reported by Davies et al in 2019. There were no cases where the application of BACTIP would have led to a delayed diagnosis. The BACTIP would serve as a conservative and appropriate imaging follow-up guideline for patients with central cartilage tumors around the shoulder and knee joint.

## CLINICAL RELEVANCE/APPLICATION

Central cartilage tumors are common incidental lesions around knee and shoulder joints. Differentiation of low grade chondroid lesions, such as enchondroma from low grade chondrosarcoma, is often difficult even on MRI given pathologic and radiologic similarities. The BACTIP was introduced in UK literature in 2019 and provides a guide to initial assessment, diagnosis, and imaging follow-up plan for incidental indeterminate central cartilage tumors (Fig 1). This imaging protocol was retrospectively validated in an article published by Davies et al in 2019. However, this protocol has not been widely accepted and has not been validated in the US population.

## R5A-SPMK-4 Iodine Quantification in Bone Marrow Using Photon-counting Detector CT: A Phantom Study

## PURPOSE

Detecting intertrabecular bone metastases, which replace bone marrow without destroying the bony structures, is a challenging task to diagnose on CT. Photon-counting detector CT (PCD-CT) enables a simultaneous multi-energy acquisition that offers further qualitative and quantitative information in a single scan. This study aimed to investigate the accuracy of iodine quantification using a PCD-CT and to assess the feasibility of measuring iodine concentrations in the tissue that has penetrated into the bone.

## METHODS AND MATERIALS

A bone marrow phantom was constructed using cellulated calcium sulfate plaster that was impregnated with iodinated contrast medium at various concentrations (0, 0.75, 1.5, 3, 6, 12, 24, 48, and 96 mgI/mL). Images were acquired using a PCD-CT scanner (NAEOTOM Alfa, SIEMENS, Germany) with a detector size of 0.2 mm and a tube voltage of 120 kVp. The acquired images were reconstructed with a 1-mm thickness using a Qr40 kernel. The CT numbers and calculated iodine quantification values were measured by placing circular regions-of-interest (ROIs, approximately 10 cm<sup>2</sup>) on the iodine maps and quantification maps, respectively, at the top, middle, and bottom of each phantom. Statistical analysis was performed using a two-way ANOVA. P-values less than 0.05 considered as statistically significant.

## RESULTS

The CT values (mean ± SD) for each ROI on the iodine maps of the phantom were as follows: 553 ± 24, 532 ± 20, 504 ± 24, 587 ± 23, 554 ± 14, 708 ± 20, 738 ± 4.4, 1130 ± 17, and 1450 ± 200 H.U. at iodine concentrations of 0, 0.75, 1.5, 3, 6, 12, 24, 48, and 96 mgI/mL, respectively. The quantified iodine values for the phantom were 16.4±0.90, 16.2±1.1, 16.3±0.82, 17.1±0.57, 19.3±0.49, 22.3±0.54, 26.5±0.047, 36.6±0.12, and 49.9±3.6mg/mL, respectively. There were significant differences in either CT values on the iodine maps or quantified iodine values between phantoms with iodine concentrations greater than or equal to 6 mg/mL (P < 0.05). However, there were no differences between phantoms with other iodine concentrations.

## CONCLUSION

s There was a correlation between iodine concentrations and both the CT values on the iodine map and the iodine quantification values in higher iodine solutions, but no clear difference was observed in lower iodine solutions when compared to the iodine quantification values in the water-impregnated bone phantom. The iodine value was overestimated in the phantom without iodine,



and appropriate correction would be necessary when applied to clinical cases.

#### **CLINICAL RELEVANCE/APPLICATION**

PCD-CT has the potential to detect intertrabecular bone metastases that may not be visible on conventional CT scans and evaluate their vascularity.

#### **R5A-SPMK-5 Is Semi-automatic Segmentation with Quantitative Analysis of Whole-body DWI-MRI Images a Feasible Parameter for Assessing Treatment Response in Multiple Myeloma Patients?**

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To study the feasibility of quantitative whole-body diffusion-weighted MRI (DWI) analysis using a semi-automatic segmentation technique for the assessment of treatment response in patients with multiple myeloma.

#### **METHODS AND MATERIALS**

34 patients with multiple myeloma underwent whole-body MRI at our center. Images were acquired and reported according to MY-RADs (Myeloma Response Assessment and Diagnosis System) guidelines. Patients were classified as responders or non-responders according to their MRI- Response Assessment Category (RAC) and the response category given following the International Myeloma Working Group (IMWG) criteria, considering the latter one as the gold standard. Quantitative analysis of DWI images of each MRI was performed after semi-automated segmentation. Data analysis was performed with SPSS 25.0 software (Chi-square and Student's t-tests). Two-tailed p-values were used for all statistical evaluations and a p-value < 0.05 was considered statistically significant.

#### **RESULTS**

13 patients (38.2%) did not respond to treatment according to IMWG response criteria. They showed no statistically significant differences in total diffusion volume (tDV: 240.82 cm<sup>3</sup> vs. 196.08 cm<sup>3</sup>; p = 0.507) or mean global apparent diffusion coefficient (gADC: 694.92 x 10<sup>-6</sup> mm<sup>2</sup>/s vs. 779.4 x 10<sup>-6</sup> mm<sup>2</sup>/s; p = 0.123) in quantitative analysis of DWI before and after treatment, respectively. Among the remaining 21 responding patients (61.8%), tDV significantly decreased (214.93 cm<sup>3</sup> vs 111.41 cm<sup>3</sup>; p = 0.01) and gADC significantly increased (738.82 x 10<sup>-6</sup> mm<sup>2</sup>/s vs 1126.29 x 10<sup>-6</sup> mm<sup>2</sup>/s; p = 0.002) after treatment. Furthermore, the percentage of high ADC values (=1400 x 10<sup>-6</sup> mm<sup>2</sup>/s) of tDV was higher in responder patients after treatment (36.57 %) than in non-responders (7.8 %), with significant differences (p < 0.001).

#### **CONCLUSION**

s Total diffusion volume (tDV) and global apparent diffusion coefficient (gADC) may be feasible parameters for assessing treatment response in patients with multiple myeloma.

#### **CLINICAL RELEVANCE/APPLICATION**

The utilization of novel imaging techniques for the follow-up and monitoring of multiple myeloma treatment represents a rapidly expanding field, which has the potential to provide dependable data and enhance the precision of radiological reports.

#### **R5A-SPMK-6 Measurement of Tumor Total Diffusion Volume (tDV) of Metastatic Bone Lesions from Prostate Cancer Using Whole-Body MRI(WB-MRI)-Evaluation for Therapeutic Effect**

#### **PURPOSE**

To measure the total diffusion tumor volume (tDV) of metastatic bone lesions from prostate cancer using whole body MRI(WB-MRI) including whole body diffusion weighted images (DWI) and to research the correlation for serum PSA level and to assess the reliability and reproducibility of our diagnostic methods.

#### **METHODS AND MATERIALS**

Nine cases of prostate cancer during various treatment in which WB-MRI was performed twice were retrospectively evaluated. In all patients, serum PSA was measured at the same time of MRI examinations. 3.0T MR scanners were used (Siemens Prisma). The pulse sequences were 1. axial direction of DWI of the level from lower neck and bottom of pelvis. 2. Sagittal direction of T1WI and STIR of total spine 3. Coronal direction of in phase and out of phase of T1WI. In all cases, two radiologists measured tDVs using BD-score (PixSpace. Inc.) which had been developed for calculating ADC value of the lesions and their volume correspond to the tumor automatically by defining the threshold of ADC value. In this study, the threshold was defined as 1.8mm<sup>2</sup>/S. We calculated tDV variation (?tDV) and serum PSA variation (?PSA) before and after therapy in each patient, and examined the relation of ?tDV and ?PSA with Spearman's rank correlation coefficient (rs). Also, the bias between the data of the data of two radiologists was assessed calculating the cross-correlation coefficient.

#### **RESULTS**

In the data of both radiologists, ?tDV and ?PSA were positive correlated strongly by Spearman's rank correlation coefficient (radiologists 1 r=0.99, p=0.000002, radiologist 2 r=0.88, p=0.002). The cross-correlation coefficient of two radiologists was 0.98 (p=0.000002).

#### **CONCLUSION**

s tDV was proved to be a reliable mark for evaluating the grade of bone metastases from prostate cancer. Using BD score for calculating tDV showed less dispersion between the readers.

#### **CLINICAL RELEVANCE/APPLICATION**

Calculating the disease volume rapidly from WBMRI returns to earth.

## **R5A-SPMK-7 Dynamic Contrast Enhanced MRI Assessment of the Chemotherapy Response of Osteosarcoma: A Machine Learning Data Analysis**

### **PURPOSE**

Accurately assessing the response to preoperative chemotherapy of osteosarcoma(OS) is vital in determining the most effective treatment plan and predicting outcomes. The study aims to perform machine learning data analysis to assess the response of OS to preoperative chemotherapy.

### **METHODS AND MATERIALS**

We recruited 20 patients (M/F=15/ 5, ages 9 to 41 years old, average 20 years) with histologically confirmed conventional OS within 2 years. After waivers of Informed Consent, MR imaging examinations were conducted after chemotherapy and before surgery. The 3D dynamic contrast enhancement (DCE) MR imaging features included: 1) for tumor permeability (Ktrans, Kep, Ve, Vp, area under the curve (AUC), and area of tumor region of interest (ROI) and 2)for tumor perfusion (relative enhancement, maximum enhancement, maximum relative enhancement, T0, time to peak, wash-in rate, wash-out rate, brevity of enhancement, AUC, and area of tumor ROI).We used machine learning data analysis techniques in Python programming language, involving clustering analysis, feature importance analysis, regression modeling (correlation heatmap), and classification modeling (decision tree plot). Precision, recall (sensitivity), F1 score, and accuracy were automatically calculated to predict the grade of tumor necrosis, lung metastasis, soft tissue/bone metastasis, and tumor recurrence.

### **RESULTS**

The feature importance analysis revealed that age, area, Ktrans, auc, Rel Enhancement, Max Enhancement, Wash Out Rate, mean ADC were the top features. Correlation heatmaps showed age was highly correlated with necrosis (rate) (coefficient 0.81), auc showed a strong correlation with Max Enhancement, Max Rel Enhancement, and Rel Enhancement (coefficient 0.89, 0.86, 0.81, respectively).Our results demonstrated high precision, recall (sensitivity), F1 score, and accuracy for predicting grading necrosis (0.80-1.00, 0.67-1.00, 0.73-1.00, and 0.91-1.00, respectively), lung metastasis (0.89-1.00, 0.89-1.00, 0.89-1.00, and 0.94-1.00, respectively), soft tissue/bone metastasis (0.90-1.00, 0.90-1.00, 0.90-1.00, and 0.94-1.00, respectively), and tumor recurrence (0.82-1.00, 0.90-1.00, 0.83-1.00, and 0.91-1.00, respectively).

### **CONCLUSION**

s Our preliminary results demonstrate the feasibility of our imaging technique combined with machine learning data analysis for advanced radiomics analysis, MR imaging assessment of chemotherapy response, histopathological correlation, and prediction of patient outcomes

### **CLINICAL RELEVANCE/APPLICATION**

The study shows that the imaging technique combined with machine learning data analysis is feasible in advanced radiomics analysis, establishing an imaging model for MR imaging assessment of chemotherapy response.

## **R5A-SPMK-8 Diagnostic Performance of Magnetic Resonance Imaging for Detecting Meniscal Ramp Lesions in Patients with Anterior Cruciate Ligament Tears. A Meta-analysis**

### **PURPOSE**

The clinical importance of meniscal ramp lesions in patients with anterior cruciate ligament (ACL) tear has emerged as a major issue. However, the diagnostic accuracy of magnetic resonance imaging (MRI) for detecting ramp lesions has a wide range. This meta-analysis was aim to meta-analyze the diagnostic performance of MRI for diagnosing ramp lesion in patients with ACL tear

### **METHODS AND MATERIALS**

Literature search of PubMed, EMBASE, and the Cochrane Library was performed based on the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines. Diagnostic performance studies using MRI as the index test and arthroscopy as the reference standard for ramp lesion were included. Bivariate and hierarchical summary receiver operating characteristic modeling was used to evaluate the diagnostic performance. We performed meta-regression analyses for potential sources of heterogeneity.

### **RESULTS**

Nine studies from eight articles (883 patients with ACL tear) were included. The summary sensitivity, summary specificity, and area under the hierarchical summary receiver operating characteristic (AUC) for ramp lesion were 0.71 (95% confidence interval [CI], 0.59-0.81) and 0.94 (95% CI, 0.88-0.97), and 0.90 (95% CI, 0.87-0.92), respectively. Among the potential covariates, magnet strength ( $P<0.01$ ), patients' knee position ( $P=0.04$ ), and MRI interpreter ( $P=0.04$ ) were associated with heterogeneity in terms of sensitivity, whereas, magnet strength ( $P=0.03$ ) was associated with heterogeneity in terms of specificity.

### **CONCLUSION**

s MRI demonstrated moderate sensitivity and excellent specificity for diagnosing ramp lesion. For increase sensitivity, use of 3T MRI with the patients' knee in the neutral position (about 30° flexion), and the involvement of musculoskeletal radiologist for MRI interpretation may be needed.

### **CLINICAL RELEVANCE/APPLICATION**

We recommend routine arthroscopic assessment for the presence of ramp lesion, although it was not suspected on MRI.

## Abstract Archives of the RSNA, 2023

R5A-SPMS

### Multisystem Thursday Poster Discussions I

#### Sub-Events

#### R5A-SPMS-1 Functional and Structural Brain Alterations in Patients Recovered from COVID-19 with Anosmia

Participants

Francisco Zamorano, Santiago, Chile (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate functional and morphological brain alterations in recovered COVID-19 patients.

#### METHODS AND MATERIALS

72 recovered COVID-19 patients (33 females, mean age 42, range [18-66]; 38 with anosmia during infection; 29 hospitalized because of respiratory symptoms) were asked to resolve a Reversal Learning Task (RLT) while their brain activity was measured with fMRI. Images were acquired with a 3T Siemens Skyra scanner. Neuropsychological alterations were assessed with Addenbrooke II and INECO tests. In the RLT, the participants had to choose between two options that were presented with different probabilities of obtaining reinforcement (0.8 vs 0.2 and 0.7 vs 0.3). Through trial and error, participants were able to learn the most advantageous option. After a certain number of repetitions, the probabilities associated with each option could be reversed, and the subject had to learn the new association. Behavior was modeled using a Rescorla-Wagner learning algorithm and Cumulative Prospect Theory. This model uses a learning rate that updates the subjective probability of being rewarded and a multiplicative approach to calculate the expected utility of each option. Brain activity associated with the decision-making period was analyzed with FSL in regard to the expected utility, controlled by reaction time as a proxy of difficulty. Cortical thickness was analyzed with Freesurfer using HCP pipeline and SurfStat from Matlab.

#### RESULTS

There was a decrease of activity in several prefrontal and subcortical regions in those patients that had anosmia, regardless of the severity of respiratory symptoms. There was cortical thinning in the left superior frontal gyrus in those patients that had anosmia, regardless of the severity of respiratory symptoms. This indicates that recovered COVID-19 patients that presented anosmia during the infection have functional and structural brain alterations.

#### CONCLUSION

Our results suggest that anosmia can be used as a marker of brain alterations in patients recovered from COVID-19. It could be important to follow the track of these patients in order to investigate possible long term consequences of COVID-19 on the nervous system.

#### CLINICAL RELEVANCE/APPLICATION

While COVID-19 primarily affects the respiratory system, the brain can also be involved. Increasing evidence indicates that recovered patients present neuropsychiatric alterations and thinning of certain cerebral cortex areas, especially those connected to the primary olfactory cortex. Given this background it is highly relevant to evaluate the possibility of alterations at the brain level in recovered COVID-19 patients, which, as we find, seem to extend to other regions.

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## Abstract Archives of the RSNA, 2023

R5A-SPNMMI

### Nuclear Medicine & Molecular Imaging Thursday Poster Discussions I

#### Sub-Events

**R5A-SPNMMI-1** **First Application of Novel Human Granzyme B Imaging Agent in a Humanized Melanoma Mouse Model Treated with Immune Checkpoint Inhibitor Therapy**

#### PURPOSE

We have previously shown that granzyme B (GZB) PET imaging can determine treatment response in cancer immunotherapy. This study evaluates whether a novel human granzyme B imaging agent CYT-200 (Cytosite) labeled with 68Ga can be used as a reliable, non-invasive biomarker of intra-tumoral GZB levels and efficacy immune checkpoint inhibitor therapy in vivo.

#### METHODS AND MATERIALS

All animal studies were approved and conducted according to the IACUC guidelines. Naïve NSG mice received human untransduced T cells intravenously for immune reconstitution 14 days prior to subcutaneous implantation of human melanoma cells (G361) into the left shoulders. Mice received three intraperitoneal doses of pembrolizumab (200 µg) and anti-CTLA-4 (100 µg) combined, administered in three days intervals, starting from when the tumors reached 336±38 mm<sup>3</sup>. PET imaging was performed prior to treatment initiation (baseline), such as on days 4, 7, and 14 after the first treatment dose. Tumor-bearing mice were injected with 4.6±0.30 MBq of CYT-200 labeled with 68Ga 60±5 min prior to PET image acquisition. Intra-tumoral T-cell activity was measured by tumor-to-blood ratio (TBR), calculated by the standard uptake values (SUVs) of the tumors normalized against the heart blood pool. Treatment response was assessed by tumor growth measurements over 30 days after tumor implantation.

#### RESULTS

PET imaging on day 4 after treatment initiation showed the highest TBR compared to the baseline (3.08±0.98 vs. 1.22±0.48) with a gradual decrease of the TBRs on day 7 (2.76±1.85) and 14 (1.91±0.23). A combination of pembrolizumab and anti-CTLA-4 therapy decreased tumor size on days 4 and 7 after treatment initiation (336±38 mm<sup>3</sup> vs. 154±31 mm<sup>3</sup> and 131±129 mm<sup>3</sup>, respectively). However, tumor growth resumed 12 days after treatment initiation (181±112 mm<sup>3</sup>), correlating with the reduced T-cell activity shown by declining CYT-200 PET uptake values.

#### CONCLUSION

These preliminary results demonstrate that the novel human granzyme B PET imaging agent CYT-200 labeled with 68Ga can detect intra-tumoral T-cell activity associated with tumor-killing following immune checkpoint inhibitor therapy in a humanized mouse model for melanoma.

#### CLINICAL RELEVANCE/APPLICATION

Granzyme B PET imaging is a tool for monitoring response to immunotherapy in melanoma patients, which could lead to more effective treatment decisions and improved patient outcomes.

**R5A-SPNMMI-2** **Incidental Detection of Focal F-18 FDG Uptake in the Prostate of Oncologic Patients with Application of Logistic Classification**

#### PURPOSE

Although prostate cancer has been refocused in the field of nuclear medicine with the advent of FDA-approved PSMA-targeted PET imaging radiopharmaceuticals, however, F-18 FDG still remains the most used drug in oncologic PET imaging. This retrospective study was to assess the incidentally observed focal prostate F-18 FDG uptake in non-prostate cancer patients, and to apply Logistic classification to improve the diagnostic accuracy.

#### METHODS AND MATERIALS

The reports of F-18 FDG PET/CT performed in non-prostate male cancer patients at our hospital were retrospectively reviewed to identify unexpectedly observed suspicious focal prostate uptake. Among them, those with final histopathological reports of the corresponding FDG uptake sites were included in this study. The focal uptakes were classified as malignant or benign according to the histopathological reports. SUV parameters such as SUV<sub>max</sub>, SUV<sub>peak</sub>, MTV of each focal uptake was measured, and compared between malignant and benign lesions. Logistic classification was applied to the SUV parameters using R software to improve the diagnostic accuracy. Statistical significance was set at  $p < 0.05$ .

#### RESULTS

About half of the focal uptakes were malignant. Among the calculated FDG parameters, maximum SUV differentiated malignant from benign lesions with the best accuracy. Application of Logistic classification didn't improve the diagnostic accuracy.

#### CONCLUSION

About half of the incidental focal prostate F-18 FDG uptake was proved to be malignant. This finding could justify the application of PET imaging to cancer patients and subjects at high risk of developing cancer. A further study with a larger number of subjects and more dedicated machine Learning algorithms might be warranted.

#### **CLINICAL RELEVANCE/APPLICATION**

Authors investigated the clinical significance of incidental prostate FDG uptake and the usefulness of application of machine Learning algorithm such as Logistic classification in the diagnostic accuracy.

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## Abstract Archives of the RSNA, 2023

R5A-SPNPM

### Noninterpretive Skills (Beyond Imaging) Thursday Poster Discussions I

#### Sub-Events

#### R5A-SPNPM-Sterile Gown and Drape, and Bouffant Cap for Thyroid FNA: Preventing Infections or Producing Unnecessary Medical Waste<sup>1</sup>

##### PURPOSE

Ultrasound-guided fine needle aspiration is a very low-risk procedure. Despite this, there remains great variability with extensive protective equipment use. Given the inherent monetary and environmental costs of protective equipment, this study aims to assess the difference in infection rate when conducted with full versus limited (without bouffant/cap, sterile gown, and full body sterile drape) protective equipment use.

##### METHODS AND MATERIALS

A total of 310 consecutive patients were retrospectively reviewed for thyroid fine needle aspirations at the main hospital and outpatient clinic site from December 1, 2020 to May 15, 2022. The hospital site operated with full protective equipment (bouffant, sterile gown, sterile gloves, and full body sterile drape), and the outpatient site operated with limited (sterile gloves, limited sterile paper drape) protective equipment. Two patients were excluded as no procedure was performed. Review for signs of infection within 30 days of procedure was performed using medical records blindly to the degree of protective equipment utilization. Descriptive statistics and confidence intervals were provided to compare the two groups.

##### RESULTS

No infections were identified in either group, with 0/230 (0%, 95CI% 0 - 2%) in the full protective equipment group vs. 0/78 (0%, 95CI% 0 - 6%) in the limited protective equipment group. There was no statistically significant difference in infection rate between full and limited protective equipment use in thyroid fine needle aspiration (FNA) in the included 308 procedures with 95% confidence interval of -6% - 2%. Two patients out of 230 (0.9%) in the full protective equipment group developed mild allergic reaction to topical antiseptic. The 78 procedures with limited protective equipment represents a saving of at least 70,590 grams of carbon dioxide equivalents compared to full protective equipment procedures.

##### CONCLUSION

Decreasing the extent of protective equipment does not impact the infection rate for thyroid FNA. Given the inherent costs involved in the procurement and waste of protective equipment, reducing protective equipment use is warranted to reduce both the monetary and environmental impacts of waste.

##### CLINICAL RELEVANCE/APPLICATION

Using limited protective equipment (sterile gloves and limited drape) for thyroid FNA does not increase infection rate as compared to full protective set, while saving significant grams of carbon dioxide equivalents.

#### R5A-SPNPM-Dual Energy CT: Less is More<sup>2</sup>

Participants

Caterina Di Manna, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the reduction of iodinated contrast agent and radiation dose using Dual Source Dual Energy CT, maintaining the same image quality.

##### METHODS AND MATERIALS

This single-center randomized prospective study enrolled 121 oncologic patients who underwent the first CT exam acquired with a single energy (SE) 128-slice CT (LightSpeed VCT) and the subsequent using a Dual Source Dual Energy CT (Somatom Force) (DSDECT). In the first exam, was administered a dose of contrast agent (CA) (Iomeron 350) of 0.7mg of iodine per kg of lean body mass (LBM). In the second exam with DSDECT the dose of CA was reduced to 0.5mg of iodine per kg of LBM. The mean value of CA administered to patients were compared between the two exams. The difference in radiation dose between the two exams was considered as secondary outcome. Quantitative image analysis was performed considering enhancement of porta, liver parenchima and aorta, and noise metrics. Image quality was evaluated considering visual perception of enhancement, noise, and artifacts based on a 5-point Likert scale.

##### RESULTS

The mean CA dose administered to patients in the first exam (SE) was 105.4ml ( $\pm 13.19$ ), with a mean iodine dose of 36.91g ( $\pm 4.62$ ); in the second control (DE), an average of 81.23ml of CA ( $\pm 14.68$ ) was administered, with an average iodine dose of 28.53g ( $\pm 5.20$ ). Qualitative analysis demonstrated comparable image quality in scans with DECT. Our study also demonstrated a reduction in the average radiation dose delivered to the patient by 36% using DECT.

##### CONCLUSION

s Our study confirms the advantages of DSDECT in the follow-up of oncologic patients. Using DSDECT it is possible to reduce the amount of iodinated CA by 30% and radiation dose by 36% maintaining the same image quality.

#### **CLINICAL RELEVANCE/APPLICATION**

Dual Energy CT is a promising technique to evaluate oncologic patients using a reduced amount of contrast media and radiation dose. These advantages are crucial in patients which, due to their pathology, frequently undergo a follow-up CT scans.

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## Abstract Archives of the RSNA, 2023

R5A-SPNR

### Neuroradiology Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPNR-1 Prediction of Future Dementia for MCI Patients from Neuroimaging and Other Multimodal Data Using a Novel Machine Learning Framework**

##### **PURPOSE**

Prediction of future dementia for patients with mild cognitive impairment (MCI) is a significant clinical goal, so that the identified cases can benefit from available treatments. Currently, the clinical standard for diagnosing dementia utilizes neuroradiological findings from multimodal imaging modalities such as MRI and PET scans, as well as cognitive tests and biomarkers like tau and amyloid uptake levels in cerebrospinal fluid. However, efficiently and objectively analyzing these complex and disparate data can be difficult in clinical settings, contributing to high rates of underdiagnosis or misdiagnosis of dementia at early stages. Machine learning (ML) offers a potentially more efficient and objective methodology to predict future dementia for MCI patients from these multimodal data.

##### **METHODS AND MATERIALS**

We recently developed Ensemble Integration (EI), an ML framework designed to advance predictive modeling from multimodal data by leveraging complementarity among the data modalities (Li et al, Bioinformatics Advances, 2022). In this work, we assessed EI's ability to predict the future development of dementia among MCI patients using processed T1-weighted MRI imaging and other multimodal data from The Alzheimer's Disease Prediction of Longitudinal Evolution (TADPOLE) challenge (Marinescu et al, Predictive Intelligence in Medicine, 2019). Specifically, we developed an EI-based predictive model of dementia from data of 672 MCI patients collected at their first visit (baseline), and rigorously evaluated this model and benchmark methods from two separate test sets.

##### **RESULTS**

For predicting the future development of dementia among MCI patients, the EI-based model performed better on the two test sets (AUROC=0.77/0.78, sensitivity=0.71/0.75, specificity=0.74/0.75) than commonly used XGBoost (AUROC=0.66/0.67, sensitivity=0.59/0.63, specificity=0.73/0.71) and deep learning (AUROC=0.63/0.64, sensitivity=0.78/0.62, specificity=0.41/0.55) approaches. Among the most predictive features in this EI model were MRI-derived measurements of the white matter volume of the thalamus, a region associated with dementia (Aggleton et al, Brain, 2016; Ryan et al, Brain, 2013).

##### **CONCLUSION**

EI is an effective framework for predicting if an MCI patient will develop dementia in the future from neuroimaging and other multimodal data collected at baseline. EI identified several neuroimaging features associated with progression to dementia that may have gone unidentified using traditional statistical methods.

##### **CLINICAL RELEVANCE/APPLICATION**

By integrating neuroimaging and other multimodal data using an effective method like Ensemble Integration, it is possible to accurately predict the development of future dementia among MCI patients.

#### **R5A-SPNR-11 Performance of Dual-Layer Spectral Detector CT in Identifying Early Ischemic Changes in Acute Ischemic Stroke Patients**

##### **PURPOSE**

This study aims to evaluate the efficacy of spectral imaging using computed tomography (CT) equipped with a dual-layer detector for diagnosing acute ischemic stroke.

##### **METHODS AND MATERIALS**

We retrospectively analyzed CT spectral images of 26 regions in 15 patients diagnosed with acute ischemic stroke. We performed non-contrast brain CT using dual-layer detector CT non-contrast brain MRI on the same day. We compared the conventional CT values, relative electron density (ED), effective atomic number (Zeff) of the ischemic stroke region the contralateral normal region. We used the Mann-Whitney U test to compare each imaging parameter in the ischemic region the normal region. Receiver operating characteristic (ROC) analysis was conducted to determine the area under the ROC curve (AUC) for the differentiation of acute ischemic stroke.

##### **RESULTS**

The CT value (28.2±3.93 HU vs. 33.4±2.34 HU, P<0.001) the ED (102.43±0.411 vs. 102.95±0.170, P<0.001) showed a significant difference between the ischemic stroke region the contralateral normal region. There was no significant difference in Zeff (7.357±0.0465 vs. 7.365±0.0365, P=0.47). The AUC for the diagnosis of acute ischemic stroke using conventional CT, ED, and Zeff were 0.846, 0.904, and 0.615, respectively. With an optimal threshold of ED of 102.65, the sensitivity, specificity, PPV, NPV, and accuracy of differentiation of acute ischemic stroke were 80.8%, 100%, 100%, 83.9%, and 90.4%, respectively.

##### **CONCLUSION**



s Our results suggest that electron density images derived from dual-layer detector CT can improve the detection of acute ischemic stroke compared to conventional non-contrast CT imaging.

#### **CLINICAL RELEVANCE/APPLICATION**

Improved discrimination of early ischemic changes region with electron density images, as compared to conventional images, is expected to lead to easier CT diagnosis of acute ischemic stroke.

#### **R5A-SPNR- Neuroimaging Features of Peripheral Neuropathy with Positive Antinodal or Paranodal Antibodies** 12

##### **PURPOSE**

To investigate the magnetic resonance neurography (MRN) characteristics of Autoimmune neuropathy (AN).

##### **METHODS AND MATERIALS**

18 AN patients with MRN examination from Hospital were collected, 2 were excluded due to unqualified images. The enrolled 16 patients included 12 with anti-NF155 IgG4 antibody positive, 1 with anti-Caspr1 antibody positive, and 3 with anti-CNTN1 antibody positive. 6 patients (4 anti-NF155 IgG4 positive, and 2 anti-CNTN1 positive) underwent follow-up MRN examination. The control groups included 18 patients with the MRN examination of the normal peripheral nerve. The basic imaging features of MRN were analyzed in baseline AN group, including the contrast enhancement of the spinal roots of post-ganglion and pre-ganglion, cauda equina. The "Sleeve sign" were also analyzed. Then, the nerve root cross-sectional area (CSA) were measured in all groups. The Kruskal-Wallis H test was used to compare the demographic differences (i.e., genders and ages) among the 3 groups. The Wilcoxon rank sum test was used to compare the CSA between the AN groups and the control groups, the follow-up and baseline groups. Pearson (or Spearman rank) correlation test was used to detect the correlations between the CSA and different clinical parameters.

##### **RESULTS**

There was no significant difference in genders ( $P=0.620$ ), disease duration ( $P=0.277$ ), cranial nerve ( $P=0.790$ ), and tremor ( $P=0.233$ ) among the three groups. Imaging features of the baseline AN patients were as follows: preganglionic nerve enhancement (90.9%), postganglionic nerve enhancement (72.7%), cauda equina enhancement (100%), The CSA of the L3-S1 (both sides) nerve roots were larger in the AN groups than in the control groups (all  $P < 0.05$ ). There was no significant difference in the CSA of nerve roots between the baseline groups and the follow-up groups. There was positive correlation between the Hughes score after treatment and the CSA of the nerve root L5L ( $r=0.88, P=0.02$ ), S1L ( $r=0.90, P=0.014$ ), L4L ( $r=0.88, P=0.021$ ), L3R ( $r=0.95, P=0.003$ ), S1R ( $r=0.92, P=0.01$ ). Spearman rank correlation analysis showed a weak positive correlation between the Hughes score of different value and the CSA of the nerve root L5L ( $r=0.093, P=0.018$ ), L3R ( $r=0.093, P=0.008$ ), S1R ( $r=0.91, P=0.008$ ) and L4L ( $r=0.83, P=0.039$ ).

##### **CONCLUSION**

s The MRN features can differentiate AN and the normal group very well. While, the features did not correlate well with the treatment effect, which needs further studies to find better imaging biomarkers to evaluate the treatment accurately.

#### **CLINICAL RELEVANCE/APPLICATION**

There are differences in MRN between AN patients and normal patients, which are correlated with clinical scores, MRN is a potential imaging biomarker for accurate diagnosis and prognosis evaluation of AN patients.

#### **R5A-SPNR- Neurotransmitters Release in the Brain Extracellular Space Following Neuronal Excitation can be** 13 **Tracked by Tracer-based MRI**

##### **PURPOSE**

The interstitial fluid (ISF) within the brain extracellular space (ECS) is a direct microscopic environment in which brain cells survive and function, however, the dynamic modulatory processes that occur in the ECS upon stimulation, as well as their underlying mechanisms, have not been elucidated. Given the potentially important capacity of tracer-based magnetic resonance imaging (MRI) in visualizing the drainage of ISF in brain ECS and analyzing the diffusion characteristics of ECS in the deep brain, it is pertinent to explore the underlying biophysical mechanisms.

##### **METHODS AND MATERIALS**

In the present study, by using an algorithm-optimized tracer-based MRI and DECS-Mapping techniques, we quantitatively measured the dynamic biophysical parameters of the brain ECS structure and ISF drainage in the thalamus following neuronal excitation in an electric pain stimulation rat model. Immunofluorescence assays and western blot were used to confirm the morphological basis for structural changes in ECS. Additionally, the release and distribution of neurotransmitters were mapped at different time-points following pain stimuli by using mass spectrometry imaging (MSI). The same examinations were performed in an aquaporin-4 (AQP4) gene knockout rat model to explore the roles of AQP4 in regulating ECS structure and ISF drainage.

##### **RESULTS**

Significantly decreased diffusion coefficient (DECS) and volume fraction ( $\alpha$ ) of the brain ECS were found in the thalamus caused by neuronal excitation, accompanied with the slowdown of ISF drainage. The morphological basis for structural changes in ECS was local spatial deformation of astrocyte foot processes. An AQP4 knockout rats model was used in which the changes of the ECS structure were reversed and found that the slowed DECS and ISF drainage persisted. Meanwhile, the dynamic changes of DECS were found to be synchronized with the release and elimination processes for neurotransmitters following neuronal excitation.

##### **CONCLUSION**

s In conclusion, tracer-based MRI represents a promising technique to reflect neuronal activity, the down-regulation of ISF drainage following neuronal excitation is caused by the restricted diffusion in the brain ECS, and DECS might be used to track the neurotransmitters release following neuronal activities in the deep brain.

#### **CLINICAL RELEVANCE/APPLICATION**

Tracer-based MRI represents a promising technique to reflect neuronal activity. Brain ECS and ISF drainage within it will become a new target for monitoring neural network excitation, which will open up new research avenues for understanding the physiology and

pathology of central nervous system diseases.

## **R5A-SPNR-2 Investigating ChatGPT's Capability to Generate Differential Diagnoses from Transcribed Radiological Findings in Neurological Imaging**

Participants

Shawn Sun, MD, MS, Anaheim, CA (*Presenter*) Nothing to Disclose

### **PURPOSE**

To assess the accuracy and reliability of ChatGPT3.5 and ChatGPT4 in producing a differential diagnosis from transcribed radiological findings of neuroradiology cases.

### **METHODS AND MATERIALS**

A sample of 32 neuroradiology cases were selected from a radiology textbook, from which the answers were used as the gold standard. The case images and history were converted into standardized prompts that contained purely descriptive language of the cases and a query for the most likely diagnosis, top three differential diagnoses, and the corresponding explanations and references from the medical literature. These prompts were fed into the ChatGPT3.5 and ChatGPT4 algorithms. Generated responses were analyzed for accuracy by comparison with the original literature and reliability through manual verification of the generated explanations and citations. The top 1 accuracy and the top 3 accuracy were defined as the percentage of generated responses that matched the original diagnosis and the complete differential provided by the original literature. An additional differential diagnosis score was defined as the proportion of differentials that matched the original literature's answers for each case. Comparisons were made between the results of the two algorithms using a one-tailed two proportion z-test method.

### **RESULTS**

The top 1 accuracy and top 3 accuracy, for ChatGPT3.5 versus ChatGPT4 were 37.5% compared to 56.3% ( $p=0.065$ ) and 9.4% compared to 15.6% ( $p = 0.23$ ), respectively. The average differential diagnosis score of ChatGPT3.5 versus ChatGPT4 was 44.3% compared to 52.5% ( $p=0.25$ ). ChatGPT3.5 and ChatGPT4 hallucinated 36.5% versus 12.2% ( $p=0.012$ ) of the references provided and generated 7 total false statements versus 3 total false statements, respectively.

### **CONCLUSION**

s The ChatGPT algorithms were able to produce a differential diagnosis for prompts containing descriptive radiological findings. The responses matched the expert literature from which the cases originated a minority of the time, though a non-statistically significant improvement was made in the accuracy categories from 3.5 to the 4th generation algorithm. The renowned hallucination effect appeared more frequently in generated citations compared to algorithm-produced statements, with both showing improvement in the latest generation.

### **CLINICAL RELEVANCE/APPLICATION**

ChatGPT and Large Language Models (LLM) hold significant potential to influence both clinical and educational aspects of medicine. Familiarity with the precision and potential errors of these algorithms can offer a deeper insight into the constraints of these emerging tools.

## **R5A-SPNR-3 Deep-Learning Augmented Contrast Enhancement Improves the Detection of Cerebral Vessel Occlusions in CT-Angiography of Acute Stroke Patients**

Participants

Sebastian Steinmetz, MD, Mainz, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

To examine the impact of deep-learning augmented contrast enhancement on diagnostic performance of poorly contrasted computed tomography angiography (CTA) in acute stroke.

### **METHODS AND MATERIALS**

This retrospective single center study included patients with suspected ischemic stroke who underwent comprehensive CT imaging including cranial computed tomography (CCT), whole brain volume perfusion CT (VPCT) and computed tomography angiography (CTA) and had poorly contrasted CTA (defined as  $<350\text{HU}$  in the proximal MCA) between 01/2021 and 12/2022. 58/102 patients had vascular occlusion with correlate in perfusion. All CTA datasets were reconstructed conventionally using iterative reconstruction (conventional CTA, cCTA) and additionally using an AI-powered Augmented Contrast Enhancing tool (ClariACE, ClariPi, Seoul South Korea), which is a pre-trained deep learning model allowing selective boosting of contrast agent components in CT images (enhanced CTA, eCTA). The quantitative features including slope, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), noise, entropy and density values were examined by software and were calculated standardized and compared. Datasets were then evaluated by two blinded radiologists, who applied 4-point-Likert-scales to general and vessel specific measures of both cCTA and eCTA datasets (overall image quality, overall contrast, artifacts, diagnostic confidence, image noise, assessability of proximal, intermediate and subcortical vessels). Furthermore, readers evaluated both datasets for presence / absence of cerebral vessel occlusions with VPCT serving as reference standard for calculating sensitivity and specificity.

### **RESULTS**

This study included 102 patients (mean age= $67.69\pm 13.18\text{y}$ ; 32 women). Objective image evaluation revealed an increase in iodine contrast by ca. 100%. eCTA revealed significantly higher subjective contrast, diagnostic confidence and overall image quality ( $p<.001$ ). Both readers achieved significantly improved sensitivity with eCTA as compared to cCTA (Reader 1: 55/58 [95%; 95%-CI: 85.62% to 98.92%] vs. 48/58 [83%; 95%-CI: 70.57% to 91.41%]; Reader 2: 53/58 [91%; 95%-CI: 81.02.% to 97.14%] vs. 46/58 [79%; 95%-CI: 66.65% to 88.83%]). Reader 1 yielded no false positive findings on cCTA or eCTA (specificity 44/44 [100%; 95%-CI: 91.96% to 100%]), reader 2 yielded no false positive findings on cCTA and 1 false positive on eCTA (reader 2: 43/44 [98%; 95%-CI: 87.98% to 99.94%]).

### **CONCLUSION**

s Deep-learning augmented contrast enhancements significantly increases image quality and diagnostic performance of poorly contrasted CTA.

## CLINICAL RELEVANCE/APPLICATION

Enabling faster and more accurate care for stroke patients.

## R5A-SPNR-4 Use of a Computer-based Program to Classify Injuries from the Upper Cervical Spine According to AO Spine Classification

Participants

David Timaran Montenegro, MD, Houston, TX (*Presenter*) Nothing to Disclose

### PURPOSE

AO classification is a detailed, laborious, and challenging standardized assessment to describe imaging findings of UCST. To improve efficiency reducing assessment time, a computerized program was developed to determine AO Classification from standardized imaging report system from Cervical Spine Imaging CT and MRI called, PAUCI: Program for Analysis of Upper Cervical Injury.

### METHODS AND MATERIALS

The computer program utilizes a series of 44 dichotomic questions based on the presence or absence of imaging findings. Initially, registration of lesions was performed retrospectively by two neuroradiologist after consensus was achieved. Then, the database was reviewed by PAUCI and a third blinded neuroradiologist to determine AO classification. Statistical analysis included calculation of agreement coefficients between the neuroradiologist assessment and AO classification according to anatomic level and severity type of injuries.

### RESULTS

Initially, 170 subjects with UCST were included in our study and registered in the database. All patients showed lesions in the upper cervical spine on CT or MRI. Among them, 70 subjects were randomized to be assessed by the third blinded evaluator and PAUCI. Second-order agreement coefficients indicated that PAUCI and the neuroradiologist demonstrated a statistically significant degree of agreement regarding AO injury level (Level I: AC2 0.886, Level II: AC2 0.874, Level III: 0.675;  $\Pr > |Z|$  (p value) <0.0001 for all). There was also significant agreement regarding AO injury severity at each level (Type A: 0.980; Type B: 0.864 Type C: 0.639;  $\Pr > |Z|$  <0.001 for Type A and B and 0.0064 for Type C).

### CONCLUSION

s AO classification for the upper cervical spine injury determined by PAUCI and neuroradiologist demonstrated a statistically significant degree of agreement. Stronger agreement was identified with lesions occurring at the anatomic Level I. More modest agreement was found with lesions at Level III with severity type C. PAUCI represents an opportunity to determine AO classification efficiently and accurately from cervical spine imaging in cases of upper cervical spine injury.

## CLINICAL RELEVANCE/APPLICATION

Detailed description of imaging findings in patients with upper cervical spine trauma using a standardized system is needed to assess prognosis and outcomes. Currently, AO spine is a reliable classification system. Main limitations include difficulty and time consumption in busy real life practice. Computerized systems can help to expedite the process to classify lesions.

## R5A-SPNR-5 Correlation of Brain Stiffness Measured Using Virtual MR Elastography Based on DWI with Enlarged Perivascular Space

Participants

Miran Han, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

Enlarged perivascular spaces (EPVS) have been known to be associated with various degenerative disease. However, since they were also frequently observed in healthy population, it is not clear how severe EPVS burden can be considered pathologic. Therefore, we investigated the relationship EPVS and brain stiffness which is also considered as biomarker of neurodegenerative disease, using the virtual magnetic resonance elastography (vMRE). That is a non-invasive and novel technique based on diffusion weighted imaging (DWI)

### METHODS AND MATERIALS

We retrospectively reviewed healthy adults who performed MR imaging for routine medical examination from March 2021 to June 2022. EPVS were rated on visual grading [grade 0, 1, 2, 3, 4 for 0, 1-10, 11-20, 21-40, >40 EPVS at centrum semiovale (CSO) and basal ganglia (BG) of either hemisphere]. We excluded patients who had high SI at white mater (> Fazekas scale 1), EPVS at BG > grade 1, hypertension, cardiovascular disease, and diabetes to minimize the effect of confounding factors. We randomly selected age matched patients according EPVS grade at CSO. Shifted apparent diffusion coefficient was calculated from DWI ( $b=200$  and  $1500\text{sec/mm}^2$ ) and converted to DWI-based virtual shear modulus ( $\mu$ ). Brain stiffness was measured in centrum semiovale area, but also in whole brain. Multiple comparison test were performed for evaluating relationship between EPVS grade and brain stiffness.

### RESULTS

Finally 248 patients (50 patient for grade 0, 1, 2, 3 and 48 patients for 4, 107 female, 141 male) were included. There were no differences in brain volume between EPSV groups ( $P = 0.109$ ), the virtual shear modulus ( $\mu$ ) decreased not only in CSO but also in whole brain, as the EPSV grade increased ( $P < 0.001$ ). In post hoc analysis, there is no significant differences of brain stiffness between G0 and G1 ( $P = 0.939$  for CSO,  $P = 0.984$  for total brain), G2 and G3 ( $P = 0.893$  for CSO,  $P = 0.418$  for total brain). When the EPVS was re-graded as normal (G0-1), mild (G2-3) and high (G4), the change of brain stiffness parameters were significant according to EPSV grade (Normal vs Mild,  $P = 0.001$ ; Mild vs High,  $P = 0.015$  for CSO and  $P = 0.001$ ;  $P = 0.016$  for total brain).

### CONCLUSION

s The higher degree of EPVS at CSO presented lower value of brain stiffness parameter. The rating system of EPVS needs to be revised in consideration of clinical impact.

## CLINICAL RELEVANCE/APPLICATION

The enlarged perivascular space showed negative correlation with brain stiffness measured using virtual MR elastography, new

rating system of EPVS based on brain stiffness could be suggested.

### **R5A-SPNR-6 Harmonized Tract Based Spatial Statistics (TBSS) with Multiple Diffusion Models of the Alzheimer's Disease Connectome Project (ADCP)**

Participants

John Roberts, BS, MADISON, WI (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Alzheimer's Disease (AD) has been mainly thought of as a disease involving gray matter changes. Gray matter atrophy is observed primarily in fronto-temporal regions, but less is known about the disruptions to white matter. This study investigates disruptions to white matter in the AD continuum (cognitive unimpaired (CU) or healthy controls (HCs); cognitive impaired (CI) - Mild Cognitive Impairment (MCI) and AD) using diffusion tensor imaging (DTI) and multi-tissue neurite and orientation dispersion and density imaging (mtNODDI) models of the multi-shell connectome diffusion MRI (ms-dMRI) data from the Alzheimer's Disease Connectome Project (ADCP).

#### **METHODS AND MATERIALS**

Data from 121 participants (Cognitive Unimpaired (26 M, 43 F) mean age 67 +/- 7.2; Cognitive Impaired (31 M, 21 F) mean age 73.2 +/- 8.8) in the ADCP with ms-dMRI were pre-processed using DESIGNER processing guidelines using tools implemented in FSL, ANTS, and MRtrix3. TBSS pre-processing was performed, and parametric ComBat data harmonization was applied to the skeletonized data for the DTI and mtNODDI parameters. The effects of cognitive impairment on these parameters were statistically evaluated using permutation testing and threshold free cluster enhancement with family wise error corrected threshold of  $p < 0.05$ , controlling for age and sex.

#### **RESULTS**

Analysis of DTI and NODDI measures revealed significant differences in mtCSF (partial volume fraction of cerebrospinal fluid), mtODI (orientation dispersion index of neurites), and mtVFEXTRA (partial volume fraction of extracellular free water) between CI and CU individuals. Specifically, CI individuals had higher mtVFEXTRA (1 cluster) and mtODI (6 clusters), and lower mtCSF (1 cluster) and mtODI (1 cluster) than CU individuals. All results are statistically significant with family-wise error corrected p-values with an a level of 0.05.

#### **CONCLUSION**

s Cognitively impaired individuals were found to have decreased axonal coherence in the brainstem and surrounding cerebellar regions as well as in frontal lobe sub gyral white matter, suggesting increased neurodegeneration in these regions. Conversely, cognitively impaired individuals were found to have reduced extracellular fluid in cerebral white matter and decreased tissue complexity in the gray matter of the posterior corona radiata. Further research is needed to replicate and extend these findings and investigate potential confounding factors.

#### **CLINICAL RELEVANCE/APPLICATION**

Neurite complexity tends to decrease in the posterior white matter and increase in the brainstem and sub gyral frontal white matter in cognitively impaired individuals on the AD continuum.

### **R5A-SPNR-7 Pretreatment MR-Based Radiomics in Patients With Glioblastoma: A Systematic Review and Meta-Analysis of Prognostic Endpoints**

Participants

Su Jeong Yang, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Recent studies have shown promise of MR-based radiomics in predicting the survival of patients with untreated glioblastoma. This study aimed to comprehensively collate evidence to assess the prognostic value of radiomics in glioblastoma.

#### **METHODS AND MATERIALS**

PubMed-MEDLINE, Embase, and Web of Science were searched to find original articles investigating the prognostic value of MR-based radiomics in glioblastoma published up to March 6, 2022. Concordance indexes (C-indexes) and Cox proportional hazards ratios (HRs) of overall survival (OS) and progression-free survival (PFS) were pooled via random-effects modeling. For studies aimed at classifying long-term and short-term PFS, a hierarchical regression model was used to calculate pooled sensitivity and specificity. Between-study heterogeneity was assessed using the Higgin inconsistency index (I<sup>2</sup>). Subgroup regression analysis was performed to find potential factors contributing to heterogeneity. Publication bias was assessed via funnel plots and the Egger test.

#### **RESULTS**

Among 596 abstracts, 17 studies were included. Respective pooled C-indexes and HRs for OS were 0.65 (95% confidence interval [CI], 0.58-0.72) and 2.88 (95% CI, 2.28-3.64), whereas those for PFS were 0.61 (95% CI, 0.55-0.66) and 2.78 (95% CI, 1.91-4.03). Among 4 studies that predicted short-term PFS, the pooled sensitivity and specificity were 0.77 (95% CI, 0.58-0.89) and 0.60 (95% CI, 0.45-0.73), respectively. There was a substantial between-study heterogeneity among studies with the survival endpoint of OS C-index (n=9, I<sup>2</sup>=83.8%). Publication bias was not observed overall.

#### **CONCLUSION**

s Pretreatment MR-based radiomics provided modest prognostic value in both OS and PFS in patients with glioblastoma.

#### **CLINICAL RELEVANCE/APPLICATION**

Pretreatment MR-based radiomics provided modest prognostic value in patients with glioblastoma with pooled C-indexes for overall survival and progression-free survival as 0.65 and 0.61, respectively.

### **R5A-SPNR-8 Imaging Findings of IIH: The Value of MRI in Predicting the Presence of Disease**

Participants

## PURPOSE

Idiopathic intracranial hypertension (IIH) is a condition characterized by an increase in cerebrospinal fluid (CSF) with a lack of identifiable structural cause or etiology. This condition is expected to rise in incidence along with an increase in obesity in the coming years. Brain imaging has been successfully used to identify this disease with specific findings prompting further evaluation. We believe that MR imaging findings can predict the presence of IIH and we attempted to reproduce and reinforce existing knowledge in the literature.

## METHODS AND MATERIALS

This study was a retrospective data analysis of MRI imaging reports completed during the calendar year 2020 at John Peter Smith hospital. Any MRI report including the phrase "Idiopathic intracranial hypertension" was reviewed and patients with a lumbar puncture confirming the diagnosis of IIH were included. The study sample was 64 IIH cases and 41 normal MRI brains as a control. All cases were deidentified and randomized. These MRI studies were reviewed by three different neuroradiologists who were blinded to the diagnoses. The presence or absence of four imaging findings was noted—empty pituitary sella, posterior globe flattening, bilateral transverse sinus stenosis, and enlarged optic nerve sheaths. Inter-rater reliability (IRR) was analyzed as well as Odds Ratios for each finding using a generalized linear mixed model.

## RESULTS

Our results demonstrated substantial and almost perfect agreement amongst radiologists when identifying empty pituitary sella, enlarged optic nerve sheaths, and posterior globe flattening (IRR value >0.6). However, there was only moderate agreement amongst radiologists when assessing bilateral transverse sinus stenosis (? value 0.569). Odds ratios for each imaging finding were statistically significant (p value <.0001). Posterior globe flattening had the highest odds ratio and was never seen in controls.

## CONCLUSION

Our results reinforce existing evidence that specific MR imaging findings can predict the presence of IIH. A limitation to this study was the lack of vascular imaging such as MR Venography, which is likely responsible for the low IRR in identifying bilateral transverse sinus stenosis. A future study could look at CT or MR venography alone or combined with these findings to predict the presence of IIH.

## CLINICAL RELEVANCE/APPLICATION

As the incidence of IIH increases in the population, it is increasingly important to recognize MR findings which predict the presence of this disease. In addition, vascular imaging should be included in the diagnostic workup of IIH.

## R5A-SPNR-9 Reduction of Injected Volume of Intravenous Contrast Media for Brain CT: Problem or Opportunity

Participants

Goni Merhav, Haifa, Israel (*Presenter*) Nothing to Disclose

## PURPOSE

This study investigates whether reducing the volume of intravenous iodinated contrast material injected during brain computed tomography (CT) provides reliable and accurate enhanced imaging without compromising diagnostic accuracy.

## METHODS AND MATERIALS

In this prospective IRB approved study of 102 consecutive patients all of whom received informed consent, enhanced brain CT was done for indications such as headache and dizziness. 47 patients then received a reduced dose of 60 ml of Omnipaque 350 iv, while the control group of 55 patients received the usual 80 cc of Omnipaque 350 iv as suggested on the package insert. All CTs were done on a Siemens Somatom Definition Flash scanner or Siemens Somatom AS 64 with the same parameters: 100kV, 300-400 mA, 3 mm slice thickness, 12/3200 window width, data collection diameter 500. Three neuroradiologists blinded to the amount of injected contrast material rated the CT scans for image quality and lesion detection using a 5-point Likert scale. Readings were controlled for age and gender. Visibility of six anatomic structures was recorded by each reader. Inter-rater reliability was tested using intra class correlation (ICC, two-way random effect model, single rater, agreement) based on the 95% confidence interval of ICC estimates. Multiple linear regression was used to predict overall diagnostic accuracy.

## RESULTS

Readers' ratings had a high intra class correlation coefficient (ICC) value of 0.873 (CI 95% 0.831-0.908). No significant demographic or clinical differences were noted between the two groups. The 80cc group had significantly higher enhancement ratings compared to the 60cc group for six anatomical structures. However the mean difference scores between the study group and the control group for the six items were less than 0.5 (p<0.001).

## CONCLUSION

The rankings of the raters for both the test and control groups did not differ significantly. Therefore, the overall diagnostic quality did not show a clinically significant difference between the two groups. The potential advantages of reduced contrast volume include shortened scan duration, lower radiation exposure, lower risk of adverse effects such as contrast induced nephropathy or cardiac failure, and cost minimization. Conservation of iodinated contrast media is a timely concern given the recent global shortage of iodinated contrast material in the year 2022.

## CLINICAL RELEVANCE/APPLICATION

Reduced IV contrast volume for brain CT yields accurate IV imaging, may reduce adverse effects (nephropathy or cardiac failure), is cost minimizing, has shorter scan times, and mitigates future supply chain contrast shortages.

## Abstract Archives of the RSNA, 2023

R5A-SPPD

### Pediatric Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPPD-1 Developing an Evidenced-Based Pediatric Pituitary Magnetic Resonance Imaging Protocol: How We Did It**

#### Participants

Michael Nance, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To develop a protocol to facilitate appropriate intravenous contrast use based on various pediatric pituitary imaging indications.

#### **METHODS AND MATERIALS**

A retrospective review of pediatric pituitary MRI protocols at Children's Healthcare of Atlanta was performed from July 2021 to June 2022 using the Empower database and review of patient records. Information for ordering specialty, imaging indication, and MRI protocol including the use of Gadolinium (Gd) were obtained. A comprehensive systematic and manual literature search was performed. PubMed MESH search criteria: (pediatrics OR child) AND magnetic resonance imaging AND (sella OR pituitary OR hypophysis), and patient age from newborn (birth-1 month) to adolescent (13-18 years). Included articles informed the magnetic resonance imaging technique for: precocious puberty, hypopituitarism, septo-optic dysplasia, Sellar mass, diabetes insipidus and pituitary adenoma. The systematic search resulted in 1,778 citations which yielded 57 articles after screening inclusion/exclusion criteria. Manual search contributed an additional 18 articles.

#### **RESULTS**

From July 2021 to June 2022, a total of 375 studies were performed (235 female, 140 male) with an age range of 6 weeks to 20 years (mean 10.7 years). The most frequent imaging indications were growth hormone deficiency (GHD) (44.1%) followed by precocious puberty (33.2%). Other indications included adenoma (13.1%) and pituitary mass (9.6%). Ordering provider specialty was predominantly endocrinology (70.9%). A total of 284 studies were ordered with Gd (75%). Based on indication, there was substantial institutional variance in the use of Gd. Adenoma (96% with Gd), GHD (59% with Gd), mass (75% with Gd), and precocious puberty (90% with Gd). Preliminary review of the literature also showed variation with included references describing Gd use in 93.3% (28/30) for pituitary mass, 50% (13/26) for hypopituitary/GHD, and 80% (4/5) for precocious puberty.

#### **CONCLUSION**

Standardized pediatric pituitary imaging protocols are not widely available potentially causing variance in the diagnostic efficacy. We demonstrate that there is substantial intra-institutional variance in the use of Gd based on pediatric pituitary imaging indication at a single institution quaternary children's hospital. We developed imaging protocol recommendations for each pituitary imaging indication based on our literature review. This will be presented to our endocrinologists for review and modifications to meet our local practice demands.

#### **CLINICAL RELEVANCE/APPLICATION**

We developed an institutional evidenced based pediatric pituitary imaging protocol to inform the appropriate use of Gd contrast for diagnostic efficacy.

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## Abstract Archives of the RSNA, 2023

R5A-SPPH

### Physics Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPPH-1 Comparison of Scan Protocols with Different Automatic Exposure Control Software Using Water Equivalent Diameter Calculated from CT Images**

##### Participants

Hsiang-Chi Kuo, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### PURPOSE

This study evaluated the patient dose and size difference when translating clinical scan protocols from one CT scanner to a new PETCT scanner with different automatic exposure control (AEC) software.

##### METHODS AND MATERIALS

Reference clinical protocols were built on a Philips big bore scanner (P) using 3D DOM version of Dose Right (DR) for AEC with different DR levels at various anatomical sites. These protocols were translated to a new Siemens Biograph V600 PETCT scanner (S) which utilizing CareDose 4D as AEC to modulate mAs in different strength from very weak to very strong with different Quality Reference mAs (Q. RefmAs). The average CareDose strength was applied. The RefmAs of the RT protocols from S were used with minor edits. An anthropomorphic phantom, wrapped with 0 and 5 cm bolus, was scanned using thorax and abdomen protocols at S and P scanners. The cross-sectional size of the phantom on the CT image was calculated as the water equivalent diameter (wED) based on the method described in AAPM TG 220 report. The CTDIvol for each slice was extracted from the DICOM header. The wED, and the CTDIvol data from each scanned protocol were statistically analyzed using the Spearman coefficient to determine the correlation. 85 patient scans on both scanners were compared to the CTDIvol as a function of wED across scanners and anatomical locations.

##### RESULTS

In phantom images' analysis, the P scanner using DR showed a higher correlation to wED ( $>0.83$  vs.  $<0.8$ ) than the S scanner, which applied RefmAs. Comparing the statistical results among protocols from both scanners, the subgroup of the scans from the same scanner (DR=17 vs. DR=21 vs. DR=25; Thorax Q. RefmAs=160 vs. Abdomen Q. RefmAs=250) showed a strong correlation (0.98). The scan results from different scanners (S vs. P) showed a weaker ( $<0.83$ ) correlation. Comparing patient scans, the images of the S scanner demonstrated a significantly higher exposure variance with wED and a sharper CTDIvol increase at wED between 25-30 cm resulting in a higher scanning dose with the pre-estimated patient size larger than  $\sim 28$  cm. P scanner had a maximum exposure limit so that CTDIvol could be kept below 27.6 mGy in the body site. S scanner did not limit maximum exposure from software such that the CTDIvol exposure could be more than 40 mGy, and in the case when scanned with the hand positioned on the chest, the CTDIvol could be more than 60 mGy.

##### CONCLUSION

This study highlights that assessing CTDI vs. wED can be a practical approach to evaluating clinical scan protocols for different AEC software and scan protocols.

##### CLINICAL RELEVANCE/APPLICATION

Translating CT scan protocols.

#### **R5A-SPPH-10 Patient-specific Analysis of Organ Doses and Image Quality in Abdominal Single Energy and Dual Energy CT Examinations**

##### Participants

Keisuke Fujii, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

The aims of this study are to evaluate organ doses for individual patients in abdominal CT examinations with conventional 120 kV single energy CT (SECT) and 80/135 kV dual energy CT (DECT), and to compare organ doses and image quality of the CT images in DECT scans with them in SECT scans.

##### METHODS AND MATERIALS

Monte Carlo (MC) simulations for each voxelized phantom of 40 adult normal weight and overweight patients undergoing abdominal CT examinations with Aquilion Precision as a SECT scanner and Aquilion ONE / PRISM Edition as a DECT scanner (Canon Medical Systems) were performed by inputting the CT images, descriptions of each CT scanner, and scanning parameters including our estimated tube current modulation profiles into MC simulation software ImpactMC (Advanced Breast CT, GmbH). Region of interests (ROI) of seven radiosensitive organs (thyroid, lung, esophagus, breast, liver, stomach, and bladder) were set on the simulated dose distribution images, and organ doses for each organ were calculated as average doses within each organ ROI. Next, we evaluated image quality of abdominal CT images from SECT scans and 70 keV virtual monochromatic images (VMI) images from DECT scans,

which were reconstructed with deep learning reconstruction algorithms. We set ROIs on liver region of plain SECT and VMI images, applied moving average filters in the ROI, and evaluated apparent noise (which showed the correlation with the subjective recognition of image noise on CT images) from standard deviation of the mean CT values for each filter size. Image contrast was calculated as differences between CT values of aorta at the early phase and those of liver region on plain SECT and VMI images, and contrast-to-noise ratio (CNR) was also calculated as the ratio of the contrast and apparent noise of each image.

## RESULTS

Organ doses for liver and stomach within scan range of normal and overweight patients in abdominal SECT scans were 22-32 mGy while the organ doses for the patients in abdominal DECT scans were 16-21 mGy. Apparent noise of the VMI images obtained from DECT scans was approximately 30% lower than that of SECT images, and contrast of the VMI images was approximately 30% higher than that of SECT images. From these results, CNR of the VMI images was approximately 2 times higher than that of SECT images.

## CONCLUSION

s DECT examinations allows for the reduction of organ doses for organs within scan range by approximately 30% compared to conventional SECT examinations, and VMI images obtained from DECT scans also provides higher signal detectability than SECT images.

## CLINICAL RELEVANCE/APPLICATION

DECT examinations can be performed with lower radiation doses than conventional SECT examinations, and VMI images obtained from DECT scans can provide higher signal detectability than SECT images.

## R5A-SPPH- Ultra-low Dose CT Imaging with a Denoising AI model in Body Composition Analysis

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Participants

Hooney Min, MD, MS, Seongnam-si, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Body composition analysis (BCA) is a crucial clinical application. CT is regarded as the gold standard for BCA, but DEXA is more common due to lower radiation exposure. This study evaluated the feasibility of using an ultra-low dose CT protocol with a denoising AI model to reduce radiation exposure without compromising reliability.

## METHODS AND MATERIALS

A prospective study of 100 subjects (26 males and 74 females, aged 23-62 years, mean BMI:  $23.2 \pm 3.25$  kg/m<sup>2</sup>) was conducted. Participants underwent a standard dose CT scan (120 mAs, 120 kVp, 0.066 mSv) and were randomly assigned a second CT scan with varying doses: 1) standard dose: 0.066 mSv, 2) half dose: 0.034 mSv, 3) quarter dose: 0.018 mSv, 4) ultra-low dose: 0.007 mSv. All effective doses included a scout view, obtained with a tin filter. Ultra-low dose CT used 10mAs, the lowest achievable on CT. CT scans captured a single 5 mm slice thickness axial image at the third lumbar spine. Standard dose CT scans were reconstructed using the Filtered Back Projection (FBP) method. Low dose CT images were reconstructed using the FBP method and a denoising AI model. CT scans were segmented using a commercially available software to obtain areas relevant to BCA (muscle, subcutaneous fat, and visceral fat). Intraclass correlation was used to compare BCA area values from low dose CT images to that of standard dose CTs. Muscle area was further divided into normal attenuation muscle (NAM) and low attenuation muscle (LAM). Wilcoxon signed rank test was used to compare NAM and LAM values from low dose CT images to that of standard dose CTs.

## RESULTS

Body composition parameters (muscle, subcutaneous fat, and visceral fat) from low dose CT scans (even without denoising) demonstrated high agreement with standard-dose CT scans, with intraclass correlation coefficients exceeding 0.95. Total muscle area was uniform across doses, but when divided into NAM and LAM, NAM was underestimated and LAM was overestimated as CT dose became lower. NAM and LAM values differed significantly in low-dose CTs compared to standard-dose CTs. The denoising AI model decreased the differences in NAM and LAM area at half-dose CTs ( $p > 0.05$ ).

## CONCLUSION

s Ultra-low dose CT provided accurate BCA without added radiation exposure, even without AI denoising. A denoising AI model enhanced the accuracy in differentiating LAM and NAM in low dose CT scans.

## CLINICAL RELEVANCE/APPLICATION

Ultra-low dose CT imaging (0.007 mSv) offers accurate and safe BCA with a lower effective dose than a single DEXA scan (0.013 mSv), suggesting better BCA without additional radiation exposure.

## R5A-SPPH- Improved Detectability of Low Contrast Objects with Deep Learning-based Denoising on Legacy CT Machine: A 10-Reader Phantom study

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## PURPOSE

This study aims to assess the detectability of low-contrast objects through a human reader test by comparing denoised images obtained from a legacy CT machine with those acquired from a recent CT machine. Additionally, the study compares the low contrast detectability of the original and denoised images obtained from the legacy CT machine.

## METHODS AND MATERIALS

A Catphan® low-contrast phantom module was used for evaluation, with an added soft tissue-mimicking ring, resulting in a total phantom diameter of 30 cm (simulating adult body size). Images were acquired using a legacy CT machine (Philips Brilliance 64) set to 12mGy and a recent CT machine (Siemens Force) set to 32mGy. The images were reconstructed using the Filtered Back Projection (FBP) method. A vendor-agnostic deep learning-based denoising model was employed to process the images from the legacy CT machine. Based on the sample size calculation using a non-inferiority test with a non-inferiority margin of 0.05 in the area under the curve (AUC), 10 human readers and 100 images were required for each setting (denoised and original 12mGy images on legacy CT, and original 32mGy images on recent CT), resulting in a total of 300 images being tested. Of the 100 images, 50 were set to include a 15 mm object with a contrast of 10 HU, and 50 were set to not include. Ten radiologists with varying years of



experience evaluated the images using a 5-point Likert scale for the presence of the object, and AUC values were calculated for each setting. A non-inferiority test was performed to compare denoised images with images obtained from the recent CT. An additional superiority test was performed between denoised and original FBP images acquired from the legacy CT.

## RESULTS

The AUC for the original FBP image from the legacy CT was 0.895, while the denoised image from the same machine had an AUC of 0.988. The recent CT had an AUC of 0.993. The low-contrast detectability of denoised FBP images from the legacy CT was found to be non-inferior to the FBP images obtained from the recent CT ( $p < 0.01$ ). Furthermore, denoised FBP images exhibited superior low-contrast detectability compared to the original FBP images acquired from the legacy CT ( $p < 0.01$ ).

## CONCLUSION

The deep learning-based denoising model significantly improved low-contrast detectability on legacy CT and was non-inferior to images obtained from recent CT.

## CLINICAL RELEVANCE/APPLICATION

The application of this vendor-agnostic denoising model may offer a potential solution to improve the detectability of low-contrast objects in clinical settings that still use legacy CT machines.

## R5A-SPPH-2 Agreement of Size-specific Dose Prediction and Site-specific Diagnostic Reference Level in Adult Abdominal CT Examinations

### PURPOSE

CT doses range across population can be predicted prospectively with size-specific phantoms or reviewed in dose monitoring software, but the agreement between the two methods lack large population confirmation<sup>1</sup>. We aimed to compare predicted size-specific dose to reported values across multiple vendors in our hospital system, and also, to develop strategies to convert between size-specific prediction with Mercury phantom and retrospective site-specific local diagnostic reference level.

### METHODS AND MATERIALS

The overall study design was illustrated (Fig a). Diagnostic reference levels across academic hospitals ( $n=9$ ) and community sites ( $n=13$ ) in the past 3 years were quantified with quantile summary of CTDIvol for different BMI groups ( $n>30$  per group), using de-identified meta-data from dose monitoring software (DoseTrack, Sectra, Fig b), retrospectively. Patient sizes (water equivalent diameter,  $D_w$ ) in Mercury 4.0 phantom were converted to BMI with a reported equation<sup>2</sup>, with an assumed error of 10%. The phantom was scanned using clinical abdomen protocols with identical tube current modulation settings (reference mAs, DRI or CareDose Index,  $n=11$ ). Phantom CTDIvol and  $D_w$  were calculated with imQuest<sup>3</sup>. The distributions of CTDIvol for different patient sizes from DoseTrack were compared with phantom-acquired CTDIvol data.

### RESULTS

Retrospective DRLs across hospitals (academic vs community) and vendors (Philips vs Siemens) were shown (Fig c,d), generally agree within BMI groups. Phantom scans with same protocols had lower CTDIvol across all patient sizes compared to local DRL. For Siemens, considerable agreement of median CTDIvol between predicted and reported was identified ( $3.4 \pm 1.8\%$  for academic,  $5.3 \pm 1.8\%$  for community). For Philips, maximum CTDIvol predicted was close to DRL reported median CTDIvol ( $9.1 \pm 5.7\%$  for academic,  $6.9 \pm 5.4\%$  for community).

### CONCLUSION

Size-specific CTDIvol estimated with Mercury phantom has considerable agreement with actual dose range of respective BMI population, with conversion of BMI and  $D_w$ . It is feasible to use size-specific phantom to estimate retrospective site-specific dose distribution, with proper optimization for different vendors and protocols.

### CLINICAL RELEVANCE/APPLICATION

Estimating CT dose range prospectively is crucial for imaging protocol optimization. Our findings suggest it is feasible to predict population patient-size-specific CTDIvol for tube-current modulated protocols using size-specific phantom.

## R5A-SPPH-3 Application of Deep Learning Image Reconstruction Algorithm to Reduce Radiation Dose in Brain CT Perfusion

Participants

Fang Wang, Yinchuan, China (*Presenter*) Nothing to Disclose

### PURPOSE

To improve the improvement of deep learning image reconstruction (DLIR) algorithm in CT perfusion (CTP) in suspected acute stroke.

### METHODS AND MATERIALS

Patients with suspected acute ischemic stroke were selected for CTP imaging. Scanning tube voltage was 80 kV and low dose current was set at 50 mA. Image reconstruction of low-dose scan data was performed using hybrid iterative reconstruction-40% (ASiR-V) and DLIR intensity (medium and high), respectively. Perfusion parameters were reconstructed for three sequential images: cerebral blood flow (CBF), brain volume (CBV) and mean passage time (MTT). Comparing the differences in parameter means and correlation of the 3 sequences. Objective evaluation and subjective evaluation (integral system) Image quality: objective evaluation mainly measures the CT value and noise of the lateral ventricle and middle cerebral artery during the peak period, calculates the signal-to-noise ratio (SNR) and contrast noise ratio (CNR); measurement data are expressed in the form of "median  $\pm$  quartile", and the objective score of the peak images of the three groups are compared. Differences between groups were compared by Friedman test and pairwise comparisons by Wilcoxon signed rank test with bonferroni correction, and  $P < 0.05$  was considered statistically significant.

### RESULTS

40% CBF and CBV differences for sir-v, DLIR-M in frontal, temporal, occipital and basal ganglia ( $36.5 \pm 12.3$  vs  $30.2 \pm 7.8$  vs  $33.6 \pm 9.4$ ,  $p < 0.001$ ) ( $2.5 \pm 0.4$  vs  $1.8 \pm 0.3$  vs  $2.1 \pm 0.5$ ,  $p < 0.001$ ), And the mean CBF and CBV in order from large to small: 40% Air-v >

DLIR-H> DLIR-M, Pairwise comparisons were statistically different ( $P < 0.05$ ). The three perfusion parameters of the DLIR sequence were correlated with 40% AIDS-v ( $P < 0.05$ ), and the CBF and CBV values (R values) for the 40% AR-v were higher (0.84,0.66) than the DLIR-M sequence (0.50,0.61). SD values in DLIR-M and DLIR-H arteries were lower than 40% Asia-v ( $P < 0.001$ ), with the highest SNR and CNR in the DLIR-H sequence ( $p < 0.001$ ).

## CONCLUSION

s DLIR-H can significantly improve the peak period image quality of low-dose cerebral CTP arteries, and the reconstructed perfusion parameters are better correlated with 40% Asia-v.

## CLINICAL RELEVANCE/APPLICATION

The DLIR reconstruction algorithm can improve the image quality of arterial vessels during the peak period without affecting the accuracy of perfusion parameters, and further validate that the reconstruction algorithm of DLIR-H is more suitable for intracranial vessels.

## R5A-SPPH-4 A Comparative Study on the Image Quality of Part-Solid Nodules in the Lung: Virtual Non-Contrast Imaging on Venous Phase Based on Dual Energy CT vs. True Non-Contrast Imaging Based on Single Energy

Participants

Jingjing Hong, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

This study explored the feasibility of using virtual non-contrast (VNC) images obtained from ultrafast synchronized KV/mA switching dual energy CT (DECT) in both pulmonary arterial and venous phase to evaluate part-solid nodules (PSN) in the lung, and compared their performance with true non-contrast (TNC) images.

## METHODS AND MATERIALS

46 Cases of Partial Solid Nodules with lung enhanced CT examination who underwent TNC scan and enhanced DECT scan (arterial and venous), and VNC images were reconstructed from DECT. The CT values, and standard deviation (SD) of the PSN and Ipsilateral erector spinae muscle (ESM), as well as diameter of lesion, were measured in VNC and TNC images. The signal-noise-ratio (SNR,  $CTSN/SDSN$ ) and ontrast-noise-ratio [CNR,  $(CTESM - CTPSN) / SDESM$ ] of PSN were calculated. Record the effective radiation dose in TNC and VNC mode. Two experienced radiologists subjectively assessed the IQ(image quality)of VNC and TNC images using a 5-point scale (1, poor; 2, fair; 3, moderate; 4, good; 5, excellent). Non-parametric test was used to compare the subjective and objective image parameters and effective radiation dose of images in different scanning phases. The Kappa test was used to assess consistency of subjective score between groups.

## RESULTS

There were no significant differences in The diameter , CT value, SD, SNR and CNR between TNC and VNC images in arterial/venous phase( $P > 0.05$ ). The TNC ( $4.79 \pm 0.33$ ) had the highest the subjective score, followed by VNC images ( $4.04 \pm 0.26$ ) in venous phase, with significant differences observed among the three groups ( $P = 0.015$ ), however, all scores were up to diagnosis requirements. The consistency of subjective scores between radiologists was strong ( $K = 0.72 \sim 0.73$ ). The effective radiation dose of VNC mode [ $(10.74 \pm 0.93)$  mSv] was lower than that of conventional mode [ $(15.21 \pm 1.89)$  mSv] ( $P < 0.001$ ), about 30% reduction.

## CONCLUSION

s Visual non-contrast on ultrafast synchronized KV/mA switching dual energy CT in venous phase can provide similar image quality to TNC, but the radiation dose is significantly reduced.

## CLINICAL RELEVANCE/APPLICATION

The ultrafast synchronized KV/mA switching dual energy enhanced venous phase VN technique can largely replace the conventional images, providing comparable image quality for patients with lung disease and significantly reducing patient radiation dose.

## R5A-SPPH-5 Clinical Value of Deep Learning Image Reconstruction in the Diagnosis of Pulmonary Nodule in Ultra-low Dose Chest CT

Participants

Zheng Zhijuan, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the image quality, lung nodule detectability and accuracy of quantitative analysis of deep learning image reconstruction (DLIR) and adaptive statistical iterative reconstruction-Veo (ASIR-V) in Ultra-low dose (ULD) CT for helping large-scale lung cancer screening in clinical.

## METHODS AND MATERIALS

102 patients required lung examination who underwent simultaneously non-contrast ULD CT and standard chest CT scan were included in this prospective study. Standard chest CT was reference standard using ASIR-V at 50% strength (50%ASIR-V). They are divided into two groups: ULD CT scanning were divided into two groups: ULD-CT (UL-A group,  $n = 46$ , 100 kVp and 50mA) using 50%ASIR-V and DLIR at high level (DLIR-H); ULD-CT (UL-B group,  $n = 56$ , 100 kVp and 30 mA) using 50%ASIR-V and DLIR-H. Radiologists detected and measured nodules. The size, maximum layer area, volume, maximum floor area, 3D long diameter, CT value and standard deviation (SD) of nodules were measured. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were to calculate. Two experienced radiologists were subjectively scored image quality and special morphological signs of partial pulmonary nodules using a 5-point method. The Difference between ULD and reference images were compared.

## RESULTS

304 nodules in 294 (96.71%) for UL-A group (50%ASIR-V and DLIR-H), 297 nodules in 280 (94.28%) for UL-B group (50%ASIR-V and DLIR-H) were detected. The detection rate of solid nodules of 99.59%, pure ground glass nodules of 84.48%, and partial solid nodules of 100% for UL-A group, and the detection rate of solid nodules of 97.19%, pure ground glass nodules of 78.26% and

partial solid nodules of 100% for UL-B group, respectively, with the same performance observed at different nodule types between 50%ASIR and DLIR. There were no differences in the size, CT value, SD, total volume, maximum layer area, and 3D long diameter of pure ground glass nodules and solid nodules and SNR in low-dose and standard-dose images for UL-A and UL-B group ( $p>0.05$ ). The DLIR-H images had significantly higher CNR of nodules, lower lung tissue noise than ASIR-V% images for UL-A and UL-B group (all  $P < 0.001$ ). There was no difference in the subjective score of overall image quality between ASIR-V and DLIR-H for UL-A and UL-B group ( $p>0.05$ ).

## CONCLUSION

s Compared with ASIR-V, DLIR-H can significantly improve image quality. The lung lesion measurements in ULD CT scan images based on DLIR reconstruction have high correlation and low difference with CT images of standard dose.

## CLINICAL RELEVANCE/APPLICATION

DLIR can reduce the noise of CT images and provide high image quality. Low-dose chest CT combined with DLIR is conducive to the wide clinical application under the condition of greatly reducing radiation dose.

## R5A-SPPH-6 Impact of the Third Generation and Deep Learning Iterative Reconstructions on Spatial Resolution with Dual energy CT-Dependency on Contrast and Dose

Participants  
Jimmy Zhou, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

The effects of third generation and deep learning iterative reconstruction (ASIR-V and DLIR) are non-linear. The degree of the impact may depend on the lesion contrast and radiation dose. The objective of this study was to quantify this impact in the context of spatial resolution versus noise reduction.

## METHODS AND MATERIALS

An anthropomorphic liver phantom was used. The liver contains various lesions of different contrast and shapes. The phantom was scanned using a GE Revolution CT at the dual-energy mode with CTDIvol of 14 mGy and 5.6 mGy (slice thickness 2.5 mm). ASIR-V from 0 to 100% and DLIR low, medium, and high were applied to images reconstructed using 70 keV. Thin rectangular regions of interest (ROI of 3 pixels width) were drawn across the boundary of the selected lesions and the horizontal profiles were obtained. The average slopes of the profiles were used as a metric delineating the lesion edge sharpness (a surrogate for spatial resolution). Meanwhile, the contrast-to-noise ratio (CNR) and noise suppression ratio (NSR), defined as the noise divided by noise at ASIR-V 0 of each lesion were also measured at both doses. For each lesion, the normalized edge sharpness was defined as the profile slope divided by the slope at ASIR-V 0 and CTDIvol of 14 mGy.

## RESULTS

The lesion edge sharpness was found significantly reduced at low dose (5.6 mGy). The application of ASIR-V and DLIR further reduced the sharpness albeit improving CNR, but DLIR enhanced the sharpness as compared with higher ASIR-V fractions (above 70%) with improved NSR. Furthermore, the effect of ASIR-V and DLIR depends on the contrast itself: the lower the contrast is, the more blurred the edge is. For the contrast higher than 70 HU, the edge blurring is much less. In addition, the noise suppression was also contrast dependent with the biggest suppression at lowest contrast.

## CONCLUSION

s The degree of spatial resolution loss was found to be dependent on the lesion contrast and radiation dose for a given ASIR-V fraction or DLIR strength. The noise suppression also increases as the contrast decreases. DLIR enhances the sharpness as compared with higher ASIR-V fractions (above 70%) with improved NSR.

## CLINICAL RELEVANCE/APPLICATION

Assist adequate use of iterative reconstructions for low contrast lesions

## R5A-SPPH-7 Assessment of Semi-automatic Whole-body Fat Quantification Using Ultra Low Dose CT Using Iterative and Artificial Intelligence-based Reconstruction in an In-vivo Swine Model: An Intra Individual Analysis

Participants  
Josephine Berger, Tuebingen, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the stability of semi-automatic body fat quantification in real low-dose swine CT scans using iterative and AI-based reconstruction.

## METHODS AND MATERIALS

Ten sedated swines received CT scans with fixed tube voltage and tube-current on the same 3rd generation dual-source scanner. Consecutive scans with reduced mAs to 50%, 25%, 10%, and 5% were performed. All scans were reconstructed using iterative reconstruction strength 2 (IR2) and a novel AI-based reconstruction algorithm (AIR), resulting in 10 datasets per swine. 100% IR2 served as the reference standard. Whole-body fat tissue volume was measured using threshold-based semi-automated segmentation (-200 HU to -40 HU). Total body fat volume, mean HU values and noise (standard deviation of HU) were extracted and compared via adequately corrected mixed-effects analysis.

## RESULTS

The volumetric segmentations were stable down to 25% ( $p=0.104$ ) using IR2 and down to 5% with AIR. Compared to the reference standard, mixed effects analysis showed stable CT values in both groups down to 10% mAs but significant HU bias at 5% IR2 ( $p<0.001$ ), while AIR results were still stable ( $p=0.136$ ). Both datasets had significantly increased image noise at lower radiation doses. Interestingly, 25% AIR produced similar noise to 100% IR2.

## CONCLUSION

s Body fat volume analysis is possible down to 25% radiation dose using conventional iterative reconstruction, although there is significantly higher image noise. AI-based reconstruction mitigates this limitation at the same dose level by enabling comparable noise levels to 100% IR2. Furthermore, AI-based reconstruction preserves CT values and volumetric results better than iterative reconstruction at only 5% mAs.

#### **CLINICAL RELEVANCE/APPLICATION**

In conclusion, our study strongly suggests that by employing AI-based reconstruction, accurate semi-automated quantification of adipose tissue volume can be accomplished with minimal radiation exposure to the patient, thus further empowering CT as a valuable tool in body composition analysis.

#### **R5A-SPPH-8 Impact of the Tube Start Angle on Patient Dose in Single and Dual Source Spiral CT**

Participants  
Edith Baader, Heidelberg, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To determine the radiation dose in single source CT (SSCT) and dual source CT (DSCT) scans as a function of tube start angle and spiral pitch value to identify the dose reduction potential by selecting the optimal start angle.

#### **METHODS AND MATERIALS**

Previous studies have shown that dose to certain radiosensitive organs in spiral CT scans could substantially be reduced by optimizing the tube start angle [MedPhys 36: 5654-5664, 2009][MedPhys 38(6):3177-85, 2011]. This applies particularly to small peripheral organs. This study investigates the impact of the tube start angle on the effective dose as a measure of the overall radiation risk. Furthermore, in addition to SSCT systems with constant tube current (noTCM) as in the previous studies, also today's standard tube current modulation minimizing the mAs-product (mAsTCM) and DSCT systems were considered. Using Monte Carlo simulations, dose values for different tube positions with an angular increment of 10° and a longitudinal increment of 5 mm were simulated in the thorax region of six adult patients based on clinical CT data. The thorax region was chosen as short scan times and thus high pitch values are particularly relevant in this body region; in total, dose simulations were performed over a scan range of 35 cm with a collimation of 38.4 mm. From the resulting dose distributions, organ doses and effective dose were determined as a function of tube angle and longitudinal position. Using these per view dose data, the individual organ doses, as well as the total effective dose, were determined for spiral scans with (mAsTCM) and without (noTCM) tube current modulation with pitch values ranging from p=0.5 to 1.5 for SSCT and up to p=3.0 for DSCT. The dose reduction of the optimal start angle relative to the worst start angle in terms of dose was determined.

#### **RESULTS**

Dose reductions for single organs are highly organ-specific. While the tube start angle affects the lung dose less than 5%, higher variations occur e.g. for the dose to the thyroid gland and the stomach. The impact of mAsTCM depends on the organ and the pitch value; however, the dose reductions are in the same order of magnitude. For the effective dose, dose reductions of up to 7% for SSCT and up to 20% for DSCT can be achieved in particular for high pitch values when selecting the optimal start angle for the simulated patients.

#### **CONCLUSION**

s Variation of the tube start angle in spiral scans exhibit substantial differences in radiation dose for high pitch values. Vendors should provide a method to automatically select the optimal scan start angle to minimize patient risk.

#### **CLINICAL RELEVANCE/APPLICATION**

By controlling the start angle in spiral scans, radiation dose to various organs and effective dose and thus patient risk can be significantly reduced.

#### **R5A-SPPH-9 Fetal Doses in the Most Frequent Diagnostic Radiology Procedures in a Pregnant Patient: Results of In-phantom Measurements**

#### **PURPOSE**

Emergencies during pregnancy do happen! Cardio/cerebrovascular, urologic, GI emergencies and trauma can be singled out. The medical team may be in doubt when choosing proper diagnostic imaging that uses ionizing radiation, potentially causing a delay in diagnosis and treatment. The purpose of this research was to experimentally measure the dose to the fetus during diagnostic imaging and fluoroscopy-guided minimally invasive procedure on a newly developed, anthropomorphic phantom of a pregnant female.

#### **METHODS AND MATERIALS**

A Tena phantom, representing a pregnant female in 2nd trimester, was scanned with imaging modalities that use ionizing radiation (Figure 1). Appropriate protocols for probable clinical emergencies in pregnant females were used: NC CT and CTA in stroke protocol, DSA in ischemic stroke endovascular treatment, PA CTA, trauma CT, abdomen/pelvis NC CT, abdominal radiography and fluoroscopy in nephrostomy placement. RPL dosimeters were placed in the fetal head and body, placenta and adjacent structures of interest, and experimental measurements were performed.

#### **RESULTS**

The highest measured doses in the fetal head and body were recorded in the trauma CT and abdomen/pelvis NC CT. 34,7 mGy and 23,7 mGy were measured in the head, and 32,5 mGy and 19,6 mGy in the body. In all other scanning protocols, the dose to the fetal head and body did not exceed 2 mGy.

#### **CONCLUSION**

s For most imaging scenarios, measured fetal doses were below 2 mGy except in scanning protocols where the fetus was in the field of direct ionizing radiation. The highest measured dose to the fetal head of 34,7 mGy in the performed WBCT was below 50 mGy and well below the 100 mGy recommended by the ICRP above which the deterministic effects on the developing fetus rise. The measured fetal doses for all clinical scenarios are consistent with published data. It should be kept in mind that the fetus in a developed phantom is with its head faced cranially. As fetuses in 2nd trimester are freely movable in the uterus, in a different

position, measured doses could be even lower. The research has limitations as it can be seen as a case report. Patient-specific physical phantoms and computational models are time-consuming and matching anthropomorphic physical phantoms to the size and location of the fetus within the maternal body is almost impossible. This is the reason why faster methods are used for fetal dose estimation in clinical practice. Such methods usually use typical doses from references or use one of a number of available dosimetry software.

#### **CLINICAL RELEVANCE/APPLICATION**

Although there have been guidelines that state how it is possible to carry out imaging diagnostics based on ionizing radiation in pregnant women, their application may still cause anxiety to some radiologists.

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## Abstract Archives of the RSNA, 2023

R5A-SPVA

### Vascular Imaging Thursday Poster Discussions I

#### Sub-Events

#### **R5A-SPVA-1 The Application Value of Black Blood Imaging Based on CT Flexible Subtraction Technology in Carotid Artery**

##### **PURPOSE**

The CT black blood images may potentially offer more insightful information. In this study, we utilized MR vessel wall imaging of carotid arteries as a gold standard to investigate the improvement effect of carotid soft plaque image quality in CT black blood images.

##### **METHODS AND MATERIALS**

After carotid artery CT angiography (CTA) examination, the images underwent reverse flexible contrast enhancement and CE-BOOST technology to achieve CT black blood. The study was divided into four groups, with Group A being the cervical artery CTA examination group, Group B being the CTA delayed scan group, Group C being the CT black blood group with image reconstruction after 4 minutes and 30 seconds of delay, and Group D being the MR vascular wall imaging group. The subjective evaluation score was 5 points, analyzing multiple dimensions such as the lumen display's clarity, the vessel wall's sharpness, and the presence of plaques. The objective scoring was conducted on the neck artery CTA images, CTA delayed scanning group, and CT black-blood group. The evaluation was based on the SD value of the cervical artery plaque lesion adjacent to the sternocleidomastoid muscle,  $CNR=CT_{lumen}-CT_{sternocleidomastoid\ muscle}/SD_{sternocleidomastoid\ muscle}$ , and  $SNR=CT_{lumen}/SD_{lumen}$ . We conducted the one-way ANOVA, the non-parametric test and Kappa analysis for subjective evaluation score, with  $p<0.05$  indicating a statistically significant difference.

##### **RESULTS**

The study included a total of 20 patients, of whom 12 were male and 8 were female, with an average age of 63 years. The differences in BMI (23.3 vs. 23.5 vs. 24.0) were not statistically significant ( $p<0.05$ ). Objective scoring: in the comparison between groups A, B, and C, group A showed advantages in CNR ( $88.64\pm 30.14$  vs.  $3.74\pm 3.85$  vs.  $-50.25\pm 15.44$ ,  $p=0.000$ ) and in SNR ( $61.27\pm 27.60$  vs.  $6.99\pm 3.91$  vs.  $-19.50\pm 6.91$ ,  $p=0.000$ ); there was no statistically significant difference in SD values ( $5.29\pm 1.34$  vs.  $5.28\pm 2.36$  vs.  $3.96\pm 1.24$ ,  $p=0.487$ ). Subjective scoring: group D > group C > group A > group B, (4.8 vs. 4.3 vs. 4 vs. 3.6,  $p=0.025$ ).

##### **CONCLUSION**

Flexible contrast-enhanced cervical artery CT black blood imaging has a high diagnostic value with a transparent vessel wall and plaque morphology display. Its diagnostic value is superior to conventional CTA scans. Therefore, we recommend adding a delayed scan with flexible contrast-enhanced CT black blood imaging during cervical artery CTA scanning.

##### **CLINICAL RELEVANCE/APPLICATION**

The CT black-blood imaging technology of the carotid arteries enables clear visualization of the anatomy and structure of the vessel wall, overcoming the limitations of traditional carotid CTA. Compared with MR vascular wall imaging, CT black-blood imaging of the carotid arteries also has good diagnostic value.

#### **R5A-SPVA-2 Performance of an Artificial Intelligence Algorithm for Quantifying the Maximum Thoracic Aortic Diameter in Patients with Aortic Pathologies**

Participants

Nicola Fink, MD, Munich, Germany (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Given the high mortality associated with acute aortic events, early detection and appropriate monitoring of aortic dilatation and aneurysm are crucial. However, accurate follow-up CT measurements remain tedious and time-consuming. In this context, artificial intelligence (AI) reduces missed findings and inter-/intra-reader variability. However, most studies evaluated this at predefined landmarks only, which may not necessarily correspond to the largest diameter. This study aimed to assess the performance of a deep neural network (DNN)-based algorithm in quantifying aortic diameters at the most dilated location in a heterogeneous population.

##### **METHODS AND MATERIALS**

A total of 100 patients (67.2 [56.0-73.4] years; 60.0% male) with thoracic aortic dilatation/aneurysm were scanned according to institutional CT protocols. Nearly two third of the included patients ( $n=62$ ) had pathologic findings of the thoracic aorta due to prior repair ( $n=29$  surgical;  $n=17$  endovascular;  $n=10$  both) and/or aortic dissection ( $n=42$ ). Segmentation and measurements of the thoracic ascending (AA) and descending Aorta (DA) were performed on non- and contrast-enhanced CT scans using a combination of multiple DNN models which were previously trained on 1582 CT datasets. All measurements were compared to manual measurements performed by two radiologists, overall as well as in the following subgroups: 1) AA vs. DA; 2) non-obese vs. obese patients ( $BMI=30\text{kg}/\text{m}^2$ ); 3) patients without vs. with aortic repair; 4) patients without vs. with aortic dissection.

## RESULTS

Mean AI-based automated and manual diameters significantly differed (non-contrast: 40.9mm [37.3-48.2] vs. 42.9mm [38.9-50.0],  $p<0.001$ ; contrast-enhanced: 40.9mm [37.3-48.2] vs. 40.3mm [36.6-46.9],  $p<0.01$ ) but showed excellent correlation and agreement ( $r>0.85$ ;  $ICC>0.9$ ). Depending on the subgroup, automated and manual values were similar in the AA but significantly different in the DA ( $p<0.001$ ), similar in obese but significantly different in non-obese patients ( $p<0.01$ ), and similar in patient without aortic repair or dissection but significantly different in patients with such pathological conditions of the aorta ( $p<0.001$ ). However, in all subgroups automated diameters showed strong correlation and excellent agreement with corresponding manual values ( $r>0.84$ ;  $ICC>0.9$ ).

## CONCLUSION

s This DNN-based algorithm enables accurate automated assessment of the largest aortic diameter in a heterogenous patient population with various aortic pathologies.

## CLINICAL RELEVANCE/APPLICATION

By showing high agreement with manual measurements, this algorithm offers the possibility to support radiologists in clinical practice, thus increasing efficiency, with good results even in a heterogenous population.

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## Abstract Archives of the RSNA, 2023

R5B-SPBR

### Breast Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPBR-1 Comparison of Advanced Breast Cancers by Ethnicity: Digital Breast Tomosynthesis versus Digital Mammography**

##### Participants

Liane E. Philpotts, MD, Madison, CT (*Presenter*) Nothing to Disclose

##### PURPOSE

Increasing early detection of nonlethal breast cancers is the main function of screening. Advanced cancers - characterized by larger size, lymph node involvement, or aggressive molecular subtypes - are those that carry a worse prognosis. Our prior data demonstrated a significant decrease in the rate of advanced cancers with digital breast tomosynthesis (DBT) screening compared with 2D full-field digital mammography (DM). The purpose of this study was to examine how the rate of advanced cancers varied with patient race/ethnicity.

##### METHODS AND MATERIALS

Our detailed database of 1407 breast cancers (142 DM, 1265 DBT) was analyzed over 13 years (DM 2008-2011, DBT 2011-2021) of screening with DBT was analyzed. Advanced cancers were defined by TMIST criteria (invasive cancers >2cm, HER2+ or triple negative cancers >1cm, one or more positive axillary lymph nodes, distant organ spread). The rates of advanced compared with non-advanced cancers were assessed by patient race/ethnicity. Statistical analysis was performed using unpaired T-tests and Chi Square with  $p < 0.05$  considered significant.

##### RESULTS

Of 1265 DBT cancers, race/ethnicity data was available in 1246 (98.5%) and was as follows: 935 (75%) White, 177 (14%) Black, 73 (6%) Hispanic, 28 (2%) Asian, 33 (3%) other. Of 968 invasive cancers, the ethnicity data was available in 952 (98.3%): 732 (77%) White, 129 (14%) Black, 45 (5%) Hispanic, 18 (2%) Asian, 28 (3%) other. Of the 968 invasive cancers, 316 (32.6%) were considered advanced. The rate of advanced to non-advanced invasive cancers was not significantly different by ethnic group, although it trended higher among Black and Asian patients: White 230/732 (31.4%), Black 47/129 (36.4%), Hispanic 14/45 (31.1%), Asian 7/18 (38.9%), Other 8/28 (28.6%). Similarly for the DM cohort, no significant differences were noted in the rates of advanced cancers between ethnic groups: White 23/58 (39%), Black 9/15 (60%), Hispanic 3/9 (33%), Asian 1/3 (33%), other 7/14 (50%). However, when comparing the rates between DBT and DM, significant reduction was noted in the White and Black groups: White 31.1% vs 39% and Black 36.4% vs 60%, DBT vs DM respectively ( $p < 0.07$ ).

##### CONCLUSION

s With DBT, advanced cancers rates varied slightly among ethnic groups but overall was not significantly different. However, when compared to DM screening, advanced cancers were significantly reduced in the White and Black populations.

##### CLINICAL RELEVANCE/APPLICATION

Screening with DBT helps reduce advanced cancers, particularly in the White and Black/African American populations.

#### **R5B-SPBR-2 Ultrasound-based Radiomics for Early Predicting Response to Neoadjuvant Chemotherapy in Patients with Breast Cancer: A Systematic Review with Meta-analysis**

##### PURPOSE

This study aimed to evaluate the diagnostic accuracy of ultrasound imaging (US)-based radiomics for early prediction of response to neoadjuvant chemotherapy (NAC) in breast cancer patients.

##### METHODS AND MATERIALS

We systematically searched PubMed, Embase, Cochrane Library, and Web of Science databases up to 1 January 2023 for eligible studies. The methodological quality of the included studies was assessed using the Diagnostic Accuracy Study Quality Assessment 2 (QUADAS-2) and Radiomics Quality Score (RQS) tools. We performed meta-analyses to summarize the diagnostic efficacy of US-based radiomics on response to NAC in breast cancer patients.

##### RESULTS

Eight studies proved eligible. Eligible studies had an average RQS score of 12.88 (35.8% of the total score), with RQS score ranging from 8 to 19. Most studies demonstrated the unclear or low risk of bias in the domains of QUADAS-2. In the meta-analyses, the pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio were 0.87 (95% CI: 0.81 - 0.92), 0.78 (95% CI: 0.72 - 0.83), 4.02 (95% CI: 3.18 - 5.08), 0.16 (95% CI: 0.10 - 0.25), and 25.17 (95% CI: 15.10 - 41.95), respectively. Results from subgroup analyses showed that prospective studies appeared to have better sensitivity than retrospective studies. Sensitivity analyses showed similar results to our primary analyses.



## CONCLUSION

s US-based radiomics could be considered an important adjuvant method to evaluate the response of breast cancer to NAC. However, more multicenter prospective studies are needed to further validate our conclusions and explore better radiomics algorithm models.

## CLINICAL RELEVANCE/APPLICATION

Our results suggested that US-based radiomics can be used as an important adjuvant method to evaluate the response of breast cancer to NAC, based on its good diagnostic performance.

## R5B-SPBR-3 Breast Ultrasound Optimization Training for Radiology Residents Utilizing an Interactive Online Module

### PURPOSE

The primary goal of the project was to create an interactive online learning module to teach breast ultrasound optimization to radiology residents and then assess whether the learning module was effective at teaching these concepts to radiology residents.

### METHODS AND MATERIALS

An on-line interactive module teaching concepts of breast ultrasound optimization was created by the lead author utilizing Articulate Storyline 3 Software. The on-line module included navigational toolbars, clickable parameters, and real breast ultrasound examples illustrating concepts of breast ultrasound optimization. Residents were assigned an anonymous study identification number. Participating radiology residents first filled out an on-line questionnaire asking them to rate their subjective breast ultrasound optimization knowledge. They then completed an on-line pre-test consisting of 24 multiple choice questions. Then, participants engaged in the interactive online training module. After completing the online training module, participants completed an online post-test (same questions as the pre-test). They also then completed a questionnaire rating new subjective breast ultrasound optimization knowledge and a questionnaire rating the effectiveness of the training module.

### RESULTS

Overall pre-test mean test scores were 54.4 +/- 4.4% and overall post-test mean scores were 78.9 +/- 3.4%. The mean score significantly improved between the pre-test and post-test by 24.4% (95% CI: [14.2%, 34.6%], P=0.0002). The mean subjective knowledge score significantly improved between the pre-test and post-test by 1.4 (95% CI: [0.9,1.9], P less than 0.0001). Subjective satisfaction with the effectiveness of the module was high: 4.4 +/- 0.2 out of 5.

## CONCLUSION

s This study suggested that an interactive online module could be effective at teaching concepts of breast ultrasound optimization to radiology residents and that learners found it to be a useful activity.

## CLINICAL RELEVANCE/APPLICATION

A breast ultrasound must be properly optimized to avoid errors in interpretation and management. Therefore, radiologists who perform breast ultrasound exams must be proficient at recognizing suboptimal images and be familiar with techniques used to optimize the breast ultrasound image. However, there is no formal program to teach these skills to radiology residents at our institution. In addition, it can be difficult to cover all of the detailed concepts of breast ultrasound optimization during a busy clinical day when scanning time and faculty teaching time can be limited. Online interactive modules can be helpful to teach such concepts allowing flexibility of learning.

## R5B-SPBR-5 Comparison of Automated Breast Ultrasound and Hand-held Breast Ultrasound in Preoperative Evaluation of Early-stage Breast Cancer: A Multicenter Prospective Study

### Participants

Ji Soo Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

To compare automatic breast ultrasound (ABUS) and hand-held breast ultrasound (HHUS) as an adjunct to full-field digital mammography (FFDM) for the preoperative evaluation of local tumor extent in women with newly diagnosed early-stage breast cancers

### METHODS AND MATERIALS

This multicenter prospective study included consecutive women with early-stage breast cancers (clinical Tis, T1-2/N0) treated by surgery who had undergone ABUS and HHUS adjunct to FFDM for preoperative local tumor staging between Oct 2019 and Apr 2021. Radiologists independently sought the index cancer and additional ipsilateral and contralateral cancers using ABUS plus FFDM (ABUS/DM) or HHUS plus FFDM (HHUS/DM). Pathologic diagnoses of all suspected lesions were used as reference standards. Sensitivity and specificity obtained for ABUS/DM and HHUS/DM were compared. Noninferiority of ABUS/DM was assessed in sensitivity at a margin of 5%.

### RESULTS

A total of 659 women (mean age, 50.5 years  $\pm$  9 [SD]) were included in the study. Seventy-nine women (12.0%, 79/659) exhibited additional cancers: 64 additional ipsilateral cancers (51 multifocal and 13 multicentric) and 15 contralateral cancers. For index cancers, both ABUS/DM and HHUS/DM showed sensitivities of 100%. ABUS/DM showed non-inferior sensitivity to HHUS/DM for additional ipsilateral cancers (71.9% [46/64] vs. 75.0% [48/64]; P=0.617) and higher sensitivity than HHUS/DM for contralateral cancers (86.7% [13/15] vs. 60.0% [9/15]; P=0.046). Specificities were not significantly different between ABUS/DM and HHUS/DM for both additional ipsilateral cancers (97.7% [581/595] vs. 97.0% [577/595]; P=0.317) and contralateral cancers (97.8% [630/644] vs. 98.3% [633/644]; P=0.467).

## CONCLUSION

s ABUS/DM showed non-inferior sensitivity to HHUS/DM with similar specificity in diagnosing additional ipsilateral and contralateral breast cancers in women with early-stage breast cancers Thus, ABUS may be used as an alternative to HHUS as a preoperative staging tool for early-stage breast cancer.

## CLINICAL RELEVANCE/APPLICATION

There is limited literature on ABUS for preoperative evaluation of newly diagnosed breast cancer patients. ABUS may be used as an alternative to HHUS as a preoperative staging tool for early-stage breast cancer, for whom preoperative axillary US is not essential.

### R5B-SPBR-6 Using Artificial Intelligence To Assess The Risk Of Malignancy In Breast Lesions Identified On Second-Look Ultrasound

#### Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Rachel Cruz, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the results of an artificial intelligence (AI) algorithm-based software for predicting the risk of malignancy in breast lesions identified on second-look ultrasound.

#### METHODS AND MATERIALS

This was a retrospective and single-center study, approved by the Institutional Review Board, which evaluated 628 second-look ultrasound examinations performed between January and December 2022 at a reference cancer center. 486 cases were excluded because they did not have had prior magnetic resonance imaging (MRI) or biopsy performed in the same institution, or because no corresponding lesion was found on second-look ultrasound. MRI and ultrasound features were classified according to the BI-RADS lexicon criteria. Subsequently, the images were analyzed using Koios DS Breast software (Koios Medical, USA). The software results were divided into: benign or probably benign (BIRADS 2/3), low or intermediate suspicion (BIRADS 4A/4B), high suspicion or probably malignant (BIRADS 4C/5). The histopathological result was considered the gold standard.

#### RESULTS

164 lesions from 142 patients were included. The mean age of the patients was 48 years (21-78 years) and the mean mass size on ultrasound was 17 mm (3-70 mm). At MRI, 25 lesions (15.2%) were classified as BIRADS 3, 120 (78.0%) as BIRADS 4, and 11 (6.7%) as BIRADS 5. At ultrasound, there were 93 masses (56.1%) and 72 non-mass findings (43.9%), of which 15 lesions (9.1%) were classified as BIRADS 3, 141 (86.0%) as BIRADS 4, and 8 (4.9%) as BIRADS 5. Analysis using the software classified 23 lesions (14.0%) as BIRADS 2/3, 113 (68.9%) as BIRADS 4A/4B, and 28 (17.1%) as BIRADS 4C/5. Core needle biopsy was performed in 129 (78.7%) and vacuum-assisted biopsy in 35 (21.3%), which yielded 131 (79.9%) benign histologic findings (24 with associated atypia) and 33 (20.1%) malignant results. None of the lesions classified as BIRADS 2/3 using the software were malignant, while 2 lesions classified as BIRADS 3 on MRI and 1 lesion classified as BIRADS 3 on ultrasound were malignant. The predictive positive value (PPV) of lesions classified as BIRADS 4A/4B and BIRADS 4C/5 by the software were 17.7% and 46.4%, respectively.

#### CONCLUSION

The AI software demonstrated high sensitivity to predict the risk of malignancy in lesions identified on second-look ultrasound, contributing to a more accurate indication of percutaneous biopsies. It can be used to avoid unnecessary biopsies in lesions classified as benign or probably benign (BIRADS 2/3).

## CLINICAL RELEVANCE/APPLICATION

AI can be used to predict the risk of malignancy in lesions identified on second-look ultrasound, and to avoid unnecessary biopsies.

### R5B-SPBR-7 Multimodal Artificial Intelligence (AI) in Diagnostic Imaging: Added Value of Breast Ultrasound (US) in Symptomatic Patients

#### Participants

Beatriu Reig, MD, MPH, New York, NY (*Presenter*) Nothing to Disclose

#### PURPOSE

The purpose of this study was to explore the accuracy of US alone, full-field digital mammography (FFDM) and/or digital breast tomosynthesis (DBT) alone, and multimodal AI in the diagnostic evaluation of the symptomatic patient.

#### METHODS AND MATERIALS

In this retrospective and IRB-approved study, our IRB-approved multimodal AI system included full-field digital mammography (FFDM), digital breast tomosynthesis (DBT) and hand-held breast ultrasound (US) examinations performed 2010-2020, with 1,964,416 exams in 324,978 patients. We used a patient-based training/validation/testing split of 60%/10%/30%. Our test set consisted of 1371 women (1490 exams) who underwent both diagnostic FFDM or FFDM/DBT with targeted ultrasound for a symptomatic indication (pain, palpable area of concern, nipple discharge). Accuracy of the AI system was evaluated for malignancy for DBT/FFDM alone, US alone, and multimodal AI by calculating AUROC, sensitivity, specificity, PPV and NPV. Cancer types (pathology-confirmed within 120 days of the imaging) detected by DBT/FFDM alone, US alone, and multimodal AI were compared. We dichotomized AI's probabilistic predictions into biopsy vs. no biopsy decisions by matching the clinical biopsy rates. Specificity was therefore standardized across categories.

#### RESULTS

Of 1,371 patients who underwent same day diagnostic FFDM/DBT and US (average age 54.4, standard deviation 11.63), the AI model AUROC for breast cancer detection was 0.956 for multimodal AI, 0.864 for FFDM/DBT only, and 0.944 for US only. Sensitivity was 89.2% (58/65 cancers) for multimodal, 60% (39/65) for FFDM/DBT only, and 84.6% (55/65) for US only. 61.6% (845/1371) of women had dense breasts. For women with dense breasts, AUROC was 0.98 for multimodal, 0.848 for FFDM/DBT only, and 0.963 for US only, with sensitivity of 92.7% (38/41), 58.5% (24/41) and 92.7% (38/41). For women with non-dense breasts, AUROC was 0.919 for multimodal, 0.895 for FFDM/DBT only, and 0.900 for US only, with sensitivity of 83.3% (20/24), 62.5% (15/24) and 70.8% (17/24). 4.61% (3/65) cancers were in women under 40. For women under 40, multimodal AUC=0.982, FFDM/DBT AUC=0.894, US=0.994.

#### CONCLUSION

A multimodal AI system showed higher performance for breast cancer detection in symptomatic diagnostic evaluations than

FFDM/DBT or US models, including women with both dense and non-dense breasts. An US-only model outperformed other models for women < 40.

#### **CLINICAL RELEVANCE/APPLICATION**

Diagnostic workup in symptomatic patients often requires both mammography and ultrasound. Use of multimodal AI in the diagnostic breast cancer setting improves cancer detection regardless of breast density.

### **R5B-SPBR-8 Comparison of Screening Recall Rates When Automated Breast Ultrasound is Coupled or Uncoupled with Screening Mammogram**

#### **PURPOSE**

To compare the screening recall rates (RR) for women with dense breast tissue who underwent automated breast ultrasound (ABUS) either as a coupled exam following same day screening mammogram or at a future date within the one-year screening interval.

#### **METHODS AND MATERIALS**

This single-institution retrospective review included women aged 35-90 with heterogeneously dense or extremely dense breast tissue who had a screening mammogram from June 2016 to June 2021 and an ABUS within the one-year screening interval. The RR for patients who underwent screening mammogram coupled with ABUS on the same day were compared to the RR for those who had screening mammogram followed by ABUS 1-364 days later. Cancer detection rates (CDR) between the two groups were also compared.

#### **RESULTS**

A total of 5,813 screening mammograms were performed on patients who met inclusion criteria. The study population RR was 2.5% (147/5,813) for mammogram and 4.3% (249/5,813) for ABUS, with a CDR of 5.3/1,000 (31/ 5,813). Of the 5,813 patients, same day ABUS was performed on 3,347 (58%) and 2,466 (42%) underwent ABUS 1-364 days following mammogram. The combined RR for the coupled screening mammogram and ABUS group was 5.9% (196/3,347) with 3.1% (105/3,347) RR on mammogram, 3.4% (114/3,347) RR on ABUS, and CDR of 4.2/1,000 (14/3,347). For mammogram and ABUS performed independently, the mammogram RR was 1.7% (42/2466) and the ABUS RR was 5.5% (135/2466), with a CDR of 6.9/1,000 (17/2,466). There was a statistically significant difference in the combined RR of coupled mammogram and ABUS compared to mammogram performed independent of ABUS ( $p<0.0001$ ), between coupled and uncoupled mammogram ( $p=0.0008$ ), and between coupled and uncoupled ABUS ( $p=0.0002$ ). There was no statistically significant difference in CDR between the coupled and uncoupled groups ( $p=0.2223$ ).

#### **CONCLUSION**

s Mammogram and ABUS interpreted as a same day, coupled exam increases both the individual mammogram RR and the combined mammogram/ABUS RR. Conversely, the ABUS RR is lower when ABUS is interpreted as a coupled exam compared to ABUS uncoupled from mammography. There is no statistically significant difference in CDR when ABUS is coupled or uncoupled with screening mammogram.

#### **CLINICAL RELEVANCE/APPLICATION**

This study supports scheduling of ABUS according to patient preference or optimal practice workflow as there is no overall screening outcomes benefit to preferential scheduling of ABUS as a coupled or uncoupled exam.

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## Abstract Archives of the RSNA, 2023

R5B-SPCA

### Cardiac Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPCA-1 Simultaneous Single-breathhold Cardiac T1, T2, T2\*, and Fat Fraction Mapping with Rosette MR Fingerprinting**

##### Participants

Evan Cummings, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### PURPOSE

In this work, we present a method for mapping cardiac T1, T2, T2\*, and fat fraction during a single breathhold acquisition. Quantitative MRI can be used to diagnose and evaluate a wide range of cardiac pathologies: T1 mapping for myocarditis, myocardial infarction, and myocardial amyloidosis<sup>1</sup>; T2 mapping for myocardial edema injury<sup>1</sup>; T2\* mapping for iron deposition<sup>2</sup>; and fat fraction mapping to determine fat content of the myocardium<sup>3</sup>. MR Fingerprinting (MRF) is a method for rapidly measuring multiple tissue properties, including T1 and T2<sup>4,5</sup>. MRF data can be collected along a rosette trajectory<sup>6</sup>, a multi-echo trajectory which has previously been used in cardiac applications to map T2\*<sup>7</sup> and fat fraction<sup>8</sup>. In this work, MRF with the rosette trajectory is extended to enable T1, T2, T2\*, and fat fraction mapping in a single breathhold.

##### METHODS AND MATERIALS

A healthy volunteer was scanned on a 1.5T MAGNETOM Sola (Siemens Healthineers, Erlangen, Germany) using a breathheld 15 heartbeat ECG-triggered sequence with the following parameters: TR=20.41 ms, TE=0.84 ms, variable flip angles up to 20°, 1.6x1.6x8mm voxel size, 300x300 mm<sup>2</sup> FOV, with multiple inversion and T2 preparation pulses. Data were acquired with a 23 lobe rosette with an 18.5 ms readout and 0.8 ms echo spacing. Images were reconstructed using an iterative approach with a cluster-based sparsity regularizer. T1 and T2 values were mapped using pattern matching<sup>4</sup>, T2\* values were calculated by fitting decay curves along the rosette echo images<sup>7</sup>, and fat fraction was extracted using Hierarchical IDEAL<sup>9</sup>. The technique was validated in phantoms for accuracy. Volunteer reference T1, T2, and T2\* maps were collected using Siemens Myomaps sequences.

##### RESULTS

Mean myocardial measurements were: T1= 1137±102 ms, T2= 44.5±7.8 ms, T2\*= 22.4±5.0 ms, PDFF= 3.6±3.7%. Rosette MRF T1 values are higher than published MOLLI T1 values<sup>10</sup>, and T2 values are lower than published T2-prep bSSFP values<sup>11</sup>, similar to prior MRF studies<sup>5,8</sup>. T2\* and PDFF values agree with published literature<sup>3,4</sup>.

##### CONCLUSION

s Rosette MRF can be used to simultaneously map T1, T2, T2\*, and fat fraction in the heart in a single-breathhold acquisition. References: 1. Messroghli DR et al. JCMR 2017 2. Triadyaksa P et al. JMRI 2020 3. Ng ACT et al. Circ Cardiovasc Imaging 2018 4. Ma D et al. Nature 2013 5. Hamilton J et al. MRM 2017 6. Noll D IEEE Trans Med Imaging 1997 7. Bush AM et al. JMRI 2020 8. Liu Y et al. Front Cardiovasc Med 2022 9. Tsao J Jiang Y. MRM 2013 10. Dabir D et al. JCMR 2014 11. Hanson CA et al. Radiology 2020

##### CLINICAL RELEVANCE/APPLICATION

We present a method for mapping cardiac T1, T2, T2\*, and fat fraction in a single breathhold acquisition with the aim of reducing patient scan times while providing comprehensive quantitative information for myocardial assessment.

#### **R5B-SPCA-2 To Investigate the Enhancement Effect Between High and Low Concentration Contrast Medium in Coronary Computed Tomography Angiography (CCTA).**

##### PURPOSE

To investigate the enhancement effect between high and low concentration contrast medium in coronary computed tomography angiography (CCTA)

##### METHODS AND MATERIALS

A total of 163 patients suspected of coronary disease (CAD) were randomly assigned into two groups with different contrast concentrations, 25mgI/kg/s injection rate for 10s. A high concentration contrast medium (Iomeprol, 400mgI/ml) was used in group A (n=85), while a lower concentration one (Iohexol, 350mgI/ml,) was used in group B (n=78). All patients were scanned with free breathing with a fixed tube voltage of 100 kVp, smart mA with tube current range from 320 to 720 mA. 50% adaptive statistical iterative reconstruction (ASIR-V50%) was used for the pre-scan dose adjustment and post-scan reconstruction. All CT images were reviewed in randomized order by two experienced radiologists blinded to scan and contrast protocol. Both quantitative measurements including CT value, standard deviation (SD), signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) and subjective scores (1-5) were obtained and compared between the two groups.

##### RESULTS

There was no significant difference in gender, age, body mass index (BMI), heart rate and radiation dose between the 2 groups (all P value >0.05). Both quantitative measurements (CT value, SD,SNR and CNR) and subjective scores were also similar between the

two groups ( $P>0.05$ ). However, there were statistically significant difference in contrast medium dosage and flow rate between the two groups ( $P$  value was 0.000 and 0.001, respectively). The low concentration contrast medium group had statistically higher in contrast medium dosage and flow rate than the high concentration contrast medium group [ $43.34\pm 8.35$  vs  $49.01\pm 8.50$ ml;  $4.2\pm 0.7$  vs  $4.6\pm 0.5$ ] ( $P$  value was 0.000 and 0.001, respectively).

## CONCLUSION

Under the premise of maintaining the same contrast agent injection scheme, there is no significant difference in image quality and radiation dose between high and low contrast agents with different concentrations, but under the condition of constant total iodine, high concentration contrast agent can achieve a relatively low injection rate.

## CLINICAL RELEVANCE/APPLICATION

High concentration contrast agent but with low injection rate can be applied in coronary computed tomography angiography.

## R5B-SPCA-3 Zero-Contrast Imaging for the Assessment of Transcatheter Aortic Valve Implantation in Candidates with Renal Dysfunction

Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## PURPOSE

Candidates for transcatheter aortic valve implantation (TAVI) are currently evaluated using computed tomography angiography and invasive cardiac catheterization as an essential part of case selection and pre-procedure interventional planning. However, both imaging methods utilize iodinated agents, which may cause contrast-induced nephropathy, particularly in patients with baseline renal dysfunction. This study aimed to describe a zero-contrast imaging protocol for pre-TAVI evaluation in patients with advanced renal impairment.

## METHODS AND MATERIALS

The pre-TAVI zero-contrast scheme consisted of the following multi-modality combinations: 1) gadolinium-free magnetic resonance imaging (three-dimensional navigator-echo with electrocardiogram-gated steady-state free-precession series); 2) iodinated-free multislice computed tomography electrocardiogram-gated; 3) lower limb arterial duplex scan ultrasound; and 4) transesophageal echocardiography. Ultimately, TAVI was performed for those deemed good candidates, and contrast was allowed during the intervention; however, operators were strongly advised to utilize the least volume possible of iodinated agents. This pilot survey included ten patients with symptomatic aortic stenosis and renal dysfunction who underwent zero-contrast multi-modality imaging.

## RESULTS

All the patients ultimately underwent TAVI. The intervention was successful in all cases, without moderate residual aortic regurgitation, prosthesis embolization, annulus rupture, major vascular complications, stroke, or death during index hospitalization. The creatinine clearance remained stable throughout the observation period (baseline:  $26.85 \pm 12.55$  ml/min; after multi-modality imaging:  $26.76 \pm 11.51$  ml/min; post-TAVI at discharge:  $29.84 \pm 13.98$  ml/min;  $p=0.3$  all).

## CONCLUSION

The proposed contrast-free imaging protocol appears to be a promising clinical tool for pre-TAVI evaluation in patients with severe renal dysfunction.

## CLINICAL RELEVANCE/APPLICATION

Chronic renal dysfunction is common in individuals with aortic stenosis and is often challenging for the evaluation of TAVI candidates. The occurrence of acute kidney injury (AKI) following pre-TAVI evaluation using methods based on angiographic contrast has been largely underreported, but everyday practice and common sense indicate that it is a major clinical issue. In this context, we developed a zero-contrast diagnostic routine for patients with severe aortic stenosis and renal dysfunction who are considered for TAVI.

## R5B-SPCA-4 Feasibility, Image Quality and Radiation Dose Evaluation of Coronary CT Angiography (CCTA) in Patients with Arrhythmia by Using the 16cm Wide Detector CT

## PURPOSE

To investigate the feasibility, image quality and radiation dose of a 16cm wide detector CT for coronary CT angiography (CCTA) within single cardiac cycle in patients with arrhythmia.

## METHODS AND MATERIALS

A total of 70 patients with suspected coronary heart disease underwent CCTA were divided into two groups for analysis: Group A ( $n=35$ , arrhythmia) and Group B ( $n=35$ , sinus rhythm). All examinations were performed under free breathing on a 16cm wide detector CT (GE Healthcare) by using the SmartPhase technique for scanning and reconstruction and SSF technique for coronary artery motion correction. Both groups used the same contrast dose rate of 25 mgI/kg/s. CT value and standard deviation in aortic sinus (AS), right coronary artery, left anterior descending, left circumflex and pericardial fat were measured. Contrast-to-noise ratio for vessels was calculated. Two experienced Radiologists independently reviewed the image quality by using a 5-point scale [1] (1: nondiagnostic and 5: excellent). Image quality and radiation dose of the two groups were compared. The Mann-Whitney test and independent sample t test were used for statistical analysis,  $P<0.05$  was considered statistically significant.

## RESULTS

There was no difference in contrast dose, radiation dose, quantitative and qualitative image quality [1] between the two patient groups (all  $p>0.05$ ). The arrhythmia group had statistically higher heart rate and higher heart variation than the sinus rhythm group [ $84.77\pm 35.02$  vs.  $67.80\pm 12.53$  beats/min] ( $P=0.009$ ). The effective radiation dose in the arrhythmia group [ $(2.86\pm 1.07)$  mSv] was higher than that in the sinus rhythm group [ $(2.22\pm 0.64)$  mSv] which was statistically significant ( $P=0.004$ ).

## CONCLUSION

CCTA is feasible in arrhythmia patients by using 16cm wide detector CT providing good image quality, but requires slightly higher

radiation dose compared with that of sinus rhythm patients.

#### **CLINICAL RELEVANCE/APPLICATION**

CCTA is feasible in atrial fibrillation patients using a new generation 256-MDCT providing good image quality and low radiation dose in this challenging population

#### **R5B-SPCA-5 A Comparative Study of Inner Diameter of Measured on CCTA Images Reconstructed by Different Algorithms Using High-definition Scanning Mode on a 512-slice CT**

##### **PURPOSE**

To explore the differences between two reconstruction algorithms in inner diameter measurement of right coronary arteries, in coronary computed tomography angiography (CCTA) with high-definition mode.

##### **METHODS AND MATERIALS**

37 patients underwent CCTA at high-definition mode on a 512-slice CT (Revolution CT, GE Healthcare) were collected in this study. 100kV and auto mA control were used for scanning. Images were reconstructed by ASIR-V60% at both conventional reconstruction function Stand mode and high-definition reconstruction function HD Stand mode. The inner diameters of proximal, middle and distal right coronary artery were measured on the reconstructed images. T-test was used to compare the differences between images reconstructed with two modes.

##### **RESULTS**

The inner diameters were (Stand vs. HD-Stand:  $2.93 \pm 0.66$  vs.  $3.02 \pm 0.66$  mm) for proximal right coronary artery, ( $2.67 \pm 0.57$  vs.  $2.75 \pm 0.59$  mm) for middle right coronary artery, respectively. Results showed statistical differences between Stand and HD-Stand images in the measurement of proximal and middle right coronary artery ( $P < 0.05$ ), and the inner diameters measured on HD-Stand images were higher than those on Stand images. The inner diameters were (Stand vs. HD-Stand:  $2.29 \pm 0.46$  vs.  $2.33 \pm 0.48$  mm) for distal right coronary artery, with no significant difference ( $P > 0.05$ ).

##### **CONCLUSION**

s On a 512-slice CT, HD-Stand images can display the lumen of proximal and middle right coronary artery more accurately than Stand images.

#### **CLINICAL RELEVANCE/APPLICATION**

HD-Stand images can display the lumen of coronary artery more accurately, showing greater values in evaluation of coronary artery stenosis.

#### **R5B-SPCA-6 Improved Detection of Subendocardial Infarction using Synthetic Double Inversion Late Gadolinium Enhancement**

Participants

Jong Eun Lee, MD, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### **PURPOSE**

A novel imaging technique called Synthetic double inversion LGE using T1 mapping has been developed. This study aimed to increase the conspicuity of the enhanced region in patients with MI, particularly those with subendocardial infarction by nulling the signal of normal myocardium and blood cavity.

##### **METHODS AND MATERIALS**

To validate the proposed method, phantom experiment was conducted using a commercial phantom (T1 MES) that mimics nine different T1 values of myocardium and blood pre- and post- enhanced at 1.5T and 3T environment. Synthetic LGE that is generated using the post T1 map allows for the nulling of signal intensity from single tissue with a specific T1 value, depending on the inversion time (TI). The proposed method employs two numerical inversion pulses, which null 2 types of tissues. For the evaluation of our method, 30 cases of MRI study from patients with subendocardial infarction were retrospectively collected, which included T1 maps and LGE images. We generated synthetic LGE for each patient using mathematical equation and nullified the signal from normal myocardium and blood cavity. This can increase contrast with infarct myocardium in MI patients as intended in this study.

##### **RESULTS**

In the phantom experiment, proposed method generated a synthetic LGE that accurately nullified the signal from the regions corresponding to the two selected T1 values. This result demonstrated the effectiveness of our approach. In the in-vivo experiment, the result showed significantly higher contrast compared to conventional LGE. The proposed method demonstrated significantly higher contrast ratios for remote/enhanced and blood/enhanced regions, with values of  $2.59 \times 10^{-5}$  and  $2.07 \times 10^{-5}$ , respectively, compared to conventional LGE with values of 0.06 and 0.91. This represents an increase in contrast of over 400-fold for blood cavity and 23-fold for remote regions compared to conventional LGE.

##### **CONCLUSION**

s Using synthetic double inversion LGE, contrast enhancement was observed in subendocardial infarction, with improved conspicuity compared to conventional LGE. This technique nulling healthy myocardium and blood cavity can improve detection of myocardial infarction.

#### **CLINICAL RELEVANCE/APPLICATION**

This study proposes a new imaging technique, Synthetic double inversion LGE, to overcome the challenges in identifying subendocardial infarction using conventional LGE. This technique has shown promising results in nulling normal myocardium and blood cavity, which can improve the contrast with infarct myocardium in MI patients.

## Abstract Archives of the RSNA, 2023

R5B-SPCH

### Chest Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPCH-1 Free-Breathing Ultra-High-Pitch Pulmonary Angiography by Means of Photon-Counting Detector CT for Diagnosis of Acute Pulmonary Embolism**

##### Participants

Pauline Pannenbecker, MD, BA, Wurzburg, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

To assess image quality (IQ) and required radiation dose of an ultra-high-pitch CT pulmonary angiography (CTPA) protocol with a low contrast medium (CM) dose in free-breathing technique for diagnosis of acute pulmonary embolism (PE) using a clinical photon-counting detector (PCD) CT scanner in comparison to a matched conventional energy-integrating detector (EID) based Single-Energy CTPA protocol.

##### METHODS AND MATERIALS

51 CTPAs performed on a clinical PCD CT (Naeotom Alpha, Siemens Healthcare GmbH) were prospectively compared to 51 CTPAs performed on a 3rd generation Dual-Source EID CT (Somatom Force, Siemens Healthcare GmbH). All CTPAs were acquired with an ultra-high-pitch CTPA scan protocol in free-breathing technique (matched parameters: 40ml CM, flow rate 4ml/sec, pitch 3.2) at 140 kV (PCD) and 70-100 kV (EID). Based on spectral CTPAs acquired on the PCD scanner, iodine-distribution maps were reconstructed. As ultra-high-pitch EID CTPA could only be performed in Single-Energy mode due to technical limitations, reconstruction of iodine-maps was not possible in this subgroup. For evaluation of objective IQ, CT attenuation within pulmonary arteries, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were compared. To assess subjective IQ, three readers rated CTPAs (at 60 keV using virtual monoenergetic imaging for PCD and at standard reconstruction for EID) and iodine-maps based on a four-point scale. For radiation dose analysis, effective dose (ED), CTDI<sub>vol</sub>, dose length product, and size-specific dose estimates were compared.

##### RESULTS

CT attenuation was higher within all pulmonary vessels in the PCD-group (all  $p < 0.05$ ). While CNR and SNR were higher in the lobar pulmonary arteries in PCD CTPAs ( $p < 0.05$ ), they were similar within the pulmonary trunk ( $p > 0.05$ ). Subjective IQ of PCD scans was rated best by all three reviewers (excellent or good IQ in 96.1% of PCD CTPAs vs. 50.9% of EID CTPAs, ICC = 0.795). All evaluated radiation dose parameters were lower in the PCD group, as is exemplified with a mean ED of 1.33 ( $\pm 0.47$ ) mSv vs. 1.80 ( $\pm 0.82$ ) mSv (PCD vs. EID; all  $p < 0.05$ ).

##### CONCLUSION

Ultra-high-pitch CTPA acquisition in free-breathing technique with PCD CT allows for superior objective and subjective image quality with reduced radiation dose, while providing full spectral assessability. Moreover, in this protocol setting, PCD CTPA enables reconstruction of color-coded iodine-distribution maps, offering additional functional information compared to matched ultra-high-pitch EID CTPA.

##### CLINICAL RELEVANCE/APPLICATION

In PCD CT, pulmonary arteries can be fully spectrally assessed despite ultra-high-pitch settings, overcoming the need for breath-holds in the context of pulmonary embolism where dys- and tachypnea are common symptoms.

#### **R5B-SPCH-2 Prediction of the Treatment of Pulmonary Embolism using CT Texture Analysis**

##### Participants

Ki Yeol K. Lee, MD, PhD, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the utility of computed tomography texture analysis (CTTA) parameters in predicting the treatment outcome in pulmonary thromboembolism (PTE).

##### METHODS AND MATERIALS

We evaluated 88 patients diagnosed with PTE on whom chest computed tomography (CT) for detecting PTE was performed. Texture analysis was performed on the acute PTE detected on chest CT. Using the software, the groups in which PTE disappeared and remained after treatment were compared. The mean, standard deviation (SD), entropy, mean of positive pixels (MPP), skewness, and kurtosis of parameters on the spatial scaling factor (SSF) 2-6 were compared between the groups. The gray-level co-occurrence matrix (GLCM) texture features were used for SSF 0 images.

##### RESULTS

PTE disappeared after treatment in 51 patients, whereas it remained in 37 patients. Entropy was significantly different in SSF

3,4,5,6 ( $p < 0.05$ ). The mean and MPP on SSF 0 and the SD on SSF 4,5,6 were also significantly different ( $p < 0.05$ ). Other parameters, such as the mean, standard deviation, MPP, skewness, and kurtosis, on other SSFs were not significantly different. Among the GLCM parameters, several parameters such as joint energy and entropy, perimeter, area, and long and short axis were significantly different ( $p < 0.05$ ).

## CONCLUSION

s CTTA allows the prediction of whether the PTE will dissolve or remain after treatment. The mean and MPP on non-filtered images, entropy, and SD values on highly filtered SSFs had the best performance in predicting the anticoagulation treatment effects. The results suggest that several parameters of GLCM texture features can be used to predict anticoagulation treatment effects.

## CLINICAL RELEVANCE/APPLICATION

CTTA can be used to predict whether PTE will dissolve or remain in the patient after treatment.

## R5B-SPCH-3 Impact of an AI Based Triage and Prioritization Solution for Incidental Pulmonary Embolism Findings on Contrast CT in an Outpatient Setting

### Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

### PURPOSE

To measure the impact of a computer aided triage and prioritization AI solution for patients with incidental pulmonary embolism (iPE) undergoing CT scan of the chest and/or abdomen.

### METHODS AND MATERIALS

Cases from a large academic health system were collected from the outpatient setting between April 2022 and April 2023. A wait time metric was calculated for AI-notified cases with suspected positive iPE findings and compared to negative non-AI-notified cases. Wait time was defined as the difference between the time of study acquisition completion to the time a radiologist opens the case for dictation. The median wait times were calculated for the AI-notified and non-AI-notified cases. A Mood's median test was used to test for statistical significance.

### RESULTS

A total of 28,914 CT contrast examinations that included the lungs (12,564 chest/abdo/pelvis and 16,350 chest only) were collected. The AI solution provided suspected positive prioritization notifications (AI-notified) on 269 cases (87 chest/abdo/pelvis and 182 chest only). The median wait time was 86 minutes (AI-notified) compared to 242 minutes (non-AI-notified). The observed median wait time reduction was 64.4% (156 minutes,  $p$ -value $<0.001$ ). The median wait time was 76 minutes (AI-notified) compared to 461 minutes (non-AI-notified) and 87 minutes (AI-notified) compared to 172 minutes (non-AI-notified) for chest/abdo/pelvis and chest only cases respectively. The chest/abdo/pelvis subcohort had the largest observed median wait time reduction (83.5%, 385 minutes,  $p$ -value $<0.001$ ) compared to chest only cases (50.6%, 85 minutes,  $p$ -value: 0.009).

## CONCLUSION

s A computer aided triage and prioritization AI solution decreased wait times for contrast CT examinations with suspected iPE potentially saving hours of diagnosis delays in the outpatient setting.

## CLINICAL RELEVANCE/APPLICATION

Using an AI solution to prioritize radiologist interpretation of CT scans with iPE findings decreases wait time. Time saved has the potential to prioritize diagnosis and facilitate earlier treatment initiation.

## R5B-SPCH-4 Feasibility Study Of DLIR Algorithm Combined With Low Contrast Dose In CTPA Imaging

### Participants

Yanbing Yang, Yinchuan, China (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the feasibility of DLIR algorithm combined with low contrast dose in CTPA imaging.

### METHODS AND MATERIALS

Retrospective analysis was performed on 30 patients who underwent CTPA examination in our hospital, the scanning tube voltage was 70kVp and the dosage of contrast agent was 35ml. The original data were reconstructed with different algorithms and levels, including FBP algorithm, adaptive statistical iterative reconstruction (50% ASIR-V) and DLIR (DLIR-L, DLIR-M, DLIR-H). Mean CT values (CT1) of pulmonary trunk, right upper lobe trunk, right medial lower lobe basal segment, venous CT values of right medial lower lobe basal segment, CT value (CT2) of erector muscle at pulmonary trunk level and corresponding noise (SD) of different algorithms and horizontal reconstruction images were measured; CT value difference between arterial and venous of right medial lower lobe basal segment = CT value of artery - CT value of vein of right medial lower lobe basal segment, SNR = CT1/SD, CNR = CT1 - CT2/SD. 4 points were used to score the images subjectively. One-way analysis of variance and Kruskal-Wallis Test were used to compare the subjective evaluation and objective evaluation of different algorithms and horizontal reconstruction images.

### RESULTS

There were no statistically significant differences between the mean CT values of pulmonary artery trunk, right upper lobe trunk, right medial lower lobe basal segment and CT value difference between arterial and venous of right medial lower lobe basal segment in FBP, ASIR-V and DLIR reconstructed images ( $P > 0.05$ ). The noise of FBP, 50% ASIR-V and DLIR (L, M, H) images decreased successively, with statistical significance ( $P < 0.001$ ), and the noise of DLIR-H images decreased by 60% compared with that of FBP images. The SNR and CNR of FBP, 50% ASIR-V and DLIR (L, M, H) images increased successively with statistical significance ( $P < 0.001$ ), compared with FBP images, SNR and CNR of DLIR-H images increased by 151.0% and 150.4%. DLIR-M and DLIR-H had the highest subjective score with the highest proportion of 4 points, while FBP had the lowest subjective score with no 4 points, 50% ASIR-V image had the middle subjective score, 50% ASIR-V, DLIR-L and DLIR-H had statistical significance compared with FBP subjective score ( $P < 0.05$ ).



## CONCLUSION

s In CTPA imaging, DLIR algorithm under 35ml contrast agent can further reduce image noise, improve image quality and diagnostic confidence.

## CLINICAL RELEVANCE/APPLICATION

There is no doubt about the harm of contrast agents, especially for special populations such as renal failure and children. Since CTPA images obtained by DLIR combined with a small amount of contrast agents can meet clinical needs, it can be used as a routine clinical examination method.

## R5B-SPCH-5 Impact of the Recent Global Iodinated Contrast Agent Shortage on Observed Positivity Rate for Pulmonary Embolism in CT Pulmonary Angiograms at a Major US Healthcare System

Participants

Axel Wismueller, MD, PhD, Pittsford, NY (*Presenter*) Nothing to Disclose

## PURPOSE

To quantitatively track the impact of the recent global shortage of iodinated contrast agents on observed Pulmonary Embolism (PE) positivity rate in CT Pulmonary Angiogram (CTPA) exams using AI-based image analysis at a major US healthcare system.

## METHODS AND MATERIALS

Using software of a commercial AI-based image analysis vendor (Aidoc Medical, Tel Aviv, Israel), we analyzed daily volumes and PE positivity rates for a total of 2,407 Computed Tomography Pulmonary Angiogram (CTPA) exams before and during the recent contrast agent shortage (both comprising 04/01/2022 through 07/01/2022). For comparison with a non-contrast CT exam type, we analyzed daily volumes and positivity rates for Intracranial Hemorrhage (ICH) on 10,843 non-contrast head CT exams during the same time period. Specifically, we compared two observational periods, namely (i) a pre-shortage control period from 04/14/22 through 05/05/2022, and (ii) a contrast shortage period from 05/21/2022 through 06/11/2022. Percentage change metrics of case volumes and positivity rates for PE and ICH were calculated, where we report relative changes with regard to a baseline measurement period from 04/01/2022 through 04/14/2022. The two observational periods were compared for statistically significant differences using Welch's unequal variances t-test.

## RESULTS

Case volumes of contrast-enhanced CTPA exams dropped from baseline during the contrast agent shortage period by  $42.88\% \pm 20.22\%$  while PE positivity rates increased by  $47.8\% \pm 13.7\%$ , where statistical differences between observational periods were highly significant ( $p < 10^{-4}$ ). For comparison, non-contrast head CT volumes dropped by only  $7.55\% \pm 2.98\%$ , and ICH positivity rates increased by only  $12.5\% \pm 1.87\%$ , with no significant difference between pre-shortage and shortage observational periods ( $p > 0.05$ ).

## CONCLUSION

s Our results suggest a significant increase of PE positivity rate in CTPA exams at significantly decreased CTPA total exam volumes during the observed global contrast agent shortage period, while non-contrast head CT exam volumes and ICH positivity rates remained essentially stable. Our observations can be explained by more restrictive ordering patterns for CTPA studies during the acute contrast agent shortage period, limiting access to such exams only to patients with high clinical pre-test probability.

## CLINICAL RELEVANCE/APPLICATION

Using AI-based image analysis can quantify effects of unexpected healthcare challenges on critical radiology findings, such as for pulmonary embolism during the observed global contrast agent shortage.

## R5B-SPCH-6 Diagnostic Ability for the Presence and Severity of Pulmonary Hypertension on Super-high-resolution Non-enhanced Chest Computed Tomography

Participants

Yukihiro Nagatani, MD, Otsu, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the detectability of pulmonary hypertension (PH) and the predictability of its severity by cross-sectional vessel area (CSA) on super-high-resolution (SHR) non-enhanced chest computed tomography (CT)

## METHODS AND MATERIALS

Thirty patients including 11 patients diagnosed as PH, 9 patients with connective tissue disease (CTD) associated interstitial pneumonia (CTD-IP) without PH and 10 age-matched controls, underwent UHR non-enhanced chest CT. Mean pulmonary arterial pressure (PAP) were measured at right heart catheterization performed within 1 month of the chest CT examination date for the 11 PH patients. Image data were obtained using iterative reconstruction algorithm with normal-resolution simulation (NRsim) mode (512×512 matrix size, 0.5-mm slice thickness), and using deep-learning-based reconstruction algorithm with SHR mode (1024×1024 matrix size, 0.25-mm slice thickness). By using binary images with the optimal threshold of -720 HU at three predefined trans-axial levels including aortic arch, tracheal bifurcation and right proximal pulmonary vein, average vessel dimension (AVD) and the percentage of the total CSA for the lung field area (%CSA) for dimensions of less than 0.5, 0.5 to 1, 1 to 2 and 2 to 5 mm<sup>2</sup> were quantified for CT data both at NRsim and SHR mode. AVD and %CSA were compared among PH, CTD-IP and age-matched controls with Kruskal-Wallis test, and correlated with mean PAP for PH with Spearman's rank coefficient.

## RESULTS

On CT images at SHR mode, AVD for dimensions of less than 0.5 mm<sup>2</sup> for PH ( $0.226 \pm 0.008$  mm<sup>2</sup>) were smaller as compared with those for CTD-IP ( $0.239 \pm 0.008$  mm<sup>2</sup>) and age-matched controls ( $0.245 \pm 0.004$  mm<sup>2</sup>). ( $p < 0.01$ ) AVD for dimensions of 1 to 2 mm<sup>2</sup> correlated negatively with mean PAP ( $r = -0.67$ ,  $p = 0.048$ ). In contrast, on CT images at NRsim mode, although %CSA for dimensions of less than 0.5 mm<sup>2</sup> correlated positively with mean PAP ( $r = 0.71$ ,  $p = 0.032$ ), the %CSA for PH ( $0.61 \pm 0.38\%$ ) was larger than that for CTD-IP ( $0.53 \pm 0.30\%$ ) and comparable to that for age-matched controls ( $0.60 \pm 0.25\%$ ).

## CONCLUSION

s AVD for dimensions of less than 2 mm<sup>2</sup> at SHR mode on non-enhanced chest CT images has the potential to indicate the presence and severity of PH.

#### **CLINICAL RELEVANCE/APPLICATION**

Quantification of pulmonary smaller peripheral vessels of less than 2 mm<sup>2</sup> depicted at SHR mode may be useful for direct assessment of peripheral arterial remodeling in PH.

### **R5B-SPCH-7 Dual-Layer Dual-Energy CT-Derived Pulmonary Perfusion for the Differentiation of Acute Pulmonary Embolism and Chronic Thromboembolic Pulmonary Hypertension**

Participants

Roman Gertz, MD, Cologne, Germany (*Presenter*) Institutional research contract, Koninklijke Philips NV

#### **PURPOSE**

To assess the ability of dual-layer dual-energy computed tomography (dIDECT)-derived pulmonary perfusion maps to differentiate between acute pulmonary embolism (PE) and chronic thromboembolic pulmonary hypertension (CTEPH).

#### **METHODS AND MATERIALS**

57 patients with acute PE, 52 patients with CTEPH and 22 controls, all of whom underwent CT pulmonary angiography on a dIDECT were included in this retrospective study. Normal and malperfused areas of lung parenchyma were semiautomatically contoured using iodine density overlay maps (IDOs). First order histogram features of normal and malperfused lung tissue were extracted. Iodine density (ID) was normalized to the mean pulmonary artery (MPA) and the left atrium (LA). Group differences were analyzed using the t-test and the Mann-Whitney U test. The data was split into training and validation sets to assess the diagnostic accuracy of the derived histogram features using the area under the receiver operating characteristic curve (AUC).

#### **RESULTS**

In acute PE, normal perfused lung areas revealed a higher mean and peak iodine uptake normalized to the MPA than in CTEPH (both  $p < 0.001$ ). After normalizing mean ID in perfusion defects to the LA, patients with acute PE revealed a reduced average perfusion (ID<sub>mean,LA</sub>) compared to both CTEPH patients and controls ( $p < 0.001$  for both). ID<sub>mean,LA</sub> allowed for a differentiation between acute PE and CTEPH with moderate accuracy (AUC: 0.72, sensitivity 74%, specificity 64%), resulting in a PPV and NPV for CTEPH of 64% and 70%.

#### **CONCLUSION**

s dIDECT enables quantification and characterization of pulmonary perfusion patterns in acute PE and CTEPH, enabling the differentiation between the two diseases.

#### **CLINICAL RELEVANCE/APPLICATION**

The identified parameters yield the potential to enable more timely identification of patients with chronic thromboembolic pulmonary hypertension.

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## Abstract Archives of the RSNA, 2023

R5B-SPER

### Emergency Radiology Thursday Poster Discussions II

#### Sub-Events

#### R5B-SPER-1 Disentangling the Knot: Our Experience with Ultrasound Assisted Manual Testicular Detorsion in the Radiology Department

#### PURPOSE

Testicular torsion (TT) is an emergency. Prompt diagnosis and management are key to preserve the testicle. Our objective is to show our experience with intravaginal TT sonographic diagnosis and ultrasound (US) assisted manual detorsion (MD).

#### METHODS AND MATERIALS

A prospective, randomized, controlled trial over an 8-year period with a total of 108 patients diagnosed with TT. Mean age was 14 years, age range 1-48 years. US was performed in 106 patients (98%). Testicular flow was absent in 73 (69%), diminished in 27 (25%), normal in 6 (6%). Torsion of the cord was documented in 103 patients (97,2%) and not demonstrated in 3 (2,8%). In the first group of 59 patients, 57 underwent surgery following sonographic diagnosis of TT and 2 went directly to surgery. In the second group, 49 patients underwent US assisted MD attempt immediately after sonographic TT confirmation and posterior surgery. MD is attempted following US TT confirmation, explaining the procedure and obtaining consent. It is performed with US assistance and without sedation or analgesia thus enabling clinical monitoring and expediting the procedure. US assisted MD was performed by 14 staff radiologist, 1 pediatric surgeon and 8 radiology residents under staff supervision.

#### RESULTS

In the first group, testicular echotexture was preserved in 33 (58%) and altered in 24 (42%). 15 orchiectomies were performed (25,4%) and 44 (76,4%) testicles were fixated including 4 that showed later atrophy (9%). 1 of the patients that did not undergo US exam turned out to be a false positive. 4 underwent spontaneous detorsion while performing the US. 2 patients had inguinal torsion. 1 patient with Asperger syndrome barely cooperated with the diagnostic US exam. In the second group, testicular echotexture was preserved in 44 (89,8%) and altered in 5 (10,2%). MD achieved testicular reperfusion and symptoms relief in 42 patients (85,7% success rate). 1 orchiectomy was performed (2%) and 48 testicles were fixated including 2 that showed later atrophy (4%). There were no complications related to US assisted MD.

#### CONCLUSION

US confirms the diagnosis of TT, evaluates pre-detorsion testicular viability, assists MD and verifies restoration of testicular flow. MD is a non-invasive, simple, feasible, quick, safe and effective maneuver that improves testicular viability by immediately restoring testicular flow if successful, relieves patient's symptoms and improves his comfort and facilitates posterior surgery.

#### CLINICAL RELEVANCE/APPLICATION

Sonographic diagnosis of TT and US assisted MD adds value to the radiologist role in this emergency clinical setting performing a medical act that is both diagnostic and therapeutic.

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## Abstract Archives of the RSNA, 2023

R5B-SPGI

### Gastrointestinal Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPGI-1 Measurement of Spleen Volume Using CT Images with Deep Learning Segmentation: Definition of Normal Spleen and Splenomegaly**

##### **PURPOSE**

To develop and evaluate a fully automated algorithm for segmenting the spleen and to establish thresholds for splenomegaly from CT.

##### **METHODS AND MATERIALS**

The dataset used to develop this deep learning software on Python consisted of anonymized non-contrast CT images of the abdomen of 138 patients provided by PSP Inc. These 138 images were divided into a training set, a validation set, and a test set. A Bayesian 3D U-Net was trained on the labeled spleen data. The initial study cohort consisted of generally healthy, asymptomatic adult outpatients who were potential renal donors, liver donors, scheduled to undergo CT colonography or abdominal CT for physical examination between April 2011 and April 2022, at a single medical center. A subanalysis was conducted prior to the clinical study. One hundred and twenty patients were randomly selected from the clinical study population. Multiple regression analysis was used to evaluate the relationship between demographic and clinical data and spleen capacity data.

##### **RESULTS**

The final sample consisted of 2554 asymptomatic adult outpatients (mean age  $\pm$  standard deviation, 65.0  $\pm$  15.3 years, including 1736 men and 821 women). The mean height  $\pm$  standard deviation of the patients was 162.1  $\pm$  9.4 cm, and the mean weight of the patients was 62.3  $\pm$  13.7 kg. The deep learning tool was used to successfully segment the spleen in all scans. The mean standardized spleen volume  $\pm$  standard deviation was 123.2  $\pm$  59.2 mL, showing a normal distribution. Patient weight was the major determinant of spleen volume and demonstrated a linear relationship. From this result, a linear weight-based upper limit of normal spleen threshold volume was derived: splenomegaly = 1.87  $\times$  weight (kg) + 124.67 mL. In the subset of 100 patients, the median difference in spleen volume between the deep learning tool and the manual method was 2.3%: mean Dice score was 0.95 (0.72-0.97).

##### **CONCLUSION**

s Weight-based thresholds for objective normal spleen and splenomegaly were derived from a spleen volume database using CT images, based on deep learning.

##### **CLINICAL RELEVANCE/APPLICATION**

Splenomegaly is defined as an abnormal enlargement of the spleen resulting from various clinical conditions such as infections, hematologic diseases, congestion, autoimmune diseases or tumors. Splenomegaly is often a diagnostic entry point for various background diseases, and accurate detection of splenomegaly is clinically important. The purpose of our study is to establish the normal distribution of splenic volume in healthy adults using automated organ segmentation techniques on abdominal CT images. Furthermore, this data will be used to establish a potential threshold for splenomegaly.

#### **R5B-SPGI-2 Imaging Practices and Clinical Outcomes Following Suboptimal Visualization Score on Hepatocellular Carcinoma Ultrasound Screening**

##### **PURPOSE**

The Ultrasound Liver Imaging Reporting and Data Systems (US LI-RADS) provides standardized terminology and reporting of ultrasound (US) screening for hepatocellular carcinoma (HCC). However, limited data exists on the clinical relevance of US LI-RADS suboptimal visualization scores of B/C. The aim of this study is to identify predictors of suboptimal visualization on HCC US screening and investigate follow-up imaging practices and clinical outcomes.

##### **METHODS AND MATERIALS**

Retrospective analysis was performed on patients who underwent initial HCC US screening from 2017-2021. Clinical factors, including demographics, body mass index (BMI), laboratory findings, hepatitis/cirrhosis status, surgical pathology, initial US and follow-up imaging, diagnosis of HCC/cirrhosis, and liver transplant, were collected. Multivariable analysis was performed to determine predictors for suboptimal (B/C) visualization on HCC US screening. Chi-square test and independent t-test were performed to compare follow-up imaging practices and clinical outcomes between scores of A and B/C. Only patients with US LI-RADS visualization scores were included.

##### **RESULTS**

Of 396 patients, 56% (221/396) had a score of A, while 44% (175/396) had suboptimal scores of B/C. Multivariable analysis revealed that BMI (OR:1.05, 95% CI:1.01-1.09,  $p=0.01$ , per 1 score increase) and cirrhosis (OR:2.64, 95% CI:1.11-6.27,  $p=0.027$ ) predicted suboptimal visualization. Further analysis showed that 42.53% (94/221) of the patients with a score of A had follow-up imaging, compared to 45.71% (80/175) with scores of B/C. The mean time to follow-up imaging was not significantly different.

However, US was more frequently performed in patients with a score of A (65.96% vs. 43.75%,  $p=0.003$ ), while CT was performed more frequently among patients with scores of B/C (23.40% vs. 38.75%,  $p=0.028$ ). Clinically, liver transplant was more common within one year from initial US among patients with scores of B/C (13.75% vs. 9.57%,  $p=0.0284$ ), while subsequent diagnosis of HCC/cirrhosis after the initial US was not significantly different.

## CONCLUSION

Our findings suggest that patients with suboptimal visualization scores of B/C on initial HCC US screening were followed at similar intervals as those with a score of A. However, patients with scores of B/C underwent CT follow-up and liver transplant more frequently than those with a score of A. This study highlights the need for establishing recommendations for imaging and clinical management following suboptimal visualization on HCC US screening.

## CLINICAL RELEVANCE/APPLICATION

Suboptimal visualization scores on initial HCC US screening impact follow-up imaging and clinical outcomes, and thus standardized recommendations are warranted for optimal care.

## R5B-SPGI-3 Effect of Liver Fibrosis on the Correlation between US-ATI and MRI-PDFF

Participants

Riwa Kishimoto, MD, PhD, (*Presenter*) Nothing to Disclose

## PURPOSE

With the increasing number of liver diseases caused by obesity and metabolic syndrome, the assessment of fatty liver by ultrasound attenuation imaging (ATI) is widely used clinically. It has been reported that ATI correlates well with MRI-derived proton density fat fraction (PDFF). On the other hand, the influence of liver fibrosis on ATI has been discussed. In the present study, we investigated whether the degree of fibrosis affects the correlation between ATI and MRI-PDFF when divided into high and low fibrosis groups using shear wave speed (SWS) and Fib-4 index.

## METHODS AND MATERIALS

Seventy-four patients with ultrasound (US) and MR examinations performed within two weeks were included. Canon Medical Systems Aplio i800 with an i8CX1 probe was used, and SWS and ATI were obtained simultaneously using an advanced SWE application. After at least 4 hours of fasting, five measurements were taken with a right intercostal procedure avoiding large blood vessels at neutral breathing during a breath hold. MRI was performed using a Philips Achieva 1.5T, and the m-Dixon method was used. ROI of about 10 mm diameter was placed in the center of the right lobe, same as US. The correlation between ATI value and MRI-PDFF was investigated. To evaluate the effect of fibrosis, the patients were divided into two groups using SWS and Fib-4 index, which is considered highly likely to be associated with fibrosis: those with SWS = 1.6 m/s and those with SWS <1.6 m/s, and those with Fib-4 index = 2.67 and < 2.67. The analysis of covariance (ANCOVA) was performed.

## RESULTS

Fifty-five patients were included, excluding those due to low reliability whose interquartile range (IQR)/median of SWS and ATI was over 0.3. The correlation between ATI value and MRI-PDFF of the liver was good,  $R=0.74$ . In a study in which the patients were divided by SWS and Fib-4 index, the correlation coefficients were similar: 0.78 for the high SWS group and 0.74 for the low SWS group, and 0.74 for the high Fib-4 index group and 0.77 for the low Fib-4 index group, respectively. The degree of liver fibrosis did not significantly affect the correlation between ATI and MRI-PDFF using ANCOVA.

## CONCLUSION

We hypothesized that the correlation between ATI and MRI-PDFF would be worse in cases with liver fibrosis, but no difference was found in the study divided into high and low fibrosis groups using SWS and Fib-4 index. The correlation was good in both groups with  $R > 0.7$ , and fibrosis had no confounding effect.

## CLINICAL RELEVANCE/APPLICATION

The degree of liver fibrosis did not significantly affect the correlation between ATI and MRI-PDFF.

## R5B-SPGI-4 Shear Wave Elastography Assessment of the Spleen Before and After Transjugular Intrahepatic Portosystemic Shunt (TIPS)

Participants

Robert Turner, Olathe, KS (*Presenter*) Nothing to Disclose

## PURPOSE

Transjugular intrahepatic portosystemic shunt (TIPS) creation is an effective intervention to minimize complications of portal hypertension. However, periodic surveillance of TIPS is required to detect asymptomatic shunt stenosis or occlusion. Spleen shear wave elastography (SWE) has previously been shown to correlation with portal pressure, therefore it may be a surrogate marker for surveillance of TIPS patency. The goal of this study was to evaluate the changes in splenic stiffness using SWE immediately before and after TIPS placement, to determine how acute changes in portal pressure effect the spleen.

## METHODS AND MATERIALS

This prospective cohort study included adult patients with portal hypertension who underwent nonemergent TIPS creation at a single institution from 10/31/2017 - 5/20/2021. Individuals were excluded if they had a prior splenectomy. Patients were evaluated with spleen SWE immediately before and after TIPS placement. Spleen length was measured by ultrasound in each individual during the pre-TIPS scan. Paired t-test analysis was performed to compare median splenic stiffness before and after the procedure and spleen length between patient groups.

## RESULTS

Thirty patients were enrolled with a mean age of 58 years ( $SD=14.8$ ). There was a decrease in median spleen shear wave velocity (SSWV) in 70% of patients following TIPS creation ( $p=0.03$ , binomial 95% CI=54% - 86%). The average decrease in SSWV after TIPS creation was 0.21 m/sec ( $p=0.01$ , 95% CI=0.38 - 0.05). Spleen length trended higher in patients who showed a decrease in SSWV (mean=16.2 cm,  $SD=2.99$ ) compared to those who had an increase in SSWV (mean=15.3 cm,  $SD=2.51$ ), though this

difference was not statistically significant ( $p=0.43$ ).

## CONCLUSION

s There was a statistically significant decrease in SSWV immediately after TIPS placement, indicating that spleen stiffness is acutely affected by changes in portal pressure. Spleen SWE may be a useful tool in longitudinal surveillance of TIPS patency, using the patient as a self-control.

## CLINICAL RELEVANCE/APPLICATION

Spleen shear wave elastography may be a complementary, non-invasive tool for monitoring TIPS patency and portal hypertension complications.

## R5B-SPGI-5 US-LIRADS: Outcomes of Category 1B and 1C Examinations on Multiphase CT/MRI

### PURPOSE

The purpose of this study is to evaluate the outcomes of ultrasound (US) LI-RADS category US-1B and US-1C examinations performed for hepatocellular carcinoma (HCC) screening and surveillance on the basis of subsequently performed multiphase MRI or CT.

### METHODS AND MATERIALS

In this retrospective analysis, 211 patients at high risk for HCC (127 men and 84 women; mean  $[\pm\text{SD}]$  age, 59.8  $\pm$  13.1 years) underwent screening liver US between June 2019 and September 2022 and were assigned US-1B (111 patients) or US-1C (100 patients) on a prospective clinical basis using the US-LIRADS algorithm. The results of follow-up imaging studies were analyzed.

### RESULTS

US visualization scores were assigned as B (52.6% [111/211]) and C (47.4% [100/211]). The most common reasons for US-1B and 1C visualization scores included overlying bowel gas (52.6% [111/211]), parenchymal heterogeneity/echogenicity (26.5% [56/211]), and body habitus/poor acoustic window (10.0% [21/211]). Follow-up US for ongoing HCC screening was available for 57.8% (122/211) of patients. On follow-up US, 98.4% of patients remained US-LIRADS category 1 (120/122), 0.8% were category 2 (1/122), and 0.8% were category 3 (1/122). Subsequently-performed multiphase contrast-enhanced MRI or CT was available for 38.3% (81/211) of patients including 43.0% (43/100) of 1B patients and 34.2% (38/111) of 1C patients with a time interval between screening US and CT/MR of 287.9  $\pm$  265.5 days. Multiphase CT or MRI results for patients with US-1B and US-1C visualization scores included no abnormality at CT or MRI (70.3% [57/81]), a benign lesion (6.2% [5/81]), a LI-RADS category 3 (LR-3) observation (16.0% [13/81]), a LI-RADS category 4 or 5 (LR-4 or LR-5) observation (5.0% [4/81]), and an LR-M observation (2.5% [2/81]). Within the US-1B cohort, an LR-4 or LR-5 observation was seen in 4.6% (2/43) and an LR-M observation was seen in 2.3% (1/43). In the US-1C cohort, an LR-4 or LR-5 observation was seen in 2.6% (1/38) and an LR-M observation was seen in 5.3% (2/38). The incidence of probable or definite HCC on CT/MR for US-1B or US-1C examinations was 5.0% (4/81) and for any malignancy was 7.4% (6/81).

## CONCLUSION

s In the HCC screening population, approximately 5% of US-1B and US-1C examinations have probable or definite HCC and 7.4% have malignant findings on multiphase CT or MR. Despite this, only 38.3% of patients with US-1B or US-1C examinations underwent multiphase CT or MRI, meaning that the majority of clinical providers are currently opting for continued ultrasound surveillance despite limited liver visualization.

## CLINICAL RELEVANCE/APPLICATION

Patients in the HCC screening population with US-1B or US-1C examinations due to suboptimal liver visualization may benefit from further evaluation with multiphase CT or MRI.

## R5B-SPGI-6 Repeatability and Reproducibility of Multi-parametric Ultrasound in Liver Assessment

### Participants

Reinhard I. Kubale, MD, Homburg/Saar, Germany (*Presenter*) Research Consultant, Siemens AG

### PURPOSE

Quantitative ultrasound-based techniques, such as ultrasound derived fat fraction (UDFF) and point shear wave elastography (pSWE), have become promising noninvasive tools for evaluating liver fibrosis and steatosis. However, the repeatability and reproducibility of these techniques remain critical factors for their broader clinical adoption. This study aims to assess the sonographer reproducibility and measurement repeatability of UDFF and pSWE in liver assessment within a cohort of 31 subjects.

### METHODS AND MATERIALS

Three experienced sonographers performed five acquisitions each on the subjects' livers using the Siemens Sequoia ultrasound system. The intraclass correlation coefficients (ICCs) and Bland-Altman analysis were employed to evaluate the repeatability within each sonographer and the reproducibility across the sonographers for both UDFF and pSWE measurements.

### RESULTS

The results demonstrated good sonographer reproducibility and measurement repeatability for both UDFF and pSWE. The ICC for UDFF repeatability ranged from 0.97 (95% CI: 0.95-0.98) to 0.99 (95% CI: 0.98-1.0), while the ICC for pSWE repeatability ranged from 0.94 (95% CI: 0.89-0.97) to 0.96 (95% CI: 0.93-0.98). Additionally, the ICC for sonographer reproducibility was 0.93 (95% CI: 0.88-0.96) for UDFF and 0.62 (95% CI: 0.43-0.77) for pSWE. Bland-Altman analysis revealed a mean difference of 0 % for UDFF and 0 m/s for pSWE, indicating no bias between the sonographers, and the limits of agreement were within  $\pm 3.51\%$  for UDFF and  $\pm 0.2$  m/s for pSWE, demonstrating acceptable agreement.

## CONCLUSION

s These findings support the repeatability and reproducibility of UDFF and pSWE measurements in liver assessment, highlighting their potential as reliable tools for noninvasive liver fibrosis and steatosis evaluation. Further research is warranted to optimize measurement protocols and investigate their performance in various clinical settings.

## **CLINICAL RELEVANCE/APPLICATION**

This study demonstrates that ultrasound-derived fat fraction (UDFF) and point shear wave elastography (pSWE) show good repeatability and reproducibility for assessing liver fibrosis and steatosis, making them promising noninvasive tools in clinical settings. The high intraclass correlation coefficients and Bland-Altman analysis results support their reliability across different sonographers, highlighting the potential for these techniques to be adopted more widely in liver assessment. Future research should focus on optimizing measurement protocols and evaluating their performance across various clinical contexts to further solidify their clinical utility.

## **R5B-SPGI-7 Ultrasound Point Shear Wave Elastography is Feasible Across All Ages to Evaluate for Sinusoidal Obstruction Syndrome after Hematopoietic Stem Cell Transplantation**

### **PURPOSE**

Veno-occlusive disease or sinusoidal obstruction syndrome (VOD/SOS) is a known potential complication of HCT and usually involves the liver. Hepatic VOD is characterized by damage to blood vessels in the liver and surrounding liver cells, with significant associated morbidity. Ultrasound point shear wave elastography (PSWE) is an imaging technique that has high sensitivity and specificity in detecting tissue stiffness, which is hypothesized to increase in VOD/SOS. A prospective, observational pilot study was performed to evaluate the feasibility and value of shear wave elastography (SWE) in the diagnosis of hepatic VOD/SOS after hematopoietic cell transplantation (HCT).

### **METHODS AND MATERIALS**

Pediatric and adult patients undergoing autologous or allogeneic HCT at a single academic institution, and who received myeloablative conditioning were consented to participate in this study. Pre-transplant liver and other organ evaluation was performed. Post-transplant evaluation and SWE imaging was performed on all subjects at day +5, day +10, day +14, day +21, day +100.

### **RESULTS**

A total of 42 patients were enrolled in the study, of which 62% were males with median age of 15 years (range: 1-50 years). Underlying malignancy was the primary indication for HCT in 73% of patients.; 95% underwent an allogeneic HCT with a median age of participation of 15 years (range: 1-50 years). No patients were diagnosed with VOD and there was no statistical significance in the median liver stiffness before and after engraftment (1.4 (1.1-2.6) vs. 1.4 (1.2-2) m/sec; p=0.81). Trends were observed by ultrasound during the course of observation including hepatic enlargement, gallbladder wall thickening and sludge, alterations in portal and hepatic venous flow, and the development of ascites, all despite the lack of VOD diagnosis.

### **CONCLUSION**

s PSWE is feasible in children and adults to assess the flow dynamics in hepatic and portal vasculature. Further studies need to be performed to evaluate its utility in diagnosis of VOD/SOS and assessing the therapeutic response.

## **CLINICAL RELEVANCE/APPLICATION**

Performing point shear wave elastography is feasible across all ages. Though there were no VOD/SOS cases, this study successfully demonstrates the radiologic changes in hepato-portal venous flow changes and organ changes after HSCT.

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## Abstract Archives of the RSNA, 2023

R5B-SPGU

### Genitourinary Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPGU-1 Estimation of Renal Function Using Iodine Maps in Dual-energy Spectral Computed Tomography Urography: A Feasibility and Accuracy Study**

##### Participants

Shigeng Wang, Dalian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To explore the feasibility of measuring glomerular filtration rate (GFR) using iodine maps in dual-energy spectral computed tomography urography (DEsCTU).

##### METHODS AND MATERIALS

One hundred and eighty patients with renal tumors referred for DEsCTU were prospectively enrolled. The DEsCTU protocol included non-contrast, nephrographic, and excretory phase imaging. The CT-derived GFR was calculated separately using the above 3-phase iodine maps (CT-GFRiodine) and 120 kVp-like images (CT-GFR120kvp). CT-GFRiodine and CT-GFR120kvp were compared with estimated GFR (eGFR) using paired t-test, correlation analysis, and Bland-Altman plots. The receiver operating characteristic (ROC) curves were used to test the renal function diagnostic performance with CT-GFR120kvp and CT-GFRiodine.

##### RESULTS

There were 100 patients with normal renal function and 80 patients with decreased renal function. The difference between eGFR ( $91.71 \pm 14.17 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{m}^{-2}$ ) as reference standard and CT-GFRiodine ( $93.42 \pm 14.04 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{m}^{-2}$ ) was not statistically significant, showing excellent correlation ( $r=0.88$ ,  $P<0.001$ ) and agreement ( $\pm 15.65 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{m}^{-2}$ ,  $P=0.091$ ). The correlation between eGFR and CT-GFR120kvp ( $84.71 \pm 21.76 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{m}^{-2}$ ) was poor ( $r=0.58$ ,  $P<0.001$ ), and the agreement was poor ( $\pm 45.75 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{m}^{-2}$ ,  $P=0.004$ ). The CT-GFRiodine had the largest area under the curve (AUC) for distinguishing between normal and decreased renal function (AUC=0.974).

##### CONCLUSION

s The GFR can be calculated accurately using iodine maps in DEsCTU.

##### CLINICAL RELEVANCE/APPLICATION

This study explored the potential information of iodine maps in DEsCTU and demonstrated that DEsCT could be a non-invasive and reliable one-stop-shop imaging technique for evaluating both the urinary tract morphology and renal function, thereby providing more quantitative parameters for clinical practice and bringing more benefits to patients.

#### **R5B-SPGU-2 AI-based Urinary Calculi Detection, Localization, and Quantification on Abdomen-pelvis CT: A Multicenter, International Internal Testing and External Validation Study**

##### Participants

Parisa Kaviani, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### PURPOSE

Detection and localization of urinary calculi have a crucial role in patient management and in choosing the best course of therapy. Therefore, we performed a multicenter, international study to assess the performance of an AI algorithm for urinary calculi detection, localization, and quantification on abdomen-pelvis CT.

##### METHODS AND MATERIALS

Our retrospective IRB-approved study included 980 patients (mean age  $60 \pm 14$  years; M:F 509:471) who underwent non-contrast abdomen-pelvis CT for the evaluation of suspected urinary calculi at one of the 8 hospitals (4 sites in India,  $n=451$  patients; 4 in the US,  $n=529$  patients). The training ( $n>1000$  CT) and internal testing data ( $n=451$  CT) belonged to the Indian sites while the US sites contributed data for the external model validation. Patients with surgical clips, stent, and metal related artifacts were excluded. All CT exams were reviewed by one of the three radiologists from India and US, and separately processed with Urologiq AI algorithm (Biocliq Technologies PVY LTD, India) to obtain information on the size of urinary calculi ( $n=451$ ) as well as to determine the urinary calculi presence and location, and hydronephrosis/hydronephroureter presence/severity ( $n=980$ ). Deidentified DICOM images were imported to a secure platform CARING Analytics platform (CARPL) for ground truthing. The sensitivity, specificity, and area under the curve of receiver operating characteristics (ROC-AUC) were estimated to assess the AI model performance.

##### RESULTS

Our AI algorithm was able to detect the presence of urinary calculi with sensitivities, specificities, and AUCs of 97.3%, 94.2%, 0.958 (internal testing data) and 100%, 100%, 0.958 (external validation set), respectively. Likewise, the AI model differentiated the location of the renal calculi with sensitivities, specificities, and AUCs of 100%, 69.2%-99.6%, and 0.700 - 0.996 (internal



testing data) and 92.9%-100%, 75.5%-100%, and 0.79-1 (external validation data) at different locations including (renal, ureteric, bladder levels), respectively. There was a strong correlation of 0.941-0.963 between AI and radiologist measured stone dimensions ( $p < 0.001$ ) with a <5% differences between the two measures.

#### **CONCLUSION**

s The assessed AI algorithm was generalizable and accurate for detection, localization, and quantification of urinary calculi in both internal testing and external validation sites.

#### **CLINICAL RELEVANCE/APPLICATION**

The assessed AI model can help improve reporting accuracy and efficiency of abdominal-pelvis CT examinations for kidney stones.

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## Abstract Archives of the RSNA, 2023

R5B-SPHN

### Head & Neck Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPHN-1 New Strategies in the Diagnosis of Thyroid Nodule: TI-RADS Risk Stratification Systems Versus Computer Aided Diagnosis Software**

##### Participants

Vincenzo Dolcetti, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

To compare thyroid nodules evaluation of a expert radiologist (based on ACR-TIRADS classification) to the CAD System S-Detect, in a cohort of patients who performed FNAC.

##### METHODS AND MATERIALS

140 patients with an age range of 34 to 78 years with one and no more than three thyroid nodules were enrolled prospectively. The B-mode ultrasound evaluation of the nodule was integrated by a CAD System S-detect evaluation on each patient, and the two were put in comparison with cytology as gold standard. The exclusion criteria were the presence of cystic or mixed predominantly cystic (fluid >50%) lesions, and nodules smaller than 5 mm. All nodules were characterized in terms of size, shape, margins, composition, echogenicity, presence of calcifications or punctate echogenic foci and extrathyroidal extension. Afterward, the S-Detect software was used to automatically determine the shape, composition, echogenicity, and margins of the same nodule.

##### RESULTS

At the cytological examination, 102 benign and 38 malignant nodules were identified. At the B mode evaluation, 99 benign nodules (TIRADS 2/3) and 41 malignant nodules (TIRADS 4/5) were identified with a sensitivity of 98%, a specificity of 93%, a positive predictive value of 97% and a negative predictive value of 97%. The S-Detect software identified 97 benign and 43 malignant nodules, with a sensitivity of 97%, a specificity of 92%, a PPV of 95%, a NPV of 95%. A high agreement (>95%) was therefore demonstrated between the evaluation of thyroid nodules performed by the radiologist at the B-mode US using the ACR-TIRADS classification system and the automatic CAD classification provided by the S-Detect software.

##### CONCLUSION

s ACR-TIRADS shows high agreement with the S-Detect and both show high agreement with cytology results.

##### CLINICAL RELEVANCE/APPLICATION

S-Detect is a viable tool for the characterization of thyroid nodules and it has a potential role as a teaching or support tool for the less experienced operators.

#### **R5B-SPHN-2 Preoperative Diagnosis of Cervical Lymph Node Metastasis in Patients with Thyroid Cancer: Integrative Analysis of CT Imaging Features Based on US**

##### PURPOSE

Ultrasound (US) is widely used as a primary imaging modality for the evaluation of cervical lymph node (LN) metastasis in thyroid cancer, but its diagnostic accuracy is limited. Computer tomography (CT) is often employed as a complementary modality, but there is no clear consensus on how to integrate the findings from the two modalities. We conducted a study to evaluate the concordance between suspicious imaging features observed on US and CT and to determine the clinical significance of concordant and discordant cases.

##### METHODS AND MATERIALS

This retrospective study included consecutive thyroid cancer patients who underwent US, CT examinations, and LN biopsy before surgery between December 2006 and June 2015. We analyzed US and CT images of LNs based on the lexicons of the Korean Society of Thyroid Radiology risk stratification system on a node-by-node basis. The concordance rate was calculated by matching US hyperechogenicity/abnormal vascularity with CT strong/ heterogeneous enhancement, US cystic changes vs. CT cystic changes, and US echogenic foci with CT calcifications. The malignancy rate of LNs was further compared according to the presence of specific suspicious features on US with their concordance with CT features.

##### RESULTS

A total of 277 cervical LNs (228 patients, mean age  $47.4 \pm 13.6$  years, female 73.2%) were analyzed, with 53.1% of them were metastatic. The positive concordance rate of suspicious features between US and CT were generally high (US hyperechogenicity vs. CT strong/heterogeneous enhancement, 89.1%; US abnormal vascularity vs. CT strong/heterogeneous enhancement, 86.4%; US cystic changes vs. CT cystic change, 70.6%; US large echogenic foci vs. CT macrocalcification, 87.0%), except for punctate echogenic foci (PEF) (vs. CT microcalcification, 6.5%). Positive concordant cases of US hyperechogenicity/abnormal vascularity showed higher malignancy risk (93.5%) than that of discordant cases (41.2%,  $P < .001$ ). The presence of cystic change or EF on US indicated a high risk of malignancy (82.6-95.8%), irrespective of presence of corresponding CT features.

## CONCLUSION

s Suspicious imaging features of cervical LNs observed on US and CT were generally concordant, except for PEF. Heterogeneous or strong enhancement features of CT reinforces the diagnostic significance of hyperechogenicity or abnormal vascularity on US. However, when cystic changes or echogenic foci are observed on US, malignancy should be suspected regardless of CT findings.

## CLINICAL RELEVANCE/APPLICATION

An integrative evaluation of the suspicious features with both US and CT can enhance the diagnostic ability for detecting cervical lymph node metastasis in thyroid cancer patients.

### **R5B-SPHN-3 Evaluating the Diagnostic Performance of a Deep Learning Model for Detecting Thyroid Nodule Malignancy: An Expert Evaluation Study**

Participants

Sanaz Vahdati, MD, Rochester, MN (*Presenter*) Nothing to Disclose

## PURPOSE

Thyroid cancer is the most common endocrine malignancy. Ultrasound is the primary imaging modality for evaluating thyroid nodules. Based on the radiologist's assessment, further management, including fine needle aspiration, which is an invasive and costly procedure, may be requested. Thyroid nodule assessment relies on the expertise of radiologists and is subjective to an intrareader agreement. In recent years many deep-learning applications have been developed for thyroid nodule characterization. However, the evaluation of the deep learning model's performance in real-world radiology settings has been limited. In the current work, we aim to evaluate the performance of our previously developed model for thyroid nodule classification into benign and malignant with a radiologist using the American College of Radiology Thyroid Imaging Reporting and Data Systems scoring (TIRAD).

## METHODS AND MATERIALS

The proposed model was trained on the ultrasound images of thyroid nodules from 983 patients with confirmed diagnostic reports from 2008 to 2018. 81 cases were held out as a testing set, and the rest of the data was used for training purposes. One radiologist with more than ten years of experience in ultrasound imaging evaluated the same images of the test set based on the TIRAD scoring system. The radiologist's thyroid nodule evaluation was recorded while the radiologist was blinded regarding the model's prediction and final pathological diagnosis of the patients.

## RESULTS

The whole pipeline from the developed model reached an AUROC of 0.84 (CI 95%: 0.75-0.91) with sensitivity and specificity of 84% and 63%, respectively. The TIRAD evaluation of the test set had a sensitivity of 76% and specificity of 34% which was comparably lower than the model's prediction (p-value=0.003). A comparison of our model's performance with ground truth and the TIRAD score based on an expert radiologist's evaluation was analyzed. In 28% of the cases, the model predicted benign nodules as benign with TIRAD >3 reports from an expert radiologist. In 19% of cases, our model predicted benign nodules with TIRAD =3 as benign, and in 33% of cases, our model predicted malignant nodules correctly with the TIRAD >3. In addition, our model predicted no nodule as malignant, while the nodule had a benign biopsy report with a TIRAD =3.

## CONCLUSION

s We demonstrate the potential diagnostic performance of the deep learning model by comparison of its predictions with TIRAD scores from an expert radiologist.

## CLINICAL RELEVANCE/APPLICATION

Thyroid nodule assessment in ultrasound is subjective to inter and intra-reader agreement. Our deep learning model can provide further assistance to radiologists for thyroid nodule evaluation.

### **R5B-SPHN-4 Real-World Costs Associated with Incidental Thyroid Nodule Workup at an Academic Medical Center**

Participants

Brandon Fields, MD, San Francisco, IL (*Presenter*) Nothing to Disclose

## PURPOSE

Incidental thyroid nodules (ITN) are a frequent finding on cross-sectional imaging, occurring in up to 18% of CT neck studies with a malignancy rate of up to 11% in the reported literature. The rising incidence of thyroid cancer in the United States, due largely to low-risk papillary thyroid cancers detected as ITNs, has been termed an "epidemic of overdiagnosis". ITN workup, including thyroid ultrasound, labs, and biopsy, may therefore cause resource burden on the healthcare system with questionable clinical benefit. The purpose of our study was to prospectively quantify the cumulative financial burden of ITN workup within a single hospital system using real-world data.

## METHODS AND MATERIALS

Starting in August 2022, all ITNs discovered on CT and MR studies that include the neck at a single hospital system were flagged using a key phrase within the radiology report. The patient's age, nodule size, nodule characteristics, and results of any further tests including thyroid labs, thyroid ultrasound, ultrasound-guided fine needle aspiration, and thyroidectomy, were recorded. The cost of thyroid labs, thyroid ultrasound, ultrasound-guided fine needle aspiration, and thyroidectomy was estimated using national 2023 Medicare reimbursement rates for each test.

## RESULTS

From August 2022 to April 2023, ITNs were found on imaging studies including the neck of 355 patients. The overall incidence of thyroid nodules in a representative selection of studies was 4.0%. Further workup was recommended in 130 of 355 patients based on American College of Radiology guidelines. Fifty of 130 patients underwent laboratory testing with TSH, total T4, free T4, and/or free T3 assays. Thus far, 28 ultrasounds and six fine needle aspiration biopsies have been performed. Of the six biopsies, only one showed malignancy and that patient has not yet undergone surgical workup. One patient underwent right partial thyroidectomy for an indeterminate ultrasound result; final surgical pathology was benign and the patient is currently euthyroid. The total cost of thyroid nodule workup thus far has been \$5,780.96 for one malignancy diagnosed. Assuming the patient with diagnosed malignancy

in our cohort undergoes a partial thyroidectomy and remains euthyroid, the total cost for one malignancy diagnosed and treated will be \$6,499.37.

#### **CONCLUSION**

s In this single center prospective cohort study, the total cost of thyroid nodule workup from August 2022 to April 2023 was \$5,780 for one malignancy diagnosed, and \$6,499 for one malignancy diagnosed and treated.

#### **CLINICAL RELEVANCE/APPLICATION**

Incidental thyroid nodule (ITN) workups cause financial burden on a healthcare system with questionable clinical benefit. Quantifying this financial burden is an important step toward cost-effective healthcare.

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## Abstract Archives of the RSNA, 2023

R5B-SPIN

### Imaging Informatics Thursday Poster Discussions II

#### Sub-Events

#### R5B-SPIN-1 Using a Large Language Model for Identifying Findings in Chest X-ray Reports

##### Participants

Pritam Mukherjee, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate Vicuna-13B, a publicly available large language model (LLM), on the task of identifying chest x-ray reports that are positive for a set of findings.

##### METHODS AND MATERIALS

This retrospective study used 25,596 chest x-ray reports from 2797 patients (M: 1,557 (56%), median age: 47, IQR: [32, 58]), corresponding to the test set of the publicly available NIH Chest X-Ray dataset. For the 13 Chexpert findings (atelectasis, cardiomegaly, consolidation, edema, enlarged cardiomeastinum, fracture, lung lesion, lung opacity, pleural effusion, pleural other, pneumonia, pneumothorax, and support devices) we considered the following multi-label binary classification task: the class label for a finding is True if the report contains a positive mention of the finding, and False otherwise. The LLM we chose is Vicuna-13B, a finetuned version of the LLaMA foundation model. We used a rule-based interactive prompting strategy, where each step is a natural language question in English. To avoid randomness in outputs, we set the "temperature" hyperparameter to 0. Since "gold label" radiologist annotations for the large dataset were not available, our primary goal was to assess the agreement of Vicuna's outputs with two popular and state-of-the-art labelers - a rule-based NLP tool Chexpert, and a deep learning model ChexBert - using the Fleiss' kappa statistic performed in a pairwise manner. A subset of 100 reports was manually annotated by a senior radiologist with more than 25 years of experience according to the Chexpert labeling rules. Receiver operating characteristics (ROC) analysis was performed using the radiologist annotations as the reference to assess the reliability of Chexpert, ChexBert and Vicuna.

##### RESULTS

Chexpert and ChexBert showed very high agreement with one another with a kappa value of 0.84 for the NIH dataset. Vicuna showed moderate agreement, with kappa values of 0.54 (P <.001) vs Chexpert and 0.56 (P <.001) vs ChexBert. When compared to radiologist annotations for 100 reports, Vicuna outperformed ChexBert on 4/11 findings (atelectasis, consolidation, enlarged cardiomeastinum, and pleural other), and Chexpert on 5/11 findings (atelectasis, cardiomegaly, enlarged cardiomeastinum, and pleural other); the mean AUROC over 13 labels was 0.85 for all models.

##### CONCLUSION

s LLMs such as Vicuna present promising alternatives to custom-built NLP or deep learning tools for analyzing radiology reports. Vicuna showed satisfactory performance on our task - without any additional training or finetuning.

##### CLINICAL RELEVANCE/APPLICATION

Vicuna can be run locally without risking patient privacy and can accurately determine the presence or absence of findings in reports without the need for any training or custom NLP rules.

#### R5B-SPIN-2 Performance Evaluation and Return on Investment Estimation of a High-Sensitivity Normal-Abnormal Chest X-ray Classifier for Enhanced Clinical Workflow

##### Participants

Eduardo Farina, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Vasanth Venugopal, MD, New Delhi, India (*Presenter*) Officer, CARPL.AI Inc

##### PURPOSE

To evaluate the performance of a high-sensitivity normal-abnormal chest X-ray classifier, in improving the clinical workflow through efficient batching of normal and abnormal cases.

##### METHODS AND MATERIALS

The IRB-approved study used an enriched retrospective dataset consisting of 2405 normal cases and 2356 abnormal cases. The abnormal cases included clinically significant findings including but not limited to consolidation, nodule, cavitation, pleural effusion, pneumothorax, pneumoperitoneum, cardiomegaly, and rib fractures. These studies were evaluated using ChestLink by Oxipit.ai to classify the chest X-rays into normal and abnormal categories. The algorithm was orchestrated and the inferencing results were analyzed on the CARPL.AI platform.

##### RESULTS

The AI classifier identified 1859 normal and 2902 abnormal cases, with 12 false negatives and 568 false positives. The calculated

sensitivity (recall or true positive rate) of ChestLink is 99.49%, and its specificity (true negative rate) is 76.38%. The positive predictive value (PPV) is 80.77%, while the negative predictive value (NPV) is 99.35%. In the existing workflow with a 30% time reduction for normal cases, the ROI is 26.4%. In the auto-batch workflow, where radiologists take 10 seconds to approve normal cases, the return on Investment (ROI) increases to 180.6%.

## CONCLUSION

s AI solutions can effectively improve the clinical workflow by batching normal and abnormal cases, allowing for the prioritization of abnormal cases for radiologists' review. This minimizes the time spent on normal cases and ensures faster diagnosis and treatment of patients with chest abnormalities. The low false-negative rate further emphasizes its potential to reduce missed abnormal cases, leading to improved patient outcomes. It also demonstrates a positive ROI in both scenarios, significantly improving the efficiency of radiology departments, especially in the auto-batch workflow.

## CLINICAL RELEVANCE/APPLICATION

Implementing ChestLink can lead to faster diagnosis and reporting for patients, while reducing radiologists' workload by optimizing their time spent on normal cases. The auto-batch workflow further enhances these benefits, making it a valuable solution for radiology departments seeking to increase productivity and efficiency.

## R5B-SPIN-3 Development and Clinical Validation of a Radiological Impression Summarization System with Large Language Models

### PURPOSE

To develop and clinically validate a large language model that automatically generates impressions to summarize radiology reports.

### METHODS AND MATERIALS

This retrospective model development study included 204,540 consecutively collected CT, MRI, US, and PET radiology reports from January 2021 to December 2021 from a single academic institution. We devised a text summarization task using a T5 large language model pretrained on the C4 dataset to generate the impression section from the clinical history, comparison, and findings sections of the radiology reports. Repetitive, non-informative phrases such as "No wet reading was provided for this report" and "The above findings have been communicated to the referring physician" were removed from the reports to improve model performance. The Recall-Oriented Understudy for Gisting Evaluation (ROUGE) score, a standard metric for measuring the quality of summaries, was used to evaluate model performance, and a five-reader performance study was conducted to validate clinical utility derived from impression generation. For each of sixty reports, readers were presented with either the report or model-generated impressions and were asked to edit the impression. Impressions were rated for their clinical accuracy, grammatical accuracy, stylistic quality, with the edit distance between their edited impression and the original impression, and time taken to edit also recorded.

### RESULTS

On a UCSF general test dataset composed of 19,710 reports, the model achieved average ROUGE-1, ROUGE-2, and ROUGE-L scores of 54.05, 36.94, and 46.92. For the reader performance study, the model achieved mean ratings of 3.6/4, 3.9/4, and 3.4/4 for clinical accuracy, grammatical accuracy, and stylistic quality respectively and a mean edit distance and edit time of 11.75 words and 18.79 seconds respectively, of a similar performance to the radiologist baseline. The reader performance study demonstrated a moderate level of interexpert agreement (ICC: 0.57).

## CONCLUSION

s Using the clinical history and findings section of a radiology report, large language models can automatically generate radiological impressions with clinical accuracy, stylistic quality, and grammatical accuracy.

## CLINICAL RELEVANCE/APPLICATION

We demonstrate that a large language model can be used to automatically generate excellent quality radiologic impressions, which could potentially improve report quality and workflow efficiency.

## R5B-SPIN-4 Evaluation of A Natural Language Processing Model for Automated Protocolling of CT/MRI Requisitions

Participants

Jia Cheng Yao, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

### PURPOSE

Assess the accuracy of a natural language processing (NLP) model for automatically protocolling CT and MRI requisitions.

### METHODS AND MATERIALS

Image requisitions of all CT/MRIs performed between January 2018-September 2022 at our institution were extracted from the Electronic Medical Record. A total of 234,193 records were obtained containing study requisition text, patient location (outpatient, emergency, inpatient), WTIS triage priority (P1-P4) and selected protocol. Studies were excluded if they did not include a priority or standardized protocol, or were for an interventional radiology procedure (n = 10,150). A total of 224,043 studies were included, with 569 unique protocols (140 CT and 429 MRI). Studies were stratified by triage priority, then randomly split into training, validation and test datasets based on a 80-10-10% split. Data was pre-processed (lower casing, punctuation removal, stop-word removal, lemmatization) using standard techniques. Two independent pre-trained Bidirectional Encoder Representations from Transformers (BERT) models for study protocol and triage priority were fine-tuned using the training dataset based on the optimal hyperparameters (batch size = 10, learning-rate 3e-4) for 5 epochs. Results were analyzed for precision/recall and accuracy, with sub-analysis based on patient location and imaging modality.

### RESULTS

For study protocol, weighted-mean F1-score, precision and recall were 0.813, 0.848 and 0.792, respectively. Overall accuracy was 0.848 (Top-3 accuracy 0.960, Top-5 accuracy 0.973). Stratified by location, accuracy for outpatient (OP), emergency department (ED), and inpatient (IP) studies were 0.832, 0.987 and 0.856, respectively. Accuracy for CT and MRI were 0.899 and 0.762, respectively. Micro-averaged one-vs-rest (OvR) area under the curve (AUC) was 0.998. For study protocol, weighted-mean F1-

score, precision and recall were 0.847, 0.845 and 0.849, respectively. Priority 1 studies demonstrated high F1, precision and recall, 0.952, 0.948 and 0.956, respectively. Overall accuracy was 0.849 (Top-2 accuracy 0.982). Stratified by location, accuracy for OP, ED, and IP studies were 0.832, 0.987 and 0.856, respectively. Accuracy for CT and MRI were 0.831 and 0.881, respectively. Micro-averaged OVR AUC was 0.974.

## CONCLUSION

s Natural language processing models are a feasible solution for automated protocolling of CT/MRI requisitions.

## CLINICAL RELEVANCE/APPLICATION

Applications include workflow optimization, protocol suggestion and study flagging. Given a relative lack of protocol standardization, automated methods also provide opportunities for standardization between institutions and radiologists.

## R5B-SPIN-5 Lifelike Pixel Print Phantoms for Clinical Evaluation of a Deep Learning CT Reconstruction Algorithm

Participants

Jessica Im, BEng, (*Presenter*) Nothing to Disclose

## PURPOSE

Deep learning CT reconstruction (DLR) has become increasingly popular as a method of improving image quality and reducing radiation exposure. Due to their nonlinear nature, these algorithms exhibit object-dependent resolution and noise performance. Therefore, traditional phantoms, which lack tissue morphology, in combination with image quality metrics, such as contrast-to-noise ratio (CNR), have become inadequate indicators of clinical imaging performance. In this study, we propose to utilize lifelike 3D-printed PixelPrint lung phantoms to evaluate DLR performance over a wide range of radiation doses.

## METHODS AND MATERIALS

A lung phantom generated from a patient chest CT with ground glass opacities (GGO) was fabricated using PixelPrint technology. The phantom was scanned with a conventional CT (Incisive CT, Philips Healthcare) at five radiation dose levels (CTDIvol 4.4, 5.6, 9.8, 14.4, 17.0 mGy). At each radiation dose, three scans were acquired, and each was reconstructed with filtered back projection (FBP), iterative reconstruction at one level (iDose4, Level 3), and AI-enabled DLR (Precise Image (PI)) at five levels (Sharper, Sharp, Standard, Smooth, Smoother). Noise and CNR were calculated for each radiation dose and reconstruction technique. With FBP at 17.0 mGy as the reference, structural similarity index measure (SSIM), multi-scale SSIM (MS SSIM), root mean square error (RMSE), and standard deviation (SD) of difference images were also calculated. A two-sample t-test with Bonferroni post hoc test was then performed to evaluate the performance of each dose and reconstruction combination in comparison to the reference for each metric.

## RESULTS

The PixelPrint phantom produced clinically realistic images. iDose4 and DLR demonstrated superior performance at lower radiation doses compared to FBP across all metrics. To match or exceed the performance of the reference for every metric, iDose4 and varying levels of DLR required 9.8 mGy and between 4.4 and 9.8 mGy, respectively. These doses corresponded to dose reductions of 42% for iDose4 and 42% to 75% for DLR.

## CONCLUSION

s DLR has been shown to reduce radiation dose compared to FBP without compromising diagnostic image quality, surpassing the dose reduction achieved through iterative reconstruction. PixelPrint phantoms offer a valuable option for evaluating non-linear and object-dependent reconstruction algorithms, including various flavors of DLR.

## CLINICAL RELEVANCE/APPLICATION

The use of PixelPrint in evaluating novel CT technologies offers a more realistic testing environment compared to traditional phantoms. This, in turn, promotes the translation of new technologies, such as DLR, into clinical practice.

## R5B-SPIN-6 Evaluation of Segmentation Performance using Multiple Reference Standards for Accurate Orbital Bone Modeling in Cranio-maxillofacial Surgery: Based on MSDA-Net Deep Learning Segmentation

Participants

Min Jin Lee, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Accurate segmentation and modeling of orbital bone on facial CT images are essential for creating customized bone templates in craniomaxillofacial surgery. This study proposes MSDA-Net, a segmentation algorithm that considers varying characteristics of orbital bone in terms of intensity and thickness, and evaluates its performance using reference standards generated through manual labeling by observers and label combination methods.

## METHODS AND MATERIALS

A dataset of 355 facial CT images was divided into 228 training, 56 validation, and 71 test sets. MSDA-Net includes multiscale hierarchy module that considers various bone thicknesses and dual-attention module that focuses on meaningful features of thin bone. Three reference standards were obtained from observers, including a neurosurgeon with over 15 years of experience and two senior medical students. Three additional reference standards were generated using label combination methods, such as label fusion, majority voting, and the STAPLE algorithm. Segmentation performance was evaluated using six reference standards, with the evaluation ROI divided into three regions: whole orbital bone, medial wall, and orbital floor.

## RESULTS

The proposed method outperformed with a DSC of over 89.75% for whole orbital bone and DSCs of 74.38% and 81.42% for the medial wall and orbital floor, respectively. However, differences in reference standards generated by observers and label combination methods resulted in varying levels of precision and recall. Observer 1 tended to generate thick labels, resulting in high precision, while Observers 2 and 3 produced relatively thin labels, leading to high recall values. Label fusion tended to generate thick labels, resulting in high precision, while majority voting and STAPLE generated similar reference standards with high recall. No significant difference in all segmentation measurements was observed between majority voting and STAPLE using the reference

standards.

## **CONCLUSION**

s MSDA-Net provides accurate segmentation results by considering varying thickness and intensity of the orbital bone. Our study emphasizes the importance of using multiple reference standards to evaluate segmentation algorithms for structures prone to inter-observer variability. (This research was supported by a grant from the Korea Health Technology RD Project through the Korea Health Industry Development Institute, funded by the Ministry of Health Welfare (HI22C1496))

## **CLINICAL RELEVANCE/APPLICATION**

Our study can assist in creating customized implants and surgical guides for reconstructing fractured or defective bones and establish reference standards for evaluating automatic segmentation algorithms.

## **R5B-SPIN-7 Evaluating the Reliability of ChatGPT as a Tool for Imaging Test Referral: A Comparative Study with a Clinical Decision Support System**

Participants

Mor Saban, PhD, Tel Aviv, Israel (*Presenter*) Nothing to Disclose

## **PURPOSE**

The purpose of this study is to investigate the feasibility of using Chat Generative Pre-trained Transformer (ChatGPT) to provide accurate imaging referrals for clinical use, as compared to the existing ESR iGuide system. With the continuous evolution and advancement of technology, Artificial Intelligence (AI) is increasingly being used to make diagnosis and decisions, including suggesting the most appropriate imaging referrals. This study aims to explore whether ChatGPT can provide equally or more accurate imaging referrals compared to the ESR iGuide. By evaluating the accuracy and effectiveness of ChatGPT, this study can contribute to the development of AI-based tools for clinical decision-making and potentially improve patient outcomes.

## **METHODS AND MATERIALS**

A comparative study was conducted in a tertiary hospital. Data was collected from 97 consecutive cases that were admitted to the emergency department with abdominal complaints. We compared the imaging test referral recommendations suggested by the ESR iGuide and the ChatGPT and analyzed cases of disagreement. In addition, we selected cases where ChatGPT recommended a Chest Abdominal Pelvis (CAP) CT (n=66), and asked four specialists to grade the appropriateness of the referral.

## **RESULTS**

ChatGPT recommendations were consistent with the recommendations provided by the ESR iGuide. No statistical differences were found between the appropriateness of referrals by age or gender. Using a sub-analysis CAP cases, high agreement between ChatGPT and the specialists was found. Cases of disagreement (12.4%) were further analyzed and presented themes of vague recommendations such as "it would be advisable" and "this would help to rule out".

## **CONCLUSION**

s ChatGPT's ability to guide the selection of appropriate tests may be comparable to some degree with the ESR iGuide. Features such as the clinical, ethical, and regulatory implications are still warranted and need to be addressed prior to clinical implementation. Further studies are needed to confirm these findings.

## **CLINICAL RELEVANCE/APPLICATION**

The article explores the potential of using advanced language models, such as ChatGPT, in healthcare as a CDS for selecting appropriate imaging tests. Using ChatGPT can improve the efficiency of the decision-making process

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## Abstract Archives of the RSNA, 2023

R5B-SPIR

### Interventional Radiology Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPIR-1 Image-guided Intratumoral Radiofrequency Hyperthermia-Enhanced Herpes Simplex Virus Thymidine Kinase Gene Therapy of Non-Small Cell Lung Cancer: The Underlying Molecular Mechanisms**

#### **PURPOSE**

To validate the feasibility of image-guided interventional radiofrequency hyperthermia (RFH)-enhanced direct suicide gene therapy of orthotopic non-small cell lung cancer (NSCLC) and the underlying molecular mechanisms.

#### **METHODS AND MATERIALS**

This study included (a) in vitro experiments to prove the principle of the concept of "RFH-enhanced killing efficacy of Herpes Simplex Virus Thymidine Kinase (HSV-TK) /ganciclovir (GCV) gene therapy" on NSCLC cells, which was confirmed by confocal microscopy, MTS assay and apoptosis analysis; (b) in vivo experiments to validate the feasibility of the new interventional oncology technique, "image-guided intratumoral RFH-enhanced local HSV-TK/GCV gene therapy of NSCLC " by using a multifunctional perfusion-thermal RFH electrode for the rat models of orthotopic lung cancer; and (c) to investigate the related biomolecular mechanisms through three potential pathways, including apoptosis, heat shock protein and immunomodulatory. Both in-vitro and in-vivo experiments were divided into four study groups (n=6/group) with different treatments: (1) combination therapy of RFH+ HSV-TK/GCV; (2) RFH alone at 42°C for 30?min; (3) gene therapy with HSV-TK/GCV; and (4) control with saline.

#### **RESULTS**

In in-vitro experiments, bioluminescence optical imaging of cells confirmed that the relative photon signal intensity in the combination therapy group was significantly lower than those in the other three groups ( $p<0.001$ ). Confocal microscopy and MTS assay also demonstrated significant decrease in cell viability in combination therapy group, compared with other three groups ( $p<0.001$ ). Flow cytometry showed remarkably increased apoptosis in the combination therapy group ( $p<0.01$ ). In in-vivo experiments, follow-up bioluminescence imaging demonstrates a significantly lower relative photon signal intensity of tumors in the combination therapy group than in the other groups ( $p<0.05$ ). Immunohistochemical staining revealed the significantly decreased expression of Bcl-2 ( $p<0.01$ ), and significantly increased expression of Bax ( $p<0.05$ ) and Caspase-3 ( $p<0.01$ ) in the combination therapy group. Immunohistochemical staining also displayed the up-regulation of HSP-70 ( $p<0.01$ ), IL-2 ( $p<0.01$ ) and CD94 ( $p<0.01$ ) in combination therapy.

#### **CONCLUSION**

s This study validated the feasibility of image-guided interventional RFH-enhanced direct suicide gene therapy of orthotopic NSCLC, which is activated through the mechanisms of augmenting Bax/Bcl-2/caspase-3-dependent apoptosis and the HSP-70/IL-2 dependent anti-tumor immunity regulation pathway.

#### **CLINICAL RELEVANCE/APPLICATION**

This study has established ground works for developing a new interventional oncology therapy to effectively manage NSCLC.

#### **R5B-SPIR-2 Delayed Sequelae Following Intranodal Lymphangiogram and Thoracic Duct Embolization**

#### Participants

Alexey Gurevich, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Over the last decade, intranodal lymphangiography replaced pedal lymphangiography as guidance for thoracic duct embolization (TDE). The long-term effects of intranodal TDE are yet to be elucidated. This study serves the purpose of determining potential delayed sequelae after technically successful intranodal TDE in traumatic and non-traumatic cases.

#### **METHODS AND MATERIALS**

Internal IR QA database (Hi-IQ) was reviewed to identify patients referred for TDE. Between January 2011 and December 2019, 172 patients underwent technically successful intranodal lymphangiogram and TDE to treat isolated chylothorax and plastic bronchitis. The patients were contacted and interviewed for the development of lower extremity edema, diarrhea, abdominal swelling, persistent weight loss, shortness of breath, and development of any other symptoms the patient felt may be temporally related to TDE. Patients were asked to rate their overall health on a scale of 1 to 10 (with 10 being the best) at the time of the interview. Patients who could not be reached were analyzed using electronic medical records (EMR).

#### **RESULTS**

42/177 (20.3%) patients were deceased due to causes unrelated to TDE or did not meet the criteria of minimum 24 months follow-up. 88/130 patients (67.7%, 55M and 43F, 54.6±16.7 years) were assessed with 61/88 (69.3%) patients being available for direct interviews and 27/88 (30.7%) having sufficient clinical information in the EMR. Average follow-up time was 69.4±22.4 months (ranging 25 to 137m). 60/61 (98.3%) patients reported improvement in their lymphatic-related symptoms. Of those who reported

improvement, self-reported health assessment averaged a 9.1 out of 10. 2/88 (2.3%) patients were identified to report one or multiple symptoms that could be related to TDE, such as post-embolization chyluria in patient #1, and abdominal pain with constipation in patient #2. No patients reported diarrhea, shortness of breath, weight loss, or lower extremity swelling that could be directly related to TDE.

## CONCLUSION

s Intranodal TDE is not only effective, but also a safe procedure for treatment of pulmonary lymphatic flow disorders with a reported long-term sequela of 2.3%. Abdominal pain and aberrant lymphatic collaterals may be related to intranodal lymphangiography and TDE, and should be included in routine informed consent.

## CLINICAL RELEVANCE/APPLICATION

This paper demonstrates the long-term safety of TDE. Clinicians should be confident in applying this technique in patients with traumatic and non-traumatic intrathoracic lymphatic leaks.

## R5B-SP1R-3 Outcomes of Percutaneous Transluminal Angioplasty and/or Stenting (PTAS) as Treatment for Transplant Renal Artery Stenosis (TRAS)

Participants

Dhane Stomp, MD,BS, Miami, FL (*Presenter*) Nothing to Disclose

## PURPOSE

The objective of this study was to investigate the efficacy of percutaneous transluminal angioplasty and/or stenting (PTAS) for treatment of transplant renal artery stenosis (TRAS).

## METHODS AND MATERIALS

This single-center, retrospective study analyzed a total of 91 patients with TRAS (median age = 61; 62.46% male and 37.36% female) who underwent 114 PTAS procedures between August 2013 and March 2020. We manually measured renal artery stenosis diameters from pre- and post-intervention angiographic images in the picture archiving and communication system (PACS) for each procedure. Technical success was defined as the ability to successfully dilate the stenosis with angioplasty and/or stent without significant residual stenosis. Baseline and post-intervention peak systolic velocities (PSV) [cm/s] and serum creatinine levels [mg/dL] at regular intervals for at least 24 months were recorded. Baseline and post-intervention results were compared using a two-sided paired samples T-test, with statistical significance defined by a p-value < 0.05.

## RESULTS

Regardless of intervention type, primary technical success was notably high (96.70%). The most performed procedure was stenting (75.44%). Angioplasty alone resulted in a higher reintervention rate compared to stenting (44.44% vs. 20.55%; p = 0.037). Serum creatinine was measured for a median of 12 months; PSV was measured for a median of 6 months. There was a statistically significant reduction in PSV up to 12 months (mean reduction 233 cm/s; p < 0.001). There was also a significant reduction in creatinine from baseline to nadir (mean reduction 0.84 mg/dL; p < 0.001), achieved at a median of 4 months. The reduction in PSV did not correlate with the reduction in creatinine (Pearson correlation coefficient = 0.33; p = 0.79). Fourteen (12.28%) procedural complications occurred, including six minor (e.g., perinephric hematoma, puncture site hematoma, stent kinking) and eight major complications (e.g., dissection, pseudoaneurysm, thromboembolism). Four deaths occurred during the study period, none of which were attributed to study interventions (SIR adverse event class E-F).

## CONCLUSION

s PTAS is an effective, safe treatment for TRAS with a high rate of technical success. A higher reintervention rate was seen with angioplasty alone compared to stenting. Following PTAS, there was a statistically significant reduction in both PSV at 12 months and serum creatinine to nadir. No permanent adverse sequelae or death resulted from any procedure.

## CLINICAL RELEVANCE/APPLICATION

Percutaneous transluminal angioplasty and/or stenting (PTAS) may serve as a safe, effective treatment option for patients with transplant renal artery stenosis (TRAS), which is procedurally and clinically applicable.

## R5B-SP1R-4 New Method of Knee OA Treatment with Intra Genicular Artery Injection of Mesenchymal Stem Cells

## PURPOSE

The aim of this study was to evaluate the role of intra-arterial mesenchymal cell injection in the management of knee osteoarthritis.

## METHODS AND MATERIALS

After IRB and the ethics committee's approval, 30 patients with moderate knee osteoarthritis (OA) were treated. All patients had an MRI prior the procedure confirming the OA. After accessing the contralateral femoral artery, the genicular artery leading to the vascular blush was catheterized. The solution of mesenchymal stem cells (70 million allogenic cells) was then injected in the vessel. All the patients were admitted for one day following the procedure. MRI of the knee is planned in all patients at one month. WOMAC scores were obtained before and weekly after the intervention.

## RESULTS

Technical success rate was 100%. 30 patients have completed clinical, and imaging follow up at one month. They were divided to four age groups and their womac score results recorded in 4 weeks as described below: A) Womac Score for age >55 (n=16) : "32.63" reduced to "7.69" B) Womac Score for age <=55 (n=14): "25.14" reduced to "3.36" C) Womac Score for weight >70 (n=17): "27.76 reduced to 5.47" D) Womac Score for weight <=70 (n=13): "30.92 reduced to 5.92" The average WOMAC score before the intervention, was about (25.14 - 32.63), and it dropped to about (7.69 - 3.36) on one month. This reduction on mean WOMAC numbers is statistically significant. Patient symptoms improved significantly. MRIs of the knee have demonstrated a significant regeneration of the affected cartilage and the subchondral lesions.

## CONCLUSION

s This preliminary study is promising demonstrating that intra-Genicular artery injection of mesenchymal Stem Cells not only

improves clinical symptoms, but also results in early cartilage regeneration. In addition to pain improvement and cartilage regeneration, MRI Pictures demonstrate that in some patients subchondral changes improved significantly

#### **CLINICAL RELEVANCE/APPLICATION**

new method to pain management for OA patients.

### **R5B-SP1R-5 All-payor Utilization of Arterial and Venous Thrombectomy for VTE in the United States**

#### **PURPOSE**

An estimated one million venous thromboembolism (VTE) events occur annually in the U.S. and the use of thrombectomy to treat VTE is becoming increasingly common. Here, we assess utilization trends of arterial and venous thrombectomy to treat VTE for commercial and Medicare beneficiaries between 2017 and 2021.

#### **METHODS AND MATERIALS**

A claims search was performed through the Standard Analytical File (SAF) and claims clearinghouse databases to collect utilization data for arterial and venous thrombectomy across commercial and Medicare payers between January 2017 and December 2021 using Common Procedural Terminology (CPT codes). Thrombectomy CPT codes (37184-37188) were cross-referenced against ICD-10 codes for venous thromboembolism (VTE). Cross-referencing with COVID-19 ICD-10 codes was performed for 2020 and 2021 data. Claim counts and percentages were tabulated, and p-values calculated using chi square in GraphPad Prism.

#### **RESULTS**

Between January 2017 to December 2021, 79,925 claims for arterial and venous thrombectomy to treat VTE were identified. There was a 125% 5-year increase in total claims. Although there were significantly more venous thrombectomy (VT) claims than arterial thrombectomy (AT) (64,258 vs. 15,667,  $p < 0.001$ ), a greater 5-year increase in AT claims was observed compared to VT (5.5- vs. 1.8-fold). AT was more often billed through commercial insurers (62.1%) than Medicare (37.9%) ( $p < 0.001$ ) with the opposite true of VT (53.2% Medicare, 46.8% commercial,  $p < 0.001$ ). Interventional Radiology (IR) performed significantly more AT and VT procedures across all payers from 2017 to 2021 (IR: 46.7%, all cardiology: 23.1%, all surgery: 4.2%, vascular surgery: 25.9%,  $p < 0.001$ ). However, cardiology subspecialties saw a greater rise in AT and VT across all payers from 2017 to 2021 compared to IR (AT: 6.6- vs. 6.0-fold, VT: 2.6- vs. 1.5-fold). The Midwest and Southeast had the highest utilization of AT and VT regardless of payer. In COVID-19 patients, AT claims in 2021 were 3-fold higher than in 2020 (393 vs. 135 claims,  $p < 0.001$ ) irrespective of payer. Top ICD-10 codes associated with AT and VT were "pulmonary embolism without acute cor pulmonale" (61% of AT) and "embolism/thrombosis of iliac/femoral/popliteal veins" (49% of VT), respectively.

#### **CONCLUSION**

From 2017 to 2021, the number of claims for arterial or venous thrombectomy to treat VTE across all payers increased significantly. While a majority of these were VT, a greater rise in the number of AT claims was observed. IR performed more AT and VT procedures than any other specialty over this 5-year period.

#### **CLINICAL RELEVANCE/APPLICATION**

The use of thrombectomy to treat VTE is growing rapidly. Nonetheless, it remains a small percentage of total VTEs occurring nationally each year.

### **R5B-SP1R-6 The Benefit of Filtered Blood Reperfusion in Suction Thrombectomy of Submassive Pulmonary Embolism**

Participants

Ryan Bitar, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Catheter-directed suction thrombectomy has emerged as a major tool for reducing right heart strain in the management high-intermediate risk pulmonary embolism (PE); however, suction thrombectomy presents a potential concern for significant blood loss during clot aspiration. The purpose of this study is to assess the benefit and safety of utilizing a blood reperfusion filtration device (BRFD) during thrombectomy which is able to filter and return aspirated blood in an attempt to minimize blood loss.

#### **METHODS AND MATERIALS**

A single-institution retrospective cohort study was conducted on patients who underwent suction thrombectomy from 2018-2022. Patients were categorized into cohorts based on the use versus nonuse of a BRFD. Inclusion criteria involved adult patients with submassive PE (either imaging and/or biomarkers indicative of right heart strain) who underwent suction thrombectomy. Patients with massive PE, preceding cardiac arrest, or contraindication to anti-coagulation were excluded. Critical data points included age, gender, pre-procedural vitals and labs, procedural change in pulmonary arterial pressure (PAP), immediate post-procedural vitals and labs, admission length, blood transfusions, and 30-day post-procedural complications.

#### **RESULTS**

50 patients were recruited for each cohort. No significant difference in patient demographics, preprocedural vitals or labs, pre-procedural PAP, or thrombectomy-related decrease in PAP was observed. Post-procedural decrease in heart rate was -12.4 bpm in the non-BRFD cohort versus -20.6 bpm in the BRFD cohort ( $p = 0.039$ ). 24-hour post-procedural complete blood count demonstrated a significantly increased drop in hemoglobin in the non-BRFD cohort (-2.54g/dL) in comparison to the BRFD cohort (-1.54g/dL) ( $p = 0.00004$ ). Of note 24-hour post-procedural platelets, white blood cells, creatinine, and potassium did not demonstrate a significant change between the two cohorts. 20% of the non-BRFD cohort and 4% of the BRFD cohort required blood transfusions ( $p = 0.028$ ). No significant difference was observed in days of admission or number of complications between the two cohorts.

#### **CONCLUSION**

The results of this study indicate that using a BRFD is a safe means of minimizing blood loss during suction thrombectomy, as evidenced by an attenuated drop in hemoglobin and a reduction in blood transfusions. Of note, the study poses limitations intrinsic to that of a low-power single-institution retrospective cohort study.

#### **CLINICAL RELEVANCE/APPLICATION**

Employment of a BRFD during suction thrombectomy should be considered as a beneficial tool for decreasing the risk of post-procedural anemia and the need for potential transfusions, improving patient energy/recovery and sparing precious blood products.

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## Abstract Archives of the RSNA, 2023

R5B-SPMK

### Musculoskeletal Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPMK-1 Are Isolated Ulnar Fractures a True Marker for Intimate Partner Violence?**

##### **PURPOSE**

What is the prevalence of confirmed or high risk for intimate partner violence (IPV) among adult women with isolated ulnar shaft fractures within a large integrated health system? Are there injury or sociodemographic characteristics associated with IPV in patients with isolated ulnar fractures?

##### **METHODS AND MATERIALS**

Adult women, age 18 to 65, with ulnar fractures from 2016 through 2021 were identified through electronic health record (EHR) query. Patients were categorized into two groups, one with isolated ulnar fractures and another with fractures of both the radius and ulna. Sociodemographic and clinical data, referral data, reported mechanism of injury and IPV documentation were collected. IPV stratification into four groups: confirmed IPV, high risk for IPV, low risk for IPV and not IPV based on ICD 9/10, internal IPV diagnosis codes and clinical chart review. Radiographs of isolated ulnar fracture group were evaluated for fracture side, location, pattern and displacement.

##### **RESULTS**

29% of 148 patients with isolated ulnar fractures were high risk or confirmed IPV, compared to 10% of the 147 patients who had non-isolated ulnar fractures ( $p < .01$ ). 95% of patients had formal documentation of screening within their EHR and 9% at time of fracture presentation. Within isolated ulna fracture group, confirmed or high-risk for IPV was associated with reported mechanism of injury of assault (37% versus 1%;  $P < .01$ ) but not other injury characteristics. Confirmed or high-risk for IPV was associated with previously reported IPV correlates of alcohol abuse history (30% versus 15%,  $p = .04$ ), depression history (42% versus 15%,  $p < .01$ ), and anxiety history (42% versus 22%,  $p = .01$ ). Increased number of prior documented emergency visits (median 2.0; interquartile range 0.0-6.0 versus median 0.0; interquartile range 0.0-1.0;  $p < .01$ ) was also associated with confirmed or high-risk for IPV.

##### **CONCLUSION**

Prevalence of confirmed or high-risk IPV in isolated ulnar fracture patients was significantly higher than those with non-isolated ulnar fractures. Frequent emergency department visits, alcohol abuse history and psychiatric history would favor IPV etiology.

##### **CLINICAL RELEVANCE/APPLICATION**

IPV is a global public health emergency which is challenging to diagnose. Prior research reported up to a third of 62 adult female patients with isolated ulnar fractures at three Level 1 trauma centers in urban setting may be associated with IPV. We found that 29% of adult female patients with this fracture identified in outpatient, urgent care, and emergency settings across a large multicenter health system had confirmed or were high risk for IPV. Our research supports isolated ulnar fracture as a true marker for IPV and highlights the importance of IPV screening at time of fracture evaluation.

#### **R5B-SPMK-2 Association Between Pelvic Bone CT-Derived Body Composition and Patient Outcomes in Older Adults With Proximal Femur Fracture**

##### **PURPOSE**

To investigate the association between pelvic bone computed tomography (CT)-derived body composition and patient outcomes in older adult patients who underwent surgery for proximal femur fractures.

##### **METHODS AND MATERIALS**

We retrospectively identified consecutive patients aged  $\geq 65$  years who underwent pelvic bone CT and subsequent surgery for proximal femur fractures between July 2018 and September 2021. Eight CT metrics were calculated from the cross-sectional area and attenuation of the subcutaneous fat and muscle, including the thigh subcutaneous fat (TSF) index, TSF attenuation, thigh muscle (TM) index, TM attenuation, gluteus maximus (GM) index, GM attenuation, gluteus medius and minimus (Gmm) index, and Gmm attenuation. The patients were dichotomized using the median value of each metric. Multivariable Cox regression and logistic regression models were used to determine the association between CT metrics with overall survival (OS) and postsurgical intensive care unit (ICU) admission, respectively.

##### **RESULTS**

A total of 372 patients (median age, 80.5 years; interquartile range, 76.0-85.0 years; 285 females) were included. TSF attenuation above the median (adjusted hazard ratio [HR], 2.39; 95% confidence interval [CI], 1.41-4.05), GM index below the median (adjusted HR, 2.63; 95% CI, 1.33-5.26), and Gmm index below the median (adjusted HR, 2.33; 95% CI, 1.12-4.55) were independently associated with shorter OS. TSF index (adjusted odds ratio [OR], 6.67; 95% CI, 3.13-14.29), GM index (adjusted OR, 3.45; 95% CI, 1.49-7.69), GM attenuation (adjusted OR, 2.33; 95% CI, 1.02-5.56), Gmm index (adjusted OR, 2.70; 95% CI, 1.22-5.88), and Gmm attenuation (adjusted OR, 2.22; 95% CI, 1.01-5.00) below the median were independently associated with ICU admission.

## CONCLUSION

s In older adult patients who underwent surgery for proximal femur fracture, low muscle indices of the GM and gluteus medius/minimus obtained from their cross-sectional areas on preoperative pelvic bone CT were significant prognostic markers for predicting high mortality and postsurgical ICU admission.

## CLINICAL RELEVANCE/APPLICATION

CT metrics of the gluteus muscle group and subcutaneous fat can be utilized as risk stratification factors in elderly patients with proximal femur fractures.

## R5B-SPMK-3 Stewart-Treves Syndrome with Lymphedema of Limbs in 21 Cases: CT and MRI Manifestations

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

Stewart-Treves syndrome (STS) is a secondary angiosarcoma based on chronic lymphedema after mastectomy and lymphadenectomy. This study is to analysis retrospectively the CT and MRI manifestations of STS in 21cases.

## METHODS AND MATERIALS

From June 2006 to March 2021, 21 patients with STS in our hospital were collected, including 17 females and 4 males, aged from 35 month to 81 years (median age 65). All patients underwent CT scan and MRI or MRL. Follow up for 2-10 years, 15 cases died (71.4%) and 6 cases (28.6%) had poor prognosis.

## RESULTS

Among the 21 patients, 18 lesions occurred in the upper limb (12 cases in right) and 3 cases in the lower limb. The size of lesions ranged from 3 to 15 cm, 8 cases were round-like and 13 cases were irregular in shape, with clear or irregular margin in 15 cases and fuzzy in 6. All lesions were located in subcutaneous connective tissue and involved the skin and adjacent muscle tissue were involved in 10 cases. On plain CT scan, the lesions showed soft tissue density (CT value = 18-46 Hu) and showed homogeneous or heterogeneous mild to moderate enhancement (CT value = 45-68 Hu) enhanced CT with necrosis and liquefaction in only 2 cases. MRI showed low signal on T1WI, high or mixed signal on T2WI and high signal on DWI. There were extensive changes of chronic lymphedema around all the lesions and ipsilateral axillary lymph node enlargement in 16 cases with the size of 1-2.6cm.

## CONCLUSION

s The main feature of Stewart Treves syndrome is a growing soft tissue mass in the area of chronic lymphedema. The CT and MRI are important methods for accurate diagnosis, staging and grading evaluation of secondary angiosarcoma based on chronic lymphedema.

## CLINICAL RELEVANCE/APPLICATION

Multimodality image are important methods for accurate diagnosis of the three subtypes of STS.

## R5B-SPMK-4 Prediction of Histopathological Subtypes of Dermatofibrosarcoma Protuberans Based on MRI Radiomics Machine Learning Model

## PURPOSE

To establish a diagnostic model for classic DFSP and FS-DFSP image information to explore the feasibility of predicting DFSP histological subtypes.

## METHODS AND MATERIALS

53 DFSPs were retrospectively included in this study: 9 subjects with FS-DFSP and 44 subjects with classic DFSP. Their T1WI and FS-T2WI images constituted the primary dataset used to train multiple machine learning algorithms for constructing DFSP histological subtype prediction model. The subjects were randomly divided into training group and testing group. The training group was used for machine learning and the testing group was used to evaluate the training model. All patients were scanned using a 3.0T MR scanner. ROIs were manually delineated by open-source software on each slice of the T1WI and FS-T2WI images by one musculoskeletal radiologist with 5 years of professional experience, and each ROI segmentation was tested by another radiologist with 10 years of experience. LASSO was used to select features from preoperative imaging data. The prediction models of RF and KNN classifiers were constructed on T1WI and FS-T2WI respectively by using the extracted imaging features. The prognostic performance was assessed in training cohort and testing cohort by means of AUC, sensitivity, specificity and accuracy.

## RESULTS

15 imaging features were selected by using LASSO algorithm. The AUC of RF based on T1WI was 0.902; sensitivity, 91.2%; specificity, 89.2%; and accuracy, 90.4%. The AUC of RF based on FS-T2WI was 0.913; sensitivity, 90.7%; specificity, 91.1%; and accuracy, 88.9%. The AUC of KNN based on T1WI was 0.798; sensitivity, 88.7%; specificity, 89.7%; and accuracy, 80.1%. The AUC of KNN based on FS-T2WI was 0.815; sensitivity, 83.5%; specificity, 86.3%; and accuracy, 82.1%.

## CONCLUSION

s This study puts forward for the first time the application of radiomics to distinguish the histopathological subtypes of DFSP, which provides a new and effective assistant diagnostic method for recognizing DFSP variants. The non-invasive machine learning method based on T1WI and FS-T2WI imaging is potential prognostic tool by distinguishing different levels of DFSP pathological subtypes before operation to improve the treatment strategy.

## CLINICAL RELEVANCE/APPLICATION

DFSP is a rare low to intermediate grade soft tissue sarcoma of skin, but the FS-DFSP is a clearly malignant pathological subtype. The identification of malignant pathological subtypes by radiomics plays an important role preoperatively. The non-invasive machine learning method based on T1WI and FS-T2WI imaging is potential prognostic tool by distinguishing different levels of DFSP pathological subtypes before operation in this study to provide a new idea for the diagnosis and treatment of DFSP.

## **R5B-SPMK-5 Radiomics Signature on Magnetic Resonance Imaging: A Feasible Imaging Biomarker for Prediction of the Histopathological Grade of Soft Tissue Sarcomas**

### **PURPOSE**

Radiomics analysis is more comprehensive and reliable to better provide the features of tumor characteristics and heterogeneity. It is important to identify the pathologic grade of soft tissue sarcomas before receiving treatment. Thus, we aimed to build a radiomics signature on the basis of magnetic resonance imaging and evaluate its ability for preoperatively identifying the grade of Soft tissue sarcoma (STS).

### **METHODS AND MATERIALS**

99 patients (55 low grade STS and 44 high grade STS) were at random segmented into a training cohort (39 low grade STS and 31 high grade STS) and a validation cohort (16 low grade STS and 13 high grade STS) with a portion of 7:3. T2 with fat saturation and T1 with fat saturation and gadolinium contrast images were used to extract radiomics features. Radiomics signature was developed by the least absolute shrinkage and selection operator (LASSO) logistic regression model. The receiver that operated characteristics curve (ROC) analysis was used to assess radiomics signature's prediction performance.

### **RESULTS**

A radiomics was developed by 8 radiomics features achieved favorable predictive efficacy. High-grade STS showed higher radiomics score than low-grade STS in both groups. An excellent prediction performance was indicated by the radiomics signature in both groups. The training cohorts and validation cohorts had an area under curves (AUCs) of 0.888 and 0.861, respectively.

### **CONCLUSION**

A radiomics signature on the basis of MRI images could help identification the grade of STS, which could help guide clinical treatment strategies

### **CLINICAL RELEVANCE/APPLICATION**

In this study, we build a radiomics signature on the basis of magnetic resonance imaging and evaluate its ability for preoperatively identifying the grade of Soft tissue sarcoma (STS). We found that the radiomics signature on the basis of MRI images could help identification the grade of STS, which could help guide clinical treatment strategies.

## **R5B-SPMK-6 Shear Wave Elastography in Benign vs Malignant Fatty Tumors**

Participants

Ilyan Mezinskiy Kushnerev, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

### **PURPOSE**

Lipomas are the most frequent soft tissue tumors of the general population, but they are not always easy to differentiate from liposarcomas. The goal of the study was to assess if shear wave elastography (SWE) could help differentiate malignant and benign iso/hyperechoic lipomatous lesions.

### **METHODS AND MATERIALS**

We retrospectively review patients with fatty lesions that underwent percutaneous core needle biopsy in a University Hospital during 2021. All patients underwent ultrasonography followed by SWE to measure elasticity in kPa before biopsy. We compared benign and malignant tumors. The biopsy findings and, in some cases, the surgical-specimen histology were used as gold-standard.

### **RESULTS**

We included 27 patients with lipomatous lesions, 22 with benign (16 lipomas, 3 spindle cell lipomas and 3 hibernomas) and 5 with malignant tumours (well differentiated liposarcomas). Malignant fatty lesions had significantly higher mean (19.07 (6.1-53.6) vs 46.86 (20.6-78.8);  $p=0.006$ ), max (74.4 (36.2-102.7) vs 33.69 (6.4-110.4);  $p=0.013$ ) and Standard Deviation (16.86 (9.8-24.3) vs 7.6 (0.5-25.2)  $p=0.008$ ) elasticity values compared to benign ones. Differences between benign subgroups do not achieve statistical significance.

### **CONCLUSION**

SWE had good specificity and sensitivity for separating benign from malignant soft-tissue lipomatous masses, while differentiation between benign subgroups was not possible. Malignant lesions were stiffer and had more heterogeneous elasticity values than their benign counterparts.

### **CLINICAL RELEVANCE/APPLICATION**

The primary objective of this study is to enhance the comfort of patients by reducing the time taken to arrive at a diagnosis and minimizing the need for unnecessary biopsies. This is a critical consideration because biopsies can be invasive, uncomfortable, and carry a risk of complications. Moreover, unnecessary biopsies can result in increased healthcare costs and undue stress for patients. By increasing the speed and accuracy of diagnosis, SWE has the potential to significantly improve patient outcomes and reduce healthcare costs.

## **R5B-SPMK-7 Feasibility of Dual-layer Spectral CT Histogram Analyses for Differentiation Between Benign and Malignant Myxoid Soft Tissue Tumors: A Preliminary Study**

Participants

Masanori Nakajo, MD, Kagoshima, Japan (*Presenter*) Nothing to Disclose

### **PURPOSE**

To evaluate the usefulness of electron density (ED) and effective atomic number (Zeff) for differentiation between benign and malignant myxoid soft tissue tumors.

### **METHODS AND MATERIALS**

Twenty-two consecutive patients (mean age 60.5 years) with pathologically proven soft tissue tumors including 11 benign myxoid

Twenty-two consecutive patients (mean age 60.5 years) with pathologically proven soft tissue tumors including 11 benign myxoid soft tissue tumors (BMSTTs) and 11 malignant myxoid soft tissue tumors (MMSTTs) were retrospectively analyzed. For all patients, preoperative dual-energy CT examination was performed using a dual-layer spectral detector CT scanner between February 2018 and March 2023. ROIs were drawn to fill the solid parts within each tumor avoiding calcified areas, and placed onto exactly the same locations in the images of Zeff, ED and conventional CT (120 KeV, CTconv). The histogram indices (the mean, skewness, kurtosis and 10th, 25th, 50th, 75th, and 90th percentiles) of the CTconv, Zeff, and ED values were compared between BMSTTs and MMSTTs using the Mann-Whitney U test. ROC curve analysis was carried out to assess the ability of each index to differentiate MMSTTs from BMSTTs. Sensitivity and specificity were calculated with a threshold criterion that would maximize the average of sensitivity and specificity by the largest Youden's index.

## RESULTS

The skewness of ED was significantly lower in MMSTTs ( $-0.11 \pm 1.32$ ) than in BMSTTs ( $0.73 \pm 0.49$ ) ( $P = 0.013$ ), while no significant difference was shown in any other parameters. The area under the ROC curve for diagnosing MMSTTs was 0.81 for ED skewness. With a cut-off value of 0.62, the sensitivity and specificity to predict MMSTTs were 90.91% and 72.73%.

## CONCLUSION

The skewness of ED may be useful in differentiating MMSTT from BMSTT.

## CLINICAL RELEVANCE/APPLICATION

Histogram analysis of dual-energy CT parameters, especially skewness of electron density may be useful in differentiating malignant from benign myxoid soft tissue tumors.

## R5B-SPMK-8 The Diagnostic Role of Ultrasound in Merkel Cell Carcinoma: Our Experience

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

## PURPOSE

Merkel cell carcinoma (MCC) is a rare and very aggressive type of skin cancer (<1% of all cutaneous malignancies), predominantly affecting old and/or immunosuppressed patients. Our purpose is to describe and illustrate the main sonographic features of this tumor.

## METHODS AND MATERIALS

We retrospectively reviewed the images of MCC diagnosed in our institution during the last 10 years. We evaluated the demographic and clinical characteristics of the patients, the gray-scale and color Doppler sonographic findings of the lesions, and the locoregional lymph node involvement.

## RESULTS

Ultrasound images of 8 patients were available, 6 women and 2 men with ages between 69 and 94 years. All but one of the tumors were in photoexposed areas. 7 patients debuted with a fast-growing nodular dermal lesion. In those 7 patients who clinically showed a cutaneous nodule, ultrasonographically the tumors were dermohypodermal, hypoechoic, non-encapsulated, with infiltrative margins through the relatively homogeneous subcutaneous septa, and with extensive vascularization that respects the architecture of the cutaneous plexuses. In 4 of the tumors, there was a "sandwich" pattern with an area of elongated dermal involvement and a parallel zone deep in the subcutaneous cellular tissue connected by infiltrated interlobular septa. Locoregional adenopathies and in-transit metastases were detected in almost half of the patients at the time of diagnosis.

## CONCLUSION

Ultrasound is the imaging test of choice in the evaluation of cutaneous and superficial tumors. Despite its rarity, the presence of a dermohypodermal tumor with infiltrating borders through the lobular septa, high vascularization, relatively respected architecture and particularly, the appearance of a "sandwich" pattern, should make us include MCC in the differential diagnosis and force us to study on the spot the locoregional adenopathies and possible in-transit metastases.

## CLINICAL RELEVANCE/APPLICATION

Recognizing the sonographic findings described above is of great importance to suggest the diagnosis of this rare entity, as well as to perform the locoregional extension study in the same exploration. All this means a considerable clinical benefit, since it allows an early management of this condition.

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## Abstract Archives of the RSNA, 2023

R5B-SPNMMI

### Nuclear Medicine & Molecular Imaging Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPNMMI-1**    **Dynamic Multi-phase 18F-NaF PET/MRI in Pediatrics**

Participants

Kip Guja, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Skeletal imaging with 18F-NaF offers improved imaging characteristics and biodistribution compared to conventional bone scintigraphy with 99mTc methylene diphosphonate (MDP) and hydroxydiphosphonate (HDP) but is typically acquired in a single delayed phase. Early blood pool phase imaging plays a vital role in pediatric skeletal scintigraphy due to its ability to reveal evidence of hyperemia, inflammation, marrow infiltration, and soft tissue abnormalities. Here we report an initial pilot study combining the superior imaging characteristics of NaF PET and the increased sensitivity of blood pool phase imaging by performing dynamic multiphase 18F-NaF PET/MRI in pediatric patients.

#### **METHODS AND MATERIALS**

Dynamic PET images were acquired in a single bed position focused on the area of clinical concern using fast list-mode starting just after injection of the radiopharmaceutical for a duration of 10 minutes. This was followed by standard delayed phase acquisition for the second portion of the exam. Dynamic blood pool phase images were reconstructed at 2.5 minutes per frame for a total of 10 minutes. Additional static blood pool phase images were reconstructed using the entire first 10 minutes of the exam. For the MRI component of the dynamic phase, zero echo time (ZTE) proton-density weighted MRI images were acquired.

#### **RESULTS**

In this prospective pilot study, a total of eight 18F-NaF PET/MRI examinations were performed on seven pediatric patients, ranging from 5 years old to 20 years old. Four of the exams were performed with traditional single delayed phase imaging only and four were acquired with dynamic and static early blood pool phase imaging in addition to the standard whole body delayed phase. Diagnoses included osteomyelitis, mastoiditis, CRMO, and one indeterminate lesion with subsequently improved after conservative therapy with NSAIDs.

#### **CONCLUSION**

s Dynamic early blood pool phase 18F-NaF pediatric PET/MRI can improve imaging evaluation of children with skeletal complaints by combining the superior imaging characteristics of 18F-NaF PET with the added sensitivity of blood pool phase images and superior contrast with reduced radiation exposure of MRI. Further studies in larger cohorts of pediatric patients with a variety of skeletal pathologies are needed.

#### **CLINICAL RELEVANCE/APPLICATION**

Skeletal scintigraphy is one of the most common indications for pediatric radionuclide imaging. Combining the strengths of 18F-NaF PET with dynamic early blood pool imaging in PET/MRI offers unique and important benefits in evaluating children with skeletal complaints.

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## Abstract Archives of the RSNA, 2023

R5B-SPNPM

### Noninterpretive Skills (Beyond Imaging) Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPNPM-Increased Adverse Iodine Contrast Agent Reactions and Resistance to Epinephrine in the Setting of Beta-blocker Therapy: A Multi-Institutional Analysis of 209,482 Patients** 1

##### Participants

Brittany Dang, BA, Galveston, TX (*Presenter*) Nothing to Disclose

##### PURPOSE

Adverse allergic reactions to iodine contrast agents are not common but can result in urticaria, nausea, vomiting, and potentially anaphylaxis. Beta-blockers, however, are a widely used class of medications that have been associated with an increased risk and severity of anaphylactic reactions. The purpose of this research is to investigate the relationship between beta blockers and adverse iodinated contrast agent reactions and response to epinephrine.

##### METHODS AND MATERIALS

The TriNetX research network provides access to de-identified medical record information for more than 111 million patients in 76 large healthcare organizations and was used for this study. Two patient cohorts were created. Beta-blocker utilization was identified by any of the following medication names and codes: acebutolol (149), atenolol (1202), bisoprolol (19484), metoprolol (6918), nadolol (7226), nebivolol (31555), and propranolol (8787). Contrast exposure was identified by ioxilan (27793), iopromide (27781), ioversol (27792), iopamidol (5966), and iohexol (5956). Both cohorts had exposure to one of the contrast agents at the time of a CT of the chest (CPT code 71260). One group was simultaneously on treatment with a beta blocker, while the other group was excluded from them. The cohorts were balanced for age, race, gender, and ethnicity by propensity score matching via the greedy nearest neighbor algorithm, resulting in 104,741 patients in each arm. They were then evaluated for subsequent ICD-10 code for "adverse effect of diagnostic agents" (T50.8X5), and medication codes for "use of epinephrine" (3992), and "use of glucagon" (4832).

##### RESULTS

Patients on beta blockers were 2.3 times more likely to have an adverse reaction to iodinated contrast agents (RR 2.3, 95% CI (1.65,3.29), p-value <0.0001). They were also 50% more likely to require treatment with epinephrine (RR 1.49, 95% CI (1.43,1.56), p-value <0.0001) and 2.6 times more likely to require treatment with glucagon (RR 2.6, 95% CI (2.43,2.7), p-value <0.0001).

##### CONCLUSION

The results from this large global data set support the idea that beta blockers increase the risk of allergic reactions to substances such as iodinated contrast agents and are associated with a reduced response to epinephrine. With the increasing use of beta blockers and iodine contrast agents, awareness of the potential adverse reactions and resistance to epinephrine is important.

##### CLINICAL RELEVANCE/APPLICATION

The current research is significant because understanding the increased risk of adverse reactions to iodine contrast agents and resistance to epinephrine in the setting of beta blockers will lead to improved safety of evaluation and treatment for patients requiring radiologic imaging with contrast.

#### **R5B-SPNPM-How Many "Lives" Does a Radiologist Save in a Career? A Modeling Analysis and Estimation** 2

##### Participants

Alexander Kuehne, MD, Clear Lake, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

Medical imaging has unquestionably revolutionized medical care over the past century. Due to radiologists playing a supportive role in the care of a large number of patients, our total impact is difficult to quantify. The purpose of this analysis is to estimate the total value, in Quality Adjusted Life Years (QALYs) and average "lives" saved during the course of a usual career in radiology.

##### METHODS AND MATERIALS

We use figures from recent literature to calculate a point estimate as well as plausible ranges for the value of radiologic work over the course of a usual career. Input parameters include the average of a career (30 years), studies read per year (9671-12,669), annual work RVUs (9,264), total/work RVU ratio (1.97), cost per RVU (\$32.41), cost-effectiveness and willingness-to-pay for QALYs in the US (50-200K/QALY), average age of the US population (39), and remaining QALYs for the average person (~35). Deterministic and probabilistic sensitivity analyses were performed to assess plausible ranges and the sensitivity of health utility impact from the career in radiology. Results are reported in 2021 US Dollars.

##### RESULTS

The average radiologist is expected to provide health services with estimated value of \$18 million during the course of their career,

reporting on the order of 300K-400K examinations (impacting at most as many patients). When the average cost-effectiveness of imaging is \$50,000/QALY, a radiologist is expected to provide 355 QALYs during a career or "save" the equivalent QALYs remaining in ~10 average lives. A pessimistic estimation, based on a higher proportion of low-value care (lower cost-effectiveness), could reduce the health utility impact by approximately 75%. Deterministic and probabilistic sensitivity analyses recapitulate the major findings, and emphasize that the health utility consequences of radiologic practice is highly dependent on the cost-effectiveness of imaging.

#### **CONCLUSION**

s Radiologists provide a large volume of clinical care during the course of a career, impacting hundreds of thousands of patients. The total sum of our impact however, is highly sensitivity to health system variables, most importantly, the cost-effectiveness of radiologic imaging. Efforts to advance both value-based care could have an outsized effect on the utility of radiologic practice as a whole.

#### **CLINICAL RELEVANCE/APPLICATION**

Due to radiologists playing a supportive role in the care of a large number of patients, our total impact is difficult to quantify. Further knowledge and analysis of various system wide factors and, the sensitivity of radiology to these variables, can raise awareness of our overall impact on the US health system and potentially point towards ways of further value-basis analysis of radiologic imaging cares.

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## Abstract Archives of the RSNA, 2023

R5B-SPNR

### Neuroradiology Thursday Poster Discussions II

#### Sub-Events

#### R5B-SPNR-1 Independent Component Analysis vs. Block Design: A Comparison of Methods for Sedated Language Mapping in Pediatric Epilepsy

##### PURPOSE

Passive task-based fMRI under anesthesia is done for presurgical language mapping in pediatric epilepsy patients who cannot complete an awake study. In our previous study, using standard block design task paradigm-based analysis methods, we observed more atypical language patterns in task fMRI under anesthesia compared to wakefulness. We hypothesize that due to the effect sedation has on the brain, unconstrained data driven methods of analyses may be more likely to reveal the language network.

##### METHODS AND MATERIALS

We retrospectively identified patients with focal epilepsy who underwent presurgical functional MRI under anesthesia, including Auditory Descriptive Decision Task paradigm at our institution from 2014-2022. We used two methods to extract language activation maps: 1) paradigm-based block design general linear model (GLM), and 2) data-driven independent component analysis (ICA). A laterality index (LI) was calculated separately in the Frontal and Temporal language regions of interest (ROI). We considered positive laterality indexes as left dominant, negative laterality indexes as right dominant, and absolute laterality indexes less than 0.2 as bilateral. We defined 2 language patterns: typical (i.e., primarily left-sided) and atypical (Fig 1a).

##### RESULTS

Twenty-four patients, mean age 7 years old (SD=3.2), 36% female, met the inclusion criteria and were analyzed. Figure 1 (b-d) shows LI distribution in each ROI based on the analysis method. The language pattern of 16% of the patients is categorized as typical with GLM, compared to 69% with ICA. There is a significant positive correlation between the Frontal and Temporal LI with the ICA (pearson  $r = 0.44$ ,  $P=0.03$ ) compared to GLM (pearson  $r = 0.3$ ,  $P=0.15$ ). There is a significant negative correlation of Temporal LI between the two methods. This is manifested as more left-dominant (typical) patterns with ICA. There is no correlation between the Frontal LIs between the two methods.

##### CONCLUSION

In this fMRI dataset under anesthesia, ICA analysis demonstrates a stronger expected correlation of the frontal and temporal laterality indexes. ICA may be a useful analysis method for sedated scans. However, the possibility of an increased typical pattern with ICA needs further analysis with larger samples.

##### CLINICAL RELEVANCE/APPLICATION

Prior research indicates that anesthesia impacts bold signal of Frontal brain regions disproportionately when compared to Temporal brain regions, which exhibit more robust signal under sedation. The presurgical pattern derived from passive task-based fMRI under anesthesia requires caution in interpretation and further data driven analysis method may improve accuracy of language pattern assignment.

#### R5B-SPNR-10 Deep Learning Enhances Reliability of Dynamic Contrast-Enhanced MRI in Diffuse Gliomas: Bypassing Post-processing and Providing Uncertainty Maps

##### PURPOSE

To propose a deep learning-based probabilistic model for directly estimating and reliably generating pharmacokinetic (PK) parameter maps from dynamic contrast-enhanced (DCE)-MRI, bypassing the limitations of low reliability due to irreproducible arterial input functions (AIFs), and incorporating uncertainty maps.

##### METHODS AND MATERIALS

From Apr 2010 to Feb 2018, we retrospectively enrolled 341 consecutive patients (mean age, 55±15 years; 202 (59.2%) male) with adult-type diffuse gliomas, who underwent preoperative DCE-MRI. We developed a neural network model combining a temporal convolutional network and a probabilistic U-net to estimate PK maps directly without using the AIF. Structural Similarity Index Measure (SSIM) between generated and ground truth (GT) maps was calculated for quantitative validation of map generation. The reliability of the PK parametric maps was evaluated by comparing the intraclass correlation coefficient (ICC) of two Ktrans, Vp, and Ve measurement, averaged for tumor subregions-of-interest, obtained twice independently, using: 1) conventional PK map generation using commercial software; 2) generated PK maps from the neural network model. For clinical validation, Area Under the Receiver Operating Characteristic Curve (AUROC) was obtained for differentiating WHO grade (low- vs high-grade) and IDH mutation.

##### RESULTS

Generated Ktrans, Vp, Ve maps showed high SSIM (0.949±0.02, 0.746±0.021, 0.745±0.023) compared to the GT maps, respectively. The ICC of PK maps was significantly higher in generated PK maps compared to the conventional approach: 0.984 vs 0.119,  $p<0.001$  for ktrans, 0.994 vs 0.465,  $p<0.001$  for Ve, 0.984 vs 0.563,  $p<0.001$  for Vp. In the IDH-mutation prediction and

glioma grading, PK values of enhancing tumor portion obtained from generated and GT maps was comparable in AUROC: 1) Ktrms, 0.844 vs 0.836 ( $p=0.78$ ); Vp, 0.846 vs 0.846 ( $p=0.97$ ); and Ve, 0.837 vs 0.826 ( $p=0.76$ ) for IDH prediction; and 2) Ktrms, 0.892 vs 0.872 ( $p=0.58$ ); Vp, 0.908 vs 0.875 ( $p=0.51$ ); and Ve, 0.910 vs 0.863 ( $p=0.39$ ) for glioma grading.

## CONCLUSION

s PK maps generated from DCE-MRI using a deep learning-based probabilistic model showed improved reliability without compromising diagnostic performance in glioma grading.

## CLINICAL RELEVANCE/APPLICATION

Quick generation of PK maps from DCE-MRI bypassing post-processing using deep-learning with improved reliability may accelerate the application of DCE-MRI to clinical practice, benefiting treatment response monitoring in diffuse gliomas.

## R5B-SPNR- 11 Correlations of Computational Modeling of Interstitial Fluid Pressure and Velocity with IDH1 Expression and Ki-67 Level in Glioblastoma

Participants

Jianan Zhou, Nanjing, China (*Presenter*) Nothing to Disclose

## PURPOSE

The immunohistochemistry features of glioblastoma have important influence on its occurrence and prognosis. This study aimed to explore correlation of computational modeling of interstitial fluid pressure (IFP) and velocity (IFV) based on dynamic contrast enhanced (DCE)-MRI with IDH1 expression and Ki-67 level in glioblastoma.

## METHODS AND MATERIALS

Patients diagnosed as glioblastoma between 2020 and 2021 were included. All patients underwent examination before surgery in a 3.0T MR scanner (uMR770, United Imaging Healthcare). DCE-MRI (transverse T1-weighted spoiled gradient-echo sequence, 100 time-points, temporal resolution 2.5s) were performed before, during and after the injection of contrast agent (gadodiamide injection, 0.2mL/kg, 3.5mL/s). IDH1 expression and Ki-67 level were evaluated by immunohistochemistry of tumor samples after surgery. The permeability parameters were calculated from extended-Tofts model. Volume-of-interests were delineated manually including the whole tumor on late DCE images. The partial differential equation of IFP and IFV was formulated from the continuity equation and solved in MATLAB. All modeling parameters were decided according to foreknowledge from previous studies. Spearman's test was used to assess the relationship between IFP and IFV indicators (mean, standard deviation, kurtosis, skewness) and immunohistochemistry markers. Significance criteria was  $P<0.05$  for all statistic results.

## RESULTS

Thirty-four patients were included (mean age  $57.2\pm 10.4$ , 17 females). IFP and IFV mappings were obtained for each patient. The IDH1 expression was negatively correlated with IFPmean ( $P=0.031$ ,  $r=-0.382$ ), IFPkurtosis ( $P=0.031$ ,  $r=-0.383$ ) and IFVmean ( $P=0.038$ ,  $r=-0.369$ ) and positively correlated with the IFPskewness ( $P=0.023$ ,  $r=0.402$ ). Ki-67 level was negatively correlated with IFVkurtosis ( $P=0.042$ ,  $r=-0.351$ ). No significance was found in other statistic results.

## CONCLUSION

s Computational modeling of IFP and IFV based on DCE-MRI has significant correlation with IDH1 expression and Ki-67 level of glioblastoma.

## CLINICAL RELEVANCE/APPLICATION

This study found that computational modeled IFP were associated with the expression of IDH1 in glioblastoma. IFP is closely associated with tumor permeability, and could be affected by the microvascular properties within the tumor. Compared with IDH mutant, IDH wild-type glioma has faster tumor cell proliferation, richer neovascularization and higher permeability. Ki-67 reflects the proliferation of tumor cells and can be used to distinguish low-grade glioma from high-grade glioma. Therefore, IFP indicators have potential significance in predicting the molecular classification, tumor recurrence and prognosis of glioma.

## R5B-SPNR- 12 Usefulness of Perfusion Imaging with Super-selective pCASL for Meningioma

Participants

Takashi Katsube, Izumo, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Identification of meningioma's feeding arteries and brain invasion is important for transcatheter arterial tumor embolization (TAE) or tumor resection. Super-selective pseudo-continuous arterial spin labeling (SS-ASL) is capable of selectively labeling the major arteries in the neck and noninvasively assessing the perfusion area of that artery. The purpose of this study is to investigate whether SS-ASL can identify the feeding arteries of meningioma and determine the presence or absence of meningioma brain invasion.

## METHODS AND MATERIALS

The subjects were 19 patients (18 women and a man, mean age 64.6) who had SS-ASL of MRI and angiography and were pathologically diagnosed meningioma. The average major axis of the tumors on MRI is 37.7mm (15-58 mm). SS-ASL was selectively labeled for an external carotid artery, an internal carotid artery, or bilateral vertebral arteries, respectively, and two to five SS-ASL images were taken in each case, with different arteries selected depending on the localization of the tumor. Two observers separately identified the feeding arteries of meningioma by SS-ASL and compared them to angiography to assess their accuracy. Also, increased perfusion in the region of the tumor bordering the brain parenchyma on SS-ASL with selected internal carotid or vertebral arteries was considered as having brain invasion, and the findings was compared with surgical and pathological findings. The image quality of SS-ASL was evaluated on a 4-point scale (grade 1-4).

## RESULTS

One case in which the feeding artery could not be clearly identified on angiography was deleted, resulting in 18 cases being evaluated. In 16 cases (88.9%) for observer 1 and 15 cases (83.3%) for observer 2, the feeding arteries noted on SS-ASL were consistent with the angiographic findings. Surgery and pathology were able to correctly determine the presence or absence of brain

invasion of meningioma in 14 cases, with 3 cases showing brain invasion. And 10 cases (71.4%) were correctly evaluated by SS-ASL. All 7 cases judged as no brain invasion by SS-ASL had no brain invasion. A total of 61 SS-ASL images were obtained in 18 cases. The images graded 3 or 4, which can be judged as good, were 55 (90.2%) for observer 1 and 52 (85.2%) for observer 2.

## CONCLUSION

SS-ASL is expected as a non-invasive method for estimating the feeding arteries of meningioma and may be useful for surgical information and TAE decisions.

## CLINICAL RELEVANCE/APPLICATION

SS-ASL can noninvasively assess blood flow in intracranial lesions. The ability to identify the distribution of blood flow in meningioma with SS-ASL provides useful information for angiography and surgery.

## R5B-SPNR- Spinal CSF Outflow using Spin Labeling MRI

13

Participants

Mitsue Miyazaki, PhD, La Jolla, CA (*Presenter*) Nothing to Disclose

## PURPOSE

In comparison to the brain, the mechanisms of intrinsic CSF spinal outflow are ones that remain to be unclear. The purpose of this research work is to investigate the location of CSF spinal outflow using novel MRI non-contrast, spin-labelling of endogenous CSF.

## METHODS AND MATERIALS

Seven healthy subjects were imaged using a clinical 3 Tesla MR imager with a 16-channel spine coil. Coronal T2-weighted 2D fluid attenuated inversion recovery (FLAIR) and coronal T2-weighted 3D centric ky-kz single-shot FSE (cSSFSE) were used to locate the lumbar regions of the spinal canal, while axial T2-weighted imaging was used to locate a spin-labeling, time-spatial labeling inversion pulse (Time-SLIP). To prevent blood contamination, an effective TE (TE<sub>eff</sub>) of 300 ms was used in the Time-SLIP experiments.

## RESULTS

Using non-invasive, non-contrast techniques, we demonstrate both proximal to distal and cranial to caudal flow gradients, with the highest level of CSF flow along the L3 and L4 nerve roots. Interestingly, the slowest outflow was in ROI 1 and 2 (L1) which also demonstrating overall increased Time - to - Peak (TTP) relative to L2-4.

## CONCLUSION

Our work is the first to validate the use of non-invasive, non-contrast MR techniques to identify and quantify intrinsic CSF spinal outflow metrics. Our quantitative results demonstrate high CSF outflow along the lumbar nerve roots as the first direct visualization of dispersed CSF egress from the nerve root sheaths into the adjacent paraspinous space.

## CLINICAL RELEVANCE/APPLICATION

New avenue for spinal CSF flow study, with implications for intrathecal drug design/delivery, identifying flow abnormalities related to CSF issues, and as biomarker for neuropathy/radiculopathy.

## R5B-SPNR-2 Does Resting-state fMRI have the Potential for Presurgical Functional Mapping?

## PURPOSE

In research, the potential of resting state has been explored for several decades, however, task-based functional MRI (tb-fMRI) is the status quo for presurgical planning where eloquent functional networks of the brain such as language and movement are mapped. But, reliable tb-fMRI mapping requires task compliance whereas resting-state fMRI (rs-fMRI), which utilizes the inherent synchronisation of fMRI BOLD signals between brain areas, enables this mapping even in sleep/anaesthesia conditions. Further, several functional networks can be mapped at once. To leverage the capabilities of rs-fMRI in clinical settings, a comparison of the two is crucial. The purpose of this study was to compare rs-fMRI and tb-fMRI.

## METHODS AND MATERIALS

The raw rs-fMRI data and partially pre-processed tb-fMRI data (n=75 language, n=80 motor) from a healthy cohort were obtained from HCP dataset. After relevant pre-processing steps including artefact correction, skull-stripping, and denoising. Independent component analysis was performed on the rs-fMRI time series using standardized reproducible pipelines in Python. The components were compared with functional atlases - Schaefer (sensory-motor) and SENSEAAS (language) using Dice coefficients, and the component with the largest coefficient was chosen for subsequent analyses. For tb-fMRI, cluster-based z-statistic maps were generated at a significance level of p=0.05 using a threshold of z = 3.69 using the FSL toolbox. Following this, four metrics were computed- sensitivity and specificity of rs-fMRI with respect to tb-fMRI (masked with an average of both to avoid null voxels), concordance of lateralization (left, right, bilateral) between rs-fMRI and tb-fMRI, the distance between the centre of mass (COM) of peak clusters in rs-fMRI and tb-fMRI, and product of group-averaged tb-fMRI and rs-fMRI maps.

## RESULTS

The tb-fMRI produced more lateralized activations than rs-fMRI. The concordance between the lateralization side indicated by rs-fMRI to that by tb-fMRI was 36 % for the language network.

## CONCLUSION

The sensitivity and specificity values were in an acceptable range. The distance between rs-fMRI and tb-fMRI COMs as well as lateralisation concordance were similar to previous studies on tumours. The product of rs-fMRI and tb-fMRI maps indicate good topographic concordance. Taken together, the results reflect that rs-fMRI is comparable to tb-fMRI but doesn't have a very high concordance, likely reflecting the unique activations captured by rs-fMRI.

## CLINICAL RELEVANCE/APPLICATION

Pre-surgical planning based on rs-fMRI can be used for patients non-compliant with tb-fMRI such as comatose, paralyzed, cognitively challenged, claustrophobic, etc.

## **R5B-SPNR-3 ABC/2 and Ice Cream Cone Method for Volumetric Assessment of Vestibular Schwannomas: Reliability of These Methods**

### **PURPOSE**

Vestibular schwannomas are three-dimensional tumors that cannot be accurately assessed with linear measurements or simple volume calculations. Volumetric analysis, using software that segments images, provides a more robust tool for measuring tumor volume, growth rate, and volumetric change. However, this software is not widely accessible and can be time-consuming. As a result, volume-estimating formulas such as ABC/2 and ice cream cone have become popular. This study aimed to evaluate the accuracy of volume estimation using these formulas compared to manual segmentation, using magnetic resonance imaging (MRI).

### **METHODS AND MATERIALS**

The study analyzed 46 cases of unilateral vestibular schwannomas confirmed by pathology and examined using MRI. Volumetric analysis was conducted using a 3-D, T1-weighted, magnetization-prepared rapid gradient echo (MPRAGE) sequence with manual image segmentation. Two-dimensional metrics were used to calculate tumor volume using ABC/2 ( $AP \times ML \times CC / 2$ ) and ice cream cone formulas. The largest anteroposterior (AP) and craniocaudal (CC) dimensions were compared for each tumor. Differences greater than 10% between these dimensions were used to assess the difference between the lesions. Unpaired t-tests were used to analyze the results, with significance set at  $p < 0.05$ .

### **RESULTS**

Of the 46 patients, 34 (74%) had intracanalicular and cisternal components, while 10 (22%) had only intracanalicular component. The comparison of volume estimation was done on a subgroup of 31 patients. The mean tumor volumes obtained by manual segmentation, ABC/2, and ice cream cone methods were 1244.41 ( $\pm 982.35$ ) mm<sup>3</sup>, 1557.23 ( $\pm 1484.05$ ) mm<sup>3</sup>, and 1043.64 ( $\pm 891.13$ ) mm<sup>3</sup>, respectively. There was no statistically significant difference between ABC/2 and manual segmentation ( $p=0.16$ ), ice cream cone and manual segmentation ( $p=0.20$ ), and ABC/2 and ice cream cone ( $p=0.52$ ) measurements. Of the tumors, 26 (57%) had longer AP dimensions, while 6 (13%) had longer CC dimensions.

### **CONCLUSION**

s Linear measurement applications such as the ABC/2 and ice cream cone methods can serve as substitutes for calculating tumor volumes, given their ease of use and accessibility. However, the ABC/2 formula tends to overestimate the tumor volume, while the ice cream cone formula tends to underestimate it. Furthermore, while the majority of vestibular schwannomas are ovoid, 13% of tumors grow predominantly in a CC fashion, which may result in preferential trigeminal nerve involvement.

### **CLINICAL RELEVANCE/APPLICATION**

The ABC/2 and ice cream cone formulas are reliable and time-efficient alternatives to manual segmentation for accurately estimating the volume of vestibular schwannomas.

## **R5B-SPNR-4 Applying ChatGPT to Predict Imaging Modalities Given Neuroradiological Patient Presentation**

Participants

Lleayem Nazario-Johnson, BS, North Providence, RI (*Presenter*) Nothing to Disclose

### **PURPOSE**

The aim of this project is to explore the ability of large language models (LLMs) to predict the best neuroradiologic imaging modality given specific clinical presentations. In addition, we seek to determine if LLMs can outperform an experienced neuroradiologist in this regard.

### **METHODS AND MATERIALS**

We utilized ChatGPT, an LLM built by Open AI that is trained on general data, as well as GlassAI, an LLM built by Glass Health that is trained on medical text. We prompted ChatGPT to rank the three best neuroimaging modalities, while taking the best responses from GlassAI and the neuroradiologist. We compared the responses to the American College of Radiology (ACR) Appropriateness Criteria for 147 conditions under the Neurologic Panel. Clinical scenarios were passed into each LLM twice, to account for stochasticity. Each output was scored out of 3, where 3 is "usually appropriate", 2 is "may be appropriate", 1 is "usually not appropriate", and 0 is not listed. Partial scores were given for non-specific answers. Scores were averaged across neurological topics. Statistical significance was determined using a two-sided student's T-test.

### **RESULTS**

ChatGPT achieved a score of 1.75 with a standard deviation of .81, while GlassAI achieved a score of 1.83 with a standard deviation of .81 across all neurological clinical scenarios. The difference between them was not found to be statistically significant ( $p > .05$ ). The neuroradiologist achieved a score of 2.19, with the difference of the scores being statistically significant when compared to LLMs ( $p < .05$ ). ChatGPT was also found to be the more inconsistent of the two LLMs, with the score difference between both outputs being statistically significant ( $p < .01$ ). It was also found that the score between different ranks outputted by ChatGPT was statistically significant ( $p < .001$  for each).

### **CONCLUSION**

s LLMs perform well selecting an appropriate neuroradiologic imaging procedure when prompted with a specific clinical scenario. ChatGPT, a general model, performed the same as GlassAI, a medical-specific model, suggesting that with medical text training, ChatGPT could significantly improve its function in this application. LLMs did not outperform an experienced neuroradiologist, indicating the need for their continued improvement in the medical context.

### **CLINICAL RELEVANCE/APPLICATION**

LLMs such as ChatGPT and GlassAI are able to comprehensively analyze large volumes of patient data and provide practitioners with accurate and reliable recommendations. This ability can improve diagnostic accuracy, reduce unnecessary testing and radiation exposure, and ultimately improve patient outcomes. Though LLMs do not yet outperform a neuroradiologist, our investigation indicates a proof of concept for their clinical implementation.

## **R5B-SPNR-5 Photon-counting Detector CT Could Visualize Brachial Plexus: A New Method to Evaluate Nervous**

## System

### Participants

Masahiro Nakashima, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

### PURPOSE

MRI is widely used to evaluate brachial plexus, however, it is often difficult to visualize it because of field inhomogeneity and anatomical complexity. Recent advent of photon-counting detector CT (PCD-CT) could provide the higher spatial resolution with better tissue characterization. The purpose of this study was to investigate the optimal reconstruction function of the PCD-CT to maximize the quality of imaging for it.

### METHODS AND MATERIALS

This retrospective study included patients who underwent neck PCD-CT for screening between March 1 and April 3, 2023 in our institution. Patients with radiological abnormalities, such as masses and postoperative cervical spine, were excluded. To evaluate the appropriate reconstruction function (kernel), the signal-to-noise ratio (SNR) was quantitatively compared in eight different kernels for each patient while other parameters, including matrix size (512×512mm), degree of iterative reconstruction (QIR2), and slice thickness (0.4mm), were fixed. Radiation dose levels were CTDIvol 11.0-13.8mGy. The kernels of quantitative regular (Qr) series from Qr40 to Qr72 (Qr40, Qr44, Qr48, Qr56, Qr60, Qr64, Qr68, and Qr72), the standard kernel for quantitative evaluation, were used. The SNR was measured on a reconstructed 1mm-thick coronal section image by setting six regions of interest (ROIs) with 3 mm<sup>2</sup> on each of the bilateral C5-C7 nerves, and the average and standard deviations (SDs) of the SNRs were calculated. All the ROIs within each subject were copied and pasted to the images with different kernels to ensure locational accuracy. The SNR was measured by a board-certified neuroradiologist with 8 years of experience. Statistical analyses were performed with the Friedman test, and the Wilcoxon signed-rank test.

### RESULTS

Ten subjects (5 males and 5 females; median 73 [range65-78]years) were evaluated. The SNR (mean±SD) was 3.39±1.30, 2.93±0.96, 2.66±0.95, 2.05±0.72, 1.74±0.59, 1.44±0.48, 1.14±0.37, 1.14±0.37, for Qr40, Qr44, Qr48, Qr56, Qr60, Qr64, Qr68, and Qr72, respectively. The SNRs exhibited a constant decrease with each increase in the Qr number. The SNRs were significantly different ( $P<0.05$ ) between any of the two groups, except for Qr68 vs Qr72. The kernel with the smaller Qr number demonstrated a better SNR in the evaluation of the brachial plexus.

### CONCLUSION

On PCD-CT, the kernel with a smaller Qr number was more suitable to evaluate the brachial plexus. Qr40, in particular, was found to have the highest SNR and was seemed to be clinically useful.

### CLINICAL RELEVANCE/APPLICATION

While MRI has been the mainstay for the evaluation of the brachial plexus, the heterogeneity of magnetic fields hampers image evaluation. PCD-CT, with its improved tissue resolution, may help in the assessment of the brachial plexus.

## R5B-SPNR-6 Large-scale Granger Causality (IsGC) for Identifying Autism Spectrum Disorder Patients Using Functional MRI - A Multivariate Brain Connectivity Analysis

### Participants

Axel Wismueller, MD, PhD, Pittsford, NY (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to create and test a new machine-learning approach for identifying individuals with Autism Spectrum Disorder (ASD). This approach uses large-scale Granger Causality (IsGC) to analyze differences in connectivity seen in resting-state functional MRI (rsfMRI).

### METHODS AND MATERIALS

We have selected a subset of 59 rsfMRI data sets from ASD patients and healthy controls from the Olin Institute of Living at Hartford Hospital. This subset is part of the publicly available preprocessed Autism Brain Imaging Data Exchange II (ABIDE II) data repository and specifically represents the Longitudinal Sample. To calculate directed functional connectivity between brain regions, we used the large-scale Granger Causality (IsGC) algorithm. This algorithm has recently been developed and leverages dimensionality reduction for causal modeling in high-dimensional fMRI time series. We applied a 100-iteration cross-validation approach with a 90%/10% train/test ratio. During the feature selection process, Kendall's tau rank correlation was used, followed by support vector machine classification. To evaluate the diagnostic accuracy of IsGC in classifying ASD patients and normal controls, we compared its performance with both a deconfounding partial correlation and the current clinical fMRI analysis standard of cross-correlation (CC). We reported accuracy, area under the ROC curve (AUC), and f1-score to quantitatively evaluate the performance of IsGC.

### RESULTS

The IsGC rsfMRI analysis method demonstrated superior performance compared to both the partial correlation and clinical standard CC techniques in classifying ASD patients from healthy subjects. With an accuracy/AUC/f1 score of 97.9%/1.0/96.4% for IsGC, 75.4%/0.79/60.5% for partial correlation, and 80.1%/0.85/66.8% for CC, respectively, it is suggested that the IsGC rsfMRI analysis method is a favored choice for accurate classification.

### CONCLUSION

Our results demonstrate that IsGC significantly enhances the diagnostic accuracy of identifying patients with ASD from rsfMRI neuroimaging. Based on our findings, we conclude that IsGC is better equipped to capture disease-related changes in brain network connectivity in ASD patients compared to both conventional CC analysis and partial correlation.

### CLINICAL RELEVANCE/APPLICATION

The IsGC method successfully classifies Autism Spectrum Disorder (ASD) patients and controls through identifying key changes in fMRI connectivity, clearly demonstrating its potential usefulness as a novel diagnostic imaging biomarker for neurologic disease.



## **R5B-SPNR-7 Adaptive Changes of Hypoxia Exposure in Normal Adults at High Altitude and Comparison of Brain Structure and Function between Insomnia and Non Insomnia by f-MRI**

Participants

Mingguang Yang, Chongqing, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To observe the brain adaptation changes in normal adults after exposure to hypoxia at high altitude and the differences in brain structure and function in patients with secondary insomnia

### **METHODS AND MATERIALS**

26 subjects of aid workers in Tibet were prospectively enrolled, and high-resolution three-dimensional T1-weighted structural images and resting state functional magnetic resonance imaging (rs-fMRI) were collected. MRI scans were taken as baseline data before admission to Tibet. Six months after emigration to Tibet, 26 subjects were divided into insomnia group (8 cases) and non-insomnia group (18 cases) according to Pittsburgh Sleep Quality Index (PSQI), and MRI scanning was performed again. Based on voxel morphology (VBM), local consistency (ReHo), low-frequency amplitude ratio (fALFF), and degree center (DC), 26 subjects were analyzed before and after entering Tibet, and the insomnia and non insomnia groups were analyzed respectively.

### **RESULTS**

Compared with the pre Tibet group, the gray matter volume (GMV) atrophy of 26 subjects in the post Tibet group was located in the middle frontal gyrus, parahippocampal gyrus and right parietal inferior marginal angular gyrus, with significant differences ( $P<0.01$ ). The ReHo value between pre Tibet and post Tibet groups were statistically significant ( $P<0.01$ ). The brain area with increased ReHo value was located in the right cerebellar hemisphere. The fALFF values between the pre Tibet and post Tibet groups were statistically significant ( $P<0.01$ ). The brain regions with increased fALFF values were located in the left lingual gyrus, the left middle temporal gyrus, and the cortex around the left talate fissure; The fALFF value between the insomnia group and the non insomnia group was statistically significant ( $P<0.01$ ). The brain area with increased fALFF value was located in the left posterior cingulate gyrus. The DC value between the insomnia group and the non insomnia group was statistically significant ( $P<0.01$ ). The brain area with reduced DC value was located in the left orbital superior frontal gyrus.

### **CONCLUSION**

The structure and function of several brain regions were changed in normal adults after migrating to high altitude and secondary insomnia.

### **CLINICAL RELEVANCE/APPLICATION**

In this study, people exposed to low oxygen in high altitude areas were tracked, and the brain function and morphology were compared with insomnia and non-insomnia after migration to high altitude areas and before and after their own migration, and multiple brain regions with abnormal brain structure and function were found

## **R5B-SPNR-8 Brain Image Reconstruction using Deep Learning CT Image Quality**

### **PURPOSE**

To compare the image quality of brain computed tomography (CT) images reconstructed with deep learning-based image reconstruction, Advanced intelligent Clear-IQ Engine (AiCE), and Iterative Reconstructions (AIDR3D)

### **METHODS AND MATERIALS**

150 consecutive patients underwent unenhanced brain CT scans with the following acquisition parameters: 120 kV, 50 mAs, slice thickness 0.5 mm, rotation time 1.5 sec, field of view, 250 mm; matrix, 512 × 512. Each dataset was reconstructed with AIDR3D and AiCE at 1 mm thickness and 1 mm increment. All images were evaluated using a dedicated PACS system. Image quality on a 4-point scale (excellent, good, sufficient, poor quality), gray matter-white matter differentiation, and anatomical detail (based on the visualization of basal ganglia, internal and external capsule) were independently assessed by two experienced readers. Interobserver agreement was assessed. Posterior fossa artifact index, the contrast to noise ratio (CNR) basal ganglia and the background image noise were evaluated.

### **RESULTS**

No significant difference was observed in image quality ( $p=0.06$ ). The gray matter-white matter differentiation was higher in AiCE reconstructions ( $p=0.003$ ), as well as the anatomical detail ( $p=0.04$ ). Image noise and artifact index of the posterior cranial fossa were significantly lower in images reconstructed with AiCE ( $p=0.003$ , and  $=0.005$ ) respectively. CNR was higher in deep learning based reconstruction ( $p=0.004$ ).

### **CONCLUSION**

In brain CT, deep learning based reconstructions allow significant reduction of noise and artifacts and better subjective image quality compared with iterative reconstructions.

### **CLINICAL RELEVANCE/APPLICATION**

Deep learning based reconstructions improve image quality when compared to iterative reconstruction: this fact may allow the reduction of CT acquisition parameters and radiation exposure in CT protocols.

## **R5B-SPNR-9 Reduction of Posterior Fossa Artifacts using Spectral Monoenergetic CT Images**

### **PURPOSE**

The radiological evaluation of the posterior fossa in conventional brain computed tomography (CT) is often interfered by beam hardening artifacts. Dual energy CT has been increasingly evaluated regarding for example reduction of metal artifacts and general image quality. Artifact reduction that could improve the assessment of the posterior fossa would be of great value since the symptoms of pathology may be non-specific such as headache, nausea, vertigo and ataxia. Patients could receive suboptimal level of care or incorrect treatment if not correctly diagnosed or while awaiting further work-up. The purpose of this study was to evaluate posterior fossa artifacts in virtual monoenergetic images (VMIs) compared to conventional CT images.

## **METHODS AND MATERIALS**

We included consecutive exams from adult (over 18 years) patients at our center who had undergone non-contrast spectral brain CT and whose exam was assessed as normal (e.g. no findings of ischemia, expansivities or hemorrhages). Regions of interest (ROIs) were drawn in predefined areas in posterior fossa grey matter (GM) and white matter (WM), in the interpetrous part of pons and in reference supratentorial GM and WM. Mean Hounsfield values and standard deviation (SD, considered image noise) were noted for the conventional images (CIs) and retrieved in spectral diagrams for monoenergetic series at 40-200 keV. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. The SD of the ROI in interpetrous pons was considered PFAI (posterior fossa artifact index). Visual assessment was performed by independent review by neuroradiologists blinded to reconstruction details.

## **RESULTS**

In the objective part of the study 188 patients were included and of them, forty consecutive patients were included in the subjective part. SNR was significantly higher compared to CIs in VMIs at 50 keV and higher for all measure points and CNR was higher in VMIs from 40 to 80 keV compared to CIs (Figure 1). Compared to CIs, mean image noise was lower for cerebellar WM in VMIs at and above 50 keV and for cerebellar GM the noise values were significantly lower in VMIs at and above 60 keV. The PFAI was significantly lower in VMIs above 50 keV compared to in CIs. VMIs at 60 keV received the highest visual assessment scores regarding overall image quality and artifact severity (higher scores indicating less artifacts) in the interpetrous pons.

## **CONCLUSION**

s Our results indicate that VMIs may improve objective and subjective image quality and artifact severity in the posterior fossa.

## **CLINICAL RELEVANCE/APPLICATION**

CT is the most used neuroradiological imaging modality in clinical routine care. Improving the diagnostic strengths of the images regarding posterior fossa pathology could have a direct impact for the patient outcome.

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## Abstract Archives of the RSNA, 2023

R5B-SPPH

### Physics Thursday Poster Discussions II

#### Sub-Events

#### **R5B-SPPH-1 Clinical Comparison of Commercial Dosimetry Software Platforms for Y-90 Radioembolization Treatment**

##### Participants

Judy James, PHD, Maywood, IL (*Presenter*) Nothing to Disclose

##### PURPOSE

Patient dosimetry is an evolving field for therapy procedures in Nuclear Medicine. Post imaging dosimetry verification is gaining importance to validate prescribed dose with delivered dose in tumor and normal tissues. In Yttrium-90 (Y-90) radioembolization, specific targeted amounts of Y-90 radiation (Gy) is prescribed to preferentially destroy the cancerous cells. Different approaches to clinical dosimetry in NM have been proposed, with planar and SPECT images. Aim of this study was to compare clinically available dosimetry softwares to evaluate patient liver tumor dose following Y90 Treatment and the associated challenges with the software calculations.

##### METHODS AND MATERIALS

Dosimetry analysis was performed on a patient that received Y-90 treatment to the right anterior lobe with a prescribed dose of 301 Gy. The lung shunt fraction was at 2.7%. SPECT/CT was acquired following Y-90 administration on two separate gamma cameras: GE CZT and Philips Bright view (BV) and quantitative SPECT images were reconstructed. Following the required segmentations of the liver and tumor, the maximum absorbed dose to the hottest area of the tumor was obtained and compared using 3 dosimetry software platforms: 1) MIM Y90 Sure Plan™, 2) HERMES Voxel dosimetry™ and 3) Simplicity™.

##### RESULTS

Variability was observed in steps leading to computation and calculation of the absorbed radiation dose. The three platforms required a post Y-90 reconstructed SPECT, CT, and the administered dose. In addition, the needs for a) MIM lung shunt fraction (LSF), b) HERMES: duration between administration and scan time; c) Simplicity a pre Y-90 planning CT or MR and LSF. Segmentation and contouring workflow variability was also observed. MIM has a streamlined workflow for contouring and calculating the maximum dose compared to HERMES and Simplicity. Maximum reported doses were: a) MIM: 522.4 Gy with 95% of tumor: 496.28 Gy (CZT) and 196.04 Gy with 95% of tumor: 186.24 Gy (BV); b) HERMES: 184.27 Gy (CZT) and 200.44 Gy (BV); c) Simplicity: 433.7 Gy (CZT) and 574.2 Gy (BV), where the true prescribed dose was 301 Gy. The doses computed by the three software had >20% deviation from the actual prescribed dose.

##### CONCLUSION

Initial results of a dosimetry software comparison provided evidence that variability exists in the calculation of absorbed dose estimates on SPECT/CT images.

##### CLINICAL RELEVANCE/APPLICATION

Absorbed dose calculation in Y-90 radioembolization treatments are feasible clinically. However, dosimetry still faces challenges of standardization among different calculation platforms, imaging scanners, dose calculation models, and target area segmentation.

#### **R5B-SPPH- 10 Radiation Effect Measurement in Brain Tumor using MR-based Conductivity Imaging**

##### Participants

Hyun Chul Kim, MD, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

The ionizing radiation produces ions inside the human body that can kill cancerous tissues by damaging DNA directly or creating charged particles that damage DNA. MR-based electrical conductivity imaging is a sensitive technique for evaluating the response of normal tissues immediately after irradiation, but it is necessary to verify responses of cancer tissues to become a reliable tool for evaluating therapeutic effects in clinical practice. In this study, we used MR-based electrical conductivity imaging to evaluate the responses of irradiated and non-irradiated tissues during the peri-irradiation period in mouse brain tumors.

##### METHODS AND MATERIALS

For intracranial tumors, C6 glioma cells were injected into the right caudate-putamen of 14 Balb/c nude mice for in vivo imaging. Tumor growth was confirmed on MR images using a 9.4T MRI 2 weeks after tumor cell inoculation. The mice were divided into an irradiated group (n = 7) and a non-irradiated group (n = 7). In the irradiated group, the mean dose rate was 0.98 Gy/min, and the field size was 5 × 30 cm under a Co-60 gamma-ray irradiation unit. Imaging experiments were performed before and at 0, 1, 2, 3, 7, and 10 days after irradiation in both groups. For electrical conductivity imaging, a multi-echo spin-echo pulse sequence was applied to obtain a B1 map, which was used to calculate high-frequency conductivity images.

##### RESULTS

Figure 1 shows full time-course MR and electrical conductivity images of tumor with and without irradiation. Morphology of tumor region in MR images showed a similar pattern over time in both groups. However, conductivity images showed clear contrast changes between the two groups over time. In line graphs, the percentage change of the normal region with irradiation increased by 27.2% up to 2 days and then decreased to 12.4%. The change of the normal region without irradiation was not observed. Meanwhile, the change of the tumor region with irradiation increased by 61.1% up to 3 days and then decreased to 52.9%. The change of the tumor region without irradiation was not observed until 3 days after irradiation, but increased to 23.2% at 10 days after.

## CONCLUSION

Conductivity image provides information on cellularity and amounts of electrolytes in tissues, it shows potential as a tool for quantifying therapeutic effects of radiation on tumor.

## CLINICAL RELEVANCE/APPLICATION

The goal of radiation therapy in cancers is to maximize suppression of local tumors and minimize side effects on normal tissue. MR-based electrical conductivity imaging showed potential as a tool with high sensitivity for measuring and evaluating tissue response after irradiation.

## R5B-SPPH- 11 **Catalyzing International Collaboration between Cancer Radiotherapy Centers at Established Institutions and Those Located in Low and Middle Income Countries via Film Dosimetry**

Participants

Achidi Fomujong, Douala, AL (*Presenter*) Nothing to Disclose

## PURPOSE

Cancer remains one of the leading causes of death worldwide, but an even more disturbing fact is the striking disparity of cancer burden among rich and so called low-and-middle-income countries (LMICs). In a recent publication of the global cancer statistics 2020, there were 10 million cancer related deaths worldwide of which 70% were in LMICs. Any collaboration no matter how small to reduce this disparity is certainly welcome news. One such collaboration area is in Quality Assurance using film dosimetry. Film's unique qualities such as tissue equivalence, high spatial resolution, near energy independence and comparatively a less expensive dosimeter ought to make it the preferred and widely used in radiotherapy centers in LMICs. This however is not always the case as other factors that often maybe taken for granted in advanced radiotherapy centers remain a challenge in LMICs. We explored the unique qualities of film dosimetry that can make it possible for one Institution to benefit from another's protocols via collaboration.

## METHODS AND MATERIALS

For simplicity, two Institutions were considered in this work. We used a single batch of films (EBT-XD) and established a calibration protocol, including scan protocols and calibration curve using radiotherapy delivery system at Institution A. We then proceeded and performed patient specific QA for patients treated on system A (PSQA-A-A). Films from the same batch were then sent to a remote center for PSQA on radiotherapy delivery system B. Irradiations were done at Institution B and then returned to Institution A for processing and analysis (PSQA-B-A). The following points were taken into consideration throughout the process (a) A reference film was irradiated to a known dose on the same system irradiating the PSQA film. (b) For calibration, we utilized the one scan protocol and maintained the same scan orientation of the calibration, PSQA and reference films.

## RESULTS

Gamma index analysis using a dose threshold of 10% and 3%/2mm criteria showed a gamma passing rate of 99.8% and 100% for the PSQA-A-A and PSQA-B-A respectively.

## CONCLUSION

This work demonstrates that one could use established film dosimetry protocols in one Institution, eg an advanced radiotherapy center and apply with similar accuracies to irradiations performed at another institution, eg a center located in LMIC which thus encourages collaboration between the two for worldwide patient benefits.

## CLINICAL RELEVANCE/APPLICATION

We show how advances in film dosimetry now make it possible to use well established film calibration protocols at one Institution to impact care at another less privileged institution thus catalyzing international collaboration.

## R5B-SPPH- 12 **Evaluation of the Feasibility of Injectable Lipiodol and Tissue Glue Fiducial Markers for CyberKnife Tracking**

## PURPOSE

To evaluate combinations of lipiodol and tissue glue using phantom and rabbit models, for feasibility in computed tomography (CT) image quality and image recognition of the Cyberknife system.

## METHODS AND MATERIALS

The gold and lipiodol fiducial markers were inserted into tissue-equivalent phantom. CT was performed to assess images in terms of contrast to noise ratio (CNR), signal to noise ratio (SNR), and streak index (SI). To investigate the performance of combination of lipiodol and tissue glue, a study is conducted in the spine phantom which was placed in such a way that the lipiodol fiducial marker was overlapped with the bone in TLS. CT values, deformation, displacement, and diffusion of lipiodol fiducial markers were evaluated one week after injected into the livers of six rabbit models. Tracking accuracy of the gold fiducial markers and the lipiodol fiducial markers were analyzed and compared.

## RESULTS

The phantom show that the fiducial markers in each group could be seen clearly visible on the CT scans. Compared to lipiodol fiducial markers, gold fiducial markers had a greater SI and poorer CNR and SNR. Groups of lipiodol fiducial markers overlapped with the spine can be identified and successfully tracked. Both the pairing tolerance and uncertainty values did not exceed the systematic threshold. There were no adverse reactions such as rupture, necrosis and infection were observed in the injection site. Over the course of a week, the volume of lipiodol glue fiducial marker decreased by 30% while CT value stayed above 1000 HU. The

registration translation deviation of gold fiducial markers tracking was lower than that of lipiodol glue fiducial markers tracking in supero-inferior, left-right and antero-posterior directions ( $Z=-2.276$ ,  $-10.226$ ,  $Z=-6.378$ ,  $P < 0.05$ ).

## CONCLUSION

s Fiducial markers composed of a combination of lipiodol and tissue glue were well visualized in a phantom on CT and produce less artifact than the gold fiducials. Lipiodol fiducial markers were successfully recognized and tracked using the Cyberknife Xsight-Lung tracking system in rabbit models.

## CLINICAL RELEVANCE/APPLICATION

Compared with solid markers, combinations of lipiodol and tissue glue possess the following advantages: ? it can be injected through the liver via a thinner needle, reducing the risk of pain and complications during puncture. ? The corresponding volume can be injected according to the size of the tumor, especially the tracking method combined with Cyberknife only needs one injection, which can reduce the number of punctures and simplify the process. ? The visibility of the markers on the imaging device can be adjusted by changing the ratio of lipiodol to tissue glue.

## R5B-SPPH-2 Clinical and Radiation Risk Across One Million Patients in Computed Tomography: Influence of Age, Size, and Race

Participants  
Francesco Ria, DMP, Durham, NC (*Presenter*) Metis Health Analytics

## PURPOSE

We recently developed a mathematical model to balance radiation risk and clinical risk, namely the risk of misdiagnosis due to insufficient image quality. In this work, we applied this model to a population of one million CT imaging cases to evaluate the risk stratification with different ages, sexes, and races.

## METHODS AND MATERIALS

The demographics were informed by literature and census information simulating a clinical liver cancer population. The Total Risk (TR) was calculated as the linear combination of radiation risk and clinical risk. The model included factors for the radiation burden for different age and sex; the prevalence of the disease; the false positive rate; the expected life-expectancy loss for an incorrect diagnosis for different ages, sex, and race; and a typical false positive rate of 5%. It was assumed that each case received an average radiologist interpretative performance of 0.75 AUC for a hypothetical lesion without any changes in radiation dose beyond routine practice. We further, for each patient, simulated 2,000 imaging conditions with CTDIvol varying from 0.1 and 200 mGy with 0.1 mGy increments. Per each CTDIvol value, the anticipated AUC was calculated by applying the established asymptotic relationships between CTDIvol and image quality. The AUC distribution was then used to calculate the theoretical minimum total risk (TRmin) per each patient.

## RESULTS

For the routine practice, the median theoretical total risk was estimated to be 0.058 deaths per 100 patients (range: 0.002 - 0.154) comprising of the median radiation risk of 0.009 (range: 0.001 - 0.069), and of the median clinical risk of 0.049 (range:  $7.0 \times 10^{-5}$  - 0.094). Considering the varying scanner output conditions, the median TRmin was 0.054 deaths per 100 patients for White male patients, 0.054 for Blacks, 0.057 for Hispanics, and 0.065 for Asians. For female patients, the median TRmin values were 0.049, 0.056, 0.054, and 0.061 deaths per 100 patients, respectively.

## CONCLUSION

s For each demographic condition, the clinical risk was found to largely outweigh the radiation risk by at least 500%. Total risk showed different stratifications with patient age and race.

## CLINICAL RELEVANCE/APPLICATION

To optimize CT conditions for specific patients and/or population, both radiation risk and clinical risks should be accounted together with demographic information. We demonstrated a methodology that allows a complete depiction of total risk in CT, considering radiation and clinical risks at comparable units, and patient demographic.

## R5B-SPPH-3 Attenuation Correction for Total-body Positron Emission Tomography by Exploiting Anatomical Priors

Participants  
Wenbo Li, Shenzhen, China (*Presenter*) Nothing to Disclose

## PURPOSE

During positron emission tomography (PET) scanning, additional computed tomography (CT) imaging is utilized to provide attenuation coefficient maps to achieve more precise quantification on PET images. However, this not only exposes patients to extra doses of ionizing radiation but also makes attenuation correction (AC) difficult for PET/MR or PET-only scanners. Recently, many efforts have been applied to address this issue but the majority of these methods have been implemented on specific anatomical tissue, ignoring the structural differences among various human body sites.

## METHODS AND MATERIALS

Experiments were performed on total-body scans of 20 patients that contained paired NAC PET and AC PET images of different sites, including the head and neck, chest, abdomen, pelvis, and extremities. Considering the anatomical disparities, we utilized the cycle-consistent generative adversarial network (Cycle GAN) as a foundation and modified its discriminator to differentiate between the authenticity of the input and its corresponding anatomy. In addition, the training process included the integration of a discriminative loss that relied on anatomical structures to enhance the quality of the generated AC PET images.

## RESULTS

The results showed that our method yielded superior quantification outcomes with a peak signal-to-noise ratio (PSNR) of  $38.02 \pm 5.52$  dB and a structural similarity index (SSIM) of  $0.96 \pm 0.05$ . Compared to nonattenuation-corrected PET (NAC PET) images ( $33.30 \pm 12.35$  dB,  $0.84 \pm 0.52$ ), our method resulted in a 14% increase in both PSNR and SSIM, indicating its effectiveness in converting NAC PET images into AC PET images.

## CONCLUSION

Our work accounts for differences in the anatomy of various human body sites and applies this information as a priori knowledge in the generation of AC PET images from NAC PET images. By incorporating prior factors, we achieved remarkable quantitative results, as evidenced by significant improvements in both PSNR and SSIM metrics compared to NAC PET images in different body sites.

## CLINICAL RELEVANCE/APPLICATION

Considering anatomical prior information, our work utilizes deep learning techniques to generate AC PET images directly from NAC PET images, bypassing the PET reconstruction step, which facilitates attenuation correction of PET images in PET/MR or PET-alone scanners.

## R5B-SPPH-4 Performance Evaluation of a Super Resolution Deep Learning Reconstruction Algorithm for Chest CT

Participants

Patrik Rogalla, MD, MBA, Toronto, ON (*Presenter*) Institutional Research Grant, Canon Medical Systems Corporation; Institutional Research Grant, KA Imaging

## PURPOSE

To evaluate the effect of Super Resolution Deep Learning Reconstruction (SR-DLR) using 1024 matrix on image quality in chest CT compared to standard-of-care reconstruction methods.

## METHODS AND MATERIALS

A DCNN-based Super Resolution Deep Learning Reconstruction (SR-DLR) model was developed for lung imaging. For training, standard-dose image data acquired using an ultra-high resolution CT scanner (Canon Aquilion Precision) served as target and low-dose image data from the normal resolution mode served as input. Projection data from 31 standard-of-care CT acquisitions (Canon Aquilion ONE PRISM) of the chest were reconstructed with 3 different methods: Hybrid iterative reconstruction (AIDR-3D for lung and body) at 512 matrix (series I), deep learning reconstruction (AiCE, lung and body algorithm) at 512 matrix (series II), and SR-DLR (lung algorithm) at 1024 matrix (series III), all at 3 mm slice thickness with 2.5 mm spacing. Images were also reconstructed using SR-DLR at 1024 matrix and 0.5 mm slice thickness (series IV). All 4 series, synchronized and without annotation, were reviewed in both window settings by 3 chest radiologists blinded to technical details on a 4K monitor with a 4x2 hanging protocol for the following categories on a scale of 1-5: lung resolution; soft tissue contrast; noise texture/level (lung, tissue), artifact (lung, tissue); overall image quality (lung, tissue). Forced ranking of the overall diagnostic confidence was also recorded (1 = highest, 4 = lowest). Image noise (SD) was measured in tissue and air.

## RESULTS

P values refer to series I vs III and I vs IV. The mean rating of series I-IV was 3.1/3.7/4.2/4.7 for lung resolution (both  $p < 0.001$ ); 3.2/4.1/4.1/3.5 for tissue contrast ( $p < 0.001$ ,  $p = 0.002$ ); 3.0/3.8/4.4/4.7 for lung noise (both  $p < 0.001$ ); 3.0/4.2/4.2/3.5 for tissue noise (both  $p < 0.001$ ); 4.3/4.3/4.4/4.4 for lung artifacts ( $p = 0.06$ ,  $p = 0.03$ ); 4.2/4.4/4.3/4.2 for tissue artifacts ( $p = 0.25$ ,  $p = 0.79$ ); 3.1/3.8/4.3/4.7 for overall image quality lung (both  $p < 0.001$ ) and 3.1/4.1/4.0/3.5 for overall image quality tissue (both  $p < 0.001$ ); the mean overall diagnostic confidence ranking was 3.9/2.8/2.1/1.1 for lung (both  $p < 0.001$ ) and 3.5/1.8/1.9/2.7 (both  $p < 0.001$ ) for tissue, respectively. For series I vs IV, mean image noise in tissue was 17.4/17.5 HU ( $p = 0.97$ ) and 45.9/12.5 in air ( $p < 0.001$ ).

## CONCLUSION

The SR-DLR using a 1024 matrix provides superior clinical image quality in chest CT; SR-DLR thin slices are overall preferred for lung parenchyma. SR-DLR holds promise to eliminate the need for separate reconstructions for the lung parenchyma and soft tissues.

## CLINICAL RELEVANCE/APPLICATION

The SR-DLR outperforms current clinical standard-of-care reconstructions and may contribute to improving the diagnostic value of chest CT

## R5B-SPPH-5 K-RCPS: Uncertainty Quantification for Diffusion Models via Conformal Prediction and Conformal Risk Control in CT Denoising

Participants

Jacopo Teneggi, Baltimore, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Diffusion models can generate varied and high-quality samples. It is paramount to estimate the uncertainty of these models when used for inverse problems in medical imaging (e.g., CT denoising). We propose a novel uncertainty quantification procedure to construct pixel-wise intervals that provably contain future samples as well as the ground-truth image while minimizing the mean interval length.

## METHODS AND MATERIALS

A diffusion denoising model was trained and validated on the AbdomenCT-1K dataset comprising 1,112 CT scans (170,000 images) from 12 different medical centers. Uncertainty quantification was carried out on random subsets of 640 images not shown during training. Every image in the subset was perturbed with isotropic Gaussian noise ( $\text{std} = 0.4$ ) and the diffusion model was used to reconstruct 128 noiseless samples (81,920 total images). We compute the pixel-wise calibrated quantiles over the samples to guarantee that with probability at least 80% every pixel in a new sample from the diffusion model on the same noisy observation will be contained in its respective interval. We then conformalize the intervals such that with probability greater than 90% no more than 5% of the pixel in the ground-truth high-quality image will fall outside of the intervals on future, unseen noisy observations. We propose a novel convex optimization extension of the original Risk Controlling Prediction Sets (RCPS) procedure, K-RCPS, that provably minimizes the mean interval length. We compare with existing uncertainty quantification approaches in terms of guarantees provided and mean interval length over 20 draws of the 640 images.

## RESULTS

K-RCPS provides the shortest mean interval length (0.1391  $\pm$  0.0025) compared to quantile regression (0.3522  $\pm$  0.0085), naïve

(i.e., not calibrated) empirical quantiles (0.1401 +- 0.0024), and the existing RCPS procedure (0.1614 +- 0.0020). K-RCPS is currently the only high-dimensional uncertainty quantification approach that guarantees both coverage of future samples on the same noisy observation and risk control on future observations.

## CONCLUSION

s Conformal prediction and conformal risk control can be deployed for diffusion models in CT denoising to construct uncertainty intervals that provide finite-sample and distribution-free guarantees on the generated noiseless images. K-RCPS provably minimizes the mean interval length, and it consistently outperforms existing methods.

## CLINICAL RELEVANCE/APPLICATION

Statistically valid uncertainty quantification techniques build radiologists' confidence in diffusion models used for inverse problems in medical imaging.

## R5B-SPPH-6 Comparing Machine Learning Algorithms for Predictive Radiomic Features of Tumor Response after Pancreatic SBRT

### PURPOSE

Pancreatic cancer is a debilitating malignancy with a short life expectancy. While pancreatic SBRT has shown robust tumor control, identifying patients that respond to SBRT remains challenging. The aim of this study was to compare ML algorithms for prediction of pancreatic tumor response utilizing radiomic features extracted from MR-guided SBRT set-up imaging. We also evaluated whether static radiomic features (e.g. obtained at first SBRT fraction) differed in this predictive potential compared to delta radiomic features (e.g. net change in features between SBRT fractions 1-2 and 1-3)

### METHODS AND MATERIALS

58 pancreatic cancer patients treated with MR-guided SBRT at our institution were analyzed. Gross tumor volumes were delineated on daily set-up MRIs prior to each fraction. Patients were treated to the pancreas at a dose of 35-50 Gy in 5 fractions. Tumor response was defined using TRG-CAP for patients who underwent resection. For patients who remained unresectable post-SBRT, tumor response was determined with RECIST v.1.1 criteria on imaging at 1-3 months. MRI scans were normalized in signal intensity and 39 texture features were extracted. Features were ranked by predictive importance using RF, LASSO, and MRMR algorithms. Top 1-4 importance features from each model were analyzed using logistic regression to determine predictive performance. Logistic regression was used to obtain the area under the curve (AUC) and the Akaike information criterion (AIC) in order to compare models.

### RESULTS

For the static feature model, an MRMR algorithm of the top 2 importance features outperformed other approaches (AUC: 0.656; AIC: 55.12). For the first delta radiomics model (fractions 1-2), an RF model of the top 3 importance features demonstrated the best performance (AUC: 0.681; AIC: 52.1). For the second delta radiomics model (fractions 1-3), LASSO - using the top importance feature only - demonstrated the best performance (AUC: 0.603; AIC: 53.76).

## CONCLUSION

s Leveraging an RF algorithm to rank delta radiomic features from SBRT fractions 1-2 demonstrated the best prediction of pancreatic tumor response.

## CLINICAL RELEVANCE/APPLICATION

Radiomic features of pancreatic tumors may contain predictive information about local control following MR-guided SBRT. These features could be used to personalize adaptive approaches to SBRT by identifying non-responders prior to completion of treatment.

## R5B-SPPH-7 Technical Performance Comparison of Super Resolution Deep Learning Reconstruction Algorithm on a Wide Area, Conventional Energy-Integrating Detector vs Conventional Reconstruction Algorithms on a Photon-Counting Computed Tomography System

Participants

Kirsten Lee Boedeker, PhD, Los Angeles, CA (*Presenter*) Employee, Canon Medical Systems Corporation

### PURPOSE

The purpose of this work is to systematically compare fundamental image quality between data reconstructed with a Super Resolution Deep Learning Reconstruction (SR-DLR) algorithm acquired on a wide volume, energy-integrating detector (EID) Computed Tomography (CT) system vs data reconstructed with Hybrid Iterative Reconstruction (HIR), as well as Filtered Backprojection (FBP), acquired on a Photon-Counting CT System (PCCT) in standard resolution mode.

### METHODS AND MATERIALS

A Catphan<sup>TM</sup> embedded in a 25-35cm body ellipse was scanned at six dose levels from 1.9mGy-19.7mGy on a wide volume EID as well as on a CZT-based PCCT in standard resolution mode (Canon Medical Systems Corporation, Otawara, Japan). Images generated from the EID system were reconstructed with FBP and an SR-DLR for cardiac to a 512 matrix and 1024 matrix. Two clinically realistic fields of view (FOV), 180mm and 360mm, were evaluated. Counting images from the PCCT were generated based on total counts registered over five energy bins and reconstructed with HIR cardiac kernels. Resolution was assessed via task-dependent Modulation Transfer Function (MTF) for three contrast levels. Noise was assessed by measuring the standard deviation (SD) and Noise Power Spectrum (NPS). Noise Equivalent Quanta (NEQ) and Low Contrast Detectability (LCD) were also assessed.

### RESULTS

For FBP, PCCT exceeded the spatial resolution of EID. However, the spatial resolution for SR-DLR with both a 512 and 1024 matrix on the EID system exceeded that of both conventional reconstruction algorithms on PCCT for all contrasts, by up to 5lp/cm at the 10% of the MTF, except at the lowest dose/contrast combinations. For FBP, PCCT decreased noise at low dose relative to EID. SR-DLR had lower noise magnitude, by 20-45%, than FBP and HIR on PCCT for all conditions. Both HIR on PCCT and SR-DLR on EID have noise shifted to lower frequencies, although with 1024 matrix the higher frequency content increases. NEQ is significantly greater for SR DLR for all conditions, leading to better LCD.

## CONCLUSION

s While PCCT provides benefit over EID when reconstructed with equivalent reconstruction algorithms, SR-DLR improves EID image quality above that of PCCT in standard resolution mode with HIR and FBP.

## CLINICAL RELEVANCE/APPLICATION

SR-DLR using both 512 and 1024 matrix sizes leads to significant image quality benefits in spatial resolution and noise relative to conventional reconstruction algorithms on EID CT and PCCT.

## R5B-SPPH-8 Evaluation of Regularized Model-Based Cone-Beam Computed Tomography Image Reconstruction for Image-Guided Radiation Therapy: A Phantom Study

Participants

Shih-Chi Lin, MS, New York, NY (*Presenter*) Nothing to Disclose

## PURPOSE

This study investigates the potential improvement in Cone-Beam Computed Tomography (CBCT) image quality for adaptive image-guided radiotherapy (IGRT) planning using regularized model-based image reconstruction methods. We evaluate maximum likelihood proximity gradient algorithms using higher-order total variation (PGA-ML-HOTV) and tight framelets (TF) regularization to improve CBCT image quality over conventional image reconstruction methods.

## METHODS AND MATERIALS

The Tomographic Iterative GPU-based Reconstruction toolbox (TIGRE) was used for projection processing, code development, and image reconstruction. The filtered back-projection algorithm (FDK), with scatter correction and a ramp filter, was used as the baseline (BL) due to the similarity to the vendors' algorithm. PGA-ML (HOTV/TF) and row-action maximum likelihood algorithm (RAMLA; for comparison) were implemented using a Poisson noise model without scatter correction. These reconstructions were initialized with an FDK and a uniform image using 50, 100, 150, and 200 iterations. A Catphan phantom was scanned using CBCT Head Protocol on a Varian TrueBeam LINAC. Image quality was evaluated using the square root of the area under the 2D noise power spectrum curve (NPS<sub>2D</sub>), contrast (?HU), contrast-to-noise ratio (CNR), target transfer function value at 50% and 10% (TTF-50 and -10), and a model observer with eye filter detectability index (DI) of the -138 HU, 12.2-mm diameter polystyrene plug.

## RESULTS

PGA-ML performances with HOTV and TF were indistinguishable. The highest performance improvement over BL was seen using PGA-ML with 150 iterations initialized with FDK. In this case, NPS<sub>2D</sub>, ?HU, TTF, CNR, and DI improved by 15%, 12%, 51-52%, 4%, and 21%, respectively. It was noted that there is a trade-off in image quality with this method. Specifically, images initialized with a uniform image and 200 iterations had better NPS<sub>2D</sub>, CNR, and DI by 56-57%, 82-83%, and 111-112%, respectively. When initializing with an FDK image, ?HU decreased by 12%, but CNR increased (4%) due to lower noise. ?HU declined with increased iterations. ?HU and TTF improved with increasing iterations with a uniform image, while NPS<sub>2D</sub> and DI worsened, outperforming FDK. CNR increased initially but decreased beyond 150 iterations due to increased noise.

## CONCLUSION

s The study demonstrates that regularized model-based image reconstruction methods can provide better image quality than FDK with optimized iteration and penalty settings and thus enhance target delineation during adaptive IGRT. Task-based performance assessment of these methods is necessary to enable integration into CBCT-based adaptive radiotherapy.

## CLINICAL RELEVANCE/APPLICATION

CBCT quality is important for CBCT-based adaptive IGRT planning.

## R5B-SPPH-9 Is the 120 KVp-like Image Synthesized from Dual-energy CT Equivalent to the Conventional 120 KVp Single-energy CT Image: From the Perspective of Dose Calculation of Photon Radiotherapy

Participants

Bo Yang, Peking, China (*Presenter*) Nothing to Disclose

## PURPOSE

Due to the difference of Hounsfield Unit (HU) characteristic of most dual-energy CT (DECT) oriented images and 120KVp Single-Energy CT (SECT) images, specific CT value to Electric Density (CT-ED) calibration curve are needed for DECT-based dose calculation in photon Radiotherapy (RT), which may hamper the widely use and cover the potential of DECT in RT. To simplify and promote the DECT application in photon RT, the equivalent between the 120 KVp-like image synthesized from DECT and 120KVp SECT image is evaluated via phantom in terms of dosimetry.

## METHODS AND MATERIALS

On the one side, to evaluate equivalent with 120KVp SECT images in dosimetry, 120 KVp-like images combined with the specific CT-ED calibration curve were used to calculate dose. On the other side, due to similarity of HU value between 120 KVp SECT images and 120 KVp-like DECT images, the 120KVp-like dose was calculated via conventional CT-ED curve directly. In detail, CIRS 062M tissue characterization phantom, stuffed with nine rod-shaped tissue substitute inserts, was scanned by DECT and SECT sequentially in the same situation. The specific 120 KVp-like CT-ED calibration curve was established by fitting the measured HU value and ground-truth ED ((FIG.1 (d))). In addition, A VMAT treatment plan with prescribed dose 7000 cGy was optimized based on the SECT image of a head and neck phantom. Finally, by Dose Volume Histogram (DVH) (FIG.2) and gamma pass rate, the recalculated dose distributions of 120 KVp-like image via the specific or conventional CT-ED curve were compared with the dose of 120KVp SECT image, respectively.

## RESULTS

With the specific 120 KVp-like CT-ED curve, the PTV D95 of 120 KVp-like DECT image and 120 KVp SECT image was 7155.4cGy and 7164.9cGy, respectively. The gamma pass rate is 99.5% (3mm,3%), 99.1%(2mm,2%), which represents that the difference between these two dose distributions is acceptable. With the conventional 120 KVp CT-ED curve, the PTV D95 of 120 KVp-like DECT is 7168.9 and is close to that of 120 KVp SECT (D95= 7155.4). The gamma pass rate of dose distribution between 120 KVp-



like DECT and 120 KVp SECT is 100% (3mm,3%), 99.5%(2mm,2%).

#### **CONCLUSION**

s Whatever using specific 120 KVp-like or conventional 120 KVp CT-ED calibration curve, the dose discrepancy between 120 KVp-like DECT image and 120 KVp SECT image is clinical acceptable. And 120 KVp-like image is equivalent with 120 KVp image from the prospective of dose distribution.

#### **CLINICAL RELEVANCE/APPLICATION**

DECT in radiotherapy

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5B-SPVA

### Vascular Imaging Thursday Poster Discussions II

#### Sub-Events

#### R5B-SPVA-1 Correlation Between Plaque Characteristics, Serological Indexes and Coronary CTA Flow Reserve Fraction in Patients with Coronary Artery Disease

##### PURPOSE

To study the correlation between coronary CT angiography (Computer tomography angiography, CTA) fractional flow reserve (Fractional flow reserve, CT-FFR) and plaque characteristics, serological indexes in patients with coronary artery disease.

##### METHODS AND MATERIALS

A total of 91 patients with coronary artery disease who underwent coronary CTA examination in the Central Hospital Affiliated to Shandong First Medical University from March 2022 to February 2023 were selected. According to CT-FFR value, patients were divided into non-myocardial ischemia group (CT-FFR value > 0.80, n=58) and myocardial ischemia group (CT-FFR value =0.80, n=33). The CT-FFR value, plaque characteristics parameters (plaque length, minimum lumen area, total plaque volume, lipid plaque volume, fibrous plaque volume, calcified plaque volume), serological indicators (low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), homocysteine (Hcy), high-sensitivity C-reactive protein (hs-CRP), apolipoprotein A (ApoA), matrix metalloproteinases (MMP-2, MMP-9)], and the correlation analysis was performed.

##### RESULTS

There were no significant differences in fibrous plaque volume, calcified plaque volume and minimal lumen area between the two groups ( $P > 0.05$ ). The plaque length, total plaque volume, lipid plaque volume and serum levels of the serum LDL-C, MMP-2, MMP-9, Hcy and hs-CRP were significantly lower, while serum levels of HDL-C and ApoA were significantly higher in CAD patients without myocardial ischemia than those in CAD patients with myocardial ischemia ( $P < 0.05$ ). The CT-FFR value was negatively correlated with plaque length, total plaque volume, lipid plaque volume, the serum LDL-C, MMP-2, MMP-9, Hcy and hs-CRP, and positively correlated with the serum HDL-C and ApoA.

##### CONCLUSION

The decrease of CT-FFR value in patients with coronary heart disease is closely related to metabolic disorders, glucose and lipid deposition, plaque enlargement and decreased stability, complement system activation, inflammatory mediators release, and endothelial cell injury.

##### CLINICAL RELEVANCE/APPLICATION

By exploring the correlation between plaque characteristics and serological indicators in patients with different CT-FFR values, the mechanism of plaque formation and progression was further understood, providing guiding value for clinical treatment and prognosis of coronary atherosclerotic heart disease.

#### R5B-SPVA-2 Spectral CT Monochromatic Imaging With Metal Artifact Reductions In Assessment Of Stent Lumen In Portal Venography After TIPS: A Retrospective Study

##### Participants

Xingpeng Li, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the clinical value of spectral CT monochromatic imaging with metal artifact reductions in assessment of stent lumen in portal venography after transjugular intrahepatic portosystemic shunt (TIPS).

##### METHODS AND MATERIALS

Twenty-seven patients with TIPS for portal hypertension were performed spectral CT portal venography (CTPV) in our study. All raw data were reconstructed as 120 kVp-like imaging, and 6 groups of monochromatic imaging from 45 keV to 70 keV with 5 keV as an interval, respectively. Four slices CTPV images were evaluated, including main portal vein, proximal, middle and distant level of stent. Objective indexes for portal vein and stent included artifact index (AI), signal intensity (SI), standard deviation (SD), signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Subjective indexes were assessed by two radiologists with 5-point scale separately. Patients with portal vein thromboses were recorded, and statistical analyses were analyzed.

##### RESULTS

According to Child-Pugh staging in all 27 patients, 3 were classified into grade A, 14 were grade B, and 10 were grade C. For objective indexes in portal vein and stent lumen, all SI, SNR and CNR decreased with the increase of keV (all  $P < 0.01$ ), and 45 keV demonstrates the highest SI, SD, SNR and CNR. The enhancement of portal vein and stent lumen were higher than 200 HU only in 45, 50, 55 and 60 keV, and there is no statistical significance for all indexes between 70 keV and 120 kVp-like group (all  $P > 0.05$ ). With MARs technique, AI decreased significantly for all 45 to 70 keV images. For subjective indexes, 60 keV group manifested best image quality scores and diagnostic confidence among all 7 groups. 1 stent thrombosis was detected in TIPS stent by CTPV,

including 7 patients with portal vein cavernous transformation.

#### **CONCLUSION**

s Combined with subjective and objective assessments of image quality, spectral CT monochromatic imaging at 60 keV with MARs technique increased SI, SNR, CNR in assessment of TIPS stent lumen and portal vein for liver cirrhosis, which is feasible in evaluation of stent lumen and portal vein after TIPS.

#### **CLINICAL RELEVANCE/APPLICATION**

Spectral CT monochromatic imaging at 60 keV with MARs technique demonstrated feasibility in evaluation of stent lumen and portal vein after TIPS.

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## Abstract Archives of the RSNA, 2023

S3A-SPBR

### Breast Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPBR-1 Performance of an Artificial Intelligence System on Screening Breast Tomosynthesis Cases

Participants

Roger S. Yang, MD, Warren, NJ (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the performance of artificial intelligence (AI) on screening tomosynthesis mammograms

#### METHODS AND MATERIALS

This retrospective study included 28,278 DBT screening exams and the subsequent BIRADS 0 workups, consecutively collected from February to July 2022 from multiple outpatient imaging centers within a private practice. The screening exams (Hologic) were evaluated by 36 MQSA radiologists and scored according to the Breast Imaging Reporting and Data Classification System (BIRADS). BIRADS 0 cases were recalled for additional evaluation and potential biopsy. All DBT screening exams were analyzed by an AI system (Transpara 1.7.1, ScreenPoint Medical), which assigned an exam score between 1-10 indicating an increasing likelihood of malignancy. The positive predictive value (PPV) of radiologists and the performance of the AI system were evaluated.

#### RESULTS

Out of 28,278 screening exams, 4170 exams were labeled as BIRADS 0, resulting in a recall rate of 14.75%. Of the 4,170 patients recalled, 3,531 returned to one of our facilities for diagnostic imaging. There were 581 diagnostic exams labeled as BIRADS 4-5 and recommended for biopsy. Biopsy results were available for 335 cases at the time of analysis, revealing 70 biopsy-proven cancers. A BIRADS-0 rating corresponded to a PPV of 3.4%. A BIRADS 4-5 rating based on DBT and subsequent workup yielded a PPV of 20.9%. AI identified 92.9% of cancers (65/70) with an exam score between 8 and 10, 84.3% of cancers (59/70) were flagged with the highest AI score of 10.

#### CONCLUSION

s AI score 8-10 has a strong predictive value for cancer. This system can be used to aid radiologists when evaluating screening mammograms.

#### CLINICAL RELEVANCE/APPLICATION

An AI tool that reliably indicates the probability of malignancy on the initial mammogram could serve as clinical decision support reducing biopsy and recall rates and increasing cancer detection rates.

#### S3A-SPBR-2 Improving Video-Based Ultrasound Diagnostic Performance for Breast Cancer to Expert-Level Using Deep Learning: A Retrospective, Multicenter, Diagnostic Study

Participants

Fajin Dong JR, MD, MD, Shenzhen, China (*Presenter*) Nothing to Disclose

#### PURPOSE

we aim to propose and validate a new automated deep learning framework based on standard video recordings of ultrasound examination.

#### METHODS AND MATERIALS

We designed a video-based framework for breast screening cineclips and integrated three classic AI models, DenseNet121, MobileNet, and Xception as backbones. For comparison, image-based framework is also constructed using the same three backbones with physician selected images, since image-based diagnosis is the current standard practice. In total, 3907 patients from two major medical centers were enrolled between July 2015 and January 2022. Both images and videos of the patients are utilized to train and evaluate models, including retrospective real-world data and prospective test data. Cineclip model tests, image model tests, and reader studies with human experts are performed on both retrospective and prospective data.

#### RESULTS

The accuracy of cineclip models is 87.40 to 92.59%, exceeding the accuracy of 76.00 to 85.60% achieved by all physicians with 7 to 10 years of experience in reader studies. In both real-world and prospective tests, cineclip models surpass image models among all evaluation metrics, including accuracy (87.40-92.59% vs. 80.80-85.83%), sensitivity (86.00-93.33% vs. 80.00-91.07%), specificity (83.10-92.00% vs. 78.87-86.67%), F1 (0.876-0.927 vs. 0.807-0.861) and AUROC (Area under Receiver Operating Characteristic Curve, 0.926-0.962 vs. 0.843-0.936). The difference in AUROC between cineclip models and image models with DenseNet121 and Xception backbone is statistically significant in real-world test under significance level ( $p=0.049$  for DenseNet backbone, and  $p=0.008$  for Xception backbone).

## CONCLUSION

s Cineclip models can achieve higher accuracy along with better robustness than image-based models, outperforming human experts. Our video-based AI framework might better aid breast cancer diagnosis and alleviate the scarcity of experienced physicians.

## CLINICAL RELEVANCE/APPLICATION

Ultrasound is one of the most widely used methods for breast cancer screening. However, its popularity is prohibited by its high operator dependence and the scarcity of skilled ultrasound specialists. This study can reduce the skill requirement and inter-operator variations.

### **S3A-SPBR-3 Deep Learning-Based MRI Model to Predict Pathologic Complete Response After Neoadjuvant Chemotherapy in HER2-Positive and Triple-Negative Breast Cancer**

Participants

Sooyeon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

There are limited studies on the prediction of pathologic complete response (pCR) after neoadjuvant chemotherapy (NAC) using deep learning technique. We aimed to develop a deep learning-based MRI model to predict pCR in women with human epidermal growth factor receptor 2 (HER2)-positive or triple-negative breast cancers.

## METHODS AND MATERIALS

In this IRB-approved single center retrospective study, a total of 852 women (mean age±standard deviation, 51±10 years old) with HER2-positive or triple negative breast cancer who underwent NAC followed by surgery between 2017 and 2021 were included. They were divided into a training set (n=724) and a validation set (n=128) in a ratio of 8.5:1.5. Post-NAC dynamic contrast-enhanced (DCE)-MRI data (subtraction images of the 1st, 3rd, and 5th dynamic phase) and clinical data (age, clinical T stage, clinical N stage, estrogen receptor, progesterone receptor, HER2, Ki-67, histologic grade, histologic type, and initial MRI size) were collected. pCR was defined as the absence of both invasive and in-situ residuals in the breast in the surgical specimen. For each woman, tumor bed or residual enhancing lesions on post-NAC MRI were annotated using the three rectangular region-of-interests for the initial, intermediate (center), and endpoints, respectively. After pre-processing, the deep learning models were developed using 3D ResNet 50 architecture, 5-fold cross validation, and Python 3.6. Clinical data model, each phase model of DCE-MRI, and the combined model were developed, and each performance was evaluated using an area under the receiver operating characteristics curve (AUC). DeLong method was used to compare AUCs.

## RESULTS

The AUCs of the 1st, 3rd, and 5th dynamic MRI model were 0.63, 0.70, and 0.67, respectively. Compared to the 3rd dynamic MRI model with the highest AUC value of 0.70, the combined MRI model obtained from all dynamic images showed a lower AUC value of 0.66 albeit without statistical significance (0.70 vs 0.66, P=0.09). The AUC of the clinical data model was 0.57. The combined model of the clinical data and all dynamic MR images showed an AUC value of 0.65, which was significantly lower than that of the 3rd dynamic MRI model (0.65 vs 0.70, P=0.02).

## CONCLUSION

s The deep learning model based on the 3rd dynamic phase of DCE-MRI showed the best performance in predicting pCR in women with HER2-positive or triple-negative breast cancers.

## CLINICAL RELEVANCE/APPLICATION

Our deep-learning based MRI model demonstrates the potential to predict pCR in women with HER2-positive or triple-negative breast cancer. This information, after careful validation in further studies, can be utilized in a prospective trial to omit breast cancer surgery for women with a high possibility of pCR.

### **S3A-SPBR-4 Combining with Convolution Neural Network and Graph Convolution Network for Predicting Axillary Lymph Node Metastasis in Breast Cancer Based on DCE-MRI: A Multicenter Study**

## PURPOSE

This study aims to develop a deep learning model combining convolution neural network (CNN) and graph convolution network (GCN) based on dynamic contrast-enhanced (DCE)-MRI for predicting axillary nodal status in breast cancer as well as to explore the biological mechanism by employing gene analysis of RNA-sequencing data.

## METHODS AND MATERIALS

A total of 935 patients with breast cancer who underwent preoperative DCE-MRI from four institutes were retrospectively analyzed. 742, 83 and 110 patients were grouped into the training, internal test and independent external test sets, respectively. The regions of interest of the breast lesions were cropped manually by two radiologists. Three conventional CNNs, namely, 3D ResNet, 3D-Xception and HRNet (high-resolution Net) were used as the backbone architecture for axillary lymph node (ALN) metastasis identification based on the tumor, ALN, and combined tumor-ALN regions on the images. The feature maps obtained by CNNs are globally pooled and fused with the spatial structure features obtained by high resolution GCN. RNA-sequencing data from 11 patients were used to explore the underlying biological basis of the AI prediction. To select the most powerful CNN or CNN-GCN model for ALN-metastasis prediction, the performance of three CNN models and three CNN-GCN models was compared with area under the receiver operating characteristic (ROC) curve (AUC), accuracy, sensitivity and specificity. The performance of these models was compared with radiomics models, the Memorial Sloan-Kettering Cancer Center (MSKCC) model, and three radiologists.

## RESULTS

The optimal HRNet-GCN\_tumor+ALN model, achieved an AUC of 0.873 in the internal test cohort, as well as an AUC of 0.870 in the external test cohort, which was better than the best performing radiomics model (logistic regression, AUC: 0.790) and MSKCC model (AUC: 0.752). Additionally, with the assistance of HRNet-GCN\_tumor+ALN, the radiologists' performance was improved (external test cohort, P < 0.05). In the biological basis exploration, the high-risk group was associated with the downregulation of pathways mediating tumor proliferation and the promotion of anti-tumor immune cell infiltration in the microenvironment.

## CONCLUSION

s The proposed GCN-CNN fusion deep learning model could effectively predict ALN status preoperatively in breast cancer patients.

## CLINICAL RELEVANCE/APPLICATION

This study successfully demonstrated a CNN-GCN model base on DCE-MRI, which could non-invasively and preoperatively predict ALN metastasis of breast cancer with high accuracy. This model may assist and guide for radiologists to make more precise evaluation of ALN status.

### S3A-SPBR-5 Patient Race Impacts the Screening Mammogram False Positive Rate of a Commercially Available AI Algorithm

Participants

Derek Nguyen, MD, Durham, NC (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate a commercially available AI algorithm's ability to accurately interpret negative screening mammograms and the impact of patient demographics on its performance.

## METHODS AND MATERIALS

This retrospective cohort study identified 27,681 negative screening tomosynthesis mammograms from our academic institution from 1/1/16 to 12/31/19. All patients had two years of follow up without a diagnosis of atypia or malignancy. Patients with prior breast surgery or implant augmentation were excluded. A subset of unique patients was randomly selected to provide a broad distribution of race/ethnicity. This final cohort was interpreted by an FDA approved, commercially available AI algorithm (ProFound AI 3.0, iCAD, Inc) which was trained prior to the study using an enriched multi-vendor screening population dataset from at least 20 institutions. The algorithm generated case and risk scores for each mammogram. Per vendor, case scores > 49 (range 0-100) have a high certainty for malignancy and risk scores > 0.8 (range 0-1) are at high-risk for developing a malignancy on the subsequent screening mammogram (1-year cancer risk). Patient demographics (age, race/ethnicity, and breast density) were compared with case and risk scores using bivariate and multivariate logistic regression.

## RESULTS

4855 unique patients (median age: 54 years [46-63]) were included. The false positive rate for case and risk scores was 17% (816/4855) and 5% (240/4855), respectively. Every patient demographic was significantly associated with patients' case and risk scores on bivariate analysis,  $p < 0.001$ . On multivariate analysis, Black patients were significantly more likely (OR: 1.45, 95% CI 1.19-1.77) to have case scores > 49 compared to White patients. Asian patients were significantly less likely (OR: 0.68, 95% CI 0.54-0.86) to have case scores > 49 when compared to White patients. Breast density did not influence case scores after adjusting for age and race. On multivariate analysis, only Black patients were significantly more likely (OR: 1.46, 95% CI 1.05-2.03) to have risk scores > 0.8 compared to White patients. Increased breast density was associated with risk scores > 0.8 (fatty - reference; scattered - OR: 1.99, 95% CI 1.33-3.05; heterogeneous - OR: 2.00, 95% CI 1.25-3.55; extremely - OR: 2.80, 95% CI 1.26-5.84).

## CONCLUSION

s Patient race influenced the performance of a commercially available AI algorithm analyzing negative screening mammograms. False positive rates for suspicious case and risk scores were 17% and 5%, respectively.

## CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware that the performance of FDA approved, commercially available AI software will vary by patient demographics and efforts to train on diverse datasets are needed.

### S3A-SPBR-6 AI for Diffusion-Weighted Breast MRI

Participants

Dimitrios Bounias, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

Diffusion-weighted imaging (DWI) is a rapidly emerging MRI technique in oncologic breast imaging that requires no contrast agent administration, rendering it an attractive potential future supplement or even alternative to mammography and dynamic contrast-enhanced MRI. Artificial intelligence (AI) has the potential to assist radiological decisions on this emerging MR technique, facilitating a quicker adoption into clinical routine. In this work, we utilized nnDetection, a state-of-the-art self-configuring Retina U-Net based object detection model, with certain breast cancer-specific extensions to create a robust model trained on a large dataset of unenhanced breast MRI acquisitions.

## METHODS AND MATERIALS

The IRB approved study included  $n=818$  patients. Histopathologically proven malignant lesions accounted for  $n=618$  lesions in  $n=268$  patients. All patients underwent a clinically indicated multiparametric breast 3T MRI examination, including a multi-b-value DWI acquisition (50,750,1500). The nnDetection AI model was trained with the following extensions: (i) Apparent Diffusion Coefficient (ADC) as additional input, (ii) random bias field, random spike, and random ghosting augmentations, (iii) a size-balanced data loader to ensure that the fewer large lesions were given an equal chance to be picked in a mini-batch and (iv) replacement of the loss function with a size-adjusted focal loss, that increases as false positive predictions get smaller or as true positive predictions get larger. This adapted loss function prioritizes finding the primary lesion while disincentivizing small indeterminate false positives. The Area Under the Receiver Operating Characteristic (AUROC) was used as the metric for patient-level performance in 5-fold cross-validation.

## RESULTS

The nnDetection AI model was able to achieve an AUROC of 0.88 using only the abbreviated unenhanced DWI MRI acquisition, and compares favorably against multireader performance metrics reported for mammography ((i)0.81, (ii) 0.87, (iii) 0.81). The model was also able to achieve 0.70 FROC (Free-response Receiver Operating Characteristic) for primary lesions, indicating a relevant localization ability.

## CONCLUSION

s This study shows that AI has the ability to complement the assessment of breast MRI in abbreviated unenhanced examinations based on DWI, even before radiologists are involved in the diagnostic process.

## CLINICAL RELEVANCE/APPLICATION

This work supports personalization in breast cancer screening by enabling radiologists to use advanced imaging techniques such as abbreviated diffusion-weighted imaging (DWI), potentially supplementing the diagnostic toolbox.

### S3A-SPBR-7 Risk-aware AI for Lesion Detection and Characterization in Breast MRI

Participants

Dimitrios Bounias, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

AI methods for medical object detection revolve around discovering and rating structures of potential relevance to the patient. Performance is commonly calculated with Free-response Receiver Operating Characteristic (FROC) analysis, which calculates sensitivity at predefined thresholds of false positives (FPs) per case. FROC weighs all lesions equally, but in practice not all lesions might be considered as having identical instantaneous impact for the further clinical pathway of a patient, revealing a risk imbalance. Here we describe the development and evaluation of such a risk-aware model for breast cancer using diffusion-weighted imaging (DWI) MR acquisitions.

## METHODS AND MATERIALS

For this IRB approved study we used a dataset with n=818 women undergoing clinically indicated 3T breast MRI including multi-b-value DWI (50,750,1500), containing n=618 histopathologically verified malignant lesions in n=268 patients. The risk function was calculated using reported 15-year breast cancer mortality based on lesion size, from a multi-year study involving n=819,647 patients from Sopik et al, 2018. A risk-adjusted adaptation of FROC (raFROC) is proposed, where true positive predictions and ground truth samples are weighted by the associated risk. FPs are weighted by 1-risk, due to the desire to minimize unneeded biopsies and the lower value of low risk lesions. To accommodate for the metric, we also propose a risk-adjusted focal loss (raFocal) that applies similar weighting. A focal loss and a raFocal model were trained using 5-fold cross validation. Evaluation took place using traditional methods and raFROC.

## RESULTS

The risk-aware (raFocal) model improved both the AUROC (Area Under the Receiver Operating Characteristic curve) and AP (Average Precision) patient-level performance (AUROC/AP 0.86/0.77) compared to the standard "focal" model (0.84/0.70). The proposed raFROC portrays a difference (focal 0.60, raFocal 0.65) between the models across all FP thresholds, being able to better mirror patient-level improvement. In contrast, a lesser difference was present for regular FROC (focal 0.50, raFocal 0.52), appearing only in lower thresholds.

## CONCLUSION

s This work showcases a first step for risk-aware AI model training and validation in medical object detection. Accounting for clinical risk and outcome is very important in medical diagnosis, as it allows balancing the trade off between FP findings and missing pathologies, significantly influencing the clinical outcome of the individual patient.

## CLINICAL RELEVANCE/APPLICATION

This work showcases how to incorporate risk into the training and evaluation of object detection models for breast cancer screening, which previously considered all lesions equal, bringing AI closer to clinical needs.

### S3A-SPBR-8 Chat GPT: How Far Has It Gone Yet?

Participants

Marcela Lumar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## PURPOSE

Chat GPT is an artificial intelligence (AI) language model trained on a dataset of human language, making it capable of understanding and generating complex sentences and paragraphs, including medical literature. The objective of this study is to analyze Chat GPT's accuracy and reproducibility in answering questions about breast radiology.

## METHODS AND MATERIALS

Questions were gathered from nationally regarded professional societies, as well as elaborated from breast radiologists with over 15 years of experience. We formulated 10 questions that were answered by medical residents (12 from the 1st/2nd year and 12 from the 3rd/4th year) and 12 professionals specialized in breast imaging. All questions had only one correct answer. The alternatives included the options of "more than one alternative is correct" and "all alternatives are incorrect", for the cases in which Chat GPT could not provide one correct answer for the question. Reproducibility was determined by asking the model each question ten times from at least 5 different devices in at least 3 different locations.

## RESULTS

The mean average of the residents in the 1st and 2nd years was 40% of correct answers, for 3rd and 4th years residents it was 60%, for breast imaging specialists it was 80% and the average of correct responses by Chat GPT-4 was 45%, and varied from 30% to 60% correct answers. Chat-GPT did not demonstrate an increasing or decreasing pattern of number of correct answers thought time that would allow us to infer that it was learning through the questions. Concerning reproducibility, Chat GPT answered the same item in all 10 attempts for only 4 questions.

## CONCLUSION

s ChatGPT could provide accurate responses in 45% of questions related to breast imaging, which is more than a 1st or 2nd year radiology resident but less than a 3rd or 4th year resident. Although it is expected that it will evolve over time, we could not state that in our study. We encourage future studies to further examine how trustworthy are the information provide by it and to analyse

if this technology will continue evolving over time, as we hope this technology may improve education for medical doctors, and even patient's outcomes and quality of life.

#### **CLINICAL RELEVANCE/APPLICATION**

ChatGPT is an AI language model launched in November 2022, trained on a dataset covering a broad range of topics, including the medical literature. Discussion regarding the potential of ChatGPT in all fields of academia is ongoing, and its applicability is under investigation. Although there is one study that tests how Chat GPT would answer questions about screening breast cancer recommendations (Haver et. al), there are currently no studies examining Chat GPT's applicability as a learning tool for professionals consult.

#### **S3A-SPBR-9 Preliminary Interim Analysis of AI-STREAM (Artificial Intelligence for Breast Cancer Screening in Mammography): A Prospective Multicenter Study Design in Korea Using AI-based CADe/x**

Participants

Yun Woo Chang, MD, PhD, (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study is to compare the diagnostic accuracy of radiologists with and without the use of AI-based CADe/x in mammography reading for breast cancer screening of Korean women with average breast cancer risk.

#### **METHODS AND MATERIALS**

Total of 24,601 participants were enrolled between February 2021 and December 2022 at six study sites in Korea. The mammograms were read by breast imaging radiologist (BR) without using AI-based CADe/x through single reading, and results were recorded on the study platform (BEST image). Then, the radiologists reviewed the mammograms with the assistance of AI-based CADe/x and recorded the results on the study platform based on the radiologist's decision after considering both with and without AI-based CADe/x. These BR were experts in breast imaging at an academic hospital for over ten years. If a recall was required, further diagnostic workup was conducted to confirm the cancer detected on screening. In the simulation study, the same participants' mammograms were read by general radiologists (GR) in the same setting of the reading process, without and with use of AI-based CADe/x. GR are radiologists not specializing in breast imaging. The diagnostic accuracy of GR and BR, with or without the use of AI-based CADe/x was compared with AI-based CADe/x for mammography reading for breast cancer screening.

#### **RESULTS**

By the end of patient enrollment, breast cancer was confirmed in 131 patients. GR without AI found 86 cancers, GR with AI found 110 cancers, BR without AI found 110 cancers, and BR with AI found 124 cancers. When a 10% cutoff was applied to AI, it detected 118 cancers. Stand-alone AI-based CADe/x detected significantly higher cancer detection than GR without AI. AI detected slightly more cancer than BR without AI or GR with AI, but there was no statistical significance. BR with AI had the highest cancer detection rate compared with AI stand-alone, BR without AI, or GR with AI, but there was no statistical significance. There was no difference between GR and AI in the recall, but recall in BR was significantly lower.

#### **CONCLUSION**

s AI-based CAD e/x could be helpful for radiologists with less experience in mammography reading. BR with AI had the highest accuracy in cancer detection and a lower recall rate compared with other situations. This is a preliminary interim analysis of the prospective study as cancer registry data will be available at least 26 months after the year of interest.

#### **CLINICAL RELEVANCE/APPLICATION**

This prospective multicenter cohort study aims to generate real-world evidence to compare the diagnostic accuracy of radiologists with and without AI-based CADe/x in mammography reading for breast cancer screening.

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## Abstract Archives of the RSNA, 2023

S3A-SPCA

### Cardiac Imaging Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPCA-1 Total Cardiac Volume Segmentation Model for Pediatric Heart Transplant Donors and Patients using Transfer Learning**

##### Participants

Elanchezian Somasundaram, PhD, MS, Cincinnati, OH (*Presenter*) Nothing to Disclose

##### PURPOSE

To develop an optimized model to predict total cardiac volumes (TCV) in donors and pediatric heart transplant patients using transfer learning techniques on pretrained models predicting individual heart segments.

##### METHODS AND MATERIALS

An internal, clinical chest computed tomography (CT) dataset (n=275), consisting of non-contrast and contrast-enhanced exams, was included for the study. 251 exams were used for model training while 27 were retained for model testing. TCV was segmented as part of clinical workflow using Mimics (Materialize NV, Leuven, Belgium). Additionally, heart chamber segments from a large public dataset (n= 866) curated by the University Hospital Radiology Department (Basel, Switzerland) was included for transfer learning. A dynamic U-net (DynUNET) architecture within the MONAI framework was first pre-trained on the public dataset for 100 epochs, using a 0.8/0.2 split for training/validation respectively, and then trained on the internal TCV dataset. Another DynUNET model was trained only on the internal TCV dataset. Experiment tracking and hyper-parameter search tools were used to find the training parameters that produced the best validation dice score. Both models were tested on the internal test dataset (n=27) as well as 20 adult, chest CT scans from multiple institutions, shared by UNOS (United Network for Organ Sharing) through a formal research agreement. UNOS exams were segmented for TCV using 3D Slicer. Relative volume error (RVE) and Dice coefficients (DSC) were calculated for model performance evaluation and comparison.

##### RESULTS

The most optimal DynUNET model trained with pre-trained weights had an initial learning rate of 0.0005 with an exponential learning rate scheduler and an Adam optimizer. The mean ( $\pm$  standard deviation) RVE and DSC was 3.3 ( $\pm$  3.0%) and 0.95 ( $\pm$  0.02) respectively for the internal dataset and 6.9 ( $\pm$  10%) and 0.90 ( $\pm$  0.10) respectively for the UNOS dataset. The most optimal DynUNET model trained only on the internal TCV dataset had an initial learning rate of 0.003 using a cosine learning rate scheduler and Adam optimizer. The mean ( $\pm$  standard deviation) RVE and DSC was 5.3 ( $\pm$  5.5%) and 0.93 ( $\pm$  0.02) respectively for the internal dataset and 11 ( $\pm$  16%) and 0.87 ( $\pm$  0.15) for the UNOS dataset.

##### CONCLUSION

s Transfer learning using pre-trained weights from a large public dataset improved model performance for prediction of TCV in an internal clinical dataset as well as a set from UNOS, where exams span various institutions, scanner manufacturers, and protocols.

##### CLINICAL RELEVANCE/APPLICATION

Total cardiac volume (TCV) is an important metric for recipient-donor organ matching for organ transplantation. A clinically deployable, optimized deep learning TCV segmentation model is useful for such organ size matching.

#### **S3A-SPCA-2 Comparison of Prognostic Value Between CAD-RADS 1.0 and CAD-RADS 2.0 Evaluated by Convolutional Neural Networks Based CCTA**

##### Participants

Zengfa Huang, Wuhan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

The aim of the present study was to investigate the prognostic value of the novel coronary artery disease reporting and data system (CAD-RADS) 2.0 compared with CAD-RADS 1.0 in patients with suspected CAD evaluated by convolutional neural networks (CNN) based coronary computed tomography angiography (CCTA).

##### METHODS AND MATERIALS

A total of 2131 consecutive inpatients with suspected CAD were evaluated by CCTA for CAD-RADS 1.0 and CAD-RADS 2.0 classifications. Kaplan-Meier and multivariate Cox models were used to estimate major adverse cardiovascular events (MACE) inclusive of all-cause mortality or myocardial infarction (MI). The C-statistic was used to assess the discriminatory ability of the two classifications.

##### RESULTS

In total, 94 (5.2%) MACE occurred over the median follow-up of 45.25 months (interquartile range 43.53 to 46.63 months). The annualized MACE rate was 0.014 (95% CI: 0.011-0.017). Kaplan-Meier survival curves indicated that the Coronary Artery Disease

Reporting and Data System (CAD-RADS) classification, segment involvement score (SIS) grade, and Computed Tomography Fractional Flow Reserve (CT-FFR) classification were all significantly associated with the increase in the cumulative MACE (all  $P < 0.001$ ). CAD-RADS classification, SIS grade, and CT-FFR classification were significantly associated with endpoint in univariate and multivariate Cox analysis. CAD-RADS 2.0 showed a further incremental increase in the prognostic value in predicting MACE (c-statistic 0.702, 95% CI: 0.641-0.763,  $P = 0.047$ ), compared with CAD-RADS 1.0.

## CONCLUSION

The novel CAD-RADS 2.0 evaluated by CNN-based CCTA showed higher prognostic value of MACE than CAD-RADS 1.0 in patients with suspected CAD.

## CLINICAL RELEVANCE/APPLICATION

The novel CAD-RADS 2.0 evaluated by CNN-based CCTA showed good performance for predicting major adverse cardiac events (MACE) in patients with suspected CAD and may serve as a non-invasive imaging marker for risk stratification in future clinical practice.

### S3A-SPCA-3 Diagnostic Utility of Artificial Intelligence in Detecting Coronary Artery Disease on CT Coronary Calcium Score Using Manual Calcium Scoring as Reference Standard- A Meta-Analysis

#### PURPOSE

The amount of coronary artery calcification is said to be a strong and independent predictor of coronary heart disease events. Calcium scoring is a non-invasive procedure wherein calcifications within the coronary arteries are quantified and this is interpreted by trained radiologists. However, this is known to be tedious and time-consuming. Artificial intelligence (AI) is now being used as an adjunct tool in cardiovascular imaging. "Machine learning or deep-learning algorithm is a subset of AI that utilizes algorithms to combine voluminous data comprising clinical information and coronary anatomical variables for optimal prediction of major adverse cardiac events" (Wang, 2019). The aim of this study is to determine the accuracy of AI in detecting coronary artery disease on CT coronary calcium score using manual counting as reference standard.

#### METHODS AND MATERIALS

We searched PUBMED, Google Scholar for studies on AI in detecting CT coronary calcium using manual counting as the reference standard. Pooled sensitivity, specificity, positive and negative likelihood ratios were calculated. Two investigators (ISB and SRL) independently extracted the data.

#### RESULTS

Out of 45 articles, three (3) were included in the study. A total of 769 calcium score procedures were included in the analysis. Overall pooled sensitivity of 0.952 (CI=95%, 0.926-0.970), pooled specificity of 0.949 (CI=95%, 0.921-0.970), positive likelihood ratio of 12.1 (CI=95%, 2.304-63.636) and negative likelihood ratio of 0.055 (CI=95%, 0.036-0.084).

#### CONCLUSION

Deep learning A.I. on coronary artery calcium score can be used to detect coronary artery disease. Further study to compare utility of machine learning with deep learning using manual counting as reference standard.

#### CLINICAL RELEVANCE/APPLICATION

Artificial intelligence is now used in a myriad of applications not only in medicine but also in daily life. AI has a potential to improve the workflow in radiology through automation of CT coronary calcium score determination, a task which is known to be time-consuming. If A.I. may be used in the clinical setting, more people may be screened for coronary artery disease in a given amount of time. This may also help in improving the efficiency of radiologists.

### S3A-SPCA-4 Accuracy of Machine Learning Algorithms for Calcium Scores on Chest Computed Tomography: A Systematic Review and Meta-analysis

Participants

Pedro Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the diagnostic accuracy of artificial intelligence (AI) algorithms for quantifying coronary artery calcium (CAC) on chest computed tomography (CT) images.

#### METHODS AND MATERIALS

PubMed, EMBASE, and Cochrane Central databases were systematically searched for studies published up to April 1st. Studies were included if they compared ML-derived calcium score categories (Agatston score) with expert manual analysis in gated and non-gated studies. The main outcome was the percentage of agreement between automatic and manual analyses of the Agatston score categories. We also calculated the rates of the underestimated and overestimated categories using automatic analysis. Heterogeneity was examined using  $I^2$  statistics. A random effects model was used to perform the meta-analysis. The study protocol was registered a priori in the International Prospective Register of Systematic Reviews (Prospero Protocol CRD42023407318).

#### RESULTS

A total of 23 studies comprising 9788 subjects with gated CT and 4967 with non-gated CT were included. The mean age of the sample was 58.9 years. The percentage of Agatston score agreement between automatic and manual analyses for gated studies was 93.1% (95% CI, 90.8-94.8%). Automatic analysis overestimated the Agatston category by 4.2% (95% CI, 2.8-6.2%) and underestimated it by 2.3% (95% CI, 1.8-2.9%). The percentage agreement for non-gated studies was 79.8% (95%CI, 68.0-88.0%). Automatic models overestimated or underestimated the Agatston category by 10% (95%CI, 4.7-20.0%) and 5% (95%CI, 2.1-11.1%), respectively. Significant heterogeneity was observed in the analyzed outcomes ( $I^2 > 50\%$ ).

#### CONCLUSION

Our findings demonstrate a high degree of agreement in calcium score analysis using machine learning algorithms, particularly in gated studies.

## CLINICAL RELEVANCE/APPLICATION

The use of AI algorithms could improve CT interpretation workflow, offering automatic quantification coronary calcium with high accuracy to both cardiac-gated and non-cardiac-gated chest CTs.

### S3A-SPCA-5 Deep Learning-Based Measurement of Left Atrial Volume on Calcium Scoring CT: Observations in the Dallas Heart Study

Participants

Fernando U. Kay, MD, PhD, Farmers Branch, TX (*Presenter*) Research Grant, Edwards Lifesciences Corporation

## PURPOSE

Coronary calcium scoring CT (CAC-CT) imaging data is currently underutilized. Left atrial (LA) enlargement is associated with atrial arrhythmias and stroke. In this study, we aimed to evaluate the accuracy of an AI-based segmentation algorithm for estimating LA volumes on CAC-CT and compare the results with other clinical variables in the Dallas Heart Study phase 2 (DHS2).

## METHODS AND MATERIALS

Participants with both CAC-CT and cardiac MRI (CMRI) were eligible for inclusion. We developed a 3D Unet Deep Learning model using a semi-supervised approach with nested cross-validation. A cardiac imager created reference cardiac chamber segmentation on CAC-CT for 70 randomly selected participants, using epicardial margins. This initial model generated synthetic segmentations in 1,931 additional scans, which were utilized for model refinement. LA volume was derived using Pyradiomics. In 749 participants, maximum LA volume was independently assessed on CMRI via the biplane method. Clinical variables were collected for analysis. We included a subset of 735 participants without prior events for a Kaplan-Meier analysis of incident atrial fibrillation, stroke, or transient ischemic attack.

## RESULTS

The segmentation model achieved a Dice score of  $0.93 \pm 0.01$  (mean  $\pm$  SD) when compared to manual segmentation. The cohort consisted of 445 females and 304 males with a median age of 50 years (IQR: 43 - 57). The intraclass correlation coefficient between CAC-CT-derived LA volume and maximum LA volume on CMRI was 0.67 (95% CI: 0.63 - 0.71). CAC-CT LA volume had an AUC curve of 0.82 (95% CI: 0.78 - 0.86) for detecting participants in the 4th quartile of maximum LA volume on CMRI. In multivariable linear analysis, CAC-CT LA volume indexed to BSA was significantly associated with male sex (Beta coefficient: 1.6\*\*), age (0.3\*\*\*), smoking habit (-0.7\*), and hypertension (2.9\*\*\*) (P: \* $<0.1$ , \*\* $<0.05$ , \*\*\* $<0.01$ ). The 4th percentile of indexed LA volume on CAC-CT was associated with incident composite events (N = 15) during follow-up when compared to the 1st-3rd percentiles (P = 0.01).

## CONCLUSION

s We developed a segmentation model capable of extracting LA volume from CAC-CT, demonstrating moderate correlation with LA maximum values derived from CMRI. This CAC-CT biomarker was significantly associated with clinical variables, including incident atrial fibrillation and cerebrovascular events in the DHS2.

## CLINICAL RELEVANCE/APPLICATION

AI-derived segmentation algorithms have the potential to enhance the extraction of LA volume from CAC-CT, enabling more comprehensive risk stratification beyond traditional calcium scoring.

### S3A-SPCA-7 Right Ventricular Strain and Abnormal Muscle Formation on Cardiac CT: To Identify Pulmonary Hypertension in Repaired Tetralogy of Fallot

## PURPOSE

In the long-term period of repaired tetralogy of Fallot (TOF), right ventricular (RV) volume augmentation due to pulmonary regurgitation is frequent, and right heart failure due to its aggravation is prognostic. Transcatheter pulmonary valve implantation (TPVI) is becoming increasingly popular as a minimally invasive treatment, but it must be carefully indicated in cases of RV pressure overload. We used multi-phase cardiac CT to assess RV volumetry, strain, and morphology to identify pulmonary hypertension in patients with repaired TOF scheduled for TPVI.

## METHODS AND MATERIALS

Forty-four patients with repaired TOF scheduled for TPVI were enrolled to undergo cardiac CT, MRI, and right heart catheterization. Pulmonary hypertension (PH) was defined as a mean pulmonary artery pressure of 25 mmHg or greater by right heart catheterization. CT-RV strain was calculated using ECG-gated CT data with motion coherence image processing. The association of PH with RV strain and abnormal muscle bundles in the right ventricular outflow tract on cardiac CT was evaluated. Additionally, RV volumetry was compared between cardiac cine MRI and CT.

## RESULTS

Eleven of the 44 patients had PH. CT-RV strain was significantly lower patients with PH than those without PH ( $-8.7 \pm 1.6$  % vs.  $-11.3 \pm 2.33$  %;  $p < 0.001$ ). Receiver-operating-characteristic curve analysis revealed that with optimal RV strain  $-10.4$  %, patients with PH can be diagnosed with an area under the curve 0.97, sensitivity 100%, and specificity 89%. The frequency of formation of abnormal muscle bundles in the RV outflow tract was significantly greater in patients with PH (7/11, 64%) than in patients without PH (11/33, 35%). RV volumes calculated from CT and MRI showed a strong positive correlation, but CT tended to increase volume more than MRI (RV-EDVi: CT vs. MRI,  $176.2 \pm 47.9$  ml/m<sup>2</sup> vs.  $147.0 \pm 42.1$  ml/m<sup>2</sup>; Pearson  $r = 0.90$ ; RV-ESVi: CT vs. MR:  $98.7 \pm 36.9$  ml/m<sup>2</sup> vs.  $79.8 \pm 28.4$  ml/m<sup>2</sup>; Pearson  $r = 0.91$ ).

## CONCLUSION

s The reduction of RV strain and the presence of abnormal muscle bundles in the RV outflow tract obtained from multi-phase CT indicate PH in repaired TOF and should make one cautious about the indication for TPVI.

## CLINICAL RELEVANCE/APPLICATION

Cardiac CT provides not only accurate anatomical information from the RV to the pulmonary artery, but also noninvasive evaluation of pulmonary hypertension.



## Abstract Archives of the RSNA, 2023

S3A-SPCH

### Chest Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPCH-1 Assessment of Solitary Pulmonary Nodules Using Dual-layer Spectral Detector Computed Tomography

##### PURPOSE

With lung cancer being the most common malignancy diagnosed worldwide, differentiating between malignant solitary pulmonary nodules (SPNs) and other lung diseases remained a substantial challenge. The aim of this study was to examine the usefulness of Dual-layer Spectral Detector Computed Tomography in solitary pulmonary nodule (SPN) assessment.

##### METHODS AND MATERIALS

Between September 2021 and December 2022, dual-layer spectral images of 71 patients confirmed by pathology were retrospectively analyzed in the venous phase. Patients were classified into the malignant group and the benign group. The iodine concentration (IC) values of the SPN, normalized IC of the SPN to aorta/pulmonary artery/pulmonary vein (NICa/NICpa/NICpv), CT values of 40 keV (HU40keV) and 80keV (HU80keV) monochromatic images, and the slope of spectral HU curve were calculated and compared between the benign and malignant groups. ROC curve analysis was performed to assess the diagnostic performance of the above parameters.

##### RESULTS

IC, NICpa, HU40keV, and slope HU had significantly higher values in the malignant group than in the benign group (all  $P < 0.05$  in Mann-Whitney U test). Iodine density (AUC = 0.78) of 1.74 mg/ml yielded a sensitivity of 95% and a specificity of 57%. Slope HU (AUC = 0.79) of 2.9 yielded a sensitivity of 95% and a specificity of 57%.

##### CONCLUSION

Both virtual monochromatic images and iodine concentration maps prove to be highly useful in differentiating benign and malignant pulmonary nodules.

##### CLINICAL RELEVANCE/APPLICATION

Dual-layer Spectral Detector Computed Tomography can help to differentiate benign from malignant SPNs.

#### S3A-SPCH-2 Value of Dual-Layer Detector Spectral CT in Predicting Lymph Node Metastasis of Non-Small Cell Lung Cancer

##### PURPOSE

To explore the potential value of dual-layer spectral detector computed tomography (SDCT) quantitative parameters combined with morphological characteristics and tumour markers for predicting lymph node metastasis (LNM) in non-small cell lung cancer (NSCLC).

##### METHODS AND MATERIALS

Patients presenting with solid solitary pulmonary nodules (SPN) (8 mm < diameter = 30 mm) with pathologically confirmed NSCLC were enrolled. The Mann-Whitney U test and independent sample t-test were used to analyse the differences in multiple SDCT quantitative parameters between the non-LNM and LNM groups. The diagnostic efficacy of the corresponding parameters in predicting LNM in NSCLC was evaluated by plotting the receiver operating characteristic (ROC) curve. To determine the independent predictive factors for LNM of NSCLC, we analysed statistically significant clinical data, tumour indicators, SDCT morphological signs of cancer lesions, and SDCT quantitative parameters using multivariate logistic regression. The best multi-parameter regression prediction model was established. Inter-observer repeatability was assessed using the intraclass correlation coefficient (ICC) and the Bland-Altman plot.

##### RESULTS

There were no significant differences in age, sex, or smoking history between the non-LNM and LNM groups. Between both groups, the lesion size and vascular convergence sign significantly differed ( $P < 0.05$ ), and there were no significant differences in six tumour markers. SDCT quantitative parameters (SAR40keV, SAR70keV, ?40keV, ?70keV, CER40keV, CER70keV, NEF40keV, NEF70keV, ?, NIC, and NZeff) in the non-LNM group were significantly higher than those in the LNM group ( $P < 0.05$ ). ROC analysis showed that CER40keV, NIC, and CER70keV had higher diagnostic efficiencies for predicting LNM. Multivariate logistic regression analysis showed that size, ?, and NIC were independent predictive factors for LNM. The combination of size + ? + NIC had the highest diagnostic efficiency (AUC=0.892). This study's inter-observer repeatability of the SDCT quantitative and derived quantitative parameters was good (ICC: 0.801-0.935).

##### CONCLUSION

SDCT quantitative parameters combined with clinical data have potential value for predicting LNM in NSCLC. The size + ? + NIC combined parameter model can further improve the prediction efficiency of LNM.

##### CLINICAL RELEVANCE/APPLICATION

This study explored the importance of SDCT quantitative parameters and their derivatives, combined with morphological information of the lesion and clinical data of patients in predicting LNM in NSCLC. We believe that our study makes a significant contribution to the literature because it provides a new technique for predicting LNM in patients with NSCLC.

### **S3A-SPCH-3 Combination of Clinical and Spectral CT Parameters for Predicting Lymphovascular Invasion in N0 Stage Non-small Cell Lung Cancer**

#### **PURPOSE**

To investigate the predictive value of spectral CT quantitative parameters for lymphovascular invasion in N0 stage non-small cell lung cancer, a diagnostic model was constructed and visualized as a nomogram to assist clinical preoperative treatment decisions.

#### **METHODS AND MATERIALS**

107 patients with N0 stage non-small cell lung cancer underwent spectral CT before surgery and were divided into two groups: positive group and negative group. Clinical baseline characteristics included age, gender, biochemical markers, serum tumor markers and Immunohistochemical markers. Imaging features included lobe location, tumor boundary, lobulation sign, spiculation, bubblelike lucency, air bronchogram, vascular convergence and pleural retraction. A radiologist delineated the regions of interest on the layer of maximum tumor diameter and the nearest upper and lower layers in axial enhanced images and calculated the average value. Monoenergetic CT value, effective atomic number (Eff-Z), iodine concentration (IC) of tumor and artery were acquired to calculate normalized iodine concentration (NIC,  $NIC = IC_{tumor} / IC_{artery}$ ).  $\chi^2$  test, t-test and U test were used for calculated differences between groups. Then, least absolute shrinkage and selection operator (LASSO) regression and multivariate logistic regression were used to select the most discriminating features, build a predictive model and visualize the model as a nomogram. ROC curves, calibration curves and decision curves analysis (DCA) were used to evaluate prediction performance and clinical utility.

#### **RESULTS**

41 patients had lymphovascular invasion in 107 N0 stage non-small cell lung cancer patients. The gender, TIF-1 and lymphocyte count differed between the two groups ( $P < 0.05$ ). After feature selection, the six variables included 70keV, 90keV and Eff-Z in the dual phase were screened by LASSO regression to construct the nomogram. The AUC of the clinical-spectral CT model were 0.93 (95%CI: 0.88~0.98). The sensitivity and specificity were 0.89 and 0.88, respectively. The model showed good calibration, and the DCA demonstrated that the model has a higher net benefit than the best single variable.

#### **CONCLUSION**

There were differences in gender, TIF-1 and lymphocyte count and spectral CT parameters in lymphovascular invasion status. The nomogram based on Clinical characteristics and 70keV, 90keV and Eff-Z in the dual phase is helpful for the preoperative determination of lymphovascular invasion status in non-small cell lung cancer.

#### **CLINICAL RELEVANCE/APPLICATION**

The nomogram is helpful for the preoperative determination of lymphovascular invasion status in N0 stage non-small cell lung cancer, which can assist in clinical preoperative decision-making and patient risk stratification.

### **S3A-SPCH-4 A Comparative Study on the Image Quality of Part-solid Nodules in the Lung Between Visual Non-contrast on Venous Phase Based on Ultrafast Synchronized KV/mA Switching Dual Energy CT and True Non-contrast**

Participants

Jingjing Hong, Guangzhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study explored the feasibility of using virtual non-contrast (VNC) images obtained from ultrafast synchronized KV/mA switching dual energy CT (DECT) in both pulmonary arterial and venous phase to evaluate part-solid nodules (PSN) in the lung, and compared their performance with true non-contrast (TNC) images.

#### **METHODS AND MATERIALS**

46 Cases of Partial Solid Nodules with lung enhanced CT examination who underwent TNC scan and enhanced DECT scan (arterial and venous), and VNC images were reconstructed from DECT. The CT values, and standard deviation (SD) of the PSN and Ipsilateral erector spinae muscle (ESM), as well as diameter of lesion, were measured in VNC and TNC images. The signal-noise-ratio (SNR,  $CTSN/SDSN$ ) and on-contrast-noise-ratio [CNR,  $(CTESM - CTPSN) / SDESMS$ ] of PSN were calculated. Record the effective radiation dose in TNC and VNC mode. Two experienced radiologists subjectively assessed the IQ(image quality)of VNC and TNC images using a 5-point scale (1, poor; 2, fair; 3, moderate; 4, good; 5, excellent). Non-parametric test was used to compare the subjective and objective image parameters and effective radiation dose of images in different scanning phases. The Kappa test was used to assess consistency of subjective score between groups.

#### **RESULTS**

There were no significant differences in The diameter, CT value, SD, SNR and CNR between TNC and VNC images in arterial/venous phase ( $P > 0.05$ ). The TNC ( $4.79 \pm 0.33$ ) had the highest the subjective score, followed by VNC images ( $4.04 \pm 0.26$ ) in venous phase, with significant differences observed among the three groups ( $P = 0.015$ ), however, all scores were up to diagnosis requirements. The consistency of subjective scores between radiologists was strong ( $K = 0.72 \sim 0.73$ ). The effective radiation dose of VNC mode [ $10.74 \pm 0.93$  mSv] was lower than that of conventional mode [ $15.21 \pm 1.89$  mSv] ( $P < 0.001$ ), about 30% reduction.

#### **CONCLUSION**

Visual non-contrast on ultrafast synchronized KV/mA switching dual energy CT in venous phase can provide similar image quality to TNC, but the radiation dose is significantly reduced.

#### **CLINICAL RELEVANCE/APPLICATION**

The ultrafast synchronized KV/mA switching dual energy enhanced venous phase VN technique can largely replace the conventional images, providing comparable image quality for patients with lung disease and significantly reducing patient radiation dose.

### **S3A-SPCH-5 Quantitative Lung and Lobar Perfusion from Dual-source, Dual-energy CTPA in Chronic Thromboembolic Pulmonary Hypertension and Acute Pulmonary Embolism**

#### **PURPOSE**

To investigate the differences in quantitative lung and lobar perfusion metrics between patients with chronic thromboembolic pulmonary hypertension (CTEPH) and acute pulmonary embolism (PE).

#### **METHODS AND MATERIALS**

Under IRB approval, 162 adult patients (>21 years) diagnosed with acute PE or CTEPH were scanned clinically using dual-source, dual-energy CT (Siemens SOMATOM Flash) pulmonary angiography (DE-CTPA) between 2019 and 2023. De-identified, thin-section DE-CTPA images from 81 PE patients (M:F 45:36; median age 69 years [60; 76]) and 81 CTEPH patients (M:F 46:35; median age 71 [61; 78]) were processed using the automated, machine-learning based eXamine DE Lung Isolation software (Siemens Healthineers) to obtain quantitative lung and lobar perfusion data. Clinical data was retrieved from electronic patient journals. Statistical analysis was performed using R (RStudio) with Mann-Whitney U test (individual perfusion parameters), PERMANOVA (for multivariate comparison) and multiple logistic regression (for correlation between perfusion parameters and clinical data and biomarkers).

#### **RESULTS**

Whole lung blood volume was lower ( $p < 0.001$ ) in PE patients (median 3399 mL [2554, 4284]) than in CTEPH patients (median 4094 mL [3397, 4818]). The same was observed at single lung and lobar level (figure 1A). The multivariate comparison encompassing all perfusion variables (figure 1A-C) showed a difference between the two groups ( $F = 6.15$ ,  $Pr > (F) = 0.004$ ) after testing for homogeneity of variance. We found poor correlation ( $r < 0.3$ ) between perfusion parameters and right heart catheterization parameters, 6-minute walking distance, and tricuspid annular plane systolic excursion (TAPSE) in CTEPH patients as well as with TAPSE, mean arterial blood pressure, and saturation in PE patients. In CTEPH, right upper lobe contrast uptake (CU), left upper lobe volume and CU, and left and lower lobe contrast concentration (CC) predicted whether patients had high ( $> 4$  L/min) cardiac output (CO) ( $p = 0.01 - 0.03$ ).

#### **CONCLUSION**

Lung and lobar perfusion are lower in patients with acute PE than patients with CTEPH as highlighted by differences in DECT-derived pulmonary blood volume parameters. This might be explained by the differences between an acute, decompensated disease phenotype and a chronic, compensated disease phenotype. Perfusion parameters correlate poorly with hemodynamic and clinical parameters in both diseases, but might predict severity.

#### **CLINICAL RELEVANCE/APPLICATION**

Fully automatic estimation of quantitative pulmonary perfusion from dual-source, dual-energy CTPA can help assess differences in patients CTEPH and PE.

### **S3A-SPCH-6 Application Value of Spectral CT Multi-Parameter Imaging in the Detection of Emboli and Assessment of Thrombus Burden in Acute Pulmonary Embolism**

#### **Participants**

Weimeng Cao, Zheng Zhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study aims to investigate the efficacy of spectral CT multi-parameter (Spectral Based Image) imaging compared to regular CT (rCT) imaging in the detection of emboli and assessment of thrombus burden in acute pulmonary embolism (PE).

#### **METHODS AND MATERIALS**

102 suspected pulmonary embolism (PE) patients who underwent dual-layer spectral CT (DLCT) pulmonary angiography (CTPA) were prospectively enrolled. Spectral data were reconstructed into conventional images (CI), iodine density maps (ID), effective atomic number (Zeff) maps, and ID-Zeff fusion maps (ID-Zeff). The detection rate of acute PE in each group was evaluated, and the diagnostic efficiency for PE was assessed using receiver operating characteristic (ROC) curves and area under the curve (AUC) for each type of image. The diagnostic efficiency for PE was evaluated separately in pulmonary lobes and main pulmonary arteries, pulmonary segmental arteries, and subsegmental pulmonary arteries. In diagnosed acute PE patients, the total number of thrombi and the number of thrombi detected in three level of pulmonary artery were counted, and the thrombus burden was compared among groups using the Qanadli (Q) score. Independent sample t-tests and chi-square tests were used for quantitative and qualitative data, respectively.

#### **RESULTS**

Among the 102 suspected PE patients, a total of 63 cases were diagnosed based on imaging, laboratory tests, and clinical data. Among them, the CI, ID, Zeff, and ID-Zeff respectively diagnosed 53, 55, 60, and 60 cases. The ID-Zeff image (AUC: 0.989, sensitivity: 97%, specificity: 100%) significantly improved the detection rate of PE compared to the CI image (AUC: 0.892, sensitivity: 84%, specificity: 94%). The total number of thrombi detected by the CI image and each spectral image group in each three level of pulmonary artery were as follows: CI (172, 25, 75, 72), ID (217, 25, 82, 100), Zeff (222, 25, 85, 112), and ID-Z-eff (230, 25, 85, 120). The Q scores for each spectral image group were as follows: CI (15.64±5.28), ID (19.25±6.42), Zeff (19.87±6.86), and ID-Zeff (20.46±6.6). The Q scores in each spectral image group were statistically significant compared to the CI group ( $p < 0.001$ ).

#### **CONCLUSION**

DLCT multi-parameter ID-Zeff maps exhibit better detection rates and thrombus detecting efficacy in PE compared to CI images, especially in subsegmental PE. Additionally, the ID-Zeff map provides more accurate Q scores.

#### **CLINICAL RELEVANCE/APPLICATION**

ID-Zeff imaging can use the wedge-shaped perfusion defect region to detect subsegmental and micro thrombi, significantly improving the detection efficacy of peripheral micro emboli in PE. This provides more accurate imaging data for the precise assessment of thrombus burden, risk stratification, and prognosis prediction.

## **S3A-SPCH-7 CT-based Automated Measure of Vertebral Fracture Associates with COPD Severity, Sex and Age in Smokers**

### **PURPOSE**

Osteoporosis is a major comorbidity of chronic obstructive pulmonary disease (COPD) contributing to high prevalence of vertebral compression fractures (VCF). Alteration in spine morphology due to VCF reduces rib-cage mobility and chest space, hinders lung expansion and function, and adversely impacts mobility, quality of life, and clinical outcomes. This retrospective study examines the association of VCF with COPD severity, sex, and age using a CT-based automated method.

### **METHODS AND MATERIALS**

Twelve thoracic and the first lumbar vertebrae were automatically segmented and labeled from chest CT scans using a previously validated deep learning-based method. Following the Genant's principle, an automated VCF assessment method was developed and applied to individual vertebral volume. Inspiratory or total lung capacity chest CT scans from the Iowa cohort of the Genetic Epidemiology of COPD (COPDGene) study at baseline visits were used. Four COPD severity groups were defined—(1) preserved lung function (GOLD 0), (2) mild COPD (PRISm and GOLD 1), (3) moderate COPD (GOLD 2), and (4) severe COPD (GOLD 3 and 4). A generalized linear model of the VCF count with age, sex, height, weight, smoking history, and COPD severity was developed.

### **RESULTS**

Study participants (n=1221; age (mean±SD): 59.29±8.98 years; 581 female) in the preserved lung function and mild, moderate, and severe COPD groups had 0.61±1.27, 0.66±1.37, 0.85±1.53, and 1.03±1.75 VCF counts, respectively. As compared to the preserved lung function group, moderate and severe COPD were associated with significantly higher VCF counts (p=0.047 and p=0.00048, respectively), while the observed higher VCF counts in mild COPD were not significant (p=0.084). Females (p<0.0001) were associated with lower VCF counts. Aging was positively correlated with the VCF count (p<0.0001).

### **CONCLUSION**

s A CT-based automated measure of VCF is presented, and its association with COPD severity, sex, and age is demonstrated. Automation of the CT-based method will facilitate its application to nationwide repositories chest CT scans exploring associations of demographic, lifestyle, and clinical factors on osteoporosis and VCF and their impacts in COPD and other lung diseases.

### **CLINICAL RELEVANCE/APPLICATION**

The new method offers CT-based automated quantification of VCF, which may be useful to investigate the osteoporosis comorbidity in COPD and its impact on lung function and clinical outcomes.

## **S3A-SPCH-8 Deep Neural Network to Detect Emphysema on Chest Radiographs.**

Participants  
Sewoo Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

Chronic obstructive lung disease (COPD) remains underdiagnosed globally, and chest radiographs are typically obtained for patients with respiratory symptoms. This study aimed to develop a deep neural network to detect emphysema on chest radiographs.

### **METHODS AND MATERIALS**

We retrospectively collected chest radiographs and CT scans between 2009 and 2020 from patients with emphysema, as identified in CT reports, at a single tertiary referral center for the model development. The emphysema index was calculated from the CT scans and dichotomized at a cutoff of 10% to determine the presence of CT-defined emphysema. A U-Net-based deep neural network was trained to predict CT-defined emphysema on chest radiographs. Chest radiographs were processed to generate three-channel images, consisting of a native chest radiograph, a segmented lung image, and a pulmonary vessel map. Lung segmentation and pulmonary vessel map extraction guided the model to focus on anatomical structures relevant to emphysema pathophysiology. The diagnostic performance of the model was evaluated using the area under the receiver operating characteristic curve (AUC) in the temporally separated internal test set and two external test sets. The prognostic value of model-defined emphysema on chest radiographs for overall survival was assessed using a Cox proportional hazards model in an independent internal set of patients with COPD.

### **RESULTS**

A total of 2,579 chest radiographs and 11,284 chest computed tomography (CT) scans from 9,192 adult patients were included in the training. The deep neural network achieved AUCs of 0.90, 0.90, and 0.87 in the internal test set (n=184), external test set 1 (n=491) and external test set 2 (n=559), respectively. In an independent internal set (n=4,919), survival analysis demonstrated that the presence of emphysema, as predicted by the deep learning model, was associated with worse overall survival on multivariable analysis (adjusted hazard ratio: 1.3; 95% confidence interval: 1.2-1.5; P < .01).

### **CONCLUSION**

s The deep neural network accurately detected emphysema presence on chest radiographs.

### **CLINICAL RELEVANCE/APPLICATION**

The deep neural network can help overcome the global underdiagnosis of COPD using chest radiographs.

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## Abstract Archives of the RSNA, 2023

S3A-SPER

### Emergency Radiology Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPER-1 Detection of Pooled Intracavitary Torso Hemorrhage on CT with Deep Learning

##### Participants

Nathan Sarkar, BS, Baltimore, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

Internal hemorrhage caused by traumatic injury is a potentially life-threatening condition requiring rapid treatment. Hemorrhage accounts for 30-40% of all trauma-related deaths, and approximately 50,000 people die from trauma-related hemorrhage in the US annually. WBCT reports are time consuming, and automated algorithms that detect hemorrhage could be used for early notification, however to our knowledge, no such methods have been described. We develop and test DL algorithms for detection of three forms of pooled hemorrhage at CT- hemothorax, hemoperitoneum, and pelvic hematoma.

##### METHODS AND MATERIALS

Three datasets of patients with hemothorax (n=77), hemoperitoneum (n=150), and pelvic hematoma (n=253) served as positive cases for each feature and 373 negative WBCT scans were used as controls in three separate experiments using a ResNeXt-101 architecture with fully connected layer pre-trained on ImageNet. Positive slices were identified using existing label masks. All scans were resampled to a uniform slice thickness of 1.5 mm, and pre-processed using an abdominal/mediastinal window [HU -175, 250]. Data augmentation was performed using rotation, translation, scaling, and shear transformations. 3 consecutive slices were used as input. Training, validation, and testing was conducted using a 70:10:20 split of the data. Models were trained on an NVIDIA Titan RTX graphics card with 24GB memory. Decision thresholds were optimized for high sensitivity for this screening task. If a single slice was determined to be positive for a given feature, the patient was predicted to be positive. Performance was measured using standard accuracy metrics. Grad-CAM saliency maps were used for explainability.

##### RESULTS

Patient level accuracies in the test sets were as follows: 1. For pelvic hematoma (test n=125 CTs), accuracy, precision (PPV), recall (sensitivity), and NPV were 97%, 93%, 100%, and 100%, respectively. 2. For hemoperitoneum (n=105), these were 97%, 97%, 93%, and 97%, and 3. For hemothorax (n=90), these were 99%, 94%, 100%, and 100%. Hemoperitoneum was the only feature with false negatives and both occurred at low segmented volumes (18 and 23 mL). Saliency maps showed that attention corresponded with areas of pooled blood.

##### CONCLUSION

Our models were highly accurate and could be used to accelerate the activation of life-saving treatment protocols in patients at risk for exsanguination.

##### CLINICAL RELEVANCE/APPLICATION

In future work, these classification algorithms can be scaled to larger datasets and included in a pipeline with segmentation algorithms to serve combined early notification (CADt) and precision medicine (CADx) purposes, thus reducing time to diagnosis and assisting with surgical decision-making in positive patients.

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## Abstract Archives of the RSNA, 2023

S3A-SPGI

### Gastrointestinal Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPGI-1 Predictive Value of a Radiomics Nomogram Model Based on Contrast-enhanced Computed Tomography for KIT Exon 9 Gene Mutation in Gastrointestinal Stromal Tumors

##### PURPOSE

To establish and validate a radiomics nomogram model for predicting the KIT exon 9 mutation status of gastrointestinal stromal tumors (GISTs) before surgery.

##### METHODS AND MATERIALS

All imaging and clinicopathological data of 87 patients diagnosed with pathologically confirmed GISTs were retrospectively collected and randomly assigned to the training set ( $n = 60$ ) and test set ( $n = 27$ ) at a ratio of 7:3. Based on contrast-enhanced CT (CE-CT) arterial and venous period images, the region of interest (ROI) of the tumors were manually drawn layer by layer, and the radiomics features were extracted. The ICC (intra-class correlation coefficient) was used to test the consistency between observers and least absolute shrinkage and selection operator regression (LASSO) was used to further screen the features. The nomogram of integrated radiomics score (Rad-Score) and clinical risk factors (extra-gastric location and distant metastasis) was drawn on the basis of multivariate logistic regression. The area under the receiver operating characteristic curve (AUC) and the correction curve were used to evaluate the predictive efficiency of the nomogram, and the clinical benefits that the decision curve evaluation model might bring to patients.

##### RESULTS

The AUC, sensitivity, specificity, and accuracy in the nomogram model were 0.902 (95% confidence interval [CI]: 0.798-0.964), 85.7%, 86.9%, and 91.7% for the training group, and 0.907 (95% CI: 0.732-0.984), 77.8%, 94.4%, and 88.9% for the test group.

##### CONCLUSION

The radiomics nomogram model based on CE-CT can effectively predict the KIT exon 9 mutation status of GISTs and may be used for selective gene analysis in the future, which is of great significance for the accurate treatment of GISTs.

##### CLINICAL RELEVANCE/APPLICATION

Our models show that radiomics has great potential for predicting GIST gene mutations, which may enable clinicians to optimize clinical decisions in patients with GIST.

#### S3A-SPGI-2 The Artificial Intelligence Iterative Reconstruction Improves the Contrast Resolution in CT Imaging of Gastric Tumor

##### Participants

Jiaqi Chen, Zhengzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To quantify the improvement on contrast resolution of the tumor infiltration on gastric wall with an artificial intelligence iterative reconstruction (AIIR) algorithm in CT imaging of gastric cancer.

##### METHODS AND MATERIALS

The contrast-enhanced CT data of 48 patients who were diagnosed with gastric cancer was retrospectively collected. The AIIR was performed in addition to the original hybrid iterative reconstruction (HIR). Contrast-to-noise ratio (CNR) was calculated for the tumor using the normal gastric wall as background. The contrast resolution between the normal gastric wall and the tumor was subjectively assessed with 5-point Likert scoring method by two radiologists (1: poor; 5: excellent). Additionally, the differentiation of layers of gastric wall was scored, where score 5 is the clear visualization and differentiation, and score 1 is non-distinguishable.

##### RESULTS

AIIR images have significantly higher CNR than HIR images ( $5.55 \pm 0.91$  vs.  $1.65 \pm 2.31$ ,  $p < 0.001$ ). Superior contrast resolution was observed on AIIR images comparing with HIR images ( $4.78 \pm 0.42$  vs.  $3.97 \pm 0.65$ ,  $p < 0.001$ ). AIIR images exhibited excellent differentiation of layers of gastric wall than HIR images ( $4.44 \pm 0.55$  vs.  $3.51 \pm 0.56$ ,  $p < 0.001$ ).

##### CONCLUSION

The AIIR provides better contrast resolution of the tumor and differentiation of layers of gastric wall in CT imaging.

##### CLINICAL RELEVANCE/APPLICATION

The artificial intelligence reconstruction algorithm has the potential in improving the accuracy of staging and prognosis for patients with gastric cancer.

### **S3A-SPGI-3 Identification of Macrotrabecular-massive Hepatocellular Carcinoma (MTM-HCC) using Gadoteric Acid-enhanced MRI and User-friendly Radiomics Analysis Suite**

Participants

Jongjin Yoon, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Radiomics analysis is often challenging for radiologists due to time-consuming pre-processing, tumor segmentation, and complex analysis. The purpose of this study was to attempt to develop a radiomics model for identifying macrotrabecular-massive HCCs (MTM-HCCs) using radiomics analysis suite that provides semi-automatic segmentation and user-friendly analysis tools, and to compare the model's performance to that of conventional radiomics analysis.

#### **METHODS AND MATERIALS**

We enrolled 3 independent cohorts from 2 tertiary care centers. The 3 cohorts consisted of a total of 464 patients who underwent gadoteric acid-enhanced MRI and surgical resection for treatment-naïve single HCCs between December 2007 and December 2014. Independent review of histopathology by two pathologists was performed for each cohort. The arterial phase images were semi-automatically segmented by reviewer 1 (faculty radiologist) in training set, and by reviewer 1, reviewer 2 (resident radiologist), and reviewer 3 (research assistant) in validation cohorts. Inter-observer agreement was evaluated using intraclass correlation coefficient (ICC). A commercial radiomics suite (syngo.via, Siemens Healthineers) was used to calculate and analyze 1,234 radiomics features. Additionally, the same radiomics features were analyzed using conventional radiomics analysis method. Area under a receiver operating characteristic curve (AUROC) was the performance metric.

#### **RESULTS**

ICC values in internal and external validation sets mostly exhibited excellent agreement. The training cohort AUROC for the radiomics suite random forest model was 0.72 for reviewer 1. The internal validation cohort AUROC values were 0.63, 0.71, and 0.73, while external validation set values were 0.72, 0.75, and 0.73 for reviewer 1, 2, and 3, respectively. The radiomics suite model demonstrated comparable or superior AUROC values compared to conventional techniques. In the pooled internal and external validation cohort (n=250), the predicted MTM-HCC by radiomics suite was significantly associated with frequent early recurrence and extrahepatic metastasis, and poor overall survival for all reviewers (P<0.05 for all)

#### **CONCLUSION**

s We developed radiomics models to classify histopathologic subtypes of HCCs using a user-friendly radiomics suite. The models' diagnostic performance was comparable to conventional methods and consistent across varying user experience levels. The model showed potential in predicting prognostic factors in a pooled validation cohort.

#### **CLINICAL RELEVANCE/APPLICATION**

This simple, user-friendly approach of developing radiomics models is expected to make radiomics more accessible to radiologists and facilitate real-world application.

### **S3A-SPGI-4 Preoperatively and Non-Invasively Predict the Malignancy of Rectal Cancer with Diffusion Weighted Imaging and Machine Learning**

Participants

Hui Liu, Shijiazhuang, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study aims to integrate different biological insights obtained from various DWI techniques, including cellular density, vascularity, and structural heterogeneity, with multiple machine learning classifiers to preoperatively grade rectal cancer.

#### **METHODS AND MATERIALS**

In this prospective study, 85 patients were enrolled, and DWI examinations were performed on a 3.0 T scanner. The DWI protocol included b values of 0, 20, 50, 80, 100, 200, 400, 600, 800, 1500, and 2000 s/mm<sup>2</sup>. Different DWI parameters, such as ADC, D, Dp, f, Dapp, and Kapp, were calculated to quantify the biological insights. Four machine learning classifiers, namely logistic regression, Random Forest, Support Vector Machine, and K nearest neighbor, were constructed using the metrics. Predictive power was evaluated using ROC analysis with 5-fold cross-validation.

#### **RESULTS**

The different DWI-derived biological inspirations were significantly correlated with each other (p < 0.05), indicating a close association between changes in cellularity, vascularity, and structural heterogeneity during the metastasis of rectal cancer. The study highlights the importance of integrating multiple DWI-derived biological inspirations for comprehensive characterization of rectal cancer. The machine learning classifiers constructed using different DWI-derived parameters, representing cellular density (ADC, D, Dapp), vascularity (f), and structural heterogeneity (Kapp), demonstrated excellent predictive power for grading rectal cancer (AUCs: 0.811 (SVM), 0.807 (RF), 0.902 (LG), 0.819 (KNN)).

#### **CONCLUSION**

s Integrating different DWI-derived biological insights using machine learning classifiers holds great potential for noninvasive and accurate grading of rectal cancer.

#### **CLINICAL RELEVANCE/APPLICATION**

Integrating different DWI-derived biological insights can comprehensively characterize tumors from different perspectives, which could aid in the diagnosis and evaluation of therapeutic efficacy.

### **S3A-SPGI-5 Deep Learning of Two- Dimensional Shear Wave Elastography for Assessment of Clinically Significant Portal Hypertension**

Participants

## **PURPOSE**

We aimed to make a deep-learning model of 2D-shear wave elastography (SWE) images to detect clinically significant portal hypertension (CSPH) [DL-CSPH] using long short-term memory (LSTM) architecture, and to compare the diagnostic performance with conventional diagnostic method.

## **METHODS AND MATERIALS**

A retrospective study was conducted using 2D-SWE image data collected in a single center, and the subject were divided into training (n=168) and test (n=113) sets. CSPH was diagnosed by hepatic venous pressure gradient measurement. With the training set, the DL-CSPH model using convolution neural network (CNN) and long short-term memory (LSTM) architecture of the 2D-SWE measurement image was derived. Especially, sequential order of liver stiffness (LS) measurement was applied into the LSTM model and compared with the LSTM model with random selection. As a conventional diagnostic method, the cut-off value of LS was calculated via a receiver operating curve analysis in the training set and applied the cut-off value in the test set.

## **RESULTS**

In the prediction of CSPH using the deep-learning model, the LSTM model with sequential order showed better performance than the CNN model (sensitivity: 94.3% VS 85.7%, specificity: 86.1% VS 79.1%, accuracy: 91.2% VS 83.2%, AUC: 0.824 VS 0.902). The difference in AUC value was statistically significant. (P=0.03) Although the DL-CSPH model in sequential order performed better in predicting CSPH compared to the LS or APRI cutoff values, this difference was not statistically significant (P=0.53, 0.19, respectively). However, the DL-CSPH model in sequential order exhibited a significant improvement over FIB4 in predicting CSPH (P=0.01).

## **CONCLUSION**

s DL-CSPH model in sequential order demonstrates excellent overall performance in predicting CSPH.

## **CLINICAL RELEVANCE/APPLICATION**

The DL-CSPH model has practical value as it enables non-invasive, automated monitoring of portal pressure in patients with chronic liver disease in a robust and reproducible manner.

### **S3A-SPGI-6 Identification of a Radiomic Signature to Predict the Risk of Hepatocellular Carcinoma in Cirrhotic Patients**

#### **Participants**

Olimpia Bazzini, Parma, Italy (*Presenter*) Nothing to Disclose

## **PURPOSE**

Patients with cirrhosis are at increased risk of Hepatocellular Carcinoma (HCC); currently, clinical and radiological scores for an accurate early prediction of the development of HCC are lacking. The study aims to assess if radiomics can assist in accurately identifying cirrhotic patients at risk of HCC.

## **METHODS AND MATERIALS**

98 patients (M:F=64:34; mean age 67 years  $\pm$ 9,81) were included in this retrospective monocentric study. Two groups were identified: group (a) with 49 patients (M:F=31:18; mean age 67,4 years  $\pm$ 9,12) who had a baseline CT with radiological signs of cirrhosis, without evidence of HCC in follow-up CT (LI-RADS 1-3); group (b) with 49 patients (M:F=33:16; mean age 67,5 years  $\pm$ 10,5) who had a baseline CT with radiological signs of cirrhosis and evidence of HCC in one follow-up CT scan (LI-RADS 4/5). Four radiologists (3 years of experience) provided complete liver segmentations, manually drawing volumes of interest (VOI) on non-enhanced baseline CT scans. 851 radiomic features (RF) were extracted from each VOI. Redundant RF (Spearman correlation coefficient = 0.99) were removed. The dataset was split into train:test set (70%:30%). Decision Tree classification algorithm and a 3-fold cross-validation were performed on train dataset to explore different cost complexity parameters to set the best pruning. The final model was validated on the test set in terms of accuracy, sensibility, sensitivity, precision, areas under the receiver operating characteristic (ROC) curve and under the precision-recall curve (PRC).

## **RESULTS**

The tree-based model included the "wavelet-LLH\_glcM\_DifferenceAverage" RF, classifying patients as positive when higher than 0.97. The final model predicted the risk of developing HCC with an accuracy, sensitivity, specificity and precision of 0.73, 0.93, 0.56, and 0.65, respectively. Areas under ROC curve and PRC were 0.74 and 0.81.

## **CONCLUSION**

s A radiomic model identified a RF for stratification of cirrhotic patients at risk of developing HCC, showing high sensitivity. To increase the specificity of the model, we aim to integrate this radiomic approach with clinical and radiological parameters.

## **CLINICAL RELEVANCE/APPLICATION**

Radiomics can non-invasively predict the development of HCC in cirrhotic patients and may assist clinicians in creating a tailored monitoring path for each patient.

### **S3A-SPGI-7 Added Value of Diffusion-weighted MR Imaging in the Diagnosis of Cholangiocarcinoma Recurrence**

## **PURPOSE**

To evaluate the added value of magnetic resonance (MR) imaging including diffusion-weighted imaging (DWI) in the diagnostic performance of contrast-enhanced computed tomography (CECT) for diagnosis of cholangiocarcinoma recurrence.

## **METHODS AND MATERIALS**

Thirty-three consecutive patients who underwent follow-up CECT and MR imaging after cholangiocarcinoma resection were included: 20 with recurrence and 13 without recurrence. Two observers independently reviewed CECT and subsequently reviewed

combined CECT and MR imaging including DWI (b value, 1000 s/mm<sup>2</sup>). A five-point scale rating for the likelihood of cholangiocarcinoma recurrence was assessed. Both observers reviewed each image set twice. Diagnostic performance (receiver operating characteristic [ROC] curve analysis), accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were evaluated. To evaluate the intra-observer and inter-observer agreement with regard to the correct diagnosis of recurrence, kappa statistics were used.

## RESULTS

For both observers, diagnostic performance (area under curve [AUC] of ROC) improved after additional review of MR imaging including DWI; AUC improved from 0.614 to 0.918 ( $P < 0.01$ ) in the first reading session of Observer A, and from 0.820 to 0.928 ( $P = 0.20$ ) in the second reading session of Observer A, from 0.566 to 0.858 ( $P < 0.01$ ) in the first reading session of Observer B, from 0.753 to 0.930 ( $P < 0.01$ ) in the second reading session of Observer B. Diagnostic accuracy, sensitivity, specificity, PPV, and NPV were higher than CECT alone in the first reading session of Observer A and both reading sessions of Observer B. Intra-observer agreement of confidence levels improved after the addition of MR imaging: kappa value improved from 0.423 to 0.636 for Observer A, from 0.199 to 0.479 for Observer B. Inter-observer agreement of confidence levels also improved after the addition of MR images: kappa value improved from 0.093 to 0.230 for the first reading session, from 0.140 to 0.460 for the second reading session.

## CONCLUSION

The addition of MR imaging including DWI to CECT, improves the detection of cholangiocarcinoma recurrence when compared with CECT alone.

## CLINICAL RELEVANCE/APPLICATION

The addition of MR imaging including DWI to CECT, helps to detect early-stage resectable recurrence lesions of cholangiocarcinoma.

## S3A-SPGI-8 To Predict Hepatic Decompensation Status using Computed Tomography-Based Radiomics Signature with the Body Composition Model

Participants

Yashbir Singh, PhD, MEng, Rochester, MN (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study was to investigate the potential value of computational radiomics in predicting hepatic decompensation using body-composition model in the patients with Primary Sclerosing Cholangitis (PSC), a chronic cholestatic liver disease that can lead to hepatic decompensation.

## METHODS AND MATERIALS

A total of 220 patients diagnosed with PSC and with an available abdomen CT acquired during the portal venous phase were included in the study. We used an in-house developed U-Net model that assesses body composition using the subcutaneous adipose tissue (SAT), skeletal muscle (SKM), visceral adipose tissue (VAT), and intermuscular adipose tissue (IMAT). The PyRadiomics library was used to extract radiomic features on the region of interest (ROI) created by the body composition model. Out of 100 radiomics features, 23 features were identified to be significant using statistical analysis (t-test). We aimed to develop a classification model using radiomics features based on a traditional machine learning approach (random forest classification).

## RESULTS

The machine learning model achieved a prediction accuracy of 97% in the validation set, which was evaluated in terms of the AUC. This study is a first step in this proof-of-concept application of combining Radiomics Signature and the Body Composition Model with imaging data and the model was designed to predict short-term outcomes.

## CONCLUSION

The study revealed the potential for prognostic features for hepatic decompensation patients in PSC and provided hidden information that may help in discovering new differentiating imaging features. This methodological approach may also have the potential for detecting other PSC-related complications such as cholangiocarcinoma and applications in other chronic liver diseases such as non-alcoholic fatty liver disease.

## CLINICAL RELEVANCE/APPLICATION

The use of radiomics with Body composition model in predicting hepatic decompensation in PSC patients may aid in early detection and intervention. The approach may also be useful in detecting other complications associated with PSC and other chronic liver diseases, thereby contributing to better clinical management and improved patient outcomes.

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## Abstract Archives of the RSNA, 2023

S3A-SPGU

### Genitourinary Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPGU-1 Prediction of Bladder Cancer Based on Biparametric MRI Radiomics: Comparison with Traditional MRI

##### PURPOSE

To compare biparametric (bp) MRI radiomics signatures and traditional MRI model for the preoperative prediction of bladder cancer (BCa) grade.

##### METHODS AND MATERIALS

This retrospective study included 255 consecutive patients with pathologically confirmed 113 low-grade and 142 high-grade BCa who underwent preoperative MRI, including T2-weighted imaging (T2WI) and apparent diffusion coefficient (ADC). The traditional MRI nomogram model was developed using univariate and multivariate logistic regression by the mean apparent diffusion coefficient (mADC), vesical imaging reporting and data system (VI-RADS) scoring, tumor size and number of tumors. Volumes of interest were manually drawn on T2WI and ADC maps by two radiologists. Using ANOVA, correlation and LASSO methods to select features. Then, a logistic regression (LR) classifier was used to develop the radiomics signatures in the training set and assessed in the validation set. Receiver operating characteristic (ROC) analysis was used to compare the diagnostic abilities of the radiomics and traditional MRI models by the DeLong test. Finally, decision curve analysis (DCA) was performed by estimating the clinical usefulness of the two models in both the training and validation sets.

##### RESULTS

The areas under the ROC curves (AUCs) of the traditional MRI model were 0.841 in the training cohort and 0.806 in the validation cohort. The AUCs of the three groups of radiomics model [ADC, T2WI, bp-MRI (ADC and T2WI)]-based logistic regression analysis algorithms were 0.888, 0.875 and 0.899 in the training cohort and 0.863, 0.805 and 0.867 in the validation cohort, respectively. The combined radiomics model achieved higher AUCs than the traditional MRI model and was compared using the DeLong test ( $P = 0.026$  and  $0.023$  in the training and validation cohorts, respectively). DCA indicated that the radiomics model had higher net benefits than the traditional MRI model.

##### CONCLUSION

The bp-MRI radiomics model may be helpful for distinguishing high-grade and low-grade BCa and outperformed the traditional MRI model. Multicenter validation is needed to acquire high-level evidence for its clinical application.

##### CLINICAL RELEVANCE/APPLICATION

Our study shows that the bp-MRI radiomics model presented superior diagnostic performance to the traditional MRI model. This may assist doctors in obtaining the preoperative histological grading of the tumor, which is convenient for determining the treatment strategy for BCa.

#### S3A-SPGU-2 Comparison of Single-shot EPI, Multi-shot EPI, and Reduced Field-of-view in Bladder DWI at 3.0 T

##### Participants

Kentaro Ono, Kurashiki, Japan (*Presenter*) Nothing to Disclose

Tsutomu Tamada, MD, PhD, Kurashiki, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

To compare the image quality of single-shot echo-planar diffusion-weighted imaging (SS-EPI DWI), multi-shot EPI DWI (MS-EPI DWI), and reduced field-of-view DWI (rFOV DWI) in bladder cancer and their diagnostic ability for muscle invasion.

##### METHODS AND MATERIALS

Seventy-three patients who had a multiparametric MRI including SS-EPI DWI, MS-EPI DWI, and rFOV DWI as a preoperative examination for bladder cancer between August 2020 and February 2023 were included in the study. Qualitative image quality was evaluated by three radiologists. Regarding the SS-EPI DWI, MS-EPI DWI, and rFOV DWI, the three items of distortion, wall clarity, and lesion conspicuity were graded in four stages: 1: poor, 2: fair, 3: good, and 4: excellent. Quantitative image quality assessment was performed by a radiologist. The signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and signal intensity ratio (SIR) were used as measures of quantitative evaluation. The control was set to the iliopsoas muscle. Three radiologists assessed the presence of muscle invasion of bladder cancer using Vesical Imaging-Reporting and Data System. Clinical information and pathology results were not known to the readers. The Wilcoxon matched pairs signed ranks test was used to compare qualitative and quantitative scores. The McNemar test and ROC analysis were used to compare diagnostic performance. A  $p$ -value  $< 0.05$  was considered significant.

##### RESULTS

The qualitative scores for distortion were MS-EPI DWI (2.95 to 3.42), rFOV DWI (2.74 to 3.18), and SS-EPI DWI (2.33 to 3.00) in descending order, with significant differences for all combinations. The wall clarity scores were MS-EPI DWI (3.00 to 3.34), SS-EPI

DWI (2.86 to 3.16), and rFOV DWI (2.44 to 2.86) in descending order, and the three readers were in agreement, with significant differences between rFOV DWI and the other two types of DWI. Quantitative evaluation showed no significant difference in SNR and CNR between each test. SIR was higher for MS-EPI DWI (average, 10.5; SD, 4.4), rFOV DWI (average, 6.5; SD, 2.1), and SS-EPI DWI (average, 5.6; SD, 1.5), in that order, with significant differences between each DWI. The diagnostic performance of muscle invasion was good for all DWIs. AUC values were 0.83 to 0.88 for SS-EPI DWI, 0.85 to 0.90 for MS-EPI DWI, and 0.83 to 0.93 for rFOV DWI. There was no significant difference between sequences.

#### **CONCLUSION**

s MS-EPI DWI and rFOV DWI reduced image distortion and MS-EPI DWI improved bladder wall visibility compared to SS-EPI DWI, but did not contribute to improve diagnostic performance of muscle layer invasion.

#### **CLINICAL RELEVANCE/APPLICATION**

If distortion or bladder wall obscuration is seen on SS-EPI DWI during examination, additional MS-EPI DWI can improve image quality.

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## Abstract Archives of the RSNA, 2023

S3A-SPHN

### Head & Neck Imaging Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPHN-1 Osteogenesis Imperfecta: Implications of Using Micro-CT for Visualizing Developmental Variation in the Middle and Inner Ear of OIM Mice**

##### **PURPOSE**

The purpose of our research is to visualize and document anatomic variation in the ears of mice bred to have the Type III OI genetic variant in order to better understand the cause of OI-related hearing loss.

##### **METHODS AND MATERIALS**

3D models of the middle and inner ears were created from micro-CT scans that also employed two new contrast-enhanced methods to visualize the cochlea and middle ear (malleus, incus, and stapes). All CT scanning were done using the new Small Animal Imaging Facility (SAIF). The scan resolution was approximately 20 $\mu$ m. The studied WT and OIM mouse samples include three time points intended to capture a developmental sequence: 0-day-old (WT=20, OIM=29), 7-day-old (WT=23, OIM=23), and 14-day-old mice (WT=22, OIM=18). The visualization software Avizo was then used to digitally segment the bone of the inner ear and middle ear.

##### **RESULTS**

In OIM inner ears, the surrounding otic capsule tended to be more demineralized, exhibiting lower threshold values than WT. This contrasts with WT specimens, where the ossified bone was more distinct from the hollow space of the inner ear. Intrusions in the vestibule were observed in both the 2D slices and the reconstructed 3D models of the OIM inner ears. Comparison of volumes for the right OI and WT inner ears and left OI and WT inner ears indicated statistically significant differences between the genotypes.?

##### **CONCLUSION**

Bony intrusions observed in the vestibules of OIM mice may negatively affect fluid movement within the semicircular canals and vestibule (utricle and saccule), possibly altering the balancing and body positioning abilities of OI mice. This is ongoing research employing additional contrast enhanced CT (CE-CT) methods to visualize not only the bony labyrinths, but also soft tissue, including muscle and cartilage. In addition, more age-points are currently being collected with the aim of elucidating the pathogenesis of osteogenesis imperfecta during different stages of ear development.

##### **CLINICAL RELEVANCE/APPLICATION**

This research uses micro-CT imaging designed to capture a developmental sequence, giving us the potential to elucidate how and when the bony intrusions are impacting surrounding structures. Insight into this anatomical damage may help disambiguate the OI-related pathology, including the distinction between sensorineural vs. mixed hearing loss, unilateral vs. bilateral pathology, and the asymmetric nature of the disease in the ear. Upon completion, this research will demonstrate the efficacy of using these new imaging approaches for studying minute structures of the ear and may markedly advance our understanding of the pathogenesis of OI-related hearing loss.

#### **S3A-SPHN-2 Magnetic Resonance Neurography of Peripheral Trigeminal Nerves: Correlation of Sunderland Class of Nerve Injury on Imaging versus Clinical Neurosensory Testing and its Diagnostic Efficacy**

##### Participants

Shuda Xia, Plano, TX (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Iatrogenic or traumatic injuries to the peripheral trigeminal nerve (PTN) can cause loss of sensation and neuropathic pain in the face and oral cavity. Clinical neurosensory testing (NST) is currently the reference standard for diagnosis but is less reliable within the first 3 months following injury and cannot precisely identify the location of the nerve injury. MR neurography (MRN) has been studied for PTN injury diagnosis but with small sample sizes. The aim of this cross-sectional study was to evaluate the correlation between Sunderland class of nerve injury on MRN and NST and obtain diagnostic efficacy with surgical findings as reference standard.

##### **METHODS AND MATERIALS**

An Institutional Review Board approved this retrospective cross-sectional study of adult patients of all genders with suspected injury of PTN who had both clinical NST by an experienced oral maxillofacial surgeon and MRN interpreted by an expert radiologist. A total of 297 patient records with a chief complaint of PTN neuralgia were identified from the university database. All patient charts were reviewed to identify Sunderland injury class on NST and MRN, previous surgeries, whether surgery was performed after the MRN, and surgical outcomes. Of the cohort, 87 patients had both NST injury grade and Sunderland class injury in their records, and 45 of these patients had surgery. Pearson correlation was obtained and the accuracy of NST and MRI was obtained with surgical and histopathology findings as reference standards. Cohen's weighted Kappa was also calculated.

##### **RESULTS**

There were 20 men and 67 women with an age range of 15 to 81 years. Most (69/87, 79%) injuries resulted from tooth extractions



and implants. On MRN, there were no class I injuries, 26 class II injuries, 26 class III injuries, 26 class IV injuries, and 9 class V injuries. There was a very strong positive correlation between injury grade on MRN and the NST injury class ( $p < .001$ ). There were substantial agreements between NST, MRN, and surgical findings.

## CONCLUSION

The results of this study confirm that MRN adequately provides the injury grade better than NST with improved diagnostic accuracy.

## CLINICAL RELEVANCE/APPLICATION

Prompt non-invasive and accurate diagnostic evaluation of suspected PTN injury is critical for successful management. MRN provides the needed pre-operative information on injury grade and its anatomic localization.

## S3A-SPHN-3 Relationship Between MRI and Clinical Findings of Anatomic Risk Factors in Adult Patients Affected by Obstructive Sleep Apnea/hypopnea Syndrome (OSAHS)

Participants

Maria Paola Belfiore, Naples, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

Identify specific anatomical abnormalities associated with Obstructive Sleep Apnea/hypopnea syndrome (OSAHS), and establish a correlation between the pathological condition and the anatomical changes and enhance treatment planning for future management

## METHODS AND MATERIALS

This case-control study conducted in 2022 investigated the potential of MRI in identifying the causes of upper airway obstruction in OSAHS patients. The study included 30 participants diagnosed with OSAHS and 16 healthy subjects enrolled as a control group, matched for gender, age, height, and weight. All participants underwent MRI examination of the cervical maxillofacial district in the bore of the same 1.5 T magnet. MRI exams revealed significant differences in the upper airway volume, midsagittal nasopharyngeal antero-posterior distance, axial CSA of the nasopharyngeal airway, midsagittal tongue area, soft palatal length, midsagittal soft palatal area, and axial volume of the right and left parapharyngeal adipose tissue in patients with OSAHS compared to controls. Furthermore, the study analyzed the correlation between cephalometric and anatomical measurements and OSAHS severity.

## RESULTS

The results showed a significant association between the severity of OSAHS and soft palate length, soft palate area, Hyoid-Sella distance, and Hyoid-Nasion distance. Soft palate length was closely associated with Hyoid-Sella distance, Hyoid-Nasion distance, and tongue area. The study also evaluated the facial skeletal structure, showing significant differences in intermandibular distance, mandibular depth, and the position of both the maxilla and mandible between the two groups.

## CONCLUSION

Multiple soft tissue and skeletal structures surrounding the upper airways may contribute to the symptoms and clinical severity of OSAHS; in some cases, they may even play a dominant role. MRI has enormous potential in evaluating the three compartments of obstruction: air lumen, soft tissues, and facial skeleton.

## CLINICAL RELEVANCE/APPLICATION

This study highlights the potential of MRI in identifying the causes of upper airway obstruction in adult OSAHS patients. While polysomnography remains the gold standard for OSAHS diagnosis, MRI can offer a valuable alternative method for evaluating the craniomaxillofacial morpho-volumetric characteristics contributing to airway size reduction. This information can assist in determining the most appropriate therapeutic approach and surgical intervention, ultimately improving OSAHS patient outcomes.

## S3A-SPHN-4 Cochlea-carotid Dehiscence: An Underappreciated Condition

## PURPOSE

Cochlea-carotid artery dehiscence (CCD) is the erosion of the bony plate between the cochlea and the petrous segment of the internal carotid artery. In one study of 1,000 temporal bones, there is a histologic prevalence of cochlea-carotid artery dehiscence of 7.7%. It has been reported to be associated with pulsatile tinnitus, conductive hearing loss, sensorineural hearing loss, vertigo, and other otologic disorders. However, the clinical significance of cochlea-carotid artery dehiscence is unknown. Other than a small number of case reports, no large-scale study investigates the radiographic prevalence of CCD and its clinical significance. This study hopes to highlight its clinical significance by retrospectively reviewing a large volume of temporal bone computed tomography (CT) exams and patients' symptoms.

## METHODS AND MATERIALS

This retrospective single-center cross-sectional study was conducted after the institution's IRB approved the study. Consecutive 1,000 patients (2,000 ears) who underwent CT temporal bones were reviewed. CT images were obtained with 0.625 mm thick and 0.3 mm reconstruction interval. First, a radiology resident reviewed all exams for possible CCD. Then, selected cases were reviewed by two board-certified neuroradiologists independently. The discrepancy was resolved by consensus. Possible CCD ears were divided into three categories: 1) dehiscence, 2) thinning/possible dehiscence, and 3) no dehiscence. The location of the dehiscence or thinning/possible dehiscence was recorded. The results were correlated with clinical findings. Duplicated exams and age less than 18 years old were excluded.

## RESULTS

Thirteen temporal bones with CCD were identified in twelve patients, including one patient with bilateral CCD (8 men, 4 women, age: 36-78). The basal turn was affected in eleven ears, and the apical turn was affected in two ears. One patient had progressive sensorineural hearing loss of high frequency of the affected ear. Another patient had bilateral hearing loss, more profound in the affected ear, with episodic dizziness. One patient had no documented otological finding in the chart. Other patients did not have symptoms that might be associated with CCD.

## CONCLUSION

s CCD is a rare condition, as reported in the literature. Its clinical significance is still unknown, although pulsatile tinnitus, conductive hearing loss, sensorineural hearing loss, vertigo, and other otologic disorders have been reported in the literature.

#### **CLINICAL RELEVANCE/APPLICATION**

CCD is a rare condition as reported in the literature. Its clinical significance is still unknown, although pulsatile tinnitus, conductive hearing loss, sensorineural hearing loss, vertigo, and other otologic disorders have been reported.

### **S3A-SPHN-5 Combining Virtual Monoenergetic Imaging and Iterative Metal Artifact Reduction in Photon-counting CT of Patients with Dental Implants**

Participants

Theresa Sophie Patzer, MD, 97080 Würzburg, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Virtual monoenergetic imaging (VMI) and iterative metal artifact reduction (MAR) are established techniques in energy-integrating detector (EID) CT. The artifact suppressing effect of both approaches is not thoroughly investigated in photon-counting detector (PCD) CT. This study aims to evaluate the potential of VMI, MAR, and combinations thereof in PCD-CT for metal artifact reduction in patients with dental implants.

#### **METHODS AND MATERIALS**

In 50 patients with dental implants (25 women; mean age  $62 \pm 9.92$  years), conventional 120 kVp imaging (T3D), VMI, T3DMAR and VMIMAR were compared. VMI datasets were reconstructed at 40, 70, 110, 150 and 190 keV. Objective image quality was assessed by ROI-based measurements of attenuation and respective standard deviations in the most hyper- and hypodense artifacts, as well as in artifact-impaired soft tissue of the mouth floor. Three readers evaluated artifact extent and soft tissue interpretability separately on a five-point scale. The introduction of new artifacts and/or overcorrection of pre-existing artifacts was assessed subjectively.

#### **RESULTS**

MAR substantially reduced hyperdense and hypodense artifacts (T3D 1305.0/-1418.4 HU; T3DMAR 103.2/-46.9 HU), soft tissue impairment (T3D 106.7 HU; T3DMAR 39.7 HU) and image noise (T3D 16.9 HU; T3DMAR 5.2 HU) compared to non-MAR datasets (all  $p=0.001$ ). While VMIMAR =150 keV did not enhance artifact reduction over T3DMAR objectively (all  $p=0.081$ ), VMIMAR =110 keV received superior subjective ratings (all  $p=0.023$ ). Without MAR, VMI displayed no measurable artifact extent reduction (all  $p=0.186$ ). However, VMI =110 keV reduced soft tissue impairment over T3D (all  $p=0.009$ ). VMI facilitated no significant denoising over T3D with or without MAR (all  $p=0.366$ ). VMIMAR =110 keV resulted in less overcorrection than T3DMAR (all  $p=0.001$ ).

#### **CONCLUSION**

While VMI alone presented only minimal metal artifact reduction potential, post-processing using MAR enabled a substantial reduction of hyperdense and hypodense artifacts. The combination of both provided a considerable benefit in subjective artifact reduction compared to MAR alone.

#### **CLINICAL RELEVANCE/APPLICATION**

Combining iterative MAR with VMI represents a potent tool for maxillofacial PCD-CT with dental implants achieving substantial artifact reduction. Thus, these approaches allow for improved image quality, improving delicate detection and evaluation of oral pathologies.

### **S3A-SPHN-6 Comparison of a 3D-real IR with a Ultralong TR and a 3D-FLAIR in the Evaluation of Endolymphatic Hydrops**

#### **PURPOSE**

To evaluate an optimized 3D-real IR sequence with a longer TR (16000 ms) based on the modulated flip angle technique in refocused imaging with extended echo train (MATRIX) for the endolymphatic hydrops (EH) after intravenous (IV) single-dose gadolinium (Gd) administration, and compare it with a heavily T2-weighted 3D-FLAIR sequence with a constant flip angle.

#### **METHODS AND MATERIALS**

The 3D-FLAIR and 3D-real IR sequences were performed in forty patients with definite Meniere's disease (MD) four hours after IV Gd administration. Image qualities of the two sequences were rated and compared. Contrast-to-noise ratios (CNRs) and signal-to-noise ratios (SNRs) of the two sequences were measured for quantitative comparison. EH was graded on the images of the two sequences by two radiologists.

#### **RESULTS**

Scores and CNRs of the 3D-real IR were significantly higher than those of the 3D-FLAIR ( $P < 0.05$ ). SNRs of the two sequences were comparable between the two groups. 3D-real IR had a higher inter- and intra-observer reliability for the grading of cochlear and vestibular EH than 3D-FLAIR. Using 3D-real IR sequence, the detection rate of EH of the whole labyrinth was higher than using 3D-FLAIR (86.6% vs. 73.3%,  $p = 0.031$ ). In the patients with unilateral MD, SNRs in the affected sides were significantly higher than the unaffected sides ( $P < 0.05$ ).

#### **CONCLUSION**

Compared with the 3D-FLAIR sequence, the optimized 3D-real IR with a longer TR may be better with an improved depiction of EH after IV administration of single-dose Gd.

#### **CLINICAL RELEVANCE/APPLICATION**

The optimized 3D-real IR after IV single-dose Gd administration allows better depiction of EH in the labyrinth with improved image quality, excellent inter- and intra-observer agreement, and higher detection rate.

### **S3A-SPHN-7 Application of parotid gland ASL and T2 mapping MRI in Sjögren's syndrome**

## **PURPOSE**

This study aims to explore the application value of ASL and T2 mapping techniques in the assessment and early diagnosis of parotid gland injury in Sjögren's syndrome(SS) patients.

## **METHODS AND MATERIALS**

This study prospectively included 54 first-time confirmed SS patients and 30 healthy volunteers from a tertiary hospital from August 2021 to October 2022. Non parametric Mann Whitney U test was used to compare various parameters between SS patients and healthy volunteers. LSD test was used to compare the differences in parameters between adjacent MRI morphological grading. Spearman rank correlation test was used to analyze the correlation between parotid gland MRI morphological grading and various parameters of SS patients. The combination of logistic regression and receiver operating characteristics is used to evaluate the diagnostic efficacy of various parameters and their combination in distinguishing healthy volunteers from early SS patients and all SS patients.

## **RESULTS**

The parotid gland BF of all SS patients and 0-3 grade SS patients was higher than that of healthy volunteers. There was no statistically significant difference in BF between grade 4 SS patients and healthy volunteers. The T2 value and standard deviation of T2 value in the parotid gland of all SS patients and 0-4 grade SS patients were higher than those of healthy volunteers. The morphological grading of parotid gland MRI (0-3 grades) showed a strong positive correlation with BF ( $r=0.785$ ,  $P<0.001$ ), a moderate positive correlation with T2 value ( $r=0.547$ ,  $P<0.001$ ), and a moderate positive correlation with T2 standard deviation ( $r=0.622$ ,  $P<0.001$ ). The area under the curve of BF is 0.813; The AUC of T2 value is 0.810; The AUC of T2 standard deviation is 0.649. The AUC of the combined diagnosis of BF, T2 value, and T2 value standard deviation is 0.842. The diagnostic efficacy of BF, T2 value, and combined diagnosis is higher than the T2 value standard deviation, while the diagnostic efficacy of combined diagnosis is higher than BF or T2 value.

## **CONCLUSION**

s The BF, T2 values, and standard deviation of T2 values of the parotid gland can distinguish between healthy volunteers and SS patients, reflecting the corresponding changes in the parotid gland of SS patients at different stages. The combination of the three can improve diagnostic efficiency. ASL technology and T2 mapping technology have certain significance in the evaluation and early diagnosis of parotid gland injury in SS patients, and are important supplementary tools for routine MRI diagnosis.

## **CLINICAL RELEVANCE/APPLICATION**

ASL technology and T2 mapping technology have certain significance in the evaluation and early diagnosis of parotid gland injury in SS patients, and are important supplementary tools for routine MRI diagnosis.

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## Abstract Archives of the RSNA, 2023

S3A-SPIN

### Imaging Informatics Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPIN-1 Deep Learning for Synthesizing Virtual Gadolinium Contrast Enhancement in Rectal Cancer from Noncontrast Conventional MRI Scans: A Multicenter Feasibility Study**

##### **PURPOSE**

Gadolinium-based contrast agents (GBCAs) MRI aids the diagnosis and surveillance of rectal cancer, whereas safety concerns have been raised recently. We aim to explore whether deep learning (DL) can synthesize Virtual T1WI enhancement (VTE) of rectal cancer.

##### **METHODS AND MATERIALS**

DL networks were trained and validated on routine nonenhanced MRI (T1WI, T2WI, DWI-ADC). Diffuse MRI scans included 697 patients with rectal cancer in A Cancer Hospital (533 retrospective, 63 prospective) and B Hospital (101 retrospective). The real T1WI enhancement (RTE) images served as the ground truth. The image quality of input was quantitatively evaluated by Natural Image Quality Evaluator (NIQE). The similarity between VTE and RTE were quantified using Mean Absolute Error (MAE), Peak Signal Noise Ratio (PSNR), Structural Similarity (SSIM) and qualitatively evaluated by two radiologists. Ablation experiment was conducted to explore the best model. T staging was evaluated on VTE and RTE and compared with pathology.

##### **RESULTS**

Quantitative and qualitative evaluation of three-channel RTE was significantly better than that of two-channel or one-channel ( $P < 0.001$ ). In internal validation (IV), external validation (EV) and prospective validation (PV): MAE was  $0.03 \pm 0.01$ ,  $0.04 \pm 0.01$  and  $0.03 \pm 0.01$ ; PSNR was  $25.86 \pm 1.63$ ,  $22.34 \pm 1.21$  and  $25.68 \pm 1.28$ ; SSIM was  $0.87 \pm 0.55$ ,  $0.66 \pm 0.06$  and  $0.88 \pm 0.03$ , accordingly. The qualitative evaluation and T staging accuracy (IV: RTE 70.71%, VTE 71.72%; EV: RTE 69.31%, VTE 69.31%; PV: RTE 71.43%, VTE 73.02%) of VTE was comparable with that of RTE. NIQE was significantly higher with EV ( $P < 0.001$ ). The correlation analysis between NIQE and MAE or SSIM or PSNR was statistically significant ( $P < 0.001$ ).

##### **CONCLUSION**

The deep learning could synthesize enhancement of rectal cancer from nonenhanced conventional MRI scans with good image quality quantitatively and qualitatively and allows accurate assessment of rectal cancer patients' T staging. Our findings could guide the application of VTE to potentially reduce GBCA administration.

##### **CLINICAL RELEVANCE/APPLICATION**

VTE synthesized by deep learning based on clinical routine MRIs can overcome the limitations of RTE and aid in the clinical diagnosis and management of rectal cancer as a noninvasive, safe, cost-efficient and time-saving tool.

#### **S3A-SPIN-2 Development of a Three-Dimensional Expression Method for Ultrasound Images Using Mixed Reality Head-Mounted Displays**

##### **PURPOSE**

This research aimed to develop a real-time three-dimensional (3D) expression of ultrasound images in mixed reality (MR) space to enhance the intuitiveness and understanding of ultrasound images, and to compare its performance with conventional two-dimensional (2D) ultrasound.

##### **METHODS AND MATERIALS**

An MR ultrasound system was developed using the Microsoft HoloLens 2™ MR head-mounted display (HMD), incorporating a 3D camera for SLAM (Simultaneous Localization and Mapping) of the ultrasound transducer. Technical performance was evaluated for MR 2D and MR 3D ultrasound modalities. User evaluation involved 20 healthcare workers (10 medical doctors (MD) group, and 10 non-MD group; 4 nurses, and 6 radiology technicians) who assessed elapsed time, target object position identification score (both of horizontal and vertical position), and shape identification score for every three modalities: 1) conventional 2D ultrasound, 2) MR 2D ultrasound, and 3) MR 3D ultrasound. For each correct identification of the position and shape for a single target object, a score of 1 point was given. The user satisfaction assessment was also conducted regarding the intuitiveness of shape recognition, location recognition, and ease of use in the 3D accumulation process on a scale of 5.

##### **RESULTS**

User evaluation revealed no significant difference in elapsed time, and position identification among the three modalities. Shape identification score was significantly improved with MR 3D ultrasound compared to conventional 2D and MR 2D ultrasound (conventional 2D:  $1.05 \pm 0.76$  [average  $\pm$  standard deviation], MR 2D:  $1.30 \pm 1.13$ , MR 3D:  $3.00 \pm 0.00$ ,  $p < 0.001$ ). All evaluators identified the correct shapes of all target objects, eliminating differences between groups in using MR 3D ultrasound. User satisfaction score in the intuitiveness of shape identification with MR 3D ultrasound was as high as  $4.85 \pm 0.37$ .

##### **CONCLUSION**

s Incorporating 2D ultrasound into the MR space and expressing it in three dimensions through a user-driven 3D accumulation process were both technically feasible to implement. Moreover, the MR 3D ultrasound display was superior to both conventional 2D and MR 2D ultrasound in discerning the shape of the target object, providing a more intuitive visualization.

#### **CLINICAL RELEVANCE/APPLICATION**

HoloLens offers the function for multiple users to simultaneously share the same MR space, which can be implemented when several users are each wearing their own HoloLens device. By employing the technology developed in this study to reconstruct and display the images as 3D MR, it is expected to facilitate sharing of examination contents and promote intuitive understanding among patients with limited anatomical knowledge and clinical support staff.

### **S3A-SPIN-3 A Novel 18F-FDG-PET Based Signature for Non-Small Cell Lung Cancer Prognostication**

Participants

Mitchell Chen, MD, PhD, (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To develop a novel 18F-fluorodeoxyglucose-positron emission tomography (FDG-PET) radiomics predictive model combined with metabolic hotspot to centroid (HOC) metric for patient prognostication in non-small cell lung cancer (NSCLC).

#### **METHODS AND MATERIALS**

Pre-therapy FDG-PET scans from 301 NSCLC patients (age:  $69.1 \pm 9.8$ , male: female (M: F) = 183:118) were acquired between July 2009 and November 2018 and included as the training data. Independent external FDG-PET data were acquired from five centers (n = 257) and used for model validation. Two board-certified clinical radiologists with 8 and 13 years of professional experience segmented the primary tumor using metabolic tumor volume 40% (MTV40) threshold. Additional regions of interests (ROI) were acquired from the peri-tumoral penumbra as annular shells of 1cm in thickness, and from the background lung parenchyma as spheres of 3cm in diameter. Following pre-processing, radiomics features compliant with the Image Biomarker Standardization Initiative (IBSI) were extracted using PyRadiomics from each ROI, normalized and aggregated to form a feature space. Non-reproducible features with an inter-class correlation (ICC) of less than 0.8 were excluded. Cox regression with elastic net regularization was performed to develop a radiomics model with patients' 3-year overall survival as the response vector. Using multivariable regression, this was combined with a novel PET metric developed based on the clonal driver mutation theory of cancer growth, namely the FDG HOC distance, to develop a composite radiomics predictive vector (RPV). Model performance for disease prognostication was tested by stratifying the patients into a high and low risk group using k-means clustering based on RPV.

#### **RESULTS**

In all external testing cohorts, statistically significant stratification of the patients into high and low risk groups was achieved using RPV (p-value < 0.05).

#### **CONCLUSION**

s A model developed based on PET radiomics and HOC can achieve patient prognostication in NSCLC. Comparing to models based on CT or PET radiomics alone, this novel signature captures explainable information on tumour growth, and demonstrates a role of the latter for predicting patient survival in NSCLC.

#### **CLINICAL RELEVANCE/APPLICATION**

Imaging-based metrics such as FDG-PET radiomics and HOC offer a non-invasive way of assessing neoplasms at the time of diagnosis. This can aid in clinical decision making, particularly in cases where tissue sampling is challenging or shows inconclusive results. The information presented by these measurements can additionally give insight into tumor composition and metabolism, thereby advancing an understanding of cancer biology that is not otherwise achievable in vivo.

### **S3A-SPIN-4 AI-assisted Volumetric Segmentation for Metastases in Follow-up CT Scans: A Multi-institutional Reader Study**

Participants

Alessa Hering, PhD, (*Presenter*) Nothing to Disclose

#### **PURPOSE**

AI-assisted techniques for lesion registration and segmentation have the potential to make CT-based tumor follow-up assessment faster and less reader-dependent. However, empirical evidence on the advantages of AI assistance for lymph node and soft tissue metastases in follow-up CT scans is lacking. Therefore, the aim of this study was to assess the efficiency, quality and inter-reader variability of an AI-assisted workflow for volumetric segmentation of lymph node and soft tissue metastases in follow-up CT scans. Three hypotheses were tested: (H1) Assessment time for follow-up lesion segmentation is reduced using an AI-assisted workflow. (H2) The quality of the AI-assisted segmentation is non-inferior to the quality of fully manual segmentation. (H3) The inter-reader variability of the resulting segmentations is reduced with AI assistance.

#### **METHODS AND MATERIALS**

This multi-institutional reader study retrospectively analyzed 126 lymph nodes and 135 soft tissue metastases from 55 patients diagnosed with stage IV melanoma. Given segmentations of these lesions on the baseline scan, three experienced readers from two institutions performed both AI-assisted and manual segmentations on the follow-up scans. The results were then statistically analyzed and compared to a manual segmentation reference standard to assess the quality and accuracy of the AI-assisted workflow.

#### **RESULTS**

AI-assisted segmentation reduced user interaction time significantly by a third (222s vs 336s per patient), achieved similar Dice scores (0.80-0.84 vs 0.81-0.82) and decreased inter-reader variability (median Dice 0.85-1.0 vs 0.80-0.82), compared to manual segmentation. In over 50% of the segmentation propositions within the AI-assisted workflow, two radiologists accepted the results without any further corrections.

#### **CONCLUSION**

s AI-assisted segmentation reduced user interaction time significantly by a third, achieved similar Dice scores and decreased inter-reader variability, compared to manual segmentation. In over 50% of the segmentation propositions within the AI-assisted workflow, two radiologists accepted the results without any further corrections.

#### **CLINICAL RELEVANCE/APPLICATION**

AI-assisted lesion segmentation makes accurate quantification of volumetric tumor growth and other characteristics feasible in clinical routine, enabling earlier and better response assessment.

### **S3A-SPIN-5 Graph-Theoretic Automatic Lesion Tracking and Detection of Patterns of Lesion Changes in Longitudinal CT Studies**

Participants

Leo Joskowicz, PhD, Jerusalem, Israel (*Presenter*) Officer, HighRAD Ltd

#### **PURPOSE**

To evaluate the performance of a novel generic method for tracking individual lesion changes and detecting patterns in liver and lung metastatic lesions in longitudinal CT.

#### **METHODS AND MATERIALS**

We define seven individual lesion change classes: new, disappeared, unique, lone, merged, split, and complex lesion and five lesion change patterns: single, linear, merged, split, and complex pattern to summarize the evolution of lesions over time. The method automatically computes the lesion matchings, the labels of the changes in individual lesions, and the patterns of the lesion changes. It uses a graph-based technique where lesions are vertices and edges are pairings of matched lesions. The inputs are the scans and the organ and lesion segmentations in each scan. It performs pairwise deformable registration of consecutive scans, organs and lesion segmentations, matches overlapping lesions, and computes the changes from the resulting graph. The method was evaluated on lung and liver metastases datasets with 83 scans from 19 patients (mean  $126 \pm 81$  days apart) and 77 scans from 19 patients (mean  $109 \pm 93$  days apart). Ground truth manual lesion segmentations, matchings and changes classification were obtained by an expert radiologist.

#### **RESULTS**

The lung and liver metastases overall individual lesion change class accuracy is 97% and 87%. The patterns of lesion changes were identified with an accuracy of 94% and 80%. The highlighting of unusual lesion labels and lesion change patterns helped the radiologist find missed lesions (57 lungs, 52 liver) and wrongly annotated lesions (1 lungs, 18 liver), accounting for 4.9% and 8.7% of the original ground-truth lesions.

#### **CONCLUSION**

s Our method accurately classifies changes in individual lesion and reliably identifies patterns of lesion changes in liver and lung longitudinal CT studies.

#### **CLINICAL RELEVANCE/APPLICATION**

Automatic lesion change classification and pattern detection in longitudinal CT studies may improve the accuracy and efficiency of radiological interpretation and disease status evaluation.

### **S3A-SPIN-6 Accurate Coverage Assessment in MRI using Deep Learning-Based Landmark Detection**

Participants

Ryan Chamberlain, PhD, Stillwater, MN (*Presenter*) Employee, ImBio, LLC

#### **PURPOSE**

This study aims to develop a deep learning-based MRI coverage detection model. By introducing key points to define coverage, using self-supervised learning to overcome annotation challenges, the model addresses crucial coverage detection obstacles and promotes patient-centered care.

#### **METHODS AND MATERIALS**

Datasets: We used three datasets for train and evaluate the model: Lumbar Spine Open dataset1 (464 T1 and T2-weighted lumbar spine MRI images); IXI MRA dataset2 (nearly 600 MR images from healthy subjects); and TubeTK MRA dataset (100 T1-weighted MRA images from healthy patients). No manual annotations of key points needed. Model: Adapted from Frueh et al.'s paper<sup>3</sup>, we employed the Template Matching Network (TMN) with separate feature encoders for the source image and augmented extracted patch. The stacked feature vectors feed into three fully connected layers, the localizer. We added a detector branch for coverage detection, sharing the localizer's architecture, but yielding binary results (Figure). Augmentation: Techniques include affine transformation, gamma adjustment, and Gaussian blurring. Images and patches are cropped before resizing to the model's input size of  $224 \times 224$ , ensuring flexible image scope and dynamic image/patch size ratios, enhancing model robustness and adaptability. Training: Loss functions comprise log negative likelihood loss for the localizer and cross-entropy loss for the detector, using multi-purpose optimization. StepLR manages learning rate scheduling, and early stopping ensures an efficient training strategy.

#### **RESULTS**

We evaluated our deep learning-based coverage detection model in spine and MRA scenarios. The spine model demonstrated a 4.84mm mean distance in localizing key points, and correctly identified vertebral levels in 55% of cross subject test cases. The model achieved an F1 score of 0.799 in detecting coverage in partial lumbar spine images. The MRA model achieved a 6.65mm mean distance in localization, and qualitatively identified correct locations in two randomly selected cross subject images (see figure).

#### **CONCLUSION**

s Our coverage detection model exhibits strong performance in spine imaging and MRA studies, with promising results in localizing random or manually labeled key points as well as detecting coverage in partial images.

#### **CLINICAL RELEVANCE/APPLICATION**

By ensuring accurate coverage of relevant anatomical structures, our deep learning-based model has the potential to reduce repeat imaging and patient revisits, conserving resources and minimizing risks for patients. By automating the coverage assessment process, the model alleviates the burden on clinicians to manually review images. This innovation ultimately boosts efficiency, and promotes better patient care.

### **S3A-SPIN-7 Discrimination of the Pulmonary Nodules Using the Chest CT Image Features by Homology Method**

#### **PURPOSE**

The degree of lung adenocarcinoma (LAc) invasion is important in determining treatment strategy, but it is not revealed until the pathological diagnosis at surgical treatment. So, we developed a method to determine it from preoperative CT images, but it is also necessary to discriminate the lesion of LAc from normal tissues. Homology is one of the topological concepts and quantifies contact. Homology-based image analysis (HA) can explain the reason for inference based on mathematics. So, we have aimed to discriminate LAc and normal tissues in CT image based on HA.

#### **METHODS AND MATERIALS**

This study uses chest CT images of patients with LAc. Fifty ROIs (regions of interest) were created for each LAc lesion, lung field (no lesion), blood vessels in the lung field, bronchi, and ribs. Next, binarized images were created while varying the CT value. The Betti numbers ( $b_0$ ,  $b_1$ : the number of isolated areas and holes) in the ROI were measured and normalized with the area of ROI. These indices were used as imaging features and compared using Mann-Whitney U test. The relationship between HU and imaging features was plotted as a homology profile. Moreover, we developed a binary classification model based on the support vector machine (SVM) that classifies the ROI for LAc or normal tissue, and five-fold cross-validation was used.

#### **RESULTS**

U test showed that each normal tissue significantly differed for nodules ( $p < 0.05$ ). The performances of SVM-based model are as follows (mean  $\pm$  SD). The discrimination between lung fields and LAc had an accuracy of  $1.00 \pm 0.00$  and area under the ROC curve (AUROC) of  $1.00 \pm 0.00$ , while the discrimination between ribs and LAc had an accuracy of  $0.99 \pm 0.01$  and AUROC  $1.00 \pm 0.00$  were the best results. For the best discrimination between blood vessels and LAc, an accuracy of  $0.91 \pm 0.03$  and AUROC of  $0.97 \pm 0.01$  were obtained, while for the discrimination between bronchi and LAc, an accuracy of  $0.97 \pm 0.01$  and AUROC  $1.00 \pm 0.00$ .

#### **CONCLUSION**

The results suggest that it is possible to extract image features for each tissue by using HA, and that the classification model using those features can classify with excellent performance. Therefore, we will discriminate the ROIs obtained from the automatic contouring technique using the multi-classification model in the future. In conclusion, we succeeded in discriminating the ROI obtained from chest CT images for LAc and normal tissues using the SVM-based model that discriminates the image features by HA.

#### **CLINICAL RELEVANCE/APPLICATION**

We will develop the hybrid model, including this proposed model and our developed model that classifies the invasiveness degree of LAc on preoperative CT images. The hybrid model may not only help in early diagnosis and predicting prognosis but also lead to the discovery of novel valuable indices.

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## Abstract Archives of the RSNA, 2023

S3A-SPIR

### Interventional Radiology Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPIR-1 Comparison of Micro Flow Imaging and Contrast Enhanced Ultrasound in Microwave Ablation of Benign Thyroid Nodules**

##### **PURPOSE**

To explore the application value of micro-flow imaging (MFI) in microwave ablation (MWA) of thyroid nodules by comparing it with contrast-enhanced ultrasound (CEUS).

##### **METHODS AND MATERIALS**

From January 2020 to March 2022, 50 patients with 55 thyroid nodules who underwent MWA in the ultrasound department of our hospital were included. According to the different ablation evaluation methods, they were divided into the CEUS group and the MFI group. Before the operation, CEUS and MFI were used to evaluate the consistency of blood flow inside the nodule. Immediately after ablation, CEUS or MFI was used to evaluate whether the ablation was complete. Follow-up was conducted at 1, 3, and 6 months after the operation and every 6 months thereafter to record the diameter and volume of the nodule, CEUS and MFI were used to evaluate the suspected recurrent nodules.

##### **RESULTS**

There was no significant difference between MFI and CEUS in assessing the internal blood flow of nodules ( $P > 0.05$ ), and the consistency between them was very strong ( $\kappa$  value = 0.81). All nodules showed complete ablation. At 1, 3, 6, and 12 months after the operation, the VRR in the CEUS group was 41%, 61%, 78%, and 89% respectively, and in the MFI group was 41%, 55%, 71%, and 83% respectively, there was no significant statistical difference between the two groups ( $p > 0.05$ ). No serious complications occurred after the operation.

##### **CONCLUSION**

The application effect of MFI in MWA of benign thyroid nodules is consistent with CEUS, and when CEUS cannot be used or unconditionally to use, MFI can be an alternative.

##### **CLINICAL RELEVANCE/APPLICATION**

CEUS can sensitively display the micro blood perfusion in tissues and can be used to differentiate benign and malignant tumors, it plays an essential role in the whole ablation process, which can determine the ablation area before ablation and evaluate the therapeutic effect after ablation. However, CEUS is an invasive and expensive examination, and not suitable for patients with severe cardiopulmonary dysfunction or hypersensitivity to ultrasound contrast agents. Explore a new, non-invasive way to evaluate the efficacy of thyroid nodule ablation will not only help to reduce the cost of patients. Micro-flow imaging (MFI) is a new ultrasound technology that can eliminate tissue motion artifacts while maintaining sensitivity to low-speed blood flow signals by using effective algorithms to visualize microvascular, it has the advantages of being non-invasive, fast, and convenient. In recent years, MFI has gradually been widely used in clinical practice. There are only a few studies on the application of MFI in the thermal ablation process of thyroid nodules. This paper aims to further study the application value of MFI in the MWA process of thyroid nodules by comparing it with CEUS.

#### **S3A-SPIR-2 Reperfusion of Pulmonary Arteriovenous Malformations Treated by Catheter Embolization**

##### **PURPOSE**

339 patients with HHT (Osler disease) underwent screening for manifestation of the disease in the brain, the lung and the liver by one CE MRI study. In 144 patients at least one pulmonary AVM was found and catheter embolization using platinum coils or vascular plugs was performed with initial complete occlusion of the PAVM. However, especially in the lung reperfusion may occur due to reopening of the treated vessel itself or newly developed collateral vessels. The aim of our study was to evaluate patients post treatment of pulmonary AVM's for possible reperfusion.

##### **METHODS AND MATERIALS**

Of 144 patients with previous treatment of PAVMs 117 patients underwent follow-up studies to detect reperfused PAVM by CE MRA. The mean follow-up period was 4 yrs and 8 month. For follow-up a time-resolved MRA was used with injection of a small CM bolus (0.025 mmol/kg BW MultiHance, Bracco). The temporal resolution of the sequence was  $< 3$  sec/dataset with a total number of 72 slices. Thereafter a high resolution CE MRA (0.075 mmol/kg BW MultiHance) was performed. Images were evaluated regarding enhancement of the AVM and if detected, time of enhancement of the draining vein.

##### **RESULTS**

In 77 of 117 patients no reperfusion in follow-up studies was found. In 35 patients reperfusion of the treated vessel and in 5 patients reperfusion of the PAVM was detected due to collateral vessels supplying the PAVM. In one patient reperfusion occurred due to systemic arterial supply from collaterals arising from the intercostal arteries. The mean time between embolization and detection of reperfusion in patients treated at our department was 6 years. 36 of 40 patients with reperfused PAVM were confirmed



by DSA and underwent reembolization. In 4 cases supplying vessels were < 2mm and only further follow-up studies were performed. Reperfusion was detected both after coil embolization and implantation of Amplatzer vascular plug 4. The mean diameter of reperfused vessels was 4.6 mm (SD 1.4).

## CONCLUSION

Reperfusion of initially completely occluded PAVMs might even occur after longer time intervals thus regular follow-up studies are mandatory. CE MR-Angiography can reliably depict reperfusion of PAVM and evaluation of the enhancement kinetics of the draining vein was helpful to distinguish between retrograde filling, filling of the still dilated draining vein via normal lung tissue and reperfusion by reopening of shunt vessels or new collateral supply.

## CLINICAL RELEVANCE/APPLICATION

Reperfusion of embolized PAVM can occur in up to 35 percent of patients and early detection is mandatory to avoid complications e.g. stroke. Dynamic CE MRA directly depicts early enhancement of the draining vein as a sign of reperfusion and thus can give important additional information not gained in conventional acquisitions or CT.

## 33A-SP1R-3 Comparative Prospective Analysis of Digital Variance Angiography and Digital Subtraction Angiography in Prostatic Artery Embolization: A Potential Solution for Radiation Dose Reduction

### Participants

Leona Alizadeh, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

### PURPOSE

Prostatic Artery Embolization (PAE) is a complex vascular intervention that requires the use of X-ray angiography imaging with high doses of radiation and iodinated contrast agent. The purpose of this study was to compare the performance of Digital Variance Angiography (DVA) with standard Digital Subtraction Angiography (DSA) in PAE and to evaluate the potential of DVA to reduce radiation exposure and contrast agent use.

### METHODS AND MATERIALS

A prospective observational study was conducted on 26 patients (mean age 72, SD 14.6, range 49-89) in two groups (n=13): Group 1: standard CARE imaging protocol and Group 2: reduced detector dose and image quality pre-settings. All patients underwent PAE at our institution between January and December 2022. The study included a total of 107 acquisitions, from which DSA and DVA images were generated from the same raw series. The Contrast-to-Noise Ratio (CNR) values were calculated, and the image quality was assessed by four experienced readers using a 5-grade-Likert-scale in a randomized blinded survey. Radiation dose data was evaluated by assessment of dose-area-product (DAP) reference point air-kerma (RP), fluoroscopy times and image frames.

### RESULTS

The DVA images provided significantly higher CNR values compared to DSA images, with a median CNR of  $32.2 \pm 9.5$  in Group 1 and  $24.8 \pm 9.9$  for Group 2 vs.  $8.1 \pm 11.1$  for Group 1 DSA and  $7.3 \pm 9.3$  for Group 2 DSA,  $p < 0.001$ . Furthermore, the DVA images received significantly higher Likert scores compared to DSA images, with a median (IQR) value of 4.52 (4-5) for Group 1 DVA 4.12 (3-5) for Group 2 and 3.24 (3-4) for Group 1 DSA and 2.9 (2-4) for Group 2,  $p < 0.001$ . Mean radiation burden in Group 1 was significantly higher by -49%/-45% with a DAP  $17.85 \mu\text{Gy} \cdot \text{m}^2 / \text{frame}$  and RP 0.89 / frame compared to Group 2 with a DAP  $9.62 \mu\text{Gy} \cdot \text{m}^2 / \text{frame}$  and RP 0.49 / frame ( $p < 0.001$ ).

### CONCLUSION

The results of this study demonstrate that DVA has significantly higher CNR compared to DSA for both Groups in PAE procedures. The use of DVA could potentially provide a quality reserve that can be utilized for significant reduction of radiation exposure and iodinated contrast agent in PAE, up to 50-70% without compromising image quality. This may have a significant impact on patient safety during complex procedures such as PAE.

### CLINICAL RELEVANCE/APPLICATION

The implementation of DVA in PAE can significantly reduce radiation exposure, which is a critical factor for improving patient safety during complex vascular interventions. These findings suggest that DVA should be considered as an alternative to DSA in PAE and other similar procedures that require high-quality imaging while minimizing the risk of radiation exposure and potentially also contrast agent use.

## 33A-SP1R-4 Quantitative MRI-based Volumetric Analysis of Percutaneous Sclerotherapy Outcomes in Peripheral Extremity Venous Malformations

### Participants

Amanda Laguna, BS, Laguna Niguel, CA (*Presenter*) Nothing to Disclose

### PURPOSE

To study the changes in MRI radiomic features occurring in peripheral venous malformations (VMs) after treatment using percutaneous sclerotherapy (PS).

### METHODS AND MATERIALS

Our vascular anomalies database was searched for patients with peripheral extremity VMs who were treated by image-guided PS and had completed their treatment plan, and clinical and imaging follow-up between 2005-2022. VMs were manually segmented on pre- and post-treatment T2-weighted (T2-WI) MRI using 3D Slicer software to assess changes in lesion volume and signal intensity (SI). To account for signal parameter differences between pre- and post-treatment T2-WI, the post-treatment T2-WI MRI signal was re-scaled to the pre-treatment T2-WI volume using a simple histogram matching algorithm, which allowed for precise and true calculation of SI change after PS. Therapeutic response was categorized as 0=worse or unchanged, and 1=improvement based on clinical evolution after treatment. Clinical outcome assessment was also scored on a 7-point scale, ranging from -3 (worst) to +3 (maximum improvement), based on patient's perception of symptom improvement. Spearman's rank correlation coefficient ( $\rho$ ) and Paired t-test were used for statistical analysis.

### RESULTS

Eighty-one patients (mean age:  $20 \pm 14$  years; 47 females) with upper (23 lesions) and lower (58) extremity VMs underwent 125 PS treatments (range: 1-6). Different sclerosants were used: alcohol (52 sessions), bleomycin (38), and sotradecol (35). Most patients (77) reported clinical improvement following PS, including mild (8 patients), moderate (22), and significant (47) improvement. The mean change in lesion volume was  $-7.9 \pm 24.6 \text{ cm}^3$  ( $P = .005$ ) and in mean SI was  $-123.1 \pm 162.9$  ( $P < .001$ ). Overall, there was a significant correlation between change in lesion volume and treatment response ( $r = .3$ ,  $P = .004$ ). On subgroup analysis, SI change correlated with clinical outcomes of VMs treated in one session ( $n = 51$ ;  $r = .3$ ,  $P = .01$ ), and VMs treated with bleomycin ( $n = 22$ ;  $r = .4$ ,  $P = .04$ ). While lesion volume change correlated with clinical outcomes of pediatric patients ( $n = 50$ ;  $r = .3$ ,  $P = .03$ ), VMs treated with sotradecol ( $n = 17$ ;  $r = .5$ ,  $P = .02$ ), and VMs located in the foot ( $n = 10$ ;  $r = .6$ ,  $P = .04$ ).

## CONCLUSION

s MRI radiomic features including lesion volume and signal intensity correlate with the clinical outcomes for peripheral VMs treated using PS.

## CLINICAL RELEVANCE/APPLICATION

This study is first to investigate the relationship between signal intensity change of VMs and clinical outcome after PS. The study represents first step for application of complex, comprehensive radiomics in vascular malformations.

### S3A-SP1R-5 Efficacy of 50% Acetic Acid Sclerotherapy for Treatment of Simple Renal Cysts - Comparison of 5-Minutes Dwell time Technique and 3-Minutes Dwell Time Technique

#### PURPOSE

To compare long term follow-up treatment results of single-session sclerotherapy for renal cyst using 50% acetic acid 3-minute dwell technique with those using 50% acetic acid 5-minute dwell technique.

#### METHODS AND MATERIALS

Total 101 simple renal cysts of 97 patients (M:F = 43:54, mean age -  $63 \pm 12.8$  years) underwent single-session 50% acetic acid sclerotherapy using less than 5 minutes (35 cysts, Group I) or 3 minutes (66 cysts, Group II) dwell technique in our institution. An acetic acid volume corresponding to a 5 ~ 40% (mean percentage- 13%) of the aspirated cyst volume was injected into the cysts and removed in less than 5 minutes or 3 minutes with position changes. Follow-up examination was performed using ultrasound or CT images at 3 to 6-months intervals for a minimum of 1 year. All patients were retrospectively reviewed on the therapeutic response and complications. The response was classified as either complete remission (volume reduction, = 95%), partial remission (volume reduction, 50-95%), or failure (volume reduction, = 50%).

#### RESULTS

In 97 simple renal cysts, complete remission on follow-up was observed in 22 of 35 cysts (62.9%) in group I and 46 of 66 cysts (69.7%) in group II. The partial remission on follow-up was observed in 11 of 35 cysts (37.1%) in group I and 20 of 66 cysts (30.3%) in group II. There was no failure in both groups. There were no statistically significant differences in the complete remission and partial remission between the two groups. There was mild post procedure complication in 25 patients, but no major procedure related complication.

## CONCLUSION

s Single-session 50% acetic acid sclerotherapy for the treatment of simple renal cysts using less than 3 minutes dwell technique is an effective and safe therapeutic option for simple renal cyst. 50% acetic acid sclerotherapy with a 3 minutes dwell time, using a volume of about 10% of the aspirated volume, is sufficient for satisfactory results of simple renal cyst sclerotherapy when compared with 50% acetic acid sclerotherapy using 5 minutes dwell time.

## CLINICAL RELEVANCE/APPLICATION

50% acetic acid sclerotherapy show higher complete remission rate than any other ethanol one session sclerotherapy and, also show acetic acid sclerotherapy with 3 minute dwell time is sufficient for complete remission of renal cysts.

### S3A-SP1R-6 Quantification and Analysis of Radiation Dose from Fluoroscopically Guided Prostate Artery Embolization Procedures

#### Participants

Rasha Makkia, PhD, MS, New Haven, CT (*Presenter*) Nothing to Disclose

#### PURPOSE

To quantify patient radiation exposure during PAE and provide radiometric data to inform clinical decision-making regarding the radiation-related deterministic and stochastic risks versus the relative benefits of PAE.

#### METHODS AND MATERIALS

121 PAE procedures were performed between 2018 and 2021 at Yale New Haven Hospital, CT. The collected patient data followed an IRB-approved protocol, including age, height, body weight, and metal implants or contrast in the bladder during the procedure. Dosimetric data included total procedure time, total fluoroscopy time, Cumulative-Air-Kerma (CAK), Kerma-Area-Product (KAP) from fluoroscopy, and total KAP. These dosimetric data were analyzed using Radimetrics software (Bayer HealthCare, NJ). As a surrogate for stochastic risk, the effective dose from each PAE was computed by multiplying the total KAP using a conversion factor of  $0.11 \text{ mSv.Gy}^{-1} \cdot \text{cm}^{-2}$  derived from values in published literature. PAE effective doses were then compared to abdominal-pelvic CT exams for patients who had individual abdominal-pelvic CTs. The CT effective dose was calculated by multiplying the DLP using the standard conversion factor of  $0.015 \text{ mSv.Gy}^{-1} \cdot \text{cm}^{-1}$ . To account for patient size, for each patient, a ratio was derived between the effective dose from PAE and that from abdominal-pelvic CT. To examine the likelihood of deterministic effects, peak skin dose (PSD) calculations were performed for PAE patients with a CAK greater than 3Gy using an in-house Matlab algorithm (MathWorks, MA).

#### RESULTS

The average PAE procedure and fluoroscopy took 150 minutes and 37.1 minutes, accordingly. KAP and CAK had a mean value of  $280 \text{ Gy.cm}^2$ , and  $2.145 \text{ Gy}$ . The average effective dose from PAE fluoroscopy was  $30.8 \text{ mSv}$  and the effective dose from CT was  $9.1 \text{ mSv}$ . The average ratio was 4.1; however, patients with CTs had a higher average PAE dose than patients without CTs due to

greater use of CBCT, DSA, and larger field sizes in earlier patients. PSD was calculated for any PAE exam with a CAK greater than 3Gy. 12 exams had a CAK between 3 and 4Gy, 6 had a CAK between 4 and 5Gy and only 2 had a CAK greater than 5Gy. The maximum PSD calculations were 4Gy and 4.1Gy. There were no deterministic complications reported within 90 days after PAE.

#### **CONCLUSION**

s This quantification data helps provide a standard for which clinicians can draw accurate judgments regarding the risks of PAE and can provide a standard for interventionalists to compare their own procedural radiation dosages during PAE.

#### **CLINICAL RELEVANCE/APPLICATION**

Benign prostatic hyperplasia is a worldwide health problem that significantly impacts men's quality of life. When radiation safety guidelines are followed, it offers effective treatment with a low risk of deterministic or stochastic radiation-related injuries.

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## Abstract Archives of the RSNA, 2023

S3A-SPMK

### Musculoskeletal Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPMK-1 Shear Wave Elastasonography Applied to Synovitis: A Preliminary Study

##### PURPOSE

This study aims to evaluate the utility of shear wave elastasonography (SWE) to identify synovitis in patients who had a history of arthritis within the diagnosis of a defined rheumatological disease.

##### METHODS AND MATERIALS

We performed a B-mode and SWE (US) to a total number of 58 participants divided in 2 groups: group 1 included 29 patients with confirmed active wrist and/or hand synovitis; group 2 included 29 healthy volunteers without suspicion of synovitis. In a subset of patients (n=8), the joint count and the rest of the disease evaluation were performed to the elastasonography to study the correlation between the clinical and radiological findings.

##### RESULTS

The difference in both the mean maximum kPa value and the average joint kPa value was statistically significant between cases and controls: maximum kPa value cases  $38.14 \pm 35.08$  kPa, controls  $4.72 \pm 5.93$  kPa; average joint value cases  $29.77 \pm 26.07$ , controls  $4.17 \pm 5.22$ . The most frequent place to find joint effusion in both cases and controls was the dorsal radiocarpal joint: 41.4% of controls, mean kPa value of  $7.66 \pm 5.39$  kPa, 58.6% of cases, mean kPa value  $40.61 \pm 40.76$  kPa (p-value 0.004). kPa values correlated with disease activity measurements in the 8 patients clinically evaluated at the moment of the SWE.

##### CONCLUSION

s SWE is a promising technique that may have a role in the diagnosis and assessment of synovial inflammatory activity.

##### CLINICAL RELEVANCE/APPLICATION

New semiquantitative ultrasound technique in the diagnosis and in monitoring of therapy of synovitis.

#### S3A-SPMK-2 Zero Time-to-Echo Imaging of the Hand and Wrist in Patients with Rheumatoid Arthritis: Comparison with Radiography and Conventional MRI using CT as Gold Standard

#### Participants

Jun Tsukamoto, MD, Kitakyushu, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Zero echo time (ZTE) imaging has been developed to detect signals from the objects with extremely short T2\* value, and this sequence can generate CT-like images from MRI after gray-scale inversion. The aim of this study is to compare ZTE imaging with radiography for the detection of hand and wrist bone erosions in patients with rheumatoid arthritis (RA), using CT as the reference method.

##### METHODS AND MATERIALS

The study was approved by the local ethics committee, and written consent was obtained from all patients. From December 2022 to April 2023, nine consecutive patients with RA were included in this prospective study. They underwent radiography, MRI at 3T (conventional T1-weighted and fat-suppressed T2-weighted imaging, and ZTE imaging), and CT of the bilateral hand and wrist on within 2weeks. MRI evaluation was performed according to the Outcome Measures in Rheumatology Clinical Trials (OMERACT) recommendations. Two certificated radiologists evaluated the images from the three imaging modalities. Bone erosion on images was independently reviewed by the 2 certificated radiologists with a four-point scale (0; normal, 1; discrete erosion, 2; less than 50% of the joint surface, 3; more than 50% of the joint surface). The images were evaluated for bone erosion in 25 sites in each finger and wrist, including the distal radius, the distal ulna, the 8 carpal bones, the first through fifth bases of metacarpal bones, and the proximal and distal aspects of first through fifth metacarpophalangeal joints. One experienced musculoskeletal radiologist performed the CT evaluation and set the findings as gold standard.

##### RESULTS

With CT as the reference method for bone erosions, the sensitivity and specificity of plain radiography, conventional MRI, and ZTE were 51.6/95.3%, 71.1/90.4%, and 93.8/96.3%, respectively. Overall diagnostic performance was significantly better at ZTE than at radiography and conventional MRI images (P<.01). Interobserver agreement on bone erosion assessment was excellent for ZTE imaging (? value of 0.815) but was not excellent for radiography (? value of 0.496) and conventional MRI (? value of 0.648).

##### CONCLUSION

s Zero time-to-echo imaging can provide reliable bone erosion assessment in RA patients.

##### CLINICAL RELEVANCE/APPLICATION

Zero time-to-echo imaging is superior to plain radiography and almost comparable to CT for the detection of bone erosion in RA patients. It can be readily incorporated into the clinical workflow in addition to conventional MRI.

### **53A-SPMK-3 Ultra-high-resolution Photon-counting Detector CT Arthrography of the Ankle: A Feasibility Study**

Participants

Karsten Luetkens, MD, Wuerzburg, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Assessing the stability of chondral lesions represents a crucial diagnostic imaging task in musculoskeletal imaging, as chondral delamination and subchondral pathologies may not be visible in direct arthroscopy but impact therapeutic concepts. This study was designed to investigate the image quality of ultra-high-resolution ankle arthrography employing photon-counting detector CT.

#### **METHODS AND MATERIALS**

A board-certified radiologist with nine years of experience in musculoskeletal imaging performed bilateral ankle arthrographies in all four cadaveric specimens using ultrasound for guidance. Bilateral arthrograms were acquired in four cadaveric specimens with full-dose (10 mGy) and low-dose (3 mGy) scan protocols. Three convolution kernels with different spatial frequencies were utilized for image reconstruction (750; Br98: 39.0, Br84: 22.6, Br76: 16.5 lp/cm). Seven radiologists subjectively assessed image quality regarding the depiction of bone, hyaline cartilage, and ligaments. Additional quantitative assessment comprised the measurement of noise and computation of contrast-to-noise ratios (CNR).

#### **RESULTS**

While optimal depiction of bone tissue was achieved with the ultra-sharp Br98 kernel ( $p=0.043$ ), visualization of cartilage improved with lower modulation transfer functions at each dose level ( $p=0.014$ ). Interrater reliability was good to excellent for all assessed tissues (intraclass correlation coefficient = 0.805). Noise levels in subcutaneous fat decreased with reduced spatial frequency ( $p<0.001$ ). Notably, low-dose Br76 matched CNR of full-dose Br84 ( $p>0.999$ ) and superseded Br98 ( $p<0.001$ ) in all tissues. No dose-dependent difference was ascertained for any of the tissues with Br98 ( $p > 0.999$ ).

#### **CONCLUSION**

Based on the reported results, photon-counting detector CT arthrography of the ankle with ultra-high-resolution collimation offers stellar image quality and tissue assessability. While bone depiction was found to be superior in combination with an ultra-sharp convolution kernel, soft tissue evaluation benefited from employing lower spatial frequency.

#### **CLINICAL RELEVANCE/APPLICATION**

Photon-counting detector CT arthrography is feasible and allows for depicting even minute anatomy at low radiation dose. The inherent advantages regarding imaging of thin layers of hyaline cartilage ought to be pursued further.

### **53A-SPMK-4 Injury of Anterior Talofibular Ligament in Ankle Based on Ultrafast Synchronized KV/mA Switching Dual Energy CT**

Participants

Jialiang Guo, Guangzhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

In this study, the feasibility of diagnosing anterior talofibular ligament (ATFL) injury was explored in both ankle joints using ultrafast synchronized KV/mA switching dual energy CT (DECT), in combination with images of both the non-traumatic sides and the affected sides.

#### **METHODS AND MATERIALS**

Consecutive 41 patients with acute ankle sprain (inversion type) who underwent bilateral ankles scan using DECT (Revolution APEX CT, GE). Axial virtual monochromatic imaging (VMI) at 60 keV with slice thickness of 0.625 mm and water (HAP) image based on material decomposition were reconstructed. The width of ATFL on 60 keV image and the water density of the ligament area on the water (HAP) image in both the healthy and affected ankles were measured respectively. Two radiologists independently evaluated the presence of soft tissue edema around the ATFL and diagnosed the ligament injury finally. Differences between two groups were tested using the Kruskal-Wallis test, and inter-reader agreement was assessed using the Kappa test.

#### **RESULTS**

The width of the ATFL ( $2.2\pm 0.2$ mm) and the water density ( $1025.5\pm 8.3$  mg/cm<sup>3</sup>) were significantly lower on the healthy side compared to the affected side ( $3.5\pm 1.1$ mm,  $1038.6\pm 9.6$  mg/cm<sup>3</sup>, all  $P<0.05$ ). Edema around the ATFL was observed for all patients on the affected side but not on the healthy side. The inter-reader agreement between the two radiologists was very strong ( $K = 0.9$ ).

#### **CONCLUSION**

In ankle DECT imaging, the diagnosis of ATFL injury is reliable by comparing the width of ligament between the healthy side and the affected side, combining the water (HAP) image to evaluate the water density in the ligament area, and subjectively evaluating the edema around ATFL.

#### **CLINICAL RELEVANCE/APPLICATION**

Under virtual monochromatic imaging (VMI) at 60 keV, in combination with a water (HAP) image based on material decomposition in dual energy CT, can accurately diagnose ATFL injuries by comparing the healthy side and the affected side. This provides a feasible imaging technique for patients with ankle ligament injuries who are not suitable for MRI examinations.

### **53A-SPMK-5 A Comparative Study Based on Ultrafast Synchronized KV/mA Switching Dual Energy CT and MRI: Grading of Injuries to the Anterior Talofibular Ligament in Ankle**

Participants

Jialiang Guo, Guangzhou, China (*Presenter*) Nothing to Disclose

## **PURPOSE**

To investigate the diagnosis of anterior talofibular ligament (ATFL) injury using ultrafast synchronized KV/mA switching dual energy CT (DECT) and to evaluate its consistency with MRI grading.

## **METHODS AND MATERIALS**

Consecutive 41 patients with acute ankle sprain (inversion type) who underwent bilateral ankles scan using DECT (Revolution APEX CT, GE). axial virtual monochromatic image (VMI) at 60 keV with slice thickness of 0.625 mm and material decomposition image (water/HAP) were reconstructed. The MRI (Proton Density Weighted Spectral Attenuated Inversion Recovery, PDW SPAIR) scans were performed on the traumatic ankle joint within two weeks. The width of the injured ATFL was measured on both MRI and VMI images, and the continuity of the ligament and the edema around the ligament were evaluated subjectively. Two radiologists independently evaluated the images and provided grading diagnosis of ATFL injury, and the consistency of DECT and MRI diagnostic grading was assessed using the Kappa test. Paired-sample t-test was used to compare the width of ATFL between DECT and MRI.

## **RESULTS**

There was no significant difference in the measured widths of ATFL grade I, II, and III injuries measured on DECT and MRI axial PDW SPAIR images (grade I, II, and III, CT:  $2.2\pm 0.2\text{mm}$ ,  $3.9\pm 0.6\text{mm}$ ,  $5.1\pm 0.6\text{mm}$ ; MRI:  $2.3\pm 0.2\text{mm}$ ,  $3.9\pm 0.6\text{mm}$ ,  $5.1\pm 0.6\text{mm}$ , all  $P > 0.05$ ). The edema within and around the ATFL on the traumatic side can be found in water (HAP) images. In the subjective evaluation of ligament continuity, the agreement between two radiologists is strong ( $K = 0.63$ ). Two radiologists had strong/very strong agreement between the CT diagnostic grading and MRI grading of ATFL injuries ( $K=0.92$ ,  $K=0.78$ ).

## **CONCLUSION**

In ankle DECT imaging, grading of ATFL injuries could be performed through the application of VMI image at 60 keV, combined with measurement of the width of ATFL, edema within and around the ligament, and ATFL continuity, which has a good consistency with MRI, providing the possibility of grading ATFL lesions on CT scans.

## **CLINICAL RELEVANCE/APPLICATION**

Under the condition of VMI imaging at 60 keV, ankle DECT can be used to properly grade ATFL injury by measuring ligament width and subjectively evaluating periligamentous edema and ATFL continuity. This approach showed a good consistency with MRI grading and provided an innovative imaging technique for ankle sprain patients who may not be suitable for MRI scans.

## **S3A-SPMK-6 Frequency of Peroneal Compartment Pathology in a Large Series of Ankle MRIs from a Tertiary Care County US Hospital: Imaging-based Epidemiological Study**

### **PURPOSE**

Peroneal compartment pathology is a frequently misdiagnosed finding or underdiagnosed as simple ankle ligament sprains in patients presenting to the healthcare system with ankle injuries. High-resolution magnetic resonance imaging allows timely identification of these injuries for outlining appropriate treatment. However, these lesions have been studied in only a few small case series, convenient samples, or review articles. The aim of this study was to elucidate the frequency of peroneal compartment pathology in a large series of patients presenting for ankle MRIs with ankle pain and/or injury in our tertiary care county system with the hypothesis that peroneal lesions are a frequent finding.

### **METHODS AND MATERIALS**

A consecutive series of 373 patients with suspected ankle internal derangement at a tertiary care county hospital (ages 13-87 years, all genders) were included. All had undergone 3 Tesla ankle MR imaging with standardized institutional MR imaging protocols. The structured reports were data-mined, and all scans were re-reviewed by a fellowship-trained musculoskeletal radiologist. Any scans performed for tumors or infections were excluded. The scans were re-analyzed for peroneal longus (PL) and peroneal brevis (PB) tenosynovitis and tendinopathy using previously described criteria for pathology in the literature. Descriptive statistics were performed.

### **RESULTS**

There were 404 MRIs from 373 patients, with 292 MRIs (72.3%) from 267 females and 112 MRIs (27.7%) from 106 males. Only 98 (24.3%) MRIs had normal peroneal compartments, and 306 MRIs (75.7%) had ankles with peroneal findings. There were 51 (12.6%) cases of PB tenosynovitis, 57 (14.1%) cases of PL tenosynovitis, 148 (36.6%) cases of PB tendinopathy, 239 (59.2%) cases of PL tendinopathy, 95 (23.5%) partial PB tendon tears, 8 (2.0%) partial PL tendon tears, 2 (0.5%) complete PB tendon tears, and 1 (0.2%) complete PL tendon tear. Peroneal longus tendinopathy was the most common finding.

### **CONCLUSION**

Peroneal compartment pathology is frequent on high-resolution 3T ankle MRIs performed for internal derangements.

### **CLINICAL RELEVANCE/APPLICATION**

The ankle MRI reader should pay close attention to peroneal compartment lesions while evaluating for ankle derangement, as these lesions are frequent.

## **S3A-SPMK-7 Clinical Application of a Deep Learning Model for Osteoporosis Screening using Chest X-rays Taken During Lung Cancer Screening**

### **PURPOSE**

The number of patients suffering from age-related osteoporosis is increasing worldwide. In Japan, osteoporosis screening is conducted in municipalities throughout the country for early detection and treatment, but the screening uptake rate remains at around 5%. To address this issue, we developed a deep learning model to test for osteoporosis from chest X-rays as a new screening method. In Japan, approximately 40 million people undergo lung cancer screening annually, which includes chest X-rays. We focused on this point and conducted a demonstration experiment, believing that it would be possible to screen a large number of citizens for osteoporosis by simultaneously assessing osteoporosis using chest X-rays taken during lung cancer screening.

## **METHODS AND MATERIALS**

The demonstration was conducted in a medium-sized city in Japan with a population of 80,000 from Apr 2022 to Apr 2023. In this city, a medical association was contracted by the local government to conduct lung cancer screening. The examinees had chest X-rays taken at 25 clinics in the city. The chest X-rays are then sent to the medical association's health checkup center for secondary reading. We installed an AI algorithm at the center and performed AI analysis on the chest X-rays of the examinees who had given their consent in advance. The examinees who were found to be in need of further examination (YAM<80%) visited an orthopedic hospital in the city and underwent a bone density test using the DEXA method. Based on the examination and test results, medication was started for those examinees who needed therapeutic intervention. The study obtained the number of people who underwent lung cancer screening, the number of people who consented to AI analysis, the number of people who required inspection, the number of people who visited orthopaedic clinics, and the number of people diagnosed and treated for osteoporosis.

## **RESULTS**

5,290 patients underwent lung cancer screening. Of these, 3,324 patients consented to AI analysis, excluding those already undergoing osteoporosis treatment. Of these, 1,848 patients required further examination. After examination and DEXA, 497 patients were diagnosed with osteoporosis, and treatment was initiated.

## **CONCLUSION**

s The study suggested the usefulness of screening for osteoporosis using chest X-rays taken during lung cancer screening.

## **CLINICAL RELEVANCE/APPLICATION**

The conventional osteoporosis screening examined 185 individuals yearly. By utilizing chest radiographs for screening, 3,324 people could be screened, roughly 18 times more. This method detected about 497 osteoporosis patients, enabling treatment initiation. It's estimated that this approach could prevent 16 hip fractures and reduce medical and nursing care costs by about 29 million yen.

## **S3A-SPMK-8 Application of a Deep Learning Algorithm in Detection of Hardware Complications for the Post-Operative Hip**

Participants

Jin Rong Tan, MD, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

## **PURPOSE**

The most common mechanical failure in the internal fixation of trochanteric hip fractures is the cutout of the sliding screw through the femoral head, with the incidence ranging from 0 to 16.5%. Radiography remains the mainstay for evaluation, both in the immediate postoperative period and at long-term follow-up. The clinical and radiological progression of hardware complications including cutout is often insidious, and can be missed especially in limited resource settings. There is relatively limited literature on the application of deep learning to assess hardware complications on radiographs. Hence, we aim to evaluate the performance of a deep convolutional neural network (DCNN) in detecting and localising implant cutout on plain frontal pelvic radiographs.

## **METHODS AND MATERIALS**

A DCNN was developed using 32,152 pelvic radiographs containing fixation hardware acquired from the emergency department and orthopaedic clinics between January 2016 and December 2020, of which 24,114 and 8,038 were allocated for training (75%) and validation (25%) sets respectively. Presence of cutout was defined as protrusion of the fixation hardware beyond the cortical margins. To determine ground truth labels (cutout present or absent), all radiographs were individually read by 2 board-certified consultant musculoskeletal subspecialty radiologists blinded to the accompanying radiology reports. In doubtful cases, the accompanying report and all imaging performed in the following 6 months were reviewed. Final decision was made by consensus between the 2 musculoskeletal radiologists. Algorithm performance was evaluated with a hold-out test dataset of 8,039 radiographs of which 53 (0.66%) were positive for cutout. The authors also used the visualization algorithm gradient-weighted class activation mapping (Grad-CAM) to assess localization accuracy.

## **RESULTS**

The algorithm achieved an accuracy of 99.5%, a sensitivity of 83%, a specificity of 99.6%, and an AUC of 0.992 for identifying implant cutout. The visualization algorithm showed an accuracy of 25%. Of the 44 true positive cases accurately predicted, there were 11 (25%) instances where the model correctly identified an activation site.

## **CONCLUSION**

s A DCNN can detect implant cutout on PXR with a high accuracy and might assist clinicians to assess the presence of post-operative hardware complications including implant cutout. However, the visualization algorithm is unable to accurately localize the site of cutout; this is work in progress at time of abstract submission

## **CLINICAL RELEVANCE/APPLICATION**

A DCNN can detect implant cutout on PXR with a high accuracy and might assist clinicians to assess the presence of post-operative hardware complications including implant cutout.

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## Abstract Archives of the RSNA, 2023

S3A-SPMS

### Multisystem Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPMS-1 Metabolic Outcomes of Aging and Obesity: A Longitudinal Study of the Dallas Heart Study Cohort

#### PURPOSE

This study aims to examine the metabolic risk factors in the longitudinal Dallas Heart Study (DHS) cohort. The baseline exam (DHS1) was conducted in 1999-2000, and the current 3rd phase exam (DHS3) has been enrolling since 2020.

#### METHODS AND MATERIALS

Subjects underwent a multi-2D axial T2-weighted spin-echo abdominal MRI (10mm axial section) in DHS1 on Philips 1.5T Intera at the baseline exam and a 3D volumetric T1-weighted gradient-echo whole-body MRI (5mm axial section) in DHS3 on Siemens 3T Prisma. Based on the DHS1 data, manual fat segmentation was previously completed on a single slice at L2-L3 measuring subcutaneous (SAT) and visceral (VAT) cross-sectional areas. On the DHS3 images, fat segmentations were performed on the same slice location corresponding with the subject's DHS1 segmentation. Changes in the segmented SAT and VAT areas between DHS1 and DHS3 were calculated. Subjects' height, weight, and serum laboratory values (lipids, cholesterol, glucose, and insulin) were collected for DHS1 and -3 exams, from which metabolic syndrome (MetS) risk factors were recorded (waist circumference  $\geq 88$ in for women,  $\geq 102$ in for men; blood pressure  $\geq 130/85$ ; LDL  $\geq 130$ ; HDL  $\leq 50$  for women,  $\leq 40$  for men; total cholesterol  $\geq 200$ ; triglycerides  $\geq 150$ ; fasting glucose  $\geq 100$ ; HOMA-IR  $\geq 2.73$ ) for both time points, and metabolic health was categorized as unhealthy ( $\geq 3$  risk factors) or healthy ( $\leq 3$  risk factors). The association between metabolic health and abdominal adiposity (SAT and VAT) was assessed using logistic regression, adjusting for age and sex as covariates.

#### RESULTS

192 subjects from the original DHS1 cohort have thus far returned for DHS3 examination. The median age of this interim cohort is 64 years (43 years at baseline). Over the 21 years, the median weight gain was  $+3.2$  [interquartile range,  $-3.3, +9.3$ ]kg, BMI gain  $+1.3$  [ $-0.6, +3.6$ ]kg/m<sup>2</sup>, SAT change  $+82$  [18, 154]cm<sup>2</sup>, VAT change  $+33$  [ $-9, +69$ ]cm<sup>2</sup>. The prevalence of MetS increased from 53.6% to 63.3%, with 53.9% of previously metabolically healthy subjects becoming metabolically unhealthy in the interim, whereas 29.1% of previously metabolically unhealthy subjects became metabolically healthy. After adjustment for age and sex, VAT, but not SAT, was consistently associated with MetS over 20 years of aging. Gain in VAT was also associated with interval development of MetS in previously metabolically healthy subjects.

#### CONCLUSION

Visceral fat, rather than subcutaneous fat, is consistently associated with MetS through aging, and the gain in visceral fat is associated with the development of MetS.

#### CLINICAL RELEVANCE/APPLICATION

Our preliminary finding in this 20-year longitudinal cohort further strengthens the evidence that visceral fat is implicated in metabolic health.

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## Abstract Archives of the RSNA, 2023

S3A-SPNMMI

### Nuclear Medicine & Molecular Imaging Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPNMMI-1 **18F-fallypride: a Valuable Agent for Islet Cell-targeted Imaging**

##### PURPOSE

To evaluate the usefulness of the dopamine D2 receptor imaging agent (S)-(-)-N-(1-allylpyrrolidine-2-N-methyl)-5-(3-18F)-2,3-dimethoxy Benzamide (18F-Fallypride) for islet cell targeted imaging.

##### METHODS AND MATERIALS

First, we investigated the effect of different concentrations of the dopamine inhibitor droperidol on the binding of islet cells to 18F-Fallypride. We calculated the cellular uptake by incubating islet cells ( $1.5 \times 10^4$  cells/well) with 18F-Fallypride (3.70 KBq). The rate of 18F-Fallypride uptake rate in six groups of islet cells treated with different concentrations of droperidol was measured, and the 18F-Fallypride uptake by the cells in relation to the inhibitor concentration was plotted. To further investigate the binding of 18F-Fallypride to islet cells in vivo, six groups (A-F) of mice were set up. Group A served as the control while groups B-F were injected with different concentrations of 18F-Fallypride 30 minutes before intravenous injection. After observation for 10 minutes, the pancreas was dissected and sectioned for autoradiography. Lastly, the gray scale of the pancreatic tissue was evaluated and quantified. The overall comparisons among all groups were done using single factor analysis of variance and comparisons among groups were done using the least significant difference test.

##### RESULTS

(1) The 18F-fallypride was  $18.4 \pm 1.21\%$ . The uptake rates of inhibiting groups were  $16.11 \pm 1.37\%$ ,  $15.76 \pm 0.99\%$ ,  $13.9 \pm 1.02\%$ ,  $8.86 \pm 0.73\%$ ,  $7.26 \pm 0.62\%$  and  $6.92 \pm 0.58\%$ , respectively. When the concentration of droperidol was  $1.0 \times 10^{-4}$  mol/L, the 18F-fallypride uptake rate of islet cells was the lowest, and the inhibiting rate was 51.85%. No significant difference was detected in uptake rates for the  $5 \times 10^{-4}$  mol/L compared to  $1.0 \times 10^{-3}$  mol/L droperidol groups ( $P=0.11$  and  $0.06$ ). (2) The autoradiography showed that the pancreas gray value of group A was  $1.21 \times 10^6$  (DLU/mm<sup>2</sup>). The pancreas gray levels of groups B to F were  $0.93 \times 10^6$  (DLU/mm<sup>2</sup>),  $0.77 \times 10^6$  (DLU/mm<sup>2</sup>),  $0.59 \times 10^6$  (DLU/mm<sup>2</sup>),  $0.32 \times 10^6$  (DLU/mm<sup>2</sup>) and  $0.25 \times 10^6$  (DLU/mm<sup>2</sup>), respectively, which decreased with increasing concentration of the inhibitor.

##### CONCLUSION

18F-fallypride specifically and efficiently binds to dopamine receptors on islet cells, and therefore presents as a promising novel radiotracer for islet cells imaging.

##### CLINICAL RELEVANCE/APPLICATION

Islet cell dysfunction and depletion often predispose patients to diabetes mellitus. The development of highly specific with satisfactory visibility in vivo imaging agent can be used for pancreatic islet cells is still a huge challenge due to the small number and scattered patterns of islets (only 1%-2% by volume of the pancreas)

#### S3A-SPNMMI-2 **Clinical Impact of Digital PET/CT Compared to Conventional PET/CT in Patients with Malignant Tumor for Initial Staging**

Participants

Naoto Kawaguchi, MD, Toon, Japan (Presenter) Nothing to Disclose

##### PURPOSE

Digital PET/CT (dPET) systems have improved the detection of small lesions by increasing spatial and temporal resolution and have the potential to allow for accurate staging in patients with malignant tumor. The purpose of this study is to compare 18F-fluorodeoxyglucose (FDG) uptake of lesions and the diagnostic performance for initial disease staging of the dPET with conventional PET/CT (cPET).

##### METHODS AND MATERIALS

Between April and August 2020, 60 patients (mean age,  $66 \pm 13$  years; 31 males) with malignant tumors underwent a single FDG injection and both dPET and conventional cPET with a randomized scan order. We measured the maximum standardized uptake values (SUV<sub>max</sub>) in up to 5 FDG-positive lesions per patients and compared them between the two scanners. Furthermore, two experienced readers independently diagnosed the initial disease staging using the TNM score (The eighth edition of the Union for International Cancer Control) or Lugano classification on both PET imaging. Cases of inconsistency between the two readers were finally determined by the third experienced reader. The final staging results for the two PET modalities were compared with the pathological diagnosis. The institutional ethics committee approved this study protocol in accordance with the ethical guidelines of the Declaration of Helsinki, and all patients provided informed consent.

##### RESULTS

One hundred and twenty-three lesions were analyzed. 14 lesions could only be measured only with dPET. In the remaining 109

lesions, SUVmax was significantly higher on the dPET compared to the cPET ( $12.0 \pm 7.8$  vs.  $8.5 \pm 7.0$ ,  $p < 0.01$ ). Especially in 36 lesions less than 10 mm in diameter, the SUVmax with the dPET was higher in all lesions. 8 of the 60 cases showed differences in staging between the two PET modalities. dPET detected new lymph node metastases in five cases and bone metastasis in one case compared to cPET, four were true positives and two were false positives. Otherwise, the N-factor was changed in two cases on dPET compared to cPET, but one was true negative, and one could not be judged pathologically.

#### **CONCLUSION**

Our study showed that the dPET can better detect small lesions compared to cPET. dPET can have an impact on the diagnosis of metastasis in the initial staging of malignant tumor compared to cPET.

#### **CLINICAL RELEVANCE/APPLICATION**

New digital PET/CT can have a big impact on the diagnosis of metastasis in the initial staging of malignant tumor.

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## Abstract Archives of the RSNA, 2023

S3A-SPNPM

### Noninterpretive Skills (Beyond Imaging) Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPNPM-Increasing Cost-effectiveness of CT-based Mobile Stroke Units in Germany: A Model-based Economic Analysis<sup>1</sup>

##### PURPOSE

To analyze the design of Computed Tomography (CT) based Mobile Stroke Unit (MSU) programs and operating modes in order to identify major determinants and cut-offs that help improve cost-effectiveness and enable large-scale implementation of MSUs.

##### METHODS AND MATERIALS

Costs of different possible operating modes, varying operating hours including weekend and non-weekend coverage, and personnel were simulated for the German healthcare system. Ischemic stroke incidence, circadian distribution, rates of alternative diagnoses and stroke mimics were included as well as missed cases to model case coverage and patient-level costs in acute stroke care. Based on internationally reported stroke outcomes, a 5-year Markov-Model was used to analyze cost-effectiveness outcomes for varying catchment zone populations.

##### RESULTS

For a catchment zone of 400,000 inhabitants, the 7-day/16-hour MSU coverage resulted in the lowest cost of MSU deployment per ischemic stroke (USD 5,667) whereas the 7-day/24-hour model caused the highest costs (USD 8,285). Comparing stroke care delivered by MSU to regular emergency medical services, MSU achieved an incremental 0.06 quality-adjusted life years (QALY) on average, with an incremental cost-effectiveness ratio of USD 37,348 per QALY. Sensitivity analyses revealed that a catchment zone population below 400,000 inhabitants together with the effect of missing stroke cases at dispatch significantly increased patient-level costs of MSU care.

##### CONCLUSION

When setting up prospective MSU programs, cost-effectiveness can be addressed by taking into account major determinants of MSU operation: For the German healthcare system, the catchment zone should cover at least 400,000 inhabitants and operating modes should include weekend coverage and 12 to 16 hour daytime coverage. Measures to reduce the rate of missed strokes are advised.

##### CLINICAL RELEVANCE/APPLICATION

The economic evaluation of MSU programs aiming at identifying major determinants and thresholds could optimize efficient resource allocation and maximize MSU cost-effectiveness.

#### S3A-SPNPM-Economic Impact in the MRI Department using Artificial Intelligence in MRI Acquisitions<sup>2</sup>

##### Participants

Patricia M. Carrascosa, PhD, Buenos Aires City, Argentina (*Presenter*) Speakers Bureau, General Electric Company

##### PURPOSE

The objective of this work is to project the economic impact of the use of Artificial Intelligence (AI) in an MRI scanner of our institution that has a high demand of scheduled studies between 8 AM to 8 PM. We previously performed an optimization of protocols and validated the new algorithm with AI in terms of image quality and diagnostic accuracy versus conventional studies determining the new time duration of the studies.

##### METHODS AND MATERIALS

During one month we worked with AI system (AIR Recon DL, GE) in two 3T MRI scanners (Signa Architect; GE) in order to obtain the best sequences in terms of image quality, signal to noise and time duration of the studies. After finishing that phase we performed a research comparing the new length time for the sequences and agenda times for each study type, image quality and diagnostic accuracy between two experienced observers to analyzed AI and conventional studies of the same patient respectively. Results have shown no differences regarding diagnosis and image quality but with a significant reduction in scanning times. With that information we will project the economic impact of using AI system in the two scanners per month. The time reduction of the studies varied according to the region. We calculated according to the normal distribution of studies the total minutes regarding each type, we projected the new duration time applying AI, the gained difference in minutes and the additional studies that could be carried out. We calculated the increment in the percentage regarding the number of studies performed in the same time range and also in relation to the total number of patients.

##### RESULTS

The most required studies at our centers were selected for the projection (knee, spine and brain MRI scans). Both scanning times and the assigned agenda time were reduced significantly using AI. The mean scan time without AI technology was 10.3 minutes, while using AI technology was 5.7 minutes. The mean assigned agenda time without AI technology was 16.6 minutes, while using AI

technology was 10 minutes. The time reduction in the projected studies allowed to be able to perform a 638,5 more studies in both scanners in the same time that only 1111 were done. This corresponds to an increment of 57,64%. The global impact regarding the total scanners production would be a 36,6%.

## **CONCLUSION**

s AI in MR is an excellent opportunity to increment the number of studies in centers with high demand and delayed accessibility. In this projection selecting only the more frequent studies required we could project an increment of 35 % in our monthly billing.

## **CLINICAL RELEVANCE/APPLICATION**

Artificial intelligence in MRI scan opens new horizons in terms of image quality, patients experience and cost effectiveness of the MRI department

## **S3A-SPNPM-Testing the Ability of ChatGPT to Generate Differential Diagnoses from Transcribed Radiological Findings in Chest and Cardiac Imaging**

Participants

Shawn Sun, MD, MS, Anaheim, CA (*Presenter*) Nothing to Disclose

## **PURPOSE**

To assess the accuracy and reliability of ChatGPT3.5 and ChatGPT4 in producing a differential diagnosis from transcribed radiological findings of specific chest and cardiac radiology cases.

## **METHODS AND MATERIALS**

A sample of 52 cases from adult and pediatric chest and cardiac imaging were evaluated. Cases were selected from a radiology textbook, from which the answers were used as the gold standard. The case images and history were converted into standardized prompts that contained purely descriptive language of the cases and a query for the most likely diagnosis, top three differential diagnoses, and the corresponding explanations and references from the medical literature. These prompts were fed into the ChatGPT3.5 and ChatGPT4 algorithms. Generated responses were analyzed for accuracy by comparison with the original literature and reliability through manual verification of the generated explanations and citations. The top 1 accuracy and the top 3 accuracy were defined as the percentage of generated responses that matched the original diagnosis and the complete differential provided by the original literature. An additional differential diagnosis score was defined as the proportion of differentials that matched the original literature's answers for each case. Comparisons were made between the results of the two algorithms using a one-tailed two proportion z-test method.

## **RESULTS**

The top 1 accuracy and top 3 accuracy, for ChatGPT3.5 versus ChatGPT4 were 57.7% compared to 69.2% ( $p=0.11$ ) and 11.5% compared to 15.4% ( $p=0.28$ ), respectively. The average differential diagnosis score of ChatGPT3.5 versus ChatGPT4 was 48.1% compared to 55.8% ( $p=0.21$ ). ChatGPT3.5 and ChatGPT4 hallucinated 34.2% versus 9.6% ( $p=0.001$ ) of the references provided and generated 10 total false statements versus 4 total false statements, respectively.

## **CONCLUSION**

s The two generations of ChatGPT were able to generate a differential diagnosis for prompts containing descriptive radiological findings. The contents of these responses matched the expert literature from which the cases originated a minority of the time, though a non-statistically significant improvement was made in the accuracy categories from 3.5 to the 4th generation algorithm. The well-known hallucination effect was encountered more commonly in citations produced than in statements made by the algorithm, both of which improved with the newest generation.

## **CLINICAL RELEVANCE/APPLICATION**

ChatGPT and Large Language Models (LLM) have a large potential to impact clinical and educational medicine. Knowledge of the accuracy and erroneous possibilities of these algorithms will provide a better understanding of the limitations of these new tools.

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## Abstract Archives of the RSNA, 2023

S3A-SPNR

### Neuroradiology Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPNR-1 Causal Associations of Genetically Determined Tinnitus with Neuroimaging Traits: Evidence from a Mendelian Randomization Study**

##### Participants

Jing Sun, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Potential reverse causality and unmeasured confounding factors are common biases in previous studies of the relationship between tinnitus and neuroanatomical features. Additionally, the causal association between neuroimaging features and the presence of tinnitus is unclear. The aim of this study was to investigate the causal role of tinnitus in the alteration of brain volumetric measures using Mendelian randomization (MR).

##### METHODS AND MATERIALS

Summary-level data from a genome-wide association study (GWAS) of tinnitus were derived from the UK Biobank ( $n = 117,882$ ). GWAS summary statistics for total brain volume, white and gray matter volume and cerebrospinal fluid volume were also obtained ( $n = 33,224$ ). A bidirectional MR analysis was performed to investigate the causal relationship between tinnitus and neuroanatomical features.

##### RESULTS

Genetic susceptibility to tinnitus was causally associated with increased white matter volume (odds ratio [OR] = 2.36, 95% confidence interval [CI] 1.03-5.39,  $p = 0.04$ ) and total brain volume (OR = 2.39, 95% CI 1.05-5.46,  $p = 0.04$ ) but inversely associated with cerebrospinal fluid volume (OR = 0.36, 95% CI 0.16-0.83,  $p = 0.02$ ). However, no causal effect of total brain volume, white matter volume, gray matter volume, or cerebrospinal fluid volume on the presence of tinnitus was detected in the reverse MR study.

##### CONCLUSION

The genetically predicted risk of tinnitus was causally associated with higher white matter volume and total brain volume, independent of any confounding factors, while neuroanatomical features were not causally associated with the presence of tinnitus. Our findings provide evidence supporting the hypothesis that tinnitus has a neurodevelopmental origin at the genetic level.

##### CLINICAL RELEVANCE/APPLICATION

Our findings provide evidence supporting the hypothesis that tinnitus has a neurodevelopmental origin at the genetic level, further elucidating the underlying pathophysiological mechanisms of tinnitus-related brain anatomical impairment.

#### **S3A-SPNR-10 Improving Image Quality of Skull Base with Volume High Definition Reconstruction in a Wide-detector CT System**

##### Participants

Yanan Zhu, Ankang, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the image quality improvement for the skull base with a volume high definition (VHD) reconstruction algorithm on a 16cm wide-detector 256-row CT.

##### METHODS AND MATERIALS

Prospectively enrolled 40 adults (Group 1) for non-enhanced head CT on a 16cm wide-detector 256-row Revolution CT scanner. The CT numbers and their standard deviation (SD) of Medulla Oblongata, cerebellum, brain stem, basal frontal lobe and centrum ovale (used as background) were measured to calculate signal to noise ratio (SNR) and artifact index (AI):  $AI = \sqrt{SD2(ROI) - SD2(\text{centrum ovale})}$ . These values were compared with those of 40 adults in Group 2 who underwent a non-enhanced head CT on a 64-row VCT. All subjects were scanned with a protocol of 120 kVp, and 1.0s rotation time. The tube currents were adjusted to have similar CT dose index (CTDI) for the two systems.

##### RESULTS

There was no statistical difference in the age, thickness of occipital tuberosity, anteroposterior or trans diameters between the two groups. Compared with 64-row CT, the image noise (in HU) with the 256-row CT was reduced by 27% ( $4.39 \pm 0.68$  vs.  $6.00 \pm 1.10$ ) at the Medulla Oblongata, 24% ( $4.48 \pm 0.51$  vs.  $5.86 \pm 0.57$ ) at cerebellum, 33% ( $4.14 \pm 0.51$  vs.  $6.17 \pm 0.74$ ) at brain stem, 39% ( $3.84 \pm 0.58$  vs.  $6.30 \pm 1.19$ ) at the basal frontal lobe and 28% ( $3.16 \pm 0.37$  vs.  $4.36 \pm 0.42$ ) at centrum ovale. This resulted in an increase of 43%, 42%, 76% and 65% in SNR in the four regions, respectively. In addition, the artifacts index was significantly reduced with 256-row CT by 25% ( $2.95 \pm 0.95$  vs.  $3.93 \pm 1.61$ ) at Medulla Oblongata, 20% ( $3.05 \pm 0.93$  vs.  $3.83 \pm 0.88$ ) at cerebellum,

40% (2.54±0.92 vs. 4.26±1.14) at brain stem, and 54% (2.00±1.14 vs. 4.33±1.83) at the basal frontal lobe.

## CONCLUSION

s The CT image quality of the skull base in terms of noise and artifacts was significantly improved on a 256-row wide-detector CT with VHD reconstruction algorithm, compared with a 64-row system at similar radiation dose.

## CLINICAL RELEVANCE/APPLICATION

Improved images of the skull base can be obtained on a wide-detector CT with VHD to overcome physical challenges such as cone beam and scattering, when keeping similar dose to 64-row CT.

## S3A-SPNR-11 Geniculate Ganglion Diverticulum: A Novel MRI Finding in Patient with Idiopathic Intracranial Hypertension

Participants

Ahmed Abdelmonem, MD, MBBS, Woodbridge, VA (*Presenter*) Nothing to Disclose

## PURPOSE

While patients with idiopathic intracranial hypertension (IIH) typically present with headache and/or visual disturbance, pulse-synchronous tinnitus (PST) and hearing loss can be the primary manifestations of this condition in a group of patients. The correct diagnosis for this group can be delayed. Although several MRI signs have been previously described to be associated with IIH, none have been proven to have a high positive predictive value (PPV). In this study, we tested the hypothesis that the presence of the geniculate ganglion diverticulum (GD) is a novel marker for the detection of IIH.

## METHODS AND MATERIALS

This is an IRB-approved single institution retrospective observational study. Brain MRI exams of patients referred by Otolaryngology division over the period of 10 years were reviewed. 400 MRI exams fulfilling inclusion and exclusion criteria were screened for presence of GD by two Neuroradiology fellows independently. In cases of discrepancy in image interpretation, an agreement was reached by reviewing images jointly. A matched control group of cases without GD was compiled. Brain MRI studies of all patients in this study were reviewed for presence of an "empty" sella appearance (ES), a known MRI sign of IIH. Electronic medical records of patients in this study were reviewed for presence of clinical manifestations of IIH. Receiver operator characteristic (ROC) curves were generated to estimate accuracy of each covariate in diagnosing IIH. Area under each ROC curve (AUC) was calculated to identify an accurate prognostic covariate. Statistical analysis was done using R programming language V 4.2.2.

## RESULTS

GD was visualized in MRI exams of 41 patients. GD was not present in the MRI exams of 359 patients. 61 patients were randomly selected from group of 359 patients that did not have GD. A total of 102 patients were included in this study. Studied groups had no significant differences in terms of age, gender, and BMI. GD and ES have a statistically significant correlation with IIH (P-value: < 0.001). There was no correlation between PST and GD (P-value: 0.83). Presence of unilateral or bilateral GD has a similar correlation with IIH (P-value: <0.001). AUC based on GD for predicting IIH was 0.84 (0.79- 0.89) and based on ES was 0.93 (0.89- 0.96). Negative predictive value of both GD and ES for IIH was 100%. PPV of GD for IIH was 31% and this value for ES was 52%.

## CONCLUSION

s There was a statistically significant correlation between the presence of GD and the presence of IIH. There was no statistically significant correlation between the presence of GD and the presence of PST.

## CLINICAL RELEVANCE/APPLICATION

The presence of GD should raise the possibility of IIH, particularly in patients presenting with otologic manifestations such as PST and low-frequency hearing loss.

## S3A-SPNR-12 Development of the Executive Function Networks, Salience and Default Mode Network in Neonates and Assessment of their Interaction with a Machine Learning Framework. A Hypothesis on Von Economo Neurons

## PURPOSE

The Salience network (SN) plays a causal role in switching between the Fronto Parietal Network (FPN) and the Default Mode Network (DMN). The SN plays also a dominant role in the detection of salient stimuli across multiple modalities thus showing overlapping functions and interactions in bottom-up and top-down mechanisms of attention with the Ventral Attention Network (VAN), Dorsal Attention Network (DAN) and Default Mode Network (DMN). Von Economo Neurons (VENs) constitute a preferred route of connection into and from the SN and should, therefore, have a role in the evolution of the connectivity of the SN.

## METHODS AND MATERIALS

In the present study we tested if the SN, FPN, VAN, DAN and DMN connectivity (FC) can infer the gestational age (GA) at birth in a study group of 88 healthy neonates, scanned at 40 weeks of post menstrual age, and with GA at birth ranging from 28 to 40 weeks. We also ascertained whether the FC within each of the SN, FPN, VAN, DAN and DMN was able to infer the average FC of the others. The ability to infer GA at birth or another network's FC was evaluated using a multi-variate data-driven framework.

## RESULTS

The VAN, DAN and the DMN inferred the GA at birth (p<0.05). The SN, FPN, DMN and VAN were able to infer the average FC of the other networks (p<0.05).

## CONCLUSION

s Our findings suggest that it might be too early for the FPN and too late for the SN to predict the GA and the role of the SN as a switch between the FPN and the DMN is not evident in neonates. The functional and structural maturation of the VENs is a critical factor the maturation of the SN, therefore, developmental anomalies of the SN FC may be able to reflect a dysfunction of the VENs.

## CLINICAL RELEVANCE/APPLICATION

Prematurity is a risk factor for both autism and schizophrenia. A lower density of VENs has been demonstrated in both of these pathological conditions. As developmental anomalies of the SN may be able to reflect early dysfunction of the VENs, understanding the pattern of SN's evolution in the newborn lays the foundation for the assessment of its pathological changes.

### S3A-SPNR-13 Treatment Response Prediction in Major Depressive Disorder using Brain Magnetic Resonance Imaging: A Systematic Review and Meta-analysis

#### PURPOSE

To quantify the value of brain magnetic resonance imaging (MRI) in predicting major depressive disorder (MDD) treatment efficacy and to assess performance variations among interventions and biomarkers.

#### METHODS AND MATERIALS

We searched eligible studies in PubMed, Embase, Web of Science, and Science Direct databases before March 22, 2023, using keywords "depress\*", "major depress\*", "MDD", "treatment outcome", "remission", "response", and "MRI". Information including individuals as responders/remitters or non-responders/non-remitters, sensitivity, and specificity were extracted. Logarithm of diagnostic odds ratios [log(DOR)] was summarized, and forest plot was drawn. Sensitivity and specificity were conducted using Reitsma's random effect model. Area under curve (AUC) of summary receiver operating characteristic (SROC) curve was calculated. We conducted Deek's funnel plot asymmetry test to evaluate impact of publication bias. Subgroup analyses were conducted based on MRI modalities (structural MRI [sMRI], resting-state functional MRI [rs-fMRI], task-based fMRI [tb-fMRI]) and interventions (antidepressant and electroconvulsive therapy [ECT]). Antidepressants were subdivided into selective serotonin reuptake inhibitors (SSRI) and mixed medication groups. Meta-regression was conducted among subgroups.

#### RESULTS

We included 44 studies with 2623 MDD participants. Overall, the SROC AUC was 0.875, sensitivity was 77.1%, specificity was 74.1%, and log(DOR) was 2.381. Deek's test indicated a negative correlation between effective sample size and log(DOR) ( $P = 0.008$ ). Rs-fMRI subgroup had higher predictive performance (79.3% sensitivity, 78.2% specificity, AUC 0.891) than tb-fMRI subgroup (74.9% sensitivity, 68.9% specificity, AUC 0.854) in terms of specificity in predicting treatment efficacy ( $P = 0.01$ ). No significant difference was found between sMRI and other modalities. No significant predicting differences were found in antidepressants and ECT, or among ECT, SSRI, and mixed group. Brain biomarkers located in limbic system and frontal were more frequently revealed contributing to prediction in antidepressant subgroup, such as functional connectivity between amygdala and anterior cingulate cortex, while those for ECT were often located in limbic system.

#### CONCLUSION

s Brain MRI has potential to predict MDD treatment efficacy, with rs-fMRI showing higher predictive performance. No significant difference were found between different interventions, but brain biomarkers located in limbic system and frontal lobe may provide clinical relevance.

## CLINICAL RELEVANCE/APPLICATION

Brain MRI biomarkers can predict treatment efficacy of MDD, reducing the financial burden, time of trial, and poor prognosis for patients.

### S3A-SPNR-14 Comparative Analysis of Normative Brain Structural Volumes Between Singapore (SG) and Caucasian Population

#### Participants

Ling Yun Yeow, Singapore, Singapore (*Presenter*) Nothing to Disclose

Chi Long Ho, MD, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### PURPOSE

Structural brain volumes vary due to differences in age, gender [males(M), females(F)], geographical location and ethnicity. Currently, MNI is most widely used brain template but it is limited to young/healthy Western population and not representative of other populations. We aim to compare differences between SG Chinese and Caucasian (Cau) brain volumes to address the need for age, gender-and-ethnicity-specific brain templates for accurate stereotactic standardization across structural brains from different individuals. Our aim is also to build a brain volumetry database for SG Chinese population (for now), which is currently lacking in Singapore.

#### METHODS AND MATERIALS

Retrospective T1W MPRAGE brain (N:248) gathered from Parkinson's Progression Markers Initiative (PPMI-Caucasian) database and SG data (N:360) obtained from Sengkang General Hospital. FastSurfer (v2.0.4) used for brain segmentation into 21 regions (some left and right regions combined); brain volumes were normalized using total intracranial volume. Subjects divided into 5 age-groups: 31-40, 41-50, 51-60, 61-70, 71-80 years. If > 2 outliers were present, subjects were removed while the rest of outliers imputed with median (age-and-gender-matched). Wilcoxon tests (Bonferroni corrected) used for comparisons between SG and Cau.

#### RESULTS

In 41-50 age-group, SG(M) have significantly greater cerebral white-matter than Cau(M), but the reversed is true for lateral ventricular volumes, while SG(F) have greater thalamus than Cau(F). SG(M+F) 51-60 age-group have significantly greater 3rd ventricle while SG(M) 71-80 age-group have greater inferior lateral ventricle and CSF compared to Cau(M). In SG 41-50 age-group, M have significantly smaller caudate, pallidum, sub-cortical gray matter, cortex, cerebellum white matter, corpus callosum, cerebellum cortex, total gray matter, hippocampus, putamen, and thalamus than F. In SG 51-60 age-group, M have significantly greater 3rd ventricles than F while reversed is true for cerebellum white matter. In SG 71-80 age-group, M have significantly smaller caudate than F.

#### CONCLUSION

s There are differences in brain structure/volumes between SG and Cau across ages and gender. Building an age, gender-and-population-specific brain volumetry database is paramount to ensure accurate comparison and greater accuracy during brain

registration, especially if comparison to neurological diseased states has to be made.

#### **CLINICAL RELEVANCE/APPLICATION**

Normative brain volumetry database for specific age-group, gender and ethnicity ensures reliable differentiation of healthy from neurological diseased brains for early diagnosis and interventions.

### **S3A-SPNR-2 Brain Functional Connectivity Alterations in the Depressed Adolescents with Suicide Behaviors**

#### **PURPOSE**

To investigate abnormalities of brain functional connectivity (FC) in both gray matter (GM) and white matter (WM) of depressed adolescents with suicide behaviors.

#### **METHODS AND MATERIALS**

Participants included 38 depressed adolescents with suicide behaviors (SA) and 28 healthy control (HC) subjects. FC differences in both gray and white matters between the two groups were identified at whole brain level with FDR corrected, based on resting-state blood oxygenation level-dependent signals. Correlation analyses were further conducted to explore the relationships between FCs and cognitive ability reflected by Wsiconsin card sorting test.

#### **RESULTS**

Age and gender were well matched between two groups (SA mean age =14.8, HC mean age =15.0; 6males and 32 females in SA, 8 males and 20 females in HC). Compared to HC, SA group presented lower FCs in left orbitofrontal area-middle cerebellar peduncle (GM10WM22,  $t=5.43$ ), left orbitofrontal area-right superior cerebellar peduncle (GM10WM45,  $t=5.28$ ), left orbitofrontal area-right corticospinal tract (GM10WM48,  $t=5.18$ ), left ventral posterior cingulate cortex-left sagittal stratum(GM18GM13, $t=4.47$ ), right ventral posterior cingulate cortex-left sagittal stratum (GM65WM13,  $t=4.55$ ), right associative visual cortex-left sagittal stratum (GM69WM13,  $t=3.57$ ), right primary visual cortex-left sagittal stratum (GM71WM13,  $t=4.79$ ), right superior temporal gyrus-left internal capsule(GM66WM8,  $t=4.00$ ), left middle temporal gyrus-left superior corona radiata (GM16WM10,  $t=6.91$ ), right anterior prefrontal cortex-right tapetum(GM73WM28,  $t=3.56$ ), left cingulate gyrus-right tapetum(WM15WM28,  $t=3.47$ ), and left orbitofrontal area-right tapetum(GM10WM28,  $t=4.95$ ). Correlation analyses further revealed that, FCs in GM18WM13 and GM65WM13 were positively associated with the percentage of correct response and negatively correlated with the perseverative response; FC in GM18WM13 was negatively associated with the percentage of perseverative errors; FC in GM71WM13 was positively associated with the percentage of correct response, and negatively associated with the perseverative response and the percentage of perseverative errors; FC in GM69WM13 was negatively correlated with the perseverative response and the percentage of perseverative errors.

#### **CONCLUSION**

s This study identified reduced FCs in essential brain areas of depressed adolescents with suicide behaviors, mainly located in the default mode network and visual network, which was related with impaired cognition.

#### **CLINICAL RELEVANCE/APPLICATION**

The findings suggested the pathophysiology of suicide behaviors in depressed adolescents and might imply targeted brain areas for future treatment of suicide.

### **S3A-SPNR-3 Concurrent Structural and Perfusion Changes in the Brain in Migraineurs with Patent Foramen Ovale: A Perfusion Functional Magnetic Resonance Imaging Study**

#### **PURPOSE**

To investigate the structural and perfusion alterations in the brain and their neural mechanisms in migraineurs with patent foramen ovale(PFO) by jointly applying magnetic resonance imaging in both structural and perfusion modalities.

#### **METHODS AND MATERIALS**

Participants included migraineurs with PFO (n=20) and healthy controls (n=28), matched for age and gender. MRI data acquisition for all subjects was performed on a GE Discovery MR750W 3.0T. Scans were performed during the interictal period of headache attacks in patients. The scanned sequences included T1 Flair,T2 Flair,T2 Propeller,3D T1 Bravo, 3D pcASL sequences. Magnetic resonance image preprocessing and statistical analysis were performed on SPM8,SPM12,CAT12 in MATLAB 2018b. CAT12 and BrainNetViewer software were used to present the results.

#### **RESULTS**

1. There was no statistical difference between the two groups of subjects in terms of gender and age composition ( $P > 0.05$ ).2. VBM analysis was performed using total intracranial volume (TIV), gender, and age as covariates. The gray matter density was found to be reduced in the midbrain and the precuneus in the left inferior temporal gyrus, left middle temporal gyrus, left middle occipital gyrus, left lingual gyrus, left inferior occipital gyrus, and left hippocampus in the patient group ( $P > 0.05$ ).3. SBM analysis was performed using age and gender as covariates. The depth of the sulcus in the insula, superior temporal gyrus, inferior frontal gyrus triangle, temporal pole, lateral prefrontal cortex, internal olfactory cortex, lingual gyrus, hippocampal gyrus, and talar parietal gyrus was found to be reduced in the patient group. The gyrification was reduced in the lateral occipital lobe, superior parietal lobule, cuneus, and precuneus ( $P > 0.05$ ).Comparisons between CBF groups were made using age and sex as covariates. CBF values were found to be elevated in the cerebellum as well as in the left perirhinal cortex, left lingual gyrus, and right lingual gyrus in the patient group. CBF values were decreased in the right middle frontal gyrus, right superior temporal gyrus, and right insula ( $P > 0.05$ ).

#### **CONCLUSION**

s Migraineurs with PFO were found to have multiple eigenvalue changes in brain structure and perfusion, and the brain regions with two or more eigenvalue changes were mainly located in the temporal lobe, frontal lobe, occipital lobe, insula, cuneus, precuneus, and cerebellum.It is suggested that subsequent studies could focus on observing the relevant brain regions.

#### **CLINICAL RELEVANCE/APPLICATION**

This study lays the foundation for the pathological mechanism of the disease and the discovery of relevant imaging markers. It



provides a basis for further research on the relatively specific brain mechanisms as well as the treatment of migraineurs with PFO.

### **S3A-SPNR-5 The Values of DRD4 Genotypes to the Characteristic Clinical Symptoms of ADHD**

#### **PURPOSE**

This study aimed to explore the contribution of the DRD4 gene to the categorical diagnosis of ADHD by using the dynamic fMRI method combined with sliding-window approach.

#### **METHODS AND MATERIALS**

We recruited 109 Chinese Han children with ADHD from the department of psychiatry from the local hospital in China. The recruited children were between 6 years and 14 years old and were diagnosed by three experienced psychiatrists in accordance with the criteria of DSM-V. Also, 34 normal controls (NC) were recruited from a local primary school and were matched for handedness. A 2×3 factor between-subjects general linear model (GLM) implemented using SPM12, including the factors of subtypes (ADHD-C vs. ADHD-I vs. NC) and genotypes (2R-allele vs. non2R-allele), was used to evaluate their effects on intrinsic brain functions. The interaction was modeled as a 2×3 group comparison. Multiple comparison correction was performed using a FWE approach, with a threshold of  $p < 0.05$  and cluster size  $>37$ .

#### **RESULTS**

ADHD-C, ADHD-I groups and NC were divided into six groups according to genotype (DRD4-2R/ADHD-C:  $n = 19$ ; DRD4-non2R/ADHD-C:  $n = 30$ ; DRD4-2R/ADHD-I:  $n = 17$ ; DRD4-non2R/ADHD-I:  $n = 43$ ; DRD4-2R/NC:  $n = 15$ ; DRD4-non2R/NC:  $n = 19$ ). The GLM revealed that there was no significant main effect of DRD4-gene and that of categorical diagnosis. The genotype × categorical diagnosis interaction effects were found to be significant, where increased dALFF variability was found in the right cuneus and lingual gyrus that extended into the calcarine (Figure 1, coordinates: 61, 73, 61) (FWE with a threshold of  $p < .05$  and cluster size  $>37$ ). After post-hoc analysis, for the NC group, 2R-carrier showed increased dALFF variability compared to that of non2R-carriers. For the 2R group, ADHD-I showed decreased dALFF variability compared to that of NC; and for the non2R group, ADHD-C showed increased dALFF variability compared to that of NC (Figure1).

#### **CONCLUSION**

s ADHD-C, ADHD-I and NC with different DRD4 genotypes exhibit opposite temporal variability in the right cuneus. ADHD patients with different DRD4 genotypes have characteristic clinical symptoms. This study provided insight into the brain dysfunction of ADHD from the perspective of dynamic local brain activity, highlighting the important role of DRD4 gene in understanding neurophysiological mechanisms of ADHD.

#### **CLINICAL RELEVANCE/APPLICATION**

This study aimed to explore the contribution of DRD4 gene to the categorical diagnosis of ADHD and whether patients with DRD4 risk gene carriers have characteristic clinical symptoms. To provide the evidence for imaging endophenotypes in differentiating subgroups of potential neurophysiological mechanisms of ADHD.

### **S3A-SPNR-6 Schizophrenia and Gray Matter Heterotopia in the Frontal Lobe: A Finding with Hitherto Little Attention Despite Nowadays High Resolution 3D MR Imaging**

#### **PURPOSE**

Only a handful of cases with gray matter heterotopia (GMH) in schizophrenia are described in the literature from the late '90s through MRI. Yet, postmortem studies detected heterotopic neurons in the white matter (WM) more frequently. The aim was to demonstrate their prevalence using images with higher spatial resolution than before.

#### **METHODS AND MATERIALS**

Inpatients with schizophrenia and an institutional MRI were included in this retrospective study, and consecutive data sets of non-schizophrenic persons served as controls. Two independent radiologists, trained for neuroimaging and blinded to any clinical information, evaluated 3D T1-weighted gradient echo sequences (1 mm<sup>3</sup> voxel size; 1.5 and 3.0 T) to look for GMH. Number and location (periventricular/deeper WM; frontal, parietal, temporal or occipital) of GMH were assessed. Presence of periventricular cysts (PVC), enlarged caves of the septum pellucidum (ECSP), dysgenesis of the corpus callosum (DCC), focal cortical dysplasia (FCD) and polymicrogyria (PMG) were noted, if present. A consensus for cases with disagreements was made in a second read. Fisher's exact and Pearson's  $\chi^2$  test were used to test for differences and relationships, respectively.

#### **RESULTS**

From 01/2013 till 07/2021, MR scans of 214 cases (mean age, 42 yrs; 69% males) and 141 controls (mean age, 46 yrs; 50% males) were analyzed. There was a prevalence of 2.8% ( $n=6/214$ ) of GMH in the patient cohort versus 0% in non-schizophrenic persons ( $p=0.046$ ). All seven lesions were located in the frontal lobe; two of them on both sides in one patient and two patients with GMH in the deeper and not in the periventricular WM. Another finding that was found solely in the patient cohort was the presence of PVC ( $n=3/214$ , 1.4%;  $p=0.218$ ). ECSP were detected in both groups ( $n=6/214$ , 2.8% vs.  $n=4/141$ , 2.8%;  $p=0.613$ ). Raters did not detect DCC, FCD or PMG in both cohorts. There were no relationships between GMH and PVC ( $\chi^2=0.052$ ;  $p=0.950$ ), GMH and ECSP ( $\chi^2=0.177$ ;  $p=0.841$ ), and PVC and ECSP ( $\chi^2=0.088$ ;  $p=0.918$ ). No associations between GMH and baseline characteristics or pre-existing conditions could be made.

#### **CONCLUSION**

s GMH in schizophrenia were found more frequently than expected, as indicated by a prevalence of 2.8%, which might be due to the nowadays higher resolution of structural MRI. All lesions were found in the frontal lobe and even in the deeper WM. Other findings were PVC and ECSP, the latter being also present in controls with almost the same frequency. Interestingly, there were no associations between GMH and epilepsy.

#### **CLINICAL RELEVANCE/APPLICATION**

High resolution 3D T1-weighting detected GMH in 2.8% of schizophrenic patients. These findings may inform personalized approaches to intervention such as in treatment-resistance despite good compliance.

### **S3A-SPNR-7 Multiclass Radiomics-based Models for Pediatric Low-Grade Neuroepithelial Tumors Molecular**

## Subtype Identification Based on Open-Radiomics Protocol

Participants

Khashayar Namdar, MSc, MEng, Toronto, ON (*Presenter*) Nothing to Disclose

### PURPOSE

Pediatric Low-Grade Neuroepithelial Tumor (PLGNT) is the most common type of brain tumor in children, and radiomics-based machine learning (ML) models have been shown to be effective for classifying BRAF fusion and BRAF V600E mutation PLGNT molecular subtypes. We investigate the effect of MRI sequence, image normalization, and radiomics extraction hyperparameters using the Open-Radiomics protocol to provide reproducible results.

### METHODS AND MATERIALS

Our REB-approved retrospective study cohort consisted of 339 children with PLGNT including 143 with BRAF fusion, 71 with BRAF V600E mutation, and 125 tumors with other molecular subtypes. MRI sequences included Fluid-Attenuated Inversion Recovery (FLAIR), T1-weighted (T1), gadolinium-based contrast agent (GBCA) enhanced T1-weighted (T1CE), and T2-weighted (T2) sequences images. Tumor segmentations were provided by a pediatric neuroradiology fellow and verified by a senior pediatric neuroradiologist. PyRadiomics was used for extracting the radiomics features from the regions of interest. We created 72 radiomics datasets using a combination of 4 sequences, 3 sets of radiomics extraction hyperparameters (binWidth of 15, 25, 35), and 6 image normalization methods (NoNormalization, MinMax, ZScore, Histogram Equalization, Gamma normalization with 0.5 and 1.5 as gamma coefficient). We used Random Forest classifiers. For each radiomics dataset, we repeated the train-validation-test (60/20/20) experiment with different data splits and model random states 100 times (7200 tests) and calculated the Area Under ROC Curve (AUC).

### RESULTS

We achieved a test AUC of 0.880 with 95% Confidence Interval (CI) [0.879, 0.882] for BRAF fusion vs BRAF V600E mutation binary classification. The highest average test performance for a specific dataset was achieved using MinMax normalization and binWidth of 25 on T1CE (AUC: 0.890). For 3-class classification, the average one-vs-the-rest (OvR) AUC was 0.789 with 95% CI [0.786, 0.792]. The top-performing dataset was ZScore, binWidth 15, FLAIR, with an average test AUC of 0.816. Unlike binWidth and image normalization, different imaging sequences resulted in statistically significant differences in AUC in both binary and multiclass scenarios.

### CONCLUSION

Among the four imaging sequences in the dataset, T1CE was the best for separating BRAF fusion from V600E mutation. However, radiomic features extracted from FLAIR images outperformed other sequences at differentiating BRAF fusion and mutation from the other subtypes.

### CLINICAL RELEVANCE/APPLICATION

Identification of the molecular subtype of PLGNT is important for treatment planning. Our comprehensive approach ensures that we capture best-performing and reproducible models.

## S3A-SPNR-8 Multiclass Radiomics-based Machine Learning Models for Medulloblastoma Molecular Subtype Identification

Participants

Khashayar Namdar, MSc, MEng, Toronto, ON (*Presenter*) Nothing to Disclose

### PURPOSE

Medulloblastoma (MB) is an aggressive brain tumor in children and qualitative MR imaging features including tumor location within the cerebellum have been shown to differentiate MB subtypes. We develop radiomics-based machine learning (ML) models using MRI Fluid-Attenuated Inversion Recovery (FLAIR) images to classify four MB molecular subtypes (WNT, SHH, group 3, group 4). We follow the Open-Radiomics protocol to achieve reproducible results.

### METHODS AND MATERIALS

Our REB-approved and retrospective study includes 104 pediatric patients with an age range of 1 to 17.2 years (mean age  $7.8 \pm 3.95$  years, 71 males, 68%). Tumor segmentations were provided by two pediatric neuroradiologists. PyRadiomics was used for extracting the radiomics features from the regions of interest (ROIs). The four MB molecular subgroups were identified based on next-generation sequencing panels, fluorescence in situ hybridization, and specialized testing (including RNA methylation array and DNA methylation array). The dataset included 44, 28, 20, and 12 cases of the WNT, SHH, group 3, and group 4 subgroups, respectively. We created 18 radiomics datasets using 3 sets of radiomics extraction hyperparameters (binWidth of 15, 25, 35), and 6 image normalization methods (NoNormalization, MinMax, ZScore, Histogram Equalization, Gamma normalization with 0.5 and 1.5 as gamma coefficient). We used Random Forests as classifiers. For each radiomics dataset, we repeated the experiment with different data splits and model random state 100 times (1800 tests) and calculated the Area Under Receiver Operating Characteristic Curve (AUC).

### RESULTS

When classifying group 3 versus all other subgroups, we achieved an overall test AUC of 0.619 with 95% confidence interval (CI) [0.607, 0.631]. On 4-class classification, the average one-vs-the-rest AUC was 0.703 with 95% CI [0.690, 0.716]. The top-performing dataset was ZScore with binWidth 25, where we achieved average test AUC of 0.750. Analyzing per-class AUCs on the top-performing setting, the highest performance was noted for SHH vs others, where we achieved an average test AUC of 0.845. We also observed significantly higher AUC for group 3 vs others when switched to multiclass classification (0.668).

### CONCLUSION

Performance of radiomics-based ML models for identifying MB subtypes using MR images depends on the subtype, how the model is trained, and how the image is normalized. Our results show ZScore is the best image normalization technique and multiclass classification can improve per-class performance of the models.

### CLINICAL RELEVANCE/APPLICATION

Pretherapeutic identification of MB subtype is important for treatment planning for which we train and evaluate reproducible machine learning models.

### **S3A-SPNR-9 Nodal Properties of Resting-State Brain Functional Network in Childhood and Adolescence**

#### **PURPOSE**

This study aimed to describe and compare the characteristics of changes in the nodal properties of brain functional networks during childhood and adolescence, revealing the developmental trajectories of different brain structures during development.

#### **METHODS AND MATERIALS**

In this study, 42 healthy volunteers aged 6-18 years were right-handed primary and middle school students were recruited, and the subgroup analysis included children (6-12 years, n =19) and adolescents (13-18 years, n =23). Resting-state functional magnetic resonance imaging (fMRI) data were collected using a 3.0T MRI scanner. The topological properties of the functional brain network were analyzed using graph theory.

#### **RESULTS**

Compared with the children group, the nodal efficiency of the superior frontal gyrus, middle frontal gyrus, left dorsolateral fusiform gyrus, and other brain regions in the adolescent group was significantly increased ( $P < 0.05$ , FDR correction) and positively correlated with age. The degree of centrality of the superior frontal gyrus, bilateral inferior frontal gyrus operculum, left medioventral fusiform gyrus, and other brain regions increased significantly ( $P < 0.05$ , FDR correction) and were positively correlated with age. The degree of centrality of the left dorsolateral fusiform gyrus, left rostral cuneus gyrus, and right medial superior occipital gyrus was significantly reduced ( $P < 0.05$ , FDR correction) and negatively correlated with age. The nodal shortest paths in the superior frontal gyrus, left ventrolateral fusiform gyrus, right superior parietal lobule, and other brain regions were significantly reduced ( $P < 0.05$ , FDR correction) and negatively correlated with age.

#### **CONCLUSION**

s The transmission efficiency of the brain core network gradually increased, and the subnetwork function gradually improved in children and adolescents with age. the functional development of each brain area in the occipital visual cortex was uneven and internally functionally differentiated.

#### **CLINICAL RELEVANCE/APPLICATION**

Changes in the topological properties of brain functional network nodes during childhood and adolescence can provide more detailed and intuitive information on the rules of brain development. We believe that our study makes a significant contribution to the literature because it provides evidence-based findings that clinicians and healthcare providers can adopt in actual clinical settings.

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## Abstract Archives of the RSNA, 2023

S3A-SPOB

### OB/Gynecology Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPOB-1 Value Addition of Subspecialty Trained Experienced Readers for O-RADS MRI Scoring and Guiding Management for Patients with Adnexal Mass Referred to Gynecology Oncology Multidisciplinary Rounds in a Tertiary Center**

##### Participants

Ankush Jajodia, MBBS, MD, New Delhi, (*Presenter*) Nothing to Disclose

##### PURPOSE

Assess the diagnostic accuracy, interobserver variability, and common lexical errors of the ACR O-RADS scoring system in staff radiologists with less experience and non-fellowship trained.

##### METHODS AND MATERIALS

Patients with an adnexal mass on standard post-contrast pelvic MRI and referred after initial interpretation by a staff radiologist (R3-lacking experience and fellowship experience) to gynec-oncology rounds in a tertiary center. Two fellowship-trained radiologists with different experience levels, R2 (2 years) and R1 (10 years), assigned O-RADS MRI scores independently. Diagnostic accuracies (ROC curve analysis) and agreement between readers were analyzed for each reader. Scores 4 and 5 were assigned malignant. R1 independently assigned misclassification if a malignant lesion scored = 3, a benign lesion scored = 4, or a non-adnexal mass was incorrectly categorized as benign or malignant.

##### RESULTS

Twelve malignant and 36 benign lesions included in the study were assigned O-RADS MRI score malignant (4,5) and benign (1,2,3) in 10 (20.8%) and 38 (79.2%), 15 (31.2%) and 33 (68.8%) and 45 (93.7%) and 3 (6.3%) by R1, R2, and R3 respectively. MR O-RADS score (4,5) associated with malignancy with diagnostic efficacy and areas under the curve values of 0.942 (95 % CI, 0.834-0.989), 0.579 (95 % CI, 0.428-0.720), and 0.553 (95 % CI, 0.403-0.697) obtained for readers R1, R2, and R3 respectively, with statistically significantly different between R1-R2 and R2-R3. Two and eleven lesions were incorrectly classified as benign by R1 and R3 readers. Inter-observer agreement interpretation obtained k values was fair between all readers; 0.435 (95 % CI, 0.224-0.646) for R1-R2, 0.441 (95 % CI, 0.238-0.645) for R2-R3, and 0.440 (95 % CI, 0.192-0.687) for R2-R3 respectively. There were nine correct upgrades and seven correct downgrades to malignant and benign categories by experienced R1 readers. Misclassification in nonexperienced readers was due to misinterpretation of solid tissue (n=14), incorrect interpretation of diffusion images (n=10), and incorrect interpretation of non-dynamic contrast enhancement (n=7).

##### CONCLUSION

Additional interpretation by experienced readers provides incremental diagnostic accuracies in the MR O-RADS score.

##### CLINICAL RELEVANCE/APPLICATION

Experienced readers correctly upgraded 18% malignant lesions with fair inter-observer agreement among readers with various experiences, although the diagnostic accuracies were significantly different between readers. Unnecessary biopsy was avoided in 14.5% by correct downgrading by experienced readers. Incorrect classification of 16% of lesions by experienced readers potentially highlights need to simplify the existing scoring system.

#### **S3A-SPOB-2 Accuracy of the Characterization of Adnexal Masses, Indeterminate at Ultrasonography, Using a Magnetic Resonance Imaging (MRI) Protocol without Contrast: External Validation of the Non-contrast MRI Adnex Score in a Multicentre setting**

##### Participants

Camilla Panico, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

The characterization of adnexal masses is critical to guide appropriate patient management. Up to 20% of adnexal masses remain uncharacterized after ultrasound and MRI is needed. The O-RADS MRI score relies on gadolinium-based contrast; however, avoiding contrast is sometimes preferable due to logistical and patient factors. A recent study proposed an alternative (Non-contrast MRI Adnex Score -NCMAS). The purpose of our study is to show the preliminary data of a multicentric prospective evaluation of the NCMAS in characterizing the adnexal masses.

##### METHODS AND MATERIALS

A multicenter observational prospective study has been set up including 16 standing Italian Centers. NCMAS is the Index Test; its aim is to predict the malignancy of the ovarian lesions on the basis of a NCMAS. The score is based on 5 categories. Two radiologists for each center (one senior and one junior) read the images, blinded to the clinical information of the patients except for age. The diagnostic end-point (absence/presence of the malignant tumor) is verified through histopathology after surgery or

through radiological follow-up at 12 months. The diagnostic accuracy of NCMAS is evaluated by measuring sensitivity, specificity, positive and negative predictive values, and ROC curve with area under the curve (AUC). To measure agreement between senior and junior radiologist Kappa statistics is performed. This preliminary analysis includes 45 patients representing about 15% of the total patients to be recruited.

## **RESULTS**

Fifteen out of the 45 patients were classified as malignant using the NCMAS. Comparing these diagnoses with the gold standard we found: sensitivity of 85.71% (95% Conf. Int. 66.13%-98.22%), specificity of 90.32% (Conf. Int. 78,58%-97.96%), positive predictive value of 80% (Conf. Int. 59.54%-95.67%), negative predictive value 93.33% (Conf. Int: 52.78%-99.18%). The malignant lesions correctly classified were 88.89% (Conf. Int. 77.78%-96.29%). The AUC was 88.02% (Conf. Int. 77.14%-98.90%). As to the comparison between senior and junior radiologists, for a diagnosis of a malignant lesion, the agreement was 90.24%, with a Kappa statistic of 0.79 (Conf. Int. 0.59-0.985).

## **CONCLUSION**

s The performance of NCMAS score was externally and prospectively confirmed. Even if found in about 15% of the total calculated sample size, the results are promising. If confirmed, the use of NCMAS may add an important tool in clinical practice when contrast imaging cannot be used for logistic or patient factors.

## **CLINICAL RELEVANCE/APPLICATION**

The results of this study may represent a confident support to the clinical use of non-contrast MRI in diagnosing adnexal masses, undetermined at ultrasonography

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## Abstract Archives of the RSNA, 2023

S3A-SPPD

### Pediatric Imaging Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPPD-1 Cardiac Computed Tomography Angiography with and without Bolus Tracking Methods in Infants with Congenital Heart Disease**

#### Participants

Takayuki Yoshiura, BA, RT, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Cardiac computed tomography angiography (CCTA) is useful in congenital heart disease (CHD) diagnosis and plays a major role in treatment. The bolus tracking (BT) methods can accurately predict the optimal scan delay that reflects the hemodynamics of the individual, but the drawback is the increased radiation dose due to pre-monitoring scans. This study aimed to compare the radiation dose, vascular CT number, and image quality of CCTA with and without BT methods for infants with CHD.

#### METHODS AND MATERIALS

This study retrospectively studied 72 consecutive patients with suspected CHD who underwent infant CCTA from December 2017 to April 2022, divided into groups with and without BT methods, in our information system. All scans were performed using a 64-detector row CT scanner (Lightspeed VCT; GE Healthcare, Milwaukee, Wisconsin) with the following parameters: rotation: 0.4 s, helical pitch: 1.375, slice thickness: 0.625 mm, tube voltage: 80 kVp, and automatic tube current modulation with a noise index of 40, iterative reconstruction (IR, blending of 30% of ASIR with FBP) algorithms under the standard kernel/filter reconstruction. Volume CT dose index (CTDI<sub>vol</sub>) and dose length product (DLP) were recorded for all CT scanning, and an effective dose was obtained using conversion factors. The CT number of the ascending aorta (AO) and pulmonary artery (PA), image noise of muscle tissue, and contrast-to-noise ratio (CNR) were measured and calculated.

#### RESULTS

The median values in the groups with and without BT were 2.20 mGy vs. 0.44 mGy for CTDI<sub>vol</sub>, 8.10 mGy·cm vs. 6.20 mGy·cm for DLP, and 0.66 mSv vs. 0.51 mSv for effective dose. The mean values in the groups with and without BT were 471.2 Hounsfield units (HU) and 515.6 HU for AO and 463.2 HU and 512.5 HU for PA, respectively. The mean image noise was 17.3 HU and 17.0 HU in the groups with and without BT ( $p = 0.76$ ), and the mean CNR was 23.9 and 26.5 in both groups ( $p = 0.21$ ).

#### CONCLUSION

s CCTA for infants with CHD without BT methods can reduce the radiation dose while maintaining the CT enhancement of the vessels and image quality compared to CCTA with BT methods.

#### CLINICAL RELEVANCE/APPLICATION

CCTA for infants with CHD can ensure good image quality and reduce radiation dose without using the BT method.

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## Abstract Archives of the RSNA, 2023

S3A-SPPH

### Physics Sunday Poster Discussions I

#### Sub-Events

#### S3A-SPPH-1 Improved Single-Shot GRASE with Flyback Variable Density Sampling and Deep Neural-Network

##### PURPOSE

To enable highly accelerated (12X) single shot gradient and spin echo (ss-GRASE) sequence without appreciable image artifacts by incorporating flyback variable density sampling coupled to a deep neural network.

##### METHODS AND MATERIALS

**SS-GRASE with flyback variable density sampling:**The sequence diagram was shown in Figure A, where a 3-fold acceleration was achieved using three gradient echoes after each refocusing pulse. This was coupled with variable density sampling for a total of 12-fold acceleration. To minimize phase inconsistency among the gradient echoes, flyback acquisition was employed with three echoes each grouped into different regions of the k-space. **Data Acquisition:**With IRB approval, images were acquired using ss-GRASE on phantom and human brains on a GE 3T Premier scanner. Key sequence parameters were: TR/TE=300/100ms, slice thickness=3mm, FOV=28cm<sup>2</sup>, matrix=256×224, slices=30 to 40, parallel imaging factor=3. A total of 90 slices of phantom and 320 slices of the human brain were acquired. The experiment was repeated using variable density sampling SSFSE with the same parameters except for TR=700ms. **Image Reconstruction:**The acquired data from both ss-GRASE and SSFSE was reconstructed using the parallel imaging compressive sensing (PICS) algorithm provided by BART and fed into the neural network as input and output, respectively. A U-Net architecture was tailored to further remove artifacts from PICS reconstruction. The U-Net consists of a downsampling encoder and an upsampling decoder network with a mirrored and reversed encoder structure (Figure B). The network was trained on an NVIDIA Titan Xp 16GB graphics card. To avoid overfitting, weight-decay (0.01) and random rotation for data augmentation were applied. Adam optimizer was used with a learning rate of 0.0005 for 1000 epochs guided by MSE loss until convergence.

##### RESULTS

The second column of Figure C illustrates the artifacts of PICS reconstruction arising from the phase inconsistency of the three gradient echoes in ss-GRASE. The artifacts can be largely removed using the deep neural network, as evidenced by the improved image quality from both phantom and human brain images (third column).

##### CONCLUSION

The performance of the ss-GRASE sequence was substantially improved with a combination of flyback variable density sampling and a deep neural network. The deep neural network enables reduction of the artifacts which PICS reconstruction fails to address in ss-GRASE.

##### CLINICAL RELEVANCE/APPLICATION

The proposed approach of ss-GRASE enables improved acquisition speed (300ms/slice) and less SAR issue as compared to conventional SSFSE, implying further applications of the technique in freezing motion such as bowel imaging, and SAR-sensitive situations such as pediatric imaging.

#### S3A-SPPH-10 Unpaired MR-CT Translation using Diffusion Model and Cross-modality Structure Extractor

##### PURPOSE

For the breast cancer patients after surgery, MRI scans are required to identify the surgical site and determine the treatment plan, but radiotherapy planning requires extra CT scans. By developing the deep learning model to synthesize CT from MRI images, physicians can reduce the time consumption and do treatment efficiently. Since a dataset containing paired MR and CT images with registration is difficult to be retrieved because of anatomical changes, unpaired MR-CT translation is the key to solve this problem. However, due to the information difference within MRI and CT, unpaired translation across the modalities is still a hard task to be done. In this paper, we propose a novel structure using a cycle-structured diffusion model and an extra algorithm for structure preservation.

##### METHODS AND MATERIALS

The dataset we used is composed of 2D MRI (T2) and CT scans of the patients who underwent partial resection for breast cancer or did radiation therapy. Train set is composed of 3,606 MR scans and 2,770 CT scans from 62 patients, and 543 pairs of MRI and CT from 15 patients were used for test. The proposed model is composed of two generators: Diffusive and Non-Diffusive. Non-diffusive generator  $G'$  is used to make a reference for the diffusive generator  $G$ . Using the image  $G'(x)$  and noisy input  $x_t$ , the diffusive generator focuses on learning the target domain's structure and reconstructing the input image  $x$ . The Modality independent neighborhood descriptor (MIND) algorithm extracts the structural information using the similarity among adjacent patches. This descriptor makes a similar output for the same object regardless of its modality, so it can guide the unsupervised model to keep the structure. We compared our model's result with other unsupervised translation models by quantitative metrics: MSE, PSNR, and SSIM.

##### RESULTS

By the metrics, we can know that our proposed model generates the most similar result with ground truth for both sides: MR to CT

By the metrics, we can know that our proposed model generates the most similar result with ground truth for both sides: MR to CT and CT to MR. The resulting image shows that the diffusive generator contributed well to build realistic images. Also, the MIND loss helped to solve the structure deformation problem, especially in CT to MR conversion.

## CONCLUSION

In this study, we showed bidirectional MR-CT unpaired translation functionality can be raised by adapting a diffusive generator as translation model. In addition, the proposed loss function in this paper can help maintain the structural information and compensate for the essential problem of unpaired translation.

## CLINICAL RELEVANCE/APPLICATION

The synthetic CT image generated by the proposed model and MRI can be used for dose calculation in radiation treatment planning for breast cancer. This method can help physicians to reduce the time consumption and establish precise treatment regions.

## S3A-SPPH- 11 The Superiority of Low-kV Renal Triphasic-enhanced CT with Deep Learning Image Reconstruction in Patient Care over the Conventional Enhanced CT Exam

Participants

Xiaobo Ding, MD, MD, Changchun, China (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate whether the deep learning image reconstruction (DLIR) can provide more patient care through the reduction of radiation dose and contrast agent volume for renal enhanced CT exam.

## METHODS AND MATERIALS

148 patients suspicious of renal lesion were included, 118 patients in the DLIR group and 30 in the conventional enhanced CT (CECT) group. The parameters for DLIR group: rotation speed of 0.5 s, collimation of 128×0.625 mm, pitch of 0.992:1, 50% ASIR-V, noise index (NI) of 9, automatic current modulation, standard kernel, 100 kV and mA range of 100-550 in the arterial phase (AP) and excretion phase (EP) and 120 kV and mA range of 150-500 in the parenchymal phase (PP); retrospective algorithm of DLIR. The volume and injection rate of contrast agent (320 mgI/ml) were 0.9 ml/kg and 3 ml/s. In CECT group: 120 kV, 281 mAs, collimation of 128×0.625 mm, pitch of 0.914:1, level 3 of iDose4, standard(B) filter for all phases. The volume and injection rate of contrast agent (320 mgI/ml) were 1.2 ml/kg and 2.7 ml/s. CT values and standard deviation (SD) of cortex, medulla, subcutaneous adipose tissue (SAT) on AP, parenchyma, pelvis and psoas muscle (PM) and SAT on PP, middle calyx (MC), upper ureter and middle ureter on EP were measured to calculate signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). SD of SAT was defined as background noise. Images were assessed by two readers using a 4-point scale (1. poor; 2. moderate; 3. good; 4. excellent). The CT DIvol and dose-length-product (DLP) was recorded. Student's t-test and Mann Whitney U test were used to analyze the differences between 2 groups.

## RESULTS

There was no difference in BMI between two groups (24.4 vs. 23.4,  $p>0.05$ ). CTDI, DLP and contrast agent volume of DLIR group were significantly lower than those of CECT group (23.7 vs. 70.8 mGy,  $p<0.001$ ; 744.1 vs. 2197.4 mGy $[[$ Unsupported Character - Symbol Font #158;]]cm,  $p<0.001$ ; 62.4 vs. 77.8 ml,  $p<0.001$ ). SNR of parenchyma and upper ureter and CNR of cortex to medulla in DLIR group were significantly higher than those in CECT group (10.83 vs. 7.52; 19.45 vs. 7.12; 11.83 vs. 6.59;  $p<0.001$  each). The SD of SAT was lower in DLIR group, compared to CECT (9.08 vs. 11.11,  $p<0.001$ ). No differences in subjective scores were observed between two groups.

## CONCLUSION

Low-kV enhanced CT exam combined with DLIR algorithm is a feasible method for better patient care, compared to conventional enhanced CT exam.

## CLINICAL RELEVANCE/APPLICATION

The scan speed is faster and image quality is better for the deep learning algorithm of low-dose renal three-phase scan of GE revolution 256 row CT than that of conventional renal three-phase scan of Philips 128 row CT, which could significantly reduce the radiation dose and contrast agent dosage of patients, and reduce the burden of liver and kidney of patients.

## S3A-SPPH- 12 Performance of an Artificial Intelligence-Based Real-time System for Breast Positioning Evaluation and Image Quality Control in Mammography

## PURPOSE

To investigate the effectiveness of an artificial intelligence (AI) system for automated assessment of breast positioning and image quality in mammography.

## METHODS AND MATERIALS

Assessment of breast positioning and image quality was performed by AI system and by two radiographers on 360 images of 90 women. Nine image quality criteria evaluating the appearance of the nipple, breast rotation, pectoral muscle, inframammary fold, pectoral nipple line, shoulder overlap shadow, abdominal skin, contralateral breast and foreign body were used for craniocaudal and mediolateral-oblique views. Image quality of cases were also evaluated with the standards of Mammography Quality Standards Act (MQSA) as grade "adequate" or "inadequate". Intraclass correlation and Cohen's kappa coefficient (?) were used to investigate the correlation and agreement between the radiographer's assessments and AI. The performance of the AI system was evaluated using accuracy, sensitivity, and specificity.

## RESULTS

The AI algorithm demonstrated high accuracy in distinguishing between adequate and inadequate images, with an overall accuracy of 93%, sensitivity of 94% and specificity of 92%. In terms of breast positioning, the AUC of poor imaging quality prediction by AI system according to incomplete gland, incomplete pectoralis muscle, over or insufficient exposure was (0.903 vs 0.937 vs 0.982). Overall accuracy of AI system was 0.958. Inter-observer agreement for breast positioning assessment indicating substantial agreement between the radiographers and AI system ( $\kappa=0.75$ ). A substantial to almost perfect agreement was observed between the radiographers and AI on the nipple in profile ( $\kappa = 0.93$ ) and contralateral breast criterion ( $\kappa = 0.82$ ). We observed a slight to



moderate agreement for the other criteria ( $\kappa = 0.55-0.79$ ).

## CONCLUSION

The AI algorithm demonstrated high accuracy in distinguishing between high and low-quality images and detecting suboptimal breast positioning in mammography. The results showed a high level of agreement between the AI system and the radiographers.

## CLINICAL RELEVANCE/APPLICATION

The high accuracy, sensitivity, and specificity of an AI system for quality control in mammography suggest its potential as a valuable tool for radiologists and technologists in the clinical setting, particularly in low-resource areas where access to experienced radiologists may be limited.

### S3A-SPPH-13 Artificial Intelligence-based Triage of Breast Cancer Screening Mammograms in a Swiss Region: Possible Impact of AI Region's Score Cutoff on Radiologist Workload

Participants

Federica Zanca, PhD, Leuven, Belgium (*Presenter*) Nothing to Disclose

## PURPOSE

To identify the optimal region's score cutoff when using an artificial intelligence (AI) cancer-detection software to triage negative screening examinations into a one-click reporting radiologist work stream, e.g. reader validation of the AI negative result.

## METHODS AND MATERIALS

This prospective multi-center simulation study aims at collecting about 10000 exams from a Swiss screening program. Preliminary data includes 3 months of screening mammograms. AI cancer-detection software (Transpara, Screenpoint Medical, v1.7.1) was used as a concurrent reading to detect potential abnormalities, for all exams collected. The software computes a region score for every marked area (soft tissue lesions and microcalcifications), indicating the likelihood of cancer on a scale from 0-98. Higher scores represent a higher likelihood of cancer. Based on these AI prediction scores, various cutoff points for the highest region score at the exam level (42, 49, 60, 74) were evaluated as thresholds to potentially channel women to the one-click reporting work stream. The different cutoff points were assessed in terms of missed abnormalities. Mean, median and variance of the AI scores were calculated. Data were also stratified per lesion type and breast density.

## RESULTS

500 exams were examined, of which 12 were recalled for further examination (recall rate: 2.4%). Of these, 4 did not return, 5 were benign and 3 were diagnosed as cancer (biopsy proven), resulting in a 0.6% cancer incidence over one screening interval of 2 years. The mean, median and variance of AI scores were, respectively, 13, 0 and 564. There were respectively 0,1,2 and 2 missed cancers in case an AI score cutoff of 42, 49, 60 and 74 was used, corresponding to 0%, 0.2%, 0.4% and 0.4% of all screen-detected cancers in the population. The cutoffs of 42/49/60/74 correspond to 79%/87%/93%/99% of the workload. More data collection and stratification per lesion type and breast density is ongoing.

## CONCLUSION

Preliminary data suggests that a cutoff score of 42 would allow triaging breast cancer screening mammograms with a 99.9% negative predicted value (NPV) into a one-click reporting.

## CLINICAL RELEVANCE/APPLICATION

Using commercial AI software to triage mammogram workflow based on a 99.9% NPV could reduce radiologist workload by 78%.

### S3A-SPPH-2 Development of a Machine Learning Algorithm for Fat-free Mass Estimation: Application to Personalized Contrast Injection in Computed Tomography

Participants

Natalie Heracleous, PhD, BSc, Sion, Switzerland (*Presenter*) Nothing to Disclose

## PURPOSE

Using fat-free mass (FFM) to personalize i.v. contrast volume injection enables reproducible target liver enhancement. However, measuring FFM requires expensive equipment and is time-consuming, limiting its applicability in clinical practice. This study aims at developing a Machine Learning (ML) model to accurately estimate the patient FFM.

## METHODS AND MATERIALS

Previously collected abdominal CT data from 689 adult patients referred for liver lesion characterization or cancer follow-up was used (11 centers, different CT vendors, 2018-2022). This dataset includes various patient characteristics and measurements such as age, gender, weight, height, Body Mass Index (BMI), Size Specific Dose Estimate (SSDE), and FFM measured with Bioelectrical Impedance meter (ground truth (GT)). A multivariate linear regression model was developed for FFM estimation. The correlations of the investigated variables with measured FFM were studied, and the most correlating variables were retained in the final model. The data was divided into training and test sets following the 80/20 rule and were validated using the K-fold technique. The model's performance was evaluated against the GT using Mean Absolute Percentage Error (MAPE), Root Mean Squared Error (RMSE) and R-squared. Our algorithm was also benchmarked against models already existing in the literature by comparing the distributions of the relative differences between theoretical and measured FFM values when applied to our data.

## RESULTS

Preliminary results show a very good performance in predicting the FFM for our patient data sample. The cross-validation results showed the model to be robust for the typical patient profiles in our clinical settings. Specifically, the model showed low MAPE (0.033 +/- 0.003), high R2 (0.91 +/- 0.02) and relatively low standard deviation of residuals RMSE (2.13 +/- 0.23).

## CONCLUSION

Our model can reliably and efficiently estimate the patient FFM to personalize i.v. contrast volume in adult abdominal CT examinations, reducing the time required for its measurement and avoiding the need for expensive equipment.

## CLINICAL RELEVANCE/APPLICATION

The ability to accurately estimate FFM enables effortless personalization of contrast volume injection for a reproducible liver enhancement in clinical practice.

### S3A-SPPH-3 Evaluation of Unsupervised Low-dose Digital Breast Tomosynthesis Denoising using Cycle-consistent Generative Adversarial Network

#### PURPOSE

This study aimed to evaluate the image quality improvement in digital breast tomosynthesis (DBT) with unsupervised cycle-consistent generative adversarial networks (cycle-GANs) during pre-reconstruction processing under low radiation exposure.

#### METHODS AND MATERIALS

The cycle-GAN pre-reconstruction manipulation with filtered back projection (FBP) was compared with and without relative GAN techniques (unsupervised image-to-image translation: UNIT and supervised image-to-image translation: pix2pix). The peak signal-to-noise ratio (PSNR), mean square error (MSE), structural similarity (SSIM), and detectability index ( $d'$ ) in the in-focus plane and artifact spread function (ASF) in the longitudinal direction using a phantom (training; BR3D [model 020, CIRS Inc.], testing; DBT quality control [model 021, CIRS Inc.] and TOR-MAM [Leeds Test Objects Inc.]) at various radiation doses (automatic exposure control reference dose: 1.36 mGy; approximately 50% reduction of reference dose: 0.66 mGy; approximately 75% reduction of reference dose: 0.31 mGy) were used to compare noise reduction and preserved contrast rates.

#### RESULTS

PSNR and MSE were similar to the references with cycle-GAN at 75% and pix2pix at 50% radiation dose reductions of reference, respectively (PSNR: cycle-GAN: 25.19 and 25.81, UNIT: 23.81 and 18.68, pix2pix: 26.46 and 25.92, without GAN (w/o-GAN): 26.03 and 24.07; MSE: cycle-GAN: 0.003 and 0.002, UNIT: 0.004 and 0.013, pix2pix: 0.002 and 0.002, w/o-GAN: 0.002 and 0.003, at 50% and 75% reduced radiation dose, respectively). The SSIM of the images generated by the cycle-GAN model at a 50% reduced radiation dose was similar to that of the reference images acquired at full radiation dose (cycle-GAN: 0.66 and 0.64, UNIT: 0.62 and 0.59, pix2pix: 0.64 and 0.62, w/o-GAN: 0.61 and 0.50 at 50% and 75% reduced radiation dose, respectively).  $d'$  was similar to the reference in cycle-GAN and pix2pix at 50% radiation dose reduction of reference (reference: 2.79, cycle-GAN: 2.80 and 2.71, UNIT: 2.64 and 2.46, pix2pix: 2.82, and 2.58, w/o-GAN: 2.73 and 1.89 at 50% and 75% reduced radiation dose, respectively). ASF revealed a similar distribution (symmetry) to the reference, except for pix2pix. Pix2pix spread the distribution and became asymmetric.

#### CONCLUSION

This phantom experiment revealed the highest usefulness of cycle-GAN in low-dose conditions considering the image quality in the in-focus plane and longitudinal direction, as well as a 50% reduction in the reference.

## CLINICAL RELEVANCE/APPLICATION

The cycle-GAN pre-reconstruction manipulation with FBP can significantly reduce noise with preserved contrast and radiation dose reduction in clinical practice.

### S3A-SPPH-4 MRI Image Generation from CT Images for Cerebral Ischemic Stroke Patients Using Deep Learning

#### PURPOSE

Cerebral ischemic stroke is a leading cause of death and disability worldwide, and timely diagnosis and treatment are crucial for improving patient outcomes. Computed tomography (CT) and magnetic resonance imaging (MRI) are both widely used imaging modalities for diagnosing stroke. However, CT is often the first choice due to its accessibility and speed, while MR provides higher sensitivity and specificity. This study aims to investigate the feasibility of converting CT images of cerebral ischemic stroke patients to MRI using deep learning techniques.

#### METHODS AND MATERIALS

The proposed method utilizes a Cycle Generative Adversarial Network (Cycle-GAN) raised by Jun et al. to learn the mapping between the two modalities and generate synthetic MRI from CT scans. We have added a new attribute to the network, based on the observation that stroke lesions are highly discernible on MR images. The dataset used in this study consists of CT and MR images from 120 patients at Longgang Central Hospital of Shenzhen. Only the MRI input contains attribute information, where the presence or absence of lesions is encoded as one-hot codes. To address the challenge of detecting lesions in CT images and improve the network's feature extraction capabilities, we adjusted the window width and center of the original CT image to 60 and 35, respectively.

#### RESULTS

Experimental results demonstrate that the proposed approach can effectively generate high-quality MRI from CT scans, achieving a peak signal-to-noise ratio (PSNR) of 24.4 dB and a structural similarity index (SSIM) of 0.78. Furthermore, our method outperforms existing image-to-image translation methods in terms of visual quality and quantitative evaluation metrics.

#### CONCLUSION

Deep learning has shown promising results in extracting subtle lesion features from CT images, although the outcomes may differ from those of the original MRI. Nonetheless, the algorithm can still provide valuable insights to medical professionals. While some progress has been made in this area, there is still significant room for improvement. Future research will focus on refining the algorithm and conducting comparative studies with related algorithms.

## CLINICAL RELEVANCE/APPLICATION

Timely diagnosis of Cerebral ischemic stroke is critical. However, traditional MRI scans are time-consuming, while CT imaging is widely available. By using deep learning to convert CT images to MRI, medical professionals can diagnose the condition more quickly and develop appropriate treatment plans.

### S3A-SPPH-5 Semi-Automatic Segmentation of Thymic Epithelial Tumors using U-Net

Participants  
Nathan Lay, PhD, Bethesda, MD (*Presenter*) Inventor, ScanMed

## **PURPOSE**

Volumetric analysis of thymic epithelial lesions can be more informative than RECIST for oncologic follow up but requires laborious segmentation with low reproducibility when done manually. To propose and quantify performance of a U-Net artificial intelligence (AI) model for segmenting thymic epithelial tumors in CT scans with user-provided 3D regions-of-interest.

## **METHODS AND MATERIALS**

A consecutive cohort comprised of 85 CT scans from 60 thymoma patients (mean age: 55 range: 32-75) was queried from a single institution database. Thymic tumors in the thorax were then manually segmented slice-by-slice on axial CT images by trainees or volunteers under the supervision of an expert cardiothoracic radiologist. The cohort was then partitioned into training and validation sets containing 63 CT scans from 45 patients and 22 CT scans from 15 patients respectively. A 2D U-Net was then trained on cropped image slices from 141 tumors over 1000 epochs. Performance was measured using the arithmetic mean and standard deviation of Dice similarity coefficient (DSC) over 3D manual segmentation masks of the whole image. DSC produces a similarity score ranging from 0 to 1 with 1 being a perfect match.

## **RESULTS**

U-Net model snapshots were validated every 10 epochs on cropped image slices coming from 49 validation tumors. The method achieved a peak overall validation Dice similarity coefficient of 0.59 +/- 0.17. This corresponds to validation tumor DSCs of 0.60 +/- 0.09 for thymoma lesions located in the lung parenchyma, 0.68 +/- 0.14 for pleural and 0.57 +/- 0.19 for mediastinal thymoma lesions.

## **CONCLUSION**

The current DSC results of our U-net AI model show promise for volumetric analysis of thymic tumors. Thymic tumors present a complicated and often unnoticed appearance in CT and a larger dataset is likely to produce a more generalizable and performant U-Net model over our current results.

## **CLINICAL RELEVANCE/APPLICATION**

Thymic tumor progression is currently tracked using RECIST v1.1. RECIST is used because it is simple and reproducible, but it is not suitable for some types of pleural thymic tumors. Automatic volumetric analysis can be simple, reproducible and accurate for all thymic tumors.

## **S3A-SPPH-6 Reproducibility of a Deep Learning COVID-19 Classification Model Based on Image Acquisition Dates and Data Resampling**

### **PURPOSE**

To investigate the impact of (1) image acquisition date and (2) data resampling, which was performed to create new training and test sets, on the ability of a deep learning (DL) model to predict COVID-19 diagnosis from chest radiographs (CXRs).

### **METHODS AND MATERIALS**

A DL model using the DenseNet-121 architecture was trained on an original dataset of 9860 COVID+/- patients (disease prevalence: 15.5%) from a single institution. The model was validated on a more current cohort of 5893 patients (disease prevalence: 12.4%) from the same institution but achieved significantly lower performance as evaluated using area under the receiver operating characteristic curve (AUC). To investigate this performance discrepancy, this work (1) compared the International Classification of Diseases 10 (ICD-10) codes between the original dataset and current test set, (2) limited the image acquisition date range of the current test set to that of the original and compared COVID severity scores and age, and (3) retrained the model using a resampling of the original dataset to evaluate whether the original results were due to a statistical anomaly. No training was performed using the current test set.

### **RESULTS**

The original dataset and current test set shared the same top-three ICD-10 codes: (1) screening for other viral disease, (2) age-related osteoporosis, and (3) unspecified osteoarthritis. COVID severity scores of patients with images obtained during the overlap of dates between the test sets failed to achieve a significant difference ( $p=0.06$ ); however, the DL prediction scores indicated more "obvious" cases within the original test set, thus correctly labeling a greater portion of true-positive and true-negative CXRs. There was a significant difference ( $p<0.001$ ) between cohort age, with the current test set having a larger mean (57.9 years  $\pm$  18.3) than the original dataset (54.7 years  $\pm$  18.9). Lastly, retraining the model by resampling the original dataset resulted in an AUC value [95% CI] of 0.71 [0.67, 0.74], significantly lower than the original AUC value of 0.76 [0.73, 0.79]. Importantly, the AUC value of the current test set was no longer statistically less than the AUC value obtained with this resampled original dataset ( $p=0.11$ ).

### **CONCLUSION**

This work examined potential factors that may impact model performance. Resampling the dataset resulted in significantly lower performance, which may explain how different partitions of a dataset (or an entirely new dataset) may yield variable performance.

### **CLINICAL RELEVANCE/APPLICATION**

With the rise of DL use in medical applications, interpretability of models is essential for proper deployment, ensuring an understanding of how various factors may impact model performance and that results are comprehensible.

## **S3A-SPPH-7 Model Calibration by Temperature Scaling of a U-Net Deep Learning Model Trained for the Segmentation of Mesothelioma Tumor: A Pilot Study**

### **PURPOSE**

To produce calibrated pixel-wise label probabilities in the task of mesothelioma segmentation, which will ensure proper generation of probability maps.

## METHODS AND MATERIALS

Temperature scaling (TS) is a post-processing probability calibration method to be used for multi-class classification. For medical image semantic segmentation tasks, the two classes would be "disease" or "no disease." TS estimates a single scalar parameter temperature  $T > 0$ , using the logit  $z_i$  vector as input, where  $i$  is the  $i$ -th image. The temperature is typically optimized only on the validation images and using the negative log-likelihood cost function, as was performed in this work. The calculated temperature "softens" the output of the last activation layer with  $T > 1$  reducing model confidence (i.e., probability predictions),  $T = 1$  indicating no change to the original probability, and  $T < 1$  increasing model confidence. The temperature was calculated for four separate validation sets: left or right hemithorax displaying either tumor only or tumor plus effusion. For the left hemithorax, 275 sections displayed tumor only, and 97 sections displayed tumor plus effusion. For the right hemithorax, 216 sections displayed tumor only, and 101 sections displayed tumor plus effusion.

## RESULTS

The calculated temperatures for tumor only on the left hemithorax, tumor plus effusion on the left hemithorax, tumor only on the right hemithorax, and tumor plus effusion on the right hemithorax were  $T = 3.7, 3.4, 2.3, 2.1$ , respectively. All temperature values were greater than unity, which demonstrated the model's overconfidence prior to calibration.

## CONCLUSION

This work demonstrated the overconfidence of the initial model, as all temperatures were greater than one. This finding is consistent with the literature, since modern neural networks have been reported to be overconfident in their predictions. With a correctly calibrated model, accurate probability maps can be generated, thus streamlining automation of the mesothelioma segmentation task.

## CLINICAL RELEVANCE/APPLICATION

Due to the widespread use of neural networks for medical image classification and segmentation tasks, there is a need to ensure that model outputs are properly calibrated so that the resulting probabilities are indicative of the model's true confidence.

### S3A-SPPH-8 Adaptive Multimodality Medical Image Translation with Total-Body PET

Participants

Yuxi Jin, Shen Zhen, Guangdong, China (*Presenter*) Nothing to Disclose

## PURPOSE

To dynamically generate specified modality images from nonattenuation-corrected PET images according to user requirements.

## METHODS AND MATERIALS

To dynamically translate nonattenuation corrected (NAC) PET images to user-specified modality images, we embed a switch layer after each skip connection in the decoder of UNet. The switch layer learns the scale and offset parameters by two fully connected layers from the switch code. The switch codes are 001/010/100 for attenuation corrected (AC) PET/CT/MRI, respectively, and are coded by one-hot coding. The proposed model can adaptively output the specified modality image by normalizing the input features into the specified modality with the scale and offset parameters. A total of 119 patients scanned with the uEXPLORER scanner and 225 patients scanned with the uPMR scanner were retrospectively enrolled. We selected 13 patient cases as an external validation set for quantitative analysis, and the remaining 108 PET/CT cases and 215 PET/MR cases were used as experimental data to train the proposed network. To better train the proposed model, we mix and slice these data along the axial orientation to obtain two-dimensional images. After excluding 6547 slices for negative samples, we obtained 104286 slice samples in total. We randomly select 83429 samples for training, 10428 samples for validation, and 10429 samples for testing. The quantitative performance is evaluated by PSNR, MAE, and SSIM. The qualitative performance is measured by the error map between the model output and the ground truth.

## RESULTS

Our results achieved small quantification errors (low bias), good image quality (high PSNR), and high similarity (high SSIM) in the different body regions. All modal translation results have a similar appearance as the ground truth. Qualitative and quantitative analyses demonstrated the outstanding performance of the proposed model.

## CONCLUSION

We design a novel deep learning model to realize adaptively multimodality translation. This work can complete one-to-many modality translation, including direct PET attenuation correction (NAC-AC), CT synthesis (PET-CT), and MRI synthesis (PET-MRI). The simulated multimodality images have small qualification errors, good image quality, and high image similarity, which demonstrates that the proposed method is a promising tool in preclinical research, such as tumor contouring, anatomical localization, and dose calculation of radiotherapy.

## CLINICAL RELEVANCE/APPLICATION

The proposed adaptive multimodality medical image translation model can provide more comprehensive and integrated image information, aiding doctors in better understanding a patient's physical condition and making more accurate diagnoses and treatment plans.

### S3A-SPPH-9 Large Language Model (LLM) Passes the Radiology Physics Quiz

Participants

Shakthi Ramasamy, MD, (*Presenter*) Nothing to Disclose

## PURPOSE

With the recent advances in natural language processing, large language models (LLMs) such as GPT-4 have become increasingly powerful in their ability to understand and generate natural language. This study aims to assess the knowledge quiz-taking capacity of GPT-4 and GPT-3.5 for the Radiology Physics quiz.

## METHODS AND MATERIALS

An IRB-approved study was conducted. The study was conducted on a set of 60 multiple-choice questions generated from the Radiology

An IRB approval is not required. The study was conducted on a set of 62 multiple-choice questions compiled from the Radiology Core Physics App, which is used by radiology residents for their board preparations, and the sample questions for the Diagnostic, Nuclear, and Therapeutic content of the Initial Certification for Medical Physics from the American Board of Radiology (ABR) ([theabr.org](http://theabr.org)) website. Image-based questions were excluded from the study due to the limitations of the current GPT models. The questions were typed into the prompt of chat.openai.com models GPT-4 (subscription required) and GPT-3.5 (freely available to the public). The answers were correlated with the respective answer keys. The performance of the models was evaluated for a passing score of 75%. The performance of GPT-4 vs GPT-3.5 was compared using a two-proportion z-test.

## **RESULTS**

GPT-4 and GPT-3.5 took the Radiology Physics quiz, with GPT-4 achieving a success rate of 79% (49 correct) and GPT-3.5 achieving a success rate of 55% (34 correct). A two-proportion z-test was conducted to compare the performances of the two models. The calculated z-score is approximately 2.863, and the p-value is approximately 0.0042. Since the p-value (0.0042) is less than the significance level of 0.05, there is a statistically significant difference between the performances of GPT-4 and GPT-3.5 on the Radiology Physics quiz.

## **CONCLUSION**

The results indicate a significant difference between the performances of GPT-4 and GPT-3.5 on the Radiology Physics quiz. GPT-4 demonstrated a higher success rate, scoring above the passing score. GPT-3.5 had a notably lower success rate, indicating that the newer GPT-4 model has improved knowledge and understanding of radiology core physics compared to its predecessor.

## **CLINICAL RELEVANCE/APPLICATION**

The performance of GPT-4 in the Radiology Physics quiz highlights the potential application of large language models in medical education and training. GPT-4 could be a valuable resource for radiology residents, medical physicists, and other healthcare professionals seeking to enhance their understanding of radiology core physics principles. Additionally, the significant improvement in performance between GPT-3.5 and GPT-4 demonstrates the rapid advancements in natural language processing, indicating a promising future for LLMs in the medical field.

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## Abstract Archives of the RSNA, 2023

S3A-SPRO

### Radiation Oncology Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPRO-1 Ten-Year Experience of 5-Fraction Lung Stereotactic Body Radiotherapy (SBRT) for Biopsy-Proven Non-Small Cell Lung Carcinoma (NSCLC)**

#### Participants

John M. Watkins, MD, (*Presenter*) Nothing to Disclose

#### PURPOSE

Describe the local control (LC) and correlative clinicopathologic prognostic factors in patients treated with 5-fraction lung SBRT for biopsy-proven NSCLC.

#### METHODS AND MATERIALS

Intradepartmental quality assurance database of SBRT patients was utilized to identify patients with biopsy-proven NSCLC treated with 5-fraction SBRT at a single institution. Overall survival (OS), disease-free survival (DFS), and LC were measured from SBRT completion to last clinical follow-up or death (with DFS/LC backdated to last clinical follow-up if death occurred more than 3 months after last imaging). Regression analyses were performed on clinical (age, gender, race, tobacco use), radiographic (maximal tumor dimension, T-stage), pathologic (histology), and treatment (target coverage by dose, frequency of SBRT, SBRT start to completion) factors for association with LC. Kaplan-Meier method was employed for survival estimation.

#### RESULTS

Between 2011-2021, 107 patients were identified for inclusion in the present analysis. There were 112 total NSCLC targets, 60 (54%) being adenocarcinoma. Median age at the time of treatment was 75 years old (range, 38-93). Median SBRT dose was 5000 cGy (4500-6000 cGy) delivered over a median treatment time of 9 days (4-45). Median maximal internal target volume (ITV) dose (D 0.1 cc) was 6554 cGy (4497-7660), with median ITV receiving 5000 cGy (V50) and 5500 cGy (V55) of 100% (0-100%) and 98.8% (0-100%), respectively. Median planning target volume (PTV) V50 and V55 were 96.6% (0-100%) and 67.4% (0-99.7%), respectively. At median follow-up of 21 months (1-139), 75 (70%) patients had died. Median survivor follow-up was 39 months (7-139) with an estimated 3-year overall survival of 42.6% (32.6-52.6%). Forty-three patients experienced disease recurrence, of whom 8 had local failures (4 biopsy-proven). Estimated 3-year local control was 86.2% (76.2-96.2%). Univariate analysis of factors associated with LC identified only ITV V50 and PTV V50 as being significantly associated with LC. Estimated 3-year LC for ITV V50 > 98% versus < 98% was 88% and 79%, respectively. Estimated 3-year LC for PTV V50 > 95% versus < 95% was 91% and 75%, respectively.

#### CONCLUSION

s ITV V50 and PTV V50 were the most strongly associated factors with LC after 5-fraction lung SBRT in the present population.

#### CLINICAL RELEVANCE/APPLICATION

SBRT for early-stage NSCLC is an excellent option for inoperable patients or those who decline lobectomy. The present study demonstrates the importance of minimum target coverage on local control in a large population with mature follow-up.

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## Abstract Archives of the RSNA, 2023

S3A-SPVA

### Vascular Imaging Sunday Poster Discussions I

#### Sub-Events

#### **S3A-SPVA-1 Perivascular Fat Attenuation on CT Angiography is a Biomarker to Identify the Inflammation of Culprit Plaques in Internal Carotid Atherosclerosis**

##### Participants

Ziyu Tian, Jinan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Our study aimed to evaluate the value of FAI as a tool for measuring plaque inflammation and identifying culprit plaques in internal carotid atherosclerosis.

##### METHODS AND MATERIALS

We analysed patients with internal carotid atherosclerosis who underwent neck CTA examination. The culprit plaque group and nonculprit plaque group were divided based on the clinical diagnosis. We compared the CTA characteristics, and baseline data between the two groups, as well as the FAI at the maximum stenosis, nonstenosis site and the whole ICA. A receiver operating characteristic (ROC) curve was used to determine the diagnostic accuracy of FAI for classifying culprit plaques in patients with bilateral ICA atherosclerotic stenosis.

##### RESULTS

In total, 101 and 94 patients were included in the culprit plaque (mean age, 64.78 years  $\pm$ 8.17; 84 men) and nonculprit plaque groups, respectively (mean age, 66.72 years  $\pm$ 7.51; 80 men). In the nonculprit plaque group, the perivascular FAI around the maximum stenosis site and around the whole ICA were lower than those in the culprit plaque group ( $P < 0.05$ ). In patients with bilateral extracranial ICA stenosis, ROC analysis of atherosclerotic stenosis in combination with FAI performed well in predicting the culprit plaque (AUC=0.863,  $P < 0.001$ ).

##### CONCLUSION

The perivascular FAI may be useful in identifying inflammation and the culprit plaque from ICA atherosclerosis and provides a new monitoring method for risk stratification.

##### CLINICAL RELEVANCE/APPLICATION

To our best knowledge, we first use the novel biomarker perivascular FAI to measure plaque inflammation and identify culprit plaques in internal carotid atherosclerosis. Our study first demonstrated that patients in the culprit plaque group had a higher level of perivascular inflammation measured by FAI than those in the nonculprit group. The noninvasive measurement of FAI can be used to evaluate and identify the local inflammation of culprit plaques in the ICA, which may help to monitor the inflammation progression of atherosclerotic plaques. Furthermore, FAI at the maximum stenosis site combined with stenosis can noninvasively predict the ICA culprit plaques, which enables the recognition of stroke risk patients and guides targeted treatments.

#### **S3A-SPVA-2 Dark Blood Computed Tomography Angiography Combined with Deep Learning Reconstruction for Thickened Carotid Artery Wall Imaging in Takayasu Arteritis Patients**

##### Participants

Tong Su, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To assess the capability of a newly developed dark-blood CTA imaging, combined with deep learning reconstruction (DLR), to visualize the thickened carotid artery wall of Takayasu arteritis (TAK) patients, compared with conventional CTA images.

##### METHODS AND MATERIALS

This prospective study continuously recruited fifty-three patients with TAK who underwent neck CTA scans. All acquisitions were performed with a 320 row-detector CT scanner (Aquilion ONE Genesis Edition). Arterial and Delayed phase images were reconstructed using HIR (Adaptive Iterative Dose Reduction [AIDR] 3D) and DLR (Advanced Intelligent Clear-IQ Engine [AiCE]). Afterward, these two groups of images processed with a dedicated software (SURESubtraction) to generate dark-blood images. Therefore, four groups of images were produced for analysis: Delayed-HIR, Delayed-DLR, Dark-blood-HIR, Dark-blood-DLR. Qualitative parameters, including overall image quality, vessel wall visualization ability, and diagnostic confidence index, were rated by two radiologists independently according to a five-point scale. Quantitative parameters, including SNR of vessel wall, CNR between the vessel wall and lumen, were computed and compared. The vessel wall thickness of thickened common carotid artery was measured and the inter-rater variability was evaluated.

##### RESULTS

The qualitative scores of overall image quality presented Delayed-DLR was superior to Delayed-HIR and Dark-blood-DLR was

superior to Dark-blood-HIR (all  $p < 0.001$ ). CTA images processed with dark-blood technique presented higher qualitative scores in terms of vascular wall display ability and diagnostic confidence index, superior to conventional CTA images (all  $p < 0.001$ ). For brachiocephalic trunk, bilateral subclavian arteries and common carotid arteries, the SNRs and the CNR of Dark-blood-DLR images were significantly higher than those of Dark-blood-HIR images. And for bilateral common carotid arteries, the CNR of DLR presented higher quantitative scores than HIR for both delayed and dark-blood phases (all  $p < 0.001$ ). CTA images processed with dark-blood technique presented higher quantitative scores superior to conventional CTA images (all  $p < 0.001$ ). The average vessel wall thickness of carotid arteries measured on dark-blood phases were thicker than delayed phases (all  $p < 0.001$ ). And the highest ICC value between two raters was obtained on Dark-blood-DLR image (ICC 0.958).

#### **CONCLUSION**

s Compared to HIR, dark blood method combined with DLR reconstruction improved CTA image quality, and enhanced the visualization of thickened vessel wall of TAK patients.

#### **CLINICAL RELEVANCE/APPLICATION**

Dark blood method combined with DLR reconstruction is conducive to rapid and accurate measurement of vessel wall thickness.

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## Abstract Archives of the RSNA, 2023

S3B-SPBR

### Breast Imaging Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPBR-1 Evaluation of a Deep-Learning Based Software Tool to Automatically Detect and Quantify Breast Arterial Calcifications on Digital Mammography**

##### Participants

Bilel Ben Jedidia, Champs Sur Marne, France (*Presenter*) Nothing to Disclose

##### PURPOSE

Breast arterial calcification (BAC) has been identified as an independent cardiovascular risk factor but is not routinely documented in mammography reports, partially because manually scoring by radiologists can be time-consuming. The aim of this study was to evaluate an artificial intelligence (AI) software that automatically detects and quantifies BAC.

##### METHODS AND MATERIALS

Women who underwent both 2D mammography and thoracic CT from 2009 to 2018 were retrospectively included in this single-center study. A deep learning based software (iCAD, Nashua, NH, USA) was used to automatically detect and quantify BAC with a 0 to 10 point BAC AI score. Results were compared with a previously described BAC manual score based on radiologists' visual quantification of BAC on the mammogram. Coronary Artery Calcium (CAC) score was manually evaluated using a 12-point scale on CT. Diagnostic performance of marked BAC AI score (defined as a BAC AI score = 5) for the detection of marked CAC (CAC score = 4) was analyzed. R software version 4.0.2 was used to perform the analysis.

##### RESULTS

502 women (mean age: 62 years  $\pm$  16) were included. BAC AI score was highly correlated with BAC manual score (Spearman's correlation 0.83,  $p < 0.01$ ). Marked BAC AI score for the detection of marked CAC had a sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 32.7%, 96.1%, 71.2%, 83.1% and 81.9%, respectively. Marked BAC AI score was associated with marked CAC with an adjusted odds ratio of 12.139, (95% CI 11.92-12.35,  $p < 0.001$ ).

##### CONCLUSION

Automatic BAC AI score shows a very strong correlation to manual BAC scoring. Marked BAC AI score is associated with marked CAC (CAC score = 4).

##### CLINICAL RELEVANCE/APPLICATION

Automatic BAC AI score could be a useful tool to promote the integration of BAC in the mammography report and improve awareness of a woman's cardiovascular risk status.

#### **S3B-SPBR-2 Comparison of Supplemental Screening with Artificial Intelligence and Breast Ultrasound in Women with Dense Breast**

##### Participants

Su Min Ha, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

Whether using artificial intelligence (AI) system for screening mammography in women with dense breasts can replace supplemental breast ultrasound (US) is not well known. This study aimed to assess the value of supplemental US and AI with screening mammography in women with dense breasts.

##### METHODS AND MATERIALS

A retrospective database search identified consecutive asymptomatic women who underwent digital mammography (DM) and supplemental screening US between January 2017 and December 2018. AI software was applied for mammography, and four-view heat maps with a representative abnormality score per breast were evaluated. A BI-RADS category =3 on US and maximum abnormality score =10 on AI were considered positive results. The cancer detection rate (CDR) per 1000 examinations, sensitivity, specificity, and abnormal interpretation rate (AIR) were estimated and compared.

##### RESULTS

Among 5708 women (mean age  $\pm$  standard deviation: 52.4  $\pm$  7.9), 33 cancers (13 ductal carcinoma in situ and 20 invasive carcinoma) were found. DM alone showed CDR of 2.8 (16/5708; 95% CI: 1.7, 4.5), sensitivity of 48.5% (16/33; 95% CI: 32.5, 64.8), specificity of 94.3% (5350/5675; 95% CI: 93.6, 94.9) and AIR of 6.0% (341/5708; 95% CI: 5.4, 6.6). DM combined with AI showed a CDR of 3.2 per 1000 examinations (18/5708; 95% CI: 1.9, 4.9), sensitivity of 54.5% (18/33; 95% CI: 38.0, 70.2), specificity of 95.3% (5409/5675; 95% CI: 94.7, 95.8) and AIR of 5.0% (284/5708; 95% CI: 4.4, 5.6). DM combined with US yielded a CDR of 5.3 per 1000 examinations (30/5708; 95% CI: 3.6, 7.5), sensitivity of 90.9% (95% CI: 30/33; 95% CI: 76.4, 96.9), specificity of 77.6% (4401/5675; 95% CI: 76.5, 78.6), and AIR of 22% (1304/5708; 95% CI: 21, 24). CDR and sensitivity of DM with supplemental US

were significantly higher than that of DM alone ( $P < .001$ ), but with higher AIR and lower specificity ( $P < .001$ ). DM with AI showed higher specificity ( $P = .001$ ) with lower AIR ( $P = .002$ ) than DM alone, however with comparable CDR and sensitivity ( $P = .157$ ). AI correctly identified one invasive lobular cancer missed by DM and US. US alone detected additional 10 cancers, of which 90% were stage 0 ( $n=4$ ) and stage I ( $n=5$ ) invasive cancers, all node negative.

## CONCLUSION

s DM with supplemental US showed higher cancer detection ability than with supplemental AI in women with dense breasts. Supplemental US detected additional early-stage cancers in women with dense breasts without AI recall.

## CLINICAL RELEVANCE/APPLICATION

The combined use of digital mammography with artificial intelligence cannot replace supplemental breast US in women with dense breasts yet.

### S3B-SPBR-3 Bias-Free Artificial Intelligence: Developing a Deep Learning Algorithm for Diverse Racial Populations in Breast Cancer Diagnosis

Participants

Dogan Polat, MD, Dallas, TX (*Presenter*) Nothing to Disclose

## PURPOSE

This study aimed to develop a deep learning (DL) algorithm to facilitate automated diagnosis of breast cancer using mammography.

## METHODS AND MATERIALS

The algorithm was trained on a total of 136,172 mammograms that includes an isolated partition of Optimam ( $n=103472$ ), DDSM ( $n=2812$ ), and multiple single and multi-institution datasets across southeast Asia, Africa, South America, and Europe ( $n=29888$ ). The algorithm was then tested on 9304 cases [Optimam ( $n=8980$ ) and independent blinded single institution ( $n=324$ )]. Cancers comprised 34.7% ( $n=3226$ ) of 9304 mammograms (23.6% invasive, 8.7% DCIS and 2.5%, unknown types), while 65.3% ( $n=6078$ ) were benign/negative. Race was stratified into five categories: white ( $n=6943$ , 74.6%), Asian ( $n=555$ , 6%), black ( $n=411$ , 4.4%), other ( $n=235$ , 2.5%), and unavailable/withheld ( $n=1160$ , 12.5%). Chi-square tests compared categorical variables, while t-tests and ANOVA compared area under the curve (AUC) of the model for different groups and means. ROC curves are compared in pairwise manner using pROC library in R.

## RESULTS

Mean patient age was 61.1 (SD±7.7). While lesion type information either was not available or negative for 5604 (60.2%) patients, 2544 (27.3%) presented as soft tissue abnormality and 1156 (12.4%) as calcifications. The algorithm achieved AUC of 0.91, 0.95 sensitivity, 0.55 specificity, 0.92 negative predictive value (NPV) and 0.66 positive predictive value (PPV). When stratified by lesion type, the algorithm performed better in characterizing soft tissue lesions [compared to calcification and other lesion types with following parameters AUC, sensitivity, specificity, NPV and PPV: 0.87, 0.9, 0.59, 0.48, 0.93 vs 0.71, 0.8, 0.49, 0.55, 0.76, 0.71 ( $p < 0.001$ )]. Similarly, better diagnostic performance was achieved in detecting invasive cancer than DCIS (AUC 0.87 vs. 0.72,  $p < 0.001$ ), and cancer size  $>20\text{mm}$  vs  $<5\text{mm}$  (AUC 0.87 vs 0.77, respectively  $p < 0.001$ ). Performance was comparable across racial groups with the following AUC, sensitivity, specificity, NPV, and PPV: White (0.90, 0.86, 0.76, 0.92, 0.63), Black (0.92, 0.89, 0.75, 0.96, 0.54), Asian (0.89, 0.86, 0.75, 0.94, 0.54), Other (0.91, 0.85, 0.82, 0.95, 0.59), and Unknown (0.90, 0.90, 0.75, 0.82, 0.86). All racial groups were compared to global AUC and found no significant difference ( $p=1$  for each).

## CONCLUSION

s The algorithm's performance on datasets comprising diverse racial populations is comparable to that of breast radiologists, tested on datasets that include cases representative of real-world clinical settings.

## CLINICAL RELEVANCE/APPLICATION

The mammography DL algorithm showed high diagnostic performance across diverse datasets, comparable to US screening benchmarks, promising for large-scale screening triaging.

### S3B-SPBR-4 Simulating Synthetic Post-contrast Breast MRI from Single Pre-contrast MRI Sequence Using Deep Learning Model

Participants

Su Min Ha, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the feasibility of deep learning model for simulated post-contrast T1-weighted breast MR images generated using single pre-contrast MR image in patients with breast cancer. In addition, to validate the deep model network implemented with five pre-contrast sequences including T2-weighted and diffusion-weighted imaging.

## METHODS AND MATERIALS

In this retrospective study, 363 women with breast cancer and contrast-enhanced breast MRI were identified between June 2019 and December 2019 at a single academic institution. An Extra-Dimensional U-net with visual geometry group was developed to simulate T1-weighted post-contrast images from single pre-contrast T1-weighted images. A total of 330 cases were used for the training set and 24 cases were used for validation set. In addition, we externally validated the deep learning model using five pre-contrast sequences (T1-weighted non-fat suppressed [FS], T1-weighted FS, T2-weighted FS, apparent diffusion coefficient, and diffusion-weighted imaging) [[https://github.com/ecalabr/breast\\_simulated\\_gad](https://github.com/ecalabr/breast_simulated_gad)]. Performance was evaluated qualitatively regarding lesion visibility and five point scale (5: excellent, 4: good, 3: acceptable, 2: poor and 1: unacceptable), and also quantitatively with metrics including peak signal to noise ratio (PSNR) and SSIM (structural similarity index).

## RESULTS

The validation set of 24 MRI examinations in 24 women (mean age, 56 years; range, 43-73 years) were evaluated. There were 23 invasive ductal carcinoma, 1 ductal carcinoma in situ; 19 masses and 1 non-mass, 4 mass with nonmass lesions (mean size, 2.2cm; range, 1.1-7.0cm). With our model, 63% (15/24) were visible and were rated 50% (12/24) good or excellent or acceptable and 50%

(12/24) unacceptable or poor. In comparison, with the open-source deep model, 70% (17/24) lesions were visible and rated 46% (11/24) good or excellent or acceptable, and 54% (13/24) unacceptable or poor. With our developed model, simulated post-contrast T1-weighted breast MR images showed PSNR of 27.10 and SSIM of 0.87.

## CONCLUSION

Our developed model using single pre-contrast T1-weighted imaging is capable of producing the simulated post-contrast MR image, and is comparable to outcomes using suggested deep learning model.

## CLINICAL RELEVANCE/APPLICATION

There is increasing need for non-contrast breast MRI for cancer detection due to gadolinium retention and more accessibility of breast MRI.

### S3B-SPBR-5 Machine Learning-based Texture Analysis of Axillary LNs Using 3-T MRI for Predicting LN Metastasis in Breast Cancer

#### PURPOSE

This study aimed to determine whether texture analysis for 3-T magnetic resonance imaging (MRI) in axillary lymph nodes (LNs) can predict LN metastasis in breast cancer.

#### METHODS AND MATERIALS

This retrospective study included 204 patients who underwent breast and axillary surgery for breast cancer between March 2022 and December 2022. We assessed common features of axillary LNs, including clinicopathologic features and MRI assessment by radiologists, as well as texture features of axillary LNs on contrast-enhanced T1-weighted images using commercial software based on PyRadiomics. The index LN was determined as the LN with the largest cortical thickness. Logistic regression with feature selection was used to reduce the dimensionality of the data (14 clinicopathologic and 869 texture features). Using the selected features, we trained an XGBoost classifier to build common, radiomics, and combined common and radiomics models for predicting LN metastasis. The diagnostic performance of predictive models for LN metastasis was compared by using generalized estimating equation analysis.

#### RESULTS

Of the 204 women, 47 (23%) were diagnosed with LN metastases. The XGBoost classifier with common features, including clinicopathologic and MRI assessment, showed the lowest diagnostic performance (accuracy and area under the receiver operating characteristic curve [AUC], 73.81% and 0.846). The radiomics and combined common and radiomics model with the XGBoost classifier showed better diagnostic performance than that the analysis of common features alone (accuracy and AUC, 90.48% and 0.939, 90.48% and 0.939 vs. 73.81% and 0.846,  $p < 0.05$ ). In addition, the combined common and radiomics model showed a positive predictive value of 100% for predicting LN metastasis.

## CONCLUSION

Texture analysis using an XGBoost classifier for axillary LNs on 3-T MRI may be a useful tool in predicting LN metastasis in patients with breast cancer.

## CLINICAL RELEVANCE/APPLICATION

Machine learning-based texture analysis of axillary LNs using 3T-MRI can help predict axillary LN metastasis and potentially de-escalate axillary surgery in patients with breast cancer.

### S3B-SPBR-6 Artificial Intelligence Helps General Radiologists and Breast Imaging Specialists Find Challenging-to-Detect Cancers

#### Participants

Jiye Kim, PhD, Cambridge, MA (*Presenter*) Employee, RadNet, Inc  
Bryan Haslam, PhD, Cambridge, MA (*Presenter*) Employee, RadNet, Inc

#### PURPOSE

There is growing evidence that AI helps radiologists detect more breast cancers in screening mammography. However, there has been little explanation of how AI helps radiologists with varying levels of specialty. Here, we investigated how AI for DBT helps general radiologists and breast imaging specialists detect breast cancer lesions with varying degrees of how challenging the cancers are to detect.

#### METHODS AND MATERIALS

Following an IRB approved protocol, a reader study was conducted to evaluate the interpretative performance of 18 radiologists including 9 general radiologists and 9 breast imaging specialists. Each reader read 240 retrospectively collected DBT screening exams (100 cancers and 140 non-cancers) once with and once without the aid of AI. General radiologists' and breast imaging specialists' performance, as measured by AUC, were examined with vs without AI. Additionally, cancer exams were sorted by degree of difficulty in two different ways. First, the cancer exams were grouped by the BIRADS assessment given at the time of original clinical interpretation: a) recalled cancers ( $n = 67$ ) were those given a BIRADS 0 and b) non-recalled cancers ( $n = 33$ ) were those given a BIRADS 1 or 2. The non-recalled exams are considered more difficult given that these are the clinically "missed" exams where the interpreting radiologist at the time of exam acquisition deemed there were no suspicious findings for a recall. Second, the cancer exams were subdivided into a) harder ( $n = 16$ ), b) medium ( $n = 11$ ) and c) easier ( $n = 73$ ) cancer cases based on the proportion of the readers in the study that recalled the exam when reading without the aid of AI ( $< 50\%$  recalled,  $50\%$  to  $75\%$  recalled, and  $> 75\%$  recalled, respectively).

#### RESULTS

Overall, both general radiologists (AUC increase of 0.075) and breast imaging specialists (AUC increase of 0.050) demonstrated improved performance when reading with AI than without AI. Across both methods of sorting the cancer exams by difficulty, there were greater improvements with AI when radiologists interpreted more challenging (AUC increase for non-recalled: 0.100, harder: 0.176 and medium: 0.110) than less challenging cancers (recalled: 0.040 and easier: 0.027). The largest boost in performance was

observed for general radiologists on the harder cancers with an AUC improvement of 0.186.

## CONCLUSION

s AI helped both general radiologists and breast imaging specialists improve cancer detection performance overall and to a greater extent for the more challenging cancer cases.

## CLINICAL RELEVANCE/APPLICATION

AI for screening DBT helps radiologists with varying levels of specialty, especially on difficult to detect cancers that would likely go undetected until a future exam, suggesting that AI may help detect these cancers earlier.

### S3B-SPBR-7 Examining the Potential of ChatGPT to Derive Differential Diagnoses from Transcribed Radiological Findings in Breast and Ultrasound Imaging

Participants  
Shawn Sun, MD, MS, Anaheim, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the accuracy and reliability of ChatGPT3.5 and ChatGPT4 in producing a differential diagnosis from transcribed radiological findings of breast and ultrasound radiology cases.

## METHODS AND MATERIALS

A sample of 25 breast and ultrasound imaging cases were selected from a radiology textbook, from which the answers were used as the gold standard. The case images and history were converted into standardized prompts that contained purely descriptive language of the cases and a query for the most likely diagnosis, top three differential diagnoses, and the corresponding explanations and references from the medical literature. These prompts were fed into the ChatGPT3.5 and ChatGPT4 algorithms. Generated responses were analyzed for accuracy by comparison with the original literature and reliability through manual verification of the generated explanations and citations. The top 1 accuracy and the top 3 accuracy were defined as the percentage of generated responses that matched the original diagnosis and the complete differential provided by the original literature. An additional differential diagnosis score was defined as the proportion of differentials that matched the original literature's answers for each case. Comparisons were made between the results of the two algorithms using a one-tailed two proportion z-test method.

## RESULTS

The top 1 accuracy and top 3 accuracy, for ChatGPT3.5 versus ChatGPT4 were 32% compared to 40% ( $p=0.28$ ) and 8.0% compared to 12.0% ( $p = 0.32$ ), respectively. The average differential diagnosis score of ChatGPT3.5 versus ChatGPT4 was 38.9% compared to 45.2% ( $p=0.33$ ). ChatGPT3.5 and ChatGPT4 hallucinated 32.0% versus 8.0% ( $p=0.017$ ) of the references provided and generated 6 total false statements versus 2 total false statements, respectively.

## CONCLUSION

s The ChatGPT algorithms were able to produce a differential diagnosis for prompts containing descriptive radiological findings. The responses matched the expert literature from which the cases originated a minority of the time, though a non-statistically significant improvement was made in the accuracy categories from 3.5 to the 4th generation algorithm. The renowned hallucination effect appeared more frequently in generated citations compared to algorithm-produced statements, with both showing improvement in the latest generation.

## CLINICAL RELEVANCE/APPLICATION

ChatGPT and Large Language Models (LLM) possess considerable potential to transform clinical and educational medicine. Awareness of their accuracy and potential for mistakes will contribute to a more comprehensive understanding of the limitations of such new tools.

### S3B-SPBR-8 Improving Artificial Intelligence (AI) Risk Assessment with Multiple Imaging Modalities and Prior Imaging Data

Participants  
Eliana Goldberg, MD, Bronx, NY (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study is to evaluate the efficacy of multimodal AI algorithms (full field digital mammography (FFDM)/digital breast tomosynthesis (DBT), breast ultrasound (US) and prior imaging) into breast cancer risk assessment models

## METHODS AND MATERIALS

Our IRB-approved research utilized a multimodal AI system trained on a dataset of FFDM, DBT, and US exams. These exams were conducted between 2010 and 2020, involving 1,964,416 exams on 324,978 patients. We used a patient-based 60-10-30 split for training/validation/testing. The testing dataset comprised FFDM/DBT/US from patients not included in the training/validation sets, with histopathology/imaging stability as reference standard. The AI risk model was designed to predict cancer risk at multiple time points: 1 year, 3 years, 5 years, and 10 years based on imaging alone. We compared the model's AUROC, sensitivity, and specificity for each risk assessment interval. We also compared 10-year risk assessments to Tyrer-Cuzick (TC) scores.

## RESULTS

On a test set of 29,845 patients (average age 59.1, standard deviation 11.09, 74,024 exams), 3.05% (910/29845) were diagnosed with breast cancer within 10 years. The AI model achieved AUROC for breast cancer risk assessment as follows: 0.888 (1 year), 0.804 (3 years), 0.770 (5 years), and 0.760 (10 years). Sensitivity was 71.5% (1 year), 52.3% (3 years), 44.0% (5 years), and 40.7% (10 years). For women with dense breasts, AI model AUROC was 0.876 (1 year), 0.779 (3 years), 0.750 (5 years), and 0.739 (10 years). Sensitivity was 69.8% (1 year), 50% (3 years), 42.7% (5 years), and 39.8% (10 years). For women with non-dense breasts, model AUROC was 0.896 (1 year), 0.822 (3 years), 0.781 (5 years), and 0.774 (10 years). Sensitivity was 72.2% (1 year), 52.8% (3 years), 43.1% (5 years), and 39.5% (10 years). Specificity was held constant at 90% for model binarization thresholds. On a random subset of 134 patients with cancer and non-cancer patients, model AUROC was 0.826 (10 years), while TC scores

was 0.644 (10 years). When patients were binarized into high or low risk, AI was more informative than was TC. For example, patients who were assessed as TC high risk but AI low risk had a low incidence of cancer (18.9%; 7/37), whereas patients who were assessed as TC low risk and AI high risk had a high incidence of cancer (89.1%; 33/37).

## **CONCLUSION**

s Multimodal breast cancer risk assessment based on FFDM/DBT, US imaging and prior examinations outperforms standardized risk cancer assessment.

## **CLINICAL RELEVANCE/APPLICATION**

Integrating multiple imaging modalities and prior imaging into AI breast cancer risk assessment models enhances performance, enabling the development of a personalized, data-driven, and evolving screening schedule based on an individual's risk profile over time.

## **S3B-SPBR-9 Self-Supervised Pretrained Vision Transformers for Breast Ultrasound Classification**

### **PURPOSE**

Develop a deep learning model for automated breast ultrasound classification. For computer vision tasks such as this one, convolutional neural networks (CNN) have been the gold standard. Here we study the application of Vision Transformers (ViT) for breast ultrasound classification. Specifically, we examine how the performance of ViT can be improved with self-supervised pretraining.

### **METHODS AND MATERIALS**

A total of 647 breast ultrasound images were collected. A label of either benign or malignant was given to each image by radiologists. Malignant cases were validated with histopathologic results from subsequent fine needle aspiration biopsies. The final dataset included 437 benign and 210 malignant US images (PMID: 31867417). The ViT explored in this study consists of 12 transformer encoder layers with 12 multi-attention heads. First the images are tokenized into patches. The patches are linearly projected and combined with positional encodings before input into the sequence of transformer encoders. We study three pretraining paradigms: random weight initialization, supervised pretraining on ImageNet, and self-supervised pretraining on ImageNet. In supervised learning, annotated labels are used during pretraining. In self-supervised learning, representations are learned without any explicit labels; instead, supervisory signals are derived from the data itself. After the models are pretrained, one fully connected layer is added on top of each model and trained to perform binary classification.

### **RESULTS**

We evaluate our models using five-fold cross validation. The ViT with random weight initialization achieves an AuROC of  $0.67 \pm 0.08$ . The supervised pretrained ViT achieves an AuROC of  $0.88 \pm 0.04$ . The self-supervised pretrained ViT achieves an AuROC of  $0.92 \pm 0.02$ . Visualization of the self-attention heat maps show that the self-supervised ViT can learn semantic segmentation information without any explicit segmentation masks.

## **CONCLUSION**

s We show that self-supervised pretraining offers a performance boost compared to supervised pretraining ViT for breast ultrasound classification. Overall, our results show that with the advances being made in deep learning, it may be worthwhile to renew the discussion on the role of ultrasound in screening for breast cancer.

## **CLINICAL RELEVANCE/APPLICATION**

In the context of breast cancer screening, mammography is the gold standard. Breast ultrasound, despite being widely available and posing no radiation risk, is limited by a high rate of false positives, operator dependency, and a growing shortage of (breast) radiologists. However, advances in deep learning can potentially mitigate these limitations.

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## Abstract Archives of the RSNA, 2023

S3B-SPCA

### Cardiac Imaging Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPCA-1 Inferior Left Atrial Diverticulum Communicating with the Right Atrium or Inferior Vena Cava: CT and Clinical Features**

##### **PURPOSE**

Interatrial communications in atypical locations are found at CT. However, information on imaging findings of atypical or nonseptal communications between two cardiac atria has not been known to dates. The purpose of this study was to evaluate the prevalence, location, size and morphological characteristics of left trial (LA) diverticula communicated with right atrium on cardiac CT.

##### **METHODS AND MATERIALS**

This retrospective study included 222 consecutive patients who underwent cardiac computed tomography and showed incidental inferior LA diverticula (ILAD). The prevalence, number, size, morphological characteristics and location of ILAD communicating with the right atrium or inferior vena cava were analyzed. Shunts were defined as anatomical defects between the two structures with or without visible contrast flow or attenuation step up.

##### **RESULTS**

The prevalence of ILAD with shunt was 9.9% (22/222) among ILADs. Shapes of ILAD with shunt were tubular (n = 12, 54.5%), saccular (n = 8, 36.3%), and network-like appearance (n = 2, 9.1%). Mean ostial diameter of ILAD and mean size of shunt were 6.4 mm, 4.9 mm, respectively. Of the 22 patients, 7 (31.8%) had two or more shunts.

##### **CONCLUSION**

s Cardiac CT helps to detect a new type of interatrial communications which can mimic classical atrial septal defects. Although their clinical significance remains unclear, radiologists should be aware of them and report their findings.

##### **CLINICAL RELEVANCE/APPLICATION**

Our study is the first study to visually assess the category using ECG gated cardiac CT for LA diverticulum with shunt to RA.

#### **S3B-SPCA-2 Cardiac CT-derived Global and Regional Epicardial Adipose Tissue Contributes to Atrial Fibrillation in Patients without Left Atrial Myopathy as Defined by Endocardial Voltage Mapping**

##### **PURPOSE**

Atrial myopathy contributes to the pathogenesis of atrial fibrillation (AF), but many AF patients have no obvious atrial myopathy. Epicardial adipose tissue (EAT) has recently been shown to be greater in AF patients than those without AF. Our aim was to assess the relationship of EAT in AF patients with/without atrial myopathy defined by endocardial voltage mapping.

##### **METHODS AND MATERIALS**

75 AF patients with cardiac CT prior to pulmonary vein ablation were prospectively enrolled. Left atrial (LA) endocardial voltage mapping was performed in all patients. Left atrial myopathy was defined as the sum of all low voltage (<0.5mV) areas (LVA) exceeding 5% of total LA surface area. AF patients were assigned to either LVA- (<5% LVA) or LVA+ (=5% LVA) groups. 48 age-, sex- and BMI-matched patients without AF and structural heart disease/coronary artery disease, who had undergone cardiac CT, were identified as a control group. Total, LA and right atrial (RA) EAT were quantified on CT using fat density thresholding (-195 to -30 HU) after segmenting areas of interest using standard 3D post-processing software. Differences between groups were assessed using one-way ANOVA and relationships were assessed using correlation analysis. Inter-observer variability of EAT analysis was assessed with correlation analysis and Coefficient of Variance (CV) using random subset of 35 AF patients.

##### **RESULTS**

LVA- patients (n=50; 6% f) were younger than LVA+ patients (n=25; 44% f). BMI correlated with total EAT (Spearman r 0.50; p<.01), LA EAT (r 0.47; p<.01) and RA EAT (r 0.41; p<.01) in AF patients and similarly in controls. Between LVA+ and LVA- AF patients, there was no significant difference for total EAT (89.1±41.1cm<sup>3</sup> vs 83.5±31.1cm<sup>3</sup>; P=.5), LA EAT (9.9±5.8cm<sup>3</sup> vs 8.9±3.5cm<sup>3</sup>; P=.6) and RA EAT (7.4±3.8cm<sup>3</sup> vs 7.5±3.1cm<sup>3</sup>; P=.9). Compared to controls, LVA- patients had greater total EAT (80.1±29.3cm<sup>3</sup> vs 56.5±22.1cm<sup>3</sup>; p<.001), greater LA EAT (8.9±3.5cm<sup>3</sup> vs 4.5±1.9cm<sup>3</sup>; p<.001) and greater RA EAT (7.5±3.1cm<sup>3</sup> vs 4.9±2.0cm<sup>3</sup>; p<.001). There was good agreement for total EAT (r=0.99), LA EAT (r=0.98) and RA EAT (r=0.98) between observers (all p<.001) with CV of 3.5%, 6.4% and 6.2% respectively.

##### **CONCLUSION**

s EAT does not differ between AF patient with or without LA myopathy, but EAT is significantly greater among AF patients without LA myopathy compared to controls without AF. These findings suggest that EAT may contribute to the pathogenesis of AF even in the absence of LA myopathy. Strategies to monitor and reduce EAT may help to improve rhythm control in these patients.

## CLINICAL RELEVANCE/APPLICATION

Increased EAT volume may play an important role in AF pathogenesis in patients without LA myopathy; further studies should analyse the effect of EAT reducing treatment and downstream effects on AF incidence.

### S3B-SPCA-3 Metabolic Syndrome is Associated with Impaired Left Atrial and Left Ventricular Deformation and Abnormal Atrioventricular Interaction in Patients with Myocardial Infarction

Participants  
jing liu, MD, Chengdu, China (*Presenter*) Nothing to Disclose

#### PURPOSE

Metabolic syndrome (MetS) is a cluster of cardiovascular risk factors that predicts poor short - or long-term outcomes in patients with myocardial infarction (MI). However, the potential mechanisms influencing prognosis are still unclear. Thus, this study aimed to determine the effect of MetS on left atrial (LA) and left ventricular (LV) deformation and abnormal atrioventricular interactions in MI patients.

#### METHODS AND MATERIALS

A total of 181 MI patients, including 119 without MetS (MI [MetS-]) and 62 with MetS (MI [MetS+]), and 58 controls who underwent 3.0 T cardiac magnetic resonance (CMR) were included. LA ejection fraction [LAEF] and deformation indices (reservoir, conduit, and booster pump function) and LV deformation parameter (global peak radial, circumferential, and longitudinal strain [PS]) based on CMR three-dimensions feature tracking were measured and compared among groups. Correlations of MetS and LV deformation and geometry with LA functional indices were assessed by multivariable linear regression analysis.

#### RESULTS

LA reservoir function (total EF and total strain) and conduit function (passive strain) and LV deformation parameters (radial, circumferential, and longitudinal PS) significantly decreased from the control group, through the MI (MetS-), to MI (MetS+) group (all  $P < 0.05$ ). Compared with controls, the booster pump function (active EF and active strain) was decreased in the MI (MetS+) group (all  $P < 0.05$ ) but preserved in the MI (MetS-) group. Furthermore, multivariate linear regression demonstrated that MetS was independently associated with total and active LAEF, total and passive strain ( $\beta = -0.172$  to  $-0.200$ , all  $P < 0.05$ ) in MI patients; LA reservoir and conduit function were independently associated with LV circumferential PS ( $\beta = 0.230$  to  $0.394$ , all  $P < 0.05$ ) and longitudinal PS ( $\beta = 0.189$  to  $0.354$ , all  $P < 0.05$ ), LA passive strain and strain rate were independently associated with LV mass ( $\beta = -0.178$  and  $-0.298$ , all  $P < 0.05$ ).

#### CONCLUSION

s Coexisting MetS may exacerbate the adverse effects of MI on LA and LV dysfunction. LV circumferential and longitudinal PS are stable predictors of LA three-phasic function; LV hypertrophy is independently associated with LA conduit function.

## CLINICAL RELEVANCE/APPLICATION

These results suggest that metabolic disorders may be important in managing patients with myocardial infarction.

### S3B-SPCA-4 MRI Evaluation by T1 Mapping of the Post Myocardial Infarction Left Ventricular Thrombus

#### PURPOSE

The objective of this study is to evaluate the post myocardial infarction left ventricular thrombus on cardiac MRI by measuring its T1 mapping value, thus to determine the age of thrombus.

#### METHODS AND MATERIALS

This observational retrospective study was performed on all patients scheduled for 3.0 Tesla cardiac MRI post myocardial infarction on our institution from January 2015 to December 2022. 35 patients with a left ventricular thrombus that may be measurable on T1 mapping sequence were included. They were separated in two groups depending on the period of time between the infarct and the MRI - less than three months: group A; more than three months: group B. T1 mapping value was measured for all thrombi.

#### RESULTS

T1 of thrombi was  $1098 \pm 61$  ms in group A and  $1316 \pm 75$  ms in group B,  $p < 0.001$ . T1 of the myocardium was  $1224 \pm 73$  ms in group A and  $1254 \pm 48$  ms in group B,  $p = 0.139$ . T1 of the blood pool was  $1934 \pm 137$  ms in group A and  $2008 \pm 124$  ms in group B,  $p = 0.135$ .

#### CONCLUSION

s Recent thrombi had shorter mapping T1 than old thrombi.

## CLINICAL RELEVANCE/APPLICATION

This method represents a new approach for the age and the maturity of left ventricular thrombus. It provides complementary information for the recommendations of imaging control and anticoagulation therapy.

### S3B-SPCA-5 STEMI Patients: Who Gets What Imaging

#### PURPOSE

Our study aims to determine if hospital and patient characteristics affect what type of imaging modality ST elevated myocardial infarction (STEMI) patients receive.

#### METHODS AND MATERIALS

The National Emergency Department Sample (NEDS) database was retrospectively queried for patients with a primary diagnosis of STEMI. Logistic regression was used to determine the likelihood of receiving ultrasound and fluoroscopy based cardiac imaging with respect to hospital characteristics such as region, teaching status, and trauma level designations. We also looked at patient characteristics including hypertension, hyperlipidemia, and tobacco usage.

## RESULTS

Of the 175,700 patients with a primary diagnosis of STEMI, most were white (74.1%), seen at a non-trauma hospital (49.7%), and insured through medicare (44.8%). Female patients were less likely to get fluoroscopy imaging (OR: .927, 95%CI .871 - .987) than male patients. Black patients were also less likely to get fluoroscopy imaging relative to white patients (OR: .711, 95%CI .583 - .869). Patients with private insurance and patients at teaching hospitals were more likely to get fluoroscopy relative to medicare patients (OR: 1.211, 95%CI 1.069 - 1.371) and patients at non teaching hospitals (OR: 1.563, 95%CI 1.133 - 2.155). Patients at trauma hospitals level 1-3 were more likely to get fluoroscopic cardiac imaging compared to non trauma hospitals: Level 1 (OR: 1.593, 95%CI 1.022 - 2.486), Level 2 (OR: 2.489, 95%CI 1.813 - 3.417), Level 3 (OR: 2.216 95%CI 1.544 - 3.180) Patients with private insurance were more likely to get ultrasound cardiac imaging compared to medicare patients (OR: 1.165, 95%CI 1.025 - 1.325). Trauma level had no effect on patients receiving ultrasound cardiac imaging compared to non trauma: Level 1 (OR: 1.548, 95%CI 0.856 - 2.801), Level 2 (OR: 1.548, 95%CI 0.796 - 2.266), Level 3 (OR: 0.941 95%CI .559 - 1.583)

## CONCLUSION

We found that females and black patients are less likely to receive fluoroscopy imaging relative to male and white patients, respectively. While ongoing gender and race disparities may play a role in these findings, further studies are needed to fully elucidate this relationship. Additionally, private insurance beneficiaries are more likely to get imaged with fluoroscopy. Proximity to hospitals with imaging capabilities and better access to resources may play a role in our findings

## CLINICAL RELEVANCE/APPLICATION

Hospitals and clinicians need to re-evaluate their imaging algorithm for black and female patients. We also found that type of insurance and teaching hospital drastically affects likelihood of receiving fluoroscopy. These findings indicate a deeper health inequality that hospitals and physicians should address together in order to make healthcare more equitable

### S3B-SPCA-6 STEMI Patients: Can Imaging Predict Cost of Stay and Mortality?

#### PURPOSE

Our study aims to determine if imaging modality can predict cost of stay and mortality in patients who have a primary diagnosis of ST elevated myocardial infarction (STEMI).

#### METHODS AND MATERIALS

The national emergency department sample (NEDS) database was retrospectively queried for patients who had a primary diagnosis of STEMI. A multivariate linear regression model was used to account for key clinical covariates including age, sex, race, insurance status, income quartile, teaching status, trauma level, and cardiac risk factors such as tobacco use, coronary artery disease, and hyperlipidemia to determine cost associated with cardiac imaging. Primary outcomes focused on cost associated with use of CT, MRI, fluoroscopy, and ultrasound. A secondary analysis, with the same multivariate model, was performed to determine if certain imaging corresponded to increased odds of death.

## RESULTS

Of the 175,700 patients, in our analysis, that presented to the emergency department with a primary diagnosis of a STEMI, most were female (69.3%), white (74.1%), and had a median income in the 1st quartile (29.4%). There was increased cost associated with all cardiac imaging modalities (relative to patients who did not receive an imaging modality); fluoroscopy (B: 27,630, 95%CI 15,748-39,311), CT (B: 32,757, 95%CI 4,036-61,478), MRI (B: 397,766 380980-414,751), x-ray (24,740, 95%CI 6,426-43,055) and ultrasound (B: 25,492, 95%CI 14,150-36,834). Patients who got imaging with ultrasound (OR: 0.76, 95%CI 0.64-0.90) or fluoroscopy (OR: 0.45 95%CI 0.39-0.53) were less likely to die relative to patients who did not get imaged by those modalities. There was no difference in death rate in patients who were imaged with X-ray (OR:0.79, 95%CI 0.47-1.35) or CT scan (OR: 0.62, 95%CI 0.37-0.1.04).

## CONCLUSION

STEMI patients who get imaging pay significantly more than patients who do not get imaging. However, the use of x-ray or CT scan imaging does not necessarily lead to better outcomes, as shown in the death rates we have found. Each imaging modality is found to increase cost of stay in the tens of thousands of dollars, with MRI, being the exception, increasing cost of stay by hundreds of thousands of dollars.

## CLINICAL RELEVANCE/APPLICATION

Hospitals and clinicians should be encouraged to rethink what type of imaging they order for STEMI patients. Our study shows that CT and X-ray do not decrease mortality rate, while increasing cost of stay for patients by tens of thousands of dollars.

### S3B-SPCA-7 Diagnostic Accuracy of Dynamic Stress CT Myocardial Perfusion with Regadenoson for the Detection of Hemodynamically Significant Coronary Artery Disease

#### Participants

Cesar Urtasun Iriarte I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### PURPOSE

To assess the diagnostic performance of dynamic stress CT myocardial perfusion imaging (CT-MPI) in combination with coronary CT angiography (CCTA) to accurately identify hemodynamically significant coronary artery disease (CAD) compared to the gold standard (invasive coronary angiography, ICA; and invasive fractional flow reserve, iFFR).

#### METHODS AND MATERIALS

Between December 2019 and February 2023, 141 patients with suspected or known CAD underwent CCTA and dynamic stress CT-MPI employing regadenoson as stressor. The presence of hemodynamically significant coronary lesions was determined by CCTA (CAD-RADS=3) and CT-MPI (myocardial blood flow relative to remote myocardium<0.85) compared to CCTA alone, using angiographic severity and a iFFR of =0.80 as reference.

## RESULTS

A total of 141 patients (113 males, mean 64.8±10.1 years old, 24 with prior stent implantation) were evaluated. CCTA and CT-MPI



were positive in 67 (47.5%) and 50 (35.5%) patients, respectively. 43 patients (32 males, 65.6±11.1 years old; 93.3% with CAD-RADS =3) who underwent ICA were retained for the statistical analysis. Compared to ICA, the patient-based analysis of CCTA showed a sensitivity of 100%; specificity of 50%, negative predictive value (NPV) of 100% and a positive predictive value (PPV) of 92.5%. The approach comprising CCTA and dynamic stress CT-MPI increased the specificity (97.4%) and PPV (97.4%). The accuracy of the combination of the anatomical and functional techniques was also higher (97.7% vs 93%). Receiver operating curve (ROC) analysis showed improved discrimination accuracy for the combination of CCTA and CT-MPI (0.92; CI 0.74-1; p=0.001) compared with CCTA alone (0.75; CI 0.49-1; p=0.052).

#### **CONCLUSION**

s Dynamic stress CT-MPI with regadenoson offers incremental diagnostic value over CCTA alone for the detection of hemodynamically significant CAD.

#### **CLINICAL RELEVANCE/APPLICATION**

Dynamic stress CT-MPI is an easy-to-perform diagnostic examination technique which increases the specificity and diagnostic accuracy of CCTA alone for the detection of hemodynamically significant CAD.

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S3B-SPCH

### Chest Imaging Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPCH-1 Quantitative Analysis for Bronchiectasis using Artificial Intelligence-based Bronchial Tapering Ratio in Patients with Chronic Obstructive Pulmonary Disease**

Participants  
Hyejin Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Bronchiectasis (BE) is associated with loss of lung function and increased morbidity and mortality. CT is the standard method used to assess bronchiectasis but current imaging methods are limited in assessing the extent of bronchiectasis on CT scans. This study aimed to automatically quantify the extent of bronchiectasis based on an artificial intelligence (AI)-based analysis of bronchial tapering ratio on chest CT and assess the association of quantified bronchiectasis score and exacerbations in patients with chronic obstructive pulmonary disease (COPD).

#### **METHODS AND MATERIALS**

We analyzed the longitudinal cohort data of COPD patients from the Korean Obstructive Lung Disease (KOLD) cohort. The bronchiectasis score accounting the extent of abnormal tapering of inner lumen compared with the proximal airway (bronchial tapering ratio = 1.1, a measure of airway dilatation) in each patients on chest CT scans was analyzed. Quantified bronchiectasis score was correlated with visual analysis by two thoracic radiologists. Multivariable logistic analysis was performed to assess the association between the bronchiectasis score and pulmonary exacerbations on follow-up adjusted by demographics, pulmonary functional measure, and airway CT parameters.

#### **RESULTS**

Total 337 patients (median age, 66 years; 328 men [97%]) were included. Among the 337 patients, 210 (62%) had a history of a least one exacerbation. Bronchiectasis was present based on visual analysis in 148 (43.9%) patients and bronchiectasis score significantly increased as extent of bronchiectasis on visual analysis increased ( $P = .02$ ). During a median 5-year follow-up, the bronchiectasis score was a significant independent predictor of acute exacerbation (adjusted odds ratio [OR], 1.12 [95%CI: 1.03-1.22];  $P = .007$ ) along with wall area percentage on CT (OR, 1.03 [1.01-1.06];  $P = 0.02$ ) and forced expiratory volume in 1 s (OR, 0.98 [0.97-0.99];  $P = 0.002$ ) in multivariable analysis.

#### **CONCLUSION**

s In COPD, artificial intelligence-based CT measures of bronchiectasis based on bronchial tapering ratio were significant predictors for acute exacerbation.

#### **CLINICAL RELEVANCE/APPLICATION**

Evaluation of extent of bronchiectasis on chest CT using artificial intelligence-based bronchial tapering ratio were reliable and automatically quantified extent of bronchiectasis on CT had prognostic implications for COPD exacerbations.

#### **S3B-SPCH-2 Lymphatic Bubble Sign in Lung and Mediastinum: Special CT Feature for the Diagnosis of Pulmonary Lymphatic Malformation with Lymphatic-airway Leakage**

Participants  
MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the special CT feature of lymphatic bubble sign (LBS) on HRCT for the diagnosis of pulmonary lymphatic malformation (PLM) with lymphatic-airway or alveolar leakage.

#### **METHODS AND MATERIALS**

Eight hundred and ten patients diagnosed as PPL were collected in this retrospective study from January of 2006 to December of 2022, of which 62 cases with chylous phlegm and plastic bronchitis showed LBS in lung and/or mediastinum on HRCT or CT lymphography. The imaging features of LBS were blinded reviewed by two chest radiologists respectively, including the position, size, quantity, morphology, and dynamic changes of bubbles. All patients were followed up for HRCT within 1-6 months.

#### **RESULTS**

LBS was seen in 62 (7.7%) of 810 patients with PPL, which was located in pulmonary interstitium in 30 cases, paraloobar-fissure with thickening in 5 and mediastinal fat area in 12, both in 20 patients. ALL the LBS manifested multiple lesions, no wall or thin wall and round-like with smooth edges with a size of 3-10mm. A dynamic changes of this sign was showed in all patients with obvious improvement in 56 cases, aggravation 6 and recurrent occurrence in 25 patients on the 1-6 months follow-up CT. In addition, similar lesions were showed in chest wall, ribs and pleural cavity, respectively. The associated-accompanying lesions include ground

glass opacity, interlobular septal thickening, tree-in-bud, chylothorax, chylo-pericardium and mediastinal opacity. All the lesions is not related to thoracic puncture drainage or direct lymphangiography, but patients often have long-term medical history of dyspnea and chronic cough.

## CONCLUSION

s This sign indicates the formation of lymphatic and airway leaks in the lungs, with chylous leakage leading to chylous pneumonia and plastic bronchitis. However, the air in the airway pours back into the lymphatic vessels due to pressure changes and other reasons, forming the LBS. Chest CT has important value in displaying this sign and helps to determine PLMs and chylous leakage and providing strong evidence for clinical treatment.

## CLINICAL RELEVANCE/APPLICATION

LBS strongly favors a diagnosis of pulmonary lymphedema and lymphatic dilatation with lymphatic-airway or alveolar leakage and plastic bronchitis.

### S3B-SPCH-3 Template Matching Method for Accurate Quantification of Cystic Tissue Volume in CT Scans of Diffuse Cystic Lung Disease

Participants

Katie Noonan, BEng, MEng, Dublin, Ireland (*Presenter*) Nothing to Disclose

## PURPOSE

Diffuse Cystic Lung Disease (DCLD) is a broad term used to describe rare lung diseases characterised by the presence of air-filled cysts within the parenchyma of the lungs. Due to their relative scarcity and visual similarity to more prevalent diseases such as emphysema, DCLDs are frequently mis-diagnosed, leading to significantly worse clinical outcomes and a higher burden on the healthcare system. Our research presents a method which accurately identifies cystic regions within DCLD CT scans, achieving a similar standard to expert defined manually annotated cases. Furthermore, the method quantifies cystic tissue volume in the sample, providing a reliable and efficient means of assessment.

## METHODS AND MATERIALS

Template matching methods involve the extraction of image features, such as shape, texture and colour, and correlates them with a pre-defined image template to identify regions of interest. In the context of a Lymphangioleiomyomatosis CT scan, circular regions of low attenuation that exhibit high correlation to a black circle template were isolated and defined as potential cystic regions. The detected regions were then compared with related manually annotated cases which had previously outlined the presence of cystic regions as identified by an expert radiologist.

## RESULTS

The method's performance was evaluated by comparing its results with that of the manual annotations of an expert radiologist. The assessment yielded a Dice Similarity Coefficient of 86%, Precision of 79%, Specificity of 99% and an F1 Score of 88%.

## CONCLUSION

s The high correlation observed between the template matching method and the manually annotated cases outlines the potential of semi-automated feature extraction methods as a faster and less labour-intensive method to quantifying cystic tissue volume across numerous cases. By computing the ratio between cystic and lung tissue volume, this method provides a reliable means of assessing the overall health of lung tissue. The use of such methods has broad implications in clinical settings, where accurate and efficient evaluation of numerous cases is essential.

## CLINICAL RELEVANCE/APPLICATION

The semi-automated method outlined identifies cystic regions comparably to expert radiologists, allowing development of a lung health score based on cystic/lung tissue volume ratio.

### S3B-SPCH-4 Clinical Course and Risk Factors for Development and Progression of Interstitial Lung Disease in Primary Sjögren's Syndrome

Participants

Eunseo Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the long-term course and prognostic factors of patients with primary Sjögren syndrome-associated interstitial lung disease (pSS-ILD).

## METHODS AND MATERIALS

This single-center, retrospective study included 120 pSS patients who underwent at least two high-resolution computed tomography (HRCT) scans between March 2013 and February 2021. Clinical symptoms, laboratory data, HRCT findings, and pulmonary function test results were collected. HRCT were scored blindly by two expert thoracic radiologists: extent of ground glass opacities (GGO), fine/coarse reticulations, and honeycombing, and coarseness score of fibrosis.

## RESULTS

In patients with pSS without ILD at baseline (n=81), no development of ILD was found on follow-up (median, 2.8 years). In patients with pSS-ILD (n=39), total disease extent, extent of coarse reticulation, and traction bronchiectasis increased on HRCT, whereas the extent of GGO decreased at follow-up (median, 3.2 years) (each p<0.001). In progressive group of pSS-ILD (n=19/39, 48.7%), the extent of coarse reticulation and coarseness score of fibrosis were increased at follow-up (p<0.05). Multivariate logistic regression analysis showed that LDH (OR, 1.012) and diffusing capacity for carbon monoxide (OR, 0.922) were independent risk factors for pSS-ILD at baseline. Usual interstitial pneumonia (UIP) pattern on CT (OR, 15.237) and follow-up duration (OR, 1.403) were independent risk factors for disease progression in patients with pSS-ILD. In response to glucocorticoid and/or immunosuppressants, GGO decreased, whereas the extent of fibrosis increased even after treatment.

## CONCLUSION

s In pSS patients with no ILD during baseline evaluation, no newly developed ILD was identified during follow-up over two years. Progression occurred in approximately half of the pSS-ILD patients with slow gradual deterioration. UIP pattern on CT and follow-up duration were independent risk factors for progression of pSS-ILD.

#### **CLINICAL RELEVANCE/APPLICATION**

HRCT is a crucial modality for determining the progression of lung fibrosis in patients with pSS, in addition to the initial screening evaluation for ILD.

### **S3B-SPCH-5 Chest Radiography, Computed Tomography and Magnetic Resonance in Evaluation of Pulmonary Sarcoidosis in Assessment of Disease Progression and Comparison with Pulmonary Function Tests**

Participants

Stephan Altmayer, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To compare radiography, high resolution computed tomography (HRCT), and magnetic resonance imaging (MRI) in the assessment of disease progression in pulmonary sarcoidosis in comparison to pulmonary function tests.

#### **METHODS AND MATERIALS**

In this prospective study of 77 adults diagnosed with sarcoidosis, all subjects underwent baseline pulmonary function testing, chest radiography, HRCT and MRI. Chest radiographs were categorized using the Siltzbach classification system. HRCT and MRI were scored using the Scleroderma Lung Study I system. Pulmonary function was reassessed after 12 months, with progressive disease defined by  $\geq 5\%$  reduction of forced vital capacity (FVC). Differences in median imaging scores were assessed with Student's t-test and Wilcoxon rank-sum test. Correlation between imaging and pulmonary function was investigated using Pearson's and Spearman's rank correlation coefficients. FVC decline was the gold standard on multivariate analysis used to calculate the odds ratios (OR) for progression of disease predicted by imaging, with score thresholds determined by maximum Youden's index. The area under the curve (AUC) of the receiver operating characteristic plot was calculated for each imaging modality.

#### **RESULTS**

There is a strong correlation between chest radiography and MRI ( $r=0.649$ ,  $P < 0.001$ ), and CT and MRI scores ( $r=0.851$ ,  $P < 0.05$ ). CT and MRI scores correlated with FVC (MRI:  $r = -0.584$ ,  $P < 0.001$ ; CT:  $r = -0.308$ ,  $P = 0.049$ ) and diffusing capacity of the lung for carbon monoxide (MRI:  $r = -0.564$ ,  $P = 0.004$ ; CT  $r = -0.216$ ,  $P = 0.017$ ). The AUCs for Radiography, MRI and CT scores were 0.70 (0.49-0.85), 0.51 (0.32-0.75), and 0.76 (0.56-0.90), respectively. Multivariate analysis demonstrated significant prediction of progressive disease by CT (OR = 1.236,  $p = 0.044$ ) and MRI (OR = 1.594,  $p = 0.021$ ).

#### **CONCLUSION**

s MRI may be a viable alternative to HRCT in lung assessment and prediction of disease progression in patients with pulmonary sarcoidosis.

#### **CLINICAL RELEVANCE/APPLICATION**

MRI may be a viable tool for the assessment of disease progression in patients with pulmonary sarcoidosis, although further studies are necessary to validate this tool.

### **S3B-SPCH-6 To Evaluate the Role of the F FDG PET CT in the Idiopathic Pulmonary Fibrosis and Diffuse Parenchymal Lung Disease**

#### **PURPOSE**

The purpose of this study was to evaluate the role of the (18)F-FDG PET/CT in patients with idiopathic pulmonary fibrosis (IPF) and diffuse parenchymal lung disease (DPLD).

#### **METHODS AND MATERIALS**

Seventy-two patients (62 men and 10 women; mean age  $\pm$  SD, 68.7  $\pm$  9.4 y) with IPF ( $n = 36$ ) or other forms of DPLD ( $n = 36$ ) were advised whole body PET/CT and also high-resolution CT (HRCT), which were acquired simultaneously. 18 F FDG was done after injecting the radiotracer and whole-body PET-CT was done after 60 minutes of FDG administration. The amount of the uptake in the pulmonary (18)F-FDG metabolism was quantified as a standardized uptake value (SUV(max)). Along with this scan the HRCT lung was done for each patient and further analysis of the various HRCT patterns of parenchymal involvement as ground-glass opacities or reticulation/honeycombing. Along with this the patients underwent a global health assessment and pulmonary function tests.

#### **RESULTS**

The pulmonary uptake metabolism in 72 of 72 patients was evaluated. The parenchymal pattern of the HRCT is seen as the maximal (18)F-FDG metabolism which was seen predominantly in ground-glass (14/72), reticulation/honeycombing (52/72), and mixed (6/72). The mean SUV(max) in patients with ground-glass and mixed patterns was 2.0  $\pm$  0.4, and in reticulation/honeycombing it was 3.0  $\pm$  1.0 (Mann-Whitney U test,  $P = 0.007$ ). The mean SUV(max) in patients with IPF was 2.9  $\pm$  1.1, and in other DPLD it was 2.7  $\pm$  0.9 (Mann-Whitney U test,  $P = 0.862$ ). The mean mediastinal lymph node SUV(max) (2.7  $\pm$  1.3) correlated with pulmonary SUV(max) ( $r = 0.63$ ,  $P < 0.001$ ). Pulmonary (18)F-FDG uptake correlated with the global health score ( $r = 0.50$ ,  $P = 0.004$ ), forced vital capacity ( $r = 0.41$ ,  $P = 0.014$ ), and transfer factor ( $r = 0.37$ ,  $P = 0.042$ ).

#### **CONCLUSION**

s The increased pulmonary (18)F-FDG metabolism is seen in all the patients with IPF and also other forms of DPLD was observed. Pulmonary (18)F-FDG uptake shows significant changes in the measurements of health and lung physiology in these patients. The analysis showed that the (18)F-FDG metabolism is higher at the site of maximal uptake which corresponds to the areas of reticulation/honeycombing on the HRCT scans other than with ground-glass patterns.

#### **CLINICAL RELEVANCE/APPLICATION**

The role of the Whole body PET-CT is important in various forms of ILD and other pathologies in the chest

## **S3B-SPCH-7 Predictors of Progressive Pulmonary Fibrosis: A Radiologic-Pathologic Correlation Study**

### **PURPOSE**

Progressive pulmonary fibrosis (PPF), which is treatable with anti-fibrotic therapy, is defined as interstitial lung disease (ILD) other than idiopathic pulmonary fibrosis (IPF) that manifests progressive features regardless of standard management. This study evaluates the radiologic-pathologic correlations of PPF and identifies predictors associated with disease progression and survival.

### **METHODS AND MATERIALS**

Between January 2004 and December 2020, 75 patients diagnosed with ILD other than IPF who underwent surgical lung biopsy were retrospectively included. Three chest radiologists reviewed chest computed tomography (CT) features and fibrosis extent on baseline and follow-up CT, and patients were subdivided into PPF and non-PPF based on progression. Two pathologists reviewed cases for pathologic features and the presence of usual interstitial pneumonia (UIP). Overall and progression-free survival were calculated using the Kaplan-Meier method, and the Cox proportional hazard method was used to examine predictors for progressive pulmonary fibrosis and survival.

### **RESULTS**

Regarding radiologic-pathologic correlations, when the pathologic UIP pattern was present in the specimen, it was associated with radiologic honeycombing, traction bronchiectasis, and reticulation ( $p < 0.001$ ). Progression was seen in 42.7% (32/75) of non-IPF ILD patients, with a median progression time of 44 months. Radiologic traction bronchiectasis was identified as the only predictive factor of PPF on the multivariate Cox-proportional hazard method (hazard ratio [HR], 6.54;  $p = 0.003$ ). PPF (HR, 3.96;  $p = 0.013$ ) and advanced age (HR, 1.13,  $p < 0.001$ ) were associated with an increased risk of death in non-IPF ILD patients. The median survival time of PPF was 120 months.

### **CONCLUSION**

A radiologic pattern of traction bronchiectasis was a predictor of PPF, while PPF and advanced age were risk factors for low survival in non-IPF ILD patients.

### **CLINICAL RELEVANCE/APPLICATION**

Recognition of traction bronchiectasis is crucial for predicting PPF in patients with non-IPF ILD, emphasizing the importance of timely initiation of anti-fibrotic therapy in improving patient outcomes.

## **S3B-SPCH-8 Granulomatous and Lymphocytic Interstitial Lung Disease in Common Variable Immunodeficiency: CT Findings and Association with Pulmonary Function Tests**

### **Participants**

Nicholas Landini, MD, PhD, Rome, Italy (*Presenter*) Nothing to Disclose

### **PURPOSE**

Common Variable Immunodeficiency (CVID) may be complicated by Granulomatous and Lymphocytic Interstitial Lung Disease (GL-ILD). GL-ILD includes a wide spectrum of ILD abnormalities, worsening CVID prognosis. We aimed to characterize chest Computed Tomography (CT) findings of GL-ILD, in comparison with CVID patients without GL-ILD, and their association with PFT worsening.

### **METHODS AND MATERIALS**

Patients with CVID followed from 2018 to 2021 were retrospectively evaluated. Inclusion criteria were: GL-ILD diagnosis, CT and PFT performed within one week. Patients on GL-ILD therapy or with the clinical suspicion of infection were excluded. Age and sex matched non-GL-ILD subjects were searched. CT findings, evaluated in consensus by two chest radiologists, were: bronchiectasis, bronchial wall thickening, mucous plugs, tree in bud, mosaic perfusion, small nodules ( $< 10$  mm) and big nodules (multiple  $> 3$ ), consolidation, ground glass opacities (GGO), reticulation, fibrotic ILD, cavitation/necrosis and bands. Small nodules main distribution (centrilobular, perilymphatic or random) was noted. CT abnormalities were assessed in upper, lower fields and whole lungs, describing disease predominance. Presence of enlarged nodes (axis  $> 10$  mm), pleural or pericardial effusion was also assessed. Fisher exact test was computed, assessing Odds Ratios (OR) for GL-ILD against non-GL-ILD. A significant  $p$ -value was set as  $< 0.05$ , with Bonferroni correction for the following PFT: TLC, FEV<sub>1</sub>, FVC and DLCO, % predicted.

### **RESULTS**

38 GL-ILD subjects and 38 controls were identified. Most common GL-ILD CT findings in GL-ILD ( $> 50\%$  patients) were: bronchiectasis, multiple non-perilymphatic small nodules, GGO, consolidations, bands and enlarged nodes. The disease was usually predominant in lower fields (92%). Bronchiectasis, GGO, reticulations, fibrosis and bands were more frequent in lower fields. GGO was associated with TLC worsening, reticulation with all PFT worsening, fibrotic ILD with DLCO ( $p$ -value  $< 0.0125$ ). Considering whole lungs analysis, small nodules, consolidations, reticulations and fibrosis had an OR  $> 10$  in identifying GL-ILD versus non-GL-ILD patients.

### **CONCLUSION**

GL-ILD usually manifests with bronchiectasis, non-perilymphatic nodules, GGO, consolidations, bands and enlarged mediastinal lymph nodes, with a lower field predominance. Reticulation is the main CT finding associated with functional worsening. Small nodules, consolidations, reticulations and fibrotic ILD are highly suggestive of GL-ILD in CVID subjects.

### **CLINICAL RELEVANCE/APPLICATION**

These results provide CT characteristics of GL-ILD that may be helpful in the diagnosis of a such polymorphic disease, verifying their relationships with PFT worsening

## Abstract Archives of the RSNA, 2023

S3B-SPER

### Emergency Radiology Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPER-1 Self-Supervised Machine Learning to Triage Acute Chest Syndrome in Pediatric Patients with SCD

#### Participants

Syed Anwar, PhD, Orlando, FL (*Presenter*) Nothing to Disclose

#### PURPOSE

Children with sickle cell disease (SCD) are at a high risk of poor outcome if they develop pneumonia or acute chest syndrome (ACS). We have developed a machine learning model for ACS prediction using chest radiographs (CXRs), hence triaging children for treatment presented to the emergency department.

#### METHODS AND MATERIALS

We performed a retrospective analysis of children with SCD who had a CXR performed at an urban pediatric emergency department between July 2015 and March 2023. A query of our clinical registry identified 1,115 pediatric SCD patients with "likely ACS" (n=601) or "likely not ACS" (n=514), based on diagnosis code and disposition. We manually reviewed the radiologist impression for each CXR and excluded 28.4% (n=171) of patients in the "likely ACS" group and 5.1% (n=26) of patients initially labeled "likely not ACS". A pre-trained, self-supervised machine learning model was fine-tuned using manually reviewed CXR impressions to predict ACS in future radiographic images. Our deep learning model used a vision transformer and was pre-trained on 400,000 CXRs from publicly available data. The model was earlier tested on other clinical conditions such as covid-19, age, and sex prediction. We report machine learning inference time and the time required to complete the radiologic assessment, reporting timing for both daytime and overnight studies because an attending radiologist is available to review new studies during daytime and evening hours but only reviews images overnight if they are paged directly with a question.

#### RESULTS

The average accuracy of our ACS prediction model was 0.85 with sensitivity of 0.77, specificity of 0.91, and AUC of 0.89. Machine learning inference time was 0.0068 (median) seconds (IQR:0.0065-0.0072) running on machine with NVIDIA RTX A5000 GPU with half-precision (FP16). Daytime studies, completed between 06:00 and 22:00 h, were read by a radiologist within 55.0 (median) minutes (IQR:23.0-115.0). Overnight studies, completed between 22:00 and 06:00 h, were read within 401.5 (median) minutes (IQR:245.25-535.75).

#### CONCLUSION

The model for ACS prediction from CXR has the potential to identify high risk SCD patients in the emergency department in a timely manner with clinically acceptable performance. Our inference time is real-time, allowing for prediction of ACS as soon as a CXR is recorded in the PACS.

#### CLINICAL RELEVANCE/APPLICATION

ACS is associated with mortality and severe morbidity in children with SCD and requires rapid recognition and intervention. At our single site, real-time machine learning prediction has the greatest potential to expedite diagnosis during overnight hours.

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## Abstract Archives of the RSNA, 2023

S3B-SPGI

### Gastrointestinal Imaging Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPGI-1 Clinical and Imaging Features of Focal Intrahepatic Biliary Stricture Visualized Only as Duct Dilatation

##### PURPOSE

The percentage of patients with precursor lesions or malignancy due to focal intrahepatic stricture (FIHS) without radiographically demonstrable bile duct abnormality, visualized only as duct dilatation, is currently unknown. Moreover, it is unknown whether there is a variable to differentiate malignant or precursor lesions from non-precursor benign lesions. Therefore, we studied the proportion of patients with FIHSs that were precursor lesions or malignancies. Additionally, we evaluated the clinical variables and MRI features that may discriminate between non-premalignant benign and premalignant/malignant FIHSs.

##### METHODS AND MATERIALS

This retrospective study assessed patients who underwent surgery for FIHS between January 2010 and March 2022. The number and proportion of non-precursor benign lesions, precursors, and malignancies were calculated. Clinical variables and MRI features were compared between non-premalignant benign and premalignant/malignant FIHSs using independent t-tests and chi-square tests for continuous and categorical variables, respectively.

##### RESULTS

Twenty-five patients with confirmed histopathological diagnoses were identified. The study included 13 men (52.0%) and 12 women (48.0%). The median age of all the patients at the first imaging diagnosis was 65 years (range, 43-78 years). Of the 25 FIHS patients, 9 (36%) were diagnosed with cholangiocarcinoma and 6 (24%) were diagnosed with precursor lesions. Among the precursor lesions, five were intraductal papillary neoplasms of the bile duct, and one was biliary intraepithelial neoplasia. Therefore, 15 (60%) had malignant or precursor lesions, and 10 (40%) were diagnosed with non-precursor benign lesions. None of the clinical variables and imaging features used for analysis showed a statistically significant difference between the non-premalignant benign and premalignant/malignant FIHS groups ( $p < .05$ ).

##### CONCLUSION

More than half of FIHSs were malignant or precursor lesions. There were no predictive values for the clinical and imaging parameters. Therefore, a more active strategy for the diagnosis and follow-up imaging should be considered.

##### CLINICAL RELEVANCE/APPLICATION

Patients with FIHS require active treatment including surgical treatment and careful imaging follow-up.

#### S3B-SPGI-2 MRI Screening with Machine Learning-supported Post-processing and Genetics of Multiple Biliary Hamartomas

##### Participants

Philipp Schindler, MD, Muenster, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

Multiple biliary hamartomas (MBH), also known as "von Meyenburg complexes", are benign and asymptomatic malformations of dilated bile ducts embedded in fibrous stroma, usually smaller than 10 mm. A detailed knowledge of these malformative cystic-like lesions is crucial because they may be misdiagnosed as malignant. The aim of this study was to investigate the feasibility of magnetic resonance imaging (MRI) screening for the detection of MBH with machine learning-supported post-processing and to explore the genetic characteristics of this rare condition.

##### METHODS AND MATERIALS

Five consecutive patients with MBH were prospectively enrolled in this study. All patients underwent high-resolution (3.0 Tesla) contrast-enhanced hepatobiliary MRI and magnetic resonance cholangiopancreatography (MRCP) at baseline to provide a structured report of imaging features of MBH and at 12-month follow-up to exclude progression. A pipeline of 3D k-means clustering based image segmentation was used for detection of cystic-like lesions. Eccentricity was calculated to identify round and oval objects in the cluster and to exclude the biliary tree. Customized next-generation sequencing (NGS) was used to identify the underlying genetic cause of MBH.

##### RESULTS

Baseline MRI showed innumerable small hepatic cystic lesions without contrast enhancement, even in the hepato-biliary phase, and without communication with the biliary tree, allowing the diagnosis of MBH. K-means clustering based image segmentation was feasible for annotation of MBH. Total liver lesion volume remained stable over time (mean volume: 104.8 ml; mean proportion of total liver volume: 8.1%). All patients had a heterozygous missense, truncating, or frameshift mutation in the polycystic kidney and hepatic disease 1 (PKHD1) gene encoding the multidomain integral membrane protein fibrocystin.

##### CONCLUSION

s This preliminary data suggests that machine learning-augmented MRI screening can be used for quantification of MBH. The genetic analysis revealed a potential association between multiple biliary hamartomas and mutations in the PKHD1 gene. These findings provide important insights into the diagnosis of this rare condition.

#### **CLINICAL RELEVANCE/APPLICATION**

Knowledge of MRI findings and genetics of MBH is helpful for a prompt and correct diagnosis, avoiding unnecessary invasive procedures and/or an excessive number of radiological investigations.

#### **S3B-SPGI-3 A Comparison of the Diagnostic Accuracies of Ultrasound and CT in 82 Proven Cases of Acute Cholecystitis**

Participants

Joshua Thurgood, Albuquerque, NM (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To compare the efficacies of US imaging vs CT imaging in the diagnosis of acute cholecystitis in aiming to improve the diagnosis and treatment of patients with acute cholecystitis.

#### **METHODS AND MATERIALS**

We retrospectively collected data on 100 patients with suspected acute cholecystitis and 100 control patients with studies occurring between 3/1/2015 and 3/31/2020. Of the 100 suspected acute cholecystitis patients, 50 had US imaging and 50 had CT imaging done. To be included as a proven case of acute cholecystitis, cases were then screened for cholecystectomy. Due to this, 7 US subjects and 11 CT subjects were removed as they did not undergo cholecystectomy or were treated via a different method. In the control group, 50 patients had US imaging and 50 had CT imaging. All studies were then reviewed by three radiologists of differing experience levels. The data from each reviewer was then combined and tabulated. One reviewer also tabulated data for patients that had both US and CT studies done, which amounted to 47 of the patients with confirmed acute cholecystitis.

#### **RESULTS**

The sensitivity of CT for diagnosing acute cholecystitis was greater than the sensitivity of US, with these being 66.67% and 53.49% respectively. The negative predictive value of CT was also greater than that of US, which were 75.93% and 64.91% respectively. There were no false positives by any of the reviewers, so the specificities and positive predictive values were 100% for both CT and US modalities. Among the 47 patients who had both US and CT studies done, 24 had both positive US and CT for acute cholecystitis, 9 patients had a positive CT and negative US, 4 patients had a positive US and negative CT, and 10 patients had both negative US and CT studies.

#### **CONCLUSION**

s CT was significantly more sensitive and had a higher negative predictive value than US. However, both modalities had lower sensitivities and negative predictive values than what is found in the literature. All three reviewers performed better on CT than US with two performing significantly better with sensitivities improving by 20.63% and 15.98% respectively. The results of our study showed significantly higher performance using CT imaging over US imaging when evaluating for acute cholecystitis. However, we still suggest US as our first imaging test in patients with suspected AC. If the US is negative, CT should be performed. If the CT is negative and there is still strong clinical suspicion for AC, a HIDA scan should be done.

#### **CLINICAL RELEVANCE/APPLICATION**

The research being conducted is significant because time to treatment of acute cholecystitis is most often imaging dependent and understanding the relative efficacies of the two most common initial imaging modalities will lead to increased efficiency and time to treatment of these patients.

#### **S3B-SPGI-4 Ultra-high-resolution Drip-infusion CT Cholangiography with Deep Learning-based Reconstruction: Comparison with Normal-resolution Simulation**

Participants

Atsushi Nakamoto, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the image quality and bile duct delineation of drip-infusion CT cholangiography (DIC-CT) using an ultra-high-resolution CT (UHR CT) with a 1024 x 1024 matrix combined with a deep learning-based reconstruction algorithm in comparison with simulated normal-resolution (NR) images.

#### **METHODS AND MATERIALS**

Twenty-five potential liver transplant donors (13 men and 12 women, age range, 21 to 61 years; mean age, 36.3 years) who underwent DIC-CT using the super-high-resolution (SHR) mode of a UHR CT scanner for preoperative evaluation were included in this retrospective study. SHR images were reconstructed with a 1024 x 1024 matrix and 0.25-mm slice thickness using a deep learning-based reconstruction algorithm. Simulated NR images were reconstructed from the same raw data with a 512 x 512 matrix and 0.5-mm slice thickness using a hybrid iterative reconstruction algorithm. Maximum CT value and contrast-to-noise ratio (CNR) of the common bile duct were compared between SHR and NR images using the paired t-test. Two radiologists independently reviewed the maximum intensity projection images and graded the image quality for delineation of the peripheral bile ducts, image sharpness, image noise, and the overall image quality using a 5-point scale, and the results were compared using the Wilcoxon signed-rank test.

#### **RESULTS**

The maximum CT number of the common bile duct was significantly higher on SHR images than on NR images ( $451.6 \pm 65.0$  vs.  $382.5 \pm 67.4$ ,  $P < .001$ ). CNR was significantly lower on SHR images than on NR images ( $19.8 \pm 4.0$  vs.  $38.9 \pm 12.4$ ,  $P < .001$ ). In qualitative analysis, NR scored significantly higher (i.e. less noise) than SHR for noise ( $4.0 \pm 0.2$  and  $4.1 \pm 0.3$  vs.  $2.0 \pm 0.2$  and  $1.9 \pm 0.3$ ,  $P < .001$ ), whereas SHR scored significantly higher for peripheral bile duct delineation ( $3.6 \pm 0.8$  and  $3.8 \pm 0.5$  vs.  $2.4 \pm 0.8$  and  $2.2 \pm 0.5$ ,  $P < .01$ ), sharpness ( $3.8 \pm 0.6$  and  $3.9 \pm 0.7$  vs.  $2.2 \pm 0.6$  and  $2.1 \pm 0.7$ ,  $P < .001$ ), and overall image quality ( $4.0 \pm 0.6$  and  $3.6 \pm 0.8$  vs.  $2.0 \pm 0.6$  and  $2.4 \pm 0.8$ ,  $P < .01$ ) for both readers.



## CONCLUSION

s UHR CT combined with a deep learning-based reconstruction provided drip-infusion CT cholangiography images with higher spatial resolution and improved the delineation of the peripheral bile duct, despite increased image noise and decreased CNR.

## CLINICAL RELEVANCE/APPLICATION

Ultra-high-resolution CT combined with a deep learning-based reconstruction provides high-quality drip-infusion CT cholangiography and improves peripheral bile duct delineation.

### S3B-SPGI-5 Breath-hold 3D Gradient- and Spin-echo (GRASE) MRCP Compared to Compressed-sensing Highly Accelerated Respiratory-triggered Technique

Participants

Nobuyuki Kawai, MD, Gifu, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate breath-hold 3D gradient- and spin-echo (GRASE) MRCP compared to respiratory-triggered 3D turbo spin-echo (TSE) MRCP highly accelerated with the compressed sensing-sensitivity encoding (C SENSE).

## METHODS AND MATERIALS

Fifty-eight consecutive patients (30 men, 28 women, mean age 67.2 years) with suspicious having pancreaticobiliary diseases underwent MRCP on a 3-T clinical scanner. All patients underwent breath-hold 3D GRASE MRCP with sensitivity encoding (SENSE) (BH-MRCP; SENSE factor, 2) and respiratory-triggered 3D TSE MRCP highly accelerated with the C SENSE (RT-MRCP; C SENSE factor, 11.6) in a random order. For quantitative image analyses, signal intensity (SI) of biliary ducts and main pancreatic duct (MPD), peribiliary ductal tissue, and peripancreatic ductal tissue were measured. The relative duct-to-periductal contrast ratios (RCs) of each pancreaticobiliary segments were calculated as  $(SI_{duct} - SI_{periduct}) / (SI_{duct} + SI_{periduct})$ , respectively. For qualitative image analyses, two radiologists coincidentally graded conspicuity of biliary ducts, MPD, and pancreatic cystic lesion, and overall image quality between the two sequences using a five-point rating scale. Artifacts were also graded using a four-point rating scale.

## RESULTS

Mean acquisition times in BH-MRCP and RT-MRCP sequence were 23 and 29 seconds, respectively. RCs of all three segments of MPD in BH-MRCP were slightly lower than those in RT-MRCP ( $P = 0.002$ ). Conspicuity of central and peripheral segments of right and left hepatic duct, cystic duct, and common bile duct in BH-MRCP were significantly higher than those in RT-MRCP ( $P = 0.015$ ). Conspicuity of MPD and pancreatic cystic lesion was comparable between the two sequences. Overall image quality in BH-MRCP was significantly higher than that in RT-MRCP ( $P = 0.038$ ). In BH-MRCP, the number of scans with the poor or non-diagnostic image quality (score = 2) in overall image quality was decreased compared with that in RT-MRCP [3.4% (2/58) vs. 8.6% (5/58),  $P = 0.242$ ].

## CONCLUSION

s BH-MRCP provided better image quality and a reduced number of poor or non-diagnostic images compared to RT-MRCP.

## CLINICAL RELEVANCE/APPLICATION

Breath-hold 3D gradient- and spin-echo MRCP provided better image quality compared to respiratory-triggered 3D turbo spin echo MRCP highly accelerated with the compressed sensing-sensitivity encoding.

### S3B-SPGI-7 Ultra-High Resolution T2-weighted PROPELLER MRI of the Rectum with Deep Learning Reconstruction: Assessment of the Image Quality and Diagnostic Performance

Participants

Takahiro Tsuboyama, MD, (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study was to evaluate the impact of ultra-high resolution acquisition with a slice thickness of 1.2 mm and deep learning reconstruction (DLR) on the image quality and diagnostic performance of T2-weighted periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) images for rectal cancer.

## METHODS AND MATERIALS

This prospective study included 34 patients who underwent MRI for the assessment of pretreatment or post-chemoradiotherapy rectal cancer. Written informed consent was obtained. The following four types of axial T2-weighted PROPELLER imaging perpendicular to the tumor were obtained: a slice thickness of 3 mm with conventional reconstruction (3-CR) and DLR (3-DLR), and a slice thickness of 1.2 mm with CR (1.2-CR) and DLR (1.2-DLR). Three radiologists independently evaluated the image quality and assessed the extramural tumor spread, extramural venous invasion (EMVI), lymph node metastasis, and response to chemoradiotherapy if applicable by using a 5-point scoring system. The image quality was compared with Friedman's test. Agreement of the scores obtained with the four types of PROPELLER imaging was assessed by the intraclass correlation coefficient. The diagnostic performance by the three readers were compared with Friedman's test in 22 patients who underwent surgery after MRI.

## RESULTS

In the image quality assessment, 1.2-DLR yielded significantly the best sharpness, rectal and tumor conspicuity, and overall image quality ( $P < 0.05$ ) for all readers. In the diagnostic performance, perfect agreement (ICC value  $> 0.80$ ) was not seen among the four PROPELLER images in all readers regarding extramural tumor spread, EMVI, and complete response. For the diagnosis of extramural tumor spread, specificity and accuracy were significantly lower with 3-DLR (mean, 0.64 and 0.74) and 1.2-DLR (mean, 0.58 and 0.74) than with 3-CR (mean, 0.75 and 0.79) and 1.2-CR (mean, 0.78 and 0.83) ( $P < 0.05$ ). For the diagnosis of venous invasion, sensitivity and accuracy were significantly higher with 1.2-CR (mean, 0.42 and 0.67) and 1.2-DLR (mean, 0.55 and 0.71) than with 3-CR (mean, 0.30 and 0.59) and 3-DLR (mean, 0.36 and 0.56) ( $P < 0.05$ ). There were no significant differences in the diagnostic accuracies of lymph node metastases and complete response.

## CONCLUSION

s Ultra-high resolution PROPELLER T2-weighted MRI using DLR could provide high image quality and accurate detection of venous invasion although it increased false-positive diagnoses of extramural tumor extension.

## CLINICAL RELEVANCE/APPLICATION

Although DLR can provide thin-slice T2-weighted PROPELLER MRI with high image quality, extramural tumor spread should be carefully interpreted because DLR may increase false-positive results.

## S3B-SPGI-8 Deep Learning Segmentation and Radiomics for Automatic Identification and Activity Assessment of CTE Lesions in Crohn's Disease

### PURPOSE

The purpose of this paper is to develop a deep learning automatic segmentation model for the segmentation of Crohn's Disease (CD) lesions in CTE images. Additionally, the radiomics features extracted from the segmented CD lesions will be analyzed, and multiple machine learning classifiers will be built to distinguish CD activity.

### METHODS AND MATERIALS

This retrospective study includes two sets of CTE image data (segmentation dataset and classification dataset). The CD lesions in the segmentation dataset were manually segmented by radiologists, and a deep learning automatic segmentation model based on nnU-Net neural network was developed. The CTE images in the classification dataset were processed using the automatic segmentation model to obtain segmentation results and extract radiomics features. The most optimal features were then selected to build five machine learning classifiers to distinguish CD activity. The performance of the automatic segmentation model was evaluated using the Dice similarity coefficient (DSC), while the performance of the machine learning classifier was evaluated using the area under the curve (AUC), sensitivity, specificity and accuracy.

### RESULTS

The segmentation dataset consisted of 84 CTE examinations of CD patients (60 males) and the classification dataset included a total of 193 CTE examinations of CD patients (136 males). The deep learning segmentation model achieved a DCS value of 0.824 on the testing set. Among the five machine learning classifiers, the Logistic Regression (LR) model showed the highest classification performance in the testing set, with an AUC, sensitivity, specificity and accuracy of 0.862, 0.697, 0.840 and 0.759, respectively.

## CONCLUSION

s Our study demonstrates that a deep learning segmentation model based on the nnU-Net neural network can accurately segment CD lesions in CTE images and build a machine learning classifier to distinguish CD activity based on the extracted radiomics features. This approach can help clinicians assess the severity of patient's disease with greater accuracy.

## CLINICAL RELEVANCE/APPLICATION

Helps radiologists aid in diagnosis and improve diagnostic efficiency, which in turn helps clinicians assess a patient's condition and provide an idea for the next step in treatment.

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## Abstract Archives of the RSNA, 2023

S3B-SPGU

### Genitourinary Imaging Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPGU-1 Radio-Metabolomics in Predicting Muscle Invasive Status of Bladder Cancer: A Pilot Study

##### Participants

Kangwen He, Wuhan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Determining muscle invasive status (MIS) of bladder cancer (BCa) is critical for treatment decision making. We attempted to identify the differential metabolites of muscle invasive BCa (MIBC) and non-muscle invasive BCa (NMIBC), and correlate them with MR radiomics features (RFs) to initially explore the biological validation of radiomics in predicting MIS of BCa.

##### METHODS AND MATERIALS

Tumor tissue of 26 patients with BCa (15 MIBC and 11 NMIBC) were collected for integrated non-targeted liquid and gas chromatography-mass spectrometry (LC/MS and GC/MS) metabolomics analysis. Preoperative MRI data were obtained for 19 of these patients (12 MIBC and 7 NMIBC). Differential metabolites were screened using univariate analysis (fold change analysis and Student's t-test) and multivariate analysis (Orthogonal partial least squares discriminant analysis, OPLS-DA). The KEGG database was used for pathway analysis to find significantly dysregulated metabolic pathways ( $p < 0.05$ , impact (IM)  $> 0.1$ ). RFs were extracted from T2-weighted image and DWI of preoperative MRI. After preliminary screening using intraclass correlation coefficient and Student's t-test, RFs were correlated with dysregulated pathway metabolites using Pearson correlation. Receiver operating characteristic curve was used to evaluate the diagnostic performance of RFs in predicting MIS of BCa.

##### RESULTS

A total of 350 significant differential metabolites were identified by metabolomics analysis, and the dysregulated metabolic pathways are predominantly amino acid synthesis pathways (compared with NMIBC group, metabolites in MIBC group were significantly up-regulated in aminoacyl biosynthesis, arginine synthesis, alanine biosynthesis, galactose metabolism and pyrimidine metabolism,  $p < 0.001$ , IM=0.167;  $p = 0.002$ , IM=0.421;  $p = 0.009$ , IM=0.455;  $p = 0.004$ , IM=0.124;  $p = 0.019$ , IM=0.163, respectively). Twenty-four differential metabolites were detected in these 5 metabolic pathways. We initially screened 432 differential RFs in radiomics analysis. Eleven radiomic-metabolomics feature pairs were screened out based on the Pearson correlation coefficient greater than 0.75. The screened RFs were capable in the assessment of MIS (AUC=0.679-0.893).

##### CONCLUSION

Metabolite pathways that can predict MIS of BCa were identified, and were highly correlated with MRI RFs, which may partly explain why radiomics could predict the MIS of BCa.

##### CLINICAL RELEVANCE/APPLICATION

Our study contributes to the identification of non-invasive methods for diagnosing the MIS of BCa, which could reduce the use of current harmful diagnostic techniques, thereby improving BCa management.

#### S3B-SPGU-2 Predicting Renal Allograft Dysfunction using Shear-wave Dispersion Slope

##### Participants

Taekmin Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the role of shear-wave dispersion slope for predicting renal allograft dysfunction.

##### METHODS AND MATERIALS

We retrospectively reviewed 126 kidney transplant recipients (median age 57 years [interquartile range 47-62 years], 60 women) who underwent kidney biopsy for allograft evaluation from November 2022 to February 2023. All patients underwent shear-wave elastography (SWE) examination just before biopsy, and parenchymal stiffness and dispersion slope were obtained in cortex. To reduce subject-to-subject variations, we performed SWE in renal sinus fat for reference tissue. Clinical and pathologic factors related to renal stiffness and dispersion slope were evaluated by multivariable linear regression analysis. We conducted univariate and multivariate analysis to predict acute rejection using imaging parameters including SWE. Diagnostic performance of significant parameters in detecting acute rejection was evaluated by area under the receiver operating curve (AUC) values.

##### RESULTS

Acute rejection was found in 31 out of 126 (24.6%) of the patients. The median cortex-to-sinus stiffness ratio (SR) did not differ between the patients with acute rejection and without rejection (1.21 vs. 1.20,  $P = 0.47$ ), while median cortex-to-sinus dispersion slope ratio (DSR) was higher in patients with acute rejection than in those without rejection (1.4 vs. 1.21,  $P < 0.01$ ). Grade of interstitial fibrosis and tubular atrophy (IFTA) was the only determinant factor for both SR (coefficient, 0.13 per grade;  $P < 0.01$ ) and

DSR (coefficient, 0.10 per grade,  $P=0.01$ ). In multivariate analysis, mean resistive index (OR 1.06, 95% CI 1.02-1.15,  $P<0.01$ ) and DSR (OR 18.3, 95% CI 3.3-101.6,  $P<0.001$ ) were independent factors for predicting acute rejection. The AUC of resistive index, DSR, and combined two parameters were 0.64, 0.68, and 0.74, respectively.

#### **CONCLUSION**

s Shear-wave dispersion slope obtained at SWE may be helpful for identifying renal allograft dysfunction.

#### **CLINICAL RELEVANCE/APPLICATION**

Shear-wave dispersion slope, which reflects the viscosity of tissue, might be used as a reliable noninvasive imaging modality that can help differentiate acute dysfunction from stable graft.

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## Abstract Archives of the RSNA, 2023

S3B-SPHN

### Head & Neck Imaging Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPHN-1 Fluoroscopic Function in Cone-beam CT Provides Video Fluorographic Swallowing Study

##### PURPOSE

Videofluoroscopic swallowing study (VFSS) is a gold-standard radiological examination for dysphagic patients. Usually, VFSS is performed using whole-body x-ray fluoroscopic unit. This prevents oral radiologists without a whole-body x-ray fluoroscopic unit from performing VFSS. Recently, a cone-beam CT unit equipped with x-ray fluoroscopy has been put into practical use. In this study, we evaluated the cone-beam CT unit's fluoroscopic function whether it is suitable for VFSS.

##### METHODS AND MATERIALS

A cone-beam CT unit for maxillofacial region (VGi evo Evolved 3D Imaging, NewTom, Inc.) was used to take fluoroscopic images. The temporal resolution was 20 and 15 frames per second. The tube current was fixed at 3 mA and tube voltage at 110 kV. The contrast and gamma values of the images were adjusted to clearly observe. First, a phantom modeled living body was subjected. A 4 mm diameter tube was attached to the inside of the phantom and a 40w/v% barium solution (Barytgen HD, FUSHIMI Pharmaceutical Co., Ltd.) was through. Two 2 mm diameter iron balls were also attached to the pharynx of the phantom. One was on the epiglottic valley, and one on the piriform sinus. Then, two healthy adults with no history of dysphagia were subjected. Saliva (with no contrast media), a 40w/v% barium solution, a paste with barium solution (Fruche, House Foods Corp.), and a gelatin jelly with barium solution (Jelly Ace, House Foods Corp.) were used as test foods. Two subjects swallowed a spoonful or 3 ml of each test food. The subject's VFSS images were evaluated using the checking items in the VFSS guideline of the Japanese Society of Dysphagia Rehabilitation.

##### RESULTS

The image of barium solution passed through the tube and 2 mm iron balls were clear observed in the phantom's VFSS images. Swallowing movements without contrast medium allowed clear observation of the anatomical structures these were tongue, pharynx, soft palate, and others. All target evaluation items including the movement of the test food into the epiglottic valley, the piriform sinus, and the esophagus could be observed. The VFSS image of the phantom and two subjects were clear observed in both 20 and 15 frames per second.

##### CONCLUSION

Although there are restrictions on the body position of the subject, a cone-beam CT unit equipped with x-ray fluoroscopy could be applied for practical VFSS examination. It allows the oral radiologists to perform VFSS in minimal clinics. Then, the accurate diagnosis of swallowing function, treatment effects, and the progress of recovery of swallowing function will be possible.

##### CLINICAL RELEVANCE/APPLICATION

This method allows performing VFSS in minimal clinics. The accurate diagnosis of swallowing function, treatment effects, and the progress of recovery of swallowing function will be possible.

#### S3B-SPHN-2 2x Thin-Slice Single-Excitation Wideband MRI (SE-WMRI) for Cranial Nerves Assessment - A Preliminary Study

##### PURPOSE

MRI examination of cranial nerves has always been difficult due to their small sizes and torturous courses of cranial nerves. Thus, multiple techniques have been devised to illustrate each cranial nerve segment. In contrast to the standard heavy T2 sequence, the T2\* gradient echo (GRE) sequence is known to be able to better reveal nuclear and fasciculus segments, as well as intra-tumor microhemorrhages of cranial nerves. Due to the prolonged scan time of high-resolution T2\* imaging, the Single-Excitation Wideband MRI (SE-WMRI) technique is utilized to enhance such MRI acquisition with double the slices in the same field of view (FOV).

##### METHODS AND MATERIALS

This study implements SE-WMRI on a Siemens PRISMA 3T MRI system. Two sets of T2\* full-brain images were acquired from healthy subjects using the standard GRE and SE-WMRI sequences with the following parameters: For standard GRE, TR/TE=500/11.4ms, resolution=0.5 x 0.5 mm, slice number=25 and thickness=4 mm, so the scan time=9:36. For thin-slice SE-WMRI, slice thickness reduced to 2 while slice number increase to 50 to maintain the overall FOV coverage; TR is extended to 1000 ms to enable the scan with extra slices, resulting in a scan time of 9:36.

##### RESULTS

This study utilizes SE-WMRI to achieve 2x slice-direction resolution (2x thinner slices) within the same scan duration and provide finer visualization of cranial nerves 5, 7, and 8. The enhanced resolution and reduced partial-volume effect of SE-WMRI images enable better estimation and tracing of the intra-brainstem fascicular segments, as well as the cisternal segments of the cranial nerves.

## CONCLUSION

s This preliminary study demonstrates SE-WMRI as a potential clinical examination tool, achieving 2x slice-direction resolution (2x thinner slices) within the same duration as standard sequences to provide a more detailed view of the cranial nerves. Since GRE T2\* sequences, used to observe hemorrhage or calcification, are often time-consuming, SE-WMRI can benefit such scans to achieve finer resolution in a reasonable scan time. In the future, this technique will be implemented in existing sequences that only focus on cranial nerves to achieve further acceleration and higher resolution.

## CLINICAL RELEVANCE/APPLICATION

Clinically, GRE T2\* imaging of the cranial nerves is used to observe the fascicular segment and detect microhemorrhage as a hallmark to differentiate meningioma from vestibular Schwannoma, while standard heavy T2 imaging could not. However, the prolonged acquisition time of GRE T2\* imaging limits its practicality. Therefore, SE-WMRI can benefit such scans to achieve high resolution while maintaining scan duration, increasing its usability in clinical scenarios.

## S3B-SPHN-3 Evaluation of Nasopharyngeal Carcinoma Involving the External Membrane of Internal Carotid Artery Based on MRI

### PURPOSE

This study aimed to explore the evaluation method of nasopharyngeal carcinoma involving the external membrane of the internal carotid artery (ICA) based on MRI and propose a new assessment criteria for ICA invasion.

### METHODS AND MATERIALS

A retrospective analysis was conducted on 50 patients of our hospital with pathologically confirmed nasopharyngeal carcinoma who had undergone MRI scans. Based on MRI images, the extent of nasopharyngeal carcinoma infiltrating the ICA wall was classified and evaluated. A new grading system for ICA invasion was proposed which consisted of four levels. In addition, other commonly used assessment criteria were compared and analyzed.

### RESULTS

Through MRI image analysis, 12 cases of nasopharyngeal carcinoma invading the external membrane of the ICA were found in the 50 patients. Among these patients, the newly proposed grading system for ICA invasion could more accurately and comprehensively evaluate the extent of nasopharyngeal carcinoma's invasion of the ICA wall compared to other assessment criteria. It also demonstrated higher sensitivity and specificity.

## CONCLUSION

s The MRI-based grading system for ICA invasion can better evaluate the degree of nasopharyngeal carcinoma's invasion of the ICA wall with high sensitivity and specificity, providing a more accurate diagnosis and treatment plan for patients.

## CLINICAL RELEVANCE/APPLICATION

These research findings are of great significance for the clinical diagnosis and treatment of nasopharyngeal carcinoma and lay the foundation for further exploration of the relationship between ICA invasion and prognosis.

## S3B-SPHN-4 Application of Multidimensional Diffusion MRI in Nasopharyngeal Carcinoma: An Exploratory Cross-sectional Study

Participants

Yingying Chen, Shenzhen, China (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the potential of multidimensional diffusion MRI (Mdd-MRI) in assessing the microscopic diffusion characteristics of nasopharyngeal carcinoma (NPC) and explore its potential application in diagnosing and differentiating tumor pathological subtypes and TNM stage, as well as determining Epstein-Barr virus (EBV) infection status.

### METHODS AND MATERIALS

Sixty-six patients with histologically-confirmed NPC were included in the study. Mdd-MRI was performed with multiple b values to obtain five microscopic diffusion metrics: anisotropic mean kurtosis (MKa), isotropic mean kurtosis (MKi), total mean kurtosis (MKt), and microscopic fractional anisotropy ( $\mu$ FA). For comparison with macroscopic diffusion characteristics, apparent diffusion coefficient (ADC) was obtained through conventional diffusion weighted imaging sequence. Diffusion-related measurements were compared using student t test between NPC tissue and normal nasopharyngeal tissue, among different histopathology, TNM stage, and EBV infection status. Spearman correlation analysis was performed between diffusion-related measurements and T stage.  $P < 0.05$  (two-tailed) indicates significant difference.

### RESULTS

Significant difference was found in ADC between tumor tissue and normal nasopharyngeal tissue ( $P = 6.023e-11$ ). Microscopic metrics and ADC showed significant differences among different primary tumor stages (T1-T4) and a significant correlation with T stage ( $\mu$ FA:  $\rho = 0.52$ ,  $P = 0.00001$ ; MKa:  $\rho = 0.38$ ,  $P = 0.002$ ; MKi:  $\rho = 0.27$ ,  $P = 0.03$ ; MKt:  $\rho = 0.32$ ,  $P = 0.009$  and ADC:  $\rho = -0.36$ ,  $P = 0.003$ ). However, no significant differences were observed in other subgroups, including histopathology, N stage, and M stage, and EBV infection status (all  $P > 0.05$ ).

## CONCLUSION

s Mdd-MRI is a valuable tool for assessing the microscopic diffusion characteristics of NPC. However, it has limited value in diagnosing NPC, differentiating tumor pathological subtypes, N stage, and M stage, and predicting EBV infection status.

## CLINICAL RELEVANCE/APPLICATION

Mdd-MRI can be a useful technique in assessing the microscopic diffusion characteristics of NPC, providing insights into tumor heterogeneity from a novel diffusion perspective.

### **S3B-SPHN-5 Demonstrating the Facial Nerve in the Parotid Gland using 3 Dimension Fast Field Echo Imaging**

#### **PURPOSE**

To assess the performance of three-dimension fast field echo imaging (T2WI-3D-FFE) in displaying the intraparotid facial nerve (IFN) and localizing the tumor.

#### **METHODS AND MATERIALS**

Seventy-nine patients with parotid tumors who underwent T2WI-3D-FFE were retrospectively enrolled (Table 1). The T2WI-3D-FFE images were reconstructed with curvilinear planar reconstruction (CPR) by two radiologists independently. The identification certainty of IFN was scored with an arbitrary scale of 0-3. The tumor locations were categorized as deep or superficial on the basis of direct and 2 indirect methods (the facial nerve line (FNL) and retromandibular vein (RMVL)). Surgical localization was considered as the criterion standard. The diagnostic accuracy, sensitivity and specificity for localizing parotid lesions using each method were calculated and compared using the McNemar tests.

#### **RESULTS**

The main trunk, temporofacial division, and cervicofacial division of IFN were visualized in 100%, 52% and 46% of patients, respectively on the reconstructed T2WI-3D-FFE images. The diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value for localizing deep lobe lesions using direct method were 96.2%, 88.9%, 91.7%, 80%, 98.6%, respectively. These findings were significantly higher than FNL and RMVL in sensitivity ( $P < 0.05$ ). The relationship between the tumor and the main trunk of the facial nerve was correctly predicted in 93.67% (74/79) of images (Table 3).

#### **CONCLUSION**

s T2WI-3D-FFE can provides detailed morphological information on the nerve relative to adjacent structures preoperatively.

#### **CLINICAL RELEVANCE/APPLICATION**

Intraparotid facial nerve (IFN) imaging is a clinical challenge in MRI that it is difficult to differentiate parotid gland tumors from facial nerve on conventional MRI. It is great demand to develop new diagnostic technology to accurately display peripheral nerve and tumor for avoiding intraoperative injury.

### **S3B-SPHN-6 A Phantom Study on the Impact of Combined Deep Learning Reconstruction and Metal Artifacts Reduction Algorithm on CT Image Quality in Different Scanning Conditions for Maxillofacial Region with Metal Implants**

#### **PURPOSE**

This study aimed to investigate the impact of combining deep learning image reconstruction (DLIR) and metal artifacts reduction (MAR) algorithms on the quality of CT images with metal implants under different scanning conditions.

#### **METHODS AND MATERIALS**

A phantom of pig's maxillofacial region designed for image quality assessment was used to acquire data at three dose levels (CTDIvol: 20/10/5/ mGy). The raw data were reconstructed using filtered back projection (FBP), adaptive statistical iterative reconstruction with Veo at a level of 50% (AV50), and DLIR (TrueFidelity™) at three levels (low, medium, and high). Regions of interest (ROIs) were selected in different tissues (near/far fat, near/far muscle, near/far bone) both with and without metal implants and artifact. The signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and metal artifact index (MAI) were calculated, and subjective image quality was assessed on a 5-point Likert scale by two experienced radiologists.

#### **RESULTS**

(1) In the same scanning condition, no significant difference was found in Hounsfield unit (HU) values among the five algorithms in different tissues. However, DLIR-L, DLIR-M, and DLIR-H produced a smaller standard deviation (SD) than that of FBP and AV50 ( $P < 0.05$ ). (2) DLIR showed a better noise reduction compared to FBP and AV50 ( $P < 0.05$ ). The SNRs showed a decreasing trend in the order of DLIR, FBP, and AV50 in three tissues. The CNR decreased in the order of DLIR, AV50, and FBP in fat and muscle, except bone. FBP led to the highest MAI in both near and far fat. (3) Both observers rated the reconstruction algorithms with MAR as having lower artifact scores than those without MAR in all three types of tissues ( $P < 0.01$ , except the far shadow and bloom of bone,  $P = 1.0$ ). The level of artifact reduction was superior while increasing the level of DLIR ( $P < 0.05$ ) and both observers agreed that DLIR produced better results in artifact reduction compared with FBP and AV50. The subjective image quality decreased in the order of DLIR, AV50, and FBP ( $P < 0.01$ ).

#### **CONCLUSION**

s The combination of DLIR and MAR algorithms can improve image quality and significantly reduce metal artifacts, providing a higher clinical application value.

#### **CLINICAL RELEVANCE/APPLICATION**

Reducing metal implant artifacts is a major concern in medical imaging. The combination of deep learning reconstruction algorithm (DLIR) and metal artifacts reduction (MAR) algorithm provides a viable alternative choice compared to conventional methods such as FBP and AV50. Using DLIR with MAR, both image quality and metal artifact reduction are improved. This approach can have a significant impact on tumor diagnosis, particularly in cases of oral neoplasms where metal artifacts can obscure critical details.

### **S3B-SPHN-7 The Feasibility Study of Virtual-unenhanced-scan Instead of Conventional True-non-contrast Scan in Neck CT Examination**

#### **PURPOSE**

To explore the feasibility of virtual-unenhanced (VUE) scan instead of true non-contrast (TNC) scan in the energy spectrum CT neck imaging of the Revolution 256-row wide volume detector.

#### **METHODS AND MATERIALS**

Twenty patients who underwent neck plain scan were collected, and GE Revolution 256 CT was used to perform true non-contrast

neck scan and energy spectrum enhanced scan. True non-contrast scan tube voltage is 120kV, and the iterative reconstruction level ASIR-V weight is 30%. The energy spectrum enhancement scan mode (GSI) tube voltage is 80kV-140kV instantaneous switching, and the other scan parameters are consistent with the true non-contrast scan. Post-processing to obtain VUE images in arterial phase and venous phase. The AW4.7 workstation was used to measure the CT value and SD value of subcutaneous fat, the CT value of the common carotid artery and the CT value of the sternocleidomastoid muscle. The subjective evaluation was performed by two deputy chief imaging physicians on the basis of conventional unenhanced scans. The iodine removal ability of virtual unenhanced scans was scored by a double-blind method. Using SPSS 23.0 software, the CT value, SD and SNR of the 3 groups of images were compared by one-way ANOVA analysis, the subjective scores were compared by Kruskal-Wallis H test.

## **RESULTS**

The CT values of common carotid artery in true non-contrast, arterial and venous phases of VUE were  $48.10 \pm 5.67$ ,  $67.35 \pm 12.36$ ,  $56.12 \pm 11.69$ , respectively, with little change but statistical difference ( $p < 0.05$ ). The CT values of sternocleidomastoid muscle were  $57.52 \pm 12.65$ ,  $54.37 \pm 9.38$ ,  $58.52 \pm 10.1$ , no statistical difference ( $p > 0.05$ ); The SD were  $6.41 \pm 2.36$ ,  $5.97 \pm 1.20$ ,  $6.18 \pm 1.93$ , respectively, and there was no statistical difference ( $p > 0.05$ ). The subjective iodine removal effect scores were  $3.25 \pm 0.44$  and  $4.00 \pm 0.52$  for arterial and intravenous VUE respectively, with statistical differences ( $p < 0.05$ ), the intravenous VUE score was higher. Conventional plain scan CTD<sub>Ivol</sub> ( $10.86 \pm 1.44$ ) mSv, energy spectrum arterial and venous enhancement CTD<sub>Ivol</sub> are each ( $9.99 \pm 1.30$ ) mSv, virtual plain scan and energy spectrum enhancement are 35.21% lower than conventional plain scan and energy spectrum enhancement CTD<sub>Ivol</sub>.

## **CONCLUSION**

s VUE image quality has the potential to replace true non-contrast scan images. The effect of VUE during intravenous phase is better, which can effectively reduce the patient's radiation dose.

## **CLINICAL RELEVANCE/APPLICATION**

VUE image has the potential to replace true non-contrast scan images. The effect of intravenous VUE is better, which can effectively reduce the radiation dose of patients. It can be promoted and used in patients with neck tumors that require multiple reexaminations.

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## Abstract Archives of the RSNA, 2023

S3B-SPIN

### Imaging Informatics Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPIN-1 Multi-parametric MRI Brain Tumor Diagnosis with Memorizing Transformer

##### PURPOSE

Deep learning has been widely utilized in MRI diagnosis. Among them, transformers have gained increasing popularity due to their ability to handle multiple modalities. However, its application has been hindered because acquiring large-scale multimodal MR data is expensive and time-consuming. To narrow the gap, we designed a transformer architecture with external memory, which memorizes the attention from the historical training process to reduce the reliance on large-scale dataset.

##### METHODS AND MATERIALS

During training, the external memory stores a paired query and value from each attention head. Importantly, this design is efficient and does not incur any additional computation cost. During inference, the cached memory is used to enhance local attention through K nearest neighbor lookup. This improves the overall performance of the model. We implemented this external memory design on an 8-layer vision transformer with 8 attention heads in each layer and the dimension of the tokens were set to 256, but it can be incorporated into any transformer-based model (Fig. a). Evaluations were performed on a dataset of 147 brain post-treatment malignant glioma cases, each of which included five MRI sequences, T1-weighted (T1w), T2-weighted (T2w), fluid-attenuated inversion recovery (FLAIR), gadolinium-enhanced T1w (GdT1w), and amide proton transfer-weighted (APTw) MR images, for classifying treatment effect and tumor recurrence. For each scan, the 3D APTw MRI protocol provided 15 slices, so all volumetric MR images had 15 instances. Each instance included T1w, T2w, FLAIR, GdT1w, and APTw images with the matrix shape of 5 (sequences) × 256 (pixels) × 256 (pixels). A proportion of 80% on the case-level was split as the training set (n=118) and the remaining 20% as the test set.

##### RESULTS

The baseline was the ViT without external memory. Our method achieved an AUC of 0.848 ( $p < 0.001$ ), which improves 5.15% of the plain ViT's AUC of 0.806 ( $p < 0.001$ ). The accuracy is 0.779, the precision is 0.625, the sensitivity is 0.818, the specificity is 0.818 and the F1-score is 0.709 (Fig. b).

##### CONCLUSION

In this work, we propose a memorizing transformer for the small-scale multi-parametric MR image analysis. The method stores the attention in the training process and applies them to the inference stage with KNN lookup, which thus costs no extra GPU run-in memory. The method can increase the plain transformer AUC by 5.15%, which confirms the effectiveness of our method.

##### CLINICAL RELEVANCE/APPLICATION

We propose a memorizing transformer for the small-scale multi-parametric MR image analysis that can increase the plain transformer AUC.

#### S3B-SPIN-2 Consistent and Efficient Image Segmentation in the German Nationwide RACOON Consortium

##### Participants

Bianca Lassen-Schmidt, PhD, Bremen, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

Multi-center studies, including large cohorts, require software tools that ensure consistent and efficient segmentation of image data. In the RACOON project, all German university hospitals jointly work with identical software systems. Here we analyze the segmentation tool of the first RACOON trial retrospectively and discuss the requirements for such a tool.

##### METHODS AND MATERIALS

In this study, a cohort of 14,023 patients (47% female, mean age 54.6 years, mean BMI 23.4) from 36 German university hospitals was collected and evaluated by radiologists. The datasets included chest CT with 22 different disease groups. Of the total cohort, 20% (2394 datasets) were randomly selected and processed using the segmentation and annotation toolkit SATORI. This client-server application is highly configurable and was utilized to provide a guided lung segmentation workflow, including automated segmentation of the lungs, lung lobes, and ground glass opacities. Additionally, other anatomical structures and pathologies could be manually or semi-automatically segmented.

##### RESULTS

The overall performance of SATORI was evaluated by 35 radiologists with varying levels of experience using the tool, ranging from 1 (less use) to 5 (frequent use) on a Likert scale of 1 (poor) to 5 (excellent). The mean overall performance rating for SATORI was 2.7. Analysis of the ratings from the different user groups, based on their intensity of use (IoU), revealed that 5/5/6/8/10 radiologists with an IoU 1/2/3/4/5 rated the performance as 1.8/2.2/2.3/2.9/3.4, respectively. A Wilcoxon rank sum test was performed to compare the ratings between inexperienced (IoU 1-3) and experienced (IoU 4-5) readers, and a difference was found

(P = 0.01). Seven radiologists reported occasional freezing or slowness as the reason for a negative rating.

## CONCLUSION

s SATORI showed promise in achieving consistent image segmentation in the RACOON project. Users with more experience rated it higher, likely due to a learning effect. SATORI is being prepared for three more RACOON studies, with improvements to usability and network connection logging to address occasional freezing. Future enhancements include individual worklists for readers and a review tool for communication between reader and reviewer. Three key requirements for segmentation software in large multi-center studies to ensure consistent and efficient image segmentation are guided workflows, simultaneous use by multiple users, and highly automatic segmentation tools. "Funded by „NUM 2.0" (FKZ: 01KX2121)".

## CLINICAL RELEVANCE/APPLICATION

Multi-center studies provide heterogeneous data, more readers, and enough data for studies with rare pathologies. Nonetheless, segmentation software needs to meet specific requirements.

### S3B-SPIN-3 Clinical Study of Low Radiation Dose Combined with Deep Learning Image Reconstruction Algorithm for Detection of Liver Metastases

Participants

Nana Liu, Zhengzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

The aim was to investigate whether low radiation doses combined with DLIR algorithms improve liver image quality and liver metastasis detection compared with ASiR-V algorithms.

## METHODS AND MATERIALS

195 patients with suspected liver lesions who needed abdominal enhanced CT scans were collected. Conventional radiation dose examination (tube current of 400 mA) was performed during the first venous phase and low radiation dose examination (200 mA or 120 mA) was performed during the second venous phase. Patients were divided into a 50% radiation dose reduction group and a 70% radiation dose reduction group according to the different tube currents at the second venous phase. All images were reconstructed with ASiR-V50%, DLIR-L, DLIR-M and DLIR-H. Quantitative parameters including subcutaneous fat noise, CT values and SNR of liver, pancreas, portal vein and muscle, and contrast-noise ratio of liver metastases were compared with one way ANOVA test. Qualitative parameters including image quality, noise, contrast, lesion conspicuity, and diagnostic confidence score were compared with Kruskal-Wallis H test. The number and size of liver metastases detected by the ASiR-V50% algorithm at standard radiation doses were used as a reference standard, and the detection rates of liver metastases of different sizes were calculated for each algorithm under low radiation dose conditions.

## RESULTS

Objective evaluation: The noise and SNR of ASiR-V50% at standard dose were comparable to DLIR-M at 50% lower dose and 70% lower dose, while DLIR-H at 50% lower dose and 70% lower dose had lower noise and higher SNR and CNR. Subjective evaluation: Compared with the ASiR-V50% of standard dose, both DLIR-M and DLIR-H with 50% reduced dose could maintain the image quality, and DLIR-M and DLIR-H with 70% reduced dose had reduced image quality but still met the diagnostic requirements with a subjective score >3. Lesion detection rate: The lesion detection rates for ASiR-V50%, DLIR-L, DLIR-M, and DLIR-H at 50% lower doses were 90.2%, 89.2%, 91.4%, and 89.9%, respectively. All algorithms were able to detect all lesions larger than 1 cm. The lesion detection rates were 69.4%, 70.5%, 73.3%, and 71.3% for ASiR-V50%, DLIR-L, DLIR-M, and DLIR-H at 70% lower doses, respectively.

## CONCLUSION

s Compared to ASiR-V50%, DLIR can improve the objective and subjective image quality, as well as lesion conspicuity and diagnostic confidence of liver metastases. DLIR can maintain or improve image quality at 50% radiation dose reduction while preserving the detection of liver metastases larger than 1 cm.

## CLINICAL RELEVANCE/APPLICATION

DLIR can maintain or improve image quality at 50% radiation dose reduction while preserving the detection of liver metastases larger than 1 cm.

### S3B-SPIN-4 Standard and Low-dose Virtual Noncontrast Imaging using Deep Learning Image Reconstruction at Abdominal Dual-energy CT

Participants

Nana Liu, Zhengzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the image quality and lesion detectability of virtual noncontrast (VUE) images from standard-dose and low-dose abdominal dual-energy CT (DECT)

## METHODS AND MATERIALS

This prospective study included 30 patients who underwent standard-dose and low-dose portal venous abdominal DECT in the same breath hold. VUE images were reconstructed from with iterative reconstruction (IR), DLIR at medium (DM) and high levels (DLIR-H) respectively. The absolute error of VUE CT attenuation (VUEerror) compared with true noncontrast (TUE) images reconstructed by IR was measured in multiple organs. The signal-to-noise (SNR) ratio for the measured organs were calculated. Two board-certified radiologists rated the qualitative assessment of image noise, image contrast, overall image quality, and lesion conspicuity on a 5-point scale. Interreader agreement was evaluated using the kappa analysis .

## RESULTS

The VUE image attenuation values for all measured organs were lower than TUE images, with standard- and low-dose VUEerror less than 5 HU in 40% and 23%, and less than 10 HU in 90% and 67%, respectively. The SNR for all organs and subjective ratings for all categories in VUE images were greater than TUE images. Among all VUE images, DLIR-M showed highest in all subjective ratings. The

lesion detection rate in the low-dose VUE images was lower compared to standard-dose VUE images.

## CONCLUSION

Dual-energy CT with DLIR allows for the reconstruction of standard-dose abdominal VNC images with accurate attenuation values, good image quality and lesion detectability compared with true noncontrast images.

## CLINICAL RELEVANCE/APPLICATION

DLIR had a significantly lower image noise, higher SNR and higher overall image quality of VUE images than the ASiR-V60%.

## S3B-SPIN-5 Prediction of T2DM using MRI Fat Fraction Maps of Ectopic Fat Deposition, Abdominal Wall Muscle Fat and Bone Marrow Adipose Tissue

Participants

Qi An, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of our study was to quantitatively assess the abdominal wall muscle adipose tissue (AMAT) and bone marrow adipose tissue (BMAT) content and ectopic adipose deposition in patients with Type 2 diabetes mellitus (T2DM) by MRI fat fraction maps to explore independent risk factors that can predict T2DM.

## METHODS AND MATERIALS

A total of 345 participants who underwent 1.5 T or 3.0 T MRI examination of upper abdomen were included in our study. The MRI images of all patients included IDEAL-IQ or mDixon Quant sequence. The fat fraction (FF) and area of visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT), AMAT were obtained at the level of the L1 and L2 vertebral bodies by Image J (National Institutes of Health, USA), and the FF and area of BMAT were automatically calculated at the level of the T12 and L1 vertebral bodies by the software where the mean of BMAT were computed. The hepatic fat fraction (HFF) and pancreatic fat fraction (PFF) were semi-automatically measured by Smart ROI on the post-processing platform (Intellispace Portal, ISP, Philips, Holland). The binary Logistic regression analysis and receiver operating characteristic (ROC) curve were used to evaluate the predictive ability of independent risk factors for T2DM.

## RESULTS

VAT area, VAT FF, HFF, PFF, BMAT FF, AMAT area and AMAT FF of the T2DM group were higher than the non-T2DM group and SAT FF was lower ( $P < 0.05$ ). However there was no statistically significant difference in SAT area of two groups ( $P > 0.05$ ). The binary logistic regression model analysis showed that SAT FF, VAT area and PFF were independent risk factors for T2DM, and OR values were 0.920, 1.007 and 1.073, respectively. The ROC curve shown that area under the curve (AUC) values of SAT FF, VAT area and PFF were 0.609, 0.681 and 0.786 respectively, and the sensitivity were 0.441, 0.676 and 0.750 respectively, and the specificity were 0.798, 0.625 and 0.773. The AUC values predicted by SAT FF combined with VAT area and PFF for T2DM were 0.787, with the sensitivity of 0.853 and the specificity of 0.661. The differences of AUC values were compared by Delong test, and the results showed that the AUC values of PFF and their combination were higher than those of SAT FF and VAT area ( $P < 0.05$ ).

## CONCLUSION

In this study, we found that SAT FF, VAT area and PFF are independent risk factors for T2DM, and PFF is a better predictor of T2DM than SAT FF and VAT area.

## CLINICAL RELEVANCE/APPLICATION

Our findings further deepened our understanding of the relationship among ectopic fat deposition, AMAT and BMAT. In addition, we found that PFF is a better independent risk factor for T2DM, so quantitative evaluation of PFF fat content in patients with T2DM by non-invasive MRI fat maps can better predict and evaluate the occurrence, progress and prognosis of T2DM.

## S3B-SPIN-6 Cardiac CT to MR Image Conversion Using Generative Diffusion Models

Participants

Albert Song, La Jolla, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate whether 1) a generative diffusion model, trained exclusively with cardiac MRI data, could be used to perform intermodality image conversion from cardiac CTA to cine SSFP MRI and 2) if these synthesized SSFP images can be used as inputs for other MRI-specific CNNs.

## METHODS AND MATERIALS

With HIPAA compliance and IRB approval, we retrospectively collected 222 cardiac MRIs to train a diffusion model to synthesize SSFP images from image edges. MRI exams were split 70/15/15 for training, validation, and testing. To evaluate cross-modality image conversion, we retrospectively identified an additional 30 patients who underwent both cardiac CTA and MRI within  $7 \pm 8$  months, between 4/2020 and 3/2023 (age  $47 \pm 20$  years, 13 male). The diffusion CNN was used to synthesize SSFP images from CTA. To show that synthesized SSFP images are superior inputs for MRI-specific CNNs, we used an existing MRI-trained 2D UNet to segment the synthetic SSFP and source CTA images and compared them against manual segmentations. Cardiac volumes were then compared between synthetic and real cine SSFP images. Statistical analyses included comparison of segmentation overlap using Dice and comparison of cardiac volumetry using Pearson correlation and paired t-test with a type I error threshold of 0.05.

## RESULTS

For the following results, segmentation Dice scores are presented in order of epicardium, myocardium, and endocardium. For short axis CTA images, median Dice was 0.900 (IQR:0.844-0.932), 0.689 (0.597-0.752), and 0.906 (0.853-0.938), respectively. For synthesized-SSFP images, median Dice was 0.926 (IQR: 0.893 - 0.945), 0.757 (0.682 - 0.812), and 0.920 (0.866 - 0.948), respectively. Mean Dice scores were significantly higher for synthetic SSFP images relative to CTA images ( $p < 0.001$  for each task, paired t-test). Volumetric measurements from synthesized and real SSFP images correlated well for EDV ( $r=0.77$ ), ESV ( $r=0.83$ ), and EF ( $r=0.88$ ).

## CONCLUSION

s Diffusion models can be used to perform intermodality image conversion, including synthesizing SSFP images from CTA. Volumetric measurements of cardiac function using synthetic SSFP images generated from cardiac CTA correlated well with direct measurements from cardiac MRI.

## CLINICAL RELEVANCE/APPLICATION

Diffusion models may enable intermodality image conversion to facilitate cross-modality image quantification, segmentation, and comparison for cardiac CTA and MRI.

## S3B-SPIN-7 AI Enhancement: Emulating Radiologists' Approach for Automated Contrast Phase Detection in Abdominal CT Scans

Participants

Eduardo Reis, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## PURPOSE

The accurate determination of contrast phases in abdominal CT scans is essential for the deployment of downstream artificial intelligence (AI) applications and reliable quantification of imaging biomarkers. DICOM tags are often used to identify contrast phases, but they can be unreliable. To address this challenge, we present an image-based AI algorithm that emulates how radiologists visually assess the enhancement patterns of key anatomical structures to determine the contrast phase. Our goal is to enhance the reliability and generalizability of contrast phase detection, independent of DICOM tags, and to facilitate its integration into clinical workflows by open sourcing the tool through an easy-to-use AI pipeline.

## METHODS AND MATERIALS

We obtained 739 abdominal CT exams, and included 1545 axial series, split into a 1183 and 362 for training and testing. Each patient's data was exclusively allocated to one set. The series were labeled as non-contrast, arterial, venous, or delayed using the "Series Description" DICOM tag. A radiologist reviewed each series to confirm or correct labels. Key anatomical structures, such as aorta, portal vein, inferior vena cava, renal parenchyma, and renal pelvis, were segmented using our open-source AI toolbox and radiomic features were extracted. An Extreme Gradient Boosting (XGBoost) classifier was trained to classify CT images into four contrast phases. The performance was evaluated using accuracy, sensitivity, specificity and F1 scores on internal and external validation datasets. External validation was performed on 209 scans (582 series) from "VinDr-Multiphase CT", a publicly available dataset that included non-contrast, arterial and venous scans.

## RESULTS

In internal validation, we achieved an overall accuracy of 92% and F1 scores of 97% for non-contrast, 79% for arterial, 92% for venous, and 95% for delayed phases. In external validation, we achieved an accuracy of 89%, and F1 scores of 97% for non-contrast, 87% for arterial, and 81% for venous phases. The performance improvement of the arterial class on external validation shows generalization capability despite limited training examples for this class. The algorithm was made publicly available through an open-source platform.

## CONCLUSION

s The proposed AI-based algorithm accurately detects contrast phases in abdominal CT scans independent of DICOM tags. The successful external validation demonstrates the algorithm's generalizability and robustness.

## CLINICAL RELEVANCE/APPLICATION

Contrast detection is crucial for deploying AI methods and ensuring the reliability of quantitative imaging biomarkers. The proposed algorithm serves as a valuable tool for enhancing AI applicability in medical imaging, allowing integration with other AI algorithms.

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## Abstract Archives of the RSNA, 2023

S3B-SPIR

### Interventional Radiology Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPIR-1 Shear Wave Elastography Evaluates the Efficacy of Microwave Ablation on Thyroid Nodules

##### PURPOSE

As a minimally invasive technique, percutaneous microwave ablation (MWA) has been applied as an alternative to thyroid surgery for benign thyroid nodules. Coagulation necrosis occurs and stiffness changes in thyroid tissue after ablation. Shear wave elastography (SWE) has been used to differentiate the malignant thyroid from benign nodules. But it has seldom been applied to monitor the change of thyroid nodules after ablation. The study aimed to investigate the efficacy of MWA on thyroid nodules and the effect of stiffness on the efficacy of MWA.

##### METHODS AND MATERIALS

Sixty-seven thyroid nodules treated with MWA were included between June 2021 and April 2023. All nodules were pathologically confirmed benign, and the maximum diameter was within 3 cm. SWE was performed to quantify the stiffness of nodules. The size, volume, volume reduction rate (VRR), and stiffness value of thyroid nodules were recorded before and at one, three, and six months after ablation. Thyroid nodules are classified as hard nodules or soft nodules according to the value of SWE. Compare the VRR between hard and soft nodules during post-ablation follow-up.

##### RESULTS

All nodules were completely ablated, and no complications occurred. The VRR of thyroid nodules gradually increased after ablation, and the VRR at one, three, and six months after ablation were 52.3% [interquartile range (IQR): 35.6-74.1%], 57.6% (IQR: 37.2-78.4%), and 74.9% (IQR: 50.4-90.2%), respectively ( $P<0.05$ ). The study showed that the stiffness of the nodules increased post-ablation compared with pre-ablation ( $P<0.05$ ). The stiffness value peaked one month after ablation and then gradually decreased ( $P<0.05$ ). The mean of SWE before ablation, and at one, three, and six months after ablation were  $36.7\pm 9.5$ KPa,  $76.5\pm 10.2$ KPa,  $62.8\pm 11.4$ KPa, and  $46.9\pm 9.5$ KPa, respectively ( $P<0.05$ ). Compared with soft nodules, hard nodules have a lower VRR after ablation ( $P<0.05$ ).

##### CONCLUSION

SWE is a noninvasive, sensitive and repeatable technique which can be applied to evaluate the efficacy of MWA of thyroid nodules and postoperative follow-up.

##### CLINICAL RELEVANCE/APPLICATION

SWE has been used for noninvasive and quantitative evaluation of the efficacy of MWA on thyroid nodules and postoperative follow-up.

#### S3B-SPIR-2 The Role of Contrast-enhanced Ultrasound in the Biopsies of Peripheral Pulmonary Lesions: A Retrospective Multicenter Study by using Propensity Score Analysis

##### PURPOSE

To compare the performance of conventional US and contrast-enhanced US (CEUS) as guiding tools in percutaneous transthoracic needle biopsy (PTNB) and evaluate the role of CEUS in PTNB for peripheral pulmonary lesions (PPLs).

##### METHODS AND MATERIALS

Patients with PPLs who received PTNB between 2017 and 2022 were retrospectively enrolled at four medical centers. According to whether pre-biopsy CEUS was performed, patients were divided into CEUS and US groups. The sampling success rate and the diagnostic accuracy of PTNB stratified by lesion size were analyzed. One-to-one propensity score-matching (PSM) analysis was performed using the nearest-neighbor matching method.

##### RESULTS

A total of 1027 lesions were analyzed: there were 634 in US group (mean age, 59 years  $\pm$  13 [standard deviation], 413 men) and 393 in CEUS group (mean age, 61 years  $\pm$  13 [standard deviation], 270 men). The CEUS group produced more acceptable samples than the US group (98.2% vs. 95.7%,  $p = .03$ ) and improved diagnostic accuracy (96.9% vs. 94.2%,  $p = .042$ ), and sensitivity (96.9% vs. 94.0%,  $p = .03$ ). PSM and stratified analyses ( $n = 358$  per group) indicated that the sample success rate (99.0% vs. 95.7%,  $p = .04$ ) and diagnostic accuracy (98.5% vs. 92.9%,  $p = .006$ ) of the CEUS group was higher than that of the US group for 2-7cm PPLs but not for lesions larger than 7cm (sample success rate: 96.9% vs. 97.1%,  $p = .93$ ; diagnostic accuracy: 95.0% vs. 99.0%,  $p = .08$ ).

##### CONCLUSION

CEUS-guided PTNB has a higher sampling success rate and diagnostic accuracy than US in 2-7cm PPLs. For PPLs larger than 7cm, consistent diagnostic accuracy can be achieved by well-trained biopsy operators whether using US or CEUS as the guide tool.

## CLINICAL RELEVANCE/APPLICATION

This study aims to investigate the role of CEUS in guiding PTNB of PPLs. The findings of this study can provide a detailed reference for selecting biopsy imaging guidance with a stratification criterion.

### S3B-SP1R-3 Comparison Between Percutaneous Transthoracic Co-axial Needle CT-guided Biopsy and Transbronchial Lung Biopsy for the Diagnosis of Persistent Pulmonary Consolidation

Participants

Juan Wang, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study is to compare the diagnostic yield and the complication rate between percutaneous transthoracic CT-guided co-axial needle biopsy (PTCNB) and transbronchial lung biopsy (TBLB) in persistent pulmonary consolidation.

## METHODS AND MATERIALS

From January 1, 2016 to December 31, 2020, we have retrospectively enrolled a total of 155 consecutive patients with persistent pulmonary consolidation who underwent both TBLB and PTCNB. The diagnostic accuracy, specificity, sensitivity and complication rate of the two biopsy methods for persistent lung consolidation has been compared. According to histopathological and microbiological analysis, the results of biopsy specimens were categorized as follows: malignant, specific benign, non-specific benign and non-diagnostic. The final diagnosis was established by surgical resection or clinicoradiological follow-up for at least 12 months following biopsy. Diagnostic yield of PTCNB/TBLB was defined as the percentage of the true diagnosis from biopsy as malignant and specific benign lesions.

## RESULTS

According to the standard reference, the final biopsy diagnoses of 11 cases were confirmed true malignant based on the surgical resections, the remaining were confirmed by clinical and imaging follow-up for at least 12 months. The overall diagnostic accuracy, sensitivity and specificity of PTCNB for malignant diagnosis were 91.61%, 72.34% and 100%, whereas of TBLB were 87.74%, 59.57% and 100%. At the same time, the overall diagnostic accuracy, sensitivity and specificity of PTCNB for specific benign diagnosis were 84.25%, 64.71% and 100%, whereas of TBLB were 63.23%, 16.18% and 100%. The diagnostic yield of PTCNB and TBLB were 50.32% and 25.16% respectively. For the TBLB-based negative cases, PTCNB provided a definite diagnostic yield of 37.93%. There were 45(45/155, 29.03%), 22(22/155, 14.19%) and 13(13/155, 8.39%) patients who experienced pneumothorax, intrapulmonary hemorrhage and hemoptysis respectively in PTCNB, while there were only 5(5/155, 3.22%) cases of mild intraprocedural bleeding occurring in TBLB.

## CONCLUSION

s PTCNB is an effective and safe modality, associated with higher diagnostic yield and better diagnostic accuracy compared to TBLB for persistent consolidation, especially as the complementary method for TBLB-based negative lung lesions.

## CLINICAL RELEVANCE/APPLICATION

In this study, we compared the diagnostic yield and the complication rate between percutaneous transthoracic CT-guided coaxial needle biopsy (PTCNB) and transbronchial lung biopsy (TBLB) of persistent pulmonary consolidation. Clinical physicians may choose appropriate biopsy method according to our study.

### S3B-SP1R-4 PI3K $\delta$ Inhibitor PI-3065 Induces Apoptosis in Hepatocellular Carcinoma Cells by Targeting Surviving

## PURPOSE

Hepatocellular carcinoma (HCC) is one of the most common malignant tumors worldwide, and its clinical treatment remains challenging. The development of new treatment regimens is important for effective HCC treatment. This research design to explore the anti-tumor function of PI3K  $\delta$  inhibitor PI-3065 on HCC and its potential mechanism.

## METHODS AND MATERIALS

CCK8 and flow cytometry were used to determine the activity of HCC cells treated with PI-3065. Apoptosis of HCC cells treated with PI-3065 were evaluated by hoechst staining and western blot. Mitochondrial staining and extraction were used to detect the mitochondrial state of HCC cells. SK-HEP-1 cells effectively transfected with survivin siRNA and plasmid overexpressed with survivin were treated with PI-3065, and then the apoptosis level of cells was evaluated by hoechst staining and western blot. The effects of PI-3065 on migration and colony formation of HCC cells were evaluated by wound-healing assay and colony formation assay. SK-HEP-1-derived xenograft tumor model in nude mice were constructed and administered by intragastric administration for 14 days. The control group were given the same dose of placebo. At the end point, the anti-hepatoma activity of PI-3065 in vivo was evaluated according to the volume, weight and protein changes of transplanted tumor.

## RESULTS

We found that PI-3065 dose- and time-dependently reduced HCC cell viability and induced apoptosis while posing no obvious apoptotic toxicity in normal liver cells. Further mechanistic analysis showed that PI-3065 induced apoptosis mainly by inhibiting survivin protein expression, decreasing mitochondrial membrane potential, and promoting cytochrome C release. Simultaneously, PI-3065 markedly suppressed the colony formation, migration, and epithelial-mesenchymal transition abilities of HCC cells. Furthermore, transplantation of nude mice with HCC tumors showed that PI-3065 inhibits HCC tumor growth in vivo by targeting survivin.

## CONCLUSION

s PI-3065 specifically inhibited survivin expression and exerted anti-HCC activity in vivo and in vitro, suggesting that it may serve as an effective antitumor drug for HCC treatment, which warrants further study.

## CLINICAL RELEVANCE/APPLICATION

In this study, we confirmed for the first time that PI-3065 can exert anti-HCC activity by inducing cell apoptosis in vivo and in vitro, which indicated that PI-3065 has great potential in clinical practice. Further studies have confirmed that PI-3065 has no toxicity to normal hepatocytes, and its safety and efficacy may provide a new choice for the treatment of HCC patients.

### **S3B-SPIR-5 Sono-activated Oxygen/Sulfate Dual-Radical Nanotherapy for Combined Cancer Suppression Infected Wound Repair**

Participants

Xiaohui Qiao, Shanghai, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To explore an all-in-one therapy for cooperatively fighting cancer, infection and boosting wound repair for patients with advanced superficial cancers or after surgical intervention to avoid multiple drug abuse and resultant adverse effects.

#### **METHODS AND MATERIALS**

The ultrasound-activated nanosensitizer PHMP was dexterously designed for combined therapy of cancer and infected wound based on oxygen/sulfate dual-radical nanotherapy. Firstly, the in vitro cancer cell killing action was proved using CCK-8 assay and fluorescence staining after the cells being treated with PHMP + US. Then, the in vitro migration promoting and bacteriostatic action was assessed through scratch test and detecting the bacteria viability respectively. Finally, the in vivo tumor-suppressive effect and repair function to the infected skin defect of PHMP + US was evaluated by constructing the subcutaneous melanoma and full thickness *S. aureus* infected skin wound model, and then monitoring tumor size, wound area as well as analyzing histological characteristics.

#### **RESULTS**

In the PHMP + US group, the descended cell viability and apparent cell death were observed, and the narrower scratch gap and fewer bacterial colonies were displayed. Simultaneously, the tumors undergoing PHMP + US disposal exhibited poor growth, distinct cell apoptosis and lower proliferation ability. In addition, the infected wounds in the PHMP + US group healed the fastest and demonstrated well-organized collagen fiber and skin structure.

#### **CONCLUSION**

s The in vitro and in vivo results suggests that US-activated PHMP can effectively inhibit tumor and promote infected wound repair.

#### **CLINICAL RELEVANCE/APPLICATION**

This study highlights the overall treatment of later stage or postoperative cancers accompanied by infectious wounds with a single US-activated multifunctional intervention which bypasses the side effects of polypharmacy and systemic administration of anticancer drugs/antibiotics. Such a conception delves the maximum capacity of each member and meanwhile reduces the harm to the minimum, which is of vast prospect in clinical transformation.

### **S3B-SPIR-6 Elucidation of the Microvascular Embolization Effects of Imipenem/Cilastatin Evaluation at the Level of Microvessels using Monochromatic X-ray in Vivo Study**

#### **PURPOSE**

To elucidate the characteristics of Imipenem/Cilastatin (IPM/CS) as an embolic material in vivo.

#### **METHODS AND MATERIALS**

Three healthy Japanese white rabbits (approximately 3 kg each) were used. A portion of one ear of each rabbit was injected subcutaneously with picibanil (0.5 KE) to create an inflammation-induced model. High spatial resolution microangiography was performed using monochromatic X-rays extracted from synchrotron radiation facility (Super Photon ring-8; SPring-8). Under anesthesia, an elastomer needle (26 G) was placed in the intermediate branch of the auricular artery, and pre-embolization angiography was performed. Then, embolization was performed from the intermediate branch of the auricular artery using a mixture of IPM/CS (0.2 g) and non-ionic contrast agent (2 ml). Angiography was performed during embolization, and at 3, 10, 20, 30, 40, 50, 60, 70, 80, and 90 minutes after embolization. The embolized vascular diameter was evaluated from the images during embolization, and the recanalization time was defined as after embolization time of "total artery area of post embolization / total artery area of pre embolization × 100" was ≥100 %. ROIs were set in both normal (n=3) and inflammation-induced (n=3) sites, and comparisons were made between the two groups.

#### **RESULTS**

The mean diameter of the embolized vessels immediately after embolization was 267±58.35 μm, with a range of 174-363 μm. In the follow-up observations after embolization, the normal vessels recanalized at an average of 70 minutes (case1: 101% on 70 min later, case2: 100% on 90 min later and case3: 101% on 50min later). In contrast, the vessels in the inflammation-induced areas did not show recanalization during the 90 minutes observation period.

#### **CONCLUSION**

s The characteristics of IPM/CS as an embolic material in vivo were elucidated. In vivo, much larger vessels are embolized than the actual particle size. It was also suggested that the embolization effect duration might differ between normal and inflammation-induced areas.

#### **CLINICAL RELEVANCE/APPLICATION**

The analgesic effect of IPM/CS embolization for pain associated with chronic arthritis has been clinically confirmed, and it may potentially become a basic data for the development of new embolic materials as alternatives to IPM/CS.

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## Abstract Archives of the RSNA, 2023

S3B-SPMK

### Musculoskeletal Imaging Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPMK-1 Feasibility Study on Classification of Meniscus Damage Based on MRI Radiomics

##### PURPOSE

To explore the value of machine learning(ML)models based on MRI radiomics features in predicting the degree of meniscus injury.

##### METHODS AND MATERIALS

MRI images of 732 knee menisci were retrospective analyzed. The menisci were randomly divided into a training group (n=512) and a validation group (n=220) at a ratio of 7:3. Radiomic features were extracted from the sagittal and coronal proton density-weighted fat suppression images. The Minimum redundancy maximum relevance (mRMR) and least absolute shrinkage and selection operator (LASSO) were used for data dimension reduction and feature selection. Then, based on the optimal features, we constructed a four-category classification model with different ML methods, and its diagnostic performance was quantified by the area under the receiver operating characteristic curve (AUC).

##### RESULTS

Eighteen significant radiomic features (10 from sagittal and 8 from coronal images) were selected for model construction. The Macro AUC of support vector machine, logistic regression, Gaussian process, random forest, quadratic discriminant analysis and Bagging decision tree model were 0.876, 0.871, 0.870, 0.869, 0.868 and 0.868, respectively. The best-performing models for each lesion grade were: random forest for normal meniscus (AUC=0.948), logistic regression for grade 1 meniscus injury (AUC=0.833), Bagging decision tree for grade 2 (AUC=0.805) and random forest (AUC=0.902) for grade 3 meniscus injury.

##### CONCLUSION

s The ML models based on MRI radiomics features can accurately assess the type of meniscal injury.

##### CLINICAL RELEVANCE/APPLICATION

By accurately assessing the type of meniscal injury, ML can enhance the reliability and reproducibility of the diagnosis and help radiologists make clinical decisions.

#### S3B-SPMK-2 Enhancing Patient-Centered Radiology Reports with Generative Artificial Intelligence: Adding Value to Radiology Reporting

##### Participants

Jiwoo Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the efficacy of AI-generated radiology reports in terms of report processing and providing high-quality, easily understandable reports that can address patient questions and to estimate the accuracy and artificial hallucination of AI-generated radiology reports.

##### METHODS AND MATERIALS

A total of 100 spine MRI reports were retrieved from our hospital database, all of which had been approved by fellowship-trained board-certified radiologists with 6 to 18 years of experience. To ensure compliance with HIPAA regulations, all reports were deidentified by removing unique identifying information. Using generative AI, AI-generated radiology reports were then produced by inputting the original reports into a new session without any prior questions having been posed. The reports were generated in four formats: (1) structured reports, (2) summary reports, (3) recommendations, and (4) patient-friendly reports. To evaluate the quality and accuracy of the AI-generated reports, they were compared with the original reports by a panel of radiologists in terms of: (1) the quality of the structured report, (2) the quality of the summary, (3) the concordance of the recommendations with those made by the radiologists, (4) the compatibility of the patient-friendly reports, and (5) the occurrence of artificial hallucinations. Two radiologists conducted qualitative and quantitative studies, independently (five-point scale).

##### RESULTS

The scoring of the AI-generated radiology reports were  $4.95 \pm 0.24$  for structured report and  $4.69 \pm 0.67$  for summary. The agreements of radiologist recommendations and generative-AI recommendations was 95.96% (score  $4.88 \pm 0.54$ ). The compatibility for patient-friendly reports was 83 % (score  $4.71 \pm 0.71$ ). There were 3% artificial hallucinations in patient-friendly reports. This amounted to 3.6 times higher prevalence of easy understandable for the generative-AI powered patient friendly reports ( $P < .001$ ).

##### CONCLUSION

s Generative AI was employed to reproduce radiology reports in various useful formats. The potential benefits of using AI assistants to generate these reports include improved report quality, greater efficiency in radiology workflows for producing structured reports, summaries, and recommendations, and a move toward patient-centered radiology.



## CLINICAL RELEVANCE/APPLICATION

The use of large language model in radiology reports can have a significant impact on the quality and efficiency of radiology workflows. By producing high-quality, easily understandable reports that can address patient questions, AI-generated reports can improve patient care and satisfaction, moving towards patient-centered radiology, which places a greater emphasis on meeting the needs and expectations of patients.

### S3B-SPMK-3 Performance of Deep Learning based Vertebral Compression Fracture Detection Algorithm in Patients with Acute and Chronic Fractures

#### PURPOSE

Although deep learning algorithms (DL) show promising detecting lesions, the robustness of DL in detecting vertebral compression fractures (VCFs) in patients with acute and chronic fractures was less well known. Therefore, the aim of this study was to investigate the robustness of a DL for detecting VCFs in patients with acute and chronic fractures.

#### METHODS AND MATERIALS

We included 178 patient CT cases (excluding those who underwent surgery with cement or screw) diagnosed with VCF at a tertiary medical center (KUMC, Seoul). Each vertebra's reference standard was established by two radiologists. A total of 1200 vertebral bodies (VBs) were labeled for use in the evaluation of which 1000 VBs were normal, 104 chronic and 171 acute. We utilized a deep learning-based quantitative spine analysis program (ClariVCF, ClariPi Inc., Seoul) in which the vertebral body was segmented automatically by using a pre-trained CNN model followed by measurement of vertebral heights at anterior, middle, and posterior portions of each vertebra. Vertebral height loss was then calculated by measuring the ratio of height at the anterior or middle portion to that of the posterior portion. In addition, a formula was used to compare the vertebral heights between the consecutive vertebra above and below. We evaluated the detection performance of DL for acute and chronic VCFs with sensitivity and specificity by using a criterion of 20% height loss ratio according to the Genant classification.

#### RESULTS

The detection performance of DL for the chronic VCFs was shown to be 94.23% (87.87-97.85%, 95% CI) in sensitivity and 86.91% (84.65-88.94%, 95% CI) in specificity. The performance was reduced for acute VCFs (N=171) to 78.95% (72.07-84.80%, 95% CI) in sensitivity and 86.91% (84.65-88.94%, 95% CI) in specificity. For the overall dataset, which included both acute and chronic VCFs, the sensitivity was 84.56% (79.71-88.64%, 95% CI) and the specificity was 86.91% (84.65-88.94%, 95% CI).

#### CONCLUSION

s The deep learning-based VCFs detection algorithm was more sensitive in detecting chronic VCFs than acute VCFs. However, the specificity remained unchanged for both chronic and acute.

## CLINICAL RELEVANCE/APPLICATION

It might be necessary to take cortical disruption or cortical step-off into account for acute VCFs, where some vertebral height loss might not be noticeable. This demonstrates the necessity for techniques other than height loss measurement. Additionally, a unique height loss measurement approach is necessary for each spinal location while taking into account the physiologic wedging of each vertebral level in order to prevent false positive results.

### S3B-SPMK-4 Describing the Effects of IV Contrast on CT Abdominal Body Composition Biomarkers

Participants  
Alexander Weston, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### PURPOSE

Automated measures of body composition from abdominal CT images are becoming more common to quantify frailty, obesity, and to predict disease outcomes. However, measures may be biased by the presence of intravenous (IV) contrast, possibly leading to prior studies avoiding reporting skeletal muscle density measurements (e.g., Magudia 2021, Radiology). We evaluated the effect of IV contrast phase on six biomarkers of abdominal body composition.

#### METHODS AND MATERIALS

We randomly sampled 244 persons with 258 abdominal CT radiologic exams (479 series) from a cohort representative of the general population. Series were manually annotated for IV contrast phase (noncontrast, arterial, venous, delayed, or nephrographic). We applied a deep-learning model to segment abdominal body composition centered at the L3 transverse process (previously validated mean Dice scores for subcutaneous fat area 0.98, visceral fat area 0.94, muscle area 0.96, and bone area 0.98). Muscle and bone density were defined as mean Hounsfield units (HU) of the segmented tissues. All available CT series were segmented and multiple acceptable series acquired at different IV contrast phases were used to calculate the difference in each body composition biomarker relative to the noncontrast CT series. Values are reported in scatter plots and significance was assessed using 2-sided paired-sample t-tests.

#### RESULTS

Based on manual review, 256/258 CT studies (99%) had one or more series with acceptable quality for body composition analysis and 95/256 studies (37%) had a noncontrast series for comparison. Skeletal muscle density measurements were higher in venous phase versus noncontrast (difference of 5.9HU, 95% CI: 4.72 - 7.15HU) and delayed phase versus noncontrast (difference of 8.5HU, 95% CI: 7.35 - 9.69HU), significant after Bonferroni correction. Vertebral bone density measurements were higher in venous phase versus noncontrast (difference of 8.2HU, 95% CI: 4.9 - 11.5HU) and delayed phase versus noncontrast (difference of 11.5HU, 95% CI: 7.5 - 15.6). No significant differences were observed between arterial phase versus noncontrast series.

#### CONCLUSION

s Skeletal muscle density and vertebral bone density measurements on abdomen CT are slightly higher in the presence of IV contrast.

## CLINICAL RELEVANCE/APPLICATION

A correction factor may be needed to account for IV contrast phase when measuring skeletal muscle density and vertebral bone

density biomarkers in CT-based body composition analysis.

### **S3B-SPMK-5 Distal Radius Fracture: Competent Radiology Reports Generated by ChatGPT Integrating RSNA Template Items and AO Classifier**

#### **PURPOSE**

While demand for radiology imaging grows worldwide, novel information technology tools promise an increase of reporting quality and as well quantity. Text report drafting tools are part of this development.

#### **METHODS AND MATERIALS**

In the present study, cases of distal radius fracture are defined. Command files for the writing of a report following a template of the Radiological Society of North America (RSNA) and Arbeitsgemeinschaft Osteosynthese (AO) are given to the natural language processing tool ChatGPT.

#### **RESULTS**

An overall high appraisal of ChatGPT radiology reports is obtained in an assessment by human radiologists. ChatGPT is able to adjust output files in response to minor changes in input command files. Shortcomings are the dealing with technical terminology and medical interpretation of findings.

#### **CONCLUSION**

In the future, text drafting tools might well support the clinical work of radiologists. ChatGPT is seen by us as a substantial step forward toward that aim.

#### **CLINICAL RELEVANCE/APPLICATION**

The amount of clinical imaging is growing because of reasons such as demographics and more complex imaging modalities. Tools which draft a text report allow the radiologist to increase output efficiency and to focus time on patient pathology.

### **S3B-SPMK-6 The Value of Incorporating Additional Carpal Tunnel Sequences in the Hand MRI for Patients Presenting with Trigger Finger Symptoms**

Participants

NA YOUNG LEE, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To determine the prevalence of carpal tunnel syndrome (CTS) in trigger finger patients and identify the MRI criteria necessary for its diagnosis, particularly in cases requiring surgical intervention by obtaining additional two sequence MRI of the carpal tunnel.

#### **METHODS AND MATERIALS**

Fifty-five hands in 49 patients underwent MRI for evaluation of trigger finger prior to surgery. The dataset included variables such as age, sex, patients' symptoms, and measurements of median nerve signal intensity (SI) and shape, cross-sectional area of the median nerve (MNA), and retinacular bowing. Patients who underwent carpal tunnel release were classified as having severe CTS. The statistical analysis of these factors was conducted using a suite of methods including the independent Student's t-test, Chi-square test, and logistic regression. ROC curves were also drawn to evaluate the precision of CTS diagnosis and to predict severe CTS.

#### **RESULTS**

A total of 22 hands underwent carpal tunnel release surgery for CTS with concomitant pulley release for trigger finger. The incidence of severe CTS in patients with trigger finger was observed to be 40%. One third of patients diagnosed with severe CTS exhibit the classical symptoms associated with CTS, including tingling sensations in their fingers. However, the remaining patients present with symptoms primarily related to trigger finger, such as pain in the fingers. Statistically significant differences were observed between patients with trigger finger and severe CTS, and those with trigger finger only groups, in relation to several key factors, including MNA, median nerve SI and shape, and retinacular bowing at the outlet ( $p < 0.001 \sim 0.005$ ). Among these factors, only MNA of proximal to inlet level (MNA-pi) and increased median nerve SI with nerve fascicle swelling exhibited a positive correlation with odds ratio of 1.657. Further analysis of ROC curves demonstrated a sensitivity, specificity, and accuracy of MNA-pi  $> 15 \text{ mm}^2$  of 77.27%, 72.73%, and 84.5%, and MNA of distal to outlet (MNA-do)  $> 13 \text{ mm}^2$  of 81.82%, 75.76%, and 84.8%.

#### **CONCLUSION**

Hand MRI is a highly accurate diagnostic modality for detecting severe CTS, which often requires surgical intervention.

#### **CLINICAL RELEVANCE/APPLICATION**

Incorporating two additional sequences of MRI of the carpal tunnel with hand MRI for preoperative evaluation of trigger finger has the potential to aid in the detection of severe CTS and in facilitating optimal surgical planning.

### **S3B-SPMK-7 Usefulness of the Floating Fat Sign in the Extensor Tendon Sheath for Predicting Extensor Pollicis Longus Tendon Rupture in Distal Radius Fracture**

#### **PURPOSE**

To evaluate the usefulness of the floating fat sign for predicting extensor pollicis longus (EPL) rupture in distal radius fracture (DRF).

#### **METHODS AND MATERIALS**

This retrospective study included patients with DRF, consisting of the EPL rupture ( $n = 9$ ) and non-rupture ( $n = 340$ ) groups. The floating fat sign was visually graded on a semi-quantitative Likert scale (0 to 2) for the second and third extensor compartments separately. The presence of bone fragment, Lister's tubercle fracture type, fracture gap, and presence of intra-articular fracture were assessed. Fisher's exact test was conducted to assess the correlation between the floating fat sign and EPL rupture.

Univariate and multivariate analyses were performed, followed by ROC curve analysis.

## RESULTS

The sum of floating fat sign scores of the second and third compartments was significantly correlated with the odds of EPL rupture ( $p = 0.001$ ). Male sex, conservative treatment, floating fat sign score of the second and third extensor compartments, and sum of floating fat sign scores of the second and third extensor compartments were significant variables associated with EPL rupture. The floating fat sign in the third compartment was an independent predictive indicator for EPL rupture ( $p = 0.002$ ). ROC curve analysis revealed that the AUC was the highest (0.835) for the multivariate model, followed by the univariate model of the sum of floating fat sign scores of the second and third compartments.

## CONCLUSION

The floating fat sign in DRF could be a predictive indicator for EPL rupture.

## CLINICAL RELEVANCE/APPLICATION

The presence of the floating fat sign in distal radius fracture may assist in predicting the risk of extensor pollicis longus tendon rupture, which could aid in developing a treatment plan or providing warning of potential tendon rupture.

## S3B-SPMK-8 Investigation of Buffer Thickness for Reducing Artifacts from the Table in Computed Tomography Examinations During the Extremities Three-Dimensional Imaging

Participants

Yoshiki Kamihoriuchi, Okayama-Shi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

If the hand is directly positioned on the computed tomography (CT) table mat, it is often difficult to separate the hand from the CT table mat due to artefacts from the CT table mat at the three-dimensional (3D) imaging. The objective of this investigation was to determine the optimal thickness of the buffer material utilized for 3D imaging, to alleviate artifact generation consequent to hand separation from the CT table mat.

## METHODS AND MATERIALS

The wrist phantom was placed on a CT table mat. Styrofoam and medical non-woven gauze were used as buffers, and 10 scans were acquired each with no buffer (none), one piece of gauze (gauze) and 1, 2, 3, 4 and 5 mm of Styrofoam. The scan parameter was following (tube voltage 135 kV, tube current 100 mA, rotation time 1.0 second, helical pitch 0.637, slice thickness 1.0 mm, field of view 150). For the 3D image, we utilized images with a reconstruction interval of 0.5 mm and reconstructed them using three different bone functions (FC30 AIDR3D mild: FC30, Aice Bone mild: BM, and Aice Bone standard: BS). Three regions of interest (ROIs) were set up within an identical image section, both in the absence of buffer and with a 5 mm Styrofoam buffer. Subsequently, profile curves were measured and the maximum CT values at the phantom edge were compared. A comparative analysis of the full-width at half-maximum (FWHM) was conducted among three scenarios: no buffer, gauze, and 1 mm buffer. Visualization scores were evaluated at three levels to assess the degree of artifacts caused by the CT table mat during 3D image creation.

## RESULTS

The results obtained indicate statistically significant differences between the scenarios without buffer and with gauze, gauze and 1 mm buffer for all cases. In terms of the maximum CT values at the phantom edges, the following comparisons were made: FC30 (none: 340 (229-348) HU, 5 mm: 289 (282-295) HU), BM (none: 446 (358-451) HU, 5 mm: 380 (366-387) HU), and BS (none: 269 (227-275) HU, 5 mm: 219 (215-222) HU) ( $p$  It; 0.05 for all). Furthermore, the full-width at half-maximum (FWHM) was analyzed for FC30 (gauze: 0.77 (0.71-0.85) mm, 1 mm: 1.08 (1.07-1.18) mm), Bone Mild (gauze: 0.72 (0.63-0.81) mm, 1 mm: 1.00 (0.99-1.08) mm), and Bone Standard (gauze: 0.77 (0.71-0.85) mm, 1 mm: 1.08 (1.07-1.18) mm) ( $p$  It; 0.05 for all).

## CONCLUSION

By inserting a buffer material with a thickness of at least 1mm between the hand and the CT table mat at creating 3D imaging, the separation of the hand and the CT table mat can be achieved easier for regardless of the conditions.

## CLINICAL RELEVANCE/APPLICATION

It was confirmed that using a buffer material of 1 mm or more can significantly reduce the effects of artifacts from the CT table mat, which can improve the quality of 3D imaging of the hand and increase flexibility in positioning.

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## Abstract Archives of the RSNA, 2023

S3B-SPMS

### Multisystem Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPMS-1 STIR-based Volume Measurement Methods for Staging Primary Lower Extremity Lymphedema: A Single-center Study of Asymmetric Volume Difference

##### Participants

MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

##### PURPOSE

The staging of lower extremity lymphedema (LEL) is hard in clinical work. The perfect soft tissue contrast of Short Term Inversion Recovery (STIR) sequence of MRI enables quantitatively assess the clinical staging of primary LEL. This study aims to explore the clinical value of MRI-based asymmetric volume measurement in the clinical staging of primary LEL.

##### METHODS AND MATERIALS

92 patients with unilateral primary LEL underwent Short Term Inversion Recovery (STIR) sequence of MRI. The volume of the middle calf was calculated using the clinical dermatome method (VCl). Two radiologists measure the total volume (V), musculoskeletal volume (VM), and subcutaneous volume (VS) in the middle calves on MRI. The difference between the affected and unaffected calf regarding V (DV) and VS (DVS) was obtained. DV and DVS were defined as asymmetric volume difference. The volume of the middle calf (Vcl) and difference in volume (DVcl) were calculated using the clinical circumferential method. The relationship between asymmetric volume difference and clinical staging was evaluated. Interobserver consistency was assessed through intraclass correlation coefficient (ICC). Volume comparisons were performed using one-way analysis of variance (ANOVA) analysis or Kruskal-Wallis test among three groups. Spearman's correlation analysis was used to assess volume and clinical stage correlation. The receiver operating characteristic (ROC) curve was drawn to assess the value of asymmetric volume difference for clinical staging.

##### RESULTS

The asymmetric volume difference was statistically significant in stage I compared to stages II and III ( $p < 0.05$ ). The asymmetric volume difference (DV:  $r = 0.753$ ; DVS:  $r = 0.759$ ) correlated more with the clinical stage than the affected Vcl ( $r = 0.581$ ), V ( $r = 0.628$ ), VS ( $r = 0.743$ ) and DVcl ( $r = 0.718$ ). The area under ROC curve (AUC) for identifying the clinical stage by the asymmetric volume difference was greater than that for the affected Vcl, V, VS and DVcl, with DVS (AUC=0.951) having the highest area under the curve to distinguish between stages I and II.

##### CONCLUSION

s STIR-based asymmetric volume difference can be used as an adjunctive measure for clinical staging of LEL with good reproducibility, and DVS could be the best indicator for differentiating between stages I and II.

##### CLINICAL RELEVANCE/APPLICATION

STIR can quantitatively assess the severity of primary lower extremity lymphedema, facilitating clinical decision making and improving prognosis.

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## Abstract Archives of the RSNA, 2023

S3B-SPNMMI

### Nuclear Medicine & Molecular Imaging Sunday Poster Discussions II

#### Sub-Events

S3B-  
SPNMMI-1

#### PSMA PET/CT for Localization of Prostate Cancer after Focal Therapy

##### PURPOSE

PSMA-ligand PET has become the first-line imaging tool for staging and re-staging patients with prostate cancer. However its role in patients with prostate cancer who underwent focal therapy (HIFU, irreversible electroporation, photodynamic therapy, cryoablation, and laser therapy) is still unknown. In this study, we aimed to investigate the diagnostic performances of PSMA PET/CT to detect and localize biochemical recurrence after focal therapy.

##### METHODS AND MATERIALS

This was a retrospective single center study. Patients with the following inclusion criteria were included: focal treatment for prostate cancer, 68Ga-PSMA-11 PET with contrast enhanced CT performed for biochemical recurrence, and no therapy between focal therapy and PET. Three independent blinded readers performed the PET image analysis and a per-region (T, N, M1a, M1b, M1c) centralized majority rule was applied (positivity rate). Inter-reader agreement of the positivity rates was calculated with Fleiss' kappa. In a sub-cohort of patients with a MRI and biopsy performed within 3 months of PSMA PET, diagnostic accuracy was evaluated on a per-patient and per-segment analysis on standard WB +60 min and the delayed +90 min pelvic images. A single radiologist blinded to PSMA and pathology performed MRI interpretation. Twelve prostatic segments were defined, and for every segment, suspicion for recurrence was assessed.

##### RESULTS

Of the 3329 patients with either a PSMA PET scan or focal therapy performed at UCLA, 100 patients met the inclusion criteria. PSMA-PET positivity rate per majority rule was 85/100 (85%) for prostate, 17/100 (17%) for pelvic lymph nodes and 20/100 (20%) for distant metastases. The inter-reader agreement for positivity rate by region was moderate (kappa=0.5). 29 patients had MRI and post-therapy biopsy data available. In these, Per-patient analysis showed a sensitivity of 92% for PSMA and 88% for MRI. Per-segment analysis performed on 297 validated segments resulted in a sensitivity, specificity, positive predictive value and negative predictive value of 53%, 90%, 74% and 78% for PSMA at +60 min, 55%, 92%, 79% and 79% for PSMA at +90 min and 29%, 92%, 72% and 65% for MRI (p<0.01), respectively. All Patients with PSMA SUVmax = 10 had GG =3 disease.

##### CONCLUSION

In this retrospective study of 100 patients treated with focal treatment for prostate cancer the PSMA-PET positivity rate was 85% for prostate. The sensitivity per-segment was 55% on delayed +90 min pelvic PSMA PET vs 29% for MRI with a similar specificity of 92%. results suggest that PSMA PET/CT has potential for localization of recurrent prostate cancer after focal therapy.

##### CLINICAL RELEVANCE/APPLICATION

PSMA PET appears promising for localization of biochemical recurrence after focal therapy.

S3B-  
SPNMMI-2

#### Manufacturing Iodine-loaded Polymeric Microcapsules: Proof-of-Concept for Theranostics in Peritoneal Carcinomatosis

##### Participants

Nils Grosse Hokamp, MD, PhD, Koln, Germany (*Presenter*) Research Grant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV; Consultant, Bristol-Myers Squibb Company

##### PURPOSE

Peritoneal carcinomatosis refers to shedding of tumor cells to the peritoneal cavity and often is indicative of incurable and/or end stage disease. Treatment options at this advanced stage include hyperthermic intraperitoneal chemotherapy (HIPEC) alongside cytoreductive surgery. Aiming for continuous chemotherapeutic delivery options, this study intended to provide proof-of-concept of polymeric microcapsules that allow incorporation of chemotherapeutic agents and that are furthermore loaded with iodine in order to allow in-vivo tracing using computed tomography.

##### METHODS AND MATERIALS

For synthesis a solvent-emulsion evaporation technique has been used. Hydrophobic iodinated oils (e.g. Lipiodol) were used as inner phase of the capsule. A biodegradable polymer [poly(lactic-co-glycolic acid), PGLA] was used as outer shell material. A fluorescent dye was added for direct visualisation. Incorporation of hydrophilic drugs, was shown with an aqueous iodinated compound (iohexol), using a water-oil-water emulsion process. Light/fluorescence microscopy, UV/Vis spectroscopy and size distribution using a Coulter Counter were conducted in addition to spectral detector CT based quantification of iodine content (SDCT).

##### RESULTS

The synthesis yielded polymeric capsules containing CT-imageable iodinated compounds with tuneable diameter. The obtained

particle diameters were in the range of 0.1 - 15  $\mu\text{m}$ . Iodide concentration was further quantified using UV/vis spectroscopy. Here, Iodine to polymer ratio varied between 23 to 125 mg I/g corresponding to 0.01 to 0.03  $\mu\text{g}$  I/capsule); similar results were obtained using SDCT. In addition cytostatic drugs could be incorporated into the particles.

#### **CONCLUSION**

s Controlled formation of iodine-loaded polymeric microcapsules can be achieved. The capsules can be visualized using SDCT which furthermore allows for quantification of their iodine content (consistent with UV/vis-based measurements as standard of reference). Furthermore, cytotoxic drugs can be incorporated into these particles.

#### **CLINICAL RELEVANCE/APPLICATION**

The described syntheses provide proof-of-concept for in-vivo traceable and quantifiable microcapsules. Attempts to alter longevity of these systems might allow for a continuous therapy of peritoneal carcinomatosis. Alternatively, advanced manufacturing might allow for targeted drug delivery, e.g. by incorporating receptors into the outer shell.

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## Abstract Archives of the RSNA, 2023

S3B-SPNPM

### Noninterpretive Skills (Beyond Imaging) Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPNPM-Disability, an Often-Overlooked Aspect of Equity, Diversity, and Inclusion Among Radiology Departments in Canada and the United States** 1

##### Participants

Ali Abbas, BS, Dallas, TX (*Presenter*) Nothing to Disclose

##### PURPOSE

Despite nearly a quarter of Canadians and Americans reported to be living with a disability, persons with disabilities continue to face both structural and cultural barriers with respect to careers in medicine. Equity, diversity, and inclusivity (EDI) statements can act as a first step in deconstruction of these cultural barriers. However, when compared to other EDI initiatives focused on gender, race, and ethnicity, persons with disabilities receive little attention.

##### METHODS AND MATERIALS

We conducted a cross-sectional analysis of all radiology residency program websites in Canada and the United States (US). Data was collected from each radiology department website including the presence or absence of an EDI statement or page; if present, we determined whether mention was made of persons with disabilities.

##### RESULTS

We reviewed the websites of 16 Canadian and 181 US radiology residency programs. Seven (44%) Canadian institutions had an EDI statement, with one (14%) mentioning persons with disabilities. In the US, 103 (57%) institutions had an EDI statement, with 42 (41%) mentioning persons with disabilities.

##### CONCLUSION

There were a significant proportion of radiology departments without EDI statements on their websites and an even smaller proportion that acknowledged persons with disabilities. Persons with disabilities are underrepresented in the medical profession and are often left out of radiology department EDI statements. This population faces many barriers to careers in medicine, underscoring the importance of physical and cultural accommodations.

##### CLINICAL RELEVANCE/APPLICATION

Patients with disabilities often report that healthcare providers lack understanding of their condition; thus, inclusion of persons with disabilities among the physician workforce may result in improved patient care. In recent years, there has been an increase in recruitment of medical students with disabilities. Therefore, it is important that post-graduate medical training programs implement the changes necessary to welcome and accommodate these individuals. An institution's public commitment to EDI, and specifically to patients and providers with disabilities, is central to implementing inclusive change going forward.

#### **S3B-SPNPM-Gender-specific Differences in Aspired Academic Qualification and Perceived Research Opportunities: Excerpts from a Nationwide German Survey** 2

##### Participants

Isabel Molwitz, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

To assess gender-specific differences in aspired academic qualifications and perceived research opportunities.

##### METHODS AND MATERIALS

Questionnaires were sent to radiologists of different career levels via the German Roentgen Society, the European Society of Radiology's Radiological Trainee Forum, the Radiological Society of North America's Resident and Fellow Committee, and manually to 4500 radiologists of the largest German hospitals. Statistical analyses were conducted with age-adjusted regression analyses only for participants from Germany, as international responses were scarce.

##### RESULTS

Of 510 radiologists with German affiliations (female: 237, 46%, mean age 42 ±10 years) men were four times more likely to have a higher academic degree (PD, habilitation) than women (odds ratio 4.39 [95%-confidence interval 2.22-8.67]) and twice as likely to pursue such a degree (2.87 [1.47-5.61]). Stated reasons to pursue further academic qualification (PD) more frequently found among male participants were: to be eligible for a position as leading physician (2.56 [1.07-6.15]) and a research interest (2.36 [1.0-5.57]). There were no gender differences in motivations occurring from an interest in teaching (1.86 [0.84-4.14]), the wish for more opportunities (1.62 [0.73-3.59]), or a higher independency (0.95 [0.44-2.05]). Most male (84%) and female (74%) radiologists were satisfied with possibilities of congress participation. The odds for dissatisfaction were slightly smaller among men than among women (0.62 [0.39-0.98]). Among both genders, dissatisfaction was high concerning time off clinical duties for

research purposes (women: 64%, men 57%; 0.69 [0.41-1.16]). Most female respondents (51%) were dissatisfied with options to be involved in research projects, while most men (61%) were satisfied with them. Differences between both genders were not significant (0.60 [0.35-1.01]). Likewise, dissatisfaction with possibilities to develop their own projects and apply for funding was slightly higher among women (48% vs. 40%) but differences not of statistical significance (0.77 [0.45-1.35]).

## CONCLUSION

Among German radiologists, men pursue academic qualification more frequently, with eligibility for a position as leading physician being a gender-specific motivational difference. Dissatisfaction with research opportunities tend to be higher among women.

## CLINICAL RELEVANCE/APPLICATION

To achieve gender equality in science and among leading academic positions, it is essential to understand differences in motivation and integration in research among male and female radiologists. Women may want more support than currently provided, in terms of integration into research projects, developing their own projects, and applying for funding.

## S3B-SPNPM-Gender Representation in Radiology Practices in the United States

3

### Participants

Elizabeth Dibble, MD, (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate gender representation in radiology practices in the United States

## METHODS AND MATERIALS

The ACR Human Resources Commission fielded the 2022 Workforce Survey 11/2022-12/2022. The sample drew from the ACR members (35,601), non-members (12,551), and RBMA members (1,482). Structured closed-end questions were used, consistent with earlier surveys. Responses were group practice deduplicated and weighted and compared to 2021 survey results.

## RESULTS

524 fully qualified (decision-maker) respondents completed the survey: 77% male and 20% female. 1278 partially qualified respondents completed it: 65% male, 29% female, and .002% nonbinary. Significantly fewer partially qualified respondents preferred not to self-report gender in 2022 vs 2021 (5% vs 8%,  $p=0.0046$ ). 325 respondents answered questions about practice size and gender composition. The median number of non-practice-leader radiologists per practice was 15 (interquartile range (IQR) 7,30); full-time 13 (IQR 6,24), part-time 2 (IQR 0,5). The median number of practice-leader radiologists was 4 (IQR 1,7); full-time 4 (IQR 2,7), part-time 0 (IQR 0,0). These numbers were not different from 2021 ( $p>0.05$ ). Of full-time non-practice-leader radiologists per practice, the median number of females age <40=0 (IQR 0, 1), 40-65=1 (IQR 0, 3), and >65=0 (IQR 0,0); the median number of males age <40=2 (IQR 0,4), 40-65=6 (IQR 3,12), and 66+= 0 (IQR 0,1). The mean number of non-practice-leader radiologists increased slightly from 2021 to 2022 across all ages and represented genders, although this did not reach significance ( $p>0.05$ ). Of full-time practice-leader radiologists, the median number of females age <40=0 (IQR 0, 0), 40-65=0 (IQR 0,1), and 66+=0 (IQR 0,0); the median number of males age <40=0 (IQR 0,0), 40-65=3 (IQR 1,5), and 66+=0 (IQR 0,0). The mean number of practice-leader females increased slightly across all age groups from 2021 to 2022. The mean number of practice-leader males increased for age <40 ( $p=0.0458$ ), decreased for 40-65 ( $p>0.05$ ), and increased for 66+ ( $p>0.05$ ). The mean and median number of radiologists identifying as nonbinary was 0 for all queries.

## CONCLUSION

Female and nonbinary radiologists are underrepresented in radiology practices. Significantly fewer respondents in 2022 preferred not to self-report gender compared to 2021. The median number of female and nonbinary radiologist practice leaders is 0. The mean number of female practice leaders increased slightly across all age groups from 2021 to 2022, although this did not reach significance.

## CLINICAL RELEVANCE/APPLICATION

Female and nonbinary radiologists are underrepresented in US radiology practices in both leadership and non-leadership roles.

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## Abstract Archives of the RSNA, 2023

S3B-SPNR

### Neuroradiology Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPNR-1 Association of Body Mass Index and Waist Circumference with Multimodal Magnetic Resonance Imaging Indicators of Brain Health in 9- to 10-year-olds in the US**

#### **PURPOSE**

To investigate the relationship of pre-adolescents' Body Mass Index (BMI) and waist circumference (WC) with magnetic resonance imaging (MRI) indicators of brain health (cortical morphometry, resting-state functional connectivity, white matter (WM) micro- and cytostructure) over two years.

#### **METHODS AND MATERIALS**

We retrieved baseline and two-year follow-up clinical and neuroimaging information of a sociodemographic diverse cohort of 11,878 9- to 10-year-olds enrolled in the Adolescent Brain Cognitive Development (ABCD) study across 21 centers in the US. Inclusion required absence of neurodevelopmental/psychiatric diagnoses and traumatic brain injury. T1- and T2-weighted structural MRI, diffusion tensor imaging, resting-state functional MRI, and restriction spectrum imaging were quantified in a region-of-interest based approach. At both time points, cross-sectional linear regression determined the association of BMI/WC with fractional anisotropy (FA), neurite density (ND), cortical thickness and resting-state functional connectivity, after correction for age, gender, puberty, race/ethnicity, handedness, socioeconomic status and scanner device. In longitudinal analyses, multivariate regression was used to examine associations of baseline BMI with interval changes in neuroimaging metrics.

#### **RESULTS**

At baseline, 4,576 children (48.3% female) at an average age of 10.0 years (7.6 months) were included. 1,567 enrollees aged 12.0 years (7.7 months) had complete follow-up. At both point in time analyses, higher BMI/WC were associated with pervasive bilateral reductions of FA ( $P < .001$ ) as well as ND ( $P < .03$ ). With higher BMI/WC, especially prefrontal cortical thickness was reduced in both hemispheres ( $P < .04$ ). We found predominantly negative associations of BMI/WC with intra- and inter-network functional coupling of salience and cingulo-opercular networks ( $P < .005$ ). Over a mean follow-up period of 23.8 (1.6) months, we observed overall interval cortical thinning and increase in averaged FA and ND. Higher BMI at baseline was associated with lower interval increment in FA and ND of several commissural, projection and association WM tracts as well as reduced interval cortical thinning of prefrontal regions.

#### **CONCLUSION**

Higher BMI and waist circumference among children are associated with reduced WM micro- and cytostructural integrity, cortical thickness, and functional connectivity. Our longitudinal analysis suggests contribution of higher BMI to hindered interval development of WM micro- and cytostructure and cortex morphology.

#### **CLINICAL RELEVANCE/APPLICATION**

Our findings highlight the neurodevelopmental implications of pre-adolescents' higher weight and point to the need for early targeting of brain health indicators.

#### **S3B-SPNR-10 Spatiotemporal Discooordination of Brain Spontaneous Activity in Major Depression Disorder**

#### **PURPOSE**

Major depressive disorder (MDD) is a world-wide debilitating mental illness. Despite extensive research, the pathogenesis of MDD remains unknown. Spatiotemporal psychopathology (STPP) posits that the symptoms of MDD arise from aberrant spatiotemporal experiences in a patient's inner world, which may be reflected by their brain spontaneous activity. In the present study, we aim at determining the spatiotemporal discooordination of MDD patient's brain spontaneous activity using fMRI.

#### **METHODS AND MATERIALS**

91 MDD and 91 demography-matched HC were recruited in this study. The fMRI data were preprocessed via fMRIPrep and the timeseries were extracted over Schaefer400 parcels. Spatiotemporal topology (SPT) of the brain activity was measured by the Euclidean distance of each pair of parcels in a 3-dimension coordinate composed by two functional gradients (Margulies et al., 2016) and time delay (Mitra et al., 2014). SPT was then averaged across Yeo's 7 network atlas, resulting in 7 intra- and 21 inter-network SPT. Repeated measures ANOVA was performed to test the mean difference of the SPTs between MDD and HC. A machine learning approach was employed to investigate the efficacy of SPT in discerning between HC and individuals with MDD.

#### **RESULTS**

A significant difference in network-specific features between MDD and HC was found ( $F(27, 5040) = 2.9, p < .001$ ). Simple-effect test identified four inter-network SPT that showed a significant group effect, including control-somatomotor distance ( $F = 7.3, p = .007$ ), salience-dorsal attention distance ( $F = 11.1, p < .001$ ), salience-visual distance ( $F = 19.2, p < .001$ ), and somatomotor-visual distance ( $F = 19.2, p < .001$ ). The logistic model yielded an accuracy of 0.73 in predicting the group label, and the ROC curve showed an AUC value of 0.86.

## CONCLUSION

s SPT may reflect the homeostatic fluctuation of neuronal activity in the brain, and it is a theoretical-driven measure inspired by STPP. The significant difference in SPT were found in the visual and somatomotor network. The machine learning approach demonstrated the effectiveness of SPT features in differentiating between individuals with MDD and HC. While SPT topology presents theoretical validity and potential clinical value, it is no more than a general evaluation of the current state of the brain. As a result, the precise interpretation of its magnitude and direction is not yet apparent.

## CLINICAL RELEVANCE/APPLICATION

In the long run, SPT topology may serve as an important reference index in diagnosing MDD using low-cost fMRI scans. In addition, SPT topology could potentially function as a prognostic marker for MDD intervention. However, in its current stage, its main value lies in fundamental research, such as enhancing our understanding of the neural abnormalities of MDD.

## S3B-SPNR-11 --Mild Cognitive Impairment in Non-alcoholic Fatty Liver Disease is Associated with Abnormal Resting-state Functional Connectivity Between the Default Mode Network and Regions within the Reward System

Participants

Jie Li, MD, HangZhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

Mild cognitive impairment (MCI) is commonly seen in patients with nonalcoholic fatty liver disease (NAFLD), but the neural mechanisms have not been elucidated. In this study, we used resting-state fMRI (RS-fMRI) to investigate the characteristics of spontaneous neural activity in NAFLD patients with MCI.

## METHODS AND MATERIALS

A total of 74 NAFLD patients and 62 demographic-matched healthy controls (HC) were enrolled. According to the Montreal Cognitive Assessment (MoCA) score, the patients were divided into two groups: 43 patients with MCI\_NAFLD and 31 patients with nonMCI\_NAFLD. All participants underwent 3.0T RS-fMRI scan and neurocognitive psychological assessment, and patients underwent liver MRI proton density fat fraction (PDFF) and blood biochemical indexes measurement. DPABI software was used to process the RS-fMRI data and obtain the whole brain amplitude of low-frequency fluctuations (ALFF) map. One-way analysis of covariance and post-hoc tests were used to compare the differences in ALFF maps among the three groups. The abnormal regions were selected as the regions of interest (ROI) to compare the differences in whole-brain seed-based functional connectivity (FC) between the two patient groups, and the correlation between abnormal FC values and clinical variables was analyzed.

## RESULTS

Compared with nonMCI\_NAFLD patients, MCI\_NAFLD patients had reduced ALFF values in the right cerebellum and right cuneus, and increased ALFF values in the left posterior cingulate gyrus (PCC), and the ALFF values in these different regions were significantly correlated with MoCA scores. Compared with nonMCI\_NAFLD patients, MCI\_NAFLD patients had enhanced FC between the left PCC and the left lingual gyrus, left parahippocampal gyrus, left medial orbitofrontal gyrus, left middle frontal gyrus, left postcentral gyrus and right postcentral gyrus, and reduced FC between the left PCC and the left insula and right supplementary motor area. Among them, the FC values between the left PCC and the regions related to the reward system were correlated with cognitive function, emotional symptoms, PDFF values and insulin function in NAFLD patients. In particular, the ALFF values of the PCC completely mediated the correlation between the FC values between the PCC and the orbitofrontal cortex and MoCA scores.

## CONCLUSION

s The development of cognitive impairment in patients with NAFLD may be closely related to the dysfunction of the default mode network and dopamine pathway, in which visceral fat accumulation and insulin dysfunction also play a crucial role.

## CLINICAL RELEVANCE/APPLICATION

These special neuroanatomical abnormalities may help to shed light on the underlying pathophysiology and manifestations of MCI in patients with NAFLD.

## S3B-SPNR-12 Altered Functional Connectivity of Olfactory Neural Circuits in Subjective Cognitive Decline under Odor Stimulation

Participants

Yajing Zhu, Nanjing, China (*Presenter*) Nothing to Disclose

## PURPOSE

Olfactory involvement is an early feature of Alzheimer's disease. The purpose of this study was to investigate the functional connectivity(FC) changes of olfactory neural circuits in subjective cognitive decline (SCD) in olfactory task fMRI under specific odor stimulation.

## METHODS AND MATERIALS

A total 56 normal controls(NC) and 57 SCD were included.All subjects were tested with cognitive scale, olfactory behavior assessment, and olfactory task fMRI. The FC difference of olfactory neural circuits between the two groups was analyzed by the method of generalized psychophysiological interaction (gPPI).

## RESULTS

There was no significant difference in olfactory behavior between the two groups. In olfactory task-fMRI with specific odor stimulation, the FC from bilateral POCs to the right parahippocampal area in the SCD group was significantly reduced; while the FC from the right hippocampus to the right frontal lobe was significantly enhanced. The connectivities from bilateral POCs to the right parahippocampal area, the right parahippocampal, and the right hippocampal were significantly positively correlated with the memory cognitive threshold; the connectivities from bilateral POCs to the right parahippocampal area, the right parahippocampal, and the right fusiform gyrus were significantly positively correlated with the global cognitive function.

## CONCLUSION

s The olfactory behavior reflects the comprehensive performance of the olfactory function, while the olfactory task-fMRI reflects the FC of the olfactory neural circuits. The results of this study indicate that although the olfactory behavior of SCD is at a normal level, the FC of olfactory neural circuits(POC-hippocampus-frontal lobe) has changed.

## CLINICAL RELEVANCE/APPLICATION

The results of this study suggest that the FC changes of olfactory nerve circuits in SCD subjects under specific odor stimulation conditions, and the correlation between the connectivity of olfactory nerve circuits and the global cognitive function and memory function, prove that the FC changes of olfactory nerve circuits in SCD patients may be used as an early identification marker of high AD risk.

## S3B-SPNR- The Evaluation of Normal Aging on Regional Brain Metabolism as Measured by 18F-FDG Uptake 13

Participants

Eric Teichner, Glen Allen, VA (*Presenter*) Nothing to Disclose

## PURPOSE

To analyze age-related changes in glucose metabolism within nine brain regions using 18F-fluorodeoxyglucose positron emission tomography (FDG-PET), providing insights for recognizing and understanding neurological disease states in the context of normal aging, and laying a foundation for further research in age-related neurological disorders.

## METHODS AND MATERIALS

We included 79 subjects (mean age  $44.5 \pm 13.8$  years, 53.2% males, ages 21-75) with no history of medical conditions that could affect results, which included a negative history of cancer, chronic inflammatory disease, autoimmune disease, immunodeficiency syndromes, alcohol and drug abuse, or cardiovascular disease. Whole-body FDG-PET/CT imaging was performed 180 minutes after administering a 4.0 MBq/kg dose of FDG. Quantitative regional analysis of PET images was conducted using MIMneuro version 7.1.5. Acquired PET data was scaled to injected dose and body weight to produce standardized uptake value (SUV) images. We recorded individual SUVs for nine brain regions: brainstem, cerebellum, frontal lobe, lateral temporal lobe, medial temporal lobe, occipital lobe, parietal lobe, temporal lobe, and thalamus. Pearson's R was calculated, evaluating significance ( $P < 0.05$  threshold) for all variables.

## RESULTS

Age was inversely correlated with regional metabolism in all nine brain regions, showing significant age-dependent reductions of 18F-FDG uptake in brainstem ( $r = -0.323$ ,  $p = 0.004$ ), cerebellum ( $r = -0.338$ ,  $p = 0.002$ ), frontal lobe ( $r = -0.463$ ,  $p < 0.001$ ), lateral temporal lobe ( $r = -0.436$ ,  $p < 0.001$ ), medial temporal lobe ( $r = -0.384$ ,  $p < 0.001$ ), occipital lobe ( $r = -0.392$ ,  $p < 0.001$ ), parietal lobe ( $r = -0.453$ ,  $p < 0.001$ ), temporal lobe ( $r = -0.427$ ,  $p < 0.001$ ), and thalamus ( $r = -0.321$ ,  $p = 0.004$ ). These findings highlight the impact of normal aging on brain metabolism.

## CONCLUSION

s Research regarding the metabolic and physiological changes that occur in healthy individuals allows us to better recognize and understand neurological disease states. Our study demonstrates significant age-dependent reductions of 18F-FDG uptake in the brain among healthy individuals, emphasizing the importance of FDG-PET in understanding normal aging effects on brain metabolism. These findings serve as a foundation for future research in identifying and understanding age-related neurological disorders, ultimately aiding in the development of potential biomarkers and therapies for neurodegenerative diseases.

## CLINICAL RELEVANCE/APPLICATION

Understanding age-related changes in glucose metabolism in healthy individuals using 18F-FDG PET imaging can aid in diagnosing and treating age-related neurological disorders and developing potential biomarkers and therapies for neurodegenerative diseases.

## S3B-SPNR- Altered Hippocampal Intra-networks in Mild Cognitive Impairment: A Structural MRI Study in a 14 General Elderly Japanese Population

Participants

Sera Kasai, Hirosaki-Shi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Although altered networks inside the hippocampus (hippocampal intra-networks) have been observed in dementia, the evaluation of hippocampal intra-networks using MRI is challenging. We employed conventional structural imaging and incident component analysis (ICA) to investigate the structural covariance of the hippocampal intra-networks. To our knowledge, there have been no population-based studies with large sample sizes to assess the association between MCI status and hippocampal intra-network connectivity. Our aim was to assess whether individuals with MCI have altered hippocampal intra-network connectivity as measured using source-based morphometry (SBM) that is a type of structural network when compared with cognitively normal older adults (CNOA).

## METHODS AND MATERIALS

This was a cross-sectional study of 2122 residents who participated in a population-based prospective study of cerebro- and cardiovascular diseases and dementia in a large population of older Japanese individuals with 3T MRI (median age 69 years, 60.9% female). The participants were divided into 218 patients with MCI and 1904 cognitively normal older adults (CNOA). By employing 3D T1-weighted imaging and ICA, we extracted the structural covariance intra-networks in the hippocampus.

## RESULTS

The ICA extracted 16 intra-networks from the hippocampal structural images, which were divided into two bilateral networks and 14 ipsilateral networks. Of the 16 intra-networks, four (one bilateral network and three ipsilateral networks) were significant predictors of MCI from the CNOA after adjusting for age, sex, education, disease history, and hippocampal volume/total intracranial volume ratio (Figure) ( $p < 0.01$ ). In addition, the networks predicted MCI independent of hippocampal volume ( $p < 0.01$ ), although hippocampal volume was also a predictor of MCI ( $p < 0.01$ ).

## CONCLUSION

s In this population-based study with a large sample size, we extracted four MCI-related hippocampal intra-networks based on SBM, which can be estimated using conventional structural imaging with 3T MRI. These hippocampal intra-networks predicted MCI independently of hippocampal volume, suggesting the altered networks may reflect a different pathology from that of brain atrophy.

#### **CLINICAL RELEVANCE/APPLICATION**

By using conventional structural imaging and ICA, we found that the relationship between hippocampal intra-networks and MCI was independent from the hippocampal volume. This method provides additional information for understanding cognitive impairment.

#### **S3B-SPNR-2 Early ASD Assessment Using DTI Analysis with Machine Learning**

Participants

Mohamed Khudri, Louisville, KY (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Autism Spectrum Disorder (ASD) impacts social skills, repetitive behaviors, speech, and nonverbal communication. Diffusion Tensor MRI (DT-MRI) can aid in accurate diagnosis, and this study aims to create an artificial diagnostic system that extracts connectivity markers from DT-MRI to improve early-stage precision in diagnosing autism.

#### **METHODS AND MATERIALS**

We developed a three-stage system to analyze DT-MRI. Firstly, FSL corrected eddy current distortions and isolated brain tissues from scans. Secondly, connectivity markers (e.g., Fractional Anisotropy, Mean diffusivity) were extracted from different brain regions using the John Hopkins White Matter Atlas. Significant markers were identified through MinMaxScalar and REC-CV feature reduction algorithms. Finally, the extracted features were fed to a Linear Support Vector Machine (LSVM)-classifier to diagnose subjects as ASD or control. Our system was validated through a five-fold cross-validation test on the Autism Brain Imaging Data Exchange-II (ABIDE-II) dataset, consisting of 126 autistic and 100 control subjects.

#### **RESULTS**

The proposed ML-Based system achieved an overall accuracy of 98.5% with a sensitivity of 97% and specificity of 98% on the ABIDE-II database.

#### **CONCLUSION**

s In conclusion, this study demonstrates the potential of DT-MRI in the diagnosis of ASD, and the use of connectivity markers can aid in understanding the development and progression of the disorder.

#### **CLINICAL RELEVANCE/APPLICATION**

Early and accurate diagnosis of ASD is crucial for improving the quality of life for individuals with the disorder. We believe that early intervention can lead to better outcomes, including the potential for individuals with ASD to achieve greater independence and higher IQs.

#### **S3B-SPNR-3 Clinical Quantitative Brain MRI: Quantifying Age-related Changes in Tissue Volume**

#### **PURPOSE**

The volumes of the brain and substructures change continuously throughout the human lifespan. Establishing normal development patterns can be useful for detecting abnormal developmental pathways by comparison. Our goal is to study the pattern of normal brain development for the general population of our hospital as stratified by sex using the high geometrical accuracy and precision of turbo spin echo-based quantitative MRI.

#### **METHODS AND MATERIALS**

This retrospective single-center cross-sectional study was conducted on healthy, ethnically diverse patients with normal brain imaging. The institution's IRB approved the study, and participants were imaged by 3.0-T MRI. Dual-echo turbo spin echo (DE-TSE; PD/T2-weighted) and single-echo turbo spin echo (SE-TSE; T1-weighted) images were used for the MRI parameter calculation. The image processing pipeline (IPP) consisted of a qMRI-based segmentation process that was programmed with Python (version 3.8.11) and the Anaconda Navigator (version 2.2.4). The IPP required a Fiji-based preparation step (version 2.1.1) to edit intracranial matter (ICM), which includes the in toto brain tissue and cerebrospinal fluid (CSF). Then, the IPP was applied consecutively for all subjects' MRIs. Finally, the mean volume for the ICM, brain, white matter (WM), gray matter (GM), and CSF were calculated. Statistical significance and Pearson correlation methods were used for the statistical analysis.

#### **RESULTS**

A total of 277 patients (146 females) with normal brain radiological reports were included in this study leading to 7 decadal age groups. The ICM, brain, GM, and CSF and CSF ventricles volumes were significantly different between the age groups (p-value 0.019, <0.001, <0.001, <0.001, <0.001 respectively). There was a significant negative association between age and the ICM, brain, and GM volumes (p-value 0.008, <0.001, and <0.001, respectively), while there was a significant positive association between age and CSF and CSF ventricles volume (p-value <0.001 and <0.001). Furthermore, the significant correlation between ICM, brain, GM, and CSF, CSF ventricle volumes, and age groups was different for male and female cohorts (0.028 and <0.001s, respectively).

#### **CONCLUSION**

s In an ethnically diverse cohort of 277 patients without neurological findings, we find that the volume of total GM decreases with age and appears to be largely replaced by CSF as the WM volume stays constant after twenty years of age.

#### **CLINICAL RELEVANCE/APPLICATION**

Clinical quantitative brain MRI is a valuable tool for quantifying age-related changes in brain tissue volume, characteristic of normal development, which can aid in early diagnosis and monitoring of age-related neurodegenerative diseases.

#### **S3B-SPNR-4 Evaluation of Brain Stiffness Change According to Brain Development using Virtual MR Elastography Based on DWI**

Participants

You Na Kim, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

## **PURPOSE**

Viscoelastic property of brain have been demonstrated to be affected by aging and various neurological disease. Based on the knowledge that measured mechanical properties of brain reflect the microstructure composition and organization of neural tissue, magnetic resonance elastography (MRE) parameters representing mechanical properties can be a potential imaging marker for brain development. However, conventional MRE acquisition has been limited in children due to its invasive property and long scan time. The virtual MRE (vMRE) is an non-invasive and novel technique to measure tissue mechanical property based on diffusion weighted imaging (DWI). The purpose of this study was to evaluate change of brain stiffness according to brain development in children and young adults using vMRE.

## **METHODS AND MATERIALS**

We retrospectively reviewed 247 children and young adults (6 months~30 years, 119 females, 128 males) without structural brain abnormality. Shifted apparent diffusion coefficient was calculated from DWI ( $b=200$  and  $1500\text{sec}/\text{mm}^2$ ) and converted to DWI-based virtual shear modulus ( $\mu$ ). Brain stiffness was measured in whole brain and thirteen brain regions; cerebrum, cerebral gray/white matter, basal ganglia, thalamus, frontal/ parietal/temporal/occipital lobe, cerebellum, middle cerebellar peduncle, hippocampus, amygdala. Multiple comparison test and linear regression were conducted to investigate changes in brain stiffness according to brain development.

## **RESULTS**

Sexual dimorphism was not observed in any brain region. The virtual shear modulus ( $\mu$ ) of whole brain increased until the age of 16 years and then reached plateau. The DWI based mechanical property parameter of whole brain was increased 1.15% per year ( $R^2=0.642$ ,  $P < 0.001$ ) until 16-year-old. The change of brain stiffness according to brain development showed regional differences. Changes of brain stiffness showed the earliest plateau (8-year-old) in cerebral gray matter and continued to increase in the basal ganglia until 30-year-old. Although steepest increase in occipital lobe (1.85% increase/year,  $R^2=0.659$ ,  $P < 0.001$ ), there was no significant difference in pattern of stiffness change according to brain lobar area.

## **CONCLUSION**

s DWI-based brain stiffness parameters increased with brain development in pediatrics period with differences by region.

## **CLINICAL RELEVANCE/APPLICATION**

DWI-based brain stiffness parameters increased with brain development until 16-year-old and reached plateau. The change of stiffness showed different pattern across the regions.

## **S3B-SPNR-5 Developmental Abnormalities of Cortical Surface Area in Infants with Congenital Heart Disease Associated with Big Motion Impairments**

### **PURPOSE**

Neurodevelopmental abnormalities are the most common non-cardiac complications in infants with congenital heart disease (CHD), motor impairment is one of its common presentation. The cortical development of the infant brain lays the foundation for the individual's neurocognitive behavior. However, studies on the relationship between cortical development and its neural correlates with motor impairments in infants with CHD is still lacking. By utilizing cortical analysis techniques and machine learning methods, this study aims to investigate whether there are developmental abnormalities in cortical surface area in infants with congenital heart disease (CHD), and whether such abnormalities are correlated with big motion impairments.

### **METHODS AND MATERIALS**

In this study, 90 preoperative infants diagnosed with congenital heart disease (CHD) and 86 healthy controls (HCs) between the ages of 12 and 26 months were recruited. T1 and T2 images were acquired using a Philips 3T magnetic resonance imaging scanner. Imaging data were preprocessed using infant FreeSurfer that registered the cortical surface of each subject to the UNC 4D infant template and calculated the surface area of 68 brain regions from DK template. After that, multioutput Gaussian process regression (GPR) was utilized to characterize normative macrostructural development using surface area as inputs and age and sex as predictors. This model was trained on HC subjects and then applied to CHD samples. Individual Z-score maps were computed and extreme deviations from the normative model were calculated by applying a threshold of  $|Z| > 3.1$ . After identifying brain regions with extreme deviations, we further examined their relationship with big motion.

### **RESULTS**

Patient with CHDs shown deviations from normative development in cortical surface area in multiple brain regions including angular gyrus, temporal lobe, middle frontal lobe, precentral and postcentral gyrus in CHDs. Furthermore, significant correlation between abnormal cortical surface area in left precentral gyrus and superiortemporal gyrus and bilateral rostral middle frontal gyrus and big motion scores in CHDs.

### **CONCLUSION**

s Our study demonstrated cortical development abnormalities in infants with CHDs. The significant correlation between abnormal cortical surface area and motor impairments suggested cortical surface area may be an effective predictor of motor function and an important imaging biomarker of future neurodevelopment risk in CHDs.

### **CLINICAL RELEVANCE/APPLICATION**

Our study provides evidence for cortical development delay in infants with CHDs. and supported inclusion of cortical surface area in neuroprotective intervention studies.

## **S3B-SPNR-6 Comparing the Clinical Utility of Linear Versus Volumetric MRI in Enlarged Vestibular Aqueduct Syndrome Patients**

Participants

Amit Gupta, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

## **PURPOSE**

Presently CT is established method (Cincinnati criteria) for diagnosis of EVAS. Recently studies showed that linear measurement on MR are similar to CT in terms of confidence of diagnosis and correlation with audiometric data. The purpose of this study was to confirm validity of linear MR measurements and explore role of volumetric MRI measurements in predicting the hearing outcomes in patients with EVAS.

## **METHODS AND MATERIALS**

A retrospective study design was used including 30 patients that fit the inclusion criteria for a total of 46 ears. Linear measurements were made using the vestibular aqueduct (VA) midpoint and VA opercular widths for determination of EVAS. Semiautomatic volumetric measurements were calculated from all slices containing both the VA and endolymphatic sac (VA-ELS) using MIM Software Platform (MIM Software Inc.). Air and bone conduction data was collected from medical records. Univariate and multivariate analyses were performed to assess for a correlation between volumetric measurements and audiometric hearing outcomes.

## **RESULTS**

Of the study population, 16 patients demonstrated bilateral EVA (53.3%). Average VA volume estimated by volumetric MRI analysis was 0.19 mm<sup>3</sup>; sd = 0.17 mm<sup>3</sup>. Volumetric MRI measurements significantly correlated to both midpoint length and operculum size for EVAS diagnosis. Univariate analysis and multivariate analyses adjusting for age, race, and gender did not reveal significant correlations between volumetric MRI measurements and audiometric hearing outcomes. Midpoint size and operculum size correlated only weakly with low frequency bone conduction hearing outcomes.

## **CONCLUSION**

These results suggests an excellent correlation between the linear and volumetric measurements for diagnosis of EVAS, however, with an unclear role for both MRI measurements in the predicting hearing outcomes. In our study, neither linear nor volumetric measurements showed strong correlations with audiometric hearing data.

## **CLINICAL RELEVANCE/APPLICATION**

Given the 3D structure of the VA-ELS, volumetric measurements may improve MRI diagnostic utility in EVAS. This study warrants further research into the relationship VA-ELS structure and hearing outcomes, and questions the previously published results on this topic.

## **S3B-SPNR-7 A Normative Model of the Brain from the Adult Colombian Population**

Participants

Jon Duque-Grajales, MEng, Medellin, Colombia (*Presenter*) Nothing to Disclose

## **PURPOSE**

The brain changes throughout life. There is an increasing interest in development of normative models based on anatomical brain features, which are related to the genetics of the population (Elliott et al. Nature, 2018). However, the normative models published so far have been mostly based on European descent population (Bethlehem et al. Nature, 2022, Rutherford et al. Elife, 2022). Here, we propose a normative model of brain aging in a Colombian adult population based on their brain volumes.

## **METHODS AND MATERIALS**

2256 healthy participants (age range: 18 - 80 years; 1058 females) were selected based on their radiological report in a retrospective cross-sectional study. This study was approved by the institution's ethical committee. Brain anatomical T1w MR were processed using FSL (V.5) (Smith et al. Neuroimage, 2004). The preprocessing included tissue segmentation and subcortical structures extraction. Additionally, we aggregate all the volumes in a new parameter, the delta age, defined as the deviation of the predicted age by a multiple linear model between the age and the volume of all brain structures. Participants with volumes above or below five mean absolute deviations from the mean population for the same sex were discarded. Six different models were evaluated as normative models based on their standardized mean squared error (SMSE) derived from a random five-fold cross-validation: centiles, locally estimated scatterplot smoothing (LOESS), Gaussian process (GP), generalized additive models of location shape and scale (GAMLSS) and linear quantile regression (quant).

## **RESULTS**

We derived one normative model per sex due to gender differences in 7 out of the 10 brain structures analyzed ( $p < 0.05$ ). Besides the GP model, all models had similar SMSE values for every structure (SMSE range, female: 0.684 - 1.136, male: 0.698 - 1.165). However, the LOESS model showed a consistent minimum SMSE across structures, having the best performance with the delta age.

## **CONCLUSION**

The LOESS model provided a consistent minimum SMSE across all brain structures. Nevertheless, the use of a composed metric aggregating the volumes from all brain structures, the delta age, outperformed the performance of the model on individual brain structures. Therefore, we propose a normative model of brain aging in a Colombian adult population based on a LOESS model in terms of the delta age, that could be evaluated on a larger dataset.

## **CLINICAL RELEVANCE/APPLICATION**

We derived a normative model of brain aging in a Colombian adult population based on the brain volume of different structures, providing a reference of brain aging which could highlight deviations from it in neurodegenerative and mental disorders.

## **S3B-SPNR-8 Can fMRI be Used to Develop Neuroimaging Biomarkers for the Risk of Developing Schizophrenia? A fMRI Study Investigating Neural Context-adaptation in Visual Perception, Object Categorization, and Reward Processing Across the Schizotypy Spectrum**

Participants

Anna Giarratana, MD, PhD, North Brunswick, NJ (*Presenter*) Nothing to Disclose

## PURPOSE

Schizophrenia can be understood to exist on a spectrum; from non-clinical individuals with higher levels of schizotypal personality traits to patients with schizophrenia. Studying schizotypy in non-clinical populations can be extremely informative, given that schizotypy is positively correlated with an increased liability for the eventual development of a schizophrenia spectrum disorder. By studying schizotypy, researchers may be able to detect biomarkers for early detection of psychosis and identify brain regions that may be targets for treatment. Our lab previously found using fMRI, that neural adaptation to reward range is impaired in both healthy individuals with stronger schizotypal personality traits and in patients with schizophrenia. However, it remained unclear whether these deficits are limited to the reward domain, or extend to other domains as well. To this end, we undertook the larger fMRI study described here.

## METHODS AND MATERIALS

We recruited 98 participants who scored within the top 10%, bottom 10%, and middle 20% of the schizotypy scale as assessed by the Schizotypal personality questionnaire - brief revised (BPQ-BRU). Participants underwent three different tasks while in the fMRI. We investigated reward processing, utilizing a variant of the Monetary Incentive Delay task previously used in our lab. We investigated visual processing, using a task previously used in a collaborators lab based on the concept of surround suppression. Finally, we investigated object categorization, using a novel face-house identification task we developed for this purpose.

## RESULTS

We find that participants exhibit neural adaptation in the context of reward, visual processing, and object categorization. However, while our previous studies showed that reward range adaptation is impaired in individuals with higher schizotypy, we find no such deficit in visual processing or object categorization.

## CONCLUSION

Our findings suggest that the inability of those on the schizophrenia spectrum to adapt to the range seen in reward tasks does not generalize to the visual domain. These results may indicate that the deficits seen are specific to the dopamine reward pathways of the brain.

## CLINICAL RELEVANCE/APPLICATION

These findings highlight reward adaptation as a possible functional neuroimaging biomarker, and a potential target for future studies to investigate interventions (i.e. behavioral interventions or brain stimulation) in an effort to decrease progression along the schizophrenia spectrum.

## **53B-SPNR-9 Multi-site rTMS Combined with Cognitive Training Modulates Effective Connectivity in Patients with Alzheimer's Disease**

### PURPOSE

Alzheimer's disease (AD) is an irreversible neurodegenerative disorder with recent understanding as a disconnection syndrome. As pharmacotherapy for AD is currently limited, attention has been paid to non-drug adjuvant interventions such as repetitive transcranial magnetic stimulation (rTMS). Multi-site rTMS associated with cognitive training (rTMS-COG) therapy has been shown to be probably effective for AD patients at early-stage. rTMS has been approved to be able to modulate local activity in a remote area that is functionally connected to cortical stimulation targets. However, the causal interactions between the stimulation targets and other brain regions has yet to be explored. The purpose of this study is to investigate the effective connectivity (EC) changes after multi-site rTMS- COG therapy.

### METHODS AND MATERIALS

Written informed consent of all participants were obtained according to the declaration of Helsinki before enrollment. 10Hz rTMS over left dorsal lateral prefrontal cortex (DLPFC) and lateral temporal lobe (LTL) were delivered for 4 weeks with COG. AD patients were divided into real (real rTMS+COG, n=11) or sham (sham rTMS+COG, n=8) group to underwent neuropsychological assessment, resting-state fMRI and 3D brain structural imaging before (T0), immediately at the end of (T4), and 4 weeks after treatment (T8). A 2x3 factorial design with "time" as within-subject factor (3 levels: T0, T4, T8) and "group" as between-subject factor (2 levels) were used to investigate the EC changes related to stimulation targets on the rest of brain, as well as the causal interactions among 7 resting state networks based on granger causality analysis (GCA).

### RESULTS

At voxel-level, the EC changes from left DLPFC out to left inferior parietal lobe and left superior frontal gyrus, as well as from left LTL out to left orbital frontal cortex had significant group x time interaction effect. At network level, significant interaction effect has been identified on the EC increment from limbic network out to default mode network. The EC decrease at voxel level and EC increase at network level were all associated with better functioning in the ability of daily living and cognition.

### CONCLUSION

Multi-site rTMS combined with cognitive training could modulate effective connectivity in patients with AD, doing better for the ability of daily living and cognitive function. Due to the longitudinal design, the sample size is limited. Further multi-center cohort study was further needed to validate our pilot study.

### CLINICAL RELEVANCE/APPLICATION

This study provides a novel explanation for the neurobiological mechanisms of multisite rTMS-COG therapy in AD patients and further shed light on the direction of targeted brain network modulation in future.

## Abstract Archives of the RSNA, 2023

S3B-SPOB

### OB/Gynecology Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPOB-1 Risk of Malignancy in Ovarian-Adnexal Imaging Reporting Data System (O-RADS) Ultrasound (US) version 2022 Score 2 Unilocular and Bilocular, Smooth Ovarian Cysts Without Solid Components**

##### Participants

Luyao Shen, MD, Sunnyvale, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

Ovarian-Adnexal Imaging Reporting Data System (O-RADS) Ultrasound (US) version 2022 (v2022) downgraded smooth bilocular cysts without solid components <10 cm to the O-RADS US 2 with a lower expected risk of malignancy (ROM) of <1% based on results from IOTA5 trial (Timmerman et al. JAMA Oncol. 2023;9(2):225-233). We aim to assess the ROM of unilocular and bilocular, smooth cysts without solid components <10 cm in a non-selected patient population presenting to academic radiology departments in the United States.

##### METHODS AND MATERIALS

In this IRB-approved, retrospective study from 6 institutions, pelvic US over 5 years were consecutively reviewed to include exams with ovarian cystic lesions. Lesions without surgical, imaging, or clinical follow-up were excluded. Malignant lesions were diagnosed by histopathology, and benignity determined by histopathology, diagnostic on CT/MRI, resolution, decreased size >10%, or stability by imaging or normal clinical exam >2 years. Investigators blinded to the final outcome recorded imaging features and scores per the O-RADS US. Mann-Whitney and Fisher's exact tests were performed (two-tailed  $p < 0.05$  significant).

##### RESULTS

Of 14302 pelvic US reviewed, 913 patients had cystic ovarian lesions. Of those, 319 patients with 337 cystic lesions with smooth walls and septations without solid components <10 cm were included. The median age was 45 years (interquartile range 35-53), and there were 212 (66%) pre-menopausal and 107 (34%) post-menopausal patients. There were 292 unilocular cysts (275 patients) and 45 bilocular cysts (45 patients). Differences in patient age, menstrual status, and lesion size were not statistically significant between the 2 groups ( $p = 0.633$ ,  $0.865$ , and  $0.845$ , respectively). The ROM was 0.3% (1/292) for unilocular cysts and 2% (1/45) for bilocular cysts. ROM was not statistically significant between the 2 groups ( $p = 0.250$ ). The 2 malignant tumors (1 unilocular, premenopausal patient, and 1 bilocular cyst, postmenopausal patient) were both borderline serous tumors.

##### CONCLUSION

A 2% ROM was noted with bilocular cysts in our cohort, which is higher than expected range for O-RADS US v2022 score 2 (<1%). ROM difference between unilocular and bilocular, smooth ovarian cysts without solid components <10 cm is not statistically different. Further investigations in a larger cohort should be undertaken to confirm these initial results.

##### CLINICAL RELEVANCE/APPLICATION

In bilocular, smooth cysts without solid components, measuring less than 10 cm, the ROM is greater than the O-RADS US v2022 expected range of <1%. Borderline tumors can have this morphology. Our results suggest further investigation in a larger cohort is needed to help determine the appropriate risk categorization for bilocular cysts.

#### **S3B-SPOB-2 Ovarian-Adnexal Reporting and Data System (O-RADS) MRI Score Effects of DWI and ADC Values**

##### Participants

Marco Gennarini, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

The aim of this study is to evaluate the potential of integrating diffusion-weighted imaging (DWI) and quantitative assessment of apparent diffusion coefficient (ADC) into the O-RADS MRI system for prognostic purposes. Subsequently, to evaluate the validity and reproducibility of this approach among operators with different levels of experience in female pelvic imaging and to identify any correlations between the histology of malignant lesions and ADC values.

##### METHODS AND MATERIALS

The study included 173 patients with 213 indeterminate masses in the adnexa that underwent MRI examination between January 2015 and June 2022. 140 patients with 172 masses met the inclusion criteria, which required them to be over 18 years old, have undergone a standard MRI exam, have no acute symptoms, and have had subsequent surgery with histopathological examination or stable follow-up for at least one year. Two radiologists with 4 and 1 year of experience in female pelvic imaging, respectively, blindly evaluated all masses according to the O-RADS MRI score system. To perform a quantitative analysis, a circular ROI was placed on the ADC map obtained from single-exponential DWI. If the lesion had multiple solid components, 4 to 6 ROIs were placed, and the ROI with the lowest ADC value was recorded. Lesions without enhanced solid tissue, with fluid, adipose, blood or fibrotic content, were considered benign (O-RADS 2) and excluded.



## RESULTS

The study showed excellent agreement between the two radiologists in classifying adnexal masses according to the O-RADS MRI score system ( $K = 0.936$ ; 95% CI). Two ROC curves were used to determine the best cut-off value for the ADC between O-RADS MRI categories 3-4 and 4-5, which allowed for some masses to be upgraded or downgraded compared to their original classification. The AUC for O-RADS MRI scores 3 and 4 was 0.951, with an optimal ADC cut-off value of  $1.411 \times 10^{-3} \text{ mm}^2/\text{sec}$ . Three adnexal masses originally classified as O-RADS MRI score 3 were upgraded to score 4, and four lesions with an ROI ADC  $> 1.411 \times 10^{-3} \text{ mm}^2/\text{sec}$  were downgraded to score 3. All 30 adnexal lesions classified as O-RADS MRI score 5 remained in that category. The AUC for O-RADS MRI scores 4 and 5 was 0.630, with an optimal ADC cut-off value of  $0.849 \times 10^{-3} \text{ mm}^2/\text{sec}$ . Twenty-two adnexal masses originally classified as O-RADS MRI score 4 were upgraded to score 5, and 36 adnexal lesions, in accordance with TIC type 2, remained in O-RADS MRI score 4. There was a significant correlation between ADC values and the histotype of ovarian carcinoma ( $p \text{ value} < 0.001$ ).

## CONCLUSION

Our research reveals how DWI and ADC values can provide valuable prognostic information for the O-RADS MRI classification, leading to improved standardization and characterization of adnexal masses.

## CLINICAL RELEVANCE/APPLICATION

### S3B-SPOB-3 Comparison of O-RADS and Simple Rules Ultrasound Classifications to Predict Adnexal Malignancy

Participants

Andrew Nanapragasam, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

## PURPOSE

This study compares performance of US O-RADS (version 2022) and Simple Rules (SR) criteria in a cohort of asymptomatic pathology-proven adnexal masses and evaluates O-RADS and SR inter-observer agreement in a subset of patients.

## METHODS AND MATERIALS

We conducted retrospective analysis in consecutive patients who underwent surgical resection between January 2008 and December 2018 at two adult university hospitals. US cine clips were available for all examinations. One experienced radiologist, blinded to diagnosis, categorized all US imaging by O-RADS and SR criteria. SR assessment assigned the following features as benign: unilocular/multilocular cyst with uniform thin septa irrespective of cyst content/size; cystic or solid mass with attenuating component; cystic mass with  $< 3 \text{ mm}$  nodule(s) or completely calcified nodule(s). Malignant features included: non-attenuating solid mass; cystic mass with non-attenuating nodule, nodule(s)  $\geq 3 \text{ mm}$ ; multilocular cysts with septa too close to be distinctly seen. A subset of cohort was randomly selected and reviewed by two blinded radiologists with fewer years of experience. Chi-square testing was used for comparison of ratios, and Kappa statistic for inter-observer agreement.

## RESULTS

791 adnexal masses in 762 patients were assessed, aged 18-92 ( $44 \pm 15$ ); 628 benign, 49 LMP, 114 malignant, measuring 1 to 39 cm ( $7.9 \text{ cm} \pm 4.2$ ). O-RADS categories were 2 ( $n=309$ ), 3 ( $n=165$ ), 4 ( $n=181$ ), 5 ( $n=136$ ) with malignant rates of 0.3%, 3%, 25%, and 82% respectively. Application of simple rules criteria identified 561 masses as benign and 230 as malignant. Combining O-RADS 4 and 5 categories as being malignant, sensitivity, specificity, NPV, PPV, and accuracy to detect invasive/LMP masses were 96% (CI:92-99%), 75% (CI:71-78%), 99% (CI:97-100%), 49% (CI:44-55%), and 79% (CI:76-82%). Corresponding results for SR were 96% (CI:91-98%), 89% (CI:85-91%), 99% (CI:98-100%), 68% (CI:61-74%), and 90% (CI:87-92%) with specificity, PPV, accuracy of SR being statistically significantly higher than O-RADS ( $p < 0.0001$ ). Inter-observer agreement between the three readers were 0.89, 0.91, and 0.93 for SR benign versus malignant categories and 0.71, 0.75, and 0.75 for O-RADS 2/3 from O-RADS 4/5.

## CONCLUSION

Adnexal mass ultrasound assessment with SR performs significantly better than O-RADS classification for specificity, PPV, and accuracy with similarly high sensitivity and NPV. High inter-observer agreement was found with both SR and O-RADS.

## CLINICAL RELEVANCE/APPLICATION

US risk stratification by experienced radiologists using SR criteria outperforms O-RADS and can result in a better triaging of patients to gynecologists versus gynecologists by predicting a more precise rate of malignancy.

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## Abstract Archives of the RSNA, 2023

S3B-SPPD

### Pediatric Imaging Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPPD-1 Reducing Iodine Load and Radiation Dose in Infants with Congenital Heart Disease with a Combination of 70kV Tube Voltage and Adaptive Statistical Iterative Reconstruction-V**

##### Participants

Chenglong Li, Xu Zhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To assess the effect of reduced iodine load to contrast enhancement and image quality of 70 kV tube voltage setting and adaptive statistical iterative reconstruction V (ASIR-V) technique in children with congenital heart disease(CHD).

##### METHODS AND MATERIALS

Totally 42 infants less than 2 year old with complex CHD were enrolled. All children were scanned at 22 noise index levels of automatic current modulation with 70kV on 256-row CT scanner. And pre-setting 50% ASIR-V was adopted to further reduce radiation dose. Two contrast protocols were set: group A, 350 mg I/mL of contrast media at a dose of 1ml/kg; group B: 270 mg I/mL of contrast media at a dose of 1ml/kg; Patients were selected to any one of the protocols randomly. Objective image qualities (density, noise) were measured in the great vessels and heart chambers by two experienced radiologists. The contrast-to-noise ratio (CNR) was calculated by measuring the density and noise of myocardial walls. Image quality was assessed by a five-point score. A score of <3 represents non-diagnostic. Effective radiation dose (ED) was calculated. Weighted Kappa test was used to analyze the image-reviewing consistency of the two reviewers.

##### RESULTS

The image-reviewing results of the two physicians showed good consistency ( $K=0.747$ ). Image quality score of 350mgI group and 270mgI group were  $4.3 \pm 0.3$  and  $4.1 \pm 0.4$  ( $p > 0.05$ ), respectively. For 350mgI group, CT values were  $436.50 \pm 89.5HU$ ,  $424.23 \pm 89.8HU$  and  $486.77 \pm 130.47HU$  in ascending aorta, descending aorta and pulmonary artery trunk, respectively. For 270mgI group, CT values were  $324.15 \pm 48.21HU$ ,  $312.37 \pm 67.7HU$  and  $326.77 \pm 90.45HU$ , respectively. However, all subjects showed at least more than standard diagnostic acceptability. The average ED (median) of 350mgI group and 270mgI group were  $0.48 \pm 0.15$  mSv and  $0.37 \pm 0.13$  mSv ( $P < 0.01$ ).

##### CONCLUSION

The use of low-tube-voltage combined with ASIR-V and low-dose contrast agent can reduce radiation dose and contrast medium without sacrificing image quality.

##### CLINICAL RELEVANCE/APPLICATION

Radiation dose and iodine load can be reduced in infants with congenital heart disease using 70 kVp and ASIR-V technique without compromising the contrast enhancement, image quality and diagnostic accuracy.

#### **S3B-SPPD-2 Automated Reconstruction and Segmentation of High-isotropic-resolution Fetal Brain MRI Data for Quantitative Brain Morphological Analysis**

##### PURPOSE

Fetal MRI has gained increasing importance in prenatal diagnosis because of its superior soft tissue contrast. To compensate for fetal and maternal motion and limited spatial resolution, two-dimensional (2D) images are acquired across each anatomical direction. In this study, we develop and present an automated pipeline that reconstructs a high-isotropic-resolution fetal brain volume from three 2D thick-slice images and segments it into multiple brain structures using state-of-the-art MR image analysis methods. The accuracy of the pipeline is validated by evaluating the correlation between brain structure volumes and gestational age.

##### METHODS AND MATERIALS

Sixty pregnant women with normal fetal brain, aged between 20 to 36 weeks of gestation, were enrolled with informed written consent and IRB approval to obtain T2-weighted images along axial, coronal, and sagittal directions using a turbo spin echo (TSE) sequence. The NiftyMIC method was employed to perform slice-to-volume motion correction and reconstruct a single fetal brain volume at 0.8 mm isotropic spatial resolution from the three 2D TSE images. The reconstruction process included brain masking, bias-field correction, volumetric reconstruction in each subject's native space, and transformation to the template space. A deep learning-based segmentation neural network named FetalBrainParcellation was then utilized to segment each high-resolution brain volume into eight brain structures, including cortical grey matter, deep grey matter, white matter, corpus callosum, brainstem, cerebellum, intra-axial cerebrospinal fluid (CSF), and extra-axial CSF. Finally, the Pearson correlation coefficient between the volume of each brain structure and the gestational age was computed.

##### RESULTS

The quality of reconstruction and segmentation results of all 60 subjects were visually confirmed by two expert pediatric

radiologists . The volume of each brain structure was highly ( $r>0.9$  for five structures,  $r>0.8$  for seven structures) and significantly ( $p<0.001$ ) correlated with the gestational age, which was consistent with previous studies.

#### **CONCLUSION**

s This study introduced a pipeline that automatically reconstructed and segmented fetal brain volumes and validated its robustness and accuracy for quantitative morphological analysis of normal fetal brains.

#### **CLINICAL RELEVANCE/APPLICATION**

The automated pipeline developed for reconstructing and segmenting fetal brain MRI data provides a novel tool for quantitative morphological analysis of fetal brains, which can aid in diagnosis and prognosis. Further research will assess its validity for fetal brains with pathologies and explore its potential clinical applications.

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## Abstract Archives of the RSNA, 2023

S3B-SPPH

### Physics Sunday Poster Discussions II

#### Sub-Events

#### S3B-SPPH-1 Evaluating ChatGPT's Performance on a Radiology-physics Question Set

##### Participants

Jaydev K. Dave, PhD, Rochester, MN (*Presenter*) Research Grant, Koninklijke Philips NV; Equipment support, Lantheus Medical Imaging; Equipment support, General Electric Company; Research Consultant, Curvebeam LLC; Consultant, Rayscan, Inc.

##### PURPOSE

Recent reports have evaluated ChatGPT's (OpenAI, San Francisco, CA) performance on several standardized examinations. The purpose of this work was to evaluate the performance of this text-based AI language model on a radiology-physics question set.

##### METHODS AND MATERIALS

A radiology-physics question set with 135 questions (RAPHEX, Radiological and Medical Physics Society of New York) was used to assess ChatGPT's performance. All questions were in the multiple-choice format with single correct answer and three to four distractors. The questions covered different imaging modalities, and included questions with images ( $n = 27$ ), calculations ( $n = 36$ ), and regulatory limits/accreditation requirements ( $n = 17$ ). Freely available, March 23, 2023 version of ChatGPT was used in this study. The questions were entered in multiple choice format with the stem and the options into the chat dialogue box. The responses were evaluated and scored. The justification provided in the ChatGPT responses was also reviewed for correctness.

##### RESULTS

Out of 27 image-based question, there were 8 questions in which interpretation of images was required and given that images are not accepted as input in ChatGPT, there were no responses for these questions. Thus, these 8 questions were not considered in the scoring. Other image-based questions either included description of artifacts/image content in the question stem or images with tabulated data. For these questions, responses were provided by ChatGPT and so these were included for assessment. From the 127 questions included in the analysis, correct responses/explanation were obtained for 79 (62.2%). For 2 questions the correct responses were obtained; however, the justification was incorrect. Evaluating the proportion of correct responses as a function of question type revealed that correct responses were obtained for 63.2% of the questions with images (12/19), 50.0% of the questions that involved calculations (18/36), and 35.3% of the questions involving regulatory limits/accreditation requirements (6/17). Modality-wise, the proportion of correct cases was 88% for radiography, 50% for mammography, 36% for fluoroscopy, 60% for computed tomography, 83% for ultrasound, 67% for magnetic resonance imaging, 43% for nuclear medicine, and 72% for fundamental questions including safety and radiobiology.

##### CONCLUSION

Leaving aside questions that rely on image interpretation, ChatGPT scored 62.2% on a radiology-physics question set covering different modalities and question categories. Image-interpretation questions remain unanswered.

##### CLINICAL RELEVANCE/APPLICATION

Analyzing the performance of chatbots will help target evaluation criteria for maintenance of certification/online longitudinal assessment.

#### S3B-SPPH-10 Opportunistic Osteoporosis Screening with Bone Mineral Density Estimation on Computed Tomography using Multi-View Semi-Supervised Learning

##### Participants

Heng Guo, Hangzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Computed tomography (CT) scans, which are widely used for other indications, can provide added-value for osteoporosis screening. We propose a novel method for estimating bone mineral density (BMD) using routine CT scans.

##### METHODS AND MATERIALS

We proposed DeepBMD that consists of automatic spine vertebrae instance segmentation and BMD regression in this work. Patients who underwent both a routine CT and a Dual-energy X-ray Absorptiometry (DXA) examination within one month between December 2020 and December 2022 were retrospectively included. This led to 3,586 CT scans (81% chest CT, 19% abdomen CT) and 3,805 DXA results with lumbar BMD values (L1 - L4). After excluding scans with low quality, metal implants and bone fractures, a dataset of 2,633 CT-DXA pairs in patient-level were obtained. An automated vertebrae instance segmentation tool was developed to distinguish vertebrae with DXA gold-standard or not. Finally, we got 4,889 vertebrae with DXA gold-standard, and 30,400 not. The paired dataset was randomly split into 60%, 10%, and 30% for training, validation, and testing. We developed a multi-view semi-supervised learning framework for BMD regression. Specifically, 3D and 2.5D vertebrae patches were extracted under different augmentation parameters. A hybrid network consisting of a CNN and a Vision Transformer was used to extract features. For

vertebrae without gold-standard, pseudo BMDs would be generated. An experienced clinical expert specialized in orthopedics checked the vertebrae identification results. The Pearson correlation coefficient, sensitivity, specificity, area under receiver operating characteristics (AUC) are reported.

## RESULTS

There are 1,005 osteoporotic patients (group A) and 1,628 non-osteoporotic patients (group B) in our dataset. Females account for 68.6% in group A and 48.6% in group B. The average ages of group A and group B are 65.56(±8.59) and 62.17(±9.12). For vertebrae identification, DeepBMD achieves a success rate of 98.7%, indicating that it is robust and reliable. DeepBMD achieves a great correlation coefficient of 0.909 on the testing set. According to the literature that a T-score of less than or equal to -2.5 is considered to be osteoporotic, DeepBMD achieves a sensitivity of 0.87, specificity of 0.90, and AUC of 0.96 for osteoporosis screening.

## CONCLUSION

The predictions of the proposed algorithm exhibit a strong correlation with DXA and can facilitate opportunistic osteoporosis screening.

## CLINICAL RELEVANCE/APPLICATION

Using routine CT for BMD estimation can provide the added-value for opportunistic osteoporosis screening. Beyond evaluating BMD in the lumbar vertebrae, our method can also assess the thoracic vertebrae, providing patients with a more comprehensive evaluation of their spine health.

## S3B-SPPH- 11 Development of a TOPAS Monte Carlo Model of a C-arm Cone Beam CT (CBCT) for Organ Dose Estimation

### PURPOSE

C-arm cone beam computed tomography (CBCT) used in an interventional radiology (IR) setting provides the radiologist with cross sectional images to assist in performing and verifying a radiological intervention. To accurately estimate the radiation dose to the patient, knowledge of the doses delivered to major radiosensitive organs is required. However, the current approaches for CBCT dosimetry are still under development. Replication of system specific complexities such as automatic exposure control (AEC), rotational geometries, beam hardening and scatter contributions make the simulation and estimation of CBCT radiation doses challenging. The main aim of this research was to develop a novel TOPAS Monte Carlo (MC) dosimetry model of a C-arm CBCT incorporating AEC, and validate it with measurements using an anthropomorphic phantom.

### METHODS AND MATERIALS

A MC model of a Siemens Artis Q C-arm CBCT system [Siemens, Erlangen, Germany] was developed in TOPAS, version 3.9. A TOPAS extension to incorporate AEC functionality was implemented into the MC model. The system's energy spectrum, CBCT rotational parameters, system geometry and tube filtration were simulated according to manufacturer specifications. Experimental data was obtained using the Body CBCT protocol and a physical CIRS ATOM® adult female anthropomorphic phantom. Verification of the dose distribution and AEC functionality of the MC model was carried out using thermoluminescent dosimeters (TLDs) placed in the tissue-equivalent organ sections of the phantom mimicking patient organs. Measured doses were compared with MC simulated doses for different sites within the phantom acquisitions.

### RESULTS

This study presents details of the development of a novel AEC module in TOPAS MC simulations for incorporation into a C-arm CBCT MC model. The AEC module, the first of its kind, will shortly be released for public use in TOPAS. The CBCT MC model has been applied to abdominal acquisition protocols in IR and validated through anthropomorphic phantom dose distributions and organ dose measurements.

### CONCLUSION

A novel AEC module has been successfully developed in TOPAS which can be easily incorporated into other imaging application models that employ such dose modulation. The MC model allows for a more realistic dosimetry estimation, advancing the current CBCT dosimetry approaches.

### CLINICAL RELEVANCE/APPLICATION

Few studies have documented radiation doses from C-arm CBCT exposures in adults. The novel AEC module developed in this research, and its validation using an anthropomorphic phantom, is a step towards personalised dosimetry in CBCT.

## S3B-SPPH- 12 Development of an Ultra-high-Resolution Dental Cone-beam CT System

### PURPOSE

The dental cone-beam computed tomography (DCBCT) systems have been clinically used since early 2000s. They provide detailed images that can help dentists diagnose and plan treatment for different dental conditions. The spatial resolutions of DCBCTs are generally higher than those of multi-slice CT systems; however, the spatial frequency limits evaluated by 5% modulation transfer function (5%MTF) are approximately 2 mm<sup>-1</sup> and those are not necessarily sufficient for observing micro structural abnormalities in oral region. This study aimed to develop a new DCBCT (DCBCTnew) that achieves a 5%MTF significantly higher than that of conventional DCBCT (DCBCTc) without increasing the radiation dose.

### METHODS AND MATERIALS

A contact geometry, in which the X-ray detector is close to the object, for reducing the focus penumbra was adopted in this system. Furthermore, since the dentition is generally located anteriorly in the head, a half scan orbit was used to prevent collisions between the occipital region and the detector. The scan duration was 6.5 s; during that, projection data with 520 views were obtained using a CsI-based detector with 1488 × 660 pixels. The pixel size at the iso-center was 0.081 mm. For the DCBCTnew and a DCBCTc, MTFs were measured from images obtained by scanning a copper wire with a diameter of 0.1 mm. The radiation dose of DCBCTnew was measured according to the standard method for the weighted CT dose index (CTDI<sub>w</sub>); then, the effective dose was estimated from the result. An oral region in an anthropomorphic head phantom was scanned using both DCBCTnew and DCBCTc.

## RESULTS

The 5%MTF of DCBCTnew was 3.80 mm<sup>-1</sup>, which was more than twice that of DCBCTc (1.65 mm<sup>-1</sup>). The estimated effective dose of DCBCTnew was 0.084 mSv which was significantly lower than reported ones (around 0.2 mSv) of the DCBCTc. The phantom images of DCBCTnew were remarkably sharper and clearer compared to those of DCBCTc.

## CONCLUSION

The developed DCBCT presented significantly higher spatial resolution and more suitable dental CT images to observe micro structures with a lower radiation dose, compared to a conventional DCBCT.

## CLINICAL RELEVANCE/APPLICATION

The developed DCBCT was able to provide high-resolution images with low dose scanning. This result suggested that there are sufficient rooms to improve the image quality of current clinical DCBCT systems.

## S3B-SPPH-13 A Dose Based Method to Optimize Virtual Monoenergetic Cone-beam Computed Tomography Imaging Parameters for Image-guided Radiotherapy

### PURPOSE

This study aims to optimize Virtual Monoenergetic (VM) cone-beam computed tomography (CBCT) protocols for Image Guided Radiation Therapy (IGRT) as functions of exposure and single frame acquisition rate while minimizing patient imaging dose.

### METHODS AND MATERIALS

First, 7 CBCT sets acquired at 80 kVp and 140 kVp with various exposures and frame rates were used to determine the average normalized Air Kerma (K<sub>air</sub>) per exposure (mAs) for the X-ray Imaging (XI) system of a Truebeam linac (Varian Medical System, CA) with a calibrated 0.6cc air Kerma Farmer chamber. Then, 6 combined dual (80 and 140 kVp) energy CBCT protocols were optimized, ensuring that their estimated cumulative K<sub>air</sub> resulted in a lower imaging dose than K<sub>air</sub> of the default 140 kVp-Pelvis CBCT protocol (K<sub>air</sub> =133 mGy). VM-CBCT projection images of a Catphan 604 (Phantomlab, NY) at specific energies were generated from DE-CBCT, and then were reconstructed using the Feldkamp-Davis-Kress (FDK) algorithm within an open-source TIGRE toolbox. The quality of VM-CBCT images at 50 keV were evaluated using quantitative metrics such as Hounsfield units (HU), contrast-to-noise ratios (CNR), and noise-level using in-house scripts.

### RESULTS

The average difference between estimated and measured cumulative K<sub>air</sub> for all combined DE-CBCT protocols was 2.2±2.1%. Qualitative evaluation of VM-CBCT images at 50 keV showed comparable image quality between those with high- and low-K<sub>air</sub>. The HU of 20% bone material in the all low-K<sub>air</sub> VM-CBCT with were within 35 HU of the theoretical value of 298 HU. Additionally, the CNR and noise level between high- and low- K<sub>air</sub> VM-CBCT images were within 1.6 (16.0±0.9) and 3 HU (19.3±1.0 HU) respectively.

### CONCLUSION

The proposed method of optimizing DE-CBCT acquisition parameters based on K<sub>air</sub> provides imaging dose estimate within 3%. VM-CBCT generated from optimized DE-CBCT with reduced K<sub>air</sub> showed comparable image quality to VM-CBCT generated from the highest K<sub>air</sub> DE-CBCT based on both qualitative and quantitative assessments. Ongoing research aims to explore the impact of further reducing the framerates in CBCT acquisition and evaluating the use of iterative reconstruction to determine imaging parameters with reduced imaging dose while maintaining image quality for clinical applications.

### CLINICAL RELEVANCE/APPLICATION

VM-CBCT has shown promise in improving visualization of soft tissues compared to standard CBCT. However, the increased imaging dose associated with VM-CBCT remains a concern. We propose to determine imaging parameters using air Kerma measurement-based approaches of optimizing DE-CBCT imaging parameters. This approach has the potential to substantially reduce imaging dose for VM-CBCT without deteriorating image quality for clinical applications.

## S3B-SPPH-2 Adaptive Deep Learning MR Image Enhancement for Flexible Rapid MR Protocol Design

Participants

Zechen Zhou, Seattle, WA (*Presenter*) Nothing to Disclose

### PURPOSE

Deep Learning (DL) based image enhancement approaches can restore the image quality for accelerated Magnetic Resonance (MR) scans. However, a single DL model might not allow flexible MR protocol setup to achieve higher acceleration and resolution. In this work, we propose a Proximal Gradient Descent based unrolled Network (PGDNet) that can adaptively resolve different levels of noise amplification and image blurring. Preliminary performance evaluations were compared with traditional DL methods on various acquisition tasks.

### METHODS AND MATERIALS

PGDNet (Fig. A, PGDNet) incorporates the image degradation model into the image restoration process to jointly estimate the degradation kernel and the high quality image, which maintains the data consistency with the acquired image while performing adaptive image enhancement. 356 MR acquisitions with paired fully sampled and undersampled (i.e. fewer number of phase encodings [NPE] or signal averages [NSA]) images were collected for training (#pairs for reduced NPE: 101, #pairs for reduced NSA: 193, #pairs for both: 18) and testing (#pairs for reduced NPE: 11, #pairs for reduced NSA: 29, #pairs for both: 4). Three different models were trained: 1) Enhanced Deep Residual Networks (EDSR) (Fig. A, EDSR) trained with all data pairs; 2) EDSR model fine-tuned with the reduced NPE data pairs as the super-resolution expert (SRE) model; 3) PGDNet trained with all data pairs. Quantitative PSNR and SSIM metrics were used to evaluate the accuracy of the model outputs on 3 acquisition tasks.

### RESULTS

In denoising tasks (Fig. B, reduced NSA scans), PGDNet can better preserve small structures, and prevent over-smoothing, particularly the trabecular bone textures in MSK cases. In deblurring tasks (Fig. B, reduced NPE scans), PGDNet can still achieve similar/superior performance compared to the EDSR SRE model, and show improved structural consistency with the reference image. Compared to EDSR and EDSR SRE, PGDNet demonstrates its adaptation and robustness in the joint denoising and deblurring tasks

(Fig. B, scans with reduced NSA and NPE). Quantitative measurements also supported the qualitative assessment.

## CONCLUSION

By explicitly leveraging the image degradation model, PGDNet outperforms the conventional DL methods in various acquisition tasks, particularly filling the gaps in acquisitions with both reduced NPE and NSA. This allows more flexible MR protocol design to achieve highly accelerated clinical exams or improved image quality for clinical diagnosis.

## CLINICAL RELEVANCE/APPLICATION

DL based image enhancement methods supporting different types of fast MR acquisitions allow more flexible rapid protocol design to achieve more efficient clinical workflow or improved image quality for clinical diagnosis.

### S3B-SPPH-3 Improving the Accuracy for Intracranial Aneurysm Detection in CT Angiography using the Combination of Artificial Intelligence-assisted Diagnostic System and Physician Intervention

#### PURPOSE

To investigate the diagnostic performance of two modes (head and neck artificial intelligence (AI)-assisted diagnostic (AIAD) system and AIAD + physician mode) in the detection of intracranial aneurysms (IA) using head and neck CT angiography (CTA).

#### METHODS AND MATERIALS

A total of 40 patients with suspected IA who underwent head and neck CTA, and digital subtraction angiography (DSA) were retrospectively included. DSA was used as the gold standard, and both the AIAD and AIAD + physician systems were used to perform IA diagnosis on CTA images. The sensitivity, specificity, and accuracy of the systems were calculated. The consistency of the IAs long diameter, short diameter, and aneurysm neck diameter between AIAD system and DSA were evaluated by Bland-Altman scatter diagram. The average post-processing and interpretation times of two modes were recorded.

#### RESULTS

The average post-processing and interpretation times of AIAD was  $2.5 \pm 0.6$  min per case vs.  $5.6 \pm 0.4$  min per case of AIAD + physician mode. Of the 40 patients (19 men;  $59.18 \pm 12.32$  years), 33 patients were diagnosed with IA by DSA, and 39 IAs were analyzed. For the diagnostic performance, on the per-patient basis, the sensitivity of the AIAD and AIAD + physician modes was 81.8%, 96.97%, respectively, and the accuracy of the two modes was 70%, 90%, respectively ( $P=0.025$ ). On the per-lesion basis, the sensitivity of the two modes was 74.36%, 89.74%, respectively and the accuracy was 65.96%, 85.11%, respectively ( $P=0.031$ ). In terms of the quantitative analysis, the consistency between AIAD automatic measurement and DSA manual measurement with Bland-Altman scatter diagram showed that most of the points were concentrated in the range of 1.96 times of the standard error.

## CONCLUSION

The AIAD + physician mode significantly improved the accuracy for the detection of IA in head and neck CTA, and AIAD system could serve as a reference standard for measuring the diameter of aneurysms.

## CLINICAL RELEVANCE/APPLICATION

AI-assisted diagnostic system + physician mode can improve the accuracy and work efficiency in the detection of IA, which have a major influence on daily clinical practice.

### S3B-SPPH-4 Assessing Racial and Age-Related Fairness in Chest X-Ray Classification Algorithms

Participants

Yonghan Ting, FRCC, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### PURPOSE

Evaluate bias in two commercial (AI1, AI2) and one academic (AI3) chest x-ray classification algorithms. Estimate the fairness of these algorithms for different age and racial groups using the Aequitas package.

#### METHODS AND MATERIALS

- 500 anonymized chest x-rays were collected from patients aged above 18, across 6 races at an academic hospital center in Singapore.
- Ground truth was established by an experienced radiologist.
- X-rays were analyzed by two commercial and one academic CXR classification model for normal-abnormal classification on the CARPL.AI platform
- Aequitas package preloaded on this platform was used to evaluate algorithm performance on metadata classes, including age group and race, with reference groups selected based on the majority population characteristics.
- False negative rate (FNR) metric was used to calculate inter-class scores of bias.

#### RESULTS

- For age, AI1 showed FNR disparity for patients aged 48-99; AI2 showed FNR disparity for patients aged 19-31 and 48-99; AI3 showed FNR disparity across all age groups.
- For race, at a 60% disparity intolerance, FNR parity was observed for Chinese and Indian populations in AI1 and AI2, respectively; AI3 demonstrated FNR parity for Chinese and Malay groups.

## CONCLUSION

The study found the AI algorithms to have racial parity but at a reduced tolerance range. Both algorithms showed a certain degree of FNR disparity for certain age groups. We propose including bias evaluation as a core component of every AI solutions' validation pipeline.

## CLINICAL RELEVANCE/APPLICATION

By identifying disparities in the performance of these algorithms across different age groups and racial backgrounds, our findings can inform clinicians, healthcare institutions, and algorithm developers about the limitations and potential risks associated with the current AI-based diagnostic tools.

### S3B-SPPH-5 Improving Reconstruction in Accelerated MRI via Transferable Deep Learning

Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Presenter*) Nothing to Disclose

## PURPOSE

The objective of this study is to develop an attentive feature refinement-based transfer learning approach for vendor transfer in medical image, which will allow any pre-trained model to transfer knowledge across domains and adapt to novel domains with relatively limited datasets.

## METHODS AND MATERIALS

Variational Feedback Network (VFN) was adopted as the base architecture to conduct and evaluate the effectiveness of our proposed transfer learning strategy. We extend the transfer learning capability of VFN beyond existing transfer learning methods (i.e., pretrained weights finetuning) by selecting pretrained features that benefit reconstruction quality. To enable knowledge transfer from the source dataset to refine target tasks, we exploit the high-level features of reconstructions from VFN network. To refine the subsampled k-space, we propose a feature extraction and refinement (FER) module. We use more than 400 T1-weighted MRI ACR phantom images collected from MAGNETOM Skyra 3.0T (SIEMENS Healthcare) and Discovery 750W 3.0T (General Electric HealthCare) scanners as our two domains and analyze the transfer in both directions.

## RESULTS

The images were reconstructed with an acceleration factor of 4. Five AI models were development in this studied and tested on GE phantom dataset. The first model was trained with SIEMENS ACR data (400 samples) using the basic VFN network. The second model was trained with GE ACR data (100 samples) using the basic VFN network. The third model was trained with SIEMENS + GE ACR data (500 samples) using the basic VFN network. The fourth model was trained based model 1 but fine-tuned with GE dataset without feature supervision. The fifth model was trained based model 1 but fine-tuned with GE dataset with a feature extractor. The reconstruction quality is compared across implicit and explicit transfer learning methods. The testing results for GE 5 dataset of PSNR are 35.7 +/- 13.05, 43.73 +/- 15.6, 44.16 +/- 13.06, 42.61 +/- 13.76, 44.72 +/- 16.38, and SSIM 0.9024 +/- 0.12, 0.9718 +/- 0.06, 0.9806 +/- 0.03, 0.9631 +/- 0.08, 0.9893 +/- 0.09 for the above 5 models.

## CONCLUSION

s Out study indicates that the reconstruction quality by using our newly developed feature refinement-based transfer learning is significantly better than these reconstructed with conventional Variational Feedback Network (VFN) with limited datasets.

## CLINICAL RELEVANCE/APPLICATION

This study established and tested a new DL model of feature refinement-based transfer learning with strong ability to handle data heterogeneity and variability at speeding up MRI scans up to 4~8 times faster. This method will be able to shorten clinical MRI scan time for improved patient experience and reduced cost while maintaining the quality for diagnosis.

## S3B-SPPH-6 Viability of an AI-enabled 0.5T Scanner to Improve MR Access

Participants

Arjun Narula, MBBS, MD, Rohtak, India (*Presenter*) Nothing to Disclose

Saban Kurucay, Waukesha, WI (*Presenter*) Employee, General Electric Company

## PURPOSE

Access to MRI is known to have improved clinical outcomes. However, it is limited to high economic regions due to high cost, lack of infrastructure and unavailability of skilled labor. Lower field strength MRI along with lower gradient and RF specifications will reduce cost and infrastructure requirements. However, image quality from these derated systems have historically not been sufficient for clinical use. Recent developments in image acquisition and reconstruction with artificial intelligence (AI) could enable improvement of quality of images obtained from such systems to make it clinically viable. This abstract tests the hypothesis that an AI-enabled 0.5T system with low gradient and RF power would provide clinically sufficient information compared to a conventional 1.5T clinical scanner.

## METHODS AND MATERIALS

Routine brain and cervical spine exams were collected from 197 patients (1188 series in total) on 0.5T, low gradient and low RF AI-enabled scanner with custom made 14-channel HNU coil. The same patients were also scanned on a commercial 1.5T scanner. The scan duration of the 0.5T AI-enabled scanner was comparable to the clinical scanner and at the most less than 2 times the clinical scanner's scan duration. Comparisons were made to study the clinical sufficiency for diagnosis of the AI-enabled 0.5T scanner images to those obtained from 1.5T scanner by at least 4 radiologists from a pool of 10 global radiologists. The radiologists rated the images on a Likert scale between 1 and 9 (1: clinically useless, 5: diagnostic quality, 9: better than reference).

## RESULTS

The 0.5T scans were rated on an average as  $6.11 \pm 1.2$ ; significantly above diagnostic quality 5 ( $p < 1e-4$ ). On a subset of the data, conventional (non-AI) reconstructed images were compared with AI-reconstructed images. AI reconstruction significantly improved ( $p < 1e-14$ ) the rating average by  $2 \pm 0.96$  points on the Likert scale. Only a total of 81 series out of 1188 obtained an average rating below 5 (diagnostic) and were mostly due to motion artefacts. The rest were due to poor acquisition parameter choices in the early phase of the study.

## CONCLUSION

s This study has shown that AI-based image quality improvement can enable head and c-spine images from a 0.5T system to be diagnostically sufficient. Further assessment on other anatomies and additional AI methods for acceleration is required.

## CLINICAL RELEVANCE/APPLICATION

AI-enabled low-field systems can provide diagnostic image quality similar to clinically accepted 1.5T scanners and has good potential to help improve access of MRI to underprivileged regions.

## S3B-SPPH-7 Improving Juxta-vascular Pulmonary Nodule Detection Capability Using a Deep Learning-based AI Detection System in Low-dose Computed Tomography (LDCT)



Participants  
Fang Wang, Yinchuan, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the performance of a deep learning computer aided diagnostic (CAD) system to improve detection rate for juxta-vascular pulmonary nodules in LDCT.

#### **METHODS AND MATERIALS**

104 healthy patients who underwent low-dose chest CT screening using a 256slice wide-detector CT (Revolution, GE Healthcare) were enrolled. Protocols were adjusted so that effective dose was set to approximately 1.5 mSv. All DICOM images were sent to a deep learning (DL) computer aided diagnostic system (InferRead CT Lung Research, Infervision) for automatic pulmonary nodule detection. Three methods were used to read the images. Method A: Independent reading of axial images by two radiologists to detect juxta-vascular pulmonary nodule (JVPN) reaching consensus. Method B: DL assisted reading result was analyzed by radiologists to judge whether they were JVPN. Method C: Based on method B results, radiologists read the films by combining the axial images. The total number and locations of nodules for each patient detected in each method were recorded. Two senior chief radiologists' consensus readings were used as the gold standard nodules. The detection rate and false positive rate of each method were calculated respectively.

#### **RESULTS**

216 JVPNs were confirmed as gold standard. In method A, 158 nodules were detected, among which 156 were true positive JVPNs; in method B, 215 nodules were detected, among which 190 were true positive JVPNs; In method C, 212 nodules were detected, among which 208 were true JVPNs. In method C, the detection rate of all JVPNs was 96.29% which was higher than that in method A and B (72.22% and 87.96%). The false positive rate for juxta-vascular pulmonary nodules detected by method C (4%) was significantly lower than that by method A (12%) and B (24%).

#### **CONCLUSION**

s The screening method of image reading combined with DL-CAD results interpreted by radiologists significantly improves the detection rate and reduce false positive rate of juxta-vascular pulmonary nodules in LDCT screening.

#### **CLINICAL RELEVANCE/APPLICATION**

Reading combined with DL-CAD results interpreted by radiologists can improve the detection efficiency of juxta-vascular pulmonary nodules which could be used as a preferred method for LDCT screening of pulmonary nodules in high risk patients.

### **S3B-SPPH-8 Towards a Fully Autonomous Artificial Intelligence Volume-rendered Segmentation Workflow for CT Angiography of the Thoracic Aorta**

#### **PURPOSE**

Three-dimensional (3D) surface rendering enables global qualitative assessment of aortic anatomy. Generating a surface model for 3D visualization requires time-consuming manual or semi-automated segmentation, taking an average of 32 minutes per case at our institution. This amounts to 2.74 FTE of 3D lab technologist time. To decrease manual effort, we developed a deep learning model to automate aortic segmentation and 3D surface model creation from CTA images, integrating an artificial intelligence (AI)-assisted workflow into the clinical practice. We then compared the visual quality of AI-assisted and fully automated surface renderings of the thoracic aorta.

#### **METHODS AND MATERIALS**

An AI model was trained on 304 manually created segmentation maps created for clinical purposes at our institution. Processing time for the AI model was 6 minutes with GPU acceleration. In this IRB-approved study, we retrospectively analyzed the visual quality of 25 3D surface renderings for CTAs acquired at a single center. Twenty-five sets of renderings were then blindly assessed by two experienced cardiovascular radiologists, comparing deep learning segmentations to those that had been manually adjusted by an experienced 3D lab technologist. Comparisons were made using a 5-point Likert scale and covered multiple anatomic features as well as overall quality.

#### **RESULTS**

The renderings based on the AI-only segmentations were assessed to be equivalent to the AI-corrected renderings ( $p \geq 0.19$ ) across all anatomic regions except for the coronary arteries ( $p = 0.06$ ), which favored the AI-corrected results. The coronary arteries are not consistently segmented across all exams, which may have caused the model to underperform in these features. The overall reader agreement was very good (Gwet AC1 = 0.68).

#### **CONCLUSION**

s Fully automated AI-based segmentation of the thoracic aorta produces 3D renderings of equal quality compared to the existing manual process, which may allow for significant time savings by fully automating 3D postprocessing.

#### **CLINICAL RELEVANCE/APPLICATION**

An AI-only workflow yielded similar image quality for thoracic aorta segmentation indicating the potential to fully automate thoracic aortic CTA post-processing.

### **S3B-SPPH-9 Validation of the QuCAD Evaluation Tool to Quantify Wait-Time-Savings from a Computer-Aided Triage and Notification (CADt) Device**

Participants  
Elim Thompson, PhD, Silver Spring, MD (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This work validates our queueing theory-based QuCAD evaluation tool designed to quantify the wait-time savings that a computer-aided triage and notification (CADt) device may bring to chest CT and chest CT angiography (CTA) pulmonary embolism (PE) STAT

cases from a tertiary academic medical center.

## **METHODS AND MATERIALS**

To validate the QuCAD evaluation tool, we retrospectively retrieved clinical reader timestamp data to characterize radiologists' work queue via the number of readers, image inter-arrival time to the PACS, and radiologists' effective reading time. The effective reading time of each radiologist was defined as the time between the opening of two consecutive readings. An exponential curve is fit to the distributions of inter-arrival times and effective reading times. We compared the wait-time savings predicted by QuCAD with the mean difference in clinical turnaround time from data before and after CADt adoption. Turnaround time is defined as the time from when an image entered the PACS to when the first review is completed by a radiologist. We stratified this comparison by cases arriving between 8am and 5pm (day shift) and those between 5pm and 8am (night shift).

## **RESULTS**

Between 2019 and 2022, 9,864 chest CT/CTA PE STAT cases were reviewed by 70+ radiologists. On average, 2 to 3 readers reviewed images at a given timepoint. The overall case arrival rate was 0.327/min, and the mean effective reading times were 20.1 min for positive PE studies and 14.9 min for negative PE cases. When having 2, 3, and 4 radiologists reviewing images, QuCAD predicts wait-time-savings for positive PE cases to be 14.9 min [95% CI: 13.3, 16.8], 1.27 min [1.00, 1.54], and 0.25 min [0.16, 0.33] respectively. From positive clinical PE cases, the mean difference in turnaround time before and after the use of CADt is 22.9 min during day shift hours. During night shift hours, the mean turnaround time difference drops to 8.26 min.

## **CONCLUSION**

Using 4 years of workflow data from a tertiary academic medical center, this study successfully validated the QuCAD tool designed to quantify potential wait-time-savings a CADt can bring to positive findings. Despite a large variability in clinical workflow, wait-time saving predictions from QuCAD estimates align with the turnaround time reduction from the clinical data.

## **CLINICAL RELEVANCE/APPLICATION**

CADt devices use artificial intelligence (AI) to process patient images and prioritize cases with suspected findings. Previous work developed an evaluation tool (QuCAD) that quantifies the time-saving benefits via queueing theory. This study validated QuCAD using timestamp data from a real clinic. QuCAD is now publicly available for evaluating the time-saving benefits of CADt devices.

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## Abstract Archives of the RSNA, 2023

S3B-SPVA

### Vascular Imaging Sunday Poster Discussions II

#### Sub-Events

#### **S3B-SPVA-1 Improving Image Quality of Blood Vessels through Deep Learning-Based Denoising and Enhancement Method Based on Low-Energy DSA**

##### PURPOSE

This work investigates the feasibility and efficacy of a novel approach that combines low-energy digital subtraction angiography (DSA) images with a new denoising and enhancement framework for improving the image quality of blood vessels while reducing ionizing radiation during surgical procedures.

##### METHODS AND MATERIALS

Between December 2021 and December 2022, 140 patients participated in a retrospective study on DSA intervention therapy for cerebral arteries, renal arteries, coronary arteries, and lower limb arteries. The study had IRB approval and waived written consent. These patients were randomly divided into training, validation, and test sets, with 98, 14, and 28 patients, respectively. The denoising and enhancement network framework consisted of a noise estimator, a denoising network, and a refinement network. The network was trained using only the noisy DSA image for joint denoising and enhancement. An ROI measuring 256 x 256 was placed over the arterial angiography region, with the non-angiographic region serving as the background. Measurements of pixel values and standard deviation were taken for the artery, and the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated for the ROI region. The image quality was assessed using the Peak Signal to Noise Ratio (PSNR) and Structural Similarity Index Measure (SSIM). Images obtained through low-energy transmission with deep learning-based denoising and enhancement were assigned to the prediction group, while images obtained through normal-energy X-ray fluoroscopy were assigned to the ground truth group for objective evaluations.

##### RESULTS

Effective use of deep learning techniques can reduce image noise and increase CNR and SNR. Low-energy DSA, when combined with denoising and enhancement network (PSNR:  $40.72 \pm 2.85$ dB; SSIM:  $0.9370 \pm 0.0440$ ; SNR:  $34.86 \pm 3.46$ ; CNR:  $5.10 \pm 4.48$ ), proves to be superior to low-energy DSA (PSNR:  $26.05 \pm 0.03$ dB; SSIM:  $0.3770 \pm 0.0436$ ; SNR:  $20.71 \pm 1.19$ ; CNR:  $2.37 \pm 2.56$ ); A single image of 1024 x 1024 with a processing speed can be achieved in 0.051 seconds.

##### CONCLUSION

s Low-energy DSA combined with deep learning denoising and enhancement techniques can enhance the contrast between arteries and surrounding tissues, optimize the quality of arterial images, reduce noise, and maintain real-time efficiency.

##### CLINICAL RELEVANCE/APPLICATION

Combining low-energy DSA with deep learning denoising and enhancement techniques can effectively reduce noise and enhance the shape of displayed arteries in real time, providing valuable assistance for various interventional procedures in clinical practice.

#### **S3B-SPVA-2 Quantitative Analysis of Lower Extremity Muscle Features Measured from Computed Tomography Angiography for Diagnosis of Peripheral Arterial Disease**

##### PURPOSE

To explore whether lower extremity muscle features can be used for the diagnosis of peripheral arterial disease (PAD).

##### METHODS AND MATERIALS

Data of patients with PAD who visited our hospital between July 2016 and September 2020 were retrospectively collected. Two radiologists evaluated PAD severity on digital subtraction angiography (DSA) and computed tomography angiography (CTA) images using the runoff score. With the DSA score as reference standard, the patients were divided into two groups: mild PAD (DSA score = 7) vs. severe PAD (DSA score > 7). After segmenting lower extremity muscles from CTA images, 95 features were extracted for: univariable analysis, logistic regression model (LRM) analysis, and sub-dataset analysis (to verify whether PAD diagnosis can be realized through only part of the lower leg images).

##### RESULTS

A total of 56 patients ( $69 \pm 11$  years; 38 men) with 56 lower legs were enrolled in this study. The lower leg muscles of the mild PAD group (36 patients) showed higher CT values ( $44.6$  vs.  $39.5$ ,  $P < 0.001$ ) with smaller dispersion ( $35.6$  vs.  $41.0$ ,  $P < 0.001$ ) than those in the severe PAD group (20 patients). The area under the curve (AUC) of the CTA score, LRM-I (model constructed with muscle features), and LRM-II (model constructed with muscle features and CTA score) for PAD diagnosis were 0.81, 0.84, and 0.89, respectively. The highest diagnostic performance was observed in the image subset of the middle and inferior segments of the lower extremity (LRM-I, 0.83; LRM-II, 0.90).

##### CONCLUSION

s Lower extremity muscle features can be used for PAD diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative analysis of lower extremity muscle features can be a useful supplement to the current clinical imaging diagnosis methods of PAD and compensate for the limitations of vascular stenosis diagnosis from the perspective of muscle ischemia evaluation.

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## Abstract Archives of the RSNA, 2023

T2-SPBR

### Breast Imaging Tuesday Poster Discussions

#### Sub-Events

#### T2-SPBR-1 Federated Deep Learning Model Predicts Breast Cancer Risk from Mammography Images

##### Participants

Daly Avendano, MD, (*Presenter*) Nothing to Disclose

##### PURPOSE

To externally validate Mirai, a DL breast cancer risk model based on mammography studies, applied in the Hispanic population with two distinct mammography vendors, utilizing a federated learning approach.

##### METHODS AND MATERIALS

This study retrospectively reviewed a database of 58,321 consecutive screening mammograms obtained from 24,060 women who received care at the TecSalud health system between January 1, 2014, and December 31, 2021. The Mirai model was utilized without the need for data sharing, using a federated learning approach. Cancer outcomes were obtained through the institutional tumor registry or imaging follow-up. The primary objective of this study was to evaluate the performance of the Mirai model in predicting the risk of breast cancer at 1-5 years from the time of the mammogram. We assessed the C-index as a measure of predictive accuracy.

##### RESULTS

Among the 23,340 patients with breast cancer-negative mammograms, 23,170 had no evidence of cancer in the following 5 years, while 170 were diagnosed with cancer during this timeframe. Mirai's performance was evaluated using a concordance index, which was found to be 0.74 (95% CI 0.71 to 0.77).

##### CONCLUSION

Our evaluation of MIRAI risk predictions indicates that the model is well calibrated, with an accurate accumulation of risk and estimations of risk over time. Our findings demonstrate that MIRAI's predictions align well with the observed number of events among both the full patient cohort and the case-matched control group.

##### CLINICAL RELEVANCE/APPLICATION

Breast cancer risk assessment is the angular stone for personalized screening. Artificial intelligence models have demonstrated promising results. The use of fair algorithms is essential for accurately assessing the overall population and avoiding the underrepresentation of minority groups. To enhance the effectiveness of these algorithms and ultimately lead to better outcomes. By adopting these practices, we can establish more equitable and inclusive systems that benefit everyone.

#### T2-SPBR-2 Comparison of Quantitative Volumetric and Subjective BI-RADS Density Classification in Women with Dense Breasts

##### PURPOSE

Increased breast density is an independent risk factor for breast cancer. A radiation-free tool for breast density assessment would be advantageous, especially for younger women. The purpose of this study was to determine the level of agreement between automated breast density based on whole breast ultrasound tomography volumetric data and commercially available volumetric breast density from 3D mammography in dense breasts. We examined agreement of quantitatively derived BI-RADS density from these two modalities with subjective mammography density assessment by breast radiologists and technologists.

##### METHODS AND MATERIALS

448 women with heterogeneously or extremely dense breasts were enrolled in a prospective case collection registry between December 2016 and October 2019. Participants underwent their annual screening digital breast tomosynthesis (DBT) (Hologic) and same day SoftVue™ automated whole breast ultrasound tomography (SV). Technologists assessed breast density using the BI-RADS density composition scale. Radiologists interpreted the mammogram and SV simultaneously and included a final BI-RADS density assessment. Quantitative volumetric density data was gathered for each case from mammography with Volpara and from SV. The Volpara overall score was used. The SV density index, a number from 0 to 100 derived from the volume-averaged sound speed, was recorded for each breast and categorized as a through d. The densest rating from the two breasts was selected. Four-way and pairwise agreement was tested using Kendall's coefficient of concordance (W). Additional analysis was completed for the disagreement cohorts.

##### RESULTS

In women with dense breasts, there was statistically significant good agreement between SV, Volpara, the radiologists' and technologists' BI-RADS density assessments. When SV was analyzed with each of the 3 other methods, there was statistically significant agreement with slightly higher concordance values. The SV BI-RADS was at a lower density level than Volpara in 12.1% of cases and at a higher density level in 13.3%.

## CONCLUSION

s SV density index, algorithmically calculated from whole breast ultrasound transmission data, has good agreement with automated breast density assessments using 3D mammography. SV breast density index is comparable with both radiologist and technologist subjective BI-RADS assessments from mammography.

## CLINICAL RELEVANCE/APPLICATION

SV's ultrasound breast density offers accuracy comparable with DBT-based tools or rating by radiologists and technologists. Clinical risk assessment using breast density may be applied, especially to women under age 40, without unnecessary radiation.

### T2-SPBR-3 Association of Breast Density Measured on Low-dose Chest Computed Tomography with Subsequent Breast Cancer Risk in Screened Population

Participants

Hyo-Jae Lee, Hwasun, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Few studies identified the relationship between CT breast density and breast cancer risk, often with limited numbers of study cohorts and based on computer-aided quantitative methods which require laborious inputs by a trained user. This study aimed to determine the association between CT breast density grading by radiologists and breast cancer risk in a large screened population, furthermore the results were compared with mammographic density.

## METHODS AND MATERIALS

In a retrospective cohort study using screened population in a tertiary hospital, women aged at least 40 years without a history of cancer who underwent both mammographic screening and low-dose chest CT in 2007-2016 were followed up through December 2022. Two board-certified radiologists with each special expertise in mammography and CT independently reviewed the breast density on mammography and CT images and classified each case into one of the four BI-RADS grades. The primary outcome focused on the occurrence of new cases of breast cancer, including both invasive breast cancer and ductal carcinoma in situ. The hazard ratio (HR) was calculated using Cox proportional hazard regression and adjusted for other covariates. To compare the relationship between breast densities on mammography and CT, the Spearman's correlation coefficient was adopted. Interreader agreements for the mammographic density and CT density grades were determined by using the Cohen weighted kappa statistic.

## RESULTS

Among 1576 women (mean age, 65 years  $\pm$  9), the ascertainment of 17 incident breast cancers was obtained. CT density grade 4 showed a higher risk of breast cancer compared with those with grade 1 and 2 (HR, 10.502 [95% CI:1.227, 89.918],  $p = 0.032$  for reader 1; 6.368 [1.227, 33.049],  $p = 0.028$  for reader 2). There was a significant correlation on breast density between mammography and CT ( $r = 0.770$  and  $0.941$ , for reader 1 and 2, respectively) and the interreader agreement was good (kappa =  $0.613$  and  $0.701$ , for mammography and CT, respectively).

## CONCLUSION

s In this preliminary result, CT density provided future breast cancer risk information and correlated well with that from mammography.

## CLINICAL RELEVANCE/APPLICATION

Low-dose chest CT scans for lung cancer screening can estimate breast density without sacrificing interreader agreement, and have an association with breast cancer risk, promising for future research on dedicated breast CT scans.

### T2-SPBR-4 Early Adulthood Adiposity, Attained Adiposity and Breast Parenchymal Complexity in Premenopausal Women

Participants

Sneha Das Gupta, PhD, (*Presenter*) Nothing to Disclose

## PURPOSE

Adiposity measures such as weight, body-mass index (BMI) and body fat% are associated with breast cancer risk. We assessed the relationship of breast parenchymal complexity with early adulthood adiposity, changes in adiposity over the life course, and attained adiposity among premenopausal women, while also accounting for breast density.

## METHODS AND MATERIALS

We analyzed routine screening digital mammograms (Selenia Dimensions; Hologic) from 325 premenopausal women without breast cancer, recruited at the Joanne Knight Breast Health Center, Washington University in St. Louis, MO from December 2015 to October 2016. Trained research personnel assessed attained adiposity measures, while weight at ages 18 and 30 were self-reported. A wide array of radiomic features were automatically extracted from each mammogram using a validated computational imaging pipeline, standardized, and fused into a breast parenchymal complexity signature (BPCS). Volumetric percent density (VPD) was calculated using the Volpara software. Spearman correlations ( $r$ ) and multivariable linear regression models were used to evaluate the associations of adiposity measures with BPCS, adjusting for potential confounders (age, race, family history of breast cancer and parity) and VPD.

## RESULTS

BPCS was moderately correlated ( $r = 0.61$ ) with VPD. Higher BPCS was significantly ( $p < 0.05$ ) associated with lower weight and BMI at age 18 and at age 30, independently of age, race, family history of breast cancer and parity; inverse associations with BPCS were also found for absolute and annual weight changes between age 18 and attained age as well as between age 30 and attained age ( $-0.60 < r < -0.15$ ; linear regression coefficients ( $b$ ) for adiposity measures ranging from  $-0.672$  to  $-0.008$ ). Attained weight, BMI and body fat were also significantly inversely associated with BPCS. When further adjusting for VPD, statistical significance was preserved, yet slightly attenuated, for most adiposity measures ( $-0.60 < r < -0.25$ ;  $-0.498 < b < -0.012$ ). Among all adiposity measures, strongest associations with BPCS were preserved for annual weight change from age 18 to attained age and annual weight change from age 30 to attained age.

## CONCLUSION

Our preliminary data suggest that adiposity in early adulthood, as well as weight gain from early adulthood to attained age are inversely associated with breast parenchymal complexity among premenopausal women, and may have a lifelong impact on breast parenchymal tissue patterns, beyond breast density.

## CLINICAL RELEVANCE/APPLICATION

Deeper understanding of the pathways through which early-adulthood adiposity modifies breast parenchymal tissue, and possibly breast cancer risk, can open new avenues for preventive interventions in premenopausal women.

## T2-SPBR-5 Predictive Performance of a Deep Learning Image-Based Five-Year Breast Cancer Risk Model Across Race/Ethnicity, Age, Breast Density and Family History of Breast Cancer

### Participants

Hari Trivedi, MD, Atlanta, GA (*Presenter*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;

## PURPOSE

Traditional breast cancer risk models demonstrate modest predictive accuracy and are limited by worse performance in races/ethnicities outside of European Caucasian ancestry. We measured the performance of a deep learning (DL) image-based five-year breast cancer risk model across race/ethnicity, age, breast density, and family history of breast cancer.

## METHODS AND MATERIALS

This retrospective study included 31,047 consecutive bilateral 2D full field digital screening mammograms from 11,536 patients from January 2011 through December 2016 from six screening facilities. These exams were not part of model training. Self-reported race and ethnicity were categorized as Black, Asian, Hispanic, White, or as all other races and ethnicities. To account for the large number of White, non-Hispanic patients, race and ethnicity were further classified as White/non-Hispanic (W/NH) or as patients of color and/or Hispanic ethnicity (POC/H). Age (<50 vs >50), breast density (dense vs not dense), and first-degree family history of breast cancer were extracted from electronic medical records. Cancer outcomes were obtained from local tumor registries and included DCIS and any invasive breast cancer. Model prediction was estimated across subgroups using areas under the receiver operating characteristic curve (AUCs).

## RESULTS

We found point estimate AUCs consistently at or above 0.73 across all subgroups. AUC by subgroup: W/NH 0.75 [95% CI 0.73, 0.77] (n = 27,323), POC/H 0.75 [95% CI 0.68, 0.82] (n = 2,529); age < 50 0.73 [95% CI 0.70, 0.76] (n = 13,742), age ≥ 50 0.74 [95% CI 0.72, 0.77] (n = 16,110); dense 0.75 [95% CI 0.75, 0.76] (n = 17,146), not dense 0.79 [95% CI 0.78, 0.80] (n = 13,052); 1st degree relative with breast cancer 0.77 [95% CI 0.73, 0.80] (n=6,713), 1st degree relative without breast cancer 0.79 [95% CI 0.76, 0.83] (n=10,618), 1st degree relative with breast cancer (unknown) 0.76 [95% CI 0.74, 0.78] (n=13,172).

## CONCLUSION

The DL model performed consistently at or above 0.73 AUC in all subgroups of race/ethnicity, age, breast density and first-degree family history of breast cancer. No differences in performance were identified in patients identifying as POC/H compared to those identifying as W/NH. Performance was significantly higher in not dense vs dense exams. No significant differences were found between other subgroups. This DL image-based model appears to reduce differences in performance associated with traditional risk models.

## CLINICAL RELEVANCE/APPLICATION

A DL based breast cancer risk prediction model can perform consistently across key patient subgroups and appears to reduce limitations of traditional risk assessment, such as differences in performance across race/ethnic groups.

## T2-SPBR-6 Artificial Intelligence for Mammography to Predict Future Breast Cancer Risk : Incorporating Longitudinal Changes to Enhance a Feasibility

### Participants

Sanghyup Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Employee, Lunit Inc

## PURPOSE

To investigate mammographic parenchymal patterns and longitudinal changes that are related to breast cancer beyond the mammographic breast density and develop an artificial intelligence (AI) model to predict future breast cancer risk.

## METHODS AND MATERIALS

We developed a mammography-based deep learning algorithm for an AI predictive model to show the risk score for future breast cancer. risk model using a total of 16,113 full-field digital mammograms (Hologic, 72.3%; Siemens, 27.7%) from 9,113 women in the United States, who underwent at least mammogram and have information of pathology-confirmed breast cancer outcomes within 5 years. To discover the feasibility of incorporating prior images to train longitudinal changes of mammographic parenchymal patterns, the baseline model (AI-1) trained prior mammograms of non-cancer women and women with breast cancer, respectively, and the other model (AI-2) additionally trained with paired current and prior examinations per woman. Discriminatory performance was assessed using C-indices and receiver operating characteristic (ROC) curves for 1- to 3-year outcomes. Mammographic breast density was evaluated for each mammogram according to the BI-RADS composition category.

## RESULTS

A total of 2,000 examinations, of which 500 cases were followed by a cancer diagnosis were evaluated with two AI predictive models. C-indices increased from 0.68 (95% CI: 0.65, 0.71) of AI-1 to 0.73 (95% CI: 0.70, 0.76) of AI-2 (P=0.004). The AI-2 model demonstrated the risk of breast cancer with AUC of 0.75 (95% CI: 0.70, 0.79) at 1-year, 0.76 (95% CI: 0.68, 0.83) at 2-year, and 0.73 (95% CI: 0.68, 0.78) at 3-year. The performance was comparable in fatty (C-index, 0.74; 95% CI, 0.70, 0.78) and dense (0.71; 0.65, 0.76) breasts. 1076 of 2000 examinations showed no longitudinal changes of mammographic density, and the

performance of AI-2 for this subgroup was similar (C-index, 0.72, 95% CI, 0.70, 0.76) to the overall performance.

## CONCLUSION

This preliminary study demonstrated the feasibility of the AI predictive model to identify mammographic parenchymal features of future breast cancer. Incorporation of longitudinal changes might be feasible to enhance risk stratification of breast cancer.

## CLINICAL RELEVANCE/APPLICATION

The image-based risk model has a potential to be used to improve personalized screening of breast cancer.

## T2-SPBR-7 Performance of Traditional Breast Cancer Risk Models Compared to a Deep Learning Model Overall and by Race/Ethnicity

### Participants

Hari Trivedi, MD, Atlanta, GA (*Presenter*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;

### PURPOSE

To compare the performance of traditional breast cancer risk models to a new deep learning (DL) image-based five-year breast cancer risk model overall and by race/ethnicity.

### METHODS AND MATERIALS

This retrospective study included 10,101 consecutive bilateral 2D full field digital screening mammograms from 8,688 patients from February 2015 through December 2016 from a U.S.-based center that operates six screening facilities. Patient race/ethnicity and traditional risk model scores (Breast Cancer Risk Assessment Tool [BCRAT] and Tyrer-Cuzick v6 [TC6]) were extracted from electronic medical records. Patient self-reported race/ethnicity was used to create two groups: White, non-Hispanic (W/NH) and patients of color and/or Hispanic (POC/H). Cancer outcomes were obtained from local tumor registries. Cancer rates were defined as total cancers (DCIS and any invasive cancer) diagnosed within five years after the index mammogram/total exams. Model predictions were estimated using areas under the receiver operating characteristic curve (AUCs) and compared across risk models overall and by race/ethnicity using Chi-squared tests. NCCN thresholds were used to categorize predicted five-year risk scores as follows: average risk < 1.7%, intermediate risk > 1.7% and < 3.0%, and high risk > 3.0%.

### RESULTS

DL model five-year predictions significantly outperformed BCRAT and TC6 five-year predictions. Overall AUC [95% confidence interval] and number of exams (n) by risk model: DL 0.75 [0.72, 0.77] (n = 10,101), BCRAT 0.62 [0.59, 0.65] (n = 10,101), and TC6 0.59 [0.56, 0.62] (n = 10,101). Observed five-year cancer rates by race/ethnicity: W/NH 4.4% and POC/H 4.2%. Predictions by BCRAT and TC6 models, but not DL model, exhibited statistically significant differences across race/ethnicity groups. Comparing risk group distributions for W/NH to POC/H generated chi-squared statistic and p-values of: BCRAT 162.36 (p<.00001), TC6 84.49 (p<.00001), DL 0.954 (p=.621). Compared to POC/H, W/NH patients were 3.8 times more likely to be labeled high risk by BCRAT and 2.3 times more likely by TC6. The DL model assessed a nearly identical percentage of W/NH and POC/H as high risk.

## CONCLUSION

An image-based DL model outperformed traditional risk models in predicting five-year breast cancer risk. Traditional risk models exhibited meaningful differences in performance across race/ethnicity that was not observed in the DL model.

## CLINICAL RELEVANCE/APPLICATION

A deep-learning based approach to breast cancer risk prediction outperforms traditional risk models and appears to remove differences in performance observed across racial/ethnic groups associated with traditional risk models

## T2-SPBR-8 Cryoablation, Ultraconservative Treatment for Low-risk Early Breast Cancer =2cm: Analysis of its Efficacy

### Participants

Maria José Roca Navarro, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate if in patients with Her2- luminal tumors =2cm and ultrasound negative axilla, after cryoablation guided by ultrasound, there is absence of infiltrating carcinoma in the lumpectomy specimen. To demonstrate that the placement of pre-surgical seed at the moment prior to cryoablation does not interfere subsequently in the disappearance of tumor cells by freezing.

### METHODS AND MATERIALS

Between April 2021 and March 2023 we performed preoperative cryoablation in 49 patients (aged 53-79 years) with 50 unifocal infiltrating ductal carcinomas (IDC) (between 4mm and 20mm). All IDCs were visible on ultrasound, were luminals low grade and ultrasound negative axilla. All patients were studied with mammography and tomosynthesis, staged and biopsied by ultrasound. MRI was performed to rule out extensive intraductal component in 16 of the 19 patients with associated intraductal carcinoma (DCIs) in the core needle biopsy (CNB). All of them underwent pre-surgical marking with ferromagnetic seed and cryoablation with 17G or 14G needle on the same procedure, taking advantage of the same anesthesia and cutaneous access. We used the ICEfx Galil Boston Scientific cryoablation system, applying the usual triple-phase protocol: freezing-passive thawing-freezing and duration of approximately 40 minutes. Subsequently we checked the correct placement of the seed with mammographic projection

### RESULTS

Out of 50 low-risk unifocal IDC: -31 were pure IDC (without associated intraductal component in the diagnostic CNB): in none there was residual IDC in the lumpectomy specimen after performing pre-surgical cryoablation. -19 were IDC mixed (with associated DCIs in the diagnostic CNB): In 4 cases residual IDC was found in the surgical specimen, with some IDC focus remaining in the periphery of the post-cryoablation necrosis. In 8 patients, DCIs foci were detected far from the cryoablation area. All the specimens were considered by the pathologist to have tumor-free margins. There was no relevant complication.



## CONCLUSION

s Cryoablation is effective in 100% of cases for pure infiltrating tumors = 2cm. The presence of nests of DCIs away from the cryoablation area or millimeter foci of IDC at the margin of steatonecrosis in mixed IDC does not indicate failure of the technique, as all surgical specimens were considered by the pathologist to have tumor-free margins. Subsequent standard adjuvant treatment will equalize the risk of relapse to conventional lumpectomy, so it may be an alternative therapy in selected patients.

## CLINICAL RELEVANCE/APPLICATION

In the near future, after evaluating studies with a larger number of cases and follow-up, in selected patients with luminal tumors = 2cm, cryoablation could be an alternative therapy thus avoiding surgery.

## T2-SPBR-9 Upgrade of MRI Detected Papillomas in Asymptomatic High Risk Patients, Patients with a History of Cancer, and Patients with Known Malignancy

### PURPOSE

The purpose is to evaluate the upgrade of papilloma identified on MRI biopsy in patients with breast cancer and high-risk patients with or without a history of breast cancer.

### METHODS AND MATERIALS

In this HIPAA-compliant IRB-approved retrospective study, all MRI-guided biopsies from 1/1/2011 to 1/31/2020 yielding papilloma were reviewed. Only patients with an imaging indication of high-risk screening, known breast malignancy, or history of breast malignancy were included. Other indications, including breast symptoms such as palpable masses or nipple discharge, were excluded. All included patients had a surgical excision with clear pathology or, at minimum, a 2-year follow-up MRI after biopsy. All cases without surgical excision or imaging follow-up were excluded. All MRI biopsy procedures were performed on a GE 1.5 T magnet using a Suros Atec 9-gauge vacuum-assisted biopsy device.

### RESULTS

Of the initial 258 MRI-guided biopsies demonstrating papilloma, 45.3% (117/263) met inclusion criteria. Of the 141 patients excluded, 90 biopsies were excluded because of breast symptoms. Most examinations, 57% (67/117), were performed for high-risk screening, including a personal history of breast cancer. The other 43% (50/117) of examinations were performed for extent of disease. Of the 117 biopsies, 4.3% (5/117) were upgraded to malignancy. One biopsy (1/117, 0.9%) was upgraded to invasive malignancy and four (4/117, 3.4%) were upgraded to DCIS. Of the 117 biopsies, 31.6% (37/117) demonstrated atypia or additional high-risk pathology at time of percutaneous biopsy while 68.4% (80/117) demonstrated benign papilloma. The upgrade rate of benign papilloma at biopsy was 3.8% (3/80) with all cases non-invasive. The upgrade rate of papilloma with atypia or additional high-risk lesion at biopsy was 5.4% (2/37) with one non-invasive and one invasive malignancy. Age, race, ipsilateral malignancy, lesion type, or additional high-risk lesion at biopsy were not associated with upgrade rate.

## CONCLUSION

s Surgical excision of biopsy-proven papilloma identified by MRI biopsy in asymptomatic high-risk patients and patients with known malignancy may not be necessary.

## CLINICAL RELEVANCE/APPLICATION

Excision is often recommended for papillomas in high-risk patients. In these patients with papillomas found on MRI, a low upgrade rate suggests surgical excision may not be necessary.

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## Abstract Archives of the RSNA, 2023

T2-SPCA

### Cardiac Imaging Tuesday Poster Discussions

#### Sub-Events

#### T2-SPCA-2 Cardiac Magnetic Resonance Imaging Features of Myocardial Involvement in Psoriasis

##### PURPOSE

Psoriasis is a systemic chronic inflammatory condition, primarily affecting skin and joints, associated with increased risk of developing major cardiovascular events (MACEs). Inflammatory myocardial involvement in psoriasis (P-IMI) has been reported but not thoroughly investigated. The aim of our study was to describe the findings at cardiac magnetic resonance (CMR) imaging in a series of patients with psoriasis related myocarditis.

##### METHODS AND MATERIALS

One hundred consecutive patients (62M, mean age  $55 \pm 13.7$  years) with psoriasis were screened by 2D echocardiography for cardiac abnormalities. Among them, five male patients showed hypokinetic dilated cardiomyopathy (HDCM). All patients with HDCM underwent invasive coronary angiography (ICA), CMR and endomyocardial biopsies (EMB) with real time PCR for cardiotropic viruses and western blot analysis for myocardial expression of Toll-Like Receptor 4 (TLR-4) and Interleukin-17A (IL-17A). CMR exams were performed on a 1.5 T scanner. Protocol included cine-bSSFP, T2-weighted STIR, T2-prep sequences for T2 mapping, MOLLI sequences for T1 mapping, acquired before and after gadolinium administration and CE T1w IR for late gadolinium enhancement images.

##### RESULTS

All patients presented with heart failure with reduced ejection fraction (HFrEF, EF  $19 \pm 2.8\%$ ), NYHA Class III-IV and various ECG abnormalities. ICA showed normal coronary arteries in all patients. All five patients were diagnosed with acute/subacute myocarditis on CMR imaging according to the updated 2018 Lake Louise Criteria. Among them, two patients showed myocardial edema on T2WI, three patients had positive LGE, while all of them had increased T1 and T2 mapping relaxation times. EMB confirmed imaging findings as an active virus-negative lymphocytic myocarditis was revealed in all patients with positive anti-heart autoantibodies, overexpression of TLR-4 and enhancement of IL-17A at western blot analysis.

##### CONCLUSION

s P-IMI is an underrecognized condition in patients with psoriasis, presenting with severe ventricular dysfunction at echocardiography, lymphocytic myocarditis at EMB and with variable myocardial signal abnormalities at CMR.

##### CLINICAL RELEVANCE/APPLICATION

Timely detection of P-IMI is crucial due to its prognostic and therapeutic implications. CMR may play a pivotal role, as a reliable and accurate non-invasive tool to identify myocardial inflammation and ventricular dysfunction.

#### T2-SPCA-3 Left and Right Ventricle Feature Tracking CMR Strain in Patients with Thoracic Sarcoidosis

##### PURPOSE

Patients with sarcoidosis may have clinically silent disease in 20-25%. Early detection of disease is essential for adequate therapy and prevent negative outcomes. This study aims to assess cardiac magnetic resonance (CMR) feature tracking (FT) strain for detection of subclinical cardiac dysfunction in patients with biopsy-proven extracardiac sarcoidosis.

##### METHODS AND MATERIALS

This retrospective study included patients who underwent chest CT and CMR examinations for biopsy-proven extracardiac sarcoidosis. For comparison age-matched controls with normal CMR were included. All CMR studies were performed with 1.5T or 3T scanners (Siemens). Chest CT examinations were conducted with 64-256 slice scanners (Siemens, General Electric). CMR used a standard protocol with b-SSFP cine sequences in long (2,3,4chamber) and short axis views for volumes/function analysis. Late gadolinium enhancement (LGE) sequences in the same orientation were performed >10 min after administration of Gadovist (0.1 mmol/Kg). CMR image analysis including strain (Global longitudinal, circumferential, or radial strain) was performed with dedicated software (CVI 42). Chest CT was analyzed by based on established criteria for the diagnosis of sarcoidosis.

##### RESULTS

The cohort included 49 patients ( $58.2 \pm 9.5$ y, 26m). Subgroups were defined by extracardiac sarcoidosis with/without lymphadenopathy and parenchymal disease (+chest) or cardiac involvement (+CMR). Group 1 13/49 ( $56.7 \pm 8.6$ y, 8m) with +chest/+CMR, group 2 33/49 ( $57.7 \pm 9.4$ y, 16m) with +chest/-CMR and group 3 3/49 patients ( $70.3 \pm 9.0$ y, 2m) with -chest/-CMR for sarcoidosis. 10 studies ( $57.5 \pm 12.3$ y, 6m) served as controls. LVGLS was impaired in all three groups compared to controls. LVGLS was significantly different between Group 1 and controls ( $-13.0 \pm 5.1$  vs.  $17.9 \pm 1$ , p-value=0.0112) and Group 2 and controls ( $-13.8 \pm 3.3$  vs.  $17.9 \pm 1.7$ ; p-value=0.0124). LVGRS LAX was significantly different between Group 1 and controls ( $20.6\% \pm 9.6$  vs.  $31\% \pm 3.6$ ; p-value=0.0086) and Group 2 and controls ( $23\% \pm 7.2$  vs.  $31\% \pm 3.6$ ; p-value=0.022). Positive LGE was detected in 13 patients: subendocardial 3/13, midmyocardial 6/13, midmyocardial/subepicardial 1/13, subepicardial/transmural 1/13 and subendocardial/midmyocardial/subepicardial in 2/13.

## CONCLUSION

s In patients with biopsy-proven extracardiac sarcoidosis independent of cardiac involvement LV GLS and LV GRS are abnormal, even when LVEF is within normal range.

## CLINICAL RELEVANCE/APPLICATION

Therefore, LV strain can be used to detect subclinical LV dysfunction in patients with extracardiac sarcoidosis.

## T2-SPCA-4 Primary Chylopericardium: A Study Based on CT Lymphangiography

Participants

Yimeng Zhang, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the diagnostic value of CT lymphangiography (CTL) in primary chylopericardium.

## METHODS AND MATERIALS

The clinical and imaging data of 39 patients with primary chylopericardium were retrospectively analyzed. All patients underwent CTL scan. CTL evaluated abnormal contrast distribution and reflux in the neck, chest, abdomen, pelvis and abnormalities in the pericardium, mediastinum, and lungs. The composition ratio of qualitative data was used for statistical description.

## RESULTS

All 39 patients with CTL showed abnormal iodine oil deposition and reflux at different sites: (1) neck: 11 cases of the end of thoracic duct, 3 cases of the end of right lymphatic duct, 24 cases of cervical trunk reflux, 25 cases of subclavian trunk reflux; (2) chest: 23 cases of bronchial mediastinal trunk reflux, 22 cases of anterior mediastinum, 12 cases of main pulmonary artery window, 29 cases of peritracheal and bronchial, 30 cases of subcarina, 24 cases of posterior mediastinum, 7 cases of thoracic duct trunk reflux, 15 cases of pericardial reflux, 11 of which were transbronchial mediastinal trunk reflux, and 10 cases of abnormal distribution of intercostal, pleural, and supra-diaphragm. (3) Abnormalities in the abdomen and pelvic region: 4 cases in the subdiaphragm, 18 cases of dilated and condensed iliac lymphatics on the contrast side, 21 cases of contralateral iliac reflux, 16 cases of abnormal distribution of contrast in the ipsilateral lumbar trunk, and 23 cases of contralateral lumbar trunk reflux. Extra-lymphatic manifestations of abnormalities: 39 cases showed fluid density in the pericardial cavity, 2 cases showed cloudy and swollen mediastinal soft tissues, 24 cases showed abnormalities in both lungs, 10 cases showed thickened lobular septa, 11 cases showed ground glass density, 10 cases showed thickened bronchovascular bundles, 5 cases showed thickened bronchial walls, 16 cases showed pleural effusion, and 11 cases showed pulmonary atelectasis or insufficiency. 16 patients were treated surgically and 7 cases were relieved after surgery.

## CONCLUSION

s CT lymphangiography can show the abnormalities of thoracic duct and accessory branches in primary chylopericardium, and abnormal lesions of mediastinum, pericardium and lungs in this disease, which can help to explore the pathogenesis, diagnosis and differential diagnosis of this disease.

## CLINICAL RELEVANCE/APPLICATION

Exploring the CTL presentation features of primary chylopericardium will help the pathogenesis study, diagnosis and differential diagnosis of this disease.

## T2-SPCA-5 The Application Value Influencing Factors of Coronary Artery Calcification Score Algorithm Based on Artificial Intelligence in Non-gated Chest CT

## PURPOSE

To explore the application value of artificial intelligence software in the measurement of coronary artery calcification score (CACS) of non-gated chest CT and its influencing factors.

## METHODS AND MATERIALS

A total of 237 patients who underwent both coronary computed tomography angiography (CCTA) and chest CT within one month were included in this study retrospectively. These Agatston scores and the time taken for each case were recorded. Take the gated-H CACS as the gold standard, the correlation and bias of AI, AI+L and gated-H CACS were compared by Spearman correlation analysis and Bland-Altman consistency analysis. Kappa test was used to evaluate the consistency of CACS risk categorization among AI, AI+L, gated-H and gated-L. The chi-square test was used to evaluate the accuracy of risk categorization among AI, AI+L and gated-H.

## RESULTS

The post-processing and calculating time on each case of AI was 42s (37~46s), reduced by 39%, 68% compared with gated-H, gated-L (all  $P < 0.001$ ), respectively. The checking and reediting times on each case of AI+L was 60s (51.5~68s), reduced by 15%, 55% compared with gated-H, gated-L (all  $P < 0.001$ ), respectively. The correlation of the gated-L, AI, AI+L-CACS with the gated-H CACS was  $r = 0.990, 0.646, 0.976$  (all  $P < 0.001$ ). The Bland-Altman plot (gated-H CACS minus gated-L, AI, AI+L-CACS) showed a mean difference of 29.5, 299.8, 102.1, and 95% limits of agreement of -310.7~369.6, -807.4 to 1405, -351.3 to 555.6. Kappa analysis showed that the CACS risk categorization consistency in gated-L and AI+L was better than that in AI, and the Kappa coefficients (?) were 0.732, 0.893 and 0.359, respectively,  $P < 0.001$ . The accuracy of CACS risk categorization in AI+L was 92.0%, which was significantly better than that in gated-L and AI (80.2% and 52.3%, respectively,  $P < 0.0001$ ).

## CONCLUSION

s AI non-gated chest CT CACS software greatly shortens the time for radiologists to measure CACS, and it is more likely to underestimate CACS by using AI merely. While the AI+doctor reading model can significantly improve the evaluating performance and the accuracy of risk categorization, which is more suitable for clinical risk grade screening of patients with coronary heart disease. In addition, high heart rate will have a negative impact on the accuracy of CACS risk categorization by AI software, which provides a basis for software optimization in the future.

## CLINICAL RELEVANCE/APPLICATION

AI non-gated chest CT CACS software greatly shortens the time for radiologists to measure CACS.

## T2-SPCA-6 Detection of Monosodium Urate Depositions Atherosclerotic Plaques in the Cardiovascular System by Dual-energy Computed Tomography

### PURPOSE

This study employed Dual-energy CT (DECT) material separation technology to quantitatively assess the urate accumulated in coronary plaques, and to compare this to the Coronary CTA (CCTA) Calcium score scan for distinguishing urate deposition from atherosclerosis. Additionally, this study aimed to explore the relationship between urate deposition and surrounding atherosclerotic plaques, and to confirm the contribution of urate deposition to the development of coronary atherosclerosis.

### METHODS AND MATERIALS

We investigated the role of dual-energy computed tomography (DECT) in diagnosis of coronary atherosclerotic plaques and urate depositions in the patients with clinically suspected coronary artery disease. The patients were examined with DECT imaging system, and their clinical data were collected.

### RESULTS

DECT showed among 872 patients, 441 patients had plaques in coronary arteries, the incidence of plaque was 50.6%. Among the patients with coronary plaques, there were 348 patients (78.9%) with simple atherosclerotic plaque (AP), 8 patients (1.8%) with simple urate depositions (UD), 85 patients (19.3%) with urate depositions and atherosclerotic plaques (UDAP). Compared with AP group, total plaque area and calcification score around the plaque in UDAP group were significantly increased, and urate deposition areas were correlated with surrounding atherosclerotic area ( $r=0.325$ ,  $p<0.001$ ). Compared with AP patients, cardiac ejection fraction in UDAP patients was slightly decreased ( $p<0.05$ ). There was no statistical difference in blood uric acid concentration and other clinical parameters between two groups.

### CONCLUSION

s Notably, patients with gout or a history of hyperuricemia were more likely to exhibit urate deposition in their atherosclerotic plaques. Furthermore, we observed a strong correlation between urate deposition and atherosclerotic plaques with larger volumes and higher calcification. Cardiac ejection fraction in UDAP patients was slightly decreased compared with AP patients.

## CLINICAL RELEVANCE/APPLICATION

DECT may provide a relatively simple method for detection and identification of coronary urate deposition at risk for cardiovascular diseases.

## T2-SPCA-7 Periaortic Adipose Radiomics Texture Features Associated with Increased Coronary Calcium Score: First Results on a Photon-Counting CT

### PURPOSE

Cardiovascular diseases remain the world's primary cause of death. Identifying and treating patients at risk of cardiovascular events is as important as ever. Adipose tissue counts as a classic risk factor for cardiovascular diseases. It has been linked to systemic inflammation and is suspected to contribute to vascular calcification. To further investigate this issue, the use of texture analysis of adipose tissue using radiomics features could prove a feasible option.

### METHODS AND MATERIALS

In this retrospective IRB-approved single-center study, 55 patients (mean age 55, 34 male, 21 female) were scanned on a first-generation photon-counting CT. On axial unenhanced images, periaortic adipose tissue surrounding the thoracic descending aorta was segmented manually. Patients were divided into three groups for feature extraction, depending on coronary artery calcification (Agatston Score 0, Agatston Score 1-99, Agatston Score =100). 106 features were extracted using pyradiomics. R statistics was used for statistical analysis, calculating mean and standard deviation with Pearson correlation coefficient for feature correlation. Feature selection was performed using Random Forest classification and visualized using Boxplots and heatmaps. Additionally, monovariate logistic regression predicting an Agatston Score > 0 was performed, selected features were tested for multicollinearity and a 10-fold cross-validation investigated the stability of the leading feature.

### RESULTS

Two higher-order radiomics features, namely "glcm\_ClusterProminence" and "glcm\_ClusterTendency" were found to differentiate between patients without coronary artery calcification and those with coronary artery calcification with respective mean values (Agatston Score 0/1-99/=100) of 92.77/79.23/77.05 for "original\_glcm\_ClusterProminence" ( $p = 0.019$ ) and 5.72/5.33/5.24 for "original\_glcm\_ClusterTendency" ( $p = 0.078$ ). As the leading differentiating feature "glcm\_ClusterProminence" was identified after assessing multicollinearity.

### CONCLUSION

s Changes in periaortic adipose tissue texture seem to correlate with coronary artery calcium score, supporting a possible influence of inflammatory or fibrotic activity in perivascular adipose tissue. Radiomic texture features may potentially aid as corresponding biomarkers in the future.

## CLINICAL RELEVANCE/APPLICATION

The possible correlation between PAAT texture and coronary artery sclerosis may allow the hypothesis of possible texture changes through inflammatory or fibrotic processes in perivascular adipose tissue influencing the process of arteriosclerosis. A radiomics signature could serve as an imaging biomarker for cardiovascular prevention in the future.

## Abstract Archives of the RSNA, 2023

T2-SPCH

### Chest Imaging Tuesday Poster Discussions

#### Sub-Events

**T2-SPCH-1 Baseline Whole-lung CT Features Deriving from Deep Learning and Radiomics: Prediction of Benign and Malignant Pulmonary Ground-glass Nodules**

#### PURPOSE

To develop and validate the model for predicting benign and malignant ground-glass nodules (GGN) based on the whole-lung baseline CT features deriving from deep learning and radiomics.

#### METHODS AND MATERIALS

This retrospective study included 385 GGN from 3 hospitals, confirmed by pathology. 239 GGN from Hospital 1 were used as the training and internal validation set. 115 and 31 GGN from Hospital 2 and Hospital 3 were used as the external test sets 1 and 2, respectively. Clinical and morphological features of GGN at baseline chest CT were evaluated, and the whole-lung radiomics features were extracted simultaneously. Besides, baseline whole-lung CT image features are further assisted and extracted using the convolutional neural network. Back propagation neural network was used to construct five prediction models based on different collocations of the features used for training. The area under the receiver operator characteristic curve (AUC) was used to compare the prediction performance among the five models. The Delong test was used to compare the differences in AUC between models pairwise.

#### RESULTS

The model integrated clinical-morphological features, whole-lung radiomic features, and whole-lung image features (CMRI) performed best among the five models, achieved the highest AUC in the internal validation set (Hospital 1), external test set 1 (Hospital 2), and external test set 2 (Hospital 3), which were 0.886 [95% confidence interval (CI): 0.841-0.921], 0.830 (95%CI: 0.749-0.893) and 0.879 (95%CI: 0.712-0.968), respectively. In all three sets, the differences in AUC between the CMRI model and other models were significant (all  $P < 0.05$ ).

#### CONCLUSION

The whole-lung baseline CT features were feasible to predict the benign and malignant GGN. The model combining clinical-morphological features, whole-lung radiomics, and whole-lung image features showed the best performance.

#### CLINICAL RELEVANCE/APPLICATION

The deep learning model based on whole-lung features can provide non-invasive and low-cost prediction and save the time of nodule segmentation.

**T2-SPCH-2 Deep Learning Models for Malignancy Estimation of Pulmonary Solid Nodules After Novel Classification**

#### PURPOSE

Identifying the malignancy of pulmonary solid nodules larger than 8mm remains a challenging task. Our study is to make a novel classification of pulmonary solid nodules based on the adjacent relationship between the pulmonary pleura and nodules and use deep learning models to diagnose the pathology-confirmed nodules divided by this classification on CT scans of the chest.

#### METHODS AND MATERIALS

A total of 453 patients with pathology-confirmed solid nodules were enrolled from 2014 to 2022 and were randomly separated into training, validation, and test cohorts. Then we made a classification of solid nodules. Nodules that were adjacent to the pleura in the largest cross-sectional area were included in the pulmonary pleura solid nodules (PPSN) group. Nodules that were adjacent to only the lung tissues were included in the isolated solid nodules (ISN) group. Two groups were also divided into three cohorts. The Swin Transformer as a deep learning model, was used to identify the malignancy.

#### RESULTS

Before classification, the area under the receiver operating characteristic curve (AUC), specificity, and sensitivity in the validation and independent test cohorts were 0.892 [95% CI: 0.864, 0.920], 0.765, and 0.858; 0.878 [95% CI: 0.831, 0.924], 0.741, and 0.871. After classification, AUC, specificity, and sensitivity in validation and independent test cohorts in the ISN group were 0.921 [95% CI: 0.884, 0.958], 0.809, and 0.868; 0.905 [95% CI: 0.873, 0.938], 0.809, and 0.868. In the PPSN group, AUC, specificity, and sensitivity in the validation and test cohorts were 0.875 [95% CI: 0.776, 0.974], 0.632, 0.934; 0.806 [95% CI: 0.735, 0.876], 0.425, 0.871. The AUC of two divided groups in the independent test cohort was significantly different as determined by the DeLong test ( $p = 0.012$ ). The AUC in the ISN group is greater than that in the whole group.

#### CONCLUSION

When using deep learning models to predict pulmonary nodules, it is necessary to consider the surrounding tissues of the tumor, and detailed classification may help improve the prediction effect.

## CLINICAL RELEVANCE/APPLICATION

After specific classification, the accuracy of using deep learning models to predict lung nodules surrounded by lung tissue would be improved.

### T2-SPCH-3 Prediction of Lung Malignancy Progression and Survival with Deep Learning Based on Pre-treatment FDG-PET/CT

#### PURPOSE

Artificial intelligence (AI) demonstrated potential for improved accuracy in the characterization of lung malignancies with fluorodeoxyglucose positron-emission tomography and computed tomography (FDG-PET/CT), but studies mostly relied on handcrafted features rather than deep learning, and focused on the prognostic utilities of CT and PET individually without investigating their additive value. The purpose of this study was to use deep learning with pre-treatment FDG-PET/CT to predict progression of lung malignancies and overall survival (OS).

#### METHODS AND MATERIALS

A retrospective review across three institutions identified patients with a pre-procedure FDG-PET/CT and an associated malignancy diagnosis. Lesions were manually and automatically segmented, and convolutional neural networks (CNNs) were trained using FDG-PET/CT inputs to predict malignancy progression. Performance was evaluated using area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, and specificity. Image features were extracted from CNNs and by radiomics feature extraction, and random survival forests (RSF) were constructed to predict OS. Concordance index (C-index) and integrated brier score (IBS) were used to evaluate OS prediction.

#### RESULTS

1168 nodules (n=965 patients) were identified. 792 nodules had progression and 376 were progression-free. The most common malignancies were adenocarcinoma (n=740) and squamous cell carcinoma (n=179). For progression risk, the PET+CT ensemble model with manual segmentation (accuracy=0.790, AUC=0.876) performed similarly to the CT only (accuracy=0.723, AUC=0.888) and better compared to the PET only (accuracy=0.664, AUC=0.669) models. For OS prediction with deep learning features, the PET+CT+clinical RSF ensemble model (C-index=0.737) performed similarly to the CT only (C-index=0.730) and better than the PET only (C-index=0.595), and clinical only (C-index=0.595) models. RSF models constructed with radiomics features had comparable performance to those with CNN features.

#### CONCLUSION

s CNNs trained using pre-treatment FDG-PET/CT and extracted performed well in predicting lung malignancy progression and OS. OS prediction performance with CNN features was comparable to a radiomics approach. The prognostic models could inform treatment options and improve patient care.

## CLINICAL RELEVANCE/APPLICATION

Features extracted from the deep learning models predict overall survival well. After prospective validation, this model based on FDG-PET/CT could predict lung malignancy progression and overall survival with high accuracy, and therefore help inform treatment options and improve patient care.

### T2-SPCH-4 Effect of Emphysema on Lung Nodule Detection Performance of AI Software

#### PURPOSE

Emphysema influences the appearance of the lungs in chest CT scans. It is unclear how well artificial intelligence (AI) based software performs in emphysema presence. The goal of this study is to check if there is a difference in lung nodule detection performance between an AI software and the human reader when emphysema is present.

#### METHODS AND MATERIALS

We selected 121 participants with (n=39) and without (n=82) emphysema (mean age 61±8, 48% men) from the Imaging in Lifelines cohort. Detection of nodules sized 30-300mm<sup>3</sup> by a commercial AI software was compared to human reading, and findings only detected by the reader or AI (discrepancies) were reviewed by an expert panel of two radiologists (gold standard). Using the gold standard, the detection performance was compared between AI and human reader for emphysema and non-emphysema groups, based on sensitivity, F1 score, and FP/scan. McNemar's test was utilized to check if there are differences between findings detected by AI and human reader.

#### RESULTS

The human reader detected 206 nodular findings and AI 223. The expert panel reviewed 211 discrepancies. Of these, 30 were actual lung nodules, 68 non-nodules, and 113 lymph nodes. In the emphysema group, AI sensitivity was 0.95 [95%CI 0.83-0.99] vs 0.87 [95%CI 0.73-0.94] for the human reader, with 0.51 FP/scan for AI vs 0.15 FP/scan for the human reader (for nodules p=0.45, for FPs p=0.01). In the non-emphysema group, AI's sensitivity was 0.87 [95%CI 0.77-0.93] vs 0.80 [95%CI 0.69-0.88] for the human reader, with 0.23 FP/scan for AI vs 0.28 FP/scan for the human reader (for nodules p=0.40, for FPs p=0.64). AI performance based on the F1 score was slightly lower than that of the human reader in participants with emphysema (0.77 [95%CI 0.68-0.84] vs 0.86 [95%CI 0.77-0.92] respectively), whereas performance of AI was slightly better than the human reader in non-emphysema participants (F1 score 0.81 [95%CI 0.74-0.87] vs 0.75 [95%CI 0.68-0.81] respectively).

#### CONCLUSION

s Overall, sensitivity of AI for lung nodules was higher than for the human reader but at the cost of higher false positive rate in emphysema presence. This resulted in slightly worse performance of AI (based on F1 score) in emphysema but slightly better than the human reader in non-emphysema.

## CLINICAL RELEVANCE/APPLICATION

AI software can sensitively detect lung nodules in individuals with and without emphysema at least as well as the human reader, but with a higher number of FPs in emphysema cases.

### T2-SPCH-5 CT-derived Radiomics Signatures as a Prognostic Factor in Osteosarcoma Patients with Pulmonary

## Metastasis Treated with Tyrosine Kinase Inhibitors

Participants

Shan Shui Zhou, Shanghai, China (*Presenter*) Nothing to Disclose

### PURPOSE

The tyrosine kinase inhibitors (TKIs) have become the main therapy in relapsed or advanced unresectable patients with osteosarcoma (OS). However, no accurate predictive biomarkers for response to TKIs have been found or reported. This study aims to explore the prognosis value of CT-based radiomics signatures and develop a multidimensional nomogram for predicting the progression-free (PFS) in OS patients with pulmonary metastasis treated with TKIs.

### METHODS AND MATERIALS

A total of 90 OS patients with pulmonary metastasis were retrospectively enrolled in this study and were randomly divided into a training cohort (60) and a testing cohort (30). A total of 854 radiomics features were extracted from the segmentation of regions of interest based on baseline chest CT images. The intra-class correlation coefficient (ICC) was implemented to evaluate the feature reproducibility and stability. Only features with ICC greater than 0.8 were retained. The random survival forest (RSF) was performed to select features and generate radiomics signatures. Kaplan-Meier survival analysis with log-rank test was implemented for univariate selection. Two multivariate cox proportional hazards regression models were established with radiomics signatures and clinical factors (R-model and C-model) respectively. A multidimensional nomogram was then built based on all predictive parameters (RC-model). The discrimination abilities, goodness of fit and clinical benefits of models were validated and compared on both training and testing sets.

### RESULTS

The R-model and radiomics signatures which was constructed with these 37 features showed good predictive ability and prognostic value in both training and testing cohorts (Training: C-index, 0.798, log-rank test,  $p < 0.0001$ ; Testing: C-index, 0.775, log-rank test,  $p = 0.04$ ). There are significant differences in C-index between the C-model from the R-model and RC-model in both training and testing cohorts (C-model: C-index, 0.567 and 0.556; RC-model: C-index, 0.798 and 0.773; all  $p < 0.05$ ). The calibration curves based on 12 and 24-month survival prediction showed better agreement between the predicted and actual probability of PFS in the R-model and RC-model than the C-model. The decision curve analysis curves showed that the R-model was similar to the RC-model, and gained much more net benefits than the C-model.

### CONCLUSION

Radiomics signature derived by chest CT images is a potential predictor for the response to TKIs in OS patients with pulmonary metastasis.

### CLINICAL RELEVANCE/APPLICATION

Radiomics could be promising for identifying whether OS patients with relapsed or advanced unresectable disease have a good prognosis after treatment with TKIs and personalize risk stratification and treatment decisions.

## T2-SPCH-6 Radiogenomics For EGFR Mutation Status Prediction in CT Images: Impact Of Model Design on Performance and Prospective Generalizability

### PURPOSE

We hypothesized that design choices could affect predictive performance and generalizability of radiogenomic models. We investigated the impact of feature extraction and selection approaches on models developed to predict EGFR mutation status (EGFRm+/-) in NSCLC, assessing robustness on two different input CT image types.

### METHODS AND MATERIALS

We analyzed CT images from CT and PET/CT studies of US patients with NSCLC from TCIA (25% EGFRm+). Two feature extraction techniques were compared: hand-crafted features from segmented lesions and deep features from a pre-trained ResNet applied to a bounding box around the largest tumor. Principal component analysis (PCA) or Least Absolute Shrinkage and Selection Operator (LASSO) was used to select 5 features prior to classification by a support vector machine, with model performances evaluated via 5-fold cross validation AUC. Splits were stratified by EGFRm and disease stage. Prospective generalizability was evaluated using a temporal split (80:20 based on shifted dates). AUCs were reported as median and interquartile range.

### RESULTS

When predicting EGFR status from diagnostic CT images ( $n=171$ ), hand-crafted features selected either with PCA or LASSO resulted in effective stratification: AUC of 0.80 (0.73 - 0.80) and 0.80 (0.69 - 0.82), respectively, and encouraging prospective generalizability (0.86 for PCA and 0.76 for LASSO). By contrast, deep features showed poor performance using either PCA (0.60 [0.60 - 0.67]) or LASSO (0.46 [0.44 - 0.66]) as well as poor prospective generalizability (0.68 and 0.38, respectively). When utilizing low-fidelity CT from PET/CT studies ( $n=134$ ), hand-crafted features selected with PCA resulted in an AUC of 0.75 (0.73 - 0.77) vs. 0.66 (0.64 - 0.76) for LASSO. However, LASSO showed better prospective generalizability (0.79 vs 0.76). In this dataset, deep features combined with PCA showed improved predictive power compared with LASSO: AUCs of 0.72 (0.69 - 0.8) and 0.47 (0.46 - 0.67), respectively. With regard to prospective generalizability AUCs were 0.73 and 0.44 for PCA and LASSO, respectively.

### CONCLUSION

Performance and prospective generalizability for predicting EGFR mutation status varied widely across design settings. Tumor-based hand-crafted features filtered by PCA performed better than deep feature-based approaches regardless of image type. The effectiveness of the hand-crafted feature models supports the potential of radiogenomics in early identification of patients likely to harbor EGFR mutations.

### CLINICAL RELEVANCE/APPLICATION

Treatment planning in NSCLC depends on EGFRm. Radiogenomic models may help to rapidly identify patients who may harbor EGFRm. However, rigorous analysis of model design is key to successful model development.

## T2-SPCH-7 Impact of Body Composition on Lung Tumor Growth

Participants  
Jiantao Pu, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

## PURPOSE

Lung nodules, a sign of lung cancer, are common abnormal findings on low-dose computed tomography (LDCT). After a lung nodule is detected, the next step is to assess its likelihood of being cancerous, usually by monitoring its growth rate through follow-up CT scans. A nodule's growth rate can suggest its chance of being malignant and indicate the need for further tests such as biopsy or positron emission tomography (PET). This study aims to investigate the potential impact of body composition tissues as depicted on LDCT on tumor growth over time.

## METHODS AND MATERIALS

We conducted a study involving 109 subjects (55 male and 54 female) who had undergone multiple LDCT lung cancer screenings and were found to have lung nodules on their baseline CT scans. The nodules identified on both baseline and follow-up scans were segmented, and their doubling time (DT) in days was calculated. These subjects were grouped based on a DT threshold of 365 days. We also segmented five different body composition tissues depicted on the baseline LDCT scans were segmented, including skeleton muscle (SM), subcutaneous adipose tissue (SAT), visceral adipose tissue (VAT), intramuscular adipose tissue (IMAT), and bone, and computed their volumes and densities in Hounsfield unit (HU). The backward stepwise multivariable logistic regression analysis was used to identify the body composition features associated with DT while adjusting for potential confounding factors, such as age, gender, pack/year, and presence of emphysema. The multicollinearity was checked by the variance inflation factor (VIF), where  $VIF > 3.0$  indicates high collinearity. The area under the receiver operating characteristics (ROC) curve (AUC) was used to evaluate the performance of the prediction models using a 5-fold cross-validation method.

## RESULTS

The identified CT-derived body composition features significantly associated with DT include VAT volume ( $p=0.043$ ) and SAT volume ( $p<0.001$ ), while SM density is marginally significant ( $p=0.067$ ). Their combination achieved an AUC of 0.717 (95% CI: 0.619-0.814).

## CONCLUSION

Body composition characteristics are significantly associated with the growth rate of a lung nodule over time and may be considered as novel image biomarkers to facilitate the assessment of indeterminate lung nodules detected in the screening setting.

## CLINICAL RELEVANCE/APPLICATION

Approximately 50% of individuals who undergo LDCT lung cancer screening are found to have pulmonary nodules. Although the majority of lung nodules identified on CT scans (>95%) are not malignant, their presence can be worrisome for healthcare providers and anxiety-provoking for patients. Therefore, it is imperative to identify new biomarkers that can aid in the evaluation of indeterminate nodules.

## T2-SPCH-8 Preoperative CT-based Radiomics Model to Predict Tumor Status of Spread through Air Space in Non-small Cell Lung Cancer

Participants  
Kaihua Lou, Hangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

This study is to establish radiomics model that can predict the spread through air space (STAS) of non-small cell lung cancer before surgery, and to explore whether the model efficiency can be improved by peritumoral information.

## METHODS AND MATERIALS

A total of 373 patients were retrospectively collected from the two centers between January 2015 to June 2022. Patients in Center 1 were randomly divided into the training group and the internal test group in a 7:3 ratio, with Center 2 serving as the external test group. Classical tumor region of interest (ROI) and expanded tumor ROI were delineated for each lesion on Shenrui scientific research platform. Correlation analysis and logistic regression are used for feature screening, and support vector machine classifier is used for the establishment of prediction model, which is verified in both internal and external test groups. Receiver operating characteristic curve and area under the curve (AUC) are used to evaluate the effectiveness of the prediction model.

## RESULTS

In this study, five models were established to predict the STAS status of patients with non-small cell lung cancer, including one clinical model, two radiomics models (classic tumor radiomics model and expanded tumor radiomics model) and two combined models (classic tumor combined model and expanded tumor combined model). In the external test group, the seven screened radiomics features show relatively good performance in predicting the STAS state alone, and most of the features had AUC values greater than 0.80. Among the prediction models, the clinical model shows relatively poor prediction efficiency, with AUC value of 0.63; The classic tumor combined model showed a relatively good prediction efficiency, with the AUC value of 0.84, which was higher than that of the single radiomics model (AUC was 0.82 and 0.71, respectively) and the expanded combined tumor model (AUC was 0.76).

## CONCLUSION

The results of this study showed that the seven selected radiomics features showed good efficiency in the identification of STAS status alone. The classical tumor radiomics model and the classical tumor combined model can predict the STAS status of patients well, but the expanded tumor ROI does not significantly improve the efficacy of the model.

## CLINICAL RELEVANCE/APPLICATION

STAS status affects the choice of surgical methods and prognosis of patients. The model established in this study can predict STAS status before surgery, which is conducive to guiding the selection of clinical surgical methods.



## Abstract Archives of the RSNA, 2023

T2-SPER

### Emergency Radiology Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPER-1 The Impact of Dermoid Size on the Chance of Torsion and the Diagnostic Performance of CT Observations in Emergency Department Patients**

##### Participants

Cameron Adler, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose  
Maitray D. Patel, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### PURPOSE

Evaluate performance of CT observations for diagnosing twisted dermoids based on dermoid size..

##### METHODS AND MATERIALS

Text search of consecutive CT reports and pathology records between 1/1/2010 and 5/31/2022 identified ED patients with an ovarian dermoid, symptoms relevant to possible ovarian torsion, and absence of CT observations indicating alternative diagnosis. Operative and clinical notes established outcome...Three abdominal radiologists blinded to history, outcome, and cohort creation independently evaluated a maximum-size-matched review cohort containing all twisted dermoids with approximately twice as many non-twisted dermoids, scoring 6 adnexal torsion CT observations using a Likert scale:••• tubal thickening••• whirlpool sign••• concentric or asymmetric wall thickening••• adnexal deviation••• uterine deviation••• pelvic fat infiltration..Observation diagnostic metrics (sensitivity/specificity/accuracy/PPV/NPV) were based on presence of the observation indicated by at least two of the reviewers..

##### RESULTS

325 patients had 350 studies (19 patients with 2 studies, 3 patients with 3 studies, 10 patients with bilateral dermoids), showing 39 twisted dermoids and 321 non-twisted dermoids. The 10.8% overall torsion prevalence varied by dermoid size:••• <40 mm = 0/180 (0%)••• 40-69 mm = 6/96 (6.3%)••• 70-99 mm = 16/43 (37.2%)••• 100-159 mm = 15/30 (50.0%)••• =160 mm = 2/11 (18.2%)..Tubal thickening and whirlpool sign had highest diagnostic performance in the review cohort (39 twisted averaging 97 mm and 70 non-twisted averaging 99 mm; 35.8% torsion prevalence).••• For 84 dermoids =70 mm: the review cohort had all 51 of 51 non-twisted and 33 of 33 twisted dermoids of this size-----Tubal thickening: 84.8%/70.6%/76.2%/65.1%/87.8%-----Whirlpool sign: 63.6%/84.3%/76.2%/72.4%/78.2%••• For 25 dermoids 40-69 mm: to achieve size match, the review cohort had 19 of the 90 non-twisted and 6 of the 6 twisted dermoids of this size-----Tubal thickening: 50.0%/89.5%/80.0%/60.0%/85.0%-----Whirlpool sign: 33.3%/94.7%/80.0%/66.7%/81.8%..Applying 40-69 mm diagnostic metrics to all 96 dermoids that size reduced tubal thickening PPV to 24.1% and reduced whirlpool sign PPV to 29.5%, reflecting more false positives due to low torsion prevalence..

##### CONCLUSION

s 10.8% of ovarian dermoids in ED patients with relevant symptoms and no other CT-identified cause for symptoms were twisted, involving no dermoids <40 mm, 6.3% of dermoids 40-69 mm, and 39.3% of dermoids =70 mm. Tubal thickening and whirlpool sign showed highest accuracy (80%), but with substantially lower PPV for dermoids <70 mm..

##### CLINICAL RELEVANCE/APPLICATION

Consider US confirmation of suspected dermoid torsion on CT when <70 mm due to low torsion prevalence.

#### **T2-SPER-2 Determination of the Most Suitable Monoenergetic Level of Virtual Monochromatic Images in Dual-source CT for the Diagnosis of Bowel Obstruction and Colitis**

##### Participants

Djamel Dabli, Nimes, France (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the monoenergetic level with the best image quality for the diagnosis of colitis and bowel obstruction in an emergency context.

##### METHODS AND MATERIALS

The images of 64 patients who benefited from an enhanced abdominal-pelvis scan in dual-energy CT (DECT) mode for the diagnosis of colitis or bowel obstruction were retrospectively analyzed. Acquisitions were performed on a third-generation dual-source CT (DSCT) scanner at portal phase. Acquisitions were performed at 100/Sn150kVp. Mixed images (simulating images at 120kVp) were generated as well as virtual monochromatic images (VMI) at 40/50/60/70keV. An objective image quality assessment was performed by measuring contrast, noise and contrast-to-noise ratio (CNR). Subjective analysis was performed by anonymous scoring of the images by two radiologists evaluating the noise, smoothing, overall quality and diagnostic quality on a Likert scale. The results were compared between the different images using the Mann-Whitney U test for paired samples.

##### RESULTS

Of all the patients, 33 had intestinal obstruction, and 31 had colitis. The mean age was  $65\pm 20$  and  $49\pm 22$  years, respectively. The maximum CNR was measured in VMI at 60keV for both examination types, but the difference was significant only compared to 70keV for bowel obstruction and to 40keV, 70keV and mixed images for colitis. A good inter-observer agreement for all subjective criteria was found with a kappa index higher than 0.86. The VMI at 60keV presented higher scores for all criteria for bowel obstruction and colitis with no significant difference in smoothing score compared to mixed images ( $p=0.119$  and  $p=0.888$ , respectively).

#### **CONCLUSION**

s VMI at 60keV could provide better image quality compared with other low monoenergetic levels and mixed images for the diagnosis of bowel obstruction and colitis.

#### **CLINICAL RELEVANCE/APPLICATION**

Improved diagnosis of colitis and digestive tract obstructions.Reduction of examination interpretation time in the emergency context by optimizing the DECT image workflow

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## Abstract Archives of the RSNA, 2023

T2-SPGI

### Gastrointestinal Imaging Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPGI-2 Improving Preoperative Prediction of High-risk Esophageal Varices in Cirrhotic Patients: A Logistic Regression Model Based on Dual Energy CT Combined with Platelets**

#### **PURPOSE**

To assess the significance of preoperative prediction of high-risk esophageal varices (EV) in cirrhotic patients using ultrafast synchronized KV/mA switching dual energy CT (DECT), and to investigate the effectiveness of regression models that incorporate quantitative DECT parameters in conjunction with platelet for preoperative prediction.

#### **METHODS AND MATERIALS**

59 cirrhotic patients who underwent upper abdominal enhanced DECT scanning (Revolution Apex CT, GE) and gastroscopy were retrospectively enrolled. The risk of EV bleeding was divided into a low-risk group (LRV, n=38) and a high-risk group (HRV, n=21) based on gastroscopic findings. Basic clinical characteristics, hepatic transient elastography parameters derived by ultrasound (US), and DECT parameters in EV including portal phase esophageal venous iodine concentration (ICev) was recorded for all patients. Non-parametric test was used to identify independent risk factors. Logistic regression models were constructed based on mixed models of DECT combined, and US combined with clinical factors, respectively. The receiver operating characteristic (ROC) curves, area under the ROC curve (AUC) and confusion matrix were calculated for assessing performance of two models.

#### **RESULTS**

A total of 59 patients were included, 38 with low-risk esophageal varices and 21 with high-risk esophageal varices. Non-parametric tests revealed significant differences between the high- and low-risk groups in terms of clinical characteristics including platelets (PLT), US factors including Liver stiffness, and DECT parameters including ICev. The mixed model of US and PLT showed a 78% precision and sensitivity of 61.9%, specificity of 86.8%, positive prediction rate of 39% and negative prediction rate of 86.8%, and an AUC of 0.817. The mixed model of DECT and PLT demonstrated a precision of 83.1%, sensitivity of 76.2%, specificity of 86.8%, positive prediction rate of 48.5% and negative prediction rate of 86.8%, and an AUC of 0.916.

#### **CONCLUSION**

s ICev based on DECT combined with platelets can effectively exclude high-risk EV and has higher diagnostic efficacy than liver stiffness combined with platelets.

#### **CLINICAL RELEVANCE/APPLICATION**

According to Baveno VI guidelines, patients with cACLD at liver stiffness <20 Kpa and platelet count >150,000/ul may not require gastroscopy. The predictive model constructed for combined ICev and PLT had better performance than the model combined liver stiffness and PLT, and was a potential model for non-invasive screening of high-risk EV in cirrhotic patients and avoiding gastroscopy.

#### **T2-SPGI-3 Feasibility Study of Quantitative Parameters of Single-source Dual Energy CT Spectrum Analysis Parameters to Predict Ki-67 Expression in Gastrointestinal Stromal Tumor**

#### **PURPOSE**

To investigate the feasibility of preoperative prediction of Ki-6 expression in gastrointestinal stromal tumors(GIST)by multi-quantitative parameters of single-source dual-energy CT.

#### **METHODS AND MATERIALS**

The imaging data of 64 patients with GIST confirmed by single-source dual-energy CT three-phase energy spectrum enhanced scan and surgical pathology immunohistochemical index including Ki-67 were retrospectively analyzed. According to the Ki-67 expression index(>6 for high expression, <6 for low expression) the patients were divided into high expression group n=28) and low expression group(n=36)The single energy CT value and iodine concentration IC value of the parenchymal area of the two groups were measured at 40-70 kV, and the normalized iodine concentration NIC)value and the slope of the energy spectrum curve were calculated. Univariate and multivariate Logistic regression analysis was performed on the two groups of patients to establish independent risk factors for predicting Ki-67 expression.

#### **RESULTS**

The CT values of 40-70 keV and NIC value in the arterial phase of the Ki-67 high expression group were higher than those in the low expression group, and the differences were statistically significant ( $P < 0.05$ ), while the differences in the slope of the energy spectrum were not statistically significant ( $P > 0.05$ ); The differences in the venous 40-70 keV CT values, slope of the energy spectrum and NIC values between the two groups were not statistically significant ( $P > 0.05$ ). The CT values of 40~70 keV and slope of the energy spectrum value in the delayed phase of the Ki-67 high expression group were lower than those in the low expression group, and the differences were statistically significant ( $P < 0.05$ ), while the differences in NIC values were not statistically significant ( $P > 0.05$ ). Univariate and multivariate logistic regression showed that arterial phase, delayed phase

40KeV,70KeV CT values,and standardized iodine concentration values were independent risk factors for predicting Ki67 high expression.

## CONCLUSION

s Preoperative single-source dual-energy CT spectral parameters are helpful in predicting the expression of Ki-67 in gastrointestinal stromal tumors before surgery.

## CLINICAL RELEVANCE/APPLICATION

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### **T2-SPGI-4 Equilibrium Phase Imaging of the Abdomen on Photon-counting CT: Assessment of the Value of 50-keV vs 70-keV Imaging**

Participants  
Toru Honda, MD, Toyonaka Shi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Equilibrium phase (EP) imaging of the abdominal CT has several diagnostic values but suffers from low contrast. The aim of this study was to perform the quantitative and qualitative assessments of virtual monochromatic images (VMIs) generated by photon counting CT (PCCT) during abdominal EP.

## METHODS AND MATERIALS

This study included 20 patients who underwent abdominal dynamic contrast-enhanced CT using PCCT for the assessment of liver and pancreatic diseases including four patients with hepatocellular carcinoma and seven patients with pancreatic solid tumor. Portal venous phase (PVP) imaging was reconstructed to VMIs at 70 keV and EP imaging was reconstructed at 50 keV and 70 keV. One radiologist placed regions of interest on the three images and signal-to-noise ratio (SNR) were measured for the liver parenchyma, portal vein, hepatic vein, pancreas, and adrenal glands, as well as calculating the contrast-to-noise ratio (CNR) of the hepatic vessels and lesions. Two radiologists assessed the image quality using a 5-point scale regarding image noise, sharpness, organ and lesion conspicuity, and overall image quality. Friedman's test was used for the comparison among the three imaging.

## RESULTS

The SNRs at 50 keV-EP imaging were significantly higher for the hepatic vessels ( $p < 0.05$ ), equivalent for the pancreas and adrenal glands, and significantly lower for the liver parenchyma compared with 70 keV-EP imaging ( $p < 0.05$ ). SNRs at the 50 keV- and 70keV-EP imaging were significantly lower than those at the 70 keV PVP imaging for all structures ( $p < 0.05$ ) except for the equivalent SNR for the portal vein at 50 keV-EP. CNRs of the hepatic vessels at 50 keV-EP were significantly higher than those at 70 keV-EP, but significantly lower than those at 70 keV-PVP ( $p < 0.05$ ). There were no significant differences among the three images in the CNR of the lesions. In the qualitative analyses, 70 keV-EP and -PVP imaging showed significantly better noise, sharpness, and overall image quality than 50 keV-EP imaging for both readers ( $p < 0.05$ ). The conspicuity of the hepatic vessels at 50 keV-EP were significantly higher than that at 70-keV EP for both readers ( $p < 0.05$ ), and equivalent to that at 70 keV-PVP for one reader. Conspicuity of the lesions and adrenal veins were significantly the highest at 50 keV-EP.

## CONCLUSION

s Although 50 keV-EP imaging had worse image quality, it provided the best conspicuity of hepatic or pancreatic lesions and adrenal veins compared with 70 keV-EP and 70 keV-PVP imaging.

## CLINICAL RELEVANCE/APPLICATION

Virtual monoenergetic imaging at 50 keV during the equilibrium phase of abdominal CT may be helpful for the assessment of hepatocellular carcinoma, pancreatic cancer, and adrenal veins.

### **T2-SPGI-5 The Extracellular Volume Fraction with Iodine (water) Image of Dual-energy Computed Tomography in Predicting P53 Expression of Rectal Cancer**

Participants  
Chen Anliang, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the feasibility of extracellular volume (ECV) fraction determined with iodine(water) image of dual-energy computed tomography (DECT) for prediction of P53 expression of rectal cancer.

## METHODS AND MATERIALS

A retrospective analysis was performed on 41 rectal cancer patients confirmed with P53 expression according to their postoperative pathology results who received abdominal enhanced DECT in our hospital. They were divided into group 1 (high-group; 21 patients; 14 male, 7 female, mean age: 67.95 years, range: 52-91 years) and group 2 (low-group; 20 patients, 15 male, 5 female, mean age: 64.60 years, range: 44-89 years) according to their P53 expression. Three ROIs were placed in the largest layer of rectal cancer in iodine(water) images created from equilibrium-phase contrast-enhanced DECT images. The iodine values of the left external iliac artery or femoral artery at the same layer with lesions were also measured. The ECV fraction were calculated and were analyzed with independent sample t-test. The ROC curve was generated using the ECV fraction, and the area under curve (AUC) was calculated to analyze the diagnostic performance of using the ECV fraction in predicting P53 expression of rectal cancer.

## RESULTS

There was a statistically significant difference in the ECV fraction between high-group (45.83±9.76)% and low-group (55.81±12.83)% ( $p < 0.05$ ). The AUC, maximum Youden index and diagnostic threshold of using the ECV fraction for prediction of P53 expression of rectal cancer was 0.717, 0.407 and 56.73%, and the sensitivity and specificity were 55.0% and 85.7%, respectively.

## CONCLUSION

s ECV fraction determined with equilibrium contrast-enhanced iodine(water) image of DECT images was useful for predicting P53

expression of rectal cancer.

#### **CLINICAL RELEVANCE/APPLICATION**

ECV fraction created from gemstone spectral imaging (GSI) has a prospective clinical application in predicting the P53 expression of rectal cancer for the treatment decision-making.

#### **T2-SPGI-6 Assessment of the Liver Low-density Lesions with a Spectral CT**

##### **PURPOSE**

This study was aimed to compare and evaluate the image quality of intra-hepatic low-density lesions in spectrum computed tomography (CT) with different monochromatic energy images in the arterial phase, the portal vein phase, and the delayed phase, respectively, and to explore the exact monochromatic value of optimum image quality.

##### **METHODS AND MATERIALS**

Patients with intra-hepatic low-density lesions were prospectively enrolled in our institution. GE Revolution CT was used to perform enhanced upper abdominal scan. Adaptive statistical iterative reconstruction (ASIR-V) was set with 40%, 50%, 40%, and 30% for true non-enhanced abdominal scanning, enhanced abdominal scanning in the arterial phase, the portal vein phase, and the delayed phase, respectively. The arterial phase and the portal vein phase applied a spectral mode with fast switch 80/140 kV, and tube current was automatic (range from 100 to 600 mA). The average CT value and standard deviation (SD) of the lesions were measured and recorded at 50, 60, 70 and 80 keV in the arterial phase, the portal vein phase respectively, and the signal-to-noise ratio value was calculated and compared pair-to-pair. Paired-samples t-test was used to compare the mean value of SNR and SD in the arterial phase, the portal vein phase, and the delayed phase, respectively.  $P < 0.05$  was considered statistically significant.

##### **RESULTS**

A total of twenty patients were prospectively included finally (male: 5, female: 15; mean age: 65.4 years old), with a total of 35 lesions. For the arterial phase, the signal-to-noise ratio values of the lesion in the imaging with 80 keV was higher than those of 50, 60 and 70 keV ( $12.75 \pm 1.6$ ,  $0.49 \pm 1.18$ ,  $0.71 \pm 1.30$ ,  $0.94 \pm 1.41$ , respectively;  $? < 0.001$ ), and there was no statistically significant difference among the 50, 60, and 70 keV groups. For the portal vein phase, the signal-to-noise ratio values of 50, 60, 70, and 80 keV groups were  $1.32 \pm 1.08$ ,  $1.41 \pm 1.26$ ,  $1.49 \pm 1.44$ ,  $1.58 \pm 1.61$ , respectively; and there was no statistical difference among the different keV groups ( $? > 0.05$ ).

##### **CONCLUSION**

The image quality with 80 keV of single-energy imaging of spectrum CT was significantly better than that of other monochromatic energy (50, 60, 70 keV) imaging in the arterial phase. But for the portal vein phase imaging, there was no statistical difference in the imaging quality of the liver lesions in scans with different keV. As a result, it is supposed to reduce the radiation dose of scans by decreasing the keV in the portal vein phase without compromising the image quality prospectively, but not in the arterial phase.

#### **CLINICAL RELEVANCE/APPLICATION**

It is supposed to reduce the radiation dose of scans by decreasing the keV in the portal vein phase without compromising the image quality prospectively, but not in the arterial phase.

#### **T2-SPGI-7 The Difference Between Virtual Non-enhanced Imaging and True Nonenhanced Imaging: A Comparison Study**

##### **PURPOSE**

To compare the difference in image quality and radiation dose between virtual non-enhanced (VNE) images and true non-enhanced (TNE) images in the arterial and the portal phase.

##### **METHODS AND MATERIALS**

Sixty-four patients were enrolled in this prospective study. GE Revolution CT was used for enhanced upper abdominal scanning. Adaptive statistical iterative reconstruction (ASIR-V) were set with 40%, 50%, 40%, and 30% for true non-enhanced abdominal scanning, enhanced abdominal scanning in arterial phase, portal vein phase, and delayed phase, respectively. The effective radiation dose (ED) and the size-specific dose estimation (SSDE) of virtual non-enhanced images and true non-enhanced images were calculated respectively. The mean CT values and standard deviation (SD) of liver parenchyma, spleen parenchyma and renal cortex in VNE images and TNE images were measured, and the signal-to-noise ratio (SNR) was calculated.

##### **RESULTS**

For radiation dose, the ED of VNE images gained from portal vein phase was the highest, followed by VNE from arterial phase reconstruction, and the lowest ED belonged to TNE images ( $4.59 \pm 1.98$ ,  $3.81 \pm 1.44$ ,  $3.67 \pm 1.71$ , respectively). The differences of ED between the latter two were significant compared with the portal phase. The significant difference was detected only between VNE images from the arterial (SSDEa) and the portal phase (SSDEp) ( $1.47 \pm 2.27$  vs  $10.50 \pm 2.03$ ,  $? = 0.036$ ). For image quality: Liver There was no significant difference between the SNR of VNE images (SNRVNE) obtained from arterial phase and TNE (SNRTNE) ( $? = 0.083$ ). The SNRVNE obtained from portal phase was better than that obtained from arterial phase and the SNRTNE. (SNRTNE vs portal SNRVNE:  $7.26 \pm 1.32$  vs  $12.85 \pm 2.21$ ,  $? < 0.001$ ; arterial SNRVNE vs portal SNRVNE:  $6.53 \pm 1.98$  vs  $12.85 \pm 2.21$ ,  $? < 0.001$ ). Spleen: The SNRVNE obtained from arterial phase and portal phase were better than that of SNRTNE and the difference was statistically significant (all  $? < 0.001$ ). Kidney The SNRVNE obtained from arterial phase and portal phase were better than that of SNRTNE and the difference was statistically significant (all  $? < 0.05$ ).

##### **CONCLUSION**

In terms of the radiation dose, the dose of VNE from portal vein was still the highest for ED, but its SSDE was the lowest instead. In terms of image quality, the VNE images of some organs at certain phases (such as hepatic portal phase, splenic artery phase and portal vein phase, renal artery phase and portal vein phase) were better than that of TNE images.

#### **CLINICAL RELEVANCE/APPLICATION**

Spectral CT was comparable to conventional CT in image quality, and even superior than it in the imaging of some organs, while radiation dose needed to be further verified.

## **T2-SPGI-8 Efficiency Analysis of Dual-layer Spectral Detector CT Iodine Concentration Value Related Parameters in Diagnosis of Regional Lymph Node Metastasis of Gastric Adenocarcinoma**

### **PURPOSE**

To compare the tumor pathological characteristics and spectral CT quantitative parameters between patients with and without regional lymph node metastasis of gastric adenocarcinoma.

### **METHODS AND MATERIALS**

The clinical data and preoperative spectral CT images of 55 cases of gastric adenocarcinoma confirmed by pathology in a hospital from June 2021 to June 2022 were retrospectively collected. Patients were divided into metastatic lymph node lesion group (32 cases) and non-metastatic lymph node lesion group (23 cases) according to whether there were metastatic lymph nodes in all the lymph nodes examined in the pathological results. Then lymph nodes were taken as the research object, and all lymph nodes were divided into the metastatic lymph node group (25 lymph nodes) and the non-metastatic lymph node group (27 lymph nodes) according to the nature of lymph nodes recorded in the pathological report. The IC values and normalized IC (nIC) values of gastric cancer lesions and lymph nodes in the arterial and venous phases (ICa and ICp, nICa and nICp) were obtained. The difference of IC and nIC values between arterial and venous phases (  $\Delta$ IC and  $\Delta$  nIC) were calculated, and the arterial enhancement fraction (AEF, ratio of ICa and ICp of lymph nodes ) was calculated. Student's t test or Mann-Whitney U test was used to compare the differences of quantitative parameters between the two groups. The parameters with statistical differences were analyzed by the receiver operating characteristic (ROC) curve to obtain the diagnostic efficacy of each parameter in evaluating lymph node metastasis of gastric cancer, and the Z test was used to compare the area under the curve (AUC) of each parameter.

### **RESULTS**

The ICp, nICp,  $\Delta$ IC and  $\Delta$  nIC of the lymph node metastatic lesion group were higher than those of the lymph node non-metastatic lesion group (all  $P < 0.05$ ). The AUC were 0.738, 0.746, 0.811 and 0.821. There were significant differences in AUC between ICp and  $\Delta$ IC,  $\Delta$  nIC ( $Z=2.41, 3.29, P=0.016, 0.001$ ), and between nICp and  $\Delta$ IC,  $\Delta$  nIC ( $Z=2.10, 3.09, P=0.036, 0.002$ ) in gastric cancer lesions. The short diameter, ICa, nICa and AEF values of lymph nodes in the metastatic lymph node group were higher than those in the non-metastatic lymph node group (all  $P < 0.05$ ). The AUC were 0.821, 0.832, 0.734 and 0.863. There were statistically significant differences in AUC between nICa and ICa, AEF ( $Z=2.09, 2.41, P=0.037, 0.016$ ) in lymph nodes.

### **CONCLUSION**

The quantitative parameters related to IC values of spectral CT can be applied to evaluate the properties of regional lymph nodes in patients with gastric adenocarcinoma, where  $\Delta$ IC,  $\Delta$  nIC of lesions and AEF of lymph nodes have the best efficacy.

### **CLINICAL RELEVANCE/APPLICATION**

Stomach neoplasms; Adenocarcinoma; Lymphatic metastasis; Spectral CT; Iodine concentration

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## Abstract Archives of the RSNA, 2023

T2-SPGU

### Genitourinary Imaging Tuesday Poster Discussions

#### Sub-Events

#### T2-SPGU-1 From Biopsy to Resection: Using CT to Predict Histologic Upgrading of Renal Masses

##### PURPOSE

Despite the popularity of renal mass biopsy, discordance can occur between the biopsy nuclear grade and the surgical specimen grade. Nuclear grade affects recurrence and mortality rates, and any discordance can lead to suboptimal management. The rate of tumor growth has been used to predict upgrade despite limited literature evidence. This study aims to create a risk prediction model for upgrading of clear cell renal cell carcinoma (ccRCC) based on CT imaging features and compare its performance against tumor growth rate.

##### METHODS AND MATERIALS

This IRB-approved single-center retrospective case-control study included 114 patients (76 male, median age=62 years) who underwent renal mass biopsy followed by surgical resection. The upgrade group (n=57) was defined as low grade ccRCC (ISUP 1 or 2) on biopsy and high grade (ISUP 3 or 4) on subsequent nephrectomy, while the control group (n=57) had no upgrade. The average growth in largest dimension per month and tumor volume doubling time were calculated using available cross-sectional imaging prior to resection. Twenty-two imaging features were assigned utilizing pre-biopsy renal triphasic CT. Features that had inadequate differentiation following univariable logistic regression were excluded. Remaining features were included in a multivariable logistic regression model using a stepwise model selection. The predictive performance of the final risk prediction model was evaluated using repeated 10-fold cross-validation and compared with measures of tumor growth.

##### RESULTS

Arterial enhancement, delayed enhancement, relative arterial enhancement, relative delayed enhancement, arterial wash-in and imaging necrosis were significantly different between the groups ( $p<0.05$ ). Importantly, tumor growth rate and doubling time were not statistically different. Four features (1 qualitative, 3 quantitative) were included in the final risk prediction model: mass heterogeneity ("heterogeneous" or "homogeneous"; OR=0.53), arterial enhancement (OR=0.46), relative delayed enhancement (OR=0.64), and enhancement ratio (OR=4.01). Using this model, a nomogram was constructed to predict probability of upgrade. The final risk prediction model resulted in a mean AUC of 0.69 (SD=0.17). This model performed better than measures of tumor growth ( $p<0.001$ ).

##### CONCLUSION

A model using CT imaging features performed better than measures of tumor growth and can be used to stratify the risk of renal mass upgrade at the time of surgical resection.

##### CLINICAL RELEVANCE/APPLICATION

This model identifies patients appropriate for active surveillance (low likelihood of upgrade) or immediate surgery (high likelihood of upgrade), avoiding the need for follow up imaging to assess tumor growth rates.

#### T2-SPGU-2 Beyond the Knife: A Retrospective Study on Surveillance-Based Management of Bilateral Multifocal Renal Oncocytomas

##### Participants

Shiva Singh, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

Bilateral multifocal renal oncocytomas account for approximately 4-6% of renal oncocytomas, and their optimal management strategy is still not well-defined due to a lack of consensus guidelines. This study aims to compare clinical, functional, and oncological outcomes of active surveillance (AS) versus surgical management in patients with bilateral multifocal renal oncocytomas, and to determine the appropriate management strategy for this group of patients.

##### METHODS AND MATERIALS

We conducted an IRB-approved retrospective cohort study on 62 patients with histopathologically confirmed bilateral multifocal renal oncocytomas. Patients with genetic alterations as seen in Birt-Hogg-Dubé syndrome or inadequate follow-up were excluded. The cohort was divided into three subgroups based on management received: active surveillance (AS) only, single unilateral surgery followed by AS, and multiple/bilateral surgeries. Clinical and imaging data were analyzed for longitudinal monitoring of tumor growth, new tumor/recurrence, and renal function changes. Statistical analysis was conducted to compare outcomes between the three management strategies.

##### RESULTS

The median age of the patients (n=62) was 64 years (IQR 57.5-69), and 49 (79%) were males. Patients were followed for an average of 5.5 years (2.8-7.2 years), and the median number of tumors per patient was 7, with no metastasis observed in any

group. The overall median tumor growth rate was 0.3 cm/year (IQR 0.1-0.5), with no significant difference among the three management groups ( $p=0.73$ ). The median age at death was 78.5 years (IQR 74.5-81.3,  $p=0.37$ ), and no significant differences were found in serum creatinine levels between the three groups at the initial time point ( $p=0.67$ ), final time point ( $p=0.5$ ), or change in serum creatinine levels over the period of treatment ( $p=0.7$ ).

## CONCLUSION

s Management strategies for bilateral multifocal renal oncocytomas are challenging, and clinicians face difficulties in choosing between surgical management and active surveillance. Findings of our study suggest that active surveillance is a safe and viable alternative to surgical management in patients with bilateral multifocal renal oncocytomas, with no detrimental impact on clinical, oncological, or functional outcomes as compared to surgical management.

## CLINICAL RELEVANCE/APPLICATION

Active surveillance may be a safe alternative to surgical management of bilateral multifocal renal oncocytomas, especially for elderly patients or patients with comorbidities who are at a heightened risk of developing surgery-related adverse events.

## T2-SPGU-3 Predicting Growth Rate of Clear Cell Renal Cell Carcinoma: A Comprehensive Analysis using Machine-Learning

Participants

Pouria Yazdian Anari, MD, North Bethesda, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Von Hippel-Lindau (VHL) syndrome is associated with multiple benign and malignant neoplasms, including renal cell carcinomas (RCC), resections of which overtime can lead to end-stage renal disease (ESRD). Active surveillance is recommended for small renal masses to avoid unnecessary surgeries while preserving renal function. However, there is currently no reliable method to predict the growth rate of renal lesions.

## METHODS AND MATERIALS

A single-center retrospective study of 55 patients with VHL was conducted from 2015 to 2021. Prior to partial or radical nephrectomy, patients underwent two MRI scans, and tumors were pathologically confirmed. Two abdominal radiologists assessed lesions based on 12 unique anatomical and sequence-specific imaging parameters using preoperative MRI scans. Lesions were divided into slow-growing (SG) and rapid-growing (RG) groups based on a 0.5 cm/year growth rate threshold. A stacked ensemble technique was employed to combine XGBoost and Random Forest algorithms, creating models that associate radiomic signatures with tumor grades. Optimal algorithm parameters were determined using 5-fold cross-validation, and performance was assessed on 100 different random test and train set combinations (85% train, 15% test) to identify the best model. Results were reported using positive predictive value (PPV), sensitivity, F1 score, and area under the Receiver Operating Characteristic curve (AUC-ROC). by using inter class correlation between two readers, they had moderate agreement.

## RESULTS

The stacked ensemble machine-learning model demonstrated promising performance in predicting the growth rate of clear cell renal cell carcinoma in VHL patients. The model demonstrated high accuracy (90%) and promising performance metrics, including a precision of 0.97 for SG tumors, recall of 0.98 for RG tumors, and an F1 score of 0.92 and 0.88 for SG and RG, respectively. The macro average for precision and recall was 0.89 and 0.92, respectively, with an overall F1 score of 0.90. The Matthews Correlation Coefficient (MCC) was 0.52, indicating a moderate correlation between the model's predictions and the true growth rates.

## CONCLUSION

s This study demonstrates the potential utility of using a stacked ensemble machine-learning model for predicting the growth rate of clear cell renal cell carcinomas in VHL patients. The model's high performance suggests it could be a valuable tool for guiding patient management and improving clinical decision-making in the active surveillance of small renal masses.

## CLINICAL RELEVANCE/APPLICATION

This machine-learning model could help optimize patient care by reducing the need for unnecessary surgeries, preserving renal function, and enabling timely interventions for patients with renal neoplasms.

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## Abstract Archives of the RSNA, 2023

T2-SPHN

### Head & Neck Imaging Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPHN-1 Establishment of a Clinical Decision Model with High Cost-effectiveness to Detect Local Recurrent Nasopharyngeal Carcinoma using Deep Learning Model Based on Magnetic Resonance Images: A Multi-center Study in Endemic Area**

#### **PURPOSE**

Routine magnetic resonance examination during post-treatment follow-up is crucial and efficient to detect recurrence nasopharyngeal carcinoma (rNPC). We aim to investigate the feasibility of detecting local rNPC using unenhanced MR images in selected subpopulation with the aid of deep learning model and proposed layered management during follow-up.

#### **METHODS AND MATERIALS**

Deep learning models using 3D DenseNet or Resnet based on unique sequence or T1W and T2W combined sequences were developed and fine-tuned to detect local rNPC in training and validation sets from three centers. Diagnostic efficacy was compared among T1WIC model and other models using McNemar's Z-test in both internal or external cohorts. A clinical decision model (CDM) was optimized through imposing T1\_T2 combined model and T1WIC models by setting sensitivity not less than 90%. Patients would be grouped into positive, suspicious and negative according to predicted values derived from T1\_T2 combined model, patients of the former two groups were recommended to have enhanced MR examination. Economic analysis was compared among CDM, T1\_T2 combined model and conventional method.

#### **RESULTS**

There were no statistics differences in overall accuracy, sensitivity and specificity between T1WIC model and other models either in internal or external cohorts when using 3D DenseNet or Resnet (all  $p > 0.0167$ ), with all of the power of test more than 95%. The ROC curves showed that the area under curve of T1\_T2 combined model was slightly above or similar to those of T1WIC model in either internal and external test set when using DenseNet (0.9296 vs 0.9124 in internal test set, 0.9065 vs 0.9071 in external test set, all  $p > 0.0167$ ). Particularly, the CDM showed higher accuracy and sensitivity and lower specificity than those of T1\_T2 combined model either in internal (accuracy, 85.91% vs 84.99%; sensitivity, 90.36% vs 84.26%; specificity, 82.20% vs 85.59%) and external (accuracy, 86.14% vs 84.16%; sensitivity, 90.32% vs 84.95%; specificity, 82.57% vs 83.49%) cohort. The total cost of examination using clinical decision model was \$344,665 and \$342,838 based on the actual incidence of internal and external cohort with a hypothetical cohort of 1,000 patients, when relative to \$326,453 of T1\_T2 combined model and \$355,233 of conventional method.

#### **CONCLUSION**

Herein, we have demonstrated that detection of local rNPC during post-treatment surveillance using unenhanced MR images with the aid of deep learning model was feasible in selected patients.

#### **CLINICAL RELEVANCE/APPLICATION**

The proposed clinical decision model showed potential application value in clinical practice with high cost-effectiveness without losing sensitivity in detecting local rNPC, contributing to layered management during follow-up.

#### **T2-SPHN-2 Artificial Intelligence Model to Predict Bethesda Score in Thyroid Nodule CT Imaging**

#### Participants

Isabel Gomez Alonso, MD, Malaga, Estonia (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The purpose of this work is to predict the Bethesda score of thyroid nodules by performing radiomic analysis of these nodules on CT images.

#### **METHODS AND MATERIALS**

This retrospective cohort study was performed by selecting 57 adult patients with thyroid nodules who underwent a CT scan of the neck and a fine needle aspiration biopsy between 2013 and 2021. Segmentation of the thyroid nodules was performed by three PGY4 radiology residents using CT images. Subsequently, 3D Slicer was used to extract the radiomic data of every segmented section in each patient. Data were processed with Python, using logistic regression and Machine Learning algorithms to predict the different Bethesda scores (score II-V) based on the radiomic features obtained. Visual assessment of the nodules was also performed by the three PGY4 radiology residents. Results were processed using IBM SPSS Statistics software. The whole process was supervised by a 5 year experienced head and neck radiologist and a 30 year experienced neuroradiologist.

#### **RESULTS**

In differentiating Bethesda II and V nodules, both logistic regression and K means showed a low performance (45% precision, 33% sensitivity and 57% specificity for logistic regression and 51% precision for K means). Random Forest classifier displayed 69 %

precision, 100% sensitivity and 100% negative predictive value, being able to detect all Bethesda V nodules. Finally, Support Vector Machine classifier showed 77% precision (75% sensitivity, 77% specificity, 87% negative predictive value).

## CONCLUSION

s Texture analysis-based artificial intelligence algorithms have demonstrated a 77% precision in differentiating Bethesda II and V nodules on CT imaging.

## CLINICAL RELEVANCE/APPLICATION

Thyroid nodule management is complex and often requires to perform invasive diagnostic procedures. Radiologists using artificial intelligence models may help predicting nodule malignancy and, consequently, reducing limitations of current diagnostic algorithms.

### T2-SPHN-3 MRI-based Radiomics Nomogram for Distinguishing Solitary Fibrous Tumor from Schwannoma in the Orbit: A Two-center Study

#### PURPOSE

To investigate the value of magnetic resonance imaging (MRI) radiomics for distinguishing solitary fibrous tumor (SFT) from schwannoma in the orbit.

#### METHODS AND MATERIALS

A total of 140 patients from two institutions were retrospectively included. All patients from institution 1 were randomized into a training cohort (n = 69) and a validation cohort (n = 35), and patients from institution 2 were used as an external testing cohort (n = 36). One hundred and six features were extracted from T2-weighted imaging (T2WI) and contrast-enhanced T1-weighted imaging (CET1WI). A radiomics model was built for each sequence using least absolute shrinkage and selection operator logistic regression, and radiomics scores were calculated. A combined model was constructed and displayed as a radiomics nomogram. Two radiologists jointly assessed tumor category based on MRI findings. The performances of the radiomics models and visual assessment were compared via area under the curve (AUC).

#### RESULTS

Seven and two radiomics features were selected from T2WI and CET1WI, respectively. The radiomics nomogram combining the two radiomics scores performed well in discriminating between schwannoma and SFT, with significantly higher AUCs than the readers in the training (AUC 0.986 vs. 0.807,  $p < 0.001$ ), validation (AUC 0.989 vs. 0.788,  $p = 0.009$ ), and the testing (AUC 0.903 vs. 0.792,  $p = 0.018$ ) cohorts. Decision curve analysis demonstrated that the radiomics nomogram had better clinical utility than visual assessment.

## CONCLUSION

s MRI radiomics nomogram can be used for distinguishing between orbital SFT and schwannoma, which may help tumor management by clinicians.

## CLINICAL RELEVANCE/APPLICATION

& It is challenging to differentiate SFT from schwannoma in the orbit due to similar clinical and image features. & A radiomics nomogram based on T2WI and CET1WI has advantages over radiologists. & Radiomics can provide a non-invasive diagnostic tool for differentiating between the two entities.

### T2-SPHN-4 Pioneering a Multi-Modal Deep Learning Approach for Hypopharyngeal Cancer Segmentation: Comprehensive Evaluation and Performance Analysis using Diverse MRI Data Across Multiple Institutions

#### PURPOSE

Accurately annotating tumors is a time-consuming process, thus it is crucial to design an approach that can automate this process while maintaining accuracy. The study aims to develop and evaluate a multi-modality deep learning-based segmentation model for accurate and efficient delineation of hypopharyngeal cancer from T1-weighted image, contrast-enhanced T1-weighted image (T1c), and T2-weighted MRI scans. We utilized the nnU-Net architecture, ensembling techniques, and multi-institution datasets to improve the performance of our model.

#### METHODS AND MATERIALS

In this study, we used a dataset of 209 patients with hypopharyngeal cancer from National Taiwan University Hospital (NTUH) to train and ensemble three separate nnU-Net models on T1-weighted image, contrast-enhanced T1 (T1c), and T2-weighted MRI scans. To determine the best combination of models, we utilized nested five-fold cross-validation and ensembled the cross-validation results. The tumor annotations were performed by experienced oncologists on the patients treated between February 2011 and January 2015. We evaluated our model using various metrics on a testing dataset from Chang Gung Memorial Hospital (CGMH), which includes 91 patients treated between 2003 and 2013. The nnU-Net architecture was selected for this study due to its remarkable performance in various medical image segmentation challenges, which is expected to improve the segmentation results of hypopharyngeal cancer from multi-modality MRI scans. It consists of a 3D U-Net with an end-to-end pipeline that includes pre-processing, data augmentation, and post-processing.

#### RESULTS

The average tumor size in our training dataset from NTUH was 27.5 cm<sup>3</sup>. Our ensemble model achieved a mean Dice similarity coefficient (DSC) of 0.92 during training. On the independent testing dataset from CGMH our model achieved an overall DSC of 0.75 and a Hausdorff distance of 19 mm, demonstrating its robustness and generalizability.

## CONCLUSION

s The developed deep learning-based segmentation model can accurately and efficiently delineate hypopharyngeal cancer from multi-modalities and multi-institutional MRI scans, which has the potential to enhance clinical diagnosis and treatment planning for patients with hypopharyngeal cancer. The nnU-Net architecture and ensembling approach improve the segmentation performance and increase the robustness of the model, and have the potential to be applied to other cancer types and imaging modalities.

## CLINICAL RELEVANCE/APPLICATION

Our metric analysis showed that the model has the potential to efficiently optimize hypopharyngeal cancer segmentation workflows and to be implemented in clinical decision support.

### T2-SPHN-5 AI for Automatic Localization and 3D Segmentation of Lymph Node Metastasis in Head and Neck Cancer

Participants  
Miriam Rinneburger, MD, Cologne, Germany (*Presenter*) Nothing to Disclose

#### PURPOSE

Evaluation of an AI algorithm for localization and segmentation of lymph nodes (LNs) in contrast-enhanced computed tomography scans (CECTs) of the head and neck region on patients with head and neck cancer with confirmed LN metastasis.

#### METHODS AND MATERIALS

We searched our local database for patients sent from the otorhinolaryngological department from January 2000 to January 2021 for staging of a head and neck cancer who had at least one untreated LN metastasis confirmed through central necrosis, PET/CT-positivity, positive histology and/or progression/regression in a follow up scan. All 125 CECTs had a slice thickness of 1-2.5 mm, were conducted supine with venous contrast enhancement and reconstructed with a soft kernel. Patient age was 61,96 +/- 10,7 years, 25 patients were female and 100 male. On this cohort, we applied our existing 3D LN segmentation model. Independently, all LNs with a short axis diameter of = 5 mm were manually segmented by an experienced radiologist and double-checked by a second radiologist as a reference. Additionally, LN metastases were labelled to evaluate the AI model's performance specifically on LN metastases.

#### RESULTS

In 125 CECT scans of the head and neck, the AI model marked 4271 LNs whilst 3656 LNs were segmented manually. Out of 544 LNs manually labelled as a clinical metastasis, the model detected 486. Overall, an average localization rate (LR) of 83.56% with 12.8 false positives (FPs) per CT scan was achieved. On average, only one of these FPs had an SAD of = 5mm. The model showed a statistically significant ( $p = 0.0029$ ) higher localization performance for metastatic LNs with an LR of 89.0% whilst for non-metastatic LNs, it reached an LR of 82.8%. The average global Dice accounts to 0.58 per CT scan. Segmentation accuracy was higher for non-metastatic LNs with a global Dice of 0.65 while it accounts to 0.42 for LN metastases. Sensitivity was higher in metastatic (0.69) than in non-metastatic LNs (0.58).

#### CONCLUSION

Our existing AI model for 3D segmentation of cervical LNs generalizes well to metastatic LNs. Overall, LR and segmentation sensitivity are higher in metastatic than in non-metastatic LNs whilst Dice is slightly worse. Clinical applicability of this model for metastatic LNs appears feasible.

## CLINICAL RELEVANCE/APPLICATION

Automatic LN localization for N staging can speed up clinical practice. LN metastasis of head and neck cancer can differ from other malignancies in shape and texture. Thus, localization might need explicit training.

### T2-SPHN-6 Morphology-based Radiomics and Machine-Learning Models for Predicting Lymph Node Status in Oral Tongue Squamous Cell Carcinoma

#### PURPOSE

To develop machine-learning models based on morphological features extracted from preoperative magnetic resonance imaging (MRI) to predict lymph node status in oral tongue squamous cell carcinoma (OTSCC).

#### METHODS AND MATERIALS

This study retrospectively enrolled 90 OTSCC patients, of whom 45 and 13 patients, respectively, had confirmed lymph node metastasis (LNM) and extranodal extension (ENE). Fourteen morphological features and two customized metrics were derived from T2-weighted (T2W) images. Tumor maximum diameter and MRI-derived depth of invasion (DOI) were measured on contrast-enhanced T1-weighted (ceT1W) images. Information gain algorithm was applied to select the top five attributes. Models were created using six machine-learning methods, including neural network (NN), random forest (RF), logistic regression (LR), support vector machine (SVM), naïve bayes (NB), and AdaBoost. An internal stratified 10-fold cross-validation was performed to assess their performance.

#### RESULTS

For predicting LNM, the NN classifier, which included Situation, Elongation, Top Bottom Area, Least Axis Length, and Minor Axis Length, yielded the best model, with an AUC of 0.746 and accuracy of 72.2%. The performance of the NN model was slightly superior to that of MRI-derived DOI (0.746 vs. 0.655), although the difference was not significant ( $P=0.122$ ). For predicting ENE, the SVM classifier, which included situation, Elongation, Top Bottom Area, Least Axis Length, and Minor Axis Length, performed the best, with an AUC of 0.750 and accuracy of 85.6%.

#### CONCLUSION

Machine-learning models using MRI morphological features have potential in preoperative evaluation of cervical lymph node status in OTSCC.

## CLINICAL RELEVANCE/APPLICATION

Morphological features of tumors such as diameter and DOI measured on preoperative imaging are predictive of tumor staging and are more straightforward for clinical use than other radiomics features. Machine-learning models using MRI-derived morphological features could be a feasible noninvasive tool for predicting cervical lymph node status in OTSCC.

### T2-SPHN-7 Study on Automatic Detection Model of Cervical Lymph Node Metastasis in Oral Squamous Cell Carcinoma Based on Deep Learning

## **PURPOSE**

The purpose of this study was to establish a deep-learning model for automatically detecting metastatic LNs of oral squamous cell carcinoma patients(OSCC) from contrast-enhanced computed tomography (CT) images.

## **METHODS AND MATERIALS**

We collected 114 contrast-enhanced CT of oral cancer patients. The metastatic LNs of these patients have been pathologically confirmed, a total of 216. All CT scans are with a slice thickness of 0.625 mm and resolution is 512x512. For evaluation, we randomly split the 114 CT scans into 80 for training and 34 for testing. The above results were trained and verified by a deep learning model. Performance in segmenting lymph node stations and detecting metastasis were obtained.

## **RESULTS**

Performance in detecting metastatic lymph nodes showed FROC@1 of 0.3915, FROC@2 of 0.5183, FROC@3 of 0.6478, FROC@4 of 0.7408, FROC@5 of 0.8169, FROC@6 of 0.8535, mFROC of 0.6615, maxF1-score of 0.4385, the best performance of recall rate is 87.32%.

## **CONCLUSION**

A deep-learning model can be used to automatically detect metastatic lymph nodes in Contrast-enhanced CT images of patients with oral squamous cell carcinomas, which provides a new idea for the rapid detection of metastatic lymph nodes and realize the spread of knowledge of radiologists of head and neck imaging and improve the training efficiency of primary radiologists.

## **CLINICAL RELEVANCE/APPLICATION**

Ariji Y, Fukuda M, Kise Y et al. Contrast-enhanced computed tomography image assessment of cervical lymph node metastasis in patients with oral cancer by using a deep learning system of artificial intelligence. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2019 May;127(5):458-463. PMID: 30497907(Ariji Y, Sugita Y, Nagao T et al. CT evaluation of extranodal extension of cervical lymph node metastases in patients with oral squamous cell carcinoma using deep learning classification. *Oral Radiol.* 2020 Apr;36(2):148-155. PMID: 31197738 Our study improves on these studies, focusing on AI's automatic recognition and mapping of metastatic lymph nodes

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## Abstract Archives of the RSNA, 2023

T2-SPIN

### Imaging Informatics Tuesday Poster Discussions

#### Sub-Events

#### T2-SPIN-1 TransUNet for Fully Automated Abdominal Multi-Organ Segmentation

##### Participants

Khoschy Schawkat, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

##### PURPOSE

The purpose of this study was to validate the efficacy of CNN-Transformer hybrid architectures for multi-organ segmentation when applied to an independent, in-house dataset consisting of abdominal CT scans. The goal is to achieve a fully automated and highly accurate abdominal multi-organ segmentation computational framework that can be applied to the routine clinical workflow.

##### METHODS AND MATERIALS

The dataset consisted of 200 abdominal CT scans with 59 axial non-contrast and 131 contrast-enhanced abdominal (20 arterial phase, 90 portal venous phase, 19 late venous phase, and 12 elimination phase) clinical CT image series. Each CT volume consists of 44-392 slices of 512 x 512 pixels. The organ segmentations were performed manually and semiautomatically with manual verification on the liver, pancreas, left and right kidney, and spleen using free software for medical image processing (3D Slicer, version 4.11.0). We use the TransUNet architecture for our network, and train it using 5-fold cross validation with splits of 160/20 scans. TransUNet is trained on 4 organs of interest; liver, pancreas, kidneys and spleen. The 4 highest individual performing models are then ensembled. We report the average dice scores on a test set of 20 scans.

##### RESULTS

DICE scores for the labelmaps generated by the network, when compared against our ground truth images, for the liver, pancreas, kidneys, and spleen were 96.51, 83.02, 94.08, and 95.42, respectively. All organs of interest outperform the original scores reported in the authors' paper.

##### CONCLUSION

s TransUNet, a U-Net structure in combination with transformers, achieves excellent performance in CT based multi-organ segmentation as shown in our independent in-house dataset.

##### CLINICAL RELEVANCE/APPLICATION

Large scale application of this fully-automated CT based multi-organ segmentation model allows for efficient assessment of volumetric and radiomics data.

#### T2-SPIN-2 Semi-Automated Longitudinal Performance Monitoring for Deployed Large Vessel Occlusion Detection Algorithm

##### Participants

Chintan Shah, MD, MS, Cleveland, OH (*Presenter*) Spouse, Employee, Merck & Co, Inc

##### PURPOSE

Real-world performance of artificial intelligence (AI) models can vary and degrade over time. However, local performance and monitoring are often overlooked and are resource-intensive. We built a semi-automated method in order to reduce the manual effort required for local performance monitoring of an AI algorithm, using intracranial large vessel occlusion (LVO) as a use case. We utilize a framework consisting of a combination of structured reporting (SR), language processing (LP), and manual review of reports to assess performance.

##### METHODS AND MATERIALS

Between January and May 2022, 1702 CTAs of the head and neck for stroke alert were processed with a commercial LVO detection algorithm (Viz LVO, Viz.ai). Scans were done at 17 different sites, including 12 hospitals, and 5 standalone ERs. Exams were interpreted by a neuroradiologist, asked to indicate concordance via an SR template. An analytical pipeline was developed for processing the reports utilizing KNIME analytics software (KNIME AG, Switzerland). Radiologist concordance was determined using SR when available. Language processing (LP) was then applied utilizing regular expression searches to identify positive or negative reports. LP results were reviewed to determine accuracy. Indeterminate reports were manually reviewed and categorized, as were those marked as discordant by either SR or LP. Summary performance statistics were calculated.

##### RESULTS

Radiologist compliance with the SR concordance statement was 57% (966/1702). Among the remainder, 74.3% (547/736) could be categorized as positive or negative reports utilizing LP, leaving 11% of original volume (189/1702) requiring manual review. Of exams marked as discordant in the SR template by the interpreting radiologist, 63% (42/67) were correctly categorized. The performance of LP in categorizing reports showed a sensitivity, specificity, negative- (NPV), and positive-predictive value (PPV) of 85, 95, 99,

and 47%, respectively. After SR, LP and manual review, the sensitivity, specificity, NPV, and PPV of the commercial LVO detection algorithm were 77, 96, 98, and 59%, respectively.

## CONCLUSION

s SR alone was insufficient due to incomplete compliance and errors in categorization. The combined pipeline substantially reduced the workload of manual review better than structured reporting alone. The benefits persist after accounting for LP errors, which occurred more often with discordant than concordant results. We were able to corroborate local performance in this large multi-hospital dataset similar to that previously published.

## CLINICAL RELEVANCE/APPLICATION

Incorrect AI inference can negatively impact patient care; local validation is necessary. A semi-automated pipeline can reduce the manual workload of this process.

## T2-SPIN-3 MRI-based Radiomic Features Fail to Accurately Predict Primary Tumor Histology of Brain Metastases in External Validation: An Investigation of Class Imbalance and the Impact of Oversampling Techniques

### PURPOSE

Growing research demonstrates the ability to predict histology or genetic information of various malignancies using radiomic features extracted from imaging data. Our aim was to investigate MRI-based radiomics in predicting the primary tumor of brain metastases through internal and external validation, using oversampling techniques to address class imbalance.

### METHODS AND MATERIALS

The local ethics committee approved this retrospective multicenter study. We included non-small and small cell lung cancer, melanoma, breast, and colorectal cancer (five-class classification). Internal train/validation/test data were acquired between 2003-2021 from 159 patients (422 metastases). External validation was performed with 67 patients (260 metastases) from the publicly available Stanford BrainMetShare dataset ([aimi.stanford.edu/brainmetshare](http://aimi.stanford.edu/brainmetshare)). Pre-processing included brain extraction, bias correction, co-registration, intensity normalization, and semi-manual binary tumor segmentation. 2889 radiomic and three location features were extracted from T1w, post-contrast T1w, FLAIR, and wavelet transforms for each sequence (eight decompositions). The internal dataset was split 80-20 into train/validation and test sets. Patients with multiple metastases were assigned to either the train/validation or test set to prevent data leakage. Various oversampling and machine learning techniques (five-fold cross-validation) were tested and evaluated on the test sets using accuracy, precision, recall, F1 score, AUC-ROC, and cross-entropy loss.

### RESULTS

Baseline (no oversampling) internal test set performance was suboptimal with accuracy, F1 score, and AUC-ROC of 0.48, 0.27, and 0.66, respectively. Accuracy and F1 score were slightly improved after random oversampling of the training partition (0.49 and 0.39, respectively). The models were not able to generalize to the external test set. Incorrect data partitioning (oversampling before train/validation/test split) resulted in a massive overestimation of model performance.

## CONCLUSION

s Radiomics models' capability to predict histologic or genomic data from imaging should be critically assessed.

## CLINICAL RELEVANCE/APPLICATION

Primary tumor histology of brain metastases is usually obtained by invasive biopsy, posing the risk of morbidity and mortality. AI methods could potentially noninvasively acquire this information.

## T2-SPIN-4 Unsupervised Learning of Chest Radiographs and Clinical Data Accurately Predicts Time to ICU Admission of COVID-19 Patients

### PURPOSE

To improve allocation of ICU resources to treat COVID patients, we developed an unsupervised learning pipeline that utilizes chest radiographs and clinical data to accurately predict time to ICU admission.

### METHODS AND MATERIALS

This HIPAA-compliant study was performed with a waiver for informed consent following institutional review board approval. The training dataset consisted of 1834 COVID positive patients from March 9 and July 20, 2020 and the external testing dataset consisted of 475 COVID positive patients between March 1 and July 18, 2020. A vision transformer (ViT) autoencoder model was used to extract unsupervised imaging features from chest radiographs before undergoing dimensionality reduction using PCA to concentrate pertinent imaging characteristics. We then combined these imaging features with age, sex and common comorbidities prior to feeding into a partially unsupervised deep clustering survival machine (DCSM) for time to ICU prediction. DCSM characterizes each instance's survival information as a weighted combination of the learned expert distribution, which allows our model to better capture patient heterogeneity.

### RESULTS

Of the 1834 patients (54.9 $\pm$ 19.8 years old, 51% Female), 493 were admitted to the ICU (27%) within 1.88  $\pm$  3 days. The DCSM model predicted time to ICU admission with a c-index of .731  $\pm$  .02 on the training dataset and .72  $\pm$  .01 on the external patient dataset.

## CONCLUSION

s We developed a pipeline with ViT autoencoder and DCSM models that incorporates radiography and clinical data to accurately predict time to ICU admission in COVID patients. This method can also be applied to other similar clinical problems.

## CLINICAL RELEVANCE/APPLICATION

An unsupervised learning approach does not require manual annotation by a radiologist or healthcare worker and can be readily

deployed in the clinical setting where it can be used to triage patients for ICU admission.

## **T2-SPIN-5 Peritumoral and Intratumoral Texture Features Based on Multiparametric MRI and Multiple Machine Learning Methods to Preoperatively Evaluate the Pathological Outcomes of Pancreatic Cancer**

### **PURPOSE**

Radiomics-based preoperative evaluation of lymph node metastasis (LNM) and histological grade (HG) might facilitate the decision-making for pancreatic cancer and further efforts are needed to develop effective models.

### **METHODS AND MATERIALS**

The pancreatic cancer patients from the main center (n = 126) were assigned to the training and validation sets at a 4:1 ratio. The patients from the other center (n = 40) served as external test sets. The multiparametric MRI used in this study were: T2-weighted imaging, diffusion-weighted imaging, and dynamic contrast enhancement T1-weighted imaging. Peritumoral and intratumoral radiomics features were extracted which contained first-order, shape-based, and texture features. The following three-step method was applied to reduce the feature dimensionality: SelectKBest (a function from scikit-learn package), least absolute shrinkage and selection operator (LASSO), and recursive feature elimination based on random forest (RFE-RF). Six classifiers (random forest, logistic regression, support vector machine, K-nearest neighbor, decision tree, and XGBoost) were trained and selected based on their performance to construct the clinical, radiomics, and combination models.

### **RESULTS**

12 significant features for LNM and 11 features for HG were obtained. Random forest and logistic regression performed better than the other classifiers in evaluating LNM and HG, respectively, according to the surgical pathological results. The best performance was obtained with the models that combined peritumoral and intratumoral features with area under curve (AUC) values of 0.944 and 0.892 in the validation and external test sets for HG and 0.924 and 0.875 for LNM.

### **CONCLUSION**

s Radiomics holds the potential to evaluate LNM and HG of pancreatic cancer. The combination of peritumoral and intratumoral features will make models more accurate.

### **CLINICAL RELEVANCE/APPLICATION**

Radiomics is a noninvasive diagnosis and prediction method with theoretically high accuracy. In this two-center study, radiomics models for predicting LNM and HD of pancreatic cancer are successfully developed, and they enable radiologists to preoperatively stratify the risk of pancreatic cancer and provide explicit guidance for surgical options.

## **T2-SPIN-6 CFTR Modulator Therapy Influences Body Tissue Composition in Adults with Cystic Fibrosis: AI-based CT Analysis**

Participants

Marko Frings, MD, Essen, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

A poor nutritional status is associated with worse pulmonary function and survival in patients with cystic fibrosis. CF transmembrane conductance regulator (CFTR) modulators can improve both pulmonary function and body weight, but more data is required to assess its effects on body composition.

### **METHODS AND MATERIALS**

A pre-trained, deep-learning network was used to perform a fully automated body composition analysis (BCA) on chest CTs from adult patients with CF before (baseline) and after (longitudinal data) receiving triple-combination elexacaftor/ tezacaftor/ ivacaftor therapy. Muscle and adipose tissue were quantified and divided by bone volume to obtain body size-adjusted ratios. Results from BCA were correlated with lung function parameters and laboratory results.

### **RESULTS**

At baseline, chest CT-based BCA was conducted in 85 patients, with 34 (40%) receiving either mono or dual-combination CFTR modulator therapy. Mono/ dual-combination CFTR modulator therapy was associated with higher adipose tissue ratios. Muscle ratio correlated with percent predicted FEV1 ( $r=0.465$ ,  $p<0.001$ ) and six-minute walk test ( $r=0.392$ ,  $p<0.001$ ). ETI therapy improved percent predicted FEV1 (+ 12 points,  $p<0.001$ ) in patients with CF at 3 months, independent of baseline BCA results. Follow-up chest CT scans were performed in 18 patients after starting elexacaftor/ tezacaftor/ ivacaftor therapy. Triple-combination therapy was associated with an increase of the total adipose tissue ratio (+27%,  $p=0.007$ ). However, muscle ratio remained stable ( $p=0.304$ ).

### **CONCLUSION**

s Fully automated CT-based BCA showed significant correlations with pulmonary function and six-minute walk test. Our findings suggest that CFTR modulator therapies primarily affect adipose tissue, not muscle tissue, in adults with CF. BCA may provide information on the individual nutritional status of patients with CF each time a CT scan is performed.

### **CLINICAL RELEVANCE/APPLICATION**

Our work presents a state-of-the-art method to quantify all body tissues from routinely acquired chest CT scans, making body composition analysis useful for daily clinical practice.

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## Abstract Archives of the RSNA, 2023

T2-SPIR

### Interventional Radiology Tuesday Poster Discussions

#### Sub-Events

#### T2-SPIR-1 Preliminary Study on Changes in Biliary Microbiota Before and After Drainage of Malignant Biliary Obstruction

##### PURPOSE

To explore the changes in biliary microbiota before and after malignant biliary obstruction drainage, and to study the impact of biliary obstruction and drainage intervention on bile microbiota from the perspective of microbiota.

##### METHODS AND MATERIALS

42 patients with malignant biliary obstruction underwent percutaneous transhepatic catheter drainage (PTCD) in our department from January 2020 to December 2022. Under DSA guidance, a 22G drainage needle was inserted into the bile duct and confirmed by angiography to be located within the intrahepatic bile duct, after that 15-20ml of bile sample was extracted; Implantation of external or internal/external drainage tubes through guide wires; After 7 days, bile sample was extracted through a drainage tube; Two bile samples were sent for culture and next-generation sequencing. Collect and organize general patient information, including whether acute cholangitis has occurred and its severity, and whether antibiotics have been used for treatment.

##### RESULTS

Among the 42 patients, there were 20 cases of cholangiocarcinoma, 13 cases of pancreatic cancer, 3 cases of hepatocellular carcinoma, and 6 cases of hilar lymph node metastasis (gastrointestinal malignant tumor). The relative abundance of Burkholderia, Acinetobacter, Pseudomonas and Staphylococcus in the bile microbiota before drainage was high; After drainage, the abundance of Staphylococcus, Klebsiella, Enterobacteriaceae, Aeromonas, Paracoccus, Anaerococcus, Diplococcus, Campylobacter and Megabacterium in bile samples increased, and the diversity and evenness of other microbial species diversity in normal biliary tract decreased.

##### CONCLUSION

There is a stable microbiota in the normal biliary system, and the composition of the microbiota in malignant obstructive bile ducts is similar to that in non diseased bile ducts. After drainage, the abundance of Bacillus, Streptococcus, Staphylococcus and Klebsiella in bile increased, which inhibited the growth of other original bacteria in the bile duct ecology, leading to the reduction of species diversity and evenness of the microbial community. This imbalance of biliary microbiota can explain the clinical phenomenon that patients are more prone to biliary tract infections after biliary drainage.

##### CLINICAL RELEVANCE/APPLICATION

After biliary drainage, the microbial community in the bile duct undergoes dysbiosis, which may continue to occur with the invasion of more invasive dominant bacteria, leading to new biliary infections. Therefore, when patients continue to be infected, bile culture needs to be performed again and clinical medication needs to be adjusted.

#### T2-SPIR-2 Characterization of Power and Microwave Ablation Volumes Following Arterial Embolization in an In Vivo Porcine Liver Model

##### Participants

Hiro Sparks, MD, (*Presenter*) Nothing to Disclose

##### PURPOSE

Combination therapy using transarterial embolization and microwave ablation (MWA) is increasingly utilized to treat hepatocellular carcinomas larger than 3 cm in diameter. Predicting the size of a MWA zone after transarterial embolization is an important component of combination therapy treatment planning, specifically to minimize damage to critical structures while maintaining adequate tumor margins. Power-time settings found in manufacturer guidelines are not applicable in embolized liver lobes due to alterations in perfusion and related heat sink effects. This study aims to better characterize the relationship between ablation volume and power in an in vivo porcine liver model following embolization.

##### METHODS AND MATERIALS

With animal IRB approval, ten female Yorkshire swine, underwent either right (n= 5) or left (n= 5) hepatic artery embolization under fluoroscopic guidance. Subsequently, ultrasound guided MWA was performed in each liver segment (left lateral, left medial, right medial, right lateral) at either 30 Watts (W) (n=4 lobes), 60W (n=4), 65W (n=20), 90W (n=4), 120W (n=4), or 140W (n=4) continuously for 5 minutes (Certus 140 and PR-15, NeuWave Medical Inc, Madison, WI). Post-procedural volumetric segmentation was performed on standardized T1-weighted postcontrast images in arterial, venous, and delayed phases.

##### RESULTS

Paired Wilcoxon test demonstrated that ablation volumes in embolized lobes (16.9 +/- 8.9 cc) were significantly larger than non-embolized lobes (12.9 +/- 6.6 cc , P = 0.012, Figure 1). MWA power had a significant positive linear correlation with both embolized



(Pearson R,  $P < 0.01$ ) and non-embolized lobes ( $P < 0.01$ , Figure 2). The slope of the linear model corresponded to a 0.21 cc/W and 0.12 cc/W increase in ablation volume per unit wattage in embolized and non-embolized lobes, respectively. Embolization had a larger effect on ablation volumes at higher Wattage with a projected convergence of trendlines at 26.7 W, suggesting minimal effect of embolization at lower powered ablation. Model-derived ablation volumes at varying power are displayed in Table 1.

## CONCLUSION

s Linear models demonstrate a near two-fold increase in ablation zone volume per additional Watt when applied to embolized lobes relative to non-embolized lobes. Volumetric differences between embolized and non-embolized lobes were greater at higher power MWA.

## CLINICAL RELEVANCE/APPLICATION

In the setting of hepatic combination therapy, transarterial embolization decreased blood flow within the liver parenchyma and reduced heat dissipation during subsequent MWA. This work provides novel insight into of the interactions between power, embolization, and MWA volume, which are critically relevant to the safe planning of combination therapy.

## T2-SPIR-3 Relationships of Plasma Arginase-1 and Transcatheter Arterial Chemoembolization Resistance and Prognosis in Patients with Hepatocellular Carcinoma

### PURPOSE

To observe the plasma arginase-1 (Arg-1) levels in patients with hepatocellular carcinoma before transcatheter arterial chemoembolization (TACE) treatment, and to investigate the relationship between Plasma Arg-1 levels and TACE resistance and prognosis.

### METHODS AND MATERIALS

A total of 148 patients with HCC, treated with TACE, were included in the study. Pre-treatment enzyme-linked immunosorbent assay detected the patients' plasma ARG1 levels, and independent predictors of early TACE refractoriness were determined using a multivariate logistic regression model, based on which a predictive model was presented using a nomogram.

### RESULTS

The mean follow-up period was 13 (range 1-26) months; 120 (69.5%) of 148 patients developed TACE refractoriness. Risk of early TACE refractoriness was negatively correlated with plasma ARG1 levels, and multivariate analysis showed tumour size (OR=1.153, 95% CI=1.004-1.3249,  $P=0.044$ ), tumour number = 4 (OR=8.699, 95% CI=1.228-61.62,  $P=0.030$ ), platelet count (OR=0.981, 95% CI=0.969-0.993,  $P=0.002$ ), and plasma ARG1 levels (OR=0.267, 95% CI=0.110-0.698,  $P=0.007$ ) to be independent prognostic factors for early TACE refractoriness; the nomogram, based on four independent prognostic factors, showed good predictive accuracy for early TACE refractoriness incidence. The c-index value for nomogram of the entire cohort was 0.833 (95% CI = 0.760-0.905).

### CONCLUSION

s Plasma ARG1 levels correlated with early TACE refractoriness, higher levels being related to lower risk. The size and number of tumours and platelets, and plasma ARG1 levels were suggested to be prognostic factors affecting early TACE refractoriness. The nomogram could realise individualised prediction of the incidence of early TACE refractoriness.

## CLINICAL RELEVANCE/APPLICATION

This study aimed to investigate the association between pre-treatment plasma ARG1 levels and early transarterial chemoembolization refractoriness in hepatocellular carcinoma patients, by developing and validating a novel plasma ARG1-based nomogram for predicting early transarterial chemoembolization refractoriness. We believe that our study makes a significant contribution to the literature because we developed a nomogram based on ARG1 expression levels combined with different tumour parameters to predict the risk of early transarterial chemoembolization refractoriness in patients with hepatocellular carcinoma treated with transarterial chemoembolization.

## T2-SPIR-5 Freiburg Index of Post-TIPS Survival (FIPS): Independent External Validation in a Cohort of Patients from a Low Socio-economic South Asian Country

### PURPOSE

To externally validate the Freiburg Index of Post-TIPS Survival (FIPS) score in a new cohort of patients and assess its performance in predicting post-TIPS survival.

### METHODS AND MATERIALS

Study design: This is a retrospective study of patients who underwent TIPS placement between January 1, 2006, and January 31, 2022, at a tertiary care center. Study population: The study population consisted of 44 patients. This study adheres to the TRIPOD checklist to ensure transparent reporting and facilitate the interpretation and reproducibility of our findings. Predictor: The FIPS score was calculated for each patient in the validation cohort using the original FIPS score equation. Outcome: The primary outcome was post-TIPS survival at 28 days, 3 months and 6 months. Statistical analysis: The discrimination and calibration of the FIPS score were assessed using the c-statistic and calibration plot, respectively. The performance of the FIPS score was compared to its original validation study, as well as to other post-TIPS survival prognostic models.

### RESULTS

The FIPS score ranged from -4.2 to 2.44. The overall 6-month observed survival rate was 75.7%. Kaplan-Meier analysis showed that patients with a high-risk FIPS score ( $\geq 0.92$ ) demonstrated significantly reduced survival compared to those with a low-risk FIPS score ( $< 0.92$ ;  $p=0.018$ ). The FIPS score demonstrated good discrimination in predicting post-TIPS survival in comparison to the MELD 3.0 score (c-statistic = 0.825 for FIPS vs 0.752 for MELD 3.0, 95%). The calibration plot showed good agreement between the observed and predicted 1-year survival rates. FIPS score showed better calibration compared to MELD 3.0 (Brier score 0.131 for FIPS vs 0.221 for MELD 3.0). The observed-to-predicted ratio (O:P) for FIPS was 1.354 and that for MELD 3.0 was 1.065. The performance of the FIPS score in the validation cohort was comparable to its original validation study.

### CONCLUSION

s Our study provides an independent external validation of the FIPS score in a new cohort of patients undergoing TIPS placement. The FIPS score showed good performance in predicting post-TIPS survival, suggesting that it can be a valuable tool in clinical practice for estimating post-TIPS survival. Further studies are needed to explore the applicability of the FIPS score in other patient populations and settings.

#### **CLINICAL RELEVANCE/APPLICATION**

Transjugular intrahepatic portosystemic shunt (TIPS) is a commonly performed procedure for patients with complications of portal hypertension. The Freiburg Index of Post-TIPS Survival (FIPS) score is a prediction model that was developed to estimate post-TIPS survival in patients with variceal bleeding and/or ascites. However, its performance has not yet been validated in South Asian populations.

#### **T2-SPIR-6 CT-based Deep Learning Model of Hepatic Venous Pressure Gradient for Predicting the Prognosis of Hepatocellular Carcinoma with Transarterial Chemoembolization (CHANCE-CHESS): A Multicenter Cohort Study**

Participants

Yuqing Wang, Nanjing, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the impact of CT-based deep learning model of hepatic venous pressure gradient (HVPG) on prognosis of hepatocellular carcinoma (HCC) patients treated with transarterial chemoembolization (TACE) and systemic therapy.

#### **METHODS AND MATERIALS**

A total of 261 consecutive HCC patients treated with TACE and systemic therapy, and had a contrast-enhanced abdominal CT as part of their pre-surgical work-up, were retrospectively collected between January 2010 and December 2021. A CT-based HVPG Score, whose computed formula was:  $17.37 - 4.91 * \ln(\text{Liver/Spleen volume ratio}) + 3.8[\text{If presence of peri-hepatic ascites}]$ , was used to diagnose CSPH (HVPG=10mmHg) with a cut-off value 11.606. The 3D liver and spleen volume were automate calculated by a deep learning segmentation model, and the presence of peri-hepatic ascites was diagnosed by two independent investigators in portal-venous phase CT. Overall survival (OS) as study endpoint was analyzed by Kaplan-Meier and Cox regression.

#### **RESULTS**

Among 261 patients, 80(30.7%) were diagnosed with CSPH by CT-based HVPG Score. The median OS in CSPH group was significantly shorter than non-CSPH group (16.9 months vs. 20.7 months,  $P=0.022$ ). Multivariable analysis indicated that the presence of CSPH was a negative prognostic factor for OS (adjusted hazard ratio [HR], 1.423,  $P=0.045$ ).

#### **CONCLUSION**

s The segmentation model shows good performance in liver and spleen segmentation in HCC patients, which may help non-invasive HVPG assessment and other CT imaging studies in HCC patients. CT-based HVPG Score was significantly associated with poor outcome and should be taken into consideration when managing HCC patients underwent TACE and systemic therapy.

#### **CLINICAL RELEVANCE/APPLICATION**

This real-world study builds a non-invasive CT-based approach for CSPH diagnosis using deep learning model, and also highlights importance of CSPH management on clinical decision-making and trial design in HCC patients treated with TACE and systemic therapy.

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## Abstract Archives of the RSNA, 2023

T2-SPMK

### Musculoskeletal Imaging Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPMK-1 Adipose Distribution Patterns as Novel Prognostic Factors in Patients with HCC: A Systematic Review and Meta-analysis**

##### **PURPOSE**

Obesity is the established risk factor for several cancers, with hepatocellular carcinoma (HCC) being strongly associated with it. However, obesity is a heterogeneous disease with high individual differences in the distribution of adipose tissue. Quantifying associations between adipose distribution patterns and the prognosis of HCC might provide vital support for the individualized management of patients. Therefore, we aim to find the optimal indicator of pretreatment adipose distribution patterns for predicting the prognosis of HCC patients through meta-analysis.

##### **METHODS AND MATERIALS**

A systematic retrieve was performed to identify studies investigating the association of adipose distribution patterns and the prognosis of HCC from the inception of PubMed, Embase, Cochrane Library, and Web of Science databases to April 27, 2022. Relevant survival data were extracted to conduct the meta-analysis.

##### **RESULTS**

30 studies were included in our studies. A total of 6,783 people were enrolled in the study, including 2,456 patients with HCV and 1,228 patients with HBV. The pooled results indicated that only pretreatment high visceral to subcutaneous adipose tissue area ratio (VSR) (univariate analysis of OS: HR=1.42, 95%CI=1.28-1.58, P<0.00001; multivariate analysis of OS: HR=1.45, 95%CI=1.27-1.65, P<0.00001; univariate analysis of RFS: HR=1.30, 95%CI=1.08-1.56, P=0.006; multivariate analysis of RFS: HR=1.36, 95%CI=1.10-1.67, P=0.004) was both related to worse OS and RFS. Meanwhile, no significant heterogeneities were found and pooled results were relatively robust.

##### **CONCLUSION**

s Pretreatment VSR is the most valuable prognostic factor in adipose distribution patterns of HCC patients.

##### **CLINICAL RELEVANCE/APPLICATION**

This is the first meta-analysis to investigate how different adipose distribution patterns affect the prognosis of HCC patients. Our results demonstrate that pretreatment visceral to subcutaneous adipose tissue area ratio is the most valuable prognostic factor in adipose distribution patterns of HCC patients.

#### **T2-SPMK-2 Maintain Accuracy in Vertebral Density Measurement after Intravenous Injection using Material Decomposition Images in Dual-energy Spectral CT**

##### **PURPOSE**

To evaluate the ability of using the material decomposition (MD) images in dual-energy spectral CT in maintaining the vertebral bone mineral density (BMD) measurement accuracy in contrast-enhanced CT scans.

##### **METHODS AND MATERIALS**

Fifty-one abdominal patients (20 females, 31 males) who underwent dual-energy spectral CT imaging in the unenhanced and contrast-enhanced arterial phase (AP) and portal phase (PP) were included. The monochromatic images (40-140keV) and MD images using hydroxyapatite (HAP)-iodine as a base material pair were reconstructed. The HAP density was measured to represent BMD in the three imaging phases at the level of L1 with a region-of-interest (ROI) placed in a homogenous area of trabecular bone in the upper part of the vertebrae, excluding the cortex and focal inhomogeneous areas. The CT value in the same ROI was also measured using the 120kVp-like images to simulate measurement in conventional CT. Measurements in different imaging phases were statistically analyzed.

##### **RESULTS**

The CT value measurements for the L1 level vertebra in the unenhanced, AP and PP phases were 154.17±52.47HU, 175.44±58.40HU and 181.10±52.84HU, respectively. There were differences between the unenhanced and AP and the unenhanced and PP phases with p<0.05 showing iodine contrast involvement and contamination in the measurement. On the other hand, the HAP density measurement (in mg/cm<sup>3</sup>) in these three phases were 695.36±18.41, 695.34±23.35, and 694.95±16.88, respectively with virtually no change (p>0.05). Post hoc analysis showed that no significant differences were present in HAP (Iodine) (p=0.993).

##### **CONCLUSION**

s Our results showed that the conventional CT attenuation measurement in the vertebra after contrast injection may be skewed by the iodine involvement. The material density (HAP) measurement using the material decomposition in dual-energy spectral CT eliminated the iodine influence and provided quantitative and consistent measurement for BMD of the vertebra.

## CLINICAL RELEVANCE/APPLICATION

The material density (HAP) measurement using the material decomposition in dual-energy spectral CT may be used to provide a quantitative and consistent vertebral bone mineral density measurement.

### T2-SPMK-3 Opportunistic Deep Learning 3D-CT for Osteoporosis: Optimizing Multimodal Strategies for DXA Estimation

Participants  
Hanqing Yao, STANFORD, CA (*Presenter*) Nothing to Disclose

#### PURPOSE

Osteoporosis is a disease marked by reduced trabecular bone mass and increased fracture risk. Dual X-ray Absorptiometry (DXA) is the clinical standard for assessing spine bone mineral density (BMD) and diagnosing osteoporosis, but remains underutilized. With ~25 million annual CTs of the chest and abdomen in the US, there exists a potential to screen for osteoporosis using CT without incurring extra cost, patient time, or radiation exposure. We hypothesized that we can (1) optimize the structure of 3D spine ROIs from abdominal CTs for DXA T-score estimation; (2) predict osteoporosis incidence by combining image measures, scanner parameters, and demographic information.

#### METHODS AND MATERIALS

Our study comprised 447 CT scans on 432 patients (332 women, mean age 65) who received a contrast-enhanced CT scan within 6 months of DXA screening (301/146 train/test scans). To optimize our 3D ROIs, we evaluated four methods for automatically segmenting and extracting 3D HU measures - (1) entire vertebra segmentations; (2) only vertebral bodies excluding spinous/transverse processes; (3) only vertebral bodies with HU constraints to exclude cortical bones; (4) 1 cm radius spherical ROIs placed at the centroids of the vertebral bodies. We augmented HU measures with tube voltage, contrast phase, slice thickness, sex, age and race in a linear regression model to predict DXA T-scores.

#### RESULTS

Entire vertebra segmentations exhibited the highest correlation across all vertebral levels (L1-L4), with Pearson correlation coefficients of 0.59, 0.57, 0.52, and 0.52, which were significantly higher than correlations of the other 3D ROI methods ( $P < 0.001$ ). Including additional covariates improved the correlations at every level: 0.67, 0.68, 0.67, and 0.67 for L1-L4. Spine HU, tube voltage, and age-range buckets starting from 65 years old were significant predictors of T-scores ( $P < 0.001$ ) for all levels. Using a  $-2.5$  T-score osteoporosis threshold, we obtained area under the receiver operator characteristic curves (AUCs) of 0.69 (95% CI 0.59 - 0.79) for L1, 0.65 (95% CI 0.56 - 0.75) for L2, 0.66 (95% CI 0.57 - 0.75) for L3, and 0.63 (95% CI 0.54 - 0.72) for L4.

#### CONCLUSION

Optimizing the structure of 3D ROIs demonstrates the superiority of entire vertebra segmentations. Augmenting ROIs with scanner-based parameters can improve T-score estimates, highlighting the potential to correct for scanner-based variations. Our features significance analysis indicates that a combination of imaging, scanner-based, and demographic features are important for DXA estimation.

## CLINICAL RELEVANCE/APPLICATION

This study shows the feasibility of opportunistic CT to approximate DXA T-scores by accounting for scanner-based variations.

### T2-SPMK-4 Muscle Kinetics on Diffusion-weighted Imaging during Plantar Flexion for Age-related Muscle Quality in Healthy Calf Muscles

Participants  
Xinyue Zhang, Guangzhou, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the feasibility of muscle kinetics on DWI during exercise for assessing age-related muscle quality in healthy skeletal muscles.

#### METHODS AND MATERIALS

This prospective study recruited 43 healthy participants (20-60 years) from November 2021 to December 2022. A plantar flexion-tailored DWI protocol was sequentially implemented with one rest phase, one exercise phase, and recovery 1, 2, and 3 phases. Each phase was corresponding to one DWI scanning. Absolute apparent diffusion coefficient (aADC,  $\times 10^{-3}$  mm<sup>2</sup>/sec) of triceps surae (TRIC) was measured in the ADC maps by two radiologists to acquire aADC in the rest phase (aADCrest), aADC in the exercise phase (aADCexer), and aADC in recovery phases (aADCreco1, 2, and 3). Based on aADC, muscle kinetics on DWI was developed by additionally collecting relative ADC (rADC,  $\times 10^{-3}$  mm<sup>2</sup>/sec) and recovery duration: rADC in the exercise phase (rADCexer) as aADCexer - aADCrest; rADC in the recovery phases (rADCreco1, 2, and 3) as aADCreco1, 2, and 3 - aADCexer; recovery duration recorded as 1min, 2min, 3min, or >3min when first aADCreco showed no statistically significant difference from aADCrest. The independent or paired t-test was performed for comparing differences. The receiver operating characteristic curves were constructed for significant indices.

#### RESULTS

Two legs were imaged in all 43 participants (age range/mean, 23-58/41 $\pm$ 10 years; 22 male; 18 youth <40 years). Aged showed lower magnitudes of right-sided rADCexer, rADCreco1, rADCreco2, and rADCreco3 than youth with  $P < .05$ ; aged had longer recovery durations of >3min than 2min in youth for left leg. Right-sided rADCexer (0.76[0.60, 0.91];  $P = .005$ ) performed best for age-related muscle quality.

#### CONCLUSION

When implementing a plantar flexion-tailored DWI protocol, rADCexer performed best for age-related muscle quality in healthy TRIC.

## CLINICAL RELEVANCE/APPLICATION

Muscle kinetics on diffusion-weighted imaging during plantar flexion were feasible for assessing age-related muscle quality in healthy calf muscles.

## **T2-SPMK-5 Changes in Paraspinal Muscles Density in Young Patients with Chronic Non-specific Lower Back Pain Quantified by Using Dual-energy CT**

Participants

Jian Xiang, Changsha, Hunan, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

The purpose of this study was to compare the muscle density of bilateral erector spinae muscles and multifidus muscles in chronic non-specific lower back pain patients with that of a normal control group.

### **METHODS AND MATERIALS**

This study was conducted as a prospective study and two groups of people were studied: CNLBP group, included 56 patients (age: 25.78±1.963, sex ratio: 21 Male/35 Female), control group, included 51 healthy volunteers (age: 25.12±1.812, sex ratio: 19 Male/32 Female). All individuals received spectral CT imaging on lumbar. Virtual monochromatic images at 70 keV were generated. CT value which indicated density of multifidus (L2/3 to L5/S1 levels) and erector spinae (L1/2 to L4/5 levels) muscles was measured in Hounsfield units (HU) on the left and right sides, and the mean value of left and right was calculated. Density of multifidus and erector spinae muscle among CNLBP patients and healthy volunteers were compared by using independent samples t-test.

### **RESULTS**

CNLBP group had lower muscle density at L4/5 level and L5/S1 level in multifidus muscle compared to control group (CNLBP vs. normal: 42.891±6.232 vs. 47.381±5.965 HU for L4/5,  $t=-3.8$ ,  $p<0.001$ ; 34.778±8.751 vs. 46.7265±6.264 HU for L5/S1,  $t=-8.049$ ,  $p<0.001$ ), however that for L2/3 (CNLBP vs. normal: 48.616±4.439 vs. 49.908±6.614 HU), L3/4 (CNLBP vs. normal: 47.034±5.109 vs. 48.931±6.961 HU) showed no statistical significance (both  $P>0.05$ ). The difference in density of the erector spinae muscle at each level between the CNLBP group and normal control group was not statistically significant (CNLBP vs. normal: 48.814±9.332 vs. 51.176±9.488 HU for L1/2; 48.779±3.481 vs. 49.086±4.373 HU for L2/3; 46.755±3.930 vs. 48.304±4.826 HU for L3/4; 43.421±7.018 vs. 45.352±6.209 HU for L4/5; all  $P > 0.05$ ).

### **CONCLUSION**

s Patients with CNLBP have lower density in the multifidus muscle at the L4/5 and L5/S1 levels than healthy volunteers.

### **CLINICAL RELEVANCE/APPLICATION**

The pathogenesis of CNLBP is unclear. Muscle density can be used to quantify the evaluation of fat and connective tissue infiltration. This study shows that the density of multifidus muscle at the L4/5 and L5/S1 levels is significantly lower in patients with CNLBP compared to healthy volunteers. Dual-energy CT measurement of muscle density can identify changes in the paravertebral muscles of patients with CNLBP, contributing the understanding of underlying mechanism, early diagnosis thus helping patients conducting interventions that can restore paravertebral muscle function and reduce recurrence of low back pain symptoms.

## **T2-SPMK-7 Non-expert usage of MRI-based Neuropathy Score Reporting and Data System (NS-RADS): Multi-Institutional Wider-usability Study of Peripheral Neuropathy Conditions**

Participants

Mina Guirguis, Dallas, TX (*Presenter*) Nothing to Disclose

Bayan Mogharrabi, BS, Dallas, TX (*Presenter*) Nothing to Disclose

### **PURPOSE**

The aim of our study was to determine inter-reader reliability and diagnostic performance of classification and severity scales of NS-RADS among radiology readers of differing experience levels after limited teaching of the scoring system by expert radiologists at their centers. We hypothesized that participants across a broad range of experiences can exhibit good accuracy and inter-reader reliability using the scoring system.

### **METHODS AND MATERIALS**

This is a multi-institutional, cross-sectional, retrospective study of MRI cases of nerves and proven peripheral neuropathy (PN) conditions. 31 radiology readers with varying degrees of training and experience levels were recruited from different institutions. Each reader attended and received a structured presentation that described the NS-RADS classification system containing imaging examples and illustrations, and a published article on this subject. After training, the readers were asked to perform NS-RADS scoring with designation of category, sub-category, and the most likely diagnosis. Inter-reader agreements were evaluated by Conger's kappa for all readers, trainees, and attendings. Diagnostic accuracy was calculated for each reader as the percent correct diagnosis. A linear mixed model was used to estimate and compare accuracy between the trainees and attendings.

### **RESULTS**

Across all 31 total (trainee and attending) readers evaluating 150 different MRI cases, the agreement was good for NS-RADS category and fair for NS-RADS subcategory. Inter-reader agreements of trainees were comparable to the attendings. The estimated accuracy for attendings was 0.73 with 95% CI (0.62, 0.81) and for trainees was 0.69 (0.58, 0.78) without significant difference in average accuracies between the trainees and attendings ( $p = 0.5$ ).

### **CONCLUSION**

s Non-expert radiologists interpreted PN conditions with good accuracy and fair to good inter-reader reliability using the NS-RADS scoring system previously validated by expert radiologists.

### **CLINICAL RELEVANCE/APPLICATION**

With limited training, the readers of differing experience and training levels can use NS-RADS scoring system in their practice to standardize MRI reporting and prudently aid in the management of PN patients.

## **T2-SPMK-8 Feasibility Assessment of Deep-learning-based Automatic Segmentation of Intercostal Muscles on**

## Computed Tomography Based on Bayesian U-Net

### PURPOSE

To assess the feasibility of deep-learning-based automatic segmentation of intercostal muscles (IMs) using Bayesian U-net on CT images in 110 patients suspected of lung cancer.

### METHODS AND MATERIALS

Using an original training dataset based on manual segmentation of IM in 10 arbitrarily selected cases, automatic segmentation with Bayesian U-Net was obtained in remaining 100 cases. Automatic segmentation was improved by updated training dataset created by manual modification in 10 cases selected in order of larger segmentation uncertainty among the remaining cases, in addition to the original one. For 95 cases, total IM volume (IMV) quantified with automatic segmentation based on final training dataset after similar process was repeated five times, were compared with quantitative pulmonary function and geographic data. For another 16 cases included as an external data set, predictive labels (PL) were generated using the identical final training dataset, and two ground truth (GT1 and GT2) was obtained with independent manual segmentation of right IM by two radiologists in median coronal cross-sections with a thickness of 10mm. Accuracy of IM segmentation by the Bayesian U-Net was assessed with Dice score (DS) as well as Bland-Altman plot analysis for regional IMV between the PL and each of GTs.

### RESULTS

The mean values and limits of agreement for regional IMV between PL and GT1 and between PL and GT2 were -1.2 and 0.3 to -2.6, and -1.7 and 0.4 to -3.7 mm<sup>3</sup>, indicating excellent concordance and slight underestimation tendency for PL. The DSs between GT1 and GT2, between GT1 and PL, and between GT2 and PL were 0.78, 0.77, and 0.80, respectively. Total IMV was larger in males (378.7 ± 66.9 cm<sup>3</sup>) as compared with females (246.7 ± 41.2 cm<sup>3</sup>, and correlated positively with height (r=0.69), body weight (r=0.70), BMI (r=0.48), forced vital capacity (r=0.56), and forced expiratory volume in 1 second (r=0.47).

### CONCLUSION

s Automatic segmentation of IM based on Bayesian U-Net was feasible and quantified total IMV correlated with body habitus and pulmonary function test parameters.

### CLINICAL RELEVANCE/APPLICATION

Automatic IM segmentation based on Bayesian U-Net can be applicable to evaluate the relation between IM impairment and respiratory functional disorder.

## T2-SPMK-9 Radiological Markers of Regenerative Maturity in Grade II Muscle Tears

Participants

Natalia Pugliese SR, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

### PURPOSE

To establish radiological signs of regenerative maturity or immaturity of muscle tears using ultrasound (US) and magnetic resonance imaging (MRI).

### METHODS AND MATERIALS

Between August 2020 and April 2021, thirty six patients with grade 2 muscle tears diagnosed by ultrasound were included. Follow-up MRI and US was performed four weeks after diagnosis, and clinical follow-up four weeks later. According to the presence or absence of symptoms in these two instances, they were classified as immature or mature regeneration, respectively.

### RESULTS

At follow-up imaging, there were no significant differences (p= 0.08) regarding the characteristics of fibers between symptomatic and asymptomatic tears, with 12 (58%) of the asymptomatic tears showing effacement or retraction of the myotendinous junction. We found heterogeneous echogenicity in 13 (87%) symptomatic and 11 (52%) asymptomatic tears, and peripheral hypoechoogenicity in 1 (7%) symptomatic and 8 (38%) asymptomatic (p= 0.03). A positive Doppler signal was identified in 3 (14%) asymptomatic and 15 (100%) symptomatic (p <0.0001) tears. By MRI, the symptomatic tears showed greater signs of edema (p = 0.002), observing linear peripheral edema in 12 (57%) of the asymptomatic ones. The presence of positive Doppler was the variable statistically most related to the presence of symptoms, with an area under the ROC curve of 0.93 (95% CI 0.79-0.99).

### CONCLUSION

s Peripheral linear edema by MRI and US is a frequent finding in asymptomatic patients with regenerative maturity. The absence of a Doppler signal in the ultrasound controls one month after the muscle injury, was the best predictor of regenerative maturity.

### CLINICAL RELEVANCE/APPLICATION

Diagnostic imaging studies provide information that influences the decision to return to play, being the absence of Doppler, a useful predictor of regenerative maturity.

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## Abstract Archives of the RSNA, 2023

T2-SPMS

### Multisystem Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPMS-1 Abbreviated Whole-Body MRI as a Novel Imaging Modality for Pediatric Lymphoma Follow-Up: A Multicenter Study**

##### Participants

Bingjie Zheng, MD, Zhengzhou, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

This multicenter prospective study aimed to evaluate the diagnostic confidence and reproducibility of a novel abbreviated 30-minute whole-body MRI (WB-MRI) for response assessment in children and adolescent patients with lymphoma.

##### **METHODS AND MATERIALS**

The study included 103 pediatric patients aged 0 to 18 years with pathologically confirmed lymphoma, who underwent both PET/CT and abbreviated WB-MRI at baseline and during follow-up. Image quality of abbreviated WB-MRI was evaluated using a 5-point Likert scale, and interobserver agreement was assessed. Sensitivity, specificity, and accuracy of abbreviated WB-MRI for detecting residual or recurrent disease were calculated, with PET/CT used as the reference standard.

##### **RESULTS**

The image quality of abbreviated WB-MRI was rated good or excellent in 97% of cases, with high interobserver agreement. Abbreviated WB-MRI demonstrated a sensitivity of 90%, specificity of 96%, and accuracy of 94% for detecting residual or recurrent disease, with excellent agreement between abbreviated WB-MRI and PET/CT findings.

##### **CONCLUSION**

s Abbreviated WB-MRI is a feasible and accurate imaging modality for follow-up of pediatric lymphoma patients undergoing various treatments, with high diagnostic performance and excellent image quality. The non-invasive nature and lack of radiation exposure make it a favorable option compared to PET/CT, especially for pediatric patients.

##### **CLINICAL RELEVANCE/APPLICATION**

The results of this study suggest that abbreviated WB-MRI is a clinically relevant and useful imaging modality for follow-up of pediatric patients with lymphoma, offering high diagnostic accuracy and image quality. Abbreviated WB-MRI has the advantage of being non-invasive and without radiation exposure, making it an attractive alternative to PET/CT for monitoring disease progression and response to treatment in pediatric patients.

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## Abstract Archives of the RSNA, 2023

T2-SPNMMI

### Nuclear Medicine & Molecular Imaging Tuesday Poster Discussions

#### Sub-Events

#### T2-SPNMMI- Diagnosis of Primary Chyluria by <sup>99</sup>Tcm-dextran Lymphography<sup>1</sup>

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the diagnostic value of <sup>99</sup>Tcm-dextran (DX) lymphography in primary chyluria.

#### METHODS AND MATERIALS

Fifty patients with primary chyluria admitted and diagnosed in our hospital from January 2011 to 2020 were retrospectively collected, and all patients underwent <sup>99</sup>Tcm-DX lymphography with complete imaging data to observe the lymphatic reflux in bilateral lymphatic vessels of lower limbs, bilateral iliac lymphatics, bilateral lumbar trunks and thoracic duct, as well as the presence of abnormal radiological distribution in both kidney areas, abdominopelvic region and chest.

#### RESULTS

Among 50 patients with primary chyluria, early visualization was seen in the renal area in 20 cases (40%), including 11 cases (22.0%) unilaterally and 9 cases (18.0%) bilaterally; 13 cases (26.0%) had unilateral or bilateral slow lymphatic reflux in the lower extremities, 6 cases (12.0%) had abnormal increased radioactivity in the abdomen, 5 cases (10.0%) had abnormal increased radioactivity in the chest; In this study, the thoracic duct visualization was divided into three types: type I: 22 cases (44.0%) with obstruction at the end of the thoracic duct, which showed persistent widening of the venous angle visualization or abnormal drainage, type II: 14 cases (28.0%) with no visualization at the end of the thoracic duct, and type III: 14 cases (28.0%) with transient visualization at the end of the thoracic duct.

#### CONCLUSION

<sup>99</sup>Tcm-DX is useful for observing abnormal renal reflux in patients with primary celiac disease, dynamically assessing systemic lymphatic reflux and thoracic duct reflux, and is a guide for the diagnosis of primary chyluria and for assisting in the search for its cause.

#### CLINICAL RELEVANCE/APPLICATION

It is a guide for the diagnosis of primary celiac disease and for assisting in the search for its cause.

#### T2-SPNMMI- PSMA PET Imaging Response Following a Single Dose <sup>225</sup>Ac J591 Therapy in Metastatic Castration Resistant Prostate Cancer: A Lesion and Patient Based Analysis<sup>2</sup>

Participants

Judith Stangl-Kremser, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

#### PURPOSE

Radionuclide therapy with <sup>225</sup>Ac-labeled PSMA targeting agents have been studied in clinical trials and emerged as a promising treatment option in the management of men with mCRPC. We hypothesized that bone, nodal or visceral metastatic sites may differ in response to this treatment.

#### METHODS AND MATERIALS

28 men with mCRPC were treated with <sup>225</sup>Ac-PSMA-J591 from 2017 to 2020 at our center on a prospective single ascending dose phase 1 trial (NCT03276572). Molecular imaging, assessing PSMA expression, was performed in most patients but was not used to select trial participants. We retrospectively analyzed 20 cases that had both a baseline <sup>68</sup>Ga-PSMA-11 PET/CT (bPET) and a post-treatment (fPET). On the patient-level, biochemical response was defined as  $\geq 50\%$  PSA decline after treatment (PSA50 response), and the overall response was assessed on the fPET using PERCIST criteria and on conventional imaging in cases with measurable disease using RECIST guidelines. For the lesion-based analysis, the SUV<sub>peak</sub> of the 3 most- and 3 least-avid lesions of the metastatic sites were measured. Pre- and post-treatment SUV<sub>peak</sub> as well as percentage decline of SUV<sub>peak</sub> were compared for every lesion. On the patient and lesion level, an objective imaging response was defined as complete or partial response. For the latter, the frequency of an objective imaging response was compared in bone, node, and visceral lesions.

#### RESULTS

Twenty patients were analyzed. Of those, 13 men (65%) had prior <sup>223</sup>Ra (n=5), <sup>177</sup>Lu-PSMA (n=10), two had both. The baseline PSA was 192.5 ng/mL (IQR: 69.1-887.3). 11 men had a PSA50 response and 7 an overall objective imaging response on the fPET. 8 cases had measurable disease; the majority had stable disease and one had progressive disease. Men with a biochemical response trended to have higher odds of having an imaging response. Overall, 204 lesions were measured on the bPET. The median SUV<sub>peak</sub> was 4.1 (IQR 1.6-10.5). The decline of post-treatment SUV<sub>peak</sub> was significant within all metastatic categories. The median



decline in SUVpeak from bPET to fPET was -40% (IQR -71;-1) in bone lesions, -52% (IQR -81;-14) in visceral lesions, and -23% (IQR -53;-6) in nodal lesions. The objective imaging response rate was different in bone lesions (52%), visceral lesions (71%), and nodal lesions (39%) (p=0.0273).

## **CONCLUSION**

s 225Ac-PSMA-J591 effectively treats all metastatic categories. However, bone and visceral lesions may respond better than nodal lesions. Our findings need further validation but are informative for trial design and patient counselling.

## **CLINICAL RELEVANCE/APPLICATION**

Metastatic patterns may influence treatment response to 225Ac-labeled PSMA targeting agents in men with mCRPC and should be considered in treatment planning.

## **T2-SPNMMI- High-risk Prostate Cancer Staging: Predictors of Extra-prostatic Spread in 18F-PSMA-1007 PET-CT Scans**

### **PURPOSE**

PSMA PET-CT has superior diagnostic accuracy over conventional imaging in staging patients with high-risk prostate cancer due to its ability to detect occult extra-prostatic disease. High-risk is defined as per the National Comprehensive Cancer Network: PSA = 20 ng/ml, Gleason score = 8, or a clinical stage of =T3. We sought to explore the predictors of bony and nodal spread in our patient cohort of high risk patients.

### **METHODS AND MATERIALS**

A total of 411 18F-PSMA PET-CT studies were identified through local PACS database search which were done during the 18-month period between 01/01/2021 - 30/06/2022. A total of 192 consecutive patients who underwent a staging PSMA PET-CT scan for high risk disease over an 18 month period were retrospectively reviewed (duplicate records, re-staging studies and patients who had undergone prior treatment were excluded). Medical record search was also done to acquire data for parameters such as PSA, prostate volume (PSA density) Gleason score, MRI Staging and PI-RADS. The data was then categorized based on the PSMA PET-CT reports into extra prostatic disease and confined prostatic disease. Extra prostatic disease is defined for the purposed of this study, as any nodal involvement and/or bone metastases.

### **RESULTS**

Of the 192 patients, 68 (35%) had evidence of malignant spread to nodes, bones or both (PMSA spread +ve). The remainder (124) showed no evidence of nodal or bony metastatic disease. There was significant difference in PSA levels (p < 0.01; Mann-Whitney U test) between positive (46.3 ; n=68) and negative (26 ; n= 124). A significant proportion (47%) of node positive scans on PSMA were reported to have no nodal involvement on MRI. 50% of patients Gleason score = 8 showed extra-prostatic spread on PSMA PET-CT.

### **CONCLUSION**

s PSA level and Gleason score were accurate predictors of extra-prostatic disease in patients with high-risk prostatic carcinoma. DRE staging was less accurate. A significant proportion of node positive PSMA scans were deemed to have no nodal involvement on MRI scans.

### **CLINICAL RELEVANCE/APPLICATION**

Within high-risk carcinoma of the prostate, Gleason score and PSA act as accurate predictors of extra-prostatic spread. The role of DRE staging alone as a parameter for high-risk classification needs to be explored further. Almost half of node positive disease on PSMA PET-CT were not picked up by MRI, reiterating the superiority of PET.

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## Abstract Archives of the RSNA, 2023

T2-SPNPM

### Noninterpretive Skills (Beyond Imaging) Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPNPM-1 Widening Disparities in Noninvasive Diagnostic Imaging Volume and wRVU Utilization for Medicare Across Hospital Referral Regions**

##### Participants

Aditya Khurana, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate all US Medicare imaging claims for potential healthcare disparities in medical imaging utilization across 306 US hospital referral regions (HRRs).

##### METHODS AND MATERIALS

All diagnostic imaging claims submitted to Medicare from 2013 to 2019 were extracted from the Medicare POSPUF dataset, including year, CPT code, wRVUs, and zip code. Dartmouth imaging atlas was used to assign each claim to an HRR via zipcode and gather the number of Medicare enrollees in each HRR. HRRs were aggregated into percentiles based on exam and wRVU utilization rates (highest 10th percentile, 25th, 50th, 75th, and 90th). Compound annual growth rates (CAGR) were calculated.

##### RESULTS

Imaging exams totaled 156,739,445 in 2013 and 176,297,932 (+19,558,487, +12.5%) in 2019. In 2013, there were 52,179,386 total imaging wRVUs, and 63,276,990 (+21.3%) in 2019. The exam utilization rate per 1,000 Medicare enrollees across all HRRs was 3188/1,000 US Medicare enrollees in 2013 and 3077 in 2019 (median 1940, standard deviation 948; -135/1,000 since 2013, CAGR -0.6%). The 2019 exam utilization rate across HRRs ranged from 288 in Terre Haute, IN to 9517 in Rochester, MN (33 fold, 188.3% difference). The exam utilization rate CAGR from 2013 to 2019 by HRR utilization rate percentile was 90th percentile +0.1%, 75th +0.2%, 50th -1.6%, 25th -1.9%, and 10th -2.9%. The wRVU utilization rate per 1,000 Medicare enrollees across HRRs was 1739 in 2013 and 2106 in 2019 (median 1940, standard deviation 948; +367.6 since 2013, CAGR +2.5%). The 2019 wRVU utilization rate across HRRs ranged from 237 in Sun City, AZ to 7237 in Rochester, MN (31 fold, 187.3% difference). The wRVU utilization rate CAGR from 2013 to 2019 by HRR wRVU percentile was 90th percentile +3.2%, 75th +3.7%, 50th +1.6%, 25th +1.6%, and 10th -0.01%.

##### CONCLUSION

s Imaging volume is decreasing and wRVUs are increasing in the US Medicare population, suggesting substitution of lower wRVU exams for those of higher wRVUs. Imaging utilization rates vary by more than 30 fold across HRRs, with the gap widening from 2013 to 2019 and HRRs with high percentile wRVUs per capita growing nearly 3.5% faster than others, annually. These findings could reflect variations in resources and/or allocation of some services across HRRs, and raise potential concern that imaging disparities across HRRs could be increasing, especially access to higher wRVU advanced imaging services.

##### CLINICAL RELEVANCE/APPLICATION

Variations in imaging across hospital referral regions are increasing, raising potential concern about healthcare access disparities for some imaging services, especially high wRVU services.

#### **T2-SPNPM-2 A Cross-sectional Analysis Examining the Disparities in Cancer Screening Among American Indians or Alaska Natives**

##### PURPOSE

American Indians or Alaska Natives (AIANs) represent 3% of the US population and have experienced continued systemic racism, resulting in limited access to health care, education, and other economic opportunities. Nationally, the incidence of cancer among AIANs is higher than among Whites for cancers including lung, colorectal, and cervical cancer. The purpose of this cross-sectional analysis is to examine potential disparities in cancer screening among AIANs.

##### METHODS AND MATERIALS

We performed a retrospective analysis of the 2021 National Health Interview Survey (NHIS) data, a nationally representative cross-sectional survey with a response rate of 50.9%. Multiple variable analysis was performed to evaluate the association between AIANs and Whites with respect to colorectal and breast cancer screening adherence.

##### RESULTS

For colorectal cancer (CRC) screening, 14,969 respondents between the age of 45-75 were included. 63% of eligible respondents reported receiving recommended CRC screening compared to 56% of AIANs. Compared to Whites, AIANs were less likely to report recommended CRC screening (OR 0.49, 95% CI 0.17, 0.83,  $p < 0.001$ ). For breast cancer screening, 9,164 respondents between the age of 40-74 were included. 89% of eligible respondents reported receiving routine screening mammography compared to 83% of AIANs. Compared to Whites, AIANs were less likely to report receiving routine mammography (OR 0.317, 95% CI 0.28, 0.36,  $p <$

0.001). For AIANs, patients who reported difficulty paying medical bills (OR 0.42, 95% CI 0.26, 0.69,  $p < 0.001$ ) and education levels of high school or lower (OR 0.12, 95% CI 0.067, 0.21,  $p < 0.001$ ) were less likely to report screening mammography use than their respective counterparts.

## **CONCLUSION**

s AIANs were less likely to report recommended CRC and breast cancer screening compared to Whites, which may partially explain the increased incidence of these cancers in the population.

## **CLINICAL RELEVANCE/APPLICATION**

Additional federal and state funding should be invested to reduce health disparities and improve the rates of cancer screening in the AIAN population.

## **T2-SPNPM-3 Prevalence of Financial Hardship among Radiology Outpatients and Role of Price Transparency**

Participants

Desiree Caballero, MSc, BS, Irvine, CA (*Presenter*) Nothing to Disclose

## **PURPOSE**

The aim of this study was to assess the prevalence of medical financial hardship among patients receiving outpatient imaging at a tertiary center in Southern California and its correlation with price transparency

## **METHODS AND MATERIALS**

Between November 2022 and March 2023 adult patients receiving outpatient advanced imaging (MRI, CT, PET/CT) at a tertiary academic center in Southern California were asked to complete a 15-minute survey screening for financial hardship. Multivariable logistic regression models were used to assess the association between financial hardship and price transparency.

## **RESULTS**

430 patients were included (mean age:57.7 (SD15.6); 57.6% female; 45.9% Caucasian; 5% Black;19.2% Asian; 21.3% Hispanic). There were 14.2% Spanish speakers, and 4.4% Vietnamese. A total of 1.4% were uninsured, 11.7% and 37.3% had Medicaid and Medicare, respectively and 47.2% had commercial insurance. Mean score for financial worry measured by Comprehensive Score for financial Toxicity (COST score) was 24 (SD11) and 34% reported imaging was a financial hardship for them and their family. Material hardship (e.g., medical debt) was reported by 46% with less than 1% declaring bankruptcy. Cost related care nonadherence and imaging nonadherence were reported by 46% and 4.3%, respectively. Having interest in knowing imaging out-of-pocket cost (OOPC) prior to receipt of imaging was associated with lower likelihood of imaging hardship (OR 0.28;95% CI 0.15,0.52), material hardship (OR 0.47; 95% CI 25, 88), and cost-related care nonadherence (OR, 0.40; 95% CI 0.18, 0.90). There was no significant association between knowing imaging OOPC estimate prior to receipt of imaging and financial hardship.

## **CONCLUSION**

s Financial hardship is common in outpatient radiology encounters. While those interested in knowing their imaging OOPC are less likely to experience financial hardship, knowing the OOPC does not impact financial hardship.

## **CLINICAL RELEVANCE/APPLICATION**

Given the high prevalence of financial hardship among radiology outpatients, interventions to mitigate financial hardship should be implemented at radiology practices. Price transparency alone may not decrease financial hardship.

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## Abstract Archives of the RSNA, 2023

T2-SPNR

### Neuroradiology Tuesday Poster Discussions

#### Sub-Events

#### T2-SPNR-1 Is MRI Sensitive Enough to Avoid Lumbar Puncture for the Diagnosis of Creutzfeldt-Jacob Disease?

##### PURPOSE

To assess the yield of lumbar puncture (LP) to diagnose clinically suspected Creutzfeldt-Jacob disease (CJD) in the absence of suggestive MRI findings.

##### METHODS AND MATERIALS

This single-center retrospective study included 103 patients clinically suspected of having CJD who underwent MRI and LP within 3 months of each other between December 2014 and January 2023. MRIs were re-interpreted for the study by a fellowship-trained CAQ-certified neuroradiologist blinded to LP results and eventual CJD diagnosis. MRIs were categorized as negative, intermediate, or positive for findings suggestive of CJD. The diagnosis from imaging was then compared to the CJD diagnosis determined clinically by a CSF prion panel. Positive and negative predictive values (PPV, NPV), sensitivity, specificity, and accuracy were calculated. A chi-squared test was performed to examine the relationship between MRI prediction and clinical diagnosis, with a threshold of  $p < 0.05$ .

##### RESULTS

Of the 103 patients suspected, 25 were eventually diagnosed with CJD (24%). Of the 103 MRIs, 18 MRIs were positive, 13 were intermediate, and 72 were negative. The PPV for positive MRIs was 83% and the NPV was 96% (95% CI = 88 to 99%). 54% of the intermediate MRIs corresponded to patients who were eventually diagnosed with CJD. Specificity of MRI was 88%, sensitivity was 88%, and accuracy was 88%. MRI categories and eventual diagnosis of CJD were statistically significantly correlated (Chi-square = 56.18,  $p < 0.00001$ ).

##### CONCLUSION

In patients without MRI findings of CJD, the diagnostic yield of lumbar puncture is 4%. In these patients, the expense of a prion panel and an invasive procedure with potential complications may not be appropriate. MRI is an excellent screening tool in cases of clinically suspected CJD.

##### CLINICAL RELEVANCE/APPLICATION

Patients without MRI findings of CJD are very unlikely to have confirmation of the disease on lumbar puncture. Screening with MRI may be used to avoid performing an invasive procedure in patients suspected of CJD.

#### T2-SPNR-10 Not ADC but Advanced Diffusion MRI Parameters can Differentiate Brain Metastases from Glioblastomas

##### Participants

Kiyohisa Kamimura, MD, PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Our purpose was to determine whether advanced diffusion-weighted imaging (DWI) parameters, including time-dependent DWI parameters and microscopic fractional anisotropy ( $\mu$ FA) derived from double-diffusion-encoding (DDE) MRI, are useful for differentiating between glioblastomas and brain metastases.

##### METHODS AND MATERIALS

A retrospective study was conducted involving 102 consecutive patients with pathologically proven brain tumors (74 with glioblastoma and 28 with brain metastasis) using a 3T scanner and advanced DWI sequences. Time-dependent DWI was performed using a sequence with oscillating motion-probing gradients (effective diffusion time ( $\tau_{eff}$ ) = 7.1ms) and a pulsed gradient sequence ( $\tau_{eff}$  = 44.5ms). In addition to ADC maps at the two diffusion times (ADC7.1ms and ADC44.5ms), maps of the ADC change (cADC) and the relative ADC change (rcADC) between the two diffusion times (cADC = ADC7.1ms - ADC44.5ms), [rcADC = (ADC7.1ms - ADC44.5ms)/ADC44.5ms  $\times$  100 (%)] were generated. From the data acquired using a DDE MRI sequence, maps of  $\mu$ FA were generated. The average values of ADC44.5ms, ADC7.1ms, cADC, rcADC, and  $\mu$ FA within enhancing areas of each tumor were measured using a ROI analysis, and those indices were compared between glioblastomas and brain metastases. The diagnostic performances of the parameters were evaluated using ROC curve analysis, and their AUCs were compared using the DeLong's method.

##### RESULTS

There was no significant difference in ADC44.5ms nor ADC7.1ms between brain metastases and glioblastomas. The cADC ( $\times 10^{-3}$  mm<sup>2</sup>/s) and rcADC (%) of brain metastases were significantly higher than those of glioblastomas ( $0.25 \pm 0.12$  vs.  $0.14 \pm 0.03$ ;  $P < 0.0001$ ,  $23.6 \pm 9.4$  vs.  $14.5 \pm 5.7$ ;  $P < 0.0001$ ). The  $\mu$ FA of brain metastases were significantly higher than those of glioblastomas ( $0.472 \pm 0.148$  vs.  $0.371 \pm 0.134$ ;  $P = 0.0014$ ). The ROC curve analysis showed significance for cADC, rcADC, and  $\mu$ FA (AUC = 0.890, 0.834, and 0.705;  $P < 0.0001$ ,  $< 0.0001$ , 0.0014; respectively). The AUC for cADC, rcADC, and  $\mu$ FA were significantly

greater than that for ADC44.5ms ( $P < 0.001$ , respectively).

## CONCLUSION

The time-dependent DWI parameters and  $\mu$ FA provide valuable information to differentiate between glioblastomas and brain metastases, whereas conventional ADC does not. The cADC may be the most efficient DWI index for distinct differentiation of the two tumor types.

## CLINICAL RELEVANCE/APPLICATION

Time-dependent DWI parameters and  $\mu$ FA may be helpful for differentiation between glioblastoma and brain metastasis.

### T2-SPNR-11 Clinical Feasibility of Multi-pool Model-based CEST Imaging in the Evaluation of Glioma Grading and Tumor Proliferation: Comparison with Apparent Diffusion Coefficient and Magnetization Transfer Ratio Asymmetry

#### Participants

Yasukage Takami, Mikicho, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Although magnetization transfer ratio asymmetry (MTR<sub>asym</sub>) analysis is often used as a chemical exchange saturation transfer (CEST), it is semiquantitative and entails some pitfalls. Recently, we developed new parameters for CEST imaging by the multi-pool model (MPM). The purpose of this study was to evaluate the clinical significance of the new parameters on CEST imaging by assessing the glioma grading and tumor proliferation on CEST imaging by MPM compared to conventional apparent diffusion coefficient (ADC) and MTR<sub>asym</sub>.

#### METHODS AND MATERIALS

22 patients with gliomas underwent the preoperative MRI. MPM assumes the magnetization transfer (MT) between free water pool, APT pool, and binding water MT pool. "APT density" x "APT transfer rate" x ("Free water T1" or "T2") was visualized as APT\_T1 or APT\_T2, respectively. The maximum values of the parameters on CEST imaging and the minimum values of ADC were measured respectively by regions of interest analysis. Ki-67 index and the presence of isocitrate dehydrogenase 1 (IDH1) mutation were obtained from tumor specimens.

#### RESULTS

There were significant positive correlations between MTR<sub>asym</sub> and Ki-67 index ( $r = 0.78$ ,  $p < 0.01$ ), and APT\_T1 and Ki-67 index ( $r = 0.68$ ,  $p < 0.01$ ). There existed significant negative correlations between T2/T1 and Ki-67 index ( $r = -0.52$ ,  $p < 0.05$ ), and ADC and Ki-67 index ( $r = -0.76$ ,  $p < 0.01$ ). Significant differences in APT\_T1 were observed between grades II and III ( $p < 0.05$ ) and grades III and IV ( $p < 0.05$ ), as well as between grades II and IV ( $p < 0.001$ ). Significant differences in MTR<sub>asym</sub>, T2/T1, and ADC were observed between grades II and IV ( $p < 0.001$ ). MTR<sub>asym</sub> and APT\_T1 of IDH1 mutant glioma patients ( $n = 10$ ) were significantly lower than that of IDH1 wild-type patients ( $n = 12$ ) ( $p < 0.001$ ). ADC and T2/T1 of IDH1 mutant glioma patients ( $n = 10$ ) were significantly higher than that of IDH1 wild-type patients ( $n = 12$ ) ( $p < 0.05$ ). APT\_T1 of IDH1 mutant glioblastoma patients ( $n = 2$ ) were significantly lower than that of IDH1 wild-type patients ( $n = 11$ ) ( $p < 0.05$ ). With respect to other parameters, there were no significant differences between IDH1 mutant glioblastoma patients and IDH1 wild-type glioblastoma patients.

## CONCLUSION

These preliminary results suggest that parameters on CEST imaging by MPM seem to correlate with the cell proliferation of gliomas as with MTR<sub>asym</sub> and ADC in patients with gliomas. APT\_T1 may be more useful than conventional parameters in evaluating the grade of glioma and the presence of IDH1 mutation in gliomas.

## CLINICAL RELEVANCE/APPLICATION

Parameters on CEST imaging by MPM appear to correlate with glioma cell proliferation as well as MTR<sub>asym</sub> and ADC. In assessing the grade of glioma and the existence of IDH1 mutation in gliomas, APT\_T1 may be more helpful than conventional parameters.

### T2-SPNR-12 Long-term Follow-up of Multinodular and Vacuolating Neuronal Tumors and Implications for Surveillance Imaging

#### Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### PURPOSE

The majority of multinodular and vacuolating neuronal tumors (MVNTs) are diagnosed and followed up with imaging, without any change over time. However, there are no surveillance guidelines or quantitative volumetric assessments of these tumors. We evaluated MVNT volumes over long follow-up periods using segmentation tools with the aim of accurate quantitative assessment.

#### METHODS AND MATERIALS

All patients with "MVNT" or "multinodular and vacuolating neuronal tumor" in a brain MRI report in our system were reviewed. Patients with only one brain MRI or where MVNT was not clearly the most likely diagnosis were excluded. All MVNTs were manually segmented. For all follow-up exams, absolute and percent volume change from immediately prior and initial exams were calculated.

#### RESULTS

48 patients (32 women, median age 50.5 years at first scan) underwent 158 brain MRIs. Median duration between the first and last scan was 15.6 months (interquartile range [IQR] 5.7 months -29.6 months, maximum 6.4 years) and between consecutive scans was 6.7 months (IQR 3.3 months-12.4 months, maximum 4.9 years). Across all 48 individual patients, the median MVNT volume on the original scan was 0.40 cm<sup>3</sup> (IQR 0.16 to 0.77 cm<sup>3</sup>) while the median MVNT volume on the last scan was 0.34 cm<sup>3</sup> (IQR 0.14 to 0.75 cm<sup>3</sup>;  $p=0.94$ ). In comparison to the immediately prior scan, the median absolute change in volume across every follow-up scan was -0.02 cm<sup>3</sup> (IQR -0.06 to 0.02 cm<sup>3</sup>), while the median percent change in volume was -5.0% (IQR -13.7% to 7.9%). Pearson correlation coefficients between days since immediately prior scan versus absolute and percent volume change from immediately prior scan were  $r=0.05$  ( $p=0.60$ ) and  $r= 0.07$  ( $p=0.45$ ) respectively. For the relationship between days since the first scan versus

absolute and percent volume change from the first scan, values were  $r=-0.06$  ( $p=0.53$ ) and  $r=-0.04$  ( $p=0.67$ ) respectively (Figure 1).

## CONCLUSION

s MVNT segmentation across follow-up brain MRI exams did not demonstrate significant volume differences over the follow-up period, suggesting these tumors don't change or enlarge over time. Hence, frequent surveillance imaging of newly diagnosed MVNTs may not be necessary. In particular, no further contrast is needed after a stable follow-up contrast-enhanced exam.

## CLINICAL RELEVANCE/APPLICATION

We provide the first set of quantitative volumetric measurements demonstrating multinodular and vacuolating neuronal tumors do not significantly change over time.

## T2-SPNR-13 Pretreatment ADC for Prediction of Relapsed and Refractory Primary Central Nervous System Lymphoma

### PURPOSE

A subset of primary central nervous system lymphoma (PCNSL) has been shown to undergo an early relapsed/refractory (R/R) period after first-line chemotherapy. This study investigated the pretreatment clinical and MRI features to predict R/R in PCNSL, emphasizing the apparent diffusion coefficient (ADC) values.

### METHODS AND MATERIALS

This retrospective study investigated the pretreatment MRI features for predicting R/R in PCNSL. Only patients who had undergone complete preoperative and postoperative MRI follow-up studies were included. From January 2006 to December 2021, 52 patients from two medical institutions with a diagnosis of PCNSL were included (median follow-up time, 26.3 months). Among these, 24 (46.2%) had developed R/R (median time to relapse, 13 months). Cox proportional hazard regression analyses were performed to determine hazard ratios for all parameters.

### RESULTS

Significant predictors of R/R in PCNSL were female sex, complete response to first-line chemotherapy, and ADC value/ratio ( $P < 0.05$ ). Cut-off points of ADC values and ADC ratios for prediction of R/R were  $0.68 \times 10^{-3} \text{ mm}^2/\text{s}$  and 0.97, with AUCs of 0.78 and 0.77, respectively ( $P < 0.05$ ). Multivariate Cox proportional hazards analysis showed that failure of CR to first-line chemotherapy and low ADC values ( $< 0.68 \times 10^{-3} \text{ mm}^2/\text{s}$ ) were significant risk factors for R/R, with hazard ratios of 5.22 and 14.45, respectively ( $P < 0.05$ ). Kaplan-Meier analysis showed that lower ADC values and ratios predicted significantly shorter progression-free survival ( $P < 0.05$ ).

## CONCLUSION

s Pretreatment ADC values and ratios for prediction of R/R offer valuable objective information for the treatment planning in PCNSL.

## CLINICAL RELEVANCE/APPLICATION

Pretreatment ADC for prediction of relapsed and refractory PCNSL offers valuable information in the treatment planning.

## T2-SPNR-14 Development of a Deep Learning Model Integrating Multisequence MRI to Assess EGFR Mutation Subtype in Brain Metastases

Participants

Ye Li, Beijing, China (*Presenter*) Nothing to Disclose

### PURPOSE

There is a lack of studies evaluating epidermal growth factor receptor (EGFR) mutation status and subtype in non-small cell lung cancer (NSCLC) patients with brain metastasis (BM). The aim of this study was to establish a predictive model based on multisequence MRI using deep learning to identify wild-type (WT) EGFR, EGFR exon 19 deletion (19Del) and exon 21 point mutation (21L858R) simultaneously.

### METHODS AND MATERIALS

A total of 399 patients with proven brain metastases (BM) of non-small cell lung cancer (NSCLC) were retrospectively enrolled and divided into training ( $n=306$ ) and testing ( $n=99$ ) cohort separately based on two timepoints. All patients underwent brain MRI (including T2WI, T2 fluid-attenuated inversion recovery (T2-FLAIR), diffusion weighted imaging (DWI) and contrast-enhanced T1-weighted imaging (T1-CE)) scans. Radiomics features were extracted from each lesion based on four MR sequences. Then a novel algorithm that combined radiomics approach with graph convolutional networks (GCN) architecture (Radio-GCN) was designed for the prediction of EGFR mutation status and subtype. The receiver operating characteristic (ROC) curve analysis was used to evaluate the predication capabilities of each model.

### RESULTS

We extracted 1290 radiomics features of each MRI sequence. The Radio-GCN model showed an excellent discrimination power for identifying EGFR 19 Del, 21 L858R, and WT in lesion-wise with the AUCs of  $0.9955 \pm 0.0038$ ,  $0.971 \pm 0.013$  and  $1.0 \pm 0$  on independent testing cohort. It also yielded excellent AUCs of  $1.0 \pm 0$ ,  $0.9913 \pm 0.0086$  and  $1.0 \pm 0$  for predicting EGFR mutations respectively in patient-wise. The kappa coefficient reached 0.7352 and 0.8121 in two wises, respectively.

## CONCLUSION

s The study demonstrated that a Radio-GCN approach based on multisequence MRI can help to predict the EGFR mutation subtypes in NSCLC patients with BM, which is beneficial to guide individual treatment.

## CLINICAL RELEVANCE/APPLICATION

The constructed Radio-GCN model can be potentially considered as new tools to predict the EGFR mutation status and subtype in NSCLC patients with BM.

## **T2-SPNR-2 Myocardial Involvement Characteristics by Cardiac MR Imaging in Neurological and Non-Neurological Wilson Disease Patients**

Participants  
Xiaohu Li, MD, PhD, Hefei, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To explore the characteristics of myocardial involvement in Wilson Disease (WD) patients by cardiac magnetic resonance (CMR).

### **METHODS AND MATERIALS**

We prospectively included WD patients and age- and sex-matched healthy population. We applied CMR to analyze cardiac function, strain, T1 maps, T2 maps, extracellular volume fraction (ECV) maps and LGE images. Subgroup analyzes were performed for patients with WD with predominantly neurologic manifestations (WD-neuro+) or only hepatic manifestations (WD-neuro-).

### **RESULTS**

41 WD patients (age 27.9±8 years) and 40 healthy controls (age 25.4±2.9 years) were included in this study. Compared to the controls, the T1, T2, and ECV values were significantly increased in the WD group (T1 1085.1±39.1 vs. 1046.5±33.1 ms, T2 54.2±3.3 ms vs. 51.5±2.6 ms, ECV 31.8±3.6% vs. 24.3±3.7%) (all P < 0.001). LGE analysis showed that LGE in WD patients was mainly found in the right ventricular insertion point and interventricular septum. In addition, the WD-neuro+ group showed more severe myocardial damage compared with WD-neuro- group. The Unified Wilson Disease Rating Scale score was significantly correlated with ECV (Pearson's r = 0.64, P < 0.001).

### **CONCLUSION**

s CMR could detect early myocardial involvement in WD patients without overt left ventricle dysfunction. Furthermore, characteristics of myocardial involvement were different between WD-neuro+ and WD-neuro-, and myocardial involvement might be more severe in WD-neuro+ patients.

### **CLINICAL RELEVANCE/APPLICATION**

We found that CMR T1 mapping could detect early myocardial involvement in WD patients without overt left ventricle dysfunction. Furthermore, characteristics of myocardial involvement were different between WD-neuro+ and WD-neuro-, and myocardial involvement might be more severe in WD-neuro+ patients.

## **T2-SPNR-3 Efficacy of 3T Segmented Acquisition Fast Spin-Echo Diffusion-Weighted Imaging for Differentiating Pituitary Abscess from Other Sellar Cystic Lesions**

Participants  
SOICHIRO ISHIUCHI, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

### **PURPOSE**

Pituitary abscesses (PAs) are rare and often difficult to differentiate from other sellar cystic lesions (OSCLs). The split acquisition of fast spin-echo signals for diffusion-weighted imaging (SPLICE-DWI) sequence can reduce artifacts and distortion caused by susceptibility differences without sacrificing signal-to-noise ratio. We aimed to evaluate the efficacy of SPLICE-DWI for the differentiation between PA and OSCLs.

### **METHODS AND MATERIALS**

Our study included 5 PAs and 27 OSCLs (11 Rathke's cleft cysts, 11 cystic pituitary adenomas, and 5 craniopharyngiomas) in 32 consecutive patients who underwent sagittal T1-, T2- and contrast-enhanced T1- weighted imaging (T1WI, T2WI, CET1WI) and SPLICE-DWI at 3T. Two radiologists qualitatively evaluated the signal intensity of cystic components on T1WI, T2WI, and SPLICE-DWI using a 5-point grading system (from 1 [very hypointensity] to 5 [very hyperintensity]). They also assessed the presence of ring enhancement, pituitary stalk enlargement and sphenoid sinusitis, and the percentage of cystic components on CET1WI. In addition, two radiologists measured apparent diffusion coefficient (ADC) values of cystic components, and the difference in the mean ADC values between PA and OSCL groups was assessed. Interobserver agreement was determined by calculating the ? coefficient. Statistical analyses, including receiver operating characteristic curve (ROC) analysis were performed.

### **RESULTS**

Although the signal intensity of T1WI and T2WI, the presence of stalk enlargement, ring enhancement and sphenoid sinusitis, and the percentage of cystic components were not significantly different between PA and OSCL groups, the signal intensity of cystic components on SPLICE-DWI was significantly different (P = .04). Interobserver agreement for SPLICE-DWI was good (? = 0.77). Mean ADC value was significantly lower for PA than OSCL (0.62 ± 0.07 vs. 1.83 ± 0.70 x 10<sup>-3</sup>mm<sup>2</sup>/s, P = .002). The area under the ROC curve of the ADC value was 0.952.

### **CONCLUSION**

s Qualitative and quantitative assessment of SPLICE-DWI helps distinguish between PA and OSCLs.

### **CLINICAL RELEVANCE/APPLICATION**

SPLICE-DWI is a useful non-invasive imaging tool for diagnosing pituitary abscesses.

## **T2-SPNR-4 The Experience of a Tertiary Center in South Brazil with Opportunistic Central Nervous Diseases of Immunocompromised Patients**

### **PURPOSE**

Our aim is to present a wide spectrum of opportunistic diseases, including unusual pathologies, that can affect the central nervous system of immunocompromised patients in two tertiary centers at south Brazil.

### **METHODS AND MATERIALS**

This is a cross-sectional retrospective study performed at two public tertiary centers in South Brazil. We selected a miscellanea of

This is a cross-sectional retrospective study performed at two public tertiary centers in South Brazil. We selected a miscellanea of 10 illustrative cases of the various conditions that can affect the immunocompromised patients' central nervous system was selected.

## RESULTS

Amongst 322 patients evaluated during the last 5 years, 10 illustrative cases were selecting to represent a gamut of opportunistic infectious diseases that affect the central nervous system of immunocompromised patients. We show the following diagnosed cases: toxoplasmosis, progressive multifocal leukoencephalopathy (PML mimicking MSA-C), cryptococcosis, tuberculosis, nocardiosis, and paracoccidioidomycosis infections, HIV-encephalitis, HIV vasculopathy, AIDS-related lymphoma (mimicking toxoplasmosis), and a rare case of eosinophilic meningitis caused by *Angiostrongylus catus* (in a slug consumer).

## CONCLUSION

The Central Nervous System is frequently affected in immunocompromised patients, as many opportunistic diseases may involve the brain. The clinical manifestations are nonspecific and depend on the type and location of the lesions. As the diagnosis of these entities is frequently made with noninvasive methods, imaging studies, especially magnetic resonance imaging, are very useful tools for the diagnosis.

## CLINICAL RELEVANCE/APPLICATION

These pathological conditions can have similar clinical manifestations, so imaging plays a crucial role in the variable diagnostic conditions and the assessment of the extent of the disease, in order to decide the best therapeutic strategy to be followed.

## T2-SPNR-5 Usefulness of Amide Proton Transfer Imaging Combined With Pseudocontinuous Arterial Spin Labeling Imaging and Apparent Diffusion Coefficient Map in Differentiating Intracranial Malignant Tumors From Benign Tumors in Young Patients

### PURPOSE

We aimed to assess combined diagnostic value of amide proton transfer (APT), tumor blood flow (TBF) obtained by pseudocontinuous arterial spin labeling (pCASL), and apparent diffusion coefficient (ADC) for differentiating intracranial malignant tumors (MTs) from benign tumors (BTs) in young patients.

### METHODS AND MATERIALS

A total of 20 patients with intracranial tumors aged 0-30 years old were enrolled. Fifteen patients were categorized into MTs by WHO 5th edition classification grade 3 or 4, or ICD behavior code /3, and five patients were categorized into BTs by WHO grade 1 or 2. All the patients were scanned with APT, pCASL, and diffusion-weighted image and evaluated by histogram analysis. Maximum (max), minimum (min), mean, 10th, 25th, 50th, 75th, and 90th percentiles, skewness, and kurtosis of APT, TBF, and ADC values were obtained by the region of interest method. The parameters were compared between the groups by Mann-Whitney U test. Diagnostic performance was evaluated by receiver operating characteristic analysis.

### RESULTS

MTs included diffuse midline glioma H3K27-altered, grade 4 (2), Diffuse paediatric-type high-grade glioma H3-wildtype and IDH-wildtype, grade 4 (2), astroblastoma, MIN1-altered (1), germinoma (3), immature teratoma (2), astrocytoma, NOS, grade 3 (1), atypical teratoid/rhabdoid tumor, grade 4 (1), rhabdomyosarcoma, NOS (1), medulloblastoma, histologically defined, grade 4 (1), and mixed germ cell tumors (1). BTs included pilocytic astrocytoma, grade 1 (1), astrocytoma, IDH-mutant, grade 2 (1), angiocentric glioma, grade 1 (1), posterior fossa ependymoma, group A, grade 2 (1), and supratentorial ependymoma, NOS, grade 2 (1). Mean, 10th, 25th, and 50th percentiles of APT ( $p=0.025$ , respectively), and ADC min showed significant differences ( $p=0.042$ ), while no parameter of TBF showed significant difference between the groups. Median values of APT mean (%), TBF max (mL/100g/min), and ADC min ( $\times 10^{-3}$  mm<sup>2</sup>/sec) were 3.26, 23.73 and 1.14 for MTs, whereas 1.92, 20.83, and 1.03 for BTs. Mean, 10th, 25th, and 50th percentiles of APT, TBF max, and ADC min were the highest AUC values among all parameters of each sequence (0.840, 0.760, and 0.813, respectively) and AUC value for combination of those was 0.933.

### CONCLUSION

Combination of APT, pCASL, and ADC may be useful in differentiating intracranial MTs from BTs in young patients.

### CLINICAL RELEVANCE/APPLICATION

Combination of APT, pCASL, and ADC map may help differentiating malignant and benign intracranial tumors in young patients.

## T2-SPNR-6 A Fully Automated Deep-learning Model for Predicting the Molecular Subtypes of Posterior Fossa Ependymomas using T2-weighted Images

### PURPOSE

Accurate determination of posterior fossa ependymoma (PF-EPN) molecular subtypes (Group A [PFA] and Group B [PFB]) according to the 2021 WHO classification could guide clinical treatment strategies and determine prognosis. We aimed to develop and validate a deep-learning (DL) model to automatically segment PF-EPNs and predict PFA and PFB subtypes from preoperative MR images.

### METHODS AND MATERIALS

We retrospectively identified 227 PF-EPNs (development and internal test sets) with both available preoperative T2-weighted (T2w) MR images and molecular status to develop and test a 3D nnU-Net (here named T2-nnU-Net) for tumor segmentation and molecular subtype prediction. The network was externally tested using one external independent sets ( $n=31$ ) and prospectively enrolled cases (prospective validation set [ $n=27$ ]). The Dice similarity coefficient was used to evaluate segmentation performance. Receiver operating characteristic analysis for molecular subtype prediction was performed.

### RESULTS

For tumor segmentation, the T2-nnU-Net achieved a dice score of  $0.94 \pm 0.02$  in the internal test set. For molecular subtype prediction, the T2-nnU-Net achieved an AUC of 0.93 and accuracy of 0.89 in the internal test set, an AUC of 0.97 and accuracy of 0.90 in the external test set. In the prospective validation set, the model achieved an AUC of 0.93 and accuracy of 0.89. The T2-nnU-Net predictive performance was superior or comparable to that using demographic and multiple radiological features (AUCs



ranging from 0.88 to 0.93).

## CONCLUSION

s A fully automated DL model was developed and validated to accurately segment PF-EPNs and predict molecular subtypes using only T2w MR images, and it could help clinical decision-making.

## CLINICAL RELEVANCE/APPLICATION

We developed and validated a fully automated deep learning model to accurately segment posterior fossa ependymomas and predict molecular subtypes using only T2w MR images based on a large multicenter sample. The ability to noninvasively classify PFA and PFB subtypes has significant implications in determining treatment plans and predicting prognosis.

## T2-SPNR-7 Whole-tumor Histogram Analysis of Postcontrast T1-weighted and Apparent Diffusion Coefficient in Predicting the Grade and Proliferative Activity of Adult Intracranial Ependymomas

### Participants

Liu Xianwang, Lanzhou, China (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of histogram analysis of postcontrast T1-weighted (T1C) and apparent diffusion coefficient (ADC) in predicting the grade and proliferative activity of adult intracranial ependymomas.

### METHODS AND MATERIALS

Forty-seven patients with histologically proven adult intracranial ependymomas were retrospectively collected. The histogram parameters, including minimum, maximum, mean, and Perc.01, Perc.05, Perc.10, Perc.25, Perc.50, Perc.75, Perc.90, Perc.95, Perc.99, as well as standard deviation (SD), variance, coefficient of variation (CV), skewness, kurtosis, and entropy of T1C and ADC images were extracted from the whole tumor using FireVoxel software. Differences in histogram parameters between grade 2- and grade 3- adult intracranial ependymomas were compared. Receiver operating characteristic curves and logistic regression analyses were conducted to determine the differential diagnostic performance. Spearman's correlation analysis was used to evaluate the relationship between histogram parameters and the Ki-67 proliferation index.

### RESULTS

Grade 3 intracranial ependymomas showed significantly higher Perc.95, Perc.99, SD, variance, CV, and entropy of T1C (all  $p < 0.05$ ), lower minimum, mean, Perc.01, Perc.05, Perc.10, Perc.25, Perc.50 of ADC, higher CV and entropy of ADC (all  $p < 0.05$ ), compared to grade 2 intracranial ependymomas. Entropy (T1C) and Perc.10 (ADC) have a higher diagnostic performance with AUCs of 0.805 and 0.827 among the histogram parameters of T1C and ADC, respectively. The diagnostic performance was further improved by combining the entropy (T1C) and Perc.10 (ADC), with an AUC of 0.857. Significant correlations were observed between significant histogram parameters of T1C and ADC and the Ki-67 proliferation index ( $p = 0.001-0.044$ ).

### CONCLUSION

s Whole-tumor histogram analysis of T1C and ADC may be a promising approach in predicting the grade and proliferative activity of adult intracranial ependymomas.

### CLINICAL RELEVANCE/APPLICATION

Grading and proliferative activity significantly influence treatment decision-making in adult intracranial ependymomas. Whole-tumor histogram analysis of T1C and ADC are useful to preoperatively evaluate the grade and proliferative activity of adult intracranial ependymomas. The combination of entropy (T1C) and Perc.10 (ADC) achieved the best diagnostic performance.

## T2-SPNR-8 Radiomics-based Prediction of TERT Promoter Mutation in Intracranial Meningiomas

### Participants

Burak Akkurt, MD, PhD, Muenster, Germany (*Presenter*) Nothing to Disclose

### PURPOSE

In meningiomas, TERT promoter mutations are rare but qualify diagnosis of anaplasia, directly impacting adjuvant therapy. Effective screening for patients at risk for promoter mutations could enable more targeted molecular analyses and improve diagnosis and treatment.

### METHODS AND MATERIALS

Semiautomatic segmentation of the meningiomas was performed on preoperative magnetic resonance imaging. Discriminatory power to predict TERT promoter mutations was analyzed in grade 2/3 meningiomas using a random forest algorithm with an increasing number of radiomic features. Two final models with 5 and 8 features were built with both fixed and differing radiomics features. Each model has been fully developed 100 times to eliminate random effects and avoid overfitting.

### RESULTS

117 image sets including training (N=94) and test data (N=23) were analyzed. Established 5- and 8-feature models with both fixed and different radiomics features enabled prediction of TERT with similar but excellent performance. Of note, a significant increase in the average discriminatory power up to the fifth feature included was observed, while addition of further features up to N=8 features only slightly increased the performance. 5-feature (different/ fixed) model predicted TERT promoter mutation status with a mean AUC of 91.8%/94.3%, mean accuracy of 85.5%/88.9%, mean sensitivity of 88.6%/91.4%, mean specificity of 83.2%/87.0%, and a mean Cohen's Kappa of 71.0%/77.7%. 8-feature (different/ fixed) model predicted TERT promoter mutation status with a mean AUC of 92.7%/94.6%, mean accuracy of 87.3%/88.9%, mean sensitivity of 89.6%/90.6%, mean specificity of 85.5%/87.5%, and a mean Cohen's Kappa of 74.4%/77.6%.

### CONCLUSION

s Radiomics based machine learning enables prediction of TERT promoter mutation status in meningiomas with excellent discriminatory performance. Future analyses in larger cohorts should include grade 1 lesions as well as additional molecular

alterations.

#### **CLINICAL RELEVANCE/APPLICATION**

Radiomics might help in the non-invasive characterization of meningiomas, impacting diagnosis and therapy.

#### **T2-SPNR-9 Predicting Meningioma Recurrence/progression Based on MRI Radiomics**

Participants

Tao Han, Lanzhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Preoperative prediction of meningioma recurrence/ progression should help in the selection of surgical options and provides a basis for guiding meningioma patients to achieve individualized treatment. However, only a few radiological features have been identified to aid in prediction. The aim of this study was to develop and validate an MRI-based nomogram to predict meningioma recurrence/progression.

#### **METHODS AND MATERIALS**

This retrospective study collected 88 patients with surgically pathologically confirmed meningiomas, including 28 patients with postoperative tumor recurrence and 60 patients with non-recurrence. All cases were randomly divided into training and validation sets according to 7:3, and 1874 features were extracted from each of preoperative T2WI and T1WI-enhanced images, respectively, and least absolute shrinkage and selection operator (LASSO) regularization was used to determine the best combination of clinical and MRI features to predict meningioma recurrence/progression, and subsequently machine learning algorithms were applied to construct a meningioma recurrence risk assessment prediction model, using receiver operating characteristic (ROC) curve analysis to determine predictive performance, and calibration curve and decision curve analysis to validate the consistency and clinical validity of the nomogram.

#### **RESULTS**

Finally, twelve radiomics features closely related to the risk of meningioma recurrence were screened to construct a nomogram of the RF model, and the results showed that the model had good predictive performance with AUCs of 0.950 and 0.852 in the training and validation sets, respectively.

#### **CONCLUSION**

s The predictive model based on MRI radiomics features has good predictive performance in predicting meningioma recurrence/ progression and can be applied to clinical practice.

#### **CLINICAL RELEVANCE/APPLICATION**

Radiomics models based on T2WI and T1C are helpful for predicting meningioma recurrence/progression.

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## Abstract Archives of the RSNA, 2023

T2-SPOB

### OB/Gynecology Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPOB-1 Could the 40keV Monochromatic Images in Dual-Energy Spectral CT Increase the Value and Consistency of Peritoneal Cancer Index in Advanced Epithelial Ovarian Cancer for Junior Radiologists**

#### PURPOSE

To investigate the value of using 40keV virtual monochromatic images (VMI) in dual-energy spectral CT (DEsCT) to increase peritoneal cancer index (PCI) value in advanced epithelial ovarian cancer (EOC) for junior radiologists and their consistency with senior radiologists.

#### METHODS AND MATERIALS

Retrospectively analyzed 32 advanced EOCs (27 serous, 2 mucinous and 3 clear cell carcinomas, and 28 in stage III and 4 in stage IV) who underwent primary cytoreduction (11 in satisfied and 21 in dissatisfied groups). VMI of venous phase at 40keV and 70keV (equivalent to 120kVp) were reconstructed from abdominal and pelvic DEsCT. A senior and junior radiologist evaluated VMIs double-blindly in the degree of ascites, abdominal and pelvic anatomical structures using Sugarbaker PCI standards and performed CT-PCI scoring for the entire and upper abdomen separately. SPSS 27.0 and Medcalc 20.1.0 were used for statistical analyses. Binary logistic regression was used to analyze parameters influencing the outcome prediction of unsatisfactory tumor reduction surgery.

#### RESULTS

The satisfied group had lower serum CA-125 level than the unsatisfied group (112 vs. 654 u/ml,  $U=58$ ,  $P=0.023$ ). And the upper abdominal (2 vs. 6,  $U=43$ ,  $P=0.003$ ) CT-PCI scores than dissatisfied group. There was no significant difference in age, FIGO stage, histological type, and ascites degree between these two groups. The 70 keV CT-PCI score was an independent factor in causing initial tumor reduction dissatisfaction in advanced EOCs ( $OR=1.785$ , 95%  $CI=1.024-3.111$ ,  $P=0.041$ ). The 70keV CT-PCI scores of senior and junior radiologists were all lower than that of the 40keV (senior: mean difference = -1.81,  $t=-6.06$ ,  $P<0.001$ ; junior: mean difference = -2.84,  $t=-6.99$ ,  $P<0.001$ ). The CT-PCI scores of the junior was lower than that of the senior when using 70keV VMI (mean difference = -1.13,  $t=-4.52$ ,  $P<0.001$ ), but no significant difference using the 40keV VMI (mean difference = -0.09,  $t=-1.36$ ,  $P=0.184$ ).

#### CONCLUSION

The use of 40keV VMI improves CT-PCI scores for both senior and junior radiologists and reduces their differences.

#### CLINICAL RELEVANCE/APPLICATION

The 40keV VMI in DEsCT increase the value and consistency of PCI in advanced EOC for junior radiologists, help clinical evaluation of tumor load in patients with advanced EOC, and guide the development of clinical treatment strategies.

#### **T2-SPOB-2 OvCA Finder: An Interpretable Hybrid Model Integrating Multimodal Information for Ovarian Cancer Diagnosis**

Participants

Huiling Xiang, Guangzhou, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To develop an interpretable hybrid model (OvcaFinder) from multimodal information that allows preoperative identification of ovarian cancer.

#### METHODS AND MATERIALS

Consecutive patients with at least one pathology-confirmed adnexal lesion visible by transvaginal ultrasound were enrolled in this study. Ultrasound images of all lesions were independently assessed by five readers using the Ovarian-Adnexal Reporting and Data System (O-RADS). The following three models were built and internally validated using 724 cases from Hospital 1: a clinical model with variables including age, lesion diameter, and cancer antigen 125 concentration; an image-based DL predictive model; and our newly developed model, OvcaFinder, using multimodal information. The performance of the models was then externally validated using 387 cases from Hospital 2 and the diagnostic performances of the models were compared.

#### RESULTS

The readers achieved mean areas under the receiver operating characteristic curve (AUCs) of 0.927 and 0.904, using the O-RADS for the internal and external test datasets, respectively. OvcaFinder outperformed the clinical model (AUC, internal dataset: 0.978 vs. 0.936,  $p = .007$ ; external dataset: 0.947 vs. 0.842,  $p < .001$ ) and the image-based DL predictive model (AUC, internal dataset: 0.978 vs. 0.970,  $p = .152$ ; external dataset: 0.947 vs. 0.893,  $p < .001$ ). Readers assisted by OvcaFinder showed significant improvements in AUCs (internal dataset: 2.3-8.0%; external dataset: 1.9-5.3%) and a reduction in false positive rate (internal dataset: 13.3%,  $p = 0.029$ ; external dataset: 8.3%,  $p = 0.033$ ) than those without.

#### CONCLUSION

s OvcaFinder, an interpretable hybrid model that integrates multimodal information, could be used by radiologists as a non-invasive tool for reliably diagnosing ovarian cancer, thus improving radiologists' diagnostic performance and helping to determine the appropriate treatment strategies.

#### **CLINICAL RELEVANCE/APPLICATION**

OvcaFinder, a novel hybrid model constructed from multimodal information can effectively distinguish between ovarian cancer and benign lesions and thus significantly improve the diagnostic performance of radiologists.

#### **T2-SPOB-3 Subendometrial Enhancement and Peritumoral Enhancement in the Uterus: Assessment of the Optimal Timing with High Spatial-temporal Resolution Multiphase Contrast Enhanced-MRI**

Participants

Takahiro Tsuboyama, MD, (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The scanning protocol of dynamic contrast-enhanced MRI (DCE-MRI) for endometrial cancer has not been standardized due to the lack of evidence regarding the optimal timing for subendometrial enhancement (SEE) and peritumoral enhancement (PTE). The purpose of this study was to assess SEE and PTE with high spatial-temporal resolution multiphase DCE-MRI using differential subsampling with cartesian ordering (DISCO).

#### **METHODS AND MATERIALS**

Fifty women (mean age, 56.8; range, 25-91 years) who underwent DCE-MRI for the assessment of suspected uterine diseases were included. Nineteen of them were proved to have endometrial cancer. DCE-MR included 11 early phases obtained with DISCO (voxel size, 0.6\*1.0\*4.0 mm) in which the first 10 phases were acquired from 20 to 50 s after contrast injection with temporal resolution of 3 s, followed by 11th phase with a full k-space data sampling at 60 s. One radiologist placed regions of interest on the uterine structures, and time-intensity curves were generated. Enhancement ratios (ERs) and contrast ratios (CRs) were calculated and compared using Wilcoxon test and Friedman test. Correlation between the start of uterine enhancement and the start of the plateau or peak of SEE was evaluated using a correlation coefficient.

#### **RESULTS**

SEE was detected in 48 of the 50 patients. It showed various degree of peak ER (range, 0.59-3.56). During the early phases, it reached a plateau in 25 patients and showed a progressive enhancement in the other 23 patients. The plateau started variably from 32 to 47 sec after contrast injection and had a moderate positive correlation with the contrast arrival time at the uterus ( $r = 0.52$ ,  $P < 0.01$ ). The mean ER of SEE on each phase was increased with time and was significantly the highest at 60 sec ( $P < 0.01$ ). CR between SEE and inner myometrium also increased with time and was the highest during 41 to 60 sec. PTE was detected in 15 patients with an endometrial cancer and displayed significantly higher peak ER and significantly earlier start of a plateau compared with SEE ( $P < 0.01$ ). The highest CR between PTE and SEE was observed during 32-44 s.

#### **CONCLUSION**

s SEE may show optimal enhancement and contrast at 60 s after contrast injection and have different enhancement patterns from those of PTE. Given some varieties in the enhancement patterns of SEE and PTE among patients, DISCO may be useful to catch the optimal timing for the detection of SEE and PTE.

#### **CLINICAL RELEVANCE/APPLICATION**

Accurate assessment of SEE and PTE with high spatial-temporal resolution DCE-MRI using DISCO may increase the accuracies of preoperative staging of endometrial cancer.

#### **T2-SPOB-4 Diagnostic Ability of Single-Shot Fast Spin-Echo T2-Weighted MRI with Deep Learning Reconstruction for the Assessment of Myometrial Invasion in Endometrial Cancer: A Comparison with Standard Sequences using PROPELLER and Fast Spin-Echo Imaging**

Participants

Kengo Kiso, MD, Suita-City, Japan (*Presenter*) Nothing to Disclose

Takahiro Tsuboyama, MD, (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Single-shot fast spin-echo (SSFSE) T2-weighted MRI (T2WI) with deep learning reconstruction (DLR) is reported to achieve high image quality in an ultra-short acquisition time. The purpose of this study was to compare its diagnostic ability for the assessment of myometrial invasion in endometrial cancer with that of standard but time consuming T2WI using periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) and fast spin-echo (FSE) imaging.

#### **METHODS AND MATERIALS**

Seventy-two consecutive patients who underwent preoperative dynamic contrast-enhanced (DCE) MRI for endometrial cancer were included. For the standard T2WI, para-axial FSE and parasagittal PROPELLER imaging were obtained. Para-axial and -sagittal SSFSE T2WI with DLR (SSFSE-DLR-T2WI) were also acquired. Two radiologists independently assessed the following four MRI sets; standard T2WI, standard T2WI+DCE, SSFSE-DLR-T2WI, and SSFSE-DLR-T2WI+DCE. Noise, artifacts, the visibility of the junctional zone and serosa of the uterus and that of the tumor were compared between standard T2WI and SSFSE-DLR-T2WI using the Wilcoxon signed-rank test. The diagnostic accuracies of the four MRI sets regarding superficial and deep myometrial invasion of the endometrial cancer were compared using the receiver operating characteristic analysis and the Cochran's Q test.

#### **RESULTS**

SSFSE-DLR-T2WI was significantly better than standard T2WI regarding noise, artifacts, and the visibility of the uterine structures and the tumor for both readers ( $p < 0.01$ ). As for the diagnosis of myometrial invasion, mean AUCs of standard T2WI, standard T2WI+DCE, SSFSE-DLR-T2WI, and SSFSE-DLR-T2WI+DCE by the two readers were 0.76, 0.83, 0.72, and 0.80, respectively for superficial myometrial invasion, and 0.87, 0.92, 0.82, and 0.91, respectively for deep myometrial invasion. There were no significant differences in AUCs, sensitivities, specificities, and accuracies between standard T2WI and SSFSE-DLR-T2WI and between standard T2WI+DCE and SSFSE-DLR-T2WI+DCE for both readers. Sensitivities for superficial myometrial invasion were significantly

lower with standard T2WI than with standard T2WI+DCE and with SSFSE-DLR-T2WI+DCE for both readers ( $p < 0.05$ ).

#### **CONCLUSION**

s For the assessment of myometrial invasion in endometrial cancer, SSFSE with DLR can provide better image quality and equivalent diagnostic accuracies compared with standard T2WI.

#### **CLINICAL RELEVANCE/APPLICATION**

Standard T2WI can be replaced by SSFSE with DLR for the assessment of myometrial invasion in endometrial cancer, which can reduce the examination time considerably.

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## Abstract Archives of the RSNA, 2023

T2-SPPD

### Pediatric Imaging Tuesday Poster Discussions

#### Sub-Events

#### T2-SPPD-1 Pediatric H3K27 Altered Diffuse Midline Gliomas: Imaging Features in 37 Children of One Institution

##### Participants

Elzbieta Jurkiewicz, MD, Warsaw, Poland (*Presenter*) Nothing to Disclose

##### PURPOSE

Pediatric diffuse midline glioma (PDMG) arises from the thalamus, hypothalamus, pineal gland, brainstem, cerebellum, and spinal cord. Regardless of the location, the prognosis of PDMG is poor with a 2-year survival rate of <10%. According to the 2021 WHO classification, pediatric diffuse high-grade gliomas are recognized as: diffuse midline glioma, H3K27-altered, diffuse hemispheric glioma, H3G34-mutant, diffuse pediatric high-grade glioma, H3-wildtype/IDH-wildtype and infant-type hemispheric glioma. The overexpression of EZHIP, or an EGFR mutation, are also observed in these tumors. The possibility of surgical resection is often limited, due to the involvement of critical brain structures. Radiation or chemotherapy is standard. We present MR examinations of 37 patients with diffuse midline glioma, H3 K27-altered, aged from 40 months to 17 years; median age 9.6 years.

##### METHODS AND MATERIALS

All patients were examined on a 1.5 T scanner with a protocol including T2/FLAIR images, DWI, SWI, and T1-weighted images with and without contrast injection. We characterized the structural MR imaging features of these tumors: presence of calcifications, hemorrhage, necrosis, and leptomeningeal spread. The presence and degree of contrast enhancement were also assessed. A biopsy was performed in all patients. Pathological/microscopic and molecular characterization was carried out in all children.

##### RESULTS

Tumors were located in the pons in 28 patients, midbrain in 12, thalamus in 6, medulla oblongata in 6, and in the spinal cord in one child. All tumors were hypointense on T1- and heterogeneously hyperintense on T2/FLAIR images. Contrast enhancement was seen in 16 patients (punctate or rim), restriction on diffusion in 9. Exophytic component was noted in one child. Hydrocephalus was present in 5, necrosis in 9, and hemorrhagic component in 3 patients. Leptomeningeal spread at the time of diagnosis was diagnosed in one case. The mutations c.83A>T H3F3A were recognized in 35 children and mutations c.83A>T HIST1H3B (H3C2) in 2 patients.

##### CONCLUSION

We found that midline gliomas with histone H3 K27M mutation centered within the thalamus and brainstem were solid with infrequent exophytic component and hemorrhage.

##### CLINICAL RELEVANCE/APPLICATION

Molecular characterization of the PDMG may be relevant to individual patients for personalized molecular therapies based on genomic analysis of the tumors.

#### T2-SPPD-2 [11C] Methionine PET in Diagnosing Pediatric Low-grade Gliomas

##### PURPOSE

Positron emission tomography (PET) imaging of the brain with amino acid tracers, such as [11C] Methionine (MET), is helpful in the evaluation of brain tumors. Although MET-PET has been extensively used in adults and some pediatric brain tumors, data on MET-PET imaging of pediatric low-grade gliomas (pLGG) are scarce. This study aimed to investigate the diagnostic performance of MET-PET in diagnosing pLGGs.

##### METHODS AND MATERIALS

Fifteen patients with newly diagnosed pLGG and twenty-six previously treated pLGG patients were evaluated with MET-PET and magnetic resonance imaging. Biopsy or tumor resection was performed in all patients within 6 months of the MET-PET. Qualitative and semi-quantitative analysis that included tumor to brain uptake ratios (TBR) were performed. TBR was consisted of TBRmax, TBRpeak, and TBRmean analyses. TBR >1 was used to define a positive MET-PET test.

##### RESULTS

The sensitivity of MET-PET for diagnosing newly diagnosed pLGG was 87% for TBRmax and TBRpeak, 80% for TBRmean, and 94% for qualitative interpretation. The sensitivity of MET-PET for diagnosing previously treated pLGG was 100% for TBRmax and TBRpeak, 81% for TBRmean, and 96% for qualitative interpretation. The sensitivity for the combined cohort was 95% for both TBRmax and TBRpeak, 80% for TBRmean, and 95% for qualitative evaluation.

##### CONCLUSION

Both quantitative and qualitative MET-PET have high sensitivity in diagnosing pLGG, both newly diagnosed and previously treated.

**CLINICAL RELEVANCE/APPLICATION**

With its high sensitivity, MET-PET can be used to complement equivocal MRI.

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## Abstract Archives of the RSNA, 2023

T2-SPPH

### Physics Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPPH-1 Quantification of Radial and Azimuthal Variation in Spatial Resolution due to Patient Positioning on Energy Integrating and Deep Silicon Photon Counting Detector CT**

##### Participants

Aria Salyapongse, BS, Madison, WI (*Presenter*) Nothing to Disclose

##### PURPOSE

Mispositioning in CT degrades spatial resolution. Existing CT technologies address this degradation using scan modes that increase view angle sampling. In this work, we investigate spatial resolution loss away from isocenter for a prototype deep silicon photon-counting detector (PCD) CT scanner and compare with existing energy-integrating detector (EID) CT.

##### METHODS AND MATERIALS

We performed three sets of scans on a wire phantom at four radial positions in the bore (isocenter, 6.7 cm, 11.8 cm, and 17.1 cm off isocenter). The acquisition modes were: 120 kV EID CT, 120 kV high-definition (HD) EID CT, and 120 kV PCD CT. HD mode used double the projection view angles as the "regular" EID scan mode. Diameter of the wire was calculated by taking the full width of half max (FWHM) of a profile drawn over the radial and azimuthal directions of the wire. Change in apparent size of the wire was assessed by taking the ratio of the radial or azimuthal diameter at each position to the radial or azimuthal diameter at isocenter.

##### RESULTS

The deep silicon PCD CT had the smallest change in the ratio of the wire diameter for both radial (ratio of  $1.00 \pm 0.09$  versus  $1.15 \pm 0.01$  and  $1.21 \pm 0.04$ ,  $p < .001$ ) and azimuthal (ratio of  $0.99 \pm 0.09$  versus  $1.36 \pm 0.01$  and  $1.12 \pm 0.01$ ,  $p < .001$ ) directions versus EID and HD EID respectively. HD EID CT had a smaller change in the ratio of the wire diameter in the azimuthal direction compared with EID CT ( $p < .001$ ), and a larger change in the radial direction compared with EID CT ( $p < .001$ ).

##### CONCLUSION

s Deep silicon PCD CT exhibits less change in spatial resolution in both the radial and azimuthal directions compared with both regular and HD modes on EID CT.

##### CLINICAL RELEVANCE/APPLICATION

Deep silicon PCD CT better preserved spatial resolution away from isocenter compared to EID CT which could translate into better bone and lung detail in regions located far away from isocenter.

#### **T2-SPPH-10 Accuracy of Volume and Linear Dimension Measurements of Hepatic Lesions with Dual Energy CT**

##### Participants

Jimmy Zhou, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

It has been proposed to use the volumes of hepatic lesions as a better metric than linear dimensions. However, as compared to linear dimensions, lesion volumes are more susceptible to segmentation error, hence the measurement accuracy remains unknown. We aimed to study the accuracy of both lesion volume and linear dimension measurements with dual energy CT using a simulated multi-phase liver phantom.

##### METHODS AND MATERIALS

The liver was simulated using material composition following ICRU 44. It was embedded in an abdomen phantom containing thoracic and lumbar spines. 34 lesions of iodine, iron, fat, and cyst were placed in the liver with known volumes (0.09 - 8.57 cc) and maximum linear dimensions (MLD) (10- 35 mm). The lesions are of various shapes (ellipsoidal and lobular), and contrast (-100 to 30 HU). The non-contrast, arterial, and venous phases were simulated by perfusing the parenchyma with different iodine concentrations (0, 0.68, and 1.89 mg/cc) in three consecutive slabs (40 - 50 mm thickness each). A GE Revolution CT was used at the dual-energy mode in three repeats with CTDIvol of 14 mGy (slice thickness 2.5 mm). 28 visually discernable lesions were contoured using GE AW-3.2 with auto segmentation and careful user correction for monochromatic reconstructed images of 50- 100 keV.

##### RESULTS

Compared with the known values, the overall volumes were overestimated across different energies by 9.4% +12.5%, whereas the overall MLDs were found underestimated by 4.7% +8.3%. The cyst and fat volumes were found most accurate with 3.1%+5.7% and 8.8%+8.1%, respectively, whilst the corresponding MLDs were with accuracies of 1.1%+1.8%, and 9.7%+9.5%. The iron and iodine volumes were measured higher than the ground truth by 12%+10% and 10%+14%, respectively, whilst the corresponding MLDs were found lower by 6.3%+6.7% and 3.2%+8.3%. The optimal energy for the volumes of the cyst, fat, iron, and iodine was found



to be  $\leq 70$  keV, 55 keV, 65 keV, and 70 keV, respectively. For MLD measurements, the results were less dependent on energy with the overall accuracy of 4.7%+8.4%.

## CONCLUSION

s With the fast-kVp switch dual-energy CT, the liver lesion volumes were overestimated by 9.4% +12.5%, and the optimal energies were identified with better accuracy. The MLD were underestimated with overall accuracy of 4.7% +8.3% and the results were found less dependent on energy.

## CLINICAL RELEVANCE/APPLICATION

Provide hepatic lesion volume and linear dimension accuracy in multiphase liver CT scans.

## T2-SPPH-11 Assessment of a Low-Dose Single-Scan Dynamic CT Myocardial Perfusion Technique using a Helical Scan Mode

Participants

Negin Hadjiabdolhamid, Irvine, CA (*Presenter*) Nothing to Disclose

## PURPOSE

This study assessed the reproducibility and accuracy of a low-dose single-scan dynamic CT myocardial perfusion technique using a fast-pitch helical scan mode available on standard CT scanners.

## METHODS AND MATERIALS

A total of 6 Yorkshire Swine ( $48.7 \pm 7.4$  Kg) were assessed under rest and stress conditions. Using a 320-slice CT scanner, 6 and 6 pairs of repeated CT perfusion measurements were obtained in helical and volume scan modes (100 kVp, 200 mA, and 2.5 s scan time), respectively. Myocardial perfusion measurements derived from a previously validated single-volume myocardial CT perfusion technique were used as a reference for accuracy assessment of measurements obtained from helical scans. Each helical pair was acquired following the acquisition of a volume pair, under the same perfusion conditions. Both contrast (0.5 mL/kg; 370 mgI/mL) and a diluted contrast/saline chaser (0.5 mL/kg; 30:70 contrast/saline) were injected peripherally at a rate of 5 mL/s. Following bolus tracking and triggering, a single scan was acquired at the peak of the aortic enhancement. Both the bolus tracking and the single scan data were used to derive perfusion in mL/min/g using a first-pass analysis model. The coronary perfusion territories of the left anterior descending (LAD), left circumflex (LCx) and right coronary artery (RCA) were automatically assigned for vessel-specific regional perfusion analysis. The reproducibility and accuracy of myocardial perfusion measurements in each coronary perfusion territory were assessed via regression analysis. The average CT dose index (CTDI) of perfusion measurements was recorded.

## RESULTS

The first (P<sub>Hel1</sub>) and second (P<sub>Hel2</sub>) helical CT perfusion measurements were related by  $P_{Hel2} = 0.89P_{Hel1} + 0.13$  ( $r = 0.91$ ; RMSE = 0.21 mL/min/g; RMSD = 0.20 mL/min/g) for the LAD, LCx, and RCA perfusion territories. The myocardial perfusion measurements obtained from helical and volume scans were also related by  $P_{Hel} = 0.98P_{Vol} + 0.02$  ( $r = 0.99$ ; RMSE = 0.04 mL/min/g; RMSD = 0.05 mL/min/g) when assessed in the whole myocardium, and by  $P_{Hel} = 0.95P_{Vol} + 0.04$  in LAD, LCx, and RCA perfusion territories. The average CTDI of CT perfusion measurement was 30.1 mGy and 13.3 mGy for helical and volume acquisitions, respectively.

## CONCLUSION

s A standard CT scanner in a helical scan mode can provide reproducible and accurate myocardial perfusion measurement in mL/min/g using a low-dose single-scan dynamic CT myocardial perfusion technique, which enables the clinical applicability of the technique.

## CLINICAL RELEVANCE/APPLICATION

Using a standard CT scanner in a helical mode, this technique will provide a noninvasive tool that allows comprehensive concurrent evaluation of coronary anatomy and physiology for routine assessment of coronary artery disease.

## T2-SPPH-12 Urinary Stone Differentiation using Material Decomposition Images in Dual Energy CT Urography

## PURPOSE

To evaluate the feasibility of differentiating urinary stones using material decomposition (MD) images in dual energy CT urography (DECTU).

## METHODS AND MATERIALS

108 consecutive patients (mean age:  $48.22 \pm 14.69$ y, male vs female: 75 vs 33) with suspected urinary stones and underwent triphasic DECTU were included. MD images with various basis material pairs at nephrographic (ENP) and excretory (EEP) phase were transferred to an AW4.7 for analysis. For stones larger than 3mm, regions of interest were defined as the largest circumference on the axial section of the images. MD densities of stones were measured using the GSI Viewer. Stones were divided into the pure calcium oxalate (pCaO: n=34), mixed calcium oxalate (mCaO: n=14) and mixed calcium phosphate (mCaP: n=70) according to the results of Fourier infrared spectrometer. One way ANOVA or Kruskal-Wallis H test was used to compare the MD density among the three stone groups with adjusted significance level. Thresholds for differentiating urinary stones were determined using receiver operating characteristics (ROC) analysis.

## RESULTS

The MD densities of stones using different basis material pairs are listed in Tab.1. Significant differences on Calcium (Water) MD images at ENP were found between pCaO and mCaO; mCaO and mCaP. While COD (HAP) MD images at ENP provided higher ability to distinguish pCaO from mCaP. The ranges of AUC of using MD density on ENP images were 0.68-0.75 (Tab.2) and MD density on COD (HAP) based images at ENP provided higher ability to differentiate and display the three stones (Fig.1).

## CONCLUSION

s MD density on COD (HAP) based images at ENP provide relatively high accuracy in distinguishing calcium oxalate from calcium phosphate.

## CLINICAL RELEVANCE/APPLICATION

Material decomposition images may play a role in identifying calcium oxalate stones and calcium phosphate, especially COD (HAP) MD images.

### T2-SPPH-13 Diagnostic Value of CT Lymphangiography in Patients with Primary Chyluria

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the application value of CT lymphangiography in diagnosis in patients with primary chyluria.

#### METHODS AND MATERIALS

Clinical and CTL imaging data of 79 patients diagnosed with primary chyluria were collected retrospectively. For CTL, the indexes were: Distribution of abnormal lymphatic vessels in the kidney: unilateral or bilateral kidney, renal sinus, renal parenchymal, suprahilum area and subhilum area; ? Distribution of perirenal and retroperitoneal abnormal lymphatic vessels: retroperitoneal, lumbar trunk, renal perivascular area, fatty capsule, adrenal area, etc; ? Distribution of dilated lymphatic vessels and lymphatic reflux in chest, abdomen and pelvis. The clinical characteristics and CTL signs of patients with primary chyluria were statistically described by the composition ratio of classification variables.

#### RESULTS

CTL showed abnormal lipiodol deposition in kidney in 74 cases (93.7%), single kidney in 55 cases (69.6%), bilateral kidneys in 19 cases (24.1%), renal sinus in 74 cases (93.7%), renal parenchyma in 37 cases (46.8%); suprahilum area in 61 cases (77.2%), 52 cases (65.8%) were unilateral and 9 cases (11.4%) were bilateral; subhilum area in 61 cases (77.2%), 47 cases (59.5%) were unilateral and 14 cases (17.7%) were bilateral; retroperitoneal area in 78 cases (98.7%); lumbar trunk area in 76 cases (96.2%), 20 cases (25.3%) were unilateral and 56 cases (70.9%) were bilateral; perivascular area in 72 cases (91.1%), 45 cases (57.0%) were unilateral and 27 cases (34.2%) were bilateral; fatty capsule in 14 cases (17.7%), 13 cases (16.5%) were unilateral and 1 case (1.3%) were bilateral; adrenal area in 12 cases (15.2%); bladder in 31 cases (39.2%), perivesical area in 12 cases (15.2%), perivascular area of the iliac in 73 cases (92.4%), abdominal and pelvic wall in 14 cases (17.7%), perineal area in 12 cases (15.2%), perirectal area in 14 cases (17.7%), mesentery in 26 cases (32.9%), intestinal wall in 11 cases (13.9%), intestinal canal in 5 cases (6.3%), peripancreatic area in 15 cases (18.9%), perisplenic area in 2 cases (2.5%), perihepatic area in 7 cases (8.8%), hilum of the lung in 1 case (1.3%), mediastinum in 14 cases (17.7%), pericardium in 1 case (1.3%), extrapleural area in 25 cases (31.6%), chest wall in 2 cases (2.5%), skeleton in 2 cases (2.5%), end of thoracic duct in 70 cases (88.6%).

#### CONCLUSION

s CTL can evaluate the distribution and range of intrarenal, perirenal and retroperitoneal dilated lymphatic vessels accurately, and evaluate the abnormal lymphatic vessels in the chest, abdomen and pelvis in patients with primary chyluria.

## CLINICAL RELEVANCE/APPLICATION

CTL can provide image basis for the diagnosis, grading and treatment of primary chyluria.

### T2-SPPH-2 Application of Silver Nanotriangles as a Novel Contrast Agent in Tumor Computed Tomography Imaging

Participants

Huiquan Yang, Nanjing, China (*Presenter*) Nothing to Disclose

#### PURPOSE

This study aimed to prepare chitosan-coated silver nanotriangles (AgNTs) and assess their computed tomography (CT) contrast property by in vitro and in vivo experiments.

#### METHODS AND MATERIALS

AgNTs with a range of sizes were synthesized by a seed-based growth method, and subsequently characterized by transmission electron microscopy (TEM), ultraviolet-visible absorption spectroscopy and dynamic light scattering. The X-ray attenuation capability of all prepared AgNTs was evaluated using micro CT. The CT contrast effect of AgNTs with the highest X-ray attenuation coefficient was investigated in MDA-MB-231 breast cancer cells and a mouse model of breast cancer.

#### RESULTS

The TEM results displayed that all synthesized AgNTs were triangular in shape and their mean edge lengths ranged from 60 to 149 nm. All AgNTs tested exhibited stronger X-ray attenuation capability than iohexol at the same mass concentration of the active elements, and the larger the AgNTs size, the higher the X-ray attenuation coefficient. AgNTs with the largest size were selected for further research, due to their strongest X-ray attenuation capability and best biocompatibility. The attenuation coefficient of breast cancer cells treated with AgNTs increased in a particle concentration-dependent manner. In vivo CT imaging showed that the contrast of the tumor injected with AgNTs was significantly enhanced.

#### CONCLUSION

s Our findings suggested that AgNTs could serve as an excellent contrast agent for CT imaging.

## CLINICAL RELEVANCE/APPLICATION

The current study provided a new thought for the development of highly efficient tumor CT contrast agents.

### T2-SPPH-3 Improvement of Demonstrating Submillimeter Vessels by a Newly Developed Photon Counting Detector CT: Comparison with an Energy Integrating CT in a Vessel Phantom Model

Participants

Shota Kondo, Hiroshima, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Demonstrating submillimeter vessels is not easy for the conventional energy integrating detector CT (EID-CT). PCD-CT offers several advantages over conventional EID-CT, including improvements in spatial resolution, image noise, and contrast resolution of materials including iodine as PCD-CT directly measure photon energy of each incident photon using a single semiconductor layer. The purpose of our study was to evaluate diagnostic capability of a newly developed PCD-CT on the visualization of submillimeter vessels compared with conventional EID-CT in a vessel phantom model.

## METHODS AND MATERIALS

We used a prototype PCD-CT scanner developed by Canon Medical Systems for this phantom study. A phantom (outer diameter 200 mm) including simulated 0.5, 1.0, 1.5, 2.0, 3.0, 5.0, and 10.0 mm vessels was scanned with a PCD- and EID-CT (Aquilion Precision, Canon Medical Systems). The simulated vessels were filled with diluted iodine contrast material (15mgI/ml). The scanning parameters for PCD-CT and EID-CT were matched: 120 kV, 9.5-9.7mGy CTDIvol. Both scans were reconstructed with hybrid-iterative reconstruction. PCD-CT scans were reconstructed using 1024- [ultra-high resolution (UHR) mode] while EID-CT scans were reconstructed using 512 matrix sizes. Modulation transfer function (MTF) was calculated using the simulated vessel with diameter of 10.0 mm. Profile curves were generated along a horizontal line crossing through the center of each simulated small vessel (diameter less than 3.0 mm) and the slope at the 50% point of each curve was calculated.

## RESULTS

The margin of each simulated vessel was clearly demonstrate on PCD-CT- compared with EID-CT image. PCD-CT could barely demonstrate the simulated vessel with diameter of 0.5 mm but EID-CT could not .The MTF for PCD-CT showed higher response than for EID-CT in all frequency domains. The slope value for simulated small vessels was higher on PCD-CT than on EID-CT image especially for smaller vessels.

## CONCLUSION

s PCD-CT with UHR mode showed higher spatial resolution and better demonstration of submillimeter vessels than conventional EID-CT in a phantom model.

## CLINICAL RELEVANCE/APPLICATION

PCD-CT with UHR mode may be able to demonstrate more detailed vascular anatomy such as the perforating branches of the brain than EID-CT; and PCD-CT has the potential to bring advances to medical practice.

## T2-SPPH-4 Quantification of Lower Extremity Blood Flow using a Low-dose CT Perfusion Technique

Participants

Alireza Shojazadeh, MD, Irvine, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the reproducibility and accuracy of lower extremity perfusion measurements with a low-dose first-pass analysis (FPA) dynamic CT perfusion technique.

## METHODS AND MATERIALS

A total of sixteen Yorkshire Swine ( $46.3 \pm 7.2$ kg) were used in this study with twenty-two CT acquisitions for accuracy and thirty-three acquisition pairs for reproducibility assessments. In each animal, acquisition pairs were obtained at baseline blood flow and under various levels of femoral artery stenosis severity induced by a vascular occluder. Reference flow measurements were recorded for each acquisition using an ultrasound flow probe for comparison and accuracy assessment of the technique. Contrast agent (370 mg/mL iodine, 1 mL/kg) and saline chaser (0.5 mL/kg) were both injected peripherally at a rate of 5 mL/s. Bolus tracking was used, and a pre-contrast (120kVp; 50mA) and post-contrast (120kVp; 200mA) helical scan were acquired at the base and approximately the peak of the aortic enhancement (CT angiogram), respectively. The pre- and post-contrast helical scan data were then used as analytical inputs into a first-pass analysis model to derive perfusion in mL/min/g. The accuracy and reproducibility of lower extremity perfusion measurement were then assessed via linear regression, Bland-Altman analysis, and paired sample t-test (p-value). The average CT dose index (CTDI) for the perfusion measurements was recorded.

## RESULTS

The first (P1) and second (P2) CT perfusion measurements were related by  $P2 = 0.97 P1 + 0.00$  ( $r = 0.97$ ,  $RMSE = 0.11$  mL/min/g and  $RMSD = 0.11$  mL/min/g,  $P$ -value= 0.56). The blood flow calculation derived from the CT perfusion technique (QCT) and the reference standard ultrasound blood flow measurement (QUS) were related by  $QCT = 0.93 QUS + 9.83$  ( $r = 0.96$ ,  $RMSE = 16.34$ ,  $RMSD = 32.20$ ,  $P$ -value= 0.09). The average CTDI of perfusion measurement using this technique was only 9.1 mGy.

## CONCLUSION

s This study shows that the low-dose quantitative CT perfusion technique can accurately measure lower extremity perfusion (mL/min/g) using only two helical scans. The CT angiogram and perfusion measurements can be used as a comprehensive technique for morphological and physiological assessment of limb ischemia.

## CLINICAL RELEVANCE/APPLICATION

Quantitative assessment of blood flow in peripheral extremities provides clinicians with a promising diagnostic tool for evaluating vascular diseases. Simultaneously acquiring CT angiography and providing accurate blood flow measurement can improve risk assessment and critical decision-making for patients across a wide spectrum of disease severity.

## T2-SPPH-5 Noise Reduction at Coronary CT Angiography with Photon-counting Detector CT: A Structured Phantom Study

Participants

Toru Higaki, PhD, Minami-ku, Hiroshima, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Photon-counting detector CT (PCD-CT) features a semiconductor detector that enables high-resolution imaging with a high-density

detector element, and low-noise imaging based on electrical noise cancellation. We developed a photon-counting detector CT scanner whose detector is made of CdZnTe. Here we evaluate the noise characteristics of PCD-CT using a structured phantom that simulates coronary CT angiography (CCTA).

## **METHODS AND MATERIALS**

Our CCTA structured phantom shown in Fig.1 uses a 3D printer (KEYENCE Agilista-3200). The vessels were filled with iodine contrast medium diluted to 20 mgI/ml. One simulated coronary artery harbored a 70% stenotic lesion, the other a stent graft (Medtronic, BeStent, 3.0 mm × 15 mm). We scanned the phantom on a PCD-CT scanner (Canon Medical Systems) in normal-resolution mode. The detector-element size was approximately the same as that of conventional EID-CT, the slice thickness was about 0.6 mm, the tube voltage was 120 kV, and the tube current was 250 mA. Comparisons were with a conventional energy-integrating detector CT (EID-CT, Aquilion ONE GENESIS, Canon Medical Systems). The structured phantom was scanned with a protocol that resulted in similar radiation exposure. All images were reconstructed with hybrid iterative reconstruction. To evaluate the image quality we measured the noise power spectrum (NPS) as a metric of the noise characteristics and the task-based modulation transfer function (MTF) as a metric of spatial resolution.

## **RESULTS**

The radiation dose (CTDIvol) was approximately 9.5 mGy. The image noise of PCD-CT was lower than of EID-CT (SD: 8.9 v.s. 13.8 HU, Fig. 2 left). The spatial resolution of PCD-CT and EID-CT were comparable (Fig. 2 right). Comparison of the images in Figs. 3 and 4 confirmed the low image noise on PCD-CT scans.

## **CONCLUSION**

Our PCD-CT suppressed the electrical noise and reduced the image noise on CCTA images.

## **CLINICAL RELEVANCE/APPLICATION**

As the normal resolution mode of PCD-CT can reduce the image noise it may be useful for reducing the radiation dose of CCTA.

### **T2-SPPH-6 Radiation Dose and Image Quality at Coronary CT Angiography using a 256-detector Scanner at Different Heart Rates**

Participants

Yuta Hirose, Adachi, Japan (*Presenter*) Nothing to Disclose

## **PURPOSE**

To retrospectively assess radiation dose and image quality (IQ) at coronary CT angiography (CCTA) with a 256-detector CT scanner in patients with different heart rates (HRs).

## **METHODS AND MATERIALS**

From January 2022 through January 2023, consecutive 158 patients were included who underwent prospectively ECG-gated axial scanning of CCTA using the high-definition scan mode with the latest 256-detector CT scanner (Revolution CT Apex, GE). Each patient was classified into one of the following 3 groups based on mean HR and HR variability (HRV), defined as difference between maximum and minimum HRs, during the scanning: Group A, mean HR < 65 bpm and HRV < 20 bpm; Group B, mean HR = 65 bpm and HRV < 20 bpm; Group C, HRV = 20 bpm. Scan window was automatically selected based on mean HR and HRV just before the examination with dedicated software as follows: Group A, mid-diastole; Group B, end-systole to mid-diastole; Group C, entire cardiac cycle of a single heartbeat. Axial images of 0.625-mm slice were reconstructed with a deep-learning algorithm at optimal cardiac phase automatically selected with dedicated software. A motion correction algorithm was applied only when motion artifact remained significant. Standard deviation (SD) of CT value was measured in the ascending aorta as image noise. Two independent radiologists subjectively assessed IQ of the right coronary artery (RCA), left anterior descending artery (LAD), and left circumflex artery (LCX) regarding motion artifact using a 4-point scale (1, poor; 4, excellent; 2-4, acceptable). One-way ANOVA test was used to compare body mass index (BMI), SD, and dose-length product (DLP) and Kruskal-Wallis test was used to compare the IQ scores with Bonferroni correction among Groups A-C at the scanning. Weighted  $\kappa$  test was used to quantify inter-reader agreement.

## **RESULTS**

Whereas BMI ( $P = 0.557$ ) and SD ( $P = 0.065$ ) were comparable among Groups A-C, DLP was significantly higher in Group C than in Groups A and B ( $P < 0.05$  for both) but comparable between Groups A and B at the scanning ( $P = 0.341$ ). The IQ score for RCA was significantly higher in Group A than in Group B ( $P < 0.001$ ) and for LAD and LCX, in Group A than in Groups B and C ( $P < 0.05$  for all); otherwise, comparable among Groups A-C ( $P > 0.05$  for all). IQ was acceptable in all vessels except one RCA in Group A and one RCA and one LCX in Group C. Inter-reader agreement was good ( $\kappa = 0.76$ ).

## **CONCLUSION**

IQ regarding motion artifact was best in Group A but acceptable in all Groups whereas radiation dose was significantly increased in Group C at the CCTA.

## **CLINICAL RELEVANCE/APPLICATION**

Whereas acceptable IQ regarding motion artifact can be preserved at CCTA with the latest 256-detector CT scanner, adequate use of beta blockers to lower HR and HRV can reduce radiation dose and improve IQ and diagnostic performance.

### **T2-SPPH-7 Reproducibility of an Automated Lobar Lung Tissue Assignment Technique using Non-contrast CT**

Participants

Sabee Y. Molloy, PhD, Irvine, CA (*Presenter*) Research Grant, Canon Medical Systems Corporation

## **PURPOSE**

Lobar segmentation is necessary for regional ventilation and perfusion analysis. This study evaluated the reproducibility of a vessel-specific minimum-cost path (MCP) technique used for lobar segmentation based on non-contrast CT.

## **METHODS AND MATERIALS**

A total of 16 Yorkshire Swine (49.88±4.69 kg) were used in this study with 46 independent CT acquisitions. A helical scan mode was used (100kV, 50 mA, 24 cm Z-coverage and 2.5s scan time). Following image acquisition, lung tissue segmentation and pulmonary arterial tree centerline extraction was performed. The pulmonary arterial tree was then divided into six lobar subtrees for lobar assignment. The MCP technique was used to assign lobar territories by assigning every voxel of the lung tissue to the nearest arterial tree segment. The reproducibility of the MCP technique was evaluated by quantitatively comparing the MCP-derived lobar territories between two CT acquisitions by tissue mass and volume, using linear regression, root mean square error (RMSE), root mean square deviation (RMSD) and paired sample t-test (p-value). An interobserver and intraobserver analysis of the lobar measurements were also performed.

## RESULTS

The lobar mass measurements from the first (MLOBE1) and second (MLOBE2) CT acquisitions were correlated by  $MLOBE1 = 0.99MLOBE2 + 1.76$  ( $r = 0.99$ ) with a p-value of 0.120, RMSE = 7.99 g and RMSD = 7.91 g. The lobar volume measurements from the first (VLOBE1) and second (VLOBE2) CT acquisitions were correlated by  $VLOBE1 = 0.98VLOBE2 + 2.66$  ( $r = 0.99$ ) with a p-value of 0.160, RSME = 15.26 mL and RMSD = 14.94 mL. The calculated whole lung mass measurements from the first (MLUNG1) and second (MLUNG2) CT acquisitions were correlated by  $MLUNG1 = 0.89 MLUNG2 + 76.32$  g ( $r = 0.96$ ) with a p-value of 0.306, RMSE= 29.13 g and RMSD= 26.10 g. The calculated whole lung volume measurements from the first (VLUNG1) and second (VLUNG2) CT acquisitions were correlated by  $VLUNG1 = 0.99 VLUNG2 - 3.27$  ( $r = 0.98$ ) with a p-value of 0.396, RMSE = 60.52 mL, RMSD = 59.49 mL.

## CONCLUSION

s The whole lung and lobar mass and volume measurements show excellent reproducibility using a vessel specific assignment technique. This technique can potentially be used for automated lung lobar segmentation, enabling regional ventilation and perfusion analysis for clinical applications.

## CLINICAL RELEVANCE/APPLICATION

Assessment of lobar mass or volume in the lung lobes may allow for efficient treatment planning and region-specific treatment strategies for diseases such as pulmonary embolism and chronic thromboembolic pulmonary hypertension.

### T2-SPPH-8 Reproducibility of a Low-Dose Single-Volume Dynamic CT Myocardial Perfusion Technique

#### Participants

Negin Hadjiabdolhamid, Irvine, CA (*Presenter*) Nothing to Disclose

#### PURPOSE

The current methods for accurate diagnosis and assessment of the physiological effects of coronary artery disease (CAD) are limited. There have been previous reports of dynamic CT perfusion techniques capable of assessing CAD, but high radiation dose has hampered widespread clinical implementation of currently existing methods. This study assessed the reproducibility of myocardial perfusion measurements in mL/min/g using a low-dose single-volume dynamic CT myocardial perfusion technique.

#### METHODS AND MATERIALS

A total of 13 Yorkshire Swine (54.3±12.3 kg) were used in this study. Thirty-four pairs of prospective CT measurements were made under rest and stress conditions. One or two acquisition pairs were acquired in each animal with a 10-minute delay between each acquisition. Contrast (0.5 mL/kg; 370 mgI/mL) and a diluted contrast/saline chaser (0.5 mL/kg; 30:70 contrast/saline) were injected peripherally at 5 mL/s, followed by bolus tracking, triggering, and acquisition of a single volume scan (100 kVp; 200 mA) using a 320-slice CT scanner. The delay time for acquisition of the single volume scan after triggering was determined using a previously validated contrast injection timing method. Following CT acquisition, both the bolus tracking and single volume scan data were used to derive perfusion in mL/min/g using a first-pass analysis model. After which, the coronary perfusion territories of the left anterior descending (LAD), left circumflex (LCx) and right coronary artery (RCA) were automatically assigned using a previously validated minimum-cost path technique. The reproducibility of CT myocardial perfusion measurement within the LAD, LCx, RCA, and the whole myocardium was assessed via regression analysis. The average CT dose index (CTDI) of perfusion measurement was also recorded.

## RESULTS

The first (Pmyo1) and second (Pmyo2) single-volume CT perfusion measurements were related by  $Pmyo2 = 1.01Pmyo1 - 0.03$  ( $r = 0.99$ ; RMSE=0.08 mL/min/g; RMSD=0.07 mL/min/g) for the whole myocardium, and by  $Preg2 = 0.86Preg1 - 0.13$  ( $r = 0.91$ ; RMSE=0.31 mL/min/g; RMSD=0.29 mL/min/g) for the LAD, LCx, and RCA vessel-specific perfusion territories (Preg). The average CTDI of the single-volume CT perfusion measurement was 10.5mGy.

## CONCLUSION

s The low-dose single-volume dynamic CT myocardial perfusion technique provides reproducible myocardial perfusion measurement in mL/min/g only requiring bolus tracking and a single whole-heart volume scan data.

## CLINICAL RELEVANCE/APPLICATION

This technique is a noninvasive tool that reproducibly measures myocardial perfusion and provides coronary CT angiogram, which allows for simultaneous anatomic-physiologic assessment of myocardial ischemia.

### T2-SPPH-9 High Temporal Resolution and Low-dose Dynamic Imaging of Airway using Photon-counting-detector CT

#### Participants

Jelena Mihailovic, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### PURPOSE

Dynamic CT imaging can provide valuable information for diagnosing airway abnormalities. Existing dynamic CT techniques for airway imaging are susceptible to cardiac and respiratory motion artifacts due to limited temporal resolution. In this work, we aim to implement and evaluate a low-dose dynamic scanning technique with a temporal resolution as fast as 66 milliseconds for airway imaging using a dual-source photon-counting-detector (PCD)-CT.

## **METHODS AND MATERIALS**

An inflatable pig lung phantom (BioQuest, USA) that can mimic respiratory cycles through manual ventilation was used. Tubes with known diameters (2 and 3 mm) were attached to the lung as a measurement reference. The phantom was scanned on a whole-body PCD-CT scanner (Naeotom Alpha, Siemens) with two scanning modes, a dual-source prospectively-gated adaptive sequential mode with a slow (30 bpm) electrocardiogram (ECG) signal and a traditional dynamic cine mode, each at three dose levels (volume CT dose index (CTDI<sub>vol</sub>) = 0.8, 1.6, and 3.5 mGy). For the slow-ECG-gated mode, in order to utilize the rapid temporal resolution used for cardiac CT while providing multi-phase imaging and reconstruction of an entire breathing cycle, an ECG simulator was modified to generate a much slower signal simulating breathing cycles of 30 rpm. This slow ECG-gated mode has a temporal resolution of 66 ms, similar to cardiac CT. The techniques used for both dynamic CT scanning modes were adjusted to a low tube potential (90 kV) to achieve the lowest possible radiation dose. The rotation time was 0.25 seconds and field of view (FOV) 300 mm. Since the acquisition is performed with detector collimation of 144x0.4 mm minimum slice thickness for dynamic scan was 0.6 mm, while for adaptive sequential mode 0.4 mm. The diameters of the tubes were measured and compared with the truth to compare the impact of motion at the two scan modes.

## **RESULTS**

Motion artifacts were significantly reduced on images acquired from the slow ECG-gated scans compared to the traditional cine-mode scans. On the slow ECG-gated dynamic images, the shape of the attached tubes was maintained, which provided a more accurate measurement of diameter than images from the cine-mode scans:  $3.10 \pm 0.02$  mm and  $1.9 \pm 0.02$  mm for ECG-gated scans, and  $3.9 \pm 0.6$  mm and  $2.6 \pm 0.5$  mm for cine-mode scans, for tubes of 3 and 2 mm, respectively.

## **CONCLUSION**

Compared to conventional dynamic CT acquired in a cine mode, the proposed slow ECG-gated dynamic imaging technique on PCD-CT can achieve a better temporal resolution, which reduces motion artifacts and improves visualization and quantitation of airways.

## **CLINICAL RELEVANCE/APPLICATION**

Implementation of a slow ECG-gated imaging method on the dual-source PCD-CT may provide dynamic images of airways with reduced motion artifacts.

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## Abstract Archives of the RSNA, 2023

T2-SPRO

### Radiation Oncology Tuesday Poster Discussions

#### Sub-Events

#### T2-SPRO-1 Preoperatively Identify Glypican-3 Positive HCC: Via Multi-phase CE-MRI Delta Radiomics

##### Participants

Yifan Pan, Fuzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the value of multi-phase contrast enhanced magnetic resonance imaging (CE-MRI) based delta radiomics for identifying the glypican-3 (GPC3) positive hepatocellular carcinoma (HCC).

##### METHODS AND MATERIALS

One hundred and twenty-six patients with pathologically-confirmed HCC (GPC3 positive : GPC3 negative = 95 : 31; training cohort: n = 88; test cohort: n = 38) were retrospectively recruited. Basic information was obtained from our medical records. Preoperative Multi-phase CE-MRI images were reviewed by abdominal radiologists and semantic features were evaluated. The 3D volume of interest (VOI) of whole tumor was segmented on non-contrast T1 weighted imaging (T1-NC), arterial phase (AP), portal venous phase (PVP), delayed phase (DP), hepatobiliary phase (HBP). Radiomic features were extracted from each phase and 3 types delta features (standardized subtraction, direct subtraction, and relative subtraction) were calculated. Feature data were resampled using Synthetic Minority Over-sampling Technique (SMOTE) algorithm. A two-step feature selection strategy was applied. First, minimal-redundancy-maximal-relevance (mRMR) was used to select 20 features and then recursive feature elimination (RFE) was used for further selection. Radiomics models were built using logistic regression and support vector machine. By combining the best radiomics model and clinical risk factors, a nomogram was constructed and evaluated.

##### RESULTS

Univariate analysis showed that serum alpha-fetoprotein (AFP) levels > 400 ng/ml ( $p = 0.013$ ) was significantly related to GPC3 positive HCC. The optimal radiomic model composed of 8 delta radiomic features had an AUC of 0.805 in training cohort and 0.851 in test cohort. Additionally, the nomogram integrated the radiomics score and AFP achieved the best performance (training cohort: AUC = 0.844; test cohort: AUC = 0.862). Calibration curve showed good agreement between the nomogram predicted probabilities and actual outcomes of GPC3 expression in both training and test cohort. Decision curve analysis further demonstrate the clinical practicality of the nomogram.

##### CONCLUSION

s Multi-phase CE-MRI based delta radiomics model can non-invasively predict GPC3 positive HCC and could be a useful method for individualized diagnosis and treatment.

##### CLINICAL RELEVANCE/APPLICATION

Multi-phase CE-MRI based delta radiomics model can non-invasively predict GPC3 positive HCC and could be a useful method for individualized diagnosis and treatment.

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## Abstract Archives of the RSNA, 2023

T2-SPVA

### Vascular Imaging Tuesday Poster Discussions

#### Sub-Events

#### **T2-SPVA-1 Assessment of the Utility of CT Angiographic Reports for Evaluation of Deep Inferior Epigastric Artery in Preparation for Rectus Flap Surgery**

##### Participants

David Polito, MD, Morton Grove, IL (*Presenter*) Nothing to Disclose  
Collin Larkin, MSc, (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Current radiology literature details the anatomy of the deep inferior epigastric artery (DIEP) and reporting requirements. However, the surgical requirements are specific, and our current literature is short of addressing those. We aim to compare imaging and surgical findings of DIEP perforators on CT angiographic (CTA) studies for improving radiology reports tailored to help in the surgical flap selection.

##### **METHODS AND MATERIALS**

Retrospective review of CTA from 1/2021 to 1/2023 for indication of DIEP evaluation for breast reconstruction planning. There were 95 studies, and 40 were included after excluding examinations with a large field of view, >3 mm slice thickness, and suboptimal image quality. The CTA was reviewed for anatomy of DIEP: origin, branching pattern, number of perforators, and their sizes. Two readers- one abdominal imaging fellow and a fellowship-trained radiologist reviewed the studies independently. The medical records were queried for factors that affect flap selection, including prior abdominal surgery, preoperative surgical choices, patient preference, clinical indication, operative findings, the reason for selecting or rejecting a flap, and post-operative complications. Descriptive statistics and kappa statistics were performed.

##### **RESULTS**

The patients ranged from 30-71 years of age. The readers reported 68-80% studies were of good quality. Inter-reader agreement for assessment of branching type and number of >1.5mm perforators on each side was moderate (Cohen's kappa value ranging 0.41-0.5). Though there were smaller number of patients with perforators that were >1.5 mm diameter and below the umbilicus that was crucial in surgical decision making, there were more perforators (up to 6) that were below the umbilicus but <1.5 mm size criteria. Sixteen patients had bilateral flap reconstruction, 9- unilateral flap of which 4 had combined rectus flap and latissimus TRAM flap surgeries. Nine patients had post-operative complications, which were ischemia and necrosis due to thrombosis of perforator or intimal tearing of the perforator during surgery.

##### **CONCLUSION**

s CTA is a viable modality for presurgical planning in anticipation of breast reconstruction and has acceptable inter-reader agreement and correlation with surgical findings. It is essential to revise our radiology reports to include DIEP perforators up to 4 perforators that are >1.5 mm thickness at the subfascial plane and below the umbilicus to help the surgeons in decision-making.

##### **CLINICAL RELEVANCE/APPLICATION**

Awareness of anatomy and reporting of the crucial details about the number and course of DIEP perforators can help in surgical planning and avoid accidental vessel tears or injury during surgery, leading to necrosis and failure of flap reconstruction.

#### **T2-SPVA-2 Deep Learning for Cerebral Artery Segmentation in 3D MRA using the Spatial Distribution Probability Map**

##### Participants

Yun Peng, Nanchang, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Thanks to the development of computational capability, deep learning based segmentation has attracted increased attention over the past few years. This study aims to develop a novel approach for the segmentation of cerebral arteries by incorporating the a-prior knowledge of the spatial distribution of cerebral arteries in the deep learning network.

##### **METHODS AND MATERIALS**

Patients who had undergone time-of-flight magnetic resonance angiography (TOF-MRA) for both the physical examination and the suspicion of cerebrovascular diseases at two different branches of a hospital were retrospectively identified. 50 healthy patients evaluated in 2022 are included. The ground truth images were first manually generated by four junior radiologists. To reduce errors, all labels were checked and corrected by two senior radiologists. The proposed network was trained with the data set of 40 patients and evaluated with the test set of 10 patients. In this study, we develop a U-net based network which embeds a trainable spatial distribution probability map (SDPM) into the network. The SDPM provides the overall location knowledge of the cerebral arteries to correct the predictions of the non-target vessels or predictions with high uncertainty. It refines the prediction for



ambiguous artery edges and reduces mislabeled vessels caused by brain imaging under different equipment and parameters. Additionally, the SDPM is trainable so that it improves the initial SDPM, which is calculated using the overall spatial distribution of cerebral arteries. The performance was assessed by the dice similarity coefficient (DSC), the false negative (FN) rate and the false positive (FP) rate.

## RESULTS

The proposed model is compared with three models: 3D Unet, 3D Res-Unet and 3D Vnet. The average DSC of the proposed model in the test set was 0.89, while the average DSC of the 3D Unet, 3D Res-Unet and 3D Vnet were 0.77, 0.80 and 0.85, respectively. The FP rate of the proposed model is 0.156, which is better than the results of 3D Res-Unet (0.171) and 3D Vnet (0.162). The 3D Unet has the best performance on FP rate, however its FN rate is 0.306. The FN rate of the proposed model is 0.126, which also outperforms the results of 3D Res-Unet (0.241) and 3D Vnet (0.132).

## CONCLUSION

By embedding the trainable SDPM into the Unet structure, the proposed model provides a fully automated segmentation method with high accuracy for cerebral arteries. Future work includes developing a cerebral aneurysm detection model using the proposed SDPM method.

## CLINICAL RELEVANCE/APPLICATION

The fully automated segmentation of cerebral arteries with high performance helps to improve clinical diagnostic efficiency and accuracy of cerebrovascular diseases, such as the cerebral aneurysm and stenosis.

## T2-SPVA-3 MRI Relaxation Properties of Ferumoxytol: A Comparison of Brand Name vs Generic

Participants

Rianne Van der Heijden, MD, PhD, Rotterdam, (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the MRI relaxation properties of brand name ferumoxytol (Feraheme®, AMAG Pharmaceuticals) with generic ferumoxytol (Sandoz).

## METHODS AND MATERIALS

A phantom experiment was performed using both brand name and generic ferumoxytol agents. Each agent was diluted in saline and also adult bovine whole blood at 5 concentrations ranging from 0.3-2.1mM within 30 ml vials, for a total of 20 vials. Prior to imaging, vials were placed in an MR compatible water bath at 37°C and imaged at both a 1.5T and 3.0T on clinical MRI systems (1.5T Artist, 3.0T Premier, GE Healthcare, Waukesha, WI) using a phase array torso coil (AIR coil). The protocol consisted of coronal acquisitions using 2D fast spin echo (FSE) inversion recovery with multiple inversion times to measure R1, 2D FSE sequence with multiple echoes to measure R2, and 3D multi-echo spoiled gradient echo chemical shift-encoded method (IDEAL-IQ) to measure R2\*. Relaxation rate constants, R1, R2, R2\* were measured in a manually drawn region of interest centrally located in each vial in three slices using Matlab. Differences in relaxivity between the agents were tested with chi-square with 2 or 3 degrees of freedom depending on the fitted model.

## RESULTS

The dependences of R1, R2 and R2\* on ferumoxytol concentrations were linear in saline and non-linear in blood. R1 values (represented by the slope of the equation and SE (s-1mM<sup>-1</sup>)) of saline for AMAG and Sandoz, respectively at 1.5 T (16.3 ± 2.2; 14.3 ± 1.3; p=.22) and 3.0 T (9.5 ± 0.04; 8.8 ± 0.01; p<.001). R2 values of saline for AMAG and Sandoz respectively at 1.5 T (59.4 ± 0.35; 60.0 ± 4.9; p=.82) and 3.0 T (61.3 ± 3.9; 57.8 ± 1.8; p=.13). R2\* values of saline for AMAG and Sandoz respectively at 1.5 T (59.4 ± 2.1; 72.0 ± 3.3; p<.001) and 3.0 T (64.2 ± 3.3; 65.3 ± 4.5; p=.92). R1 relaxivity of blood followed a quadratic relationship for AMAG and Sandoz respectively at 1.5 T (6.7x<sup>2</sup>+1.23x+7.4; 8.3x<sup>2</sup>-1.9x+7.6; p=.22) and 3.0 T (1.4x<sup>2</sup>+6.6x+0.8; 1.6x<sup>2</sup>+5.4x+0.7; p<.001), where x=concentration. R2 relaxivity of blood for AMAG and Sandoz respectively at 1.5 T (20.1x<sup>2</sup>+45.7x+12; 20.7x<sup>2</sup>+35.5x +13.3; p=.07) and 3.0 T (15.9x<sup>2</sup>+41.6x +15.2; 30.2x<sup>2</sup>+6.8x +22.7; p=.44). R2\* relaxivity of blood for AMAG and Sandoz respectively at 1.5 T (60.0x<sup>2</sup>-3.31x+108.5; 41.7x<sup>2</sup>+30.0x+80; p<.001) and 3.0 T (43.9x<sup>2</sup>+24.2x+57; 38.5x<sup>2</sup>+26.2x+56; p<.001).

## CONCLUSION

There were no statistically significant differences between the AMAG and Sandoz agents for most relaxivity values and those with differences were small and of doubtful clinical relevance.

## CLINICAL RELEVANCE/APPLICATION

Ferumoxytol is increasingly being used for MR angiography and in patients with contraindications to gadolinium. The use of generic agents may reduce cost without any clinically relevant differences in the relaxation properties.

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## Abstract Archives of the RSNA, 2023

T5A-SPBR

### Breast Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPBR-1 Screening after Breast Conserving Surgery with Acellular Dermal Matrix Reconstruction: Mammography, Ultrasonography and MRI**

##### Participants

Dawon Jung, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the findings of postoperative images of patients who underwent breast reconstruction with acellular dermal matrix (ADM) and assess which imaging modality is more feasible to detect local tumor recurrence: mammography(MG), ultrasound(US), or MRI.

##### METHODS AND MATERIALS

This retrospective study included consecutive women who were first diagnosed with breast cancer and underwent breast-conserving surgery between Jan 2015 and Aug 2021 and immediate reconstruction with MegaDerm®, followed by at least one MG, US, and MRI. Postoperative images were analyzed by breast radiologists and classified as positive for BI-RADS categories 0, 4, and 5 and negative for BI-RADS categories 1,2, and 3. The reference standard was defined with 1-year follow-up Imaging findings and pathologic reports. Diagnostic performances of each imaging modality was evaluated. Imaging features of ipsilateral recurrent breast cancers were reviewed.

##### RESULTS

207 women (mean age 46 years) were enrolled with a total 725 MG, 1097 US and 621 MRI. During the follow-up, the mean numbers of MG, US, and MRI scans of 3.5, 5.3, and 3.0 respectively, and a mean follow-up interval of 35.5 months (range 13-71 months). Among 207 women, total recurrence occurred in 15 (7.2%) patients and 11 (5.3%) patients recurred on the same breast. Sensitivity was 80 % for MG and 100% for both US and MRI. Specificity was 99% for MG, 99.4% for US and 96.9% for MRI. Diagnostic accuracy was 98.6% for MG, 99.4% for US and 96.9% for MRI. All 11 ipsilateral recurrence were suspicious on both US and MRI, while 3 cases (27.3%) were considered as benign on MG. All ipsilateral recurrences showed masses/nom-mass lesions with hypervascularity and enhancement, near the ADM.

##### CONCLUSION

Screenings with MG, US and MRI are useful imaging tool, after breast conserving surgery with ADM reconstruction. Especially, US and MRI are helpful modalities for the ipsilateral recurrence.

##### CLINICAL RELEVANCE/APPLICATION

After breast conserving surgery with ADM reconstruction, screening with MG, US and MRI might be hindered by ADMs. However, all screening modalities are useful, especially US and MRI. The most common findings of ipsilateral recurrence was mass/nom-mass lesion with hypervascularity and enhancement, near the ADM.

#### **T5A-SPBR-2 The Observation of VM1 Gadolinium Tumor Markers Placed in Fibroadenomas Over Time**

##### PURPOSE

Fibroadenomas are one of the most common breast masses, affecting nearly 10% of women. These benign tumors most often appear in the 3rd and 4th decades of life, but can arise at any age. Fibroadenomas can be recognized on imaging by their characteristic smooth, solid, ovoid appearance, being narrower in the A/P diameter, and with discrete internal echoes. Gadolinium (Gd) tumor markers are the only markers visible on all imaging modalities. These markers also have the benefit of remaining stable during radiation treatment. Often, they are surgically resected, however, if they are placed in benign tumors, they may remain in the patient (pt) indefinitely. In this study, we followed scans of pts with Gd tumor markers placed in biopsy-proven fibroadenomas. It was hypothesized that over time, the marker would remain the same intensity, would not migrate, and that the tumor bed would be unchanged.

##### METHODS AND MATERIALS

Charts of pts who had VM1 Gd tumor markers placed between 2016 and 2020 for breast masses were reviewed. Initial scans were assessed, and those with masses characteristic of fibroadenomas were separated. Pts with biopsy-proven fibroadenomas were included. Subsequent imaging studies were reviewed, and the implanted tumor marker, as well as the tumor bed, were assessed for changes over time.

##### RESULTS

Thirty-six pts who had VM1 tumor markers placed for discrete breast masses were identified and seven had biopsy-proven fibroadenomas diagnosed during the study period. Three pts had scans suitable for analysis, two had subsequent surgical resections, and two pts were lost to follow-up. One pts had imaging for six-months following VM1 marker placement, one pt had

imaging for two years, and one pt had imaging for seven subsequent years. In these three pts, the VM1 tumor marker did not change in position, brightness, or intensity, nor did the fibroadenoma change in size or internal characteristics.

## CONCLUSION

In this study, we assessed the stability of VM1 Gd tumor markers placed in fibroadenomas. Although only a small group of pts were assessed, our study demonstrated that VM1 Gd tumor markers remain stable over time with regard to position and appearance. Additionally, the fibroadenomas in which the markers were placed did not change over time. Further studies should seek to include more pts over longer follow-up periods.

## CLINICAL RELEVANCE/APPLICATION

This study shows unresected VM1 Gd tumor markers remain stable in appearance and in place for up to seven years in subsequent imaging. The VM1 Gd marker is available as the first new FDA approved soft tissue marker in nearly 10 years and is visible on all imaging modalities (MRI, ultrasound, tomo, X-Ray). This information will aid radiologists in localizing breast masses over time and assessing them for future change.

## 5A-SPBR-3 The Value of Imaging Combined with Clinicopathological Features in the Diagnosis of High-risk Breast Lesions

Participants  
Jiayin Zhou, Shanghai, China (*Presenter*) Nothing to Disclose

## PURPOSE

Comparing the diagnostic and predictive value of imaging features of different modes for breast high-risk lesions (HRLs) to improve image recognition and assist in clinical decisions.

## METHODS AND MATERIALS

We retrospectively reviewed 230 HRLs detected by mammography, ultrasound, and MRI before biopsy at the XXX Hospital from January 2017 to March 2018. The clinical features, imaging data according to the Breast Imaging Reporting and Data System (BI-RADS) lexicon, and tumor upgrade rates were received. Based on the different risks of upgrade reported, the lesions were classified into high-risk I (HR-I, with atypical hyperplasia (AH)) and high-risk II (HR-II, without AH). We analyzed the association between clinicopathological and imaging factors and upgrade. We used the receiver operating characteristic (ROC) curve to compare the efficacy of three imaging modes for predicting upgrade.

## RESULTS

We included 230 HRLs in 230 women in the study, and the overall upgrade rate was 20.4% (47/230). The upgrade rate was higher in HR-I compared to HR-II (38.5% vs. 4.1%,  $P < 0.01$ ). In patients with AH, estrogen receptor-positive (ER+) patients accounted for 81.0% (64/79). For all HRLs and HR-I, in clinical characteristics, age, maximum size of lesion, and menopausal status were significantly associated with upgrade ( $P < 0.05$ ). In imaging factors, MRI background parenchymal enhancement (BPE), signs of MRI and ultrasound were significantly correlated with upgrade ( $P < 0.05$ ). Patients with negative MRI or ultrasound manifestations had lower upgrade rates ( $P < 0.01$ ). For HR-II, only BPE showed a significant difference between groups ( $P = 0.001$ ). Multifactorial analysis of all HRLs showed that age and BPE were independent predictors of upgrade ( $P < 0.01$ ). AUCs for predicting upgrade in mammography, ultrasound, and MRI were 0.606, 0.590, and 0.913, respectively, indicating that MRI diagnosis was significantly better than mammography and ultrasound ( $P < 0.001$ ).

## CONCLUSION

HRLs with AH had a higher rate of upgrade and increased ER expression. Among three imaging modes, MRI was more effective than ultrasound and mammography in diagnosing the upgrade of HRLs. Older age and moderate to marked BPE can indicate malignant upgrade. MRI can provide a certain value for the diagnosis and follow-up of HRLs.

## CLINICAL RELEVANCE/APPLICATION

We explored the relationship between the imaging signs of different modes and the upgrade of HRLs, helping to suggest the correlation between HRLs and the risk of breast cancer, and providing references for clinical decision-making in the follow-up treatment of HRLs.

## 5A-SPBR-4 Outcomes of Pre-operative MRI versus Ultrasound in Axillary Nodal Staging: Association with Clinicopathological Breast Cancer Features

Participants  
Firouzeh Arjmandi, MD, Dallas, TX (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the diagnostic accuracy of MRI versus ultrasound (US) in breast cancer axillary nodal evaluation in the same patient cohort.

## METHODS AND MATERIALS

All breast cancer (BCA) patients that underwent dynamic contrast-enhanced breast MRI (N=529) for baseline staging between 2.2013-3.2016 at 2 hospitals (university and safety net) were reviewed. Race, clinicopathological features, size, and radiologist axillary assessment on imaging prior to biopsy [suspicious=Rad(+), benign=Rad(-)] were collected. Radiologist imaging assessment (regardless of biopsy result) was compared to surgical pathology [(SLNB or axillary node dissection (ALND), pN]. We collected the sequence of US and MRI evaluation of axilla in diagnostic order to identify initial detection of a suspicious lymph node (LN) in 319/529 patients. Chi-square test was used to compare hormone status, multifocality, axillary imaging modality [MRI first vs US first] and Mann-Whitney-U to compare age, tumor size, and Ki67% between defined groups.

## RESULTS

Mean age was 51.3 (SD±23.6) years and tumor size was 37.4 mm (SD± 23.6). Patients received US first (includes US+MRI and US+MRI+US groups) in 80.6% and MRI first [(includes MRI alone (MRI) and MRI followed by US (MRI+US)] in 19.4%. Axillae were Rad(+) in 52.4% and Rad(-) in 48.0%. FN values were calculated in Rad(-). Negative predictive value (NPV) for patients that

underwent MRI first vs. US first was 85.1% vs. 70.1% ( $p < 0.05$ ). Hispanics and Blacks were more likely to have FN on MRI (22.2% and 18.2%) compared to non-Hispanic Whites ( $p = 0.8$ ) and on US, Hispanics were more likely than non-Hispanic Whites (37.5% vs. 27.7%,  $p = 0.2$ ). On both MRI and US, FNs were higher in younger age, higher clinical T stage (cT) and lower Ki67. FNs were lowest in triple negative (TNBC) and highest in HER2+ ( $p = 0.2$ ,  $p = 0.4$ , respectively). Unifocal tumors had significantly lower FNs compared to multifocal/centric (21.2% vs. 44.7%,  $p = 0.009$ ) in the US first group but not in MRI first (14.7% vs. 15.4%,  $p = 1$ ). Overall sensitivity and specificity in MRI first was 93.4% and 72.7% ( $p < 0.001$ ) and in US first was 72.3% and 74.2% ( $p = 0.8$ ), respectively.

## CONCLUSION

s MRI performs better than US for LN metastasis with better NPV and higher sensitivity. For both MRI and US, FNs are highest in Hispanics (followed by Blacks on MRI), increase in younger age and higher cT, and are lowest in TNBC and highest in HER2+ subtypes.

## CLINICAL RELEVANCE/APPLICATION

MRI performs better than US in LN metastasis, and NPV is affected by clinicopathological factors in both. MRI should be considered especially in higher cT stage.

## T5A-SPBR-5 Evaluation of the Differential Diagnosis Ability of Breast BI-RADS Class 4 Lesions Based on MRI and Clinical Features

Participants

Hua He, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

The development of breast cancer is influenced by many factors. Different imaging parameters can provide comprehensive information about the lesion, which can help more accurate diagnosis and individualized treatment. This study explores the predictive value of nomogram based on MRI and clinical features in the differential diagnosis of benign and malignant breast BI-RADS 4 lesions.

## METHODS AND MATERIALS

A total of 98 BI-RADS 4 patients, including 68 cases assigned to a malignant group and 33 cases assigned to a benign group, were prospectively enrolled, and their their MRI and clinical information were collected. Two physicians jointly analyzed the characteristics of conventional MRI. T1, T2, proton density (PD), and ADC values were obtained from three different regions interest (ROIs). Logistic regression analyses were used to select features and build models, and a nomogram was constructed with the best model.

## RESULTS

Using the ROI delineation method at the most obvious enhancement to measure the ADC value revealed the best diagnostic performance in diagnosing BI-RADS type 4 mass lesions. The diagnostic efficiency of the maximum level drawing method of the quantitative relaxation model was better than that of the whole drawing method and the most obvious enhancement method. The best relaxation model (model A) was composed of two parameters: T2stand and  $\Delta T1\%$ stand (AUC=0.887), and the BI-RADS model (model B) was constructed by two MRI features of edge and TIC curve (AUC=0.793). Using the quantitative parameters of SyMRI and DWI of the best ROC method combined with DISCO enhanced MRI features to establish a joint diagnostic model (model C: edge, TIC curve type, ADClocal, T2stand,  $\Delta T1\%$ stand) showed the best diagnostic efficiency (AUC=0.953). The nomogram also had calibration curves with good overlap.

## CONCLUSION

s The combined diagnosis model of SyMRI and DWI quantitative parameters combined with DISCO can improve the diagnostic efficiency of BI-RADS 4 types of mass lesions. Also, the line diagram based on this model can be used as an auxiliary diagnostic tool.

## CLINICAL RELEVANCE/APPLICATION

In this study, a preoperative diagnostic model of breast BI-RADS class 4 lesions was constructed by combining clinical, imaging and pathological multimodal indicators, and the data complementary information of different modalities was directly obtained in a non-invasive manner, and the data complementarity from single modality to multimodal quantitative diagnosis was transformed, which could greatly improve the accuracy of preoperative diagnosis of BI-RADS 4 lesions compared with traditional MRI technology.

## T5A-SPBR-6 Lymph Node Status in Breast Cancer Patients: Can Tumor Features Predict it More Accurately than Direct Axillary Imaging Evaluation

Participants

Panagiotis Kapetas, MD, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the diagnostic performance of tumoral imaging and clinical characteristics with the direct evaluation of the axillary lymph nodes (LNs) for the prediction of the LN status in breast cancer (BC) patients.

## METHODS AND MATERIALS

This retrospective, IRB-approved study included 513 patients with histologically confirmed invasive BC and a histological confirmation of their LN status (either pre-therapeutic, for patients undergoing neoadjuvant treatment, or at the time of surgery for all others). By search of the local PACS, the diagnostic examinations (mammography-MG, ultrasound-US and magnetic resonance imaging-MRI) of the patients were identified. Further clinical information (age, tumor proliferation index Ki-67 and hormone- and HER2-receptor status) were recorded as well. 4 readers (2 breast fellows and 2 experienced radiology residents who had completed both stages of their breast imaging rotation), blinded to the LN status of the patient, independently evaluated the images, assessing both the tumor according to BI-RADS descriptors and the depicted LNs, using standardized criteria. Logistic regression was used to identify independent predictors of metastatic LNs, both among the tumor and the LN descriptors and create respective models, based on the different imaging modalities and their combinations. The diagnostic performance of the models was evaluated using ROC curve analysis. Histopathology served as the standard of reference.

## RESULTS

114 patients (22.2%) had metastatic LNs. None of the clinical or tumoral MRI-based features reached predictive statistical significance. From the tumor-based models, the one combining MG and US features performed significantly better than the others, however at an AUC of 0.593. All models based on LN features (cortical thickening in US and MRI, short axis >1cm in MG) performed significantly better than the ones based on tumoral ones, with AUCs ranging between 0.648 and 0.719. There was no significant difference between the individual LN-based models, which were able to correctly predict 75.1-78.5% of all cases.

## CONCLUSION

s Tumor characteristics in BC patients are less predictive of the LN status as compared to the imaging evaluation of the axillary LNs per se.

## CLINICAL RELEVANCE/APPLICATION

Direct imaging assessment of axillary lymph nodes in breast cancer patients remains more accurate than the prediction of their status based on imaging and clinical tumor features.

## T5A-SPBR-7 Mammographic Changes within Two Years Following Novel Breast Intraoperative Radiation Therapy

Participants

Kassandra Tulenko, BA, Charlottesville, VA (*Presenter*) Nothing to Disclose

## PURPOSE

Intraoperative radiation therapy (IORT) is accelerated partial breast irradiation (APBI) that involves a single dose of RT at the time of breast conserving surgery (BCS). Precision Breast intraoperative radiation therapy (PB-IORT) is a novel form of IORT that combines CT-on-rails imaging to guide high dose rate (HDR) balloon brachytherapy to deliver 12.5 Gy of radiation to the lumpectomy bed at the time of BCS. The goal of the present study is to describe the short-term mammographic appearance of participants treated with PB-IORT.

## METHODS AND MATERIALS

All patients were part of a multi-institutional clinical trial with an inclusion criteria of age  $\geq$ 45 years, N0, and invasive or in situ tumors < 3 cm. Participants received annual diagnostic mammograms post PB-IORT and additional imaging was performed if warranted clinically. All participants with 2 years of follow-up were included in this study. Mammograms were reviewed and categorized by breast density and radiographic changes, including scar formation, trabecular thickening, fat necrosis, seroma, skin thickening, skin retraction, calcifications, asymmetry, or mass. Presence of suspicious findings (BI-RADS 4 or 5) and biopsy results were also recorded.

## RESULTS

The cohort included 567 mammograms in 291 participants. The median timing of mammograms included in the study was 23 months post IORT (6 to 30 months). Median age was 64 years (46 to 83 years) and mean tumor size was 9.76mm +/- 6.56mm. Scar and trabecular thickening were the most frequent imaging findings, occurring in 286 (98.3%) and 230 (79.0%) participants respectively. Fat necrosis occurred in 187 (64.3%), seroma in 80 (27.5%), skin thickening in 115 (39.5%), skin retraction in 140 (48.1%), calcifications in 78 (26.8%), asymmetry in 3 (1.0%), and mass in 6 (2.1%) of participants. Thirteen biopsies were performed in 12 participants: 8 were benign, 2 were atypical and 3 were malignant. When stratified by breast density, there were no statistically significant differences of mammographic findings or biopsy frequency between the dense and non-dense groups.

## CONCLUSION

sParticipants who underwent PB-IORT developed mammographic findings of scar, trabecular thickening, seroma, fat necrosis, skin thickening and skin retraction. Breast density does not have a significant impact on post PB-IORT imaging findings or biopsy rate. This study is unique as it compares post treatment mammographic findings with respect to breast density. Knowledge of the spectrum of radiographic changes after IORT can facilitate image interpretation and guide management.

## CLINICAL RELEVANCE/APPLICATION

Knowledge of the spectrum of imaging findings, biopsy rate, and impact of breast density after IORT can facilitate image interpretation and guide management.

## T5A-SPBR-8 Nomogram Based on US and Clinicopathologic Characteristics: Axillary Nodal Evaluation Following Neoadjuvant Chemotherapy in Patients with Node-Positive Breast Cancer

Participants

Xiao-Qing Pei, PhD, MD, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To avoid surgical over-treatment of the axilla in breast cancer patients with lymph node (LN) conversion following neoadjuvant chemotherapy (NAC), this study is designed to develop a convenient modality to predict the axillary response to NAC.

## METHODS AND MATERIALS

In this a multi-center study, breast cancer patients with biopsy-proven positive node receiving NAC followed by axillary lymph node dissection (ALND) were identified. A total of 1019 patients were randomly assigned to the training and validation groups at a ratio of 7:3. Clinicopathologic and ultrasound (US) characteristics of both primary tumors and LNs were used to develop corresponding prediction models, and a nomogram integrating clinicopathologic and US predictors was generated to predict the axillary response to NAC.

## RESULTS

Axillary pathological complete response (pCR) was achieved for 47.79% in patients with initially node-positive breast cancer. The expression of estrogen receptor, human epidermal growth factor receptor -2, Ki-67 score, and clinical nodal stage were independent predictors for the nodal response to NAC. Location and radiological response of primary tumors, cortical thickness and shape of LNs on US were also significantly associated with nodal pCR. In the validation cohort, the discrimination of US model (AUC,

0.76; sensitivity, 68.67%; specificity, 75.00%) was superior to clinicopathologic model (AUC, 0.68; sensitivity, 74.67%; specificity, 53.85%). AUCs of the nomogram based on clinicopathologic and US characteristics was 0.85, with a sensitivity of 83.33% and specificity of 73.72%.

## **CONCLUSION**

s US characteristics of primary tumors and axillary LNs were independently associated with axillary status after NAC for breast cancer with initially positive-node. The nomogram constructed with readily available clinicopathologic features and US characteristics improved the predictive capability.

## **CLINICAL RELEVANCE/APPLICATION**

Even if patients with excellent response to chemotherapy may be potential candidates for omission of ALND, it is difficult to determine status of axillary LNs following NAC. Nomogram incorporating routine clinicopathologic and US characteristics of breast tumors and axillary LNs can predict nodal pCR after NAC and may be a feasible modality to aid in surgical decisions-making for axilla.

## **T5A-SPBR-9 The Value of IVIM-DWI and DCE-MRI in Predicting Molecular Subtypes of Breast Cancer**

### **PURPOSE**

To explore the value of IVIM-DWI and DCE-MRI in predicting the molecular subtypes of breast cancer.

### **METHODS AND MATERIALS**

187 patients with suspected breast cancer admitted to our hospital from March, 2019 to December, 2021 were enrolled in this study. Pathological examination was performed after MRI to observe the expression of ER, PR, HER-2 and Ki-67. The quantitative parameters of IVIM-DWI (ADCstandard, ADCslow, ADCfast, f) and DCE-MRI (Ktrans, Kep, Ve) were measured. SPSS software was used to analyze the relationship between all parameters and the expression of ER, PR, HER-2 and Ki-67 as well as the correlation between all parameters and the prognostic factors of breast cancer. The differences in parameters of IVIM-DWI and DCE-MRI of different molecular subtypes were compared. Receiver operating characteristic curve (ROC) was plotted for parameters with statistical significance and the area under curve (AUC) was calculated.

### **RESULTS**

180 cases of breast cancer were included. Containing 15 cases of LuminalA, 45 cases of LuminalB (HER-2-), 68 cases of LuminalB (HER-2+), 30 cases of HER-2 over expression, and 22 cases of triple negative. DCE:Kep and Ktrans showed statistically significant differences between HER-2 positive and negative groups and Ki-67 high and low expression groups, but no statistically significant differences between ER and PR positive and negative groups, while Ve was significantly different between ER, PR, HER-2 positive and negative groups, but was not different between Ki-67 high and low expression groups. Kep still had predictive value for HER-2 status and Ve still had statistical significance for PR status prediction in Logistic multivariate regression analysis. The prediction threshold of Kep ( $p < 0.001$ , AUC=0.878) and Ve ( $p < 0.001$ , AUC=0.84) was 0.602 (specificity=87.5%, sensitivity=72.7%) and 0.547 (specificity=96.1%, sensitivity=58.6%), respectively. IVIM: ADCstandard and ADCslow showed statistical significance between positive and negative groups of ER, PR and HER-2, but no statistical significance between high and low expression groups of Ki-67 ( $p > 0.05$ ). Kep, Ktrans, Ve, ADCstandard and ADCslow showed statistically significant differences among different molecular subtypes of breast cancer.

### **CONCLUSION**

s Kep, Ktrans, Ve, ADCstandard and ADCslow have certain predictive value for different molecular subtypes, and can provide an important reference for clinical development of personalized treatment.

### **CLINICAL RELEVANCE/APPLICATION**

Provide a non-invasive prediction method for the preoperative diagnosis of molecular subtypes of breast cancer, which lays a foundation for the accurate diagnosis of breast cancer and the formulation of personalized treatment programs.

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## Abstract Archives of the RSNA, 2023

T5A-SPCA

### Cardiac Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPCA-1 Association of Liver Multiparameter Quantitative Metrics Determined by Dual Layer Spectral Detector CT with Coronary Plaque Scores: A Preliminary Study**

#### PURPOSE

To explore potential impacts of the extent and severity of coronary artery plaques on the liver quantitative metrics measured by dual-layer spectral detector CT (SDCT).

#### METHODS AND MATERIALS

Patients who underwent an unenhanced SDCT scan of the upper abdomen and coronary computed tomography angiography (CCTA) were enrolled. The segmental stenosis score (SSS) and segmental involvement score (SIS) were used to evaluate the extent and severity of plaques and then grouped by SIS and SSS. The CT attenuation of liver assessed by polychromatic images and spectral metrics of the liver were assessed by virtual mono-energetic images at 40keV and 70keV, the slope of spectral attenuation curve and effective atomic number (written as CT40keV, CT70keV, ?HU and Zeff, respectively). Logistic regression model was used to evaluate association of liver quantitative metrics with SIS and SSS.

#### RESULTS

644 patients were enrolled, including low SIS (<5) group (n=451), high SIS (≥5) group (n=193), low SSS (<5) group (n=461) and high SSS (≥5) group (n=183). Except for the CT70poly value (p=0.115) in SSS group, other liver spectral steatosis metrics were significantly different between SIS and SSS groups (All p<0.05). Compared with other collinearity spectral metrics, Zeff was more closely correlated with the SIS and SSS. Zeff was divided into four groups according to the interquartile interval. Compared with the patients in the lowest quartile of Zeff, the adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for SIS were 2.401 (1.284-4.493), 3.215 (1.661-6.224), and 4.126 (2.152-7.911) for those in the second, the third, and the fourth quartile of Zeff, whereas the corresponding ORs (95% CI) for SSS were 2.098 (1.130-3.894), 3.078 (1.602-5.916), and 3.582 (1.876-6.840) for the upper three quartiles of Zeff, especially among these who were < 60 years old, male and VAT/SAT < 1.18.

#### CONCLUSION

The quantitative parameter Zeff from SDCT, was an independent factor of the extent and severity of coronary artery plaques. Liver fat quantification may be useful for evaluating risk and prognosis of coronary artery disease.

#### CLINICAL RELEVANCE/APPLICATION

Liver multi-parameter metrics measured by SDCT may help to achieve the screening and primary prevention of high-risk population of coronary artery disease.

#### **T5A-SPCA-2 Feasibility of Fast Manual Left Atrial Long-axis Strain Using Cardiac Computed Tomography in Patients with Paroxysmal Atrial Fibrillation**

#### Participants

Takaaki Hosokawa, Toon, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Left atrial (LA) function is important for the prognosis of patients with atrial fibrillation (AF). LA strain (LAS) is a sensitive parameter that reflects the complex LA function. Recently, it can be evaluated using cardiac computed tomography (CT). However, LAS analysis requires a dedicated software and experience owing to complex LA anatomy (pulmonary veins and appendages). Semi-automatic fast long-axis strain is a novel simplified method for LAS analysis that improves reproducibility and reduces analysis time; however, it requires a dedicated software, limiting its availability. We hypothesized that LAS could be evaluated manually without using a dedicated software with fast long-axis strain. We aimed to assess the feasibility of fast manual LA long-axis strain (FM-LALS) in patients with paroxysmal AF (PAF).

#### METHODS AND MATERIALS

In this study, 40 patients with PAF who underwent cardiac CT and echocardiography were retrospectively enrolled. CT data of the entire cardiac cycle was reconstructed every 5% of RR intervals (RR; 0-95%). LA reservoir and pump strain were evaluated by conventional semi-automatic LAS (cLAS) and FM-LALS. FM-LALS was derived by measuring the distance between the left atrioventricular junction and LA posterior wall in three phases (end-diastole, end-systole, and mid-diastole). Moreover, LAS was assessed using speckle tracking echocardiography (STE). We assessed the correlations between cLAS, FM-LALS, and STE. Inter-observer reproducibility was evaluated in 15 randomly selected patients by two radiologists.

#### RESULTS

FM-LALS showed an extremely strong correlation with cLAS (r = 0.93-0.94, p < 0.001). FM-LALS and cLAS showed moderate to strong correlations with STE (r = 0.67-0.77, p < 0.001). FM-LALS and cLAS showed good to excellent reproducibility (intra-class

correlation coefficient 0.85-0.91). FM-LALS significantly reduced the analysis time compared to cLAS (median 92 vs 146 s,  $p < 0.001$ ), while cLAS consumed an additional 4 min for pre-processing.

## CONCLUSION

s FM-LALS enables rapid and highly reproducible LAS analysis without using a dedicated software and is useful as a highly available LAS analysis method in patients with PAF.

## CLINICAL RELEVANCE/APPLICATION

FM-LALS can be assessed rapidly and easily without using a dedicated software, providing high clinical availability.

## T5A-SPCA-3 Dual Energy Computed Tomography to Evaluate Coronary Pericoronary Adipose Tissue Attenuation in Acute Aortic Dissection Patients

### PURPOSE

Pericoronary adipose tissue (PCAT) attenuation is an indicator of active inflammation of perivascular adipose tissue and is supposed to increase in acute aortic dissection(AAD) patients. We aimed to investigate the PCAT attenuation values in acute aortic dissection patients with or without atherosclerosis of the coronary arteries.

### METHODS AND MATERIALS

Consecutive patients with chest pain were prospectively enrolled and underwent coronary computed tomography angiography (CCTA) and/or aorta computed tomography angiography. The patients were divided into two groups, AAD and non-AAD, according to the results of CTA. The PCAT attenuation values of three major epicardial coronary vessels were measured. The PCAT attenuation values were compared between the AAD and non-AAD subjects according to the atherosclerosis of the coronary arteries. Similarly, the PCAT attenuation values of the AAD patients were compared between the preoperative and postoperative steady states.

### RESULTS

A total of 136 patients (42 female, 94 male; mean age,  $63 \pm 11.9$  years) were divided into two groups according to the presence of aortic dissection on CTA. PCAT<sub>RCA</sub>, PCAT<sub>LAD</sub> and PCAT<sub>LX</sub> were significantly higher in AAD subjects than in non-AAD subjects, regardless of the presence of atherosclerosis of the coronary arteries ( $-85.1 \pm 9.3$  HU vs.  $-92.9 \pm 10.0$  HU;  $-83.2 \pm 7.4$  HU vs.  $-89.9 \pm 9.1$  HU;  $-77.5 \pm 8.4$  HU vs.  $-85.6 \pm 7.9$  HU,  $p < 0.05$  all). The preoperative PCAT<sub>RCA</sub>, PCAT<sub>LAD</sub> and PCAT<sub>LX</sub> were higher in the AAD patients than in postoperative steady-state subjects ( $-82.9 \pm 8.7$  HU vs.  $-97.6 \pm 8.8$  HU;  $-79.8 \pm 7.6$  HU vs.  $-92.8 \pm 6.8$  HU;  $-74.6 \pm 7.1$  HU vs.  $-87.7 \pm 6.9$  HU,  $p < 0.05$  all). According to multivariable logistic regression analysis, PCAT<sub>RCA</sub> and PCAT<sub>LAD</sub> were the parameters showing consistent difference between the AAD and non-AAD patients (OR=0.010; 95%CI:0.001 to 0.189;  $p=0.002$ , OR=0.115; 95%CI:0.023 to 0.563;  $p=0.008$ , OR=0.156; 95%CI: 0.032 to 0.770;  $p=0.023$  and OR=0.014; 95%CI:0.001 to 0.177;  $p=0.001$ , OR=0.041; 95%CI:0.008 to 0.210;  $p < 0.001$ ).

### CONCLUSION

s PCAT<sub>RCA</sub>, PCAT<sub>LAD</sub> and PCAT<sub>LX</sub> were significantly higher in AAD patients than in non-AAD patients regardless of atherosclerosis of the coronary artery. Similarly, in AAD patients with atherosclerosis of the coronary artery, PCAT<sub>RCA</sub>, PCAT<sub>LAD</sub> and PCAT<sub>LX</sub> were significantly higher preoperatively than postoperatively.

## CLINICAL RELEVANCE/APPLICATION

It provides more clinical evidence for the relationship between macrovascular adipose tissue and extracardiac adipose tissue, and can provide more information for drug treatment for the mutual disease.

## T5A-SPCA-4 iPSC-based Engineered Heart Tissue for Myocardial Repair - An In-vivo Pilot Study

### PURPOSE

Chronic heart failure as a result of myocardial infarction remains a major burden on the healthcare systems of the industrialized countries and the respective average life expectancy of their citizens. This calls for therapies targeting the regeneration of the underlying loss of cardiomyocytes. The aim of the project was a proof of concept for the remuscularization of the myocardium by the use of engineered heart tissue based on induced pluripotent stem cells (iPSC) in a macaque model (non-human primate).

### METHODS AND MATERIALS

Engineered heart tissue was implanted as functional tissue patches to 14 macaques in two cohorts. An epicardial midventricular position of the left ventricle was chosen for implantation. The heart function was quantified using 3T MRI. After two baseline measurements the first cohort received a single dose (40x20x1 mm cell cluster consisting of 40 million myocytes) and a monthly follow-up for three months. The second cohort received a five-fold dose (48x48x2.5 mm, 200 million cells) and an additional fourth follow-up measurement after six months. The evaluation was carried out by two different examiners. The animal experiments were carried out as part of an approved study.

### RESULTS

After three months the systolic and diastolic wall thickness of the left ventricle of all animals increased ( $7 \pm 1$  mm to  $9 \pm 2$  mm  $p=0.001$ ). At the end of the follow-up the left ventricular mass increased ( $12 \pm 2$  g to  $13 \pm 3$  g,  $p=0.11$ ). The left ventricular ejection fraction increased ( $59 \pm 3\%$  to  $60 \pm 5\%$   $p=0.001$ ) without a significant change in the cardiac output. The right ventricular ejection fraction and wall thickness did not change significantly. The longitudinal strain the 4-chamber view and vertical longitudinal axis did not show any significant changes during the observation period.

### CONCLUSION

s The implantation of artificial heart tissue from iPSC resulted in a sustained increase in left ventricular mass and wall thickness in healthy animals without any adverse effects.

## CLINICAL RELEVANCE/APPLICATION

iPSC-based functional myocardial patches are a promising therapy of infarct-related chronic heart failure. This proof-of-concept



study in a non-human primate shows feasibility and safety of this innovative approach. It is the first step towards its application in patients.

## **T5A-SPCA-5 Cardiac CT-based Radiomics Analysis can Predict Left Ventricular Adverse Remodeling after TAVI in Patients with Severe Aortic Stenosis**

### **PURPOSE**

To develop a radiomics model based on cardiac computed tomography (CT) to predict left ventricular adverse remodeling in patients who underwent transcatheter aortic valve implantation (TAVI) with severe aortic stenosis.

### **METHODS AND MATERIALS**

A total of 293 patients (45.7% female) (mean age: 73.1 $\pm$ 7.6 years) with severe aortic stenosis confirmed by transthoracic echocardiography were retrospectively enrolled. All patients underwent TAVI and had a follow-up time of more than 3 months for evaluating left ventricular remodeling. The patients were randomly assigned to the training (n=205) and validation cohort (n=88). Adverse remodeling was defined as a 15% increase in the baseline value of left ventricular end-diastolic volume or a 10% decrease in left ventricular ejection function. The volume of interest comprising the left ventricle wall and papillary muscle was segmented on cardiac CT images of diastolic phase. Radiomic features were extracted using the least absolute shrinkage and selection operator (LASSO) regression analysis method, and clinical variables were screened via logistic regression. The model's performance was evaluated using a receiver operating characteristic curve (ROC) and decision curve analysis.

### **RESULTS**

Thirty-one features were extracted from 216 (73.7%, 216/293) non-adverse remodeling cases and 77 (26.3%, 77/293) adverse remodeling cases, among which 6 radiomic features and 2 clinical features were manually screened to construct a radiomic model, a clinical model, and a nomogram model. The 14 features extracted by random forests were used in the composed model. The radiomics nomogram model and composed model both achieved a better diagnostic performance than the clinic model in the validation cohort with the AUCs being 0.89 (95% confidence interval [CI]: 0.874-0.893) and 0.819 (95% confidence interval [CI]: 0.808-0.833), respectively. Moreover, the decision curve analysis demonstrated that the composed model had a better net benefit than others.

### **CONCLUSION**

The developed radiomics-based analysis showed outstanding predictive effectiveness for adverse remodeling of severe aortic stenosis patients after TAVI. Radiomics based on cardiac CT could serve as a valuable tool for predicting left ventricular adverse remodeling after TAVI in patients with severe aortic stenosis.

### **CLINICAL RELEVANCE/APPLICATION**

The radiomics-based analysis developed in this study demonstrated exceptional predictive efficacy for adverse remodeling in severe aortic stenosis patients undergoing TAVI. Our findings suggest that the radiomics analysis based on cardiac CT may serve as a useful tool for predicting left ventricular adverse remodeling after TAVI in this patient population.

## **T5A-SPCA-6 Fat Fraction Analysis as a Novel Method for the Assessment of Pericoronary Adipose Tissue Inflammation**

### **Participants**

Caterina Monti, MD, PhD, Milan, Italy (*Presenter*) Travel support, Bracco Group  
Francesco Secchi, MD, PhD, Milano, Italy (*Presenter*) Nothing to Disclose

### **PURPOSE**

The aim of our study was to assess pericoronary adipose tissue via the analysis of its fat fraction (FF), comparing it to conventional biomarkers such as pericoronary fat attenuation index (FAI) and the degree of coronary stenosis.

### **METHODS AND MATERIALS**

We retrospectively included all consecutive patients who underwent a dual-energy, unenhanced computed tomography (CT) scan for calcium scoring at our institution. For each patient, we processed the FF maps through a dedicated software, and segmented regions of interest around each coronary artery, namely the left anterior descending artery (LAD), circumflex artery (LCX) and right coronary artery (RCA) to obtain FF and FAI. We retrieved data concerning coronary stenosis from CT reports.

### **RESULTS**

Overall, 99 patients were included, 32 (32%) of whom females, with a median age of 66 years (interquartile range, IQR, 58-74 years). For each coronary artery, pericoronary FF displayed moderate, negative correlations with FAI (LAD:  $r=-0.617$ ,  $p<0.001$ ; LCX:  $r=-0.493$ ,  $p<0.001$ ; RCA:  $r=-0.506$ ,  $p<0.001$ ). Pericoronary FF displayed a weak negative correlation with coronary stenosis at the LAD ( $r=-0.220$ ,  $p=0.035$ ), whereas at the LCX and RCA no significant correlations were observed ( $p=0.572$ ).

### **CONCLUSION**

Our proof-of-concept analysis indicates that epicardial adipose tissue FF, which can be easily computed on dual-energy, unenhanced CT scans, could represent an additional biomarker of cardiovascular risk and coronary inflammation.

### **CLINICAL RELEVANCE/APPLICATION**

Evaluating pericoronary fat fraction at dual energy CT could provide data concerning the status of coronary arteries even from unenhanced cardiac CT.

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## Abstract Archives of the RSNA, 2023

T5A-SPCH

### Chest Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPCH-1 Prediction Model of PD-L1 Expression in Primary Lung Adenocarcinoma based on Artificial Intelligence Analysis Software**

##### **PURPOSE**

To constitute a stratified prediction model of PD-L1 expression in primary lung adenocarcinoma based on artificial intelligence analysis software.

##### **METHODS AND MATERIALS**

The imaging data of 129 patients with primary lung adenocarcinoma confirmed by operation were analyzed retrospectively. The imaging features of the lesions, CT quantitative parameters and texture features were automatically obtained by the artificial intelligence analysis software. The expression of PD-L1 in pathological specimens was detected by IHC. The patients were divided into PD-L1 positive expression group (TPS=1%) and PD-L1 negative expression group (TPS<1%). SPSS26.0 software was used for statistical analysis. Logistic regression analysis was used to screen the predictive factors and construct predictive model. ROC analysis was used to evaluate the efficacy of the model. P values less than 0.05 were considered statistically significant.

##### **RESULTS**

The volume and proportion of solid components in PD-L1 positive expression group were significantly higher than those in negative expression group ( $P<0.001$ ). The mass of solid components between the two groups was 5.57 and 1.59mg $\times$ 10<sup>3</sup> respectively. The difference was statistically significant ( $P<0.001$ ). The proportion of solid components in the positive expression group was also significantly higher than that in the negative group, which were 0.73 and 0.41 respectively ( $P<0.001$ ). The total mass of positive group and negative group was 6.40, 2.76 mg $\times$ 10<sup>3</sup> respectively. The maximum and average CT values in PD-L1 positive expression group were higher than those in negative expression group ( $P<0.001$ ). There were significant differences in skewness and entropy between the two groups ( $P=0.001,0.002$ ). The solid components, CT values and texture features were included in the Logistic regression analysis to constitute a prediction model. The ROC curve analysis showed that the AUC value of the combined variables was 0.887, the sensitivity was 74.5%, and the specificity was 90.2%. The difference was statistically significant ( $P<0.001$ ).

##### **CONCLUSION**

The imaging quantitative features based on artificial intelligence analysis software can be used to predict the expression of PD-L1 in primary lung adenocarcinoma, and the prediction model of multi-parameter combination variables is the best.

##### **CLINICAL RELEVANCE/APPLICATION**

At present, the clinical detection of PD-L1 mainly depends on IHC. For patients who are unable to operate or puncture biopsy, it is difficult to detect PD-L1. Therefore, the wide application of ICIs therapy is limited. As the AI is more widely used in clinic, it is of great clinical significance to build a hierarchical prediction model of PD-L1 based on artificial intelligence analysis software.

#### **T5A-SPCH-2 Clinical Values of Deep Learning-based Lung Nodule Detection System for Metastasis Evaluation in Patients with Colorectal Cancer: In-depth Analyses of Effects on Thoracic Radiologists**

##### Participants

Chul Hwan Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### **PURPOSE**

This study aimed to evaluate the clinical values of a deep learning-based computer-aided diagnosis (DL-CAD) system with in-depth analyses of radiologists' performance and reading time in pulmonary metastasis evaluation on chest computed tomography (CT).

##### **METHODS AND MATERIALS**

The multi-reader study with a randomized cross-over design was performed during two reading sessions. For the six experienced thoracic radiologists, 64 chest CT scans from patients with colorectal cancer, including 77 pulmonary nodules, were prepared based on a pilot study's sample size calculation. Each reader evaluated nodule presence, size, and location with or without a commercially available DL-CAD system with a 4-week washout period. The reading platform automatically measured the reading time. Per-nodule sensitivity, false-positive per scan, and readers' reading time with or without the DL-CAD system were compared using logistic regression, Poisson regression, and linear mixed model, respectively. Inter-reader agreements for nodule detection and size measurement were analyzed with Fleiss kappa ( $k$ ) and concordance correlation coefficient (CCC).

##### **RESULTS**

Using the DL-CAD system, the pooled sensitivity of six readers for lung nodules significantly improved (from 0.703 [95% CI, 0.651-0.756] to 0.842 [95% CI, 0.782-0.902],  $p <0.001$ ), reading time significantly reduced (from 212.8 s [95% CI, 198.9-226.7] to 165 s [95% CI, 151.1-178.8],  $p <0.001$ ), and inter-reader agreements for nodule detection ( $k$ , 0.682-0.884,  $p <0.001$ ) and size measurement (CCC, 0.385-0.543,  $p <0.001$ ) enhanced. The improved sensitivity was significant for nodules located in the

intraparenchymal (from 0.597 [95% CI, 0.359-0.836] to 0.986 [95% CI, 0.959-1.013],  $p = 0.002$ ) and perivascular (from 0.553 [95% CI, 0.383-0.723] to 0.649 [95% CI, 0.472-0.826],  $p = 0.006$ ) areas and those  $< 6$ mm in axial diameter (from 0.669 [95% CI, 0.611-0.728] to 0.823 [95% CI, 0.750-0.895],  $p < 0.001$ ). However, there was no significant change in the pooled false-positive per case without versus with the DL-CAD system (0.094 [95% CI, 0.052-0.168] vs. 0.094 [95% CI, 0.054-0.163],  $p > 0.999$ ).

## CONCLUSION

s With the DL-CAD system, the readers showed significantly improved performance for pulmonary nodule detection and reduced CT reading time without a false-positive increase in pulmonary metastasis evaluation on chest CT.

## CLINICAL RELEVANCE/APPLICATION

The DL-CAD system show good enough performance to be clinically utilized as an assistant in the setting of pulmonary metastasis screening.

## T5A-SPCH-3 Lymphatic Plastic Bronchitis: A Study Based on CT and MR Lymphangiography

Participants

Yan Zhang, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the diagnostic value of CT lymphangiography (CTL) and non-contrast MR lymphangiography (MRL) in lymphatic plastic bronchitis.

## METHODS AND MATERIALS

The clinical and imaging data of 31 patients with lymphatic plastic bronchitis diagnosed by clinical, imaging and pathological results were retrospectively analyzed. All patients underwent CTL and MRL. The McNemar test was used to compare the parameters between CTL and MRL.  $P < 0.05$  was statistically significant. The Kappa test was used to evaluate the consistency of CTL and MRL in evaluating lymphatic plastic bronchitis.

## RESULTS

MRL showed that the abnormal lymphatic reflux in the right lymphatic duct, thoracic duct, cervical trunk and subclavian trunk was better than CTL ( $P < 0.05$ ), and the diagnostic consistency was general (Kappa  $< 0.40$ ). There was no significant difference between MRL and CTL in the detection of abnormal lymphatic reflux in the lymphatic trunk. MRL was superior to CTL in detecting lymphatic abnormalities such as cystic changes at the end of the thoracic duct, spot-like or tubular changes at the end of the right lymphatic duct, cystic changes at the end of the right lymphatic duct, and cystic changes in the mediastinum ( $P < 0.05$ ), and the diagnostic consistency was poor, fair, fair, and moderate (Kappa  $< 0.60$ ), respectively. MRL and CTL showed abnormal signs in the lung: CTL was superior to MRL in showing the thickening of interlobular septum, lung nodules and airway stenosis ( $P < 0.05$ ), and the diagnostic consistency was moderate, moderate and poor (Kappa  $< 0.60$ ). There was no significant difference between CTL and MRL in atelectasis, consolidation in lobar and segmental distribution, consolidation in non-lobar and segmental distribution, and the thickening of the bronchovascular bundle ( $P > 0.05$ ), and the diagnostic consistency was very good, very good, good, good (Kappa  $> 0.60$ ). There was no significant difference between CTL and MRL in ground glass opacity, airway wall thickening and intralobular interstitial thickening ( $P > 0.05$ ), and the diagnostic consistency was average, fair and poor (Kappa  $< 0.40$ ).

## CONCLUSION

s The MRL is superior to CTL in showing the abnormalities of the thoracic duct, the right lymphatic duct and other abnormal lymphatic vessels. CTL is superior to MRL in the detection of pulmonary abnormalities. The combination of CTL and MRL can provide more comprehensive imaging information for diagnosing and treating lymphatic plastic bronchitis.

## CLINICAL RELEVANCE/APPLICATION

The combination of CTL and MRL can provide more comprehensive imaging information for diagnosing and treating lymphatic plastic bronchitis.

## T5A-SPCH-4 Spectral Imaging of Thymic Epithelial Tumours: A Combined Radiomics Nomogram to Predict Histologic Subtypes

## PURPOSE

The aim of this study is to develop and compare performance of radiomics signatures using texture features extracted from spectral CT images for preoperative predicting risk categorization of thymic epithelial tumours (TETs).

## METHODS AND MATERIALS

Between August 2021 and December 2021, a total of 93 patients with histopathologically confirmed TETs were enrolled in this retrospective study, all patients underwent spectral CT scans with arterial phase (AP) and venous phase (VP) before treatment. Iodine concentrations were derived from iodine-based material-decomposition CT images and normalized to the iodine concentration in the aorta. Selecting the feature subset with mRMR method, retaining 30 features with minimum Redundancy Maximum Relevance. Multivariable logistic regression, filtering the independently discriminative feature, and constructing the final model. Cross-validation, proving texture analysis was valuable in discriminating one group from another group and the result was not due to overfitting. A radiomics nomogram for evaluating the risk categorization was developed by combining the selected radiomics features with age and spectral parameters. Receiver operating characteristic (ROC) curves were used to evaluate the diagnostic performance of the radiomics nomogram.

## RESULTS

Of the 93 patients, 38 had low-risk thymoma (LRT), 26 had high-risk thymoma (HRT), and 49 had thymic carcinoma (TC). The radiomics model, age, spectral parameters constituted a radiomics nomogram, with an AUC value of 0.86(0.79~0.94) for LRT vs HRT+TC and 0.81(0.72~0.91) for LRT+HRT vs TC. Diagnostic performance for LRT vs HRT+TC, the sensitivity, specificity, and accuracy reached 87.27%, 66.79%, and 78.49%, respectively. For LRT+HRT vs TC, they reached 68.97%, 82.81% and 78.49%, respectively.

## CONCLUSION

s The combined radiomics nomogram exhibited good performance in the individual prediction of TETs, and might be used for surgical management of TETs.

#### **CLINICAL RELEVANCE/APPLICATION**

For preoperative predicting risk categorization of thymic epithelial tumours.

#### **T5A-SPCH-5 Conjugate Gradient (CG) Reconstruction vs. Grid Reconstruction: Capabilities for Acquisition Time Reduction, Image Quality and Nodule Detection on Pulmonary Thin-Section MR Imaging with Ultra-Short TE at In Vitro and In Vivo Studies**

##### **Participants**

Yoshiharu Ohno, MD, PhD, (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, Daiichi Sankyo Co, Ltd; Research Grant, Ministry of Education, Culture, Sports, Science and Technology

##### **PURPOSE**

Pulmonary thin-section MR imaging with UTE (UTE-MRI) has been reported its' clinical potential as substitution for thin-section CT for lung nodule detection or characterization in the last several years. However, one of its' drawbacks are relatively longer acquisition time because of high numbers of 3D radial sampling and grid reconstruction method. In this situation, we develop and clinically set conjugate gradient (CG) reconstruction for UTE-MRI to overcome this drawback. The purpose of this study was to directly compare utility for acquisition time reduction with keeping image quality and nodule detection capability among UTE-MRI obtained with different sampling spoke numbers and reconstructed with CG and grid reconstructions at in vitro and in vivo studies.

##### **METHODS AND MATERIALS**

At in vitro study, commercially available MR phantom for evaluation of image distortion was scanned by UTE-MRI sequence with original (n=1), 1/2, 1/4 and 1/6 sampling spoke numbers at five times, and each UTE-MRI data was reconstructed with CG and grid reconstructions. Moreover, at in vivo study, 40 patients suspected with lung nodule underwent thin-section CT and UTE-MRI by same sequence with original, 1/2, 1/4 and 1/6 sampling spoke numbers. Then, all UTE-MRI data were also reconstructed with CG and grid reconstructions. Standard protocol in this study was UTE-MRI obtained with original sampling spoke number and reconstructed with grid reconstruction. To determine the influence of sampling spoke number reduction and reconstruction method difference at in vitro study, full width at half maximum (FWHM) of each phantom was measured. At in vivo study, lung signal-to-noise ratio (SNR), overall image quality, artifact and probability for nodule presence were assessed by ROI measurement or 5-point scales. FWHM and SNR were compared between each UTE-MRI and standard protocols by Student's t-test. All qualitative indexes were compared by Wilcoxon's signed rank test between each UTE-MRI and standard protocols.

##### **RESULTS**

FWHM and SNR of standard protocol had significant differences with those of all UTE-MRI protocols except UTE-MRIs obtained with original and 1/2 sampling numbers and reconstructed with CG reconstruction ( $p < 0.05$ ). Each qualitative index of standard protocol had significant differences with those of all UTE-MRI protocols except UTE-MRIs obtained with original and 1/2 sampling numbers and reconstructed with CG reconstruction ( $p < 0.05$ ).

##### **CONCLUSION**

s CG reconstruction is useful for reducing acquisition time without any influence on image quality and nodule detection on UTE-MRI.

#### **CLINICAL RELEVANCE/APPLICATION**

CG reconstruction is useful for reducing acquisition time without any influence on image quality and nodule detection on UTE-MRI.

#### **T5A-SPCH-6 Low-Field (0.55T) Fourier-Decomposition Magnetic Resonance Imaging for Ventilation and Perfusion Defect Evaluation of Pulmonary Diseases**

##### **Participants**

Dante Capaldi, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Low field (0.55T) MRI has recently shown great potential for lung imaging, with reduced susceptibility artifacts and superior image quality for anatomical assessment as compared to higher field MRI. Fourier decomposition MRI (FDMRI) offers a non contrast enhanced, free breathing method to generate both pulmonary ventilation and perfusion maps over a short tidal breathing duration. Our objective was to evaluate for both pulmonary ventilation and perfusion in volunteers and lung disease patients using low field FDMRI. As patients with lung pathology are more frequently known to have ventilation or perfusion defects, we hypothesize that FDMRI ventilation and perfusion defects would be visible and elevated in these patients as compared to our volunteers.

##### **METHODS AND MATERIALS**

We prospectively enrolled 17 patients with heterogeneous lung disease diagnoses (57±17yrs, interstitial lung disease=4, sarcoidosis=1, bronchiectasis=1, non small cell lung cancer=4, chronic thromboembolic pulmonary hypertension=2, emphysema=1, benign nodules=4) and four volunteers (48±17yrs) who provided written informed consent. Multi slice coronal plane (anterior, center, posterior) free breathing 1H MRI were acquired over a period of 90s per plane using an optimized balanced steady state free precession sequence on a 0.55T scanner (MAGNETOM Free.Max, Siemens Healthineers, Erlangen, Germany). FDMRI analysis was performed using an inhouse software (MATLAB) and the ventilation (VDP) and perfusion defect percent (QDP) were generated using a hierarchical k means clustering approach to extract the ventilation and perfusion defect volumes and a seeded region growing algorithm to segment the thoracic cavity volume. Quantitative comparisons between volunteers and patients with lung disease were performed using unpaired t tests.

##### **RESULTS**

Low field FDMRI ventilation and perfusion maps showed visible ventilation heterogeneity (i.e. V/Q mismatch) in the lung disease patients, such as visible ventilation defects in fibrotic sarcoidosis patients and perfusion defects in a patient with pulmonary hypertension, as compared to the volunteers. Quantitatively as compared to the volunteers, both VDP (volunteer=1.9±0.6%, disease=5.1±3.8%;  $p=0.03$ ) and QDP (volunteer=2.5±0.3%, disease=7.8±4.4%;  $p=0.03$ ) were significantly elevated in lung disease patients.

## CONCLUSION

s In patients with lung disease, low field fMRI ventilation and perfusion defects were qualitatively visible and quantitatively elevated, as compared to volunteers.

## CLINICAL RELEVANCE/APPLICATION

Low field (0.55T) free breathing MR ventilation/perfusion (MRVQ) holds promise to functionally evaluate pulmonary diseases without needing intravenous/inhaled contrast agents or ionizing radiation.

## T5A-SPCH-7 Free Breathing 19F MRI Detects Lobar Differences in Ventilation Kinetics

Participants

Courtney Wing, MD, Wellington, FL (*Presenter*) Nothing to Disclose

## PURPOSE

This study was conducted to interpret lobar ventilation kinetics in both healthy supine subjects using a free-breathing 19F MRI ventilation technique.

## METHODS AND MATERIALS

5 healthy volunteers completed a single MR session on a Siemens 3T Prisma. 1H ultrashort-echo time (UTE) MRI sequences were used for registration and masking, and ventilation images with 19-Fluorine (19F) MRI were obtained while the subjects breathed a normoxic mixture of 79% perfluoropropane and 21% oxygen (O<sub>2</sub>). 0.4 second spiral 19F MR imaging was performed during a free breathing recovery breath. The 19F spiral data were denoised using a low-rank matrix recovery approach. Lobar ventilation mapping was created via manual segmentation tools available using 3D Slicer software on the UTE images. Time constants for wash-in and wash-out kinetics (t<sub>1</sub>(s), t<sub>2</sub>(s), respectively) taken from right upper lobe (RUL), right middle lobe (RML), right lower lobe (RLL), left upper lobe (LUL), and left lower lobe (LLL) were used to measure physiologic lobar differences in ventilation kinetics among healthy supine patients.

## RESULTS

19F gas wash-in and wash-out rate constants (t<sub>1</sub>(s), t<sub>2</sub>(s)) were used to measure efficiency of gas exchange in the inspiratory and expiratory phases. On average, bilateral lower lobes demonstrated the most rapid wash-in and wash-out rates in supine subjects (average t<sub>1</sub>(s) RLL = 69.42, RML = 73.3, RUL = 83.5, LUL = 68.0, LLL = 58.1, average t<sub>2</sub>(s) LUL = 27.5, LLL = 22.8).

## CONCLUSION

s This follows known physiologic principles in standing patients, in which maximum perfusion in the lower lung zones allows for the largest potential for gas exchange. In order to maintain the most efficient rates of gas exchange in bilateral lower lobes, "standing" pulmonary perfusion ratios must be maintained. This may be explained by supine pulmonary blood flow regulatory mechanisms that are not yet studied. Ventilation mapping with free-breathing 19F MRI is sufficiently sensitive to detect known lobar differences in ventilation kinetics among healthy supine subjects.

## CLINICAL RELEVANCE/APPLICATION

Free breathing 19F MRI has already been proven valuable in monitoring treatment outcomes in CF as well as progression of disease. Here, we offer its utility in studying regional ventilation kinetics in supine subjects, which is not possible with current standard ventilation-space MRI techniques. 19F also lacks dependence on hyperpolarization protocols needed for current functional MRI (Helium-3 (3He), Xenon-129 (129Xe)), so it can be offered at institutions that may lack the resources for hyperpolarization protocols.

## T5A-SPCH-8 Assessment of Lung Density in Preterm Infants Using Three-dimensional Ultrashort Echo-time MRI

## PURPOSE

Postnatal Lung development is important in infants, especially in preterm children, while relevant imaging data is scarce. Recent studies have shown that normalized lung signal intensity using UTE-MRI could be correlated to lung density comparable to CT, so we aim to explore the quantitative ability of UTE-MRI for assessing lung tissue density and analyze the differences in lung signal intensity among premature infants.

## METHODS AND MATERIALS

A prospective recruitment from March 2021 to October 2022 was conducted at the West China Second University Hospital of Sichuan University for infants aged 0-2 years. A total of 101 subjects were enrolled and divided into three groups based on gestational age (GA): extremely-to-very preterm group (GA<28 weeks, n=33), mid-to-late preterm group (GA>28 weeks and <37 weeks, n=34), and full-term group (GA=37 weeks, n=34). All subjects underwent pulmonary MRI using a 3.0-Tesla pediatric-specific MRI scanner (UIH uMR Alpha), including UTE sequence scanning. The lung-to-muscle ratio (LMR) was used to normalize lung signal intensity and quantify lung tissue density, and investigate the anterior-to-posterior(A-P) gradient of lung tissue and the inter-group differences among premature infants.

## RESULTS

LMR-A and LMR-P based on UTE-MRI were found to be linearly correlated (R<sup>2</sup>=0.582, P<0.001), indicating a A-P gradient in lung density. There is a gradually decreased tendency of the mean LMR in full-term, mid-to-late preterm, and extremely-to-very preterm infants, the whole lung LMR averages were 45.1, 48.7 and 50.8, respectively, with a statistically-significant difference between extremely-to-very preterm and full-term group (P=0.045), and a nearly statistically-significant difference between extremely-to-very preterm and mid-to-late preterm group (P=0.083), but the difference between mid-to-late preterm and full-term group was not statistically significant (P=0.290).

## CONCLUSION

s UTE-MRI shows the quantitative ability for assessing lung tissue density, and extremely-to-very preterm infants had lower lung tissue density compared to term infants.

## CLINICAL RELEVANCE/APPLICATION

Our study reflects that, the extremely-to-very preterm infants with GA<32 weeks, especially those with bronchopulmonary dysplasia (BPD), may have persistent structural abnormalities, such as alveolar simplification and impaired vascular growth, thereby lead to hyperinflation or cysts manifested as reduced signal intensity on UTE-MRI. Our results provides structural evidence for that, extremely-to-very preterm infants may have persistently reduced lung function compared to full-term infants, and have higher risk to get early-onset chronic obstructive pulmonary disease (COPD) , as previous studies suggested.

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## Abstract Archives of the RSNA, 2023

T5A-SPER

### Emergency Radiology Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPER-1 Optic Nerve Sheath Diameter Measurement for Predicting Raised Intracranial Pressure in Pediatric Patients: A Meta Analysis**

##### **PURPOSE**

This meta-analysis was aimed to evaluate the diagnostic performance of optic nerve sheath diameter (ONSD) for diagnosis of raised intracranial pressure (ICP) in pediatric patients.

##### **METHODS AND MATERIALS**

A database search of PubMed and EMBASE was performed to identify relevant studies. Bivariate modelling and hierarchical summary receiver operating characteristics (HSROC) modelling were performed to evaluate diagnostic performance. A pooled diagnostic odds ratio (DOR) with a 95% confidence interval (CI) not including 1 was considered informative. Subgroup analysis was performed according to the modality (ocular ultrasound vs. brain computed tomography [CT]/magnetic resonance imaging [MRI]). We performed meta-regression analyses for heterogeneity exploration.

##### **RESULTS**

Eleven studies including 546 patients were included. According to pooled DORs, ONSD was informative for evaluation of the raised ICP (DOR, 47; 95% CI, 11-206). ONSD showed a pooled sensitivity of 0.88 (95% CI, 0.79-0.94), a pooled specificity of 0.86 (95% CI, 0.70-0.95), and an area under the HSROC curve of 0.93 (95% CI, 0.91-0.95) for diagnosis of raised ICP. According to the subgroup analysis, ocular ultrasound (sensitivity, 0.91 [95% CI, 0.81-0.96]; specificity, 0.86 [95% CI, 0.65-0.96]) showed higher sensitivity and comparable specificity than ONSD measured on brain CT/MRI (sensitivity, 0.75 [95% CI, 0.51-0.99]; specificity, 0.91 [95% CI, 0.74-1.00]). On meta-regression analysis, study design, number of patients, and reference standard were sources of heterogeneity.

##### **CONCLUSION**

ONSD may be a useful method for predicting raised ICP in pediatric patients.

##### **CLINICAL RELEVANCE/APPLICATION**

We recommend that measurement of ONSD be performed using ocular ultrasound for more accurate diagnosis of raised ICP in pediatric patients.

#### **T5A-SPER-2 Is it Necessary to Perform Triple Rule-out Computed Tomography Angiography that Includes Abdominal Aorta in Patients with Chest Pain: A Study with More than 1000 Patients**

##### **PURPOSE**

To investigate whether it is necessary to perform the triple rule-out (TRO) computed tomography angiography (CTA) that includes abdominal aorta in patients with chest pain.

##### **METHODS AND MATERIALS**

A total of 1482 patients with nontraumatic chest pain (chief complaints: chest pain, difficulty in breathing, or hemoptysis) were included in this retrospective study. Four hundred and fourteen patients underwent the conventional TRO-CTA scans, and 1068 patients underwent TRO-CTA that included the abdominal aorta (TRO-CTA<sub>WAA</sub>) under the request of clinicians. All scanning parameters were the same only the scanning range for the third phase in TRO-CTA was different: conventional TRO-CTA covered only the thoracic aorta, while TRO-CTA<sub>WAA</sub> extended to the entire aorta. Patient etiology was investigated and the detection rates of major vessel abnormalities (aortic dissection, aneurysm, penetrating ulcer, vascular occlusion, and thrombosis) between the two groups and within the TRO-CTA<sub>WAA</sub> group (thoracic aorta vs. entire aorta) were compared using chi square tests and paired chi square tests. The radiation dose (CTDI<sub>vol</sub> and DLP) between the two groups was compared using analysis of variance (ANOVA).

##### **RESULTS**

The TRO-CTA<sub>WAA</sub> had significantly higher detection rate of major artery abnormalities than the TRO-CTA group (38.8% Vs. 8.5%,  $P < 0.001$ ). Within the TRO-CTA<sub>WAA</sub> group, only 28.4% abnormalities happened in thoracic aorta, which means the vessel abnormalities of 111 patients (27%) in this group would be missed with the conventional scan range. The TRO-CTA<sub>WAA</sub> group had slightly higher CTDI<sub>vol</sub> ( $5.64 \pm 1.44$  mGy) and DLP ( $473.64 \pm 146.50$  mGy\*cm) values for the complete examination than the TRO-CTA group ( $5.25 \pm 1.38$  mGy and  $453.03 \pm 139.22$  mGy\*cm, respectively). However, the differences were not statistically significant (all  $P > 0.05$ ).

##### **CONCLUSION**

TRO-CTA with scan range including the abdominal aorta significantly improves the detection rate for major vessel abnormalities in patients with chest pain with minor radiation dose increase.

**CLINICAL RELEVANCE/APPLICATION**

For chest pain patients, the scan range of triple rule-out CTA should be extended to include abdominal aorta since about quarter of the major vessel abnormalities happen beyond the thoracic aorta.

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## Abstract Archives of the RSNA, 2023

T5A-SPGI

### Gastrointestinal Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPGI-1 Correlation between Triglyceride/high-density Lipoprotein Cholesterol Ratio and Spectral Parameters Measured on a Fast kVp Switching Dual-energy CT**

##### Participants

Anjie Xie, Xiamen, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the correlation between triglyceride/high-density lipoprotein cholesterol (TG/HDL-C) ratio and spectral parameters measured on a fast kVp switching dual-energy CT

##### METHODS AND MATERIALS

This study included 50 patients with non-alcoholic fatty liver disease (NAFLD) and 46 healthy individuals, all received TG and HDL-C examination and TG/HDL-C was calculated. According to TG/HDL-C, the individuals were divided into two groups: low-ratio group (TG/HDL-C  $\leq$ 1.5, n=56), and high-ratio group (TG/HDL-C >1.5, n=40). Abdominal spectral imaging was performed on all individuals. Virtual monochromatic images at 50keV, 70keV, 90keV, and 100keV were reconstructed, the CT value of liver at 50-100 keV (HU50-100 keV) and that of spleen at 70keV were measured and the CT value of liver/ CT value of spleen ratio (HUL/S) was calculated. Mann Whitney U or two-sample t test was used to compare the differences between two groups, Spearman or Pearson correlation analysis was used to analyze the correlation between TG/HDL-C ratio and CT quantitative parameters, and ROC curve was used to analyze the performances of those parameters in predicting TG/HDL-C ratio.

##### RESULTS

Correlation analysis showed that TG/HDL ratio was negatively correlated with HU50keV, HU70keV, HU90keV, HU100keV, HUL/S, and the correlation coefficients were -0.4171 (-0.5740 to -0.2307,  $p < 0.0001$ ), -0.6129 (-0.7272 to -0.4655,  $p < 0.0001$ ), -0.6878 (-0.7830 to -0.5612,  $p < 0.0001$ ), -0.7006 (-0.7923 to -0.5778,  $p < 0.0001$ ), -0.7513 (-0.8291 to -0.6450,  $p < 0.0001$ ). HU50keV, HU70keV, HU90keV, HU100keV, and HUL/S in high-ratio group were lower than those in low-ratio group ( $p < 0.05$ ). When using HU50keV (threshold 68.625), HU70keV (57.71), HU90keV (58.785), HU100keV (55.89) and HUL/S (threshold 1.105) to predict TG/HDL-C ratio, the sensitivities were 0.804, 0.821, 0.625, 0.732 and 0.804, the specificities were 0.69, 0.714, 0.952, 0.8821 and 0.833, and AUC were 0.723, 0.803, 0.832, 0.835 and 0.837, respectively.

##### CONCLUSION

Conclusion The quantitative spectral parameters (HU50keV, HU70keV, HU90keV, HU100keV, HUL/S) were all correlated with TG/HDL-C ratio and had high performance to predict TG/HDL-C in NAFLD patients.

##### CLINICAL RELEVANCE/APPLICATION

Spectral imaging can help predict cardiovascular events in NAFLD patients, which is valuable for therapy and prognosis.

#### **T5A-SPGI-2 Opportunistic Screening for Bone Mineral Density Changes using Virtual Non-calcium of Spectral CTE in Patients with Inflammatory Bowel Disease**

##### Participants

Shaotong Wang, Xian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Objective The purpose of this study was to explore the feasibility of opportunistic screening for bone mineral density (BMD) changes in patients with inflammatory bowel disease using virtual non-calcium of spectral computer tomography enterography (CTE)

##### METHODS AND MATERIALS

Materials and Methods Twenty patients (10 males, 10 females, average age  $38.2 \pm 11.5$ ) confirmed with inflammatory bowel disease (IBD) were prospectively enrolled. And 19 patients with non-inflammatory bowel disease (10 males, 9 females, mean age  $37.8 \pm 10.1$ ) were enrolled as control group. Patients were excluded if they had the following conditions: (a) no informed consent; (b) fracture in spine; (c) primary or metastatic bone tumors in the spine; (d) incomplete CT images; (e) Severe degenerative changes. Dual energy CTE was performed at 100/Sn150kVp using a 3rd generation dual-source CT scanner (SOMATOM Force, Siemens Healthcare). Dual energy images were reconstructed with a) virtual non-contrast images (VNC), b) virtual non-calcium images (VNCA). The CT value for contrast media (CM), the contrast agent density (CaD) which correspond to the CT value of calcium density, CT value of 50% mixed-energy imaging (CTmix) and fat fraction (FF) for 1st lumbar were measured, respectively.

##### RESULTS

Results FF and CaD of IBD group were significantly higher than those of control group ( $p < 0.05$ ). But CM and CTmix were similar between two groups ( $p > 0.05$ ). The results were shown in Table 1.

## CONCLUSION

s Conclusion FF and CaD measurements on VNCA images in spectral CT could provide feasibility of BMD quantification in patients with IBD by spectral CTE.

## CLINICAL RELEVANCE/APPLICATION

Clinical application Spectral CTE prescribed for IBD evaluation could also provide opportunistic screening for BMD changes, extending the clinical application of Spectral CT without additional radiation to patients.

## T5A-SPGI-3 Feasibility of Diagnosing Non-alcoholic Fatty Liver Disease using Spectral Imaging and Multi-material Decomposition Technique on Dual-energy CT

Participants

Anjie Xie, Xiamen, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the feasibility to diagnose non-alcoholic fatty liver disease (NAFLD) using multi-material decomposition (MMD) measured liver fat fraction (FF) and spectral parameters.

## METHODS AND MATERIALS

Fifty patients with clinically diagnosed NAFLD (reference of ultrasound examination or liver biopsy results) and 46 without NAFLD volunteers (N-NAFLD) were included in this study. Abdominal spectral imaging was performed on all individuals. Then visceral fat content (FV) and visceral fat content percentage (FCV) were measured by an auto measurement software. The FF in the left lobe of liver (FFL), right anterior lobe of liver (FFRA), and right posterior lobe of liver (FFRP) were measured using MMD. Virtual monochromatic images at 50keV, 70keV, 90keV, and 100keV were reconstructed, the CT value of liver at 50-100 keV (HU50-100 keV) and that of spleen at 70keV were measured. CT value of liver/ CT value of spleen ratio (HUL/S) and slope of spectral curve ? HU which was defined as  $(HU_{100keV}-HU_{40keV})/(100-40)$  were calculated. Differences between groups were compared using Mann Whitney U. Receiver operating characteristic curves were used to analyze the performances of those parameters in the diagnosis of NAFLD, sensitivity, specificity and area under the curve (AUC) were calculated.

## RESULTS

Comparing to N-NAFLD group, NAFLD group had higher FFL, FFRA, FFRP, FV, FCV ( $p<0.05$ ), and lower HU50keV, HU70keV, HU90keV, HU100keV, HUL/S ( $p<0.05$ ). ?HU was not statistically different between two groups. When using FFL (threshold of 0.981%), FFRP (1.065%), FFRA (4.2635%), and FV (68.8%), FVC (13013mm<sup>2</sup>), HU50keV (67.29 HU), HU70keV (58.05 HU), HU90keV (54.8 HU), HU100keV (55.678 HU), and HUL/S (1.1) to diagnose NAFLD, the sensitivities were 0.96, 0.96, 0.96, 0.52, 0.92, 0.978, 1, 1, 0.935 and 0.978, the specificities were 0.957, 0.935, 1, 0.891, 0.674, 0.72, 0.8, 0.84, 0.94 and 0.88, the AUC were 0.991, 0.989, 0.999, 0.743, 0.873, 0.84, 0.934, 0.978, 0.984 and 0.968, respectively. Therein, FFL, FFRA, FFRP had highest diagnostic performances.

## CONCLUSION

s CT spectral scanning could provide additional quantitative parameters for diagnosis of NAFLD, and FF measured by MMD had highest performance.

## CLINICAL RELEVANCE/APPLICATION

MMD technique in spectral imaging mode has great potential in rapid and non-invasive diagnosis of NAFLD.

## T5A-SPGI-4 Photon Counting CT of the Abdomen and Pelvis: A Clinical Comparison of Image Quality to Dual Energy CT Across Different Virtual Monoenergetic Images

Participants

Winston Joe, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

## PURPOSE

Photon counting detector computed tomography (PCCT) represents the latest step forward in CT technology with early experience demonstrating improvements in spatial resolution, artifact reduction, material decomposition, and dose reduction, yet there are few studies documenting how these advancements translate to improved clinical utility, especially when compared to prior state of the art dual energy integrating detector CT (DECT). The purpose of this work is to evaluate the spectral capabilities of PCCT by comparing image quality of PCCT to that of DECT across a range of virtual monoenergetic images (VMI).

## METHODS AND MATERIALS

In this institutional review board-approved retrospective study, we identified patients who underwent both routine contrast enhanced CT of the abdomen and pelvis on a clinical PCCT scanner (NAEOTOM Alpha, Siemens Healthineers) and a clinical DECT (SOMATOM FORCE, Siemens Healthineers) since December 2021 ( $n = 12$ ). Individual subjects received the same iodine contrast dose for both examinations. PCCT was performed at a tube voltage of 120 kVp, and DECT performed with a tube voltage pair of 100/150 kVp. Subsequently, VMIs from both scans were reconstructed at 40, 50, 60, 70, 100, and 150 keV. For both PCCT and DECT examinations, contrast-to-noise ratios (CNR) were calculated relative to the psoas musculature for select organs and vessels (aorta, liver, spleen, renal cortex, and pancreas). Quantitative signal-to-noise ratios (SNR) were calculated. PCCT versus DECT were evaluated with respect to CNR and SNR at each virtual monoenergetic image reconstruction. Average radiation doses were compared between PCCT and DECT.

## RESULTS

PCCT has superior CNR of the aorta at 40 keV and SNR at 40 keV and 50 keV and superior CNR and SNR for renal cortex at 40 keV. There was no significant difference in CNR of the liver or pancreas for all evaluated VMIs, while DECT showed slightly improved CNR in the spleen at 100 keV and 150 keV. PCCT achieved a statistically significant 16% radiation dose reduction compared to DECT.

## CONCLUSION

s At lower keV virtual monoenergetic images, PCCT offers improved CNR and SNR with respect to the aorta and renal cortex. Comparable contrast and signal to noise characteristics were observed for the liver, spleen, and pancreas at lower keV

reconstructions. Importantly, these findings were achieved at a statistically significant 16% radiation dose reduction compared to DECT.

#### **CLINICAL RELEVANCE/APPLICATION**

At low keV monoenergetic image reconstructions, PCCT enables quantitatively comparable to improved image quality compared to DECT while allowing for a statistically significant reduction in radiation dose.

#### **T5A-SPGI-5 Longitudinal Intra Individual Consistency of Virtual Unenhanced Images Derived from Spectral Detector CT**

##### **Participants**

Nils Grosse Hokamp, MD, PhD, Köln, Germany (*Presenter*) Research Grant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV; Consultant, Bristol-Myers Squibb Company

##### **PURPOSE**

Virtual non-contrast images (VNC) images obtained from different dual energy approaches are frequently suggested to serve as problem-solvers in case of missing true unenhanced acquisitions and even as replacement of the latter. While *ex vivo* consistency have been reported as accurate in literature, data on longitudinal, intra-individual consistency is lacking, yet another helpful measurement of their clinical utility. The objective of this study is the evaluation of longitudinal, intraindividual consistency of virtual unenhanced images (VNC) reconstructed from spectral detector CT (SDCT) in large patient cohort.

##### **METHODS AND MATERIALS**

Baseline and follow-up examinations of 166 patients with malignant melanoma were retrospectively included, resulting in a total of 323 scans. All patients underwent clinically indicated SDCT examinations of the chest and abdomen. In all patients, contrast administration, image acquisition and reconstruction were performed using a standardized protocol. Using additional cross-sectional follow-up imaging (=3 months), macroscopic tumor burden was excluded. A total of 35 ROI in parenchymatous organs, vessels and connective tissue were placed in contrast-enhanced scans (to allow for exclusion of unrepresentative tissues such as fasciae or vessels). To allow for identical ROI placement, baseline and follow-up images were displayed side-by-side using a dedicated software for oncologic image analysis (MintLesion Research, MintMedical, Heidelberg). The software then automatically copied and pasted all ROI on VNC images and collected attenuation and its standard deviation in VNC images for all ROI. Data was statistically assessed using a normalized deviation parameter:  $NDP = \frac{|(TP1;TP2)|}{\text{mean}(TP1;TP2)}$ .

##### **RESULTS**

As suggested earlier, a difference = 1 standard deviation was considered indicative of excellent reproducibility and found in 85% of cases. Good reproducibility (indicated by  $NDP = 2$  standard deviations) was found for 91% of all ROI. While good reproducibility was found for arterial vessels and all parenchymatous organs of the upper abdomen as well as connective tissues; differences in pelvic organs and venous vessels showed greater variation.

##### **CONCLUSION**

s SDCT-derived VNC reconstructions demonstrate little intraindividual, longitudinal variations and good reproducibility. These findings substantiate the validity of VNC calculations and further underline the clinical applicability of VNC reconstructions.

#### **CLINICAL RELEVANCE/APPLICATION**

VNC are more commonly used as a replacement for a true unenhanced acquisition, our data provides further substantiation that this is a valid approach.

#### **T5A-SPGI-6 Four-Dimensional Esophageal Computed Tomography Imaging: Assessment of Treatment Effect for Esophagogastric Junction Outflow Disorders after Per-oral Endoscopic Myotomy**

##### **Participants**

Hikaru Nishiyama, Toon, Japan (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Per-oral endoscopic myotomy (POEM) is a novel minimally invasive treatment method for Disorders of EGJ outflow (disorders of EGJO). However, there is no consensus on the method for evaluating the therapeutic effect of esophageal achalasia treatment other than the subjective clinical symptom score called the "Eckardt score". This study aimed to examine the clinical feasibility of four-dimensional esophageal computed tomography imaging (4D-ECT) for assessing treatment effect for esophageal achalasia after POEM.

##### **METHODS AND MATERIALS**

This prospective study included 24 patients with esophageal achalasia or EGJO obstruction who underwent 4D-ECT using 320-detector-row CT scanner before and after POEM. The patients were seated on the chair in a semi-reclining position at a 45-60 degree angle. Dynamic volume CT scan was performed during swallow of 5% diluted contrast medium (Ioversol, 320mgI/mL). Scanning was performed in sequence over a 10 s duration for swallow, and scan range was from thoracic esophagus to gastric cardia including lower esophageal sphincter (LES). CT images were reconstructed in 102 phases at an interval of 0.1 s. The maximum esophageal length and area at LES level. The volume integral with time (VIT) of contrast medium during scanning was calculated to evaluate esophageal clearance. Additionally, the Eckardt score was recorded to assess treatment effect of POEM. These results were compared between pre- and post-POEM using Wilcoxon signed-rank test.

##### **RESULTS**

For all patients, POEM were successful without major complications, and the median Eckardt score was significantly improved after POEM (7.0 [5.0-8.8] vs. 0.5 [0-1.0],  $p < 0.0001$ ). The median of maximum esophageal length at LES level was significantly longer (2.1 [0.7-4.9] vs. 7.7 [5.6-9.4] mm,  $p = 0.0001$ ), and the median of maximum esophageal area at LES level was significantly larger after POEM (2.0 [0.2-10.8] vs. 23.0 [12.4-47.0] mm<sup>2</sup>,  $p = 0.0001$ ). The VIT was significantly smaller after POEM (602.1 [216.4-717.3] vs. 92.9 [50.3-333.1] ml;  $p < 0.0001$ ).

##### **CONCLUSION**

s 4D-ECT allowed for the quantitative assessment of improving both impaired relaxation of LES and esophageal clearance after POEM.

#### **CLINICAL RELEVANCE/APPLICATION**

4D-ECT is a novel imaging technique for the assessment of esophageal dynamics, and provides quantitative parameters for evaluating esophageal morphology, motility, and clearance. 4D-ECT enables quantitative and objective assessment of treatment effect for EGJO disorders after POEM.

#### **T5A-SPGI-7 Quantitative Spectral Computed Tomography Parameters as Pre-operative Prediction Factors for Ki-67 Expression in Hepatocellular Carcinoma**

##### **PURPOSE**

To investigate the performance of spectral parameters measured by a dual-energy CT for predicting the Ki-67 expression in hepatocellular carcinoma (HCC).

##### **METHODS AND MATERIALS**

This study retrospectively analyzed 91 patients with HCC who underwent both Ki-67 immunohistochemistry and two-phase contrast-enhanced spectral CT imaging. These patients were divided into two groups according to the positive rate of Ki-67 (Ki-67%): high expression (Ki-67% > 20%, n = 51) and low expression (Ki-67% = 20%, n = 40). CT values on 100 and 140 keV monochromatic energy images (HU100-140keV), normalized effective atomic number (Neff-Z), water density (Dwater) and fat density (Dfat) were measured and calculated. Receiver Operating Characteristics (ROC) curves were utilized for evaluating the predicting performance, area under curve (AUC), sensitivity and specificity were calculated, and multi-variable logistic regression analysis were conducted.

##### **RESULTS**

In prediction of Ki-67 expression, the AUCs of Neff-Z, Dfat, HU100-140keV and Dwater were 0.650, 0.677, 0.692-0.750, 0.777, with thresholds of 0.68, 995.28, 64.42-48.79 and 1035.17 respectively. The corresponding sensitivities were 0.647, 0.804, 0.529-0.824 and 0.961, respectively. The specificities were 0.600, 0.525, 0.825-0.625 and 0.475, respectively. Dwater was an independent predicting factor for high Ki-67 expression (OR=1.286, P<0.001), and had the highest prediction efficiency with area under the curve (AUC) of 0.777. The multi-variable analysis combining spectral CT parameters and morphological characteristics improved the prediction efficiency (AUC=0.814).

##### **CONCLUSION**

s Spectral CT provides a non-invasive method to evaluate the proliferation status of HCC cells, and the efficiency would be improved by combining spectral CT parameters and morphologic features.

#### **CLINICAL RELEVANCE/APPLICATION**

Ki-67 was a significant marker for HCC prognosis and clinical decision, however current method to evaluate Ki-67 always needs surgery, which is detrimental for assessing patients who lost surgery chance. Contrast-enhanced spectral imaging on dual-energy CT provides various parameters to predict cell proliferation in HCC with good performance, shedding lights in clinical diagnosis and therapeutic strategy decision.

#### **T5A-SPGI-8 Imaging, Pathological and Molecular Characteristics of Programmed Cell Death Ligand 1 Positive Hepatocellular Carcinoma**

Participants  
Azusa Kitao, MD, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Immunotherapy has been rapidly developed and is being applied for increasing number of hepatocellular carcinoma (HCC) patients. The purpose of this study is to clarify the imaging, pathological and molecular characteristics of hepatocellular carcinoma showing programmed cell death ligand 1 (PD-L1) expression, for the prediction of immunotherapy reactivity.

##### **METHODS AND MATERIALS**

We enrolled surgically resected 353 HCCs from April 2008 to July 2018 at our institution and classified into PD-L1 positive HCCs and PD-L1 negative HCCs by immunohistochemistry. We compared the qualitative and quantitative findings on dynamic CT and gadoteric acid-enhanced MRI, pathology and immunohistological expression of P53, beta-catenin, glutamine synthetase and organic anion transporting polypeptide 1B3 (OATP1B3). Mann-Whitney test, chi-square test, multivariable analysis and Pearson's correlation analysis were used for statistical analyses.

##### **RESULTS**

PD-L1 positive HCC (n=82) frequently showed arterial phase rim enhancement or heterogenous hypo-hyperenhancement compared to PD-L1 negative HCC (n=271) (52.4% vs 29.0%, P<0.001, odds ratio=5.00, 95% CI 2.34-10.68). Apparent diffusion coefficient (ADC) in PD-L1 positive HCC was lower than in PD-L1 negative HCC ( $1.13 \times 10^{-3}$  mm<sup>2</sup>/s vs  $1.30 \times 10^{-3}$  mm<sup>2</sup>/s, P=0.01, odds ratio=0.45 [cutoff value  $1.18 \times 10^{-3}$  mm<sup>2</sup>/s], 95% CI 0.24-0.82). Patients with PD-L1 positive HCC showed higher serum AFP level than those without PD-L1 positive HCC (median 20 ng/ml vs 10 ng/ml, P<0.001). Poorly differentiated HCC was frequent in PD-L1 positive HCC (37.8% vs 19.9%, P<0.001). PD-L1 expression grade showed a significant positive correlation with P53 expression grade (P<0.0001, R=0.36), however, no correlation with the other molecules.

##### **CONCLUSION**

s Imaging characteristics of PD-L1 positive HCC are arterial phase rim enhancement or heterogenous enhancement and lower ADC value. PD-L1 positive HCC showed higher serum AFP level, higher percentage of poorly differentiated HCC and a positive correlation with p53 expression, indicating aggressive biological natures.

#### **CLINICAL RELEVANCE/APPLICATION**

Imaging characteristics of PD-L1 positive HCC with more aggressive natures, namely arterial phase rim enhancement or

imaging characteristics of PD-L1 positive NSCLC with more aggressive natures, namely arterial phase rim enhancement or heterogenous enhancement in dynamic CT and low ADC value will be useful to predict immunotherapy response in personalized medicine.

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## Abstract Archives of the RSNA, 2023

T5A-SPGU

### Genitourinary Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPGU-1 An MRI-based Grading System for Preoperative Risk Estimation of Positive Surgical Margin after Radical Prostatectomy**

##### Participants

Lili Xu, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aimed to construct a simplified grading system based on MRI features to predict positive surgical margin (PSM) after radical prostatectomy (RP) and then validate it internally.

##### METHODS AND MATERIALS

Patients who had undergone prostate MRI followed by RP at our institution between January 2017 and January 2021 were retrospectively enrolled as the derivation group, and those between February 2021 and November 2022 were enrolled as the validation group. One radiologist evaluated tumor-related MRI features, including the capsule contact length (CCL) of lesions, capsular irregularity or bulge, neurovascular bundle asymmetry, obliteration of rectoprostatic angle, frank extraprostatic extension (EPE), and apex abutting. Binary logistic regression and decision tree analysis were used to select risk features for PSM among the significant variables from univariate analysis. The area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of different systems were calculated and then compared. The interreader agreement of the scoring systems was evaluated using the kappa statistic.

##### RESULTS

A total of 42 (29.8%) and 32 (36.4%) patients had PSM in the derivation and validation cohorts, respectively. The first grading system was proposed (mrPSM1) using two imaging features, namely, CCL = 20 mm and apex abutting. After combining the radiologist's perspective, the grading system was updated by adding frank EPE (mrPSM2) as follows: Grade 1, CCL < 20 mm without apex abutting; Grade 2, CCL = 20 mm or apex abutting; Grade 3, CCL = 20 mm and apex abutting, or frank EPE. In the derivation group, the AUC was 0.705 for mrPSM1 and 0.713 for mrPSM2. In the validation group, our grading systems showed slightly higher AUC than Park et al.'s model (0.672-0.686 vs. 0.646,  $p > 0.05$ ) and significantly higher specificity (0.732-0.750 vs. 0.411,  $p < 0.001$ ). The kappa value was 0.764 for mrPSM1 and 0.776 for mrPSM2. Decision curve analysis showed a higher net benefit for mrPSM2.

##### CONCLUSION

s The proposed grading systems based on MRI have feasibility in predicting PSM and are easily interpretable.

##### CLINICAL RELEVANCE/APPLICATION

Our proposed MRI-based grading systems for PSM might benefit the management of prostate cancer.

#### **T5A-SPGU-2 Prediction of Clinically Significant Prostate Cancer from Equivocal PI-RADS Category 3 Patients with a Deep Learning Approach: A Retrospective Multicenter Study**

##### PURPOSE

The presence of clinically significant prostate cancer (csPCa) is equivocal for patients with Prostate Imaging Reporting and Data System (PI-RADS) category 3, and therefore need confirmations of biopsy pathology. We aim to develop deep learning models for identifying csPCa and PCa from equivocal PI-RADS category 3 patients, and thereby reduce unnecessary biopsies.

##### METHODS AND MATERIALS

This retrospective multicenter study included bi-parameter MRI images of consecutive men patients from 6 centers. Deep learning models for predicting PCa and csPCa were constructed separately. Each model was first pretrained using 1144 PI-RADS 1~2 and 4~5 patients and then retrained using 238 PI-RADS 3 patients in randomly selected three centers, and finally tested using 185 PI-RADS 3 patients of the other three centers.

##### RESULTS

The deep learning models achieved excellent predicting performances in each external testing cohort with the area under the receiver operating characteristic curves of 0.795 (95%CI, [0.700,0.891]), 0.963 (95%CI, [0.915,1]) and 0.922 (95%CI, [0.810,1]) for predicting PCa, and 0.827 (95%CI, [0.703, 0.952]) and 0.926 (95%CI, [0.846, 1]) for predicting csPCa. Especially, 71.1% to 92.2% of non-csPCa patients were identified by our model, who would have safely spared from invasive biopsy or RP procedure.

##### CONCLUSION

s Our model offers a noninvasive clinical tool to predict csPCa from PI-RADS 3 patients, thereby reducing the unnecessary invasive

biopsies and improving the effectiveness of biopsies.

#### **CLINICAL RELEVANCE/APPLICATION**

1 The AttenNet models included channel attention and soft attention modules. 2 The AttenNet models had relatively strong generalization and reliability. 3 The AttenNet models were developed by a transfer learning strategy.

#### **T5A-SPGU-3 Performance of an Ultra-fast Deep-learning Accelerated MRI Screening Protocol for Prostate Cancer Compared to a Standard Multiparametric Protocol**

Participants

Benedict Oerther, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To establish and evaluate an ultra-fast MRI screening protocol for prostate cancer in biopsy-naïve men regarding PI-RADSv2.1 classification in comparison to the standard multiparametric protocol.

#### **METHODS AND MATERIALS**

This prospective monoinstitutional study included consecutive patients with suspected prostate cancer without prior biopsy. A PI-RADSv2.1 conform mpMRI protocol was acquired in a 3 T MRI scanner (tripplanar T2 TSE, axial T1 DIXON native and contrast-enhanced, DWI, DCE; scan time: 23min, 43sec). Additionally, two deep-learning accelerated sequences (axial T2-weighted TSE and diffusion-weighted „ZOOMit“) were acquired (scan time: 3min 28sec). Two experienced readers independently evaluated the images for image quality (Likert-scale; 1=non-diagnostic, 5=excellent) and the presence of prostate cancer according to PI-RADSv2.1 criteria. In a first reading session, only the screening protocol (axial T2-weighted and ZOOMit imaging was available). Subsequently, the full conventional mpMRI protocol was assessed (blinded to the results of the first session) and served as a reference standard. Intrareader-agreement was assessed using weighted kappa statistics.

#### **RESULTS**

The final cohort after exclusions consisted of 77 patients. Diagnostic performance of the screening protocol was excellent with a sensitivity and specificity of 87.5%/100% and 100%/100% (cut-off = PI-RADS 4) for reader 1 and reader 2, respectively. Mean image quality was 4.4 (R1) and 3.9 (R2) for the standard protocol vs. 4.6 and 4.7 for the accelerated T2- and diffusion-weighted images ( $p < 0.05$ ). Intrareader-agreement was substantial ( $k=0.72$ ) for reader 1 and excellent ( $k=0.98$ ) for reader 2.

#### **CONCLUSION**

s An abbreviated screening protocol for prostate cancer in biopsy-naïve men proved similar diagnostic performance and better imaging quality compared to the conventional extensive mpMRI protocol, requiring just 15% of scan time.

#### **CLINICAL RELEVANCE/APPLICATION**

Ultra-fast deep-learning accelerated MRI protocols can render prostate cancer screening more time efficient.

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## Abstract Archives of the RSNA, 2023

T5A-SPHN

### Head & Neck Imaging Tuesday Poster Discussions I

#### Sub-Events

#### T5A-SPHN-1 CT Diagnosis of Cricoarytenoid Joint Dislocation

##### Participants

Xueming Zeng, Nanjing City, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the value of CT in diagnosis of cricoarytenoid joint dislocation, and evaluate the diagnostic points of different types of dislocation.

##### METHODS AND MATERIALS

41 patients who had been diagnosed with cricoarytenoid joint dislocation retrospectively reviewed, all patients were treated by reduction forceps, and the voice returned to normal or significantly improved. Including respiratory phase and phonation phase CT images. ?Observe the exposure of arytenoid articular surface of cricoid cartilage on VR images: complete exposure means total dislocation, incomplete exposure means subluxation; posterior part exposure means anterior dislocation, anterior part exposure means posterior dislocation; lateral part exposure means medial dislocation, medial part exposure means external dislocation (respiratory phase). ?Observe laryngoscopic video of each case, judge the direction of dislocation (anterior and posterior) according to morphology of vocal folds; compare the results with CT judgment. ?The characteristics of MPR CT images in each case were analyzed based on VR images.

##### RESULTS

? On VR images, there were 38 cases of cricoarytenoid subluxation (92.7%, 38/41), 3 cases of complete dislocation (7.3%, 3/41); 32 cases (78.0%, 32/41) of left dislocation, 9 cases (22.0%, 9/41) of right dislocation; Posterior dislocation in 37 cases (90.2%, 37/41), anterior dislocation in 4 cases (9.8%, 4/41); There were 32 cases of medial dislocation (78.0%, 32/41), 2 cases of external dislocation (4.9%, 2/41), 7 cases without obvious internal/external dislocation (17.1%, 7/41). 3 cases of complete dislocation were left posterior and internal dislocation. ?On laryngoscopy, there were 24 cases of posterior dislocation (58.5%, 24/41), 12 cases of anterior dislocation (29.3%, 12/41), 5 cases were difficult to assess (12.2%, 5/41). Laryngoscopy diagnosis were consistent with CT in 20 cases (55.6%, 20/36), inconsistent in 16 cases (44.4%, 16/36). ?On MPR CT images, dislocated arytenoid cartilage ridged on the top of cricoid cartilage plate in all 3 cases of complete dislocation. The manifestations of 38 cases of cricoarytenoid joint subluxation on MPR CT images are shown in Table 1. ( Fig.1~6)

##### CONCLUSION

s VR images can display dislocation of cricoarytenoid joint visually and accurately. MPR images can compensate for the poor evaluation of VR in younger patients.

##### CLINICAL RELEVANCE/APPLICATION

This study is based on the diagnostic method of limb joint dislocation and has high diagnostic accuracy. Reduction forceps adopts different techniques for total dislocation and subluxation, only CT can distinguish them currently.

#### T5A-SPHN-2 Identification of Methicillin-resistant Staphylococcus Aureus (MRSA) via Head and Neck Imaging

##### PURPOSE

It is currently unclear how methicillin-resistant Staphylococcus aureus (MRSA) infection presents in medical imaging uniquely from other types of acute infection. The characteristics of MRSA neck infections in radiological exams have not yet been established. This study aimed to compare the presentation of MRSA positive patients to that of patients with other types of acute neck infection in radiological exams.

##### METHODS AND MATERIALS

A retrospective review of children and young adults aged 0 to 24 years who underwent medical imaging for suspected acute infection at our pediatric hospital between January 2013 and September 2022 was conducted. A blinded radiologist reviewed initial and follow-up head and neck CT and MR imaging of patients with and without MRSA infection. Noted features included nodal necrosis, pattern of fat stranding, discrete abscess, and retropharyngeal edema. MRSA diagnosis was determined using microbiology lab results.

##### RESULTS

A total of 18 patients were reviewed, with a mean age of  $6.4 \pm 7.7$  years old (range 0-24) at time of diagnosis. 7 patients were female and 12 patients were male. 8 patients were positive for MRSA (MRSA-P), and 10 patients were MRSA negative but had acute neck infection (MRSA-N). Statistical analysis was conducted using SPSS 28.0.1.0 (142). No significant difference was found in age or sex between MRSA-P and MRSA-N groups. More MRSA-P patients (5/8, 62.5%) had nodal necrosis compared to the MRSA-N group (2/10, 20.0%), a borderline significant difference in proportions of 0.425,  $p = 0.145$ . All but one MRSA-P patients



(7/8, 87.5%) had a diffuse pattern of fat stranding compared to the MRSA-N group (6/10, 60.0%), but we failed to find a significant difference in proportions ( $p > 0.10$ ). A higher number of MRSA-P patients (7/8, 87.5%) had discrete abscess compared to MRSA-N patients (5/10, 50.0%), with the 0.375 difference in proportions being borderline significant,  $p = 0.152$ . More MRSA-P patients (4/8, 50.0%) had retropharyngeal edema compared to the MRSA-N patients (1/10, 10.0%), with a borderline significant difference in proportions of 0.400,  $p = 0.118$ .

## CONCLUSION

s MRSA neck infections show a higher proportion of observed nodal necrosis, diffuse pattern of fat stranding, discrete abscess, and retropharyngeal edema than acute neck infections unrelated to MRSA. However, these differences are not necessarily significant and further investigation with a larger patient sample size is needed to validate the significance of our findings and establish their potential use in clinical practice.

## CLINICAL RELEVANCE/APPLICATION

The differences in presentation between neck infections due to MRSA vs. other pathogens in head and neck MR and CT exams will allow for enhanced ability to identify MRSA from other types of neck infection.

## T5A-SPHN-3 MRI in the Evaluation of Facial Dermal Fillers

### PURPOSE

To ascertain with MRI the presence of filler injected in facial soft tissue and to evaluate contrast-enhancement in filler-related complications.

### METHODS AND MATERIALS

45 pts after filler augmentation underwent MRI. 19 pts (10 after temporary and 9 after permanent filler) had no problem while 26 pts had filler-related problems. TSE-T1-weighted, TSE-T2-weighted, fat-saturated TSE-T2-weighted and TIRM scans on axial and coronal plane were performed. In filler-related complications, fat-suppressed TSE-T1-weighted scans were performed after i.v. administration of Gadolinium-DOTA. Skin biopsy was performed in patients with soft tissue enhancement and in 5 pts without any enhancement who haven't any clinical improvement after antibiotic therapy. Fisher's exact test was used for statistical analysis. In complicated cases, cervical lymph node enlargement was evaluated (longitudinal axis >10mm).

### RESULTS

MRI always identified and quantified the filler in soft tissue. Temporary dermal fillers appeared as spots hypointense on T1-weighted and hyperintense on T2-weighted images. Permanent fillers appeared as hypointense spots on T1-weighted images while the signal intensity on T2-weighted images varied. In patients with complications, on T2-weighted images they appeared hyperintense in 20 pts and hypointense in 16 pts. When a positive subcutaneous contrast-enhancement was detected (9 pts), skin biopsy always found an inflammatory granulomatous reaction which wasn't found in 5 pts without contrast-enhancement. Fisher's exact test found a significant correlation ( $P < 0.001$ ) between subcutaneous contrast-enhancement and granulomatous reaction. Cervical lymph nodes enlargement was found in 16 complicated patients and their levels determined (IA, IB, IIA, IIB).

## CONCLUSION

s MRI is a useful and non-invasive tool for visualization of facial dermal filler and i.v. Gadolinium administration is advised in complicated cases.

## CLINICAL RELEVANCE/APPLICATION

MRI criteria to evaluate patients after facial dermal filler implants in normal and pathological cases and to diagnose a possible granulomatous reaction using i.v. administration of paramagnetic contrast media.

## T5A-SPHN-4 Feasibility of Paranasal Sinus MR Imaging at 0.5T: Comparison with CT and 1.5T MR

Participants

Harsh Agarwal, PhD, Bangalore, India (*Presenter*) Employee, Samsung Electronics Co, Ltd

### PURPOSE

CT is imaging modality of choice for medical and surgical management of the paranasal sinus (PNS) such as for inflammation, ESS and DNS. It is however associated with radiation exposure especially to eyes and in young individuals. Usage of CT also limits the repeat imaging follow-up of the PNS patients. It has been shown that MRI can be used in place of CT and can give additional information about various soft tissues in sinus. However due to the sensitivity of MRI to metal such as that present in dental crowns can limit the use of MRI. 0.5T is impacted much less by the metal and can be used to replace CT for sinus evaluation.

### METHODS AND MATERIALS

Over the period of 3 weeks, all patients who visited the diagnostic centre for PNS CT was given an option to participate in IRB approved MRI study. Further patients undergoing MRI exam and have sinus related issues were given option to participate in the study. These patients were scanned with thin section CT and high-resolution thin slice MRI scan (Cor T2w, Cor T2 STIR, Ax T2, Cor T1w) at both 1.5T commercial MRI scanner and 0.5T MRI scanner. 2 expert radiologists reviewed the CT, and MR images from 1.5T and 0.5T independently and reported their findings. These findings were then compared to access if any clinical finding is missing in any of CT, 1.5T and 0.5T MRI reports.

### RESULTS

3 patients were scanned at CT and both the MRI scanners and additional 5 patients were scanned at both the MRI scanners. Scans were successfully completed. No clinical finding was missed at either of the CT, 1.5T and 0.5T MRI reports of the two radiologists. MRI was preferred by the two-radiologist due to additional soft tissue information in MRI. One patient has large dental cap which was causing susceptibility artifact in 1.5T MRI over the maxillary sinus but reduced extent of artifact was observed for 0.5T MRI with clear diagnosis over the maxillary sinus area.

## CONCLUSION

s Compared to CT 1.5T and 0.5T MRI showed similar clinical diagnosis for medical and surgical management of the sinus patients.

Unlike 1.5T MRI 0.5T is minimally affected by the metal and can be used in imaging with metal embeddings like dental fillings and crown. Therefore 0.5T can potentially replace CT for imaging management of sinus diseases and clinically superior for soft tissue tumors and fungal soft tissue involvement.

#### **CLINICAL RELEVANCE/APPLICATION**

CT imaging for PNS leads to unwanted exposure to eyes and in young patients where DNS surgery is typically performed. The usage of 0.5T MRI will enable sinus imaging even in the presence of metal such as dental crowns and braces. AI augmented 0.5T MRI could be more accessible to cities and patients where MRI was previously not accessible.

#### **T5A-SPHN-5 Feasibility, Diagnostic Efficacy, and Safety of Core Needle Biopsy as a First-Line Biopsy Method for Cervical Lymph Nodes**

##### **PURPOSE**

The role of ultrasound-guided core needle biopsy (CNB) as a first-line method for cervical lymph nodes (LNs) has not yet been established. This retrospective study aimed to determine the feasibility, diagnostic efficacy, and safety of ultrasound-guided CNB as a first-line biopsy method for cervical LNs in patients with cervical nodal disease of non-thyroid origin.

##### **METHODS AND MATERIALS**

From March 2017 to October 2022, CNB was routinely applied as a first-line biopsy method by an experienced radiologist to 1331 cervical LNs in 995 consecutive patients with cervical nodal disease of non-thyroidal origin. CNB was performed by using 18-gauge, single- or double action spring-activated needles and the number of CNB sampling was 2-4 times in most cases. The hydrodissection technique was selectively used for high risk LNs located adjacent to large vessels and critical neck nerves. The results of CNB were categorized into four categories of inadequate, benign, indeterminate, and malignant. The feasibility of CNB was evaluated by the technical success rate. The diagnostic efficacy was evaluated by the inadequacy rate and diagnostic accuracy (sensitivity, specificity, and accuracy) for malignant LNs. The diagnostic accuracy was estimated by two criteria for test positivity (criterion 1, malignant; criterion 2, malignant or indeterminate) in 1097 LNs with final diagnoses (634 benign and 463 malignant LNs). The safety of the CNB procedure was evaluated by the major and minor complication rates.

##### **RESULTS**

The technical success rate was 99.4 % (987/995 patients) and CNB procedure technically failed in six patients with small LNs adjacent to the lung apex and two patients with poor cooperation. The CNB results were inadequate in 15 (1.1%), benign in 659 (49.5 %), indeterminate in 53 (4.0 %), and malignant in 604 (45.4 %) of 1331 LNs. The sensitivity, specificity, and accuracy of CNB for malignant LNs were 95.3%, 100%, and 97.3% with criterion 1 and those were 99.5%, 97.4%, and 98.8 % with criterion 2. The sensitivity and specificity of CNB for diagnosis of lymphoma were 73.2% and 100% with criterion 1 and those were 98.2%, 97.4% with criterion 2. There were no major complication such as large symptomatic hemorrhage requiring admission or needle tract seeding. Minor complication (asymptomatic small hematoma) was found only in 8 (0.8%) patients.

##### **CONCLUSION**

s CNB was technically feasible, effective, and safe as a first-line biopsy method for cervical LNs in patients with cervical nodal disease of non-thyroid origin with high diagnostic accuracy for malignant nodal disease.

#### **CLINICAL RELEVANCE/APPLICATION**

CNB can be used as an effective first-line diagnostic method for LNs in patients with cervical nodal disease of non-thyroid origin.

#### **T5A-SPHN-6 Stellate Ganglion Block with CT Guidance for Post-COVID Parosmia**

Participants

Adam Zoga, MD, MBA, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Long term anosmia and parosmia are known late sequelae of COVID-19. While promising treatments for anosmia have evolved, parosmia is often refractory to pharmaceutical and topical therapies, leading to mood disorders, weight loss, and decreased quality of life. We worked with ENT colleagues to assess the potential benefits of CT-guided stellate ganglion block (SGB) in patients with long term post-COVID parosmia.

##### **METHODS AND MATERIALS**

Subjects were referred from an ENT olfactory subspecialist after at least 6 months of post-COVID parosmia, refractory to pharmaceutical/topical therapies. Situs was selected based upon hand dominance. CT guidance was used to position a 25-gauge spinal needle anterior to the lateral margin of the longus coli muscle at the level of T1 and positioning was confirmed with iodinated contrast. 1cc Lidocaine was injected and any Horner's syndrome was documented. In this location, 40mg of Depo Medrol and 2cc of were injected at the stellate ganglion. Change in symptoms was monitored through scheduled survey responses.

##### **RESULTS**

54 subjects presented for SGT (74% female, mean age 46 and range 14-71). Follow-up was obtained for 65% (37/54) of patients among whom 59% (22/37) reported improved symptoms at 1 week post injection. 82% (18/22) experienced progressive improvement with significant increase in mean reported improvement by 1 month post procedure ( $p=0.02$ , Figure 1). At 3 months, responders to SGB reported a mean of 49% improvement in symptoms (range 10-100%). 26 subjects returned for a contralateral injection with at least a 6 week interval. Of these, 100% (8/8) who reported no improvement after the 1st injection had no improvement after the 2nd injection. 86% (12/14) of subjects who reported some improvement after the 1st injection reported additional improvement after subsequent contralateral injection. For all injections, a Horner's syndrome was confirmed by exam in 95% (76/80), and all signs of Horner's syndrome resolved within 30 minutes of the injection. No complications or adverse events were reported.

##### **CONCLUSION**

s Percutaneous SGB shows promise for patients with long term post-COVID parosmia, and CT provides ideal efficiency and guidance. For patients with improvement post SGB, and 2nd contralateral treatment may provide additional benefit.

## CLINICAL RELEVANCE/APPLICATION

CT-guided stellate ganglion block is a new, minimally invasive and potentially impactful image guided therapy for patients with longstanding post-COVID parosmia.

## T5A-SPHN-7 Preoperative Prediction of Pathologic Response to Neoadjuvant Immunotherapy in Resectable Locally Advanced Head and Neck Squamous Cell Carcinoma Using Multiparametric MRIC<sub>13</sub> + CHAR<sub>10</sub>

Participants

Yaqin Zhang, MD, PhD, Zhuhai, China (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate the value of quantitative changes in MRI imaging after neoadjuvant immunotherapy in predicting pathologic response in resectable locally advanced head and neck squamous cell carcinoma (HNSCC) patients.

### METHODS AND MATERIALS

Fifteen patients with resectable locally advanced HNSCC who were enrolled in the prospective phase Ib clinical trial were included in the current retrospective analysis. In this current analysis, patients have underwent contrast-enhanced MRI and diffusion-weighted MRI scanning before neoadjuvant immunotherapy and radical resection of the tumor respectively. Response to neoadjuvant immunotherapy was based on histopathological evaluation of the resected specimen. The volume of the primary tumor and the value of the apparent diffusion coefficient (ADC) was measured. The difference between the two groups of treatment response (good response and poor response) was assessed using Fisher's exact test and the Mann-Whitney U test. The ability of the relative changes of the ADC value and tumor volume to discriminate between different pathologic response groups was quantified using the area under the receiver operating characteristic curve.

### RESULTS

Good response was found in 33.3% of all patients. Relative changes in primary tumor volume ( $V_{\text{primary}}$   $p=0.001$ ) and in DW-MRI parameters ( $ADC_{\text{primary}}$   $p=0.03$ ) after neoadjuvant immunotherapy were significantly different between the groups of good response and poor response. When the relative changes in tumor volume were used for predicting treatment response, the area under the receiver operating characteristics curve (AUC) was 0.98 with a sensitivity of 100% and a specificity of 90%. Change in ADC value achieved an AUC of 0.89 with a sensitivity of 100% and a specificity of 71% for the prediction of treatment response.

### CONCLUSION

Changes in tumor volume and ADC value after neoadjuvant immunotherapy can help identify patients with good response to neoadjuvant immunotherapy in HNSCC.

## CLINICAL RELEVANCE/APPLICATION

Accurate preoperative prediction of pathologic response to Neoadjuvant immunotherapy in patients with HNSCC could guide clinical selection and the patients could also be spared from ineffective and unnecessary toxicity. Although the use of MRI to evaluate the progression of immunotherapy has been explored in other types of tumors, information on HNSCC is limited. As far as we are aware, there are no published studies that use the gold standard of surgical histopathology to assess the response of neoadjuvant immunotherapy for HNSCC on imaging. The results of this study showed that the changes of tumor volume and ADC value can effectively evaluate the immunotherapy response of HNSCC in clinical work.

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## Abstract Archives of the RSNA, 2023

T5A-SPIN

### Imaging Informatics Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPIN-1 Transitioning to Fully-Supervised Pre-Training with Large-Scale Radiology ImageNet for Improved AI Transferability in Three-Dimensional Medical Segmentation**

##### Participants

Zongwei Zhou, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

Fully-supervised pre-training has experienced long-standing success in the realm of computer vision, largely attributable to the extensive annotated ImageNet dataset. This research examined the transferability of medical AI fully supervised pre-trained on a similarly sized Radiology ImageNet.

##### METHODS AND MATERIALS

We first constructed a large-scale dataset by assembling 3,410 publicly available abdominal CT scans with partially annotated 25 organs and 6 tumors. We then completed the missing annotations using an efficient human-in-the-loop approach, resulting in Radiology ImageNet. This dataset enabled us to pre-train an AI model using full supervision. Segmentation, partitioning an image into multiple segments, can be viewed as a per-voxel classification. Therefore, the per-voxel annotations in our Radiology ImageNet (2,109 million annotated voxels) provided an order of magnitude larger than the per-image annotations in ImageNet (14 million images). AI transferability was evaluated on three medical segmentation tasks, i.e., 19 cardiovascular structures, 22 muscles, and 18 organs, using two external datasets, i.e., TotalSegmentator and JHH, comprising 6,062 CT scans. Dice Similarity Coefficient (DSC) was used as the evaluation metric. For a comprehensive comparison, we benchmarked fully-supervised pre-training against three dominant AI models pre-trained on 5,050, 5,022, and 888 unlabeled CT scans, respectively.

##### RESULTS

Fully-supervised pre-training demonstrated improved transfer learning performance compared to self-supervised counterparts, with increases from 86.5% to 90.9%, 89.9% to 94.4%, and 85.8% to 90.4% for the segmentation of cardiovascular structures, muscles, and organs in CT scans, respectively, using the TotalSegmentator dataset. As the annotated CT scans became more limited, fully-supervised pre-training achieved substantially better performance than self-supervised pre-training, with improvements of 17.5%, 12.1%, and 16.6% for 5-shot, 10-shot, and 20-shot transfer learning in the JHH dataset.

##### CONCLUSION

We created Radiology ImageNet and demonstrated its importance in the field of medical image analysis. Pre-training medical AI on this dataset led to an improved transferability for segmenting various anatomical structures in the human body. Our investigation suggested that fully-supervised pre-training mitigated the marked difference between self-supervised and segmentation tasks. This highlighted the potential of fully supervised pre-training to advance precision medicine.

##### CLINICAL RELEVANCE/APPLICATION

Medical AI, pre-trained on our Radiology ImageNet, excelled in the segmentation of anatomical structures, executing its vast potential in robotic surgery and treatment planning.

#### **T5A-SPIN-2 Nomogram based on CT-derived extracellular volume to predict pathological grading of hepatocellular carcinoma: a multicenter study**

##### PURPOSE

To evaluate the potential of CT-derived extracellular volume (ECV) to predict the pathological grading of hepatocellular carcinoma (HCC), and to develop two nomograms that combine clinical factors to predict high-grade HCC preoperatively.

##### METHODS AND MATERIALS

A total of 230 patients diagnosed with HCC were collected from Hospital X and Hospital Y. Due to the presence of multiple lesions in some patients' livers, a total of 238 lesions were included in the study. Due to the imbalance in data, we have used oversampling techniques (SMOTE) to balance it. After balancing, patients from Hospital X were included in the training and internal validation sets at a ratio of 7:3, while patients from Hospital Y were used as an independent external validation set. Absolute enhancement values of the liver tumor and the abdominal artery were calculated using non-contrast enhanced and delayed phase images. The ECV was calculated using the following formula:  $ECV (\%) = \frac{HU_{tumor} - HU_{aorta}}{HU_{aorta} - HU_{Hct}} [100 - Hct(\%)]$ . Two machine learning algorithms (logistic regression and random forest) were selected for modeling the nomogram.

##### RESULTS

According to the logistic regression algorithm, CT-derived ECV is an independent predictive factor for distinguishing high and low-grade HCC, with statistically significant differences ( $p < 0.001$ ). In the training, internal, and external validation cohorts, the AUCs of CT-ECV for evaluating the pathological grading of high-grade HCC were 0.895, 0.832, and 0.740, respectively. The logistic

regression-nomogram model had AUCs of 0.899, 0.853, and 0.750 in the training, internal, and external validation cohorts, respectively. The random forest-nomogram model had AUCs of 0.905, 0.847, and 0.812 in the training, internal, and external validation cohorts, respectively. Both models had satisfactory goodness of fit in the training and validation cohorts, and good clinical net benefit.

## CONCLUSION

s CT-derived ECV may represent a new quantitative CT marker for the identification of HCC pathological grading, providing incremental diagnostic value. The nomogram presents the predicted results in a visual and easy-to-understand manner, which helps physicians and patients better understand the disease progression and prognosis.

## CLINICAL RELEVANCE/APPLICATION

ECV is an indicator that reflects the changes in the microenvironment of liver tumors, which can calculate the percentage of extracellular space in the total volume of liver tumor tissue through contrast agent kinetic characteristics. The level of ECV is closely related to the malignancy and prognosis of liver tumors, and therefore has important significance in the diagnosis and treatment of liver tumors.

## T5A-SPIN-3 Deep Learning for Automated Measurement of Patellofemoral Anatomic Landmarks

### PURPOSE

To train a deep learning model to identify patellofemoral anatomic landmarks and enable the automated measurement of anatomical parameters.

### METHODS AND MATERIALS

This is an IRB-approved retrospective study with CT knee imaging from 483 patients acquired from April 2017-May 2022. Patients were selected from two cohorts: a pathological cohort of patients scheduled for knee arthroplasty (KA), and one of patients with healthy knee anatomy. 14,652 CT images were annotated with the location of 7 patellofemoral landmarks by trainees and approved by a senior musculoskeletal radiologist. A two-stage deep learning model was trained to predict landmark coordinates. A modified ResNet50 architecture was used, with an additional supervision mechanism. Models were initialized with self-supervised learning pre-trained weights on the RadImageNet radiological imaging database.

### RESULTS

Spatial accuracy is critical for model performance, as all patellofemoral measurements are calculated based on the predicted landmark coordinates. The mean absolute error between predicted and ground truth landmarks was 3.70 pixels in the healthy cohort and 5.33 pixels in the KA cohort at a 512x512 resolution. Various patellofemoral parameters were calculated, including transepicondylar axis (TEA) length, TEA-posterior femur axis angle, sulcus medial asymmetry ratio, and sulcus angle. There was no statistically significant difference ( $p>0.05$ ) between the predicted and ground truth measurements for all four parameters in both cohorts, except for the sulcus angle in the healthy cohort.

## CONCLUSION

s We have developed a deep learning model that accurately identifies key anatomic landmarks of the patellofemoral compartment with 3-5 pixel accuracy on a 512x512 image and produces measurements with no statistically significant difference from human-derived measurements on healthy and pathological knees. This work represents the first deep learning regression model for automated patellofemoral annotation trained on both physiologic and pathologic CT imaging at this scale. This novel model has the potential to enhance our ability to analyze anatomy of the patellofemoral compartment at scale.

## CLINICAL RELEVANCE/APPLICATION

KA procedures are among the most common surgeries, but morbidity has been associated with patellofemoral compartment-related complications in up to 20% of cases. Understanding this anatomy is crucial for restoring anatomic knee morphology and function, but patellofemoral anatomy has not been well-characterized. Developing a tool that enables the automated annotation of key landmarks would enable the measurement of anatomical parameters at scale in a precise, reproducible, and time-sensitive fashion free of inter- and intra-rater variability.

## T5A-SPIN-4 Development of a Small-data Deep-learning Model Based on an MTANN for Soft Tissue Sarcoma Diagnosis in MRI

### PURPOSE

Deep learning requires a large number of training cases (i.e., 10k to 100k), which makes the development of AI for rare cancer less feasible. Our purpose was to develop a "small-data" deep-learning model based on a massive-training artificial neural network (MTANN) to accurately discriminate between benign and malignant soft-tissue tumors in MRI.

### METHODS AND MATERIALS

We collected T2-weighted MRI of 146 patients with 96 benign and 50 malignant soft-tissue tumors in this study, where tumors were segmented by a radiologist and reviewed by an orthopedic surgeon. The proposed scheme used a patch-wise neural network called an MTANN which was trained in a patch-to-pixel manner. Desired teaching images were generated with a Gaussian-blurred manual tumor segmentation mask for malignancy and a completely dark image for benignancy. During the training phase, the input was a 3D image patch extracted from input MR images. The neural network predicted a probability of malignancy for the input patch. The cross-entropy was used as the loss function to train the model. Once the MTANN model was trained, the entire image was computed as the likelihood map of malignancy by shifting the patch-wise window over the input image in a convolutional manner. Finally, a fully-connected classification layer with the image features extracted from the likelihood maps in a feature-scoring layer was used to classify the known tumor.

### RESULTS

Our small-data MTANN model was able to be trained with only 77 benign and 40 malignant soft-tissue tumors. Our experiment showed that our MTANN model outperformed several state-of-the-art radiomics and other deep learning models in discriminating between benign and malignant tumors and achieved an area under the curve (AUC) of 0.78 which was higher than that (0.73) of the best-performing state-of-the-art model with a p-value  $<0.05$ .

## CONCLUSION

Our small-data patch-wise deep-learning model based on an MTANN showed higher performance in discriminating between benign tumors and malignant soft-tissue tumors, which are rare cancer, in MRI, compared with several state-of-the-art radiomics and deep-learning models.

## CLINICAL RELEVANCE/APPLICATION

Our small-data MTANN deep-learning model makes the development of deep learning for rare cancer possible. It can potentially prevent non-expert radiologists from diagnosing rare cancer inaccurately.

## T5A-SPIN-5 Deep Learning-enabled CT Number Neutralization in Heterogeneous Tube Voltage CT Imaging: A Pilot Study

### PURPOSE

Depending on types of examinations and image applications, CT images are frequently taken with various tube voltages which results in differing Hounsfield units for the same tissue. This causes difficulties in quantification of imaging biomarkers in various applications. We postulated that application of deep learning might enable neutralization of CT numbers in heterogeneous tube voltage CT imaging. This study presents a pilot experimental result.

### METHODS AND MATERIALS

We used datasets of abdomen which were acquired from Siemens Somatom Force Dual Energy CT where A tube has 80 kV and B tube has 150 kV tube voltage. Among the total of 211 cases, 200 were used for training/validating and 11 were used for testing. A generative deep learning model architecture was employed consisting of a generator and a discriminator. The generator was designed to have five residual blocks and a skip connection which connects the first block with the last block. It takes in 80 kV CT images and outputs 150 kV CT images. Since true 150 kV CT images are available, the discriminator is given both images, generated-150 kV CT images made by the generator and real-150 kV CT images and trained to discern between the two. The loss is fed back into the generator to produce more accurate 150 kV CT images. The average Hounsfield unit for 80 kV, generated-150 kV and real-150 kV are compared using t-test on homogeneous regions of organs, such as liver, aorta and thoracic spine in order to observe statistical difference between them. Also scatter plot was used to compare between generated-150 kV and real-150 kV with linear equation and R-squared calculated.

### RESULTS

The average Hounsfield unit for 80 kV, generated-150 kV and real-150 kV were 80.4, 61.6 and 63.0 for liver, 513.4, 181.1 and 180.0 for aorta, and 226.6, 111.6 and 111.5 for thoracic bone, respectively. For all tissues, p-value between 80 kV and real-150 kV was less than 0.001, indicating both are significantly different and p-value between generated-150 kV and real-150 kV ranged from 0.14 to 0.77, indicating both are not significantly different. The scatter plot results in a linear equation  $y = 1.01 * x - 2.28$  and  $R^2 = 0.9911$ .

## CONCLUSION

From given 80 kV CT images, the network was able to produce generated-150 kV CT images statistically indistinguishable to that of real-150 kV CT images. Our study demonstrated the application of deep learning enabled neutralization of CT numbers from CT images taken with different tube voltage settings.

## CLINICAL RELEVANCE/APPLICATION

The work has shown the ability to convert 80 kV CT images to 150 kV CT images. In the future, it could be possible to convert any CT images taken with a different kV to single standard kV CT images, and thus neutralize CT numbers in heterogeneous tube voltage CT imaging.

## T5A-SPIN-6 Improved Prognostic Prediction of Pancreatic Cancer Using Multi-Phase CT by Integrating Neural Distance and Texture-Aware Transformer

Participants

Hexin Dong, Beijing, China (*Presenter*) Nothing to Disclose

### PURPOSE

Pancreatic ductal adenocarcinoma (PDAC) is a highly lethal cancer in which the tumor-vascular involvement greatly affects the resectability and, thus, overall survival of patients. We propose a novel learnable neural distance that describes the precise relationship between the tumor and vessels. Combined with dynamic tumor-related texture features in multi-phase contrast-enhanced CT (CECT), We aim to develop a new deep learning-based CT imaging-derived biomarker for predicting PDAC survival.

### METHODS AND MATERIALS

We conducted a multicenter study with 1,070 patients to validate our method, using one center (892 patients) for training and the other three centers (178 patients) for independent testing. The CECT protocol included non-contrast, pancreatic, and portal venous phases. We constructed a prognostic biomarker - NDTAT-PDAC - which captures both tumor enhancement patterns and tumor-vascular involvement for OS prediction. The marker was tested in both nested 5-fold cross-validation and external validation cohorts to evaluate its performance, robustness, and clinical usefulness.

### RESULTS

The continuous NDTAT-PDAC score performed a c-index of 0.656 (95% CI 0.639-0.673) and a AUC of 0.695 (95% CI 0.672-0.718) in the nested 5-fold cross-validation cohort, and a c-index of 0.710 and a AUC of 0.792 in the external validation cohort. We used univariate and multivariate Cox proportional-hazards models to evaluate our signature and other clinicopathologic factors in the independent test set. The proposed risk stratification was a significant prognostic factor, along with other factors like pathological TNM stages. After selecting significant variables ( $p < 0.05$ ) in univariate analysis, our proposed staging remained strong in multivariable analysis (HR=1.847,  $p=0.027$ ) after adjusting for important prognostic markers like pT (HR=2.438,  $p < 0.0001$ ) and resection margins (HR=1.681,  $p=0.091$ ). Notably, our proposed marker remained the strongest among all pre-operative markers, such as tumor size and CA 19-9.

## **CONCLUSION**

s We developed a new deep learning-based CT imaging-derived biomarker for predicting PDAC survival. The new biomarker was the strongest predictor of overall survival among preoperative factors and it has the potential to be combined with established clinical factors to select patients at higher risk who might benefit from neoadjuvant therapy.

## **CLINICAL RELEVANCE/APPLICATION**

Our novel tool sets a new standard in this area, and can benefit clinicians by selecting patients who might benefit from neoadjuvant chemotherapy with aggressive tumor types. Our represents a significant advancement in the development of prognostic models and may lead to improved clinical decision-making, ultimately resulting in better patient outcomes.

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## Abstract Archives of the RSNA, 2023

T5A-SPIR

### Interventional Radiology Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPIR-1 A Multi-institutional One-year Prospective Follow-up of Fluoroscopic, Cholangioscopy-assisted Large Bore Gallstone Extraction for Inoperable Calculous Cholecystitis**

##### Participants

Venkatesh Balaji, BA, New York, NY (*Presenter*) Nothing to Disclose

##### PURPOSE

The aim of this study is to assess for recurrent cholelithiasis on one-year imaging post percutaneous large bore (24-30 French) gallstone extraction for a subset of patients who are poor surgical candidates for cholecystectomy.

##### METHODS AND MATERIALS

This is a multi-institutional Institutional Review Board approved prospective observational review of patients at two large academic centers who present with acute calculous cholecystitis and were deemed high-risk surgical candidates. Review parameters include procedural technical and clinical data, clinical presentation, average hospital length of stay, and post-intervention symptom reduction. Technical success was defined as the removal of all stones during the procedure. Clinical success was defined as stone-free on 12-month follow-up imaging.

##### RESULTS

Fifteen patients (mean age 77.9yr, range 52-94yr; 8 male and 7 female) underwent large bore sheath (24-30Fr) cholangioscopy assisted gallstone extraction. The size of the gallstones ranged from 0.5-4.0cm. All patients had prior transhepatic or transperitoneal cholecystostomy access for 3-6 weeks prior to gallstone extraction. All patients' indwelling accesses were upsized to 24Fr or 30Fr sheaths using the NephroMax balloon sheath system (Boston Scientific, Marlborough, MA). There was 86.7% technical success rate with no major procedure-related complications. 86.7% were symptom and pain-free immediately post-procedure. There were no major complications. Median hospital stay was 1-day post-procedure. Of the fifteen patients, twelve patients had 12-month follow-up US or CT. 75% did not have recurrent cholelithiasis on imaging.

##### CONCLUSION

Majority of patients were stone-free and asymptomatic on one-year follow-up imaging after percutaneous fluoroscopic-guided large bore (24 -30 French) gallstone extraction.

##### CLINICAL RELEVANCE/APPLICATION

High risk patients diagnosed with calculous cholecystitis who are poor candidates for cholecystectomy may benefit from a cholangioscopy-assisted large bore gallstone extraction for symptom reduction. This proved to be a safe and effective procedure with no major complications and a median hospital stay of 1 day. The majority of cases achieved technical and clinical success with no recurrent cholelithiasis.

#### **T5A-SPIR-2 Combined Multiple Regional Anesthesia for Microwave Ablation of Liver Tumors Initial Experience**

##### Participants

Man Lu, PhD, Chengdu, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the feasibility and safety of combined multiple regional anesthesia (CMRA) in reducing pain and intravenous analgesic requirements during and following the ultrasound guided microwave ablation (US-guided-MWA) of liver tumors.

##### METHODS AND MATERIALS

A total of 75 patients with 99 liver tumors who received US-guided-MWA of liver tumors were recruited. They were randomly divided into three groups: A, B, C. Before ablation, patients in group A received hepatic hilar block (HHB), Transversus abdominis plane block (TAPB) and local anesthesia (LA). Patients in group B received HHB+LA. Patients in group C received TAPB+LA. Numerical Rating Scale (NRS) scores, morphine intake, complications and the factors influent perioperative pain were evaluated.

##### RESULTS

All the patients were successfully received the US-guided-MWA. The maximum NRS score for pain during ablation of the three groups were  $2.36 \pm 1.19$ ,  $3.28 \pm 1.59$  and  $4.24 \pm 1.42$  respectively ( $P < 0.01$ ), while the number of patients used morphine were 4/25, 8/25, 13/25 respectively ( $P < 0.01$ ). NRS scores of the three groups at 4, 8, 12, 24 and 36 hours after operation all showed a trend of rising first and then decreasing, and the order at each time point was:  $A < C < B$ . The patients with larger tumor, more tumors, longer procedure and ablation time experienced more pain ( $P < 0.05$ ). There were no major complications occurred among the three groups.



## CONCLUSION

s For patients not suitable for or unwilling to undergo general anesthesia, combined multiple anesthesia is an effective and safe way to control pain during and after microwave ablation of liver tumors. Factors influencing pain during microwave ablation include tumor size, number of tumors, procedure time, ablation time and shortest distance from lesional edge to live capsule.

## CLINICAL RELEVANCE/APPLICATION

Percutaneous thermal ablation is now a frontline treatment option for liver tumors. During the procedure, general anesthesia and conscious sedation are often used for pain control. But some patients can't use general anesthesia. Regional anesthesia is a crucial component of anesthesia. Especially in the last 2 or 3 decades, the practice of regional anesthesia regimens has changed considerably and it is extensively be applied to provide peri-procedural pain control. Our study presents a feasibility and safety study of combined multiple regional anesthesia (CMRA) in an effort to reduce pain and intravenous analgesic requirements during and following the ultrasound guided microwave ablation (US-guided-MWA) of liver tumors. For patients not suitable for or unwilling to undergo general anesthesia, CMRA is an effective and safe way to control pain during and after US-guided-MWA of liver tumors.

### **T5A-SP1R-3 Radiofrequency Ablation Followed by Cavity Creation and Cement Augmentation with Steerable Devices in the Management of Painful Spinal Metastases**

Participants

Claudio Pusceddu, MD, Cagliari, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

In the treatment of spinal metastases, cement distribution following radiofrequency ablation can be unpredictable due to several tumor factors. Achieving satisfactory filling of the vertebrae requires advanced devices to prevent cement leakage. This study aimed to assess the safety and efficacy of using steerable technologies with an articulating radiofrequency ablation (RFA) probe and targeted cavity creation before vertebral augmentation to manage painful spinal metastases.

## METHODS AND MATERIALS

Sixteen patients (mean age, 67 years) underwent RFA with vertebral augmentation after the creation of a targeted balloon cavity for metastatic spinal disease. The patients were followed up for six months, and pain and functional mobility were assessed pre-treatment and post-treatment using the Visual Analogue Score (VAS) and Functional Mobility Scale (FMS). Data on complications, predictability of cement distribution, anatomical restoration, and local recurrence were collected. Technical success was defined as successful intraoperative ablation and predictable cement distribution after cavity creation without major complications.

## RESULTS

Sixteen patients with 21 lesions in the thoracolumbar spine were treated. All treatments were technically successful and were followed by targeted cavity creation and vertebral augmentation. A significant reduction in median VAS score was observed one week after RFA treatment ( $p < 0.001$ ). Of the seven patients who reported limited painful ambulation before treatment, six reported normal ambulation one month after treatment, while the remaining patient reported no improvement. Patients who reported wheelchair use before treatment improved to normal ambulation (four/eight) or limited painful ambulation (four/eight). The improvement in mobility before and after treatment was statistically significant ( $p = 0.002$ ). Technical success was achieved in all the combined procedures.

## CONCLUSION

s The combination of RFA and vertebral augmentation with a steerable platform that allows the creation of a targeted cavity before cement injection is a safe and effective procedure for managing painful spinal metastases. The procedure resulted in improved quality of life as assessed by the VAS and FMS.

## CLINICAL RELEVANCE/APPLICATION

New technique combined with steerable devices to cement and treat complex vertebral metastases with radiofrequency ablation

### **T5A-SP1R-4 Minimally Invasive Treatment of Vertebral Metastases with Combined CT-Guided Percutaneous Microwave Ablation, Pedicle Screw Fixation, and Vertebroplasty**

## PURPOSE

The purpose of this retrospective study was to assess the safety and effectiveness of the combined approach of percutaneous microwave ablation (MWA) guided by CT and pedicle screw fixation followed by vertebroplasty (MASFVA) for the treatment and stabilization of painful vertebral metastases involving vertebral pedicles.

## METHODS AND MATERIALS

We retrospectively evaluated the records of 11 patients with 16 vertebral metastatic lesions who underwent MASFVA between January 2015 and January 2018. The technical success, complication rate, and pain relief using the visual analogue scale (VAS) and Oswestry Disability Index (ODI) were analyzed along with local tumor control.

## RESULTS

Technical success was achieved in all cases without any significant complications. The VAS and ODI scores improved significantly after the procedure (VAS from  $6.8 \pm 0.7$  to  $0.6 \pm 0.6$  and ODI from  $3.1 \pm 0.7$  to  $1.2 \pm 0.4$ ). All patients could walk independently without neurological complications one week after the procedure. During the 12-month follow-up, no new bone fractures or local disease recurrence occurred.

## CONCLUSION

s The combination of MWA, percutaneous pedicle screw fixation, and vertebroplasty is a safe and effective treatment for painful vertebral metastases with vertebral pedicle involvement, providing both pain relief and local tumor control.

## CLINICAL RELEVANCE/APPLICATION

First description of combined treatment of vertebroplasty, microwave ablation and pedicle fixation in complex vertebral metastases

with pedicle extension.

## **T5A-SPIR-5 Evaluation of Ice-ball Size and Temperature Change During Cryoablation in a Lard Phantom**

### **PURPOSE**

Cryoablation is a minimally invasive technique to treat various kinds of soft tissue tumors. It may be applied in tissues with various water and fat composition. Whether the fat concentration of the ablation target or environment will influence the ice-ball size and temperature change has not yet been explored. In this in-vitro study, we aim to evaluate how different concentrations of lard affect temperature change and ice ball size during cryoablation.

### **METHODS AND MATERIALS**

We constructed a phantom with 6 glass bottles, including one bottle of 0.9% normal saline (NS) as control, and the others contains 100ml of agar phantoms with lard and NS mixed in five different fractions (0%, 10%, 40%, 70% and 100% of lard). A total of 6 Endocare V-Probes (Cryocare cryoablation system, Varian Medical system, Palo Alto, California, US), with 2.5cm cool-tip, were placed into each bottle aiming at the center. The freezing started simultaneously in 6 bottles with a starting temperature at 20°C. The temperature readings of the probes were documented every 10 seconds during the 9-minute freezing. Axial CT scans of the bottles were done before and 3, 6, 9 minutes after initiation of freezing, and the largest diameter of the ice-ball in each bottle was measured with the longitudinal view (coronal view) in the 1mm reconstructed image.

### **RESULTS**

The probe temperature of the NS and 0% lard agar phantom (which contains 0.9% NS agar) have a similar freezing rate, reaching -80°C at about 320 seconds of freezing, and stabilized until 540 second. The rest of the agar phantoms that contain lard showed an increased freezing rate with increased concentration of lard, and all stabilized at around -150°C after 490 seconds of freezing until 540 second. The ice ball diameter was largest in the 0% and 10% lard agar phantom, both reaching 3.4 cm at 9 minutes of freezing. We observed a marked decrease in diameter of the ice ball with increased concentration of lard, with only 0.9cm at 9 minutes in the 100% lard agar.

### **CONCLUSION**

s Different concentrations of lard may affect the temporal temperature change and ice ball size during cryotherapy.

### **CLINICAL RELEVANCE/APPLICATION**

This ex-vivo study demonstrated that the fat composition may influence the temperature change and ice-ball size during cryoablation and should be taken into consideration when treatment planning.

## **T5A-SPIR-6 Oligoprogression in Neuroendocrine Liver Metastases - CT-guided HDR-brachytherapy to Delay Systemic Therapy Escalation**

### **Participants**

Uli Fehrenbach, MD, Berlin, Germany (*Presenter*) Grant, Siemens AG; Grant, Bayer AG; Grant, Ipsen SA; Grant, Asahi Intecc Co, Ltd; Grant, ESGAR; Grant, General Electric Company

### **PURPOSE**

Heterogeneous growth behavior of hepatic metastases are not uncommon in gastroenteropancreatic neuroendocrine tumors (GEP-NETs). Rapid progression of one or two metastases make therapy escalation necessary despite the otherwise stable disease. If these progressive metastases could be controlled by local therapy, the patients could be managed further with their current strategy. The present study aims on determining the period by which CT-guided high-dose-rate brachytherapy (CT-HDR-BT) of rapidly growing liver metastases can delay the indication of systemic therapy escalation.

### **METHODS AND MATERIALS**

In this retrospective, monocentric observational study a total of 23 patients from our ENETS center of excellence were retrospectively included. A total of 37 CT-HDR-BT sessions were performed in these patients. In addition to the parameters described in previous studies (local tumor control (LTC), progression-free survival (PFS), overall survival (OS)), this study evaluated the delay of a systemic therapy escalation.

### **RESULTS**

Median follow up was 46 months. 82% OS was shown after 102 months. Mean LTC was 64 months (95%-CI: 55-74; median was not reached), median PFS (not RECIST based) was 6 months (95%-CI: 2-10) and mean OS was 75 months (95%-CI, 55-96; median not reached). No further escalation of therapy (Watch and wait- and/or SSA-therapy) after CT-HDR-BT was necessary in 6/23 cases (26%). A median delay of 19 months (median; 95%-CI, 9-29 months) to the escalation of systemic therapy could be achieved.

### **CONCLUSION**

s In oligotopic progression of liver metastases and otherwise stable disseminated GEP-NET, CT-HDR-BT as a safe one-time procedure can delay the onset of systemic therapy escalation. This offers a significant interval without drug related side effects and costs and saves the patients systemic treatment options for a later date.

### **CLINICAL RELEVANCE/APPLICATION**

Our study reveals that CT-HDR-BT can significantly postpone the need for systemic therapy escalation in patients with oligotopic progression of neuroendocrine liver metastases. This approach offers patients a valuable interval without the burden of drug-related side effects and associated costs, while also preserving other therapeutic options for future disease progression. As systemic therapy options for this condition are limited, CT-HDR-BT may prove to be a safe and effective alternative in select cases.

## **T5A-SPIR-7 Synergistic Effect of OK-432 in Combination with Anti-PD-1 Antibody for Residual Tumors after Radiofrequency Ablation of Hepatocellular Carcinoma**

### **PURPOSE**

Radiofrequency ablation (RFA) is widely used in clinical practice for solid malignant tumors. However, for medium-to-large or irregular tumors, RFA often suffered from incomplete tumor ablation. To solve this clinical problem, we proposed a new treatment strategy of OK-432 in combination of anti-programmed cell death protein 1 (aPD-1) antibody to treat the residual tumors after incomplete RFA (iRFA) of hepatocellular carcinoma (HCC).

## **METHODS AND MATERIALS**

The effect of OK-432 on immature dendritic cells (iDCs) was evaluated by flow cytometry analysis, western blot, and ELISA in vitro. CCK-8 kit and ELISPOT were used to assess the killing effect of OK-432-induced CD8+ T cells in combination with aPD-1 antibody for hepa1-6 cells. In vivo experiment, the mouse models with HCC were treated by: (1) pseudo iRFA+phosphate buffered saline (PBS); (2) iRFA+PBS; (3) iRFA+OK-432; (4) iRFA+aPD-1; (5) iRFA+OK-432+aPD-1. Tumor progression was assessed by ultrasound imaging, which was confirmed by subsequent histopathology. The immune response to the treatments was evaluated by flow cytometry analysis, immunohistochemical staining, and ELISA.

## **RESULTS**

OK-432 significantly increased the maturation level of DCs and the abundance of conventional type 1 DCs (cDC1s). OK-432-induced CD8+ T cells in combination with aPD-1 antibody significantly enhanced the killing ability of CD8+ T cells for hepa1-6 cells. The combined therapy of OK-432 with aPD-1 antibody significantly increased the infiltration and function of CD8+ T cells, and significantly decreased the number of FoxP3+ regulatory T cells in residual tumors after iRFA of HCC. The smallest tumor volumes and the longest survival were observed in the iRFA+OK-432+aPD-1 antibody group compared with other four groups.

## **CONCLUSION**

s The combined therapy of OK-432 with aPD-1 antibody induced a strong anti-tumor immune response, which significantly inhibited the residual tumors after iRFA of HCC.

## **CLINICAL RELEVANCE/APPLICATION**

This concept may provide a new strategy to increase the curative efficacy of RFA for medium-to-large or irregular HCCs.

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## Abstract Archives of the RSNA, 2023

T5A-SPMK

### Musculoskeletal Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPMK-1 Application of Magnetic Resonance Diffusion Kurtosis Imaging in Microstructural Complexity of the Pubovisceral Muscle in Pelvic Floor Dysfunction Female**

##### Participants

Huiqing Zhou, Jinan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aimed to explore the microstructural complexity of the pubovisceral muscle in patients with pelvic floor dysfunction using the DKI technique.

##### METHODS AND MATERIALS

Fourteen patients with pelvic floor dysfunction [aged 47-67 years, mean (50.5±2.4) years] were included as group A. Twenty-six young healthy nulliparous female volunteers [aged 22-33 years, mean (25±2) years] were included as group B, and seven healthy middle-aged multiparous female volunteers [aged 46-69 years, median age 51 years] were included as group C. All three groups underwent DKI examination, and the parameter values of each group were measured and compared by three physicians with 5 years above of MRI diagnostic experience. The inter-observer consistency was evaluated using the Kendall W coefficient, and the differences in the measurement values of each parameter among the researchers were compared using single-variable ANOVA. Independent sample t-tests or U-tests were used to compare the differences in parameter values of the left and right pubovisceral muscle and DK parameters among the three groups.

##### RESULTS

The DKI parameter values of both pubovisceral muscles in the three groups were successfully measured. The consistency among the three observers was good, with W coefficients of 0.834-0.994 for the parameter values of both pubovisceral muscles. There was no significant statistical difference in the measurement values of the parameters of the bilateral pubovisceral muscles among the three physicians, with P values of 0.155-0.978. There was no significant statistical difference in the parameter values of the left and right pubovisceral muscles within each group, with P values of 0.224-0.957. There were statistically significant differences in the DK parameters (MK, AK, RK) between group A and group B for the left and right pubovisceral muscles ( $P < 0.001$ ), There were statistically significant differences between group A and group C for bilateral AK and RK, and left-side MK values ( $P < 0.05$ ), There were statistically significant differences between group B and group C for bilateral RK values ( $P < 0.05$ ).

##### CONCLUSION

s DKI can detect microscopic differences in the pubovisceral muscle between patients with pelvic floor dysfunction and normal individuals. DKI has high sensitivity and can detect changes in the microstructure of tissues in the absence of significant morphological or signal changes.

##### CLINICAL RELEVANCE/APPLICATION

DKI technology is widely used and well-established in central nervous system. Drawing on its application in brain tissue, this study applied DKI technology to the pelvic floor muscles and evaluated the DKI parameter values of pubovisceral muscle in healthy young females, females with pelvic floor dysfunction, and healthy middle-aged females.

#### **T5A-SPMK-2 Neurovascular Crossovers between Leash of Henry and Deep Branch of Radial Nerve: Implications for Diagnostic Imaging and Neurointervention**

##### Participants

Aurea Mohana-Borges, MD, MSc, (*Presenter*) Nothing to Disclose

##### PURPOSE

To identify the crossing patterns of the LoH and DBRN, specifically the ascending branch of the radial recurrent artery (RRAab) and the transverse muscular vessels to the mobile wad by high-resolution ultrasound (HRUS), using B-mode and Doppler.

##### METHODS AND MATERIALS

In this cross-sectional study, HRUS was performed in the short axis of the DBRN in asymptomatic participants, bilaterally and in two different forearm positions (pronation and supination), enrolled over a 6 month period. Inclusion criteria included asymptomatic volunteers of both genders over 15 years of age. Exclusion criteria were as follows: a) previous interventional procedure or surgery in the radial tunnel and elbow, and b) incidental masses compressing the nerve. HRUS was performed with an 18-5 MHz linear transducer (Philips, Affiniti 50) by a single musculoskeletal radiologist with more than 20 years of experience. B-mode and Doppler cine clips taken in the short axis of the nerve were acquired and saved for offline analysis. Images were evaluated in consensus by two radiologists. The crossings were evaluated in the nerve segment between the origin from the radial nerve to the superior arcade of the supinator muscle. They were classified as occurring above or below the DBRN. The pattern was characterized as

unrelated when no observed vessel was seen crossing the nerve. Welch's test was used as appropriate.

## RESULTS

The study population consisted of 102 nerves from 55 asymptomatic participants (median age, 37.0 years; interquartile range [IQR], 23.5 - 51.0 years; age range, 16-63 years; 29 [52.7%] women), with 48 participants with bilateral evaluation. Eight DBRN relationships were excluded from the analysis because of Doppler unavailability (N= 6 limbs, 3 right sides) and the undetectability of the muscular branch on B-mode (N= 2 limbs bilaterally). Age was not significantly different between women (median 37 years, IQR, 24.0 - 50.0 years) and men (median 36.5 years, IQR, 22.8 - 52.8 years) with  $p=0.74$ . The neurovascular crossings were as follows: a) RRAab above DBRN = 15 (14.7%) and muscular branch above= 12 (11.7%), below= 0 (0%), and unrelated= 3 (2.9%), and b) RRAab below DBRN = 87 (85.3%) and muscular branch above= 53 (52.0%), below= 28 (27.4%), and unrelated= 6 (5.9%).

## CONCLUSION

There is a predominant pattern of neurovascular crossings, with the RRAab mainly crossing below the DBRN from an inferomedial position and the transverse vessels of LoH crossing above the nerve, proximal to the arcade of Frohse.

## CLINICAL RELEVANCE/APPLICATION

Anatomic variations in the relationship of the neurovascular crossover of the Leash of Henry (LoH) and the deep branch of the radial nerve (DBRN) are relevant for diagnostic imaging and interventional procedures, but poorly described in the literature.

## T5A-SPMK-3 Undifferentiated and Preclinical Rheumatoid Arthritis and Longitudinal Thigh Muscle Loss: Deep-Learning Derived Data from Osteoarthritis Initiative

### PURPOSE

Undifferentiated Arthritis (UA) and Preclinical Rheumatoid Arthritis (Pre-RA) are considered as early-stage inflammatory arthropathy before clinical RA occurrence. Pre-RA is retrospectively defined as the early stage prior to development of clinical RA. UA is defined as a type of arthritis when criteria for RA or other connective tissue diseases are not met. UA/Pre-RA could potentially cause generalized muscle degeneration by provoking systemic inflammation and autoimmunity akin to established RA that is clearly associated with Rheumatoid Cachexia. Aim of this study was to investigate the association of UA/Pre-RA with longitudinal changes in muscle quality.

### METHODS AND MATERIALS

All the 4,796 participants of the Osteoarthritis Initiative (OAI) were initially included as established RA were excluded from this cohort. OAI participants were categorized to UA, Pre-RA (not exclusionary to the OAI), and control groups in baseline (Fig. 1). Longitudinal 4-year changes of thigh muscles quality in Pre-RA and UA groups were compared with their propensity score (PS)-matched control groups. PS matching was conducted to minimize the potential effect of confounding variables. For measurement of thigh muscle quality, we used our previously validated deep learning model to segment and quantify all available MRIs of thigh muscles at baseline, year 2-4 of the cohort. Outcome measures were MRI biomarkers of thigh muscle mass [i.e., cross-sectional area (CSA)] and composition [i.e., intramuscular adipose tissue (intra-MAT) and contractile percentage (non-fat muscle CSA/total muscle CSA)] in the thigh muscle groups (Fig. 2).

### RESULTS

After PS-matching of the groups for confounding variables (Table 1), regression models of comparison of MRI biomarkers of total thigh muscles between Pre-RA and control group over a 4-year period showed that presence of Pre-RA is associated with decreased CSA (MD, 95% CI: -220.12 mm<sup>2</sup>, -310.58 - -129.66) but a similar change in intra-MAT (MD, 95% CI: 11.57 mm<sup>2</sup>, -167.16 - 190.30) and contractile percentage (MD, 95% CI: -0.50 %, -1.98 - 0.97) (Table 2). On the other hand, comparison of MRI-derived biomarkers between UA and matched control group showed that neither of changes in CSA, intra-MAT, and contractile percentage are significantly different between the groups (Table 2).

### CONCLUSION

Presence of Pre-RA is associated with a longitudinal decrease in CSA but not increase in Intra- or Inter-MAT akin to rheumatoid cachexia seen in established RA patients. Causal effect of Pre-RA on muscle quality requires further attention.

### CLINICAL RELEVANCE/APPLICATION

Results of this study could promote the role of secondary preventive treatment (e.g., low dose DMARD) to mitigate accelerated muscle degeneration among Pre-RA subjects.

## T5A-SPMK-4 Improving Sonographic Visualization of the Ulnar Nerve and Morphology

### PURPOSE

Cubital Tunnel Syndrome (CuTS) is defined as ulnar nerve compression in the cubital tunnel of the elbow, the second most common upper extremity peripheral nerve entrapment. CuTS often remains undiagnosed until patients present with progressive motor deficits, usually indicating severe nerve injury. Quantitative diagnostic criteria for ultrasound have been developed for other nerve entrapment syndromes, including carpal tunnel syndrome, however greater variability of diagnostic criteria is in use for the diagnosis of CuTS. New transducer technology may enable better imaging of the ulnar nerve and development of new diagnostic criteria for CuTS. Our study aimed to objectively evaluate this newer transducer technology compared to conventional transducers in the evaluation of the ulnar nerve and to assess a reproducible ratio for more reliable nerve measurement.

### METHODS AND MATERIALS

Seven fresh frozen cadaveric specimens were examined using both 18 MHz and 24 MHz transducers (GE Healthcare, Milwaukee, WI). The number of ulnar nerve fascicles was measured in each specimen just proximal to the cubital tunnel with both transducers. Two examiners assessed the number of nerve fascicles with consensus agreement reached on the final count. The cross-sectional area of the ulnar nerve was measured proximally at both the cubital tunnel and distally at the anatomical location where the ulnar artery and nerve meet in the distal forearm.

### RESULTS

The 24 MHz probe visualized more fascicles of the ulnar nerve (mean 8.7, std dev 2.3) compared to the 18 MHz transducer (mean

4.4, std dev 2.7,  $p < 0.005$ ). The mean of the proximal ulnar nerve cross-sectional area (CSA) measured 7.08 mm (std dev 2.40). The mean distal ulnar nerve CSA was 5.08 mm (std dev 1.21,  $p = 1.21$ ). The cross-sectional area of the proximal ulnar nerve was not found to be statistically different compared to the distal CSA of the ulnar nerve, 7.1 mm<sup>2</sup> (std dev 2.4) vs. 5.1 mm<sup>2</sup> (std dev 1.2),  $p = 0.112$ .

## CONCLUSION

A higher frequency 24 MHz transducer can visualize more fascicles of the ulnar nerve at the cubital tunnel compared to a conventional 18 MHz transducer. Utilizing this 24 MHz transducer, there was no statistical difference in the measurement of the cross-sectional area of the ulnar nerve proximal and distal to the cubital tunnel in our cadaver specimens. Further investigation of ulnar nerve morphology and of the ratio of nerve measurement of symptomatic cubital tunnel syndrome patients and normal controls with new higher frequency transducers may enable the development of better diagnostic criteria for CuTS.

## CLINICAL RELEVANCE/APPLICATION

Nerve fascicle count and size in addition to the use of nerve ratios for size assessment may help to more accurately differentiate demyelinating neuropathies from nerve entrapment.

## T5A-SPMK-5 Improved Visualization of the Brachial Plexus MR Neurography with Deep Learning Reconstruction in Conventional and Accelerated Sequences: Study of Healthy Volunteers

Participants  
ILKWON KO, Bucheon, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To prospectively compare the effectiveness of deep learning reconstruction (DLR) for brachial plexus MR imaging with that of a conventional and accelerated MR imaging protocol in healthy volunteers.

## METHODS AND MATERIALS

This prospective study included 14 healthy volunteers (7 men, 7 women; mean age,  $24.3 \pm 3.5$  [SD] years) who underwent 3-T brachial plexus contrast enhanced STIR sequence. Examinations included conventional sequence with parallel factor (PF) 3 (scan time, 7 minutes 5 seconds) and accelerated sequences with PF 5 (4 minutes 39 seconds), Standard (PF3) and accelerated sequences (PF 5) were acquired with and without DLR. Two musculoskeletal radiologists qualitatively evaluated examinations for brachial plexus visualization (1-3, none to full), and motion artifact, visualization of the supraspinatus and axillary nerve (1-4, none to complete), which was scored individually at three separate regions along the brachial plexus: supraclavicular (extraforaminal roots, trunks, and proximal divisions), retroclavicular (distal divisions), and infraclavicular (cords). Interobserver agreement between two readers for the image quality were assessed using weighted kappa statistics. Comparisons of quantitative scores were performed with use of student T-test.  $P < .05$  was deemed statistically significant.

## RESULTS

A total of 28 brachial plexus images were included in 14 subjects. Standard (PF3) and accelerated sequences (PF 5) with DLR enabled significantly improved visualization of the brachial plexus ( $P < .001$ ) and motion artifact ( $P < .05$ ) in the all three regions for two readers except for PF3 at the supraclavicular area ( $p = 0.09$ ) and retroclavicular area ( $p = 0.06$ ) in reader 1. For visualization of the axillary nerve, only PF5 with DLR images significantly improved image quality ( $p = 0.007-0.037$ ). However, there was no improvement in image quality with DLR for visualization of suprascapular nerve in PF3 and PF5 ( $p = 0.07-0.71$ ) except for PF3 at the retroclavicular area in reader 2 ( $p = 0.0014$ ). Agreement between image two readers ranged from a kappa of 0.5-0.83 in brachial plexus visualization 0.5-0.77 in motion artifact, 0.59-0.91 in suprascapular nerve and 0.58-0.85 in axillary nerve.

## CONCLUSION

Accelerated sequences with DLR effectively reduce scan time and artifacts, providing similar subjective image quality to conventional sequences for brachial plexus MR imaging.

## CLINICAL RELEVANCE/APPLICATION

Accelerated sequences with DLR may provide an alternative to standard sequences for clinical brachial plexus MRI

## T5A-SPMK-6 The Diagnostic Value of Multimodal Imaging for Primary Lower Limb Lymphedema

Participants  
MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

## PURPOSE

To retrospectively analyze the imaging characteristics of primary lower limb lymphedema on CT and MRI multi-modal sequences, compare the diagnostic value of multi-modal imaging examinations for lower limb lymphedema, and identify the optimal techniques or methods for displaying lymphedema.

## METHODS AND MATERIALS

A retrospective analysis was conducted on patients with primary lower extremity lymphedema (LEL) admitted to our lymphatic surgery department from January to December 2019. All patients underwent both CT and MRI examinations of the lower extremities. The MRI multi-modal sequences included Short Time Inversion Recovery (STIR) and mDIXON sequences. Image analysis and scoring were independently performed by two radiologists, including assessment of skin thickening, fat separation, fascial effusion (effusion above and below the fascia). Skin thickening was defined as dermal thickness  $> 2$ mm; fat separation was defined as abnormal signal and density shadows distributed in a mesh-like or honeycomb-like pattern around the fat lobules; fascial effusion was defined as abnormal signal or density shadows in a strip or crescent shape on the fascial surface or below the fascia. The frequency of appearance of CT and MR manifestations in the affected limb was recorded. The sensitivity of lesions displayed by CT and MR sequence were evaluated as clear, general, or unidentifiable, and the best imaging method for displaying edema was selected. The frequency differences of multi-modal imaging manifestations of lower extremity lymphedema were compared using chi-square test or Fisher's exact test.

## RESULTS

A total of 36 patients were included in the study. There was no statistically significant difference in the detection rate of skin thickening among other imaging methods ( $P>0.05$ ). The detection rate of fascial superficial lymphatic fluid by mDIXON-FAT was significantly lower than that by other imaging methods ( $P<0.05$ ), and there was no statistically significant difference in the detection rate of fascial superficial lymphatic fluid among other imaging methods ( $P>0.05$ ). STIR had higher sensitivity than CT and mDIXON sequences for detecting fat septa, subfascial/epifascial effusion, and dilated tubular shadows

## CONCLUSION

s Multi-modal imaging has high diagnostic value for primary lower extremity lymphedema. The STIR sequence is more sensitive than other CT and MRI sequences for detecting primary lower extremity lymphedema, and can be used as the preferred imaging sequence for the diagnosis and evaluation of lymphedema

## CLINICAL RELEVANCE/APPLICATION

Multi-modality imaging can accurately diagnose primary lower extremity lymphedema, with STIR sequence having the highest sensitivity for detecting edema

## T5A-SPMK-7 Optimization of keV for Radiomics Extracted from Spectral Virtual Monochromatic Images to Predict Osteoporosis

Participants

Jinling Wang, Changsha, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the effect of radiomics obtained from different virtual monochromatic images (VMIs) by dual-energy computed tomography (CT) on the prediction of osteoporosis.

## METHODS AND MATERIALS

A retrospective study of 62 participants who underwent both single source dual-energy CT and quantitative computed tomography (QCT) lumbar-spine examination were enrolled. With QCT as the reference standard, the patients were divided into two groups according to the guidelines introduced by the International Society for Clinical Densitometry (ISCD) and American College of Radiology (ACR), osteoporosis ( $n=16$ ) of the spine was defined as a BMD value  $<80$  mg/cm<sup>3</sup>, and non-osteoporosis ( $n=46$  [osteopenia and normal]) was defined as a BMD value  $\geq 80$  mg/cm<sup>3</sup>. Radiomics scores (RSs) for osteoporosis prediction were constructed from 11 sets of VMIs (40-140 keV, 10 keV interval). Receiver operating characteristic (ROC) curves were drawn and the area under the curves (AUCs) was calculated to evaluate the discriminatory power of RS for each VMI.

## RESULTS

The AUC values for osteoporosis prediction with RS of 40-140 keV VMIs were 0.995, 0.996, 1.000, 1.000, 1.000, 1.000, 0.793, 0.787, 0.807, 0.821, 0.846. The accuracies of RS of VMIs were 0.952, 0.968, 0.984, 1.000, 1.000, 1.000, 0.705, 0.721, 0.746, 0.742, 0.770. The sensitivities of RS of VMIs were 0.882, 0.938, 0.941, 1.000, 1.000, 1.000, 0.400, 0.375, 0.444, 0.444, 0.545. The specificities of RS of VMIs were 0.978, 0.978, 1.000, 1.000, 1.000, 1.000, 0.765, 0.774, 0.796, 0.792, 0.820. The negative prediction values of RS of VMIs were 0.957, 0.978, 0.979, 1.000, 1.000, 1.000, 0.867, 0.891, 0.896, 0.894, 0.891. And the positive prediction values of RS of VMIs were 0.938, 0.938, 1.000, 1.000, 1.000, 1.000, 0.250, 0.200, 0.267, 0.267, 0.400.

## CONCLUSION

s The RS obtained from multiple VMIs in dual-energy CT had a good ability to predict osteoporosis. And the RS of 40-90 keV VMIs showed higher performance than the RS of 100-140 keV VMIs.

## CLINICAL RELEVANCE/APPLICATION

The prevalence of osteoporosis in the population is increasing year by year. One of the reference standards for the diagnosis of osteoporosis today is the volumetric BMD measured by QCT, but the QCT post-processing process is very complex and requires additional phantom calibration, etc. Spectral CT imaging provides VMIs to improve the image quality thereby radiomics efficacy, however the optimized keV for radiomics extraction was still obscure. Our proposed RS models obtained from 40-90 keV VMIs can serve as useful tools for osteoporosis prediction and have the potential to be applied in clinical treatment planning in the future.

## T5A-SPMK-8 Quantitative Analysis of Bone Mineral Density in Patients with Chronic Kidney Disease by Revolution CT Substance Separation Technique

Participants

Na Gao, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

Patients with chronic kidney disease are prone to fracture and other serious complications. Early and accurate measurement of Bone mineral density (BMD), an important index of bone mass in human body, is of great clinical significance for predicting the risk of fracture in patients with CKD. X-ray attenuation images of Revolution CT scanned by high and low voltages can be expressed as density maps of two substances, thus realizing substance separation of single voxel. Therefore, this study explored the value of Revolution CT in the diagnosis of BMD in patients with CKD.

## METHODS AND MATERIALS

Total abdominal energy spectrum plain scan data of 48 patients with CKD were collected. According to the principle of three quantiles, the patients were divided into three groups: Group A (= 48 years old), Group B (49-61 years old) and Group C (= 62 years old). GSI scanning mode combined with 40% ASiR-V, at automatically modulated tube current (Smart mAs), noise index was 9. Using GSI Viewer software, the images of HAP (FAT)-based material pairs were reconstructed from 0.625mm thick images, and the Region of interest (ROI) was placed in the middle layer of L3 vertebral body (ROI was about 100mm<sup>2</sup>), and the HAP concentration was recorded. One-way analysis of variance was used to compare the concentration of HAP in vertebral body of L3 in different age groups of patients with CKD. Pearson correlation analysis was used to analyze the concentration of HAP in vertebral body of L3 in three age groups. The difference was statistically significant with  $P < 0.05$ .

## RESULTS

The concentrations of HAP in vertebrae of L3 were (185.12±11.83)mg/cm<sup>3</sup>, (138.55±12.58)mg/cm<sup>3</sup>, (96.38±10.16)mg/cm<sup>3</sup> in each age group of patients with CKD, and there was statistical differences between three groups(P < 0.05). There was a negative correlation between the age of the three groups and the concentrations of HAP (r=-0.309,-0.211,-0.028, P < 0.05).

## CONCLUSION

s The HAP concentration measured by energy spectrum CT in L3 vertebral cancellous of patients with CKD is related to age, and the HAP concentration in vertebral body of CKD patients gradually decreases with age after 48 years old.

## CLINICAL RELEVANCE/APPLICATION

Revolution CT based material imaging technology provides a new idea for BMD measurement. HAP (FAT) as a base material pair can reflect the change of BMD with age. For patients with CKD, Revolution CT can find the changes of bone mass as early as possible, and provide basis for making personalized diagnosis and treatment plans.

## T5A-SPMK-9 The Effect of Different Monochromatic Energy on Quantitative Parameters of Osteoporosis in Chronic Kidney Disease

Participants

Hua He, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

Dual-energy X-ray absorptiometry (DEXA) is the "gold standard" for measuring bone mineral density (BMD). However, this method can not completely and accurately reflect the true changes of bone density. Multi-parameter imaging of energy spectrum CT can provide a new idea for BMD measurement, therefore, this study explored the diagnostic value of different monochromatic energy of Revolution CT in osteoporosis.

## METHODS AND MATERIALS

48 patients with CKD were collected by GSI scanning mode combined with 40% ASiR-V, at automatically modulated tube current (Smart mAs), noise index was 9. Using GSI Viewer software, the HAP (FAT) base material pair image was reconstructed from 0.625mm layer thickness image, and the base material and monochromatic energy joint image were selected. the images of HAP (FAT)-based material pairs were reconstructed from 0.625mm thick images. And the Region of interest (ROI) was placed in the middle layer of L3 vertebral body (ROI was about 100mm<sup>2</sup>, the distance from the edge of vertebral body is at least 5mm, avoiding vertebral venous plexus, bone island and other structures). The HAP concentrations in L3 vertebral body of 120Kvp-like images and 11 groups of monochromatic energy images at 40-140keV (10keV intervals) were recorded. The HAP concentration under different monochromatic energy and mixed energy was analyzed by one-way ANOVA, the difference was statistically significant with P < 0.05.

## RESULTS

The HAP concentration at 70keV and 80keV were (140.01±8.41)mg/cm<sup>3</sup> and (117.05±7.27)mg/cm<sup>3</sup>, respectively, and there was not significantly different from that at 120kvp-like (137.74±4.94)mg/cm<sup>3</sup> (P > 0.05).

## CONCLUSION

s The concentration of HAP in L3 vertebrae of patients with CKD was affected by different single energy of energy spectrum CT, and the concentration of HAP in L3 vertebrae was stable under single energy of 70keV and 80keV.

## CLINICAL RELEVANCE/APPLICATION

Through this study, we can understand the influence of different monochromatic energy on BMD measurement.

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## Abstract Archives of the RSNA, 2023

T5A-SPMS

### Multisystem Tuesday Poster Discussions I

#### Sub-Events

#### T5A-SPMS-1 A Cross-sectional Study to Quantify Cardiac, Hepatic and Pancreatic Iron Overload on MR Imaging in Beta Thalassemia Major Patients

#### PURPOSE

Regular blood transfusions are the mainstay in beta thalassemia major; however, it may cause cardiac and hepatic hemosiderosis - the most common cause of death in these patients. Chelation requires constant adjustments to avoid either iron or chelator toxicity. In recent years, various MRI methods have been validated for quantifying iron overload.

#### METHODS AND MATERIALS

31 beta-thalassemia major patients (22 males and 9 females) (age range 8-18 years) receiving regular blood transfusions and chelation therapy were enrolled. Patients were scanned on 3-Tesla MRI and mFFE T2\* and R2\* weighted sequences were acquired with parameters mentioned in Figure 1. LIC and MIC values were calculated using the formulae:  $0.032 \times R2^* - 0.14$  and  $(0.0254 \times R2^*) + 0.202$  respectively. They were then graded as follows: For LIC Normal < 2, Light 2-7, Moderate 7-15, Severe >15. For MIC Normal <1.16, Light 1.16-1.65, Moderate 1.65-2.71, Severe >2.71. For pancreas Normal <30, Mild 30-100, Moderate 100-400, Severe >400.

#### RESULTS

This is an interim analysis of an ongoing study. Liver R2\* had a very weak but insignificant positive correlation with SF levels ( $r = 0.167$ ,  $p = 0.397$ ). Cardiac R2\* had a moderate but significant positive correlation with SF levels ( $r = 0.535$ ,  $p = 0.003$ ). Pancreatic T2\* had a weak but insignificant positive correlation with SF levels ( $r = 0.281$ ,  $p = 0.165$ ). LIC had a very weak but insignificant positive correlation with SF levels ( $r = 0.146$ ,  $p = 0.459$ ). MIC had a moderate but significant positive correlation with SF levels ( $r = 0.427$ ,  $p = 0.024$ ). Liver T2\* had a weak but insignificant positive correlation with serum total bilirubin levels ( $r = 0.258$ ,  $p = 0.223$ ). LIC had a very weak but insignificant positive correlation with SGPT ( $r = 0.170$ ,  $p = 0.439$ ). LIC had a weak but insignificant positive correlation with SGOT ( $r = 0.270$ ,  $p = 0.212$ ). No statistically significant difference in mean SF, LIC and MIC values between 2-weekly, 3-weekly and 4-weekly transfusion regimens.

#### CONCLUSION

LIC had a very weak positive correlation with serum ferritin. Whereas, MIC had a moderate and significant positive correlation with serum ferritin. Pancreatic T2\* and R2\* values had a weak positive correlation with serum ferritin. LIC showed a weak and insignificant positive correlation with liver function tests (LFTs). No statistically significant difference was seen in the mean serum ferritin, LIC and MIC values between 2-weekly, 3-weekly and 4-weekly transfusion regimens. However, a larger sample size is required to determine true statistical significance and we plan to achieve the same in the near future.

#### CLINICAL RELEVANCE/APPLICATION

At present, our study shows that T2\*/R2\* MRI prove to be a valuable non-invasive method for evaluating iron overload, especially when compared to a liver biopsy.

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## Abstract Archives of the RSNA, 2023

T5A-SPNMMI

### Nuclear Medicine & Molecular Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPNMMI-1 Differential FDG Uptake in the Brain at Early and Delayed Imaging Assessed by Dual Time-point Total-body PET**

##### Participants

Shashi Singh, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

The purpose of the study was to examine the changes in the global FDG uptake in the brain from early to delayed scans in dual time-point imaging (DTPI) before and after treatment in patients with lymphoma, using total-body PET/CT. We also assessed uptake in the brain before and after 2 cycles of chemotherapy.

##### METHODS AND MATERIALS

FDG-PET/CT data from 20 patients referred for initial staging of non-Hodgkin's lymphoma at UC Davis- age 12 to 74.9 years (mean =  $44.12 \pm 19.70$  years; males = 9; females = 11) were analyzed. It included 40 scans conducted 60 and 120 minutes following intravenous injection of 8 mCi of FDG. Interim scans after 2 cycles of chemotherapy (6/20 patients) were assessed at both 60 and 120 minutes after injection of 8 mCi of FDG. The FDG-PET/CT scans were analyzed using OsiriX MD software v. 12.5.2 (Pixmeo SARL, Bernex, Sweden). A region of interest was manually placed on fused PET/CT images for global assessment of FDG uptake in the entire brain, including the supratentorial region, cerebellum, midbrain, and medulla but excluding spinal cord. Metabolic activity was assessed by calculating global SUVmean across all slices. Finally, global SUVmean scores were compared at 60 and 120 minutes of scan in both baseline and post-treatment scans.

##### RESULTS

For the baseline scans, an overall increase in FDG uptake in the brain was observed from 60 minutes to 120 minutes. The average SUVmean at 60 minutes was  $7.48 \pm 2.10$  (range: 3.81 to 11.99) whereas at 120 minutes was  $8.51 \pm 2.32$  (range: 4.36 to 12.88) at baseline. The difference in the average SUVmean at 120 minutes and 60 minutes was found to be  $1.03 \pm 0.66$  (range: 0.45 to 3.17) ( $p < .00001$ ) and the average 60-120 min percent change was  $14.32 \% \pm 10.25 \%$  (range: 7.28 % to 53.21 %). Similarly, for post-treatment scans, an overall increase in FDG uptake in the brain was observed from 60 minutes to 120 minutes. The average SUVmean at 60 minutes was  $6.97 \pm 2.45$  (range: 3.71 to 10.43) whereas at 120 minutes was  $7.56 \pm 2.47$  (range: 4.40 to 11.18). The difference between the average SUVmean at 120 minutes and 60 minutes was found to be  $0.59 \pm 0.30$  (range: 0.006 to 0.84) ( $p = 0.00518$ ) and the average 60-120 min percent change was  $9.64 \% \pm 6.21 \%$  (range: 0.08 % to 18.76 %).

##### CONCLUSION

s FDG uptake in the brain increases from 60 minutes to 120 minutes during DTPI of the brain with total body FDG PET/CT. Therefore, early imaging of the patients with suspected brain tumors may help to identify the lesions more clearly than delayed imaging due to relatively lower background uptake. In addition, this study demonstrated an initial possible decrease in brain uptake after 2 cycles of chemotherapy.

##### CLINICAL RELEVANCE/APPLICATION

It may be possible to distinguish the lesions more clearly with early imaging than with delayed imaging in patients with suspected brain tumors.

#### **T5A-SPNMMI-2 Comparison of Diagnostic Image Quality and Radiation Dose of Directly Contrast-enhanced CT for FDG-PET Image Attenuation and Co-registration to Sequential Non-enhanced PET/CT Followed a Dedicated Diagnostic CT**

##### PURPOSE

To compare diagnostic image quality and extent of attenuation correction artifacts due to iodinated contrast in PET images and total radiation dose of the CT-component of sequential partial body (head to thigh) non-enhanced CT F-18 Fluorodeoxy (FDG) - PET/CT followed by a dedicated diagnostic contrast-enhanced CT (thorax/abdomen/neck) (cePET/CT) protocol to directly intravenous contrast-enhanced FDG-PET/CT protocol (head to thigh) (dicePET/CT) in the same oncological patient population.

##### METHODS AND MATERIALS

An inter-group comparison of 48 patients (m=20, f=28, initial mean age 65.8 y; 33-81 y) undergoing cePET/CT and dicePET/CT in clinical oncological routine on the same PET/CT scanner (Siemens mCT128) within an average of 529 d (76 - 949d) were compared. PET-image quality were objectively (standard uptake value SUVc cerebellum, SUVbp blood pool, SUVlu lung and SUVli liver) and subjectively evaluated for the presence of attenuation artifacts. Average effective CT radiation dose (aeCTRD) of the CT component for both groups were determined.

##### RESULTS

Average dose for scePET/CT and dcePET/CT was 3.48 and 3.50 MBq/kg, respectively. Significant attenuation artifacts in PET image quality was seen in both groups only by mis-match in the brain and liver (n=2) not in the vasculature. No significant differences were found in the SUV values for the scePET/CT and dcePET/CT - SUVc 12.3 vs. 12.3 (p=0.93), SUVbp 3.0 vs. 3.2 (p=0.07), SUVlu 0.80 vs. 0.85 (p= 0.13), SUVli 3.9 vs. 4.1 (p= 0.08). aeCTRD for scePET/CT and dcePET/CT was 15.03 mSv vs. 7.08 mSv, respectively (Difference 52.3%).

## CONCLUSION

s If a ceCT in the FDG-PET/CT protocol is needed, a direct contrast enhanced CT protocol is favorable due to significant radiation dose reduction without constraints in PET image quality and quantitative analysis since a non-enhanced CT head-to-thigh for attenuation correction can be omitted and attenuation artifacts due to intravenous enhancement is negligible.

## CLINICAL RELEVANCE/APPLICATION

If a ceCT in the FDG-PET/CT protocol is needed, a direct contrast enhanced CT protocol is favorable due to significant radiation dose reduction.

## T5A-SPNMMI-3 Evaluating the Ability of ChatGPT to Create a Differential Diagnosis from Transcribed Radiological Findings in Nuclear Medicine

Participants

Gillean Cortes, DO, Orange, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the accuracy and reliability of ChatGPT3.5 and ChatGPT4 in creating a differential diagnosis from transcribed radiological findings of specific nuclear medicine cases.

## METHODS AND MATERIALS

A sample of 50 cases specific to nuclear medicine imaging was selected from a radiology textbook, from which the answers were used as the gold standard. The history and case images were converted into standardized prompts that contained purely descriptive language of the cases and a query for the most likely diagnosis, the top three differential diagnoses, and the corresponding explanations and references from the medical literature. These prompts were entered into the ChatGPT3.5 and ChatGPT4 algorithms. The output diagnoses were analyzed for accuracy by comparison with the original literature and reliability through manual verification of the generated explanations and citations. The top 1 accuracy and the top 3 accuracies were defined as the percentage of generated responses that matched the original diagnosis and the complete differential provided by the original literature. An additional differential diagnosis score was defined as the proportion of differentials that matched the original literature's answers for each case. Comparisons were made between the results of the two algorithms using a one-tailed two proportion z-test method.

## RESULTS

The top 1 accuracy and top 3 accuracy for ChatGPT3.5 versus ChatGPT4 were 60.0% compared to 70.0% (p = 0.15) and 12.0% compared to 10.0% (p = 0.37), respectively. The average differential diagnosis score of ChatGPT3.5 versus ChatGPT4 was 58.1% compared to 58.7% (p = 0.48). ChatGPT3.5 and ChatGPT4 hallucinated 41.5% versus 8.3% (p = 0.00006) of the references provided and generated 6 total false statements versus 4 total false statements, respectively.

## CONCLUSION

s While ChatGPT has shown some potential in generating accurate diagnoses, this technology requires further development before it can be implemented into clinical and educational practice. It is important to acknowledge that the most recent version of ChatGPT has made slight improvements in the accuracy of its diagnoses as well as reducing the hallucination effect.

## CLINICAL RELEVANCE/APPLICATION

ChatGPT and Large Language Models have the potential to impact clinical and educational medicine. Knowledge of the accuracy and possible errors of these algorithms can provide a better understanding of the limitations of these tools.

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## Abstract Archives of the RSNA, 2023

T5A-SPNPM

### Noninterpretive Skills (Beyond Imaging) Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPNPM-The Association Between Food Security and Mammography Screening: Cross-Sectional Survey 1 Results from the National Health Interview Survey**

#### Participants

Jade Anderson, MD, Madison, WI (*Presenter*) Nothing to Disclose

#### PURPOSE

In one prior randomized control trial, providing food vouchers and a food pantry to food insecure individuals was associated with a 94.6% cancer treatment completion percentage. There is limited data about food insecurity within the cancer screening setting. To inform the potential need for food insecurity interventions, our study evaluated the association between food security and mammographic screening among eligible participants.

#### METHODS AND MATERIALS

Female survey respondents aged 40-74 in the 2019 National Health Interview Survey (NHIS) without history of breast cancer were included. Food insecurity was assessed using the Six-Item Food Security Scale developed by the National Center for Health Statistics. Scores from the six questions were aggregated to assign food security status. Individuals with low or very low food security were defined as food insecure. Proportion of patients who reported mammographic screening within the last year was estimated, stratified by food security status. Multiple variable logistic regression analyses were conducted to evaluate the association between food security and mammography screening, adjusted for potential confounders. All analyses were performed accounting for complex survey design features.

#### RESULTS

9,139 weighted survey respondents met inclusion criteria. Due to lack of money for food, 11.8% of participants indicated that the food they bought wouldn't last, 10.9% couldn't afford to eat balanced meals, and 10.1% worried that food would run out. 90.1% were classified as having high or marginal food security of whom 56.6% reported mammography screening. 6.1% were classified with low food security of whom 42.1% reported screening. 3.8% were classified with very low food security of whom 43.1% reported screening. In our unadjusted analyses, participants with low food security (OR 0.56, 95%CI 0.44 to 0.70,  $p<0.001$ ) and very low food security (OR 0.58, 95%CI 0.44 to 0.77,  $p<0.001$ ) were less likely to report mammography screening within the last year. In our adjusted analyses, participants with very low food security (OR 0.54, 95%CI 0.33 to 0.88,  $p=0.013$ ) were less likely to report mammography screening within the last year.

#### CONCLUSION

In a nationally representative cross-sectional survey, 9.9% of eligible participants experienced food insecurity. In our unadjusted and adjusted analyses, food insecurity was associated with significantly reduced mammography screening percentages.

#### CLINICAL RELEVANCE/APPLICATION

Radiology practices should consider screening patients for food insecurity and other social determinants of health using validated instruments. Evidence-based food insecurity interventions should be made available to participants experiencing food insecurity.

#### **T5A-SPNPM- Can ChatGPT help promote health literacy?: Generating, summarizing and simplifying patient-facing 2 information about breast cancer prevention and screening**

#### Participants

Hana Haver, MD, (*Presenter*) Nothing to Disclose

#### PURPOSE

Disparities in health literacy are known to impact patient decision-making, particularly in the context of breast cancer prevention and screening. We evaluated the use of the large language model ChatGPT as a tool to generate and simplify responses to common questions about breast cancer.

#### METHODS AND MATERIALS

ChatGPT was asked to simplify responses to 25 fundamental questions about breast cancer prevention and screening to a 6th grade reading level from a prior study by Haver et al. (Radiology 2023). The simplified responses were evaluated for clinical appropriateness by a fellowship-trained breast radiologist. Language complexity was assessed on the Flesch Reading Ease scale and readability was assessed on 5 scales: Flesch-Kincaid Grade Level, Gunning-Fog Index, Coleman-Liau Index, Automated Readability Index, and the Simple Measure of Gobbledygook. Paired t-tests of mean language complexity and mean readability scores for the original and simplified for each question were analyzed. Based on NIH guidelines, we considered language complexity score of  $<60$  and readability score  $>8$ th grade reading level to be too difficult for the average adult patient.

#### RESULTS

For ChatGPT's original responses, the average language complexity was 45 and the average readability of 13.2 grade level which was considered too difficult for the average adult patient. The responses that had been simplified by ChatGPT to a "6th grade" reading level had improved readability metrics with an average language complexity of 59 (higher is better) and 11th grade readability level ( $p < 0.005$  across all scales compared to original responses) [Figure 1]; these were still considered too difficult for the average adult patient, however. The simplified responses were appropriate 88% of the time upon review by a board-certified breast imaging radiologist, which is the same as that of the original responses by ChatGPT, as reported previously by Haver et al. (Radiology 2023).

## CONCLUSION

s ChatGPT provides health information about breast cancer screening that is accurate and appropriate 88% of the time, albeit at high reading levels inappropriate for the average adult patient. When provided with an appropriate prompt, ChatGPT can simplify its responses' readability by >2 grade levels while retaining the appropriateness of its responses. With improved prompt engineering, these readability levels will likely be able to be further improved, which our group is actively working on next.

## CLINICAL RELEVANCE/APPLICATION

ChatGPT's answers to questions about breast cancer are difficult to read. This model can be prompted to simplify this information, though it underestimates the readability level of the output.

## T5A-SPNPM- Ecodesign and Operational Strategies to Reduce MRI Energy Consumption: Cost Savings and Reduced Carbon Footprint

Participants

Sean Woolen, MD, MS, San Francisco, CA (*Presenter*) Research Grant, Siemens AG; Investigator, Siemens AG

## PURPOSE

To determine the energy, cost, and carbon savings that could be achieved through different MRI scanner power management strategies.

## METHODS AND MATERIALS

Four outpatient MRI scanners from three vendors were individually equipped with power meters (1-Hz sampling rate). Power measurement logs were extracted over 39 days. Data were segmented into off, idle, prepared-to-scan, scan, or Eco-Power (one vendor's power-saving mode) modes for each scanner. Energy, cost (assuming a mean cost of \$0.14 per kWh), and carbon savings were calculated for the lowest scanner activity modes.

## RESULTS

Projected annual energy-consumption per scanner ranged from 82.7-171.1 MWh, with 72-91% defined as non-productive. Power draws for each mode were measured as  $6.4 \pm 0.1$  kW (Eco-Power),  $7.3 \pm 0.6$  kW to  $9.7 \pm 0.2$  kW (off),  $9.5 \pm 0.9$  to  $14.5 \pm 0.5$  kW (idle),  $17.3 \pm 0.5$  to  $25.6 \pm 0.6$  kW (prepared-to-scan), and  $28.6 \pm 8.6$  to  $48.3 \pm 11.8$  kW (scan). Switching MRIs from idle to off mode for 12 overnight hours reduced power-consumption by 25-33%, translating to a potential annual savings of 12.3-21.0 MWh, \$1,717-\$2,943 USD, and 8.7-14.9 mt CO<sub>2</sub>eq. The Eco-Power mode further reduced consumption by 28% compared to off mode, potentially saving an additional 11.0 MWh, \$1,533 USD, and 7.8 mt CO<sub>2</sub>eq per year for 12 hours overnight. Turning off a fleet of 30 MRIs for 12 hours overnight offers a potential savings of 367.9-630.7 MWh, \$51,509-\$88,301 USD, and 260.9-447.2 mt CO<sub>2</sub>eq. Overnight implementation of Eco-Power mode on all outpatient MRI in the U.S. could save U.S. healthcare 73,354.1 MWh, \$10.3 million USD, and 52,008 mt CO<sub>2</sub>eq.

## CONCLUSION

s Powering down MRIs when not needed can make radiology departments more energy efficient and gain substantial sustainability and cost benefits.

## CLINICAL RELEVANCE/APPLICATION

Our data details how an ecodesign approach by scanner vendors and strategic changes to routine MRI operations by healthcare systems can be effectively used to reduce cost and impact environmental sustainability. These results should help radiologists, healthcare administrators, and corporate partners understand the benefits of energy-efficient MRI operations.

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## Abstract Archives of the RSNA, 2023

T5A-SPNR

### Neuroradiology Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPNR-1 Multisequence MRI-Based Radiomics Signature as Potential Biomarkers for Predicting KRAS Mutations in Brain Metastases**

##### Participants

Xinna Lv, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Kirsten rat sarcoma virus (KRAS) has evolved from a genotype with predictive value to a therapeutic target recently with the observation of novel agents. The aim of this study was to establish non-invasive radiomics models based on MRI to discriminate Kirsten rat sarcoma virus (KRAS) from epidermal growth factor receptor (EGFR) or anaplastic lymphoma kinase (ALK) mutations in lung cancer patients with brain metastases (BM), then further explore the optimal sequence for prediction.

##### METHODS AND MATERIALS

This retrospective study involved 317 patients with proven BM of lung cancer (218 patients in the training cohort and 99 patients in the testing cohort) who had confirmed of KRAS, EGFR or ALK mutations. Radiomics features were separately extracted from T2WI, T2 fluid-attenuated inversion recovery (T2-FLAIR), diffusion weighted imaging (DWI) and contrast-enhanced T1-weighted imaging (T1-CE) sequences. Synthetic minority oversampling technique was used in the training cohort to separately balance KRAS to EGFR or ALK mutations in consideration of the unbalanced nature of the training dataset. The maximal information coefficient and recursive feature elimination method were used to select informative features based on these four regular sequences respectively. Then we separately construct four radiomics models for differentiating KRAS from EGFR or ALK mutations using random forest classifier. ROC curves were used to validate the capability of the models in the training and testing cohorts.

##### RESULTS

The four radiomics models for discriminating KRAS from EGFR mutations all worked well, especially DWI and T2WI model with AUCs of 0.942 and 0.949, 0.942 and 0.954 in the training and testing cohorts. The T1-CE and T2-FLAIR models yielded AUCs of 0.918 and 0.954, 0.956 and 0.838 in the two cohorts. When KRAS compared to ALK mutations, the AUCs were 0.947 and 0.850, 0.917 and 0.824, 0.896 and 0.795, 0.892 and 0.790 in DWI, T2-FLAIR, T2WI and T1-CE sequences in training and testing cohorts respectively. The DWI and T2-FLAIR models showed excellent performance in distinguishing KRAS from ALK mutation.

##### CONCLUSION

The radiomics classifiers integrating MRI may have potential to discriminate KRAS from EGFR (DWI and T2WI model) or ALK mutations (DWI and T2-FLAIR model) that could guide targeted therapy.

##### CLINICAL RELEVANCE/APPLICATION

Radiomics classifiers integrating multisequence MRI may have potential to identify KRAS mutations, which are helpful to guide clinical therapeutic strategies and facilitate the discovery of new approaches capable of achieving this long-sought goal of cure in populations of patients with KRAS-mutant lung cancer.

#### **T5A-SPNR-10 Prediction of IDH and EGFR Mutation Status in Diffuse Glioma Patients Using Dynamic Susceptibility Contrast Imaging-derived Oxygenation and Microvascular Transit Time Heterogeneity Biomarkers**

##### Participants

Yunhwa Roh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To obtain tumor microvascular and oxygenation information and evaluate their potential for noninvasive assessment of IDH and EGFR mutation status in diffuse glioma patients using perfusion MRI.

##### METHODS AND MATERIALS

This retrospective single-institution study included patients with adult diffuse glioma who had undergone preoperative dynamic susceptibility contrast (DSC) perfusion MRI. Contrast-enhancing lesion (CEL) and non-enhancing lesion (NEL) were segmented using deep learning segmentation. Imaging parameters of cerebral blood volume (CBV), cerebral blood flow (CBF), capillary transit time heterogeneity (CTH), oxygen extraction fraction (OEF), and cerebral metabolic rate of oxygen (CMRO2) were obtained using the capillary function-based perfusion model (Cercare Medical Neurosuite) for CEL and NEL, respectively. The diagnostic abilities of the imaging biomarkers for predicting IDH and EGFR mutation status were independently assessed. Predictors were selected using logistic regression analysis, and performance was measured with the area under the receiver operating characteristics curve (AUC) analysis.

##### RESULTS

Abstract 5110: Predicting IDH and EGFR Mutation Status in Diffuse Glioma Patients Using Dynamic Susceptibility Contrast Imaging-derived Oxygenation and Microvascular Transit Time Heterogeneity Biomarkers

A total of 110 patients were included (mean age, 58.8 years; range, 25-82; 49 women), with 25 cases of IDH mutation. Of the 85 patients with IDH wild-type glioblastoma, 34 patients showed EGFR mutation. Lower rCBV (Odds ratio [OR] 0.69; 95% confidence interval [CI]: 0.55-0.82,  $P < .001$ ) and lower rCMRO2 (OR 0.7; 95% CI: 0.54-0.85,  $P = .002$ ) measured in CEL were predictive for the presence of IDH mutation. The combination of rCBV and rCMRO2 showed an AUC of 0.85 in predicting IDH mutation status. In IDH-wild type gliomas, higher rCMRO2 (OR 1.15; 95% CI: 1.02-1.31,  $P = .029$ ) in CEL and higher rCBF (OR 1.38; 95% CI: 1.06-1.87,  $P = .023$ ) in NEL was predictive of EGFR mutation. The combination of the parameters showed an AUC of 0.66 in predicting EGFR mutation status.

## CONCLUSION

s Perfusion MRI utilizing the cerebral metabolic rate of oxygen, vascular density, and flow parameters provided the diagnostic value of predicting IDH and EGFR mutation status in glioma patients. Lower rCMRO2 is indicative for IDH mutation, while higher rCMRO2 is indicative for EGFR mutation.

## CLINICAL RELEVANCE/APPLICATION

The molecular status of IDH and the EGFR mutation have prognostic significance in glioma. Our study on perfusion MRI used a capillary function-based model and calculated the cerebral metabolic rate of oxygen (CMRO2) along with vascular density and flow parameters. The tumor oxygenation parameters enabled noninvasive diagnosis of IDH and EGFR mutation status, which may support the clinical standard of care in glioma patients.

## 15A-SPNR-11 Role of DOTATATE PET/MRI in Evaluating WHO grade 3 Meningiomas: Potential for Differentiating Secondary Progressive and De novo Tumors

Participants

Joon Tae Kim, New York, NY (*Presenter*) Nothing to Disclose

## PURPOSE

MRI has significant limitations in meningioma evaluation, especially in intermediate- and high-risk tumors. [68-Ga]-DOTATATE PET has demonstrated high utility in meningioma evaluation and treatment planning. While rare, and thus understudied, WHO grade 3 meningiomas (WHO3-M) are particularly aggressive with higher propensity for recurrence, metastases, and worse clinical outcomes compared to lower grade meningiomas. There thus exists a marked unmet need for improved targeted imaging strategies in the management of WHO3-M. Here, we evaluate the clinical, pathology, imaging characteristics and outcomes of patients with WHO3-M in our larger prospective cohort of patients with meningiomas undergoing DOTATATE PET/MRI and explore differences in PET findings between patients with de novo versus secondary progressive WHO3-M, as the latter are known to have worse prognosis.

## METHODS AND MATERIALS

Inclusion criteria were patients with WHO3-M who underwent DOTATATE PET/MRI. Clinical chart review was performed to document clinical course, surgical and radiation (RT) therapy, WHO grade, and molecular pathology. Progression free survival (PFS) was determined by applying RANO criteria to follow-up MRI. Mann-Whitney Tests were used to determine statistical significance.

## RESULTS

15 patients were included, 8 with secondary progressive and 7 with de novo WHO3-M. Secondary progressive cohort had significantly higher per-patient number of surgeries (4.0 vs 1.6;  $p = 0.012$ ) and a trend for higher number of RT courses (2.5 vs 1.6;  $p = 0.23$ ), higher cumulative RT dose (106 vs 68.3;  $p = 0.31$ ), and decreased PFS (20.9 vs 37.7 months;  $p = 0.17$ ). Secondary progressive tumors had distinct molecular pathology profiles with higher number of mutations (3.6 vs 1.3;  $p = 0.037$ ). DOTATATE PET demonstrated significantly higher SUV in secondary progressive tumors (17.1 vs 12.4;  $p = 0.0052$ ).

## CONCLUSION

s This is the first study evaluating clinical characteristics and the utility of DOTATATE PET/MRI in WHO3-M and comparing secondary progressive and de novo cohorts. In addition to distinct molecular profiles, we report significantly increased SUV in secondary progressive WHO3-M compared to de novo WHO3-M. This work further supports DOTATATE PET/MRI as a useful management strategy in WHO3-M and raises the possibility of differentiating secondary progressive and de novo WHO3-M with PET/MRI in the clinical context. This work raises important questions regarding meningioma biology such as the potential role of SSTR2 signaling in WHO3-M.

## CLINICAL RELEVANCE/APPLICATION

DOTATATE PET/MRI may be of particular clinical benefit in WHO3 meningiomas, improving diagnosis and treatment planning as well as identifying the secondary progressive subtype which conveys worse clinical outcomes.

## 15A-SPNR-12 Radiomics Nomogram Based on Multiparametric MRI Features for Preoperative Prediction of MGMT Promoter Methylation Status in Glioblastomas

## PURPOSE

Preoperative identification of O6-methylguanine-DNA methyltransferase (MGMT) promoter methylation status is of great clinical significance in selecting potential patients who might benefit from therapy. This study aimed to establish and validate a radiomics nomogram using the radiomics features and clinical characteristics for preoperative prediction MGMT promoter methylation status in glioblastomas.

## METHODS AND MATERIALS

216 patients in local institution and 68 patients from The Cancer Genome Atlas (TCGA) were enrolled. 851 radiomics features were extracted from the apparent diffusion coefficient (ADC) and isotropic volumetric contrast-enhanced T1 (ISO-CE-T1) weighted images, respectively. The features were selected using Mann-Whitney U-test, followed by refining using least absolute shrinkage and selection operator (LASSO) regression combing 10-fold cross-validation. Three radiomics signatures were built based on ADC, ISO-CE and joint radiomics features. The optimal radiomics signature with age and sex were processed by multivariate logistic regression analysis to construct a prediction model, which was developed in the training dataset and tested in the test and independent external validation dataset from TCGA. A radiomics nomogram was plotted to represent the prediction model. The performance of the radiomics nomogram was evaluated using discrimination, calibration, and decision curves.

## RESULTS

Three radiomics signatures comprising of five, five and six robust features were built. The joint signature showed the highest area under the curve (AUC) of 0.811/0.790 in the test and validation dataset. The accuracy, sensitivity, specificity and AUC were 84.62%, 82.76%, 86.11%, 0.903(0.804-0.963) and 80.88%, 81.25%, 80.56%, 0.845(0.737-0.922) in the test and external validation dataset, respectively. The radiomics nomogram with clinical data outperformed the radiomics signature alone. The Hosmer-Lemeshow test concluded that the radiomics nomogram showed goodness of fit (all  $p > 0.05$ ). Decision curve analysis demonstrated the clinical value of the radiomics nomogram.

## CONCLUSION

The radiomics nomogram based on multiparametric MRI features is a promising approach for preoperatively predicting the MGMT promoter methylation status in glioblastomas noninvasively. The combination of radiomics features from different sequences and the addition of clinical characteristics to the nomogram showed incremental predictive value.

## CLINICAL RELEVANCE/APPLICATION

This study aimed to find imaging biomarkers for noninvasively predicting the MGMT promoter methylation status for a tailored treatment plan and prognosis assessment in GBM patients from the initial stage of the tumor diagnosis.

### 13 T5A-SPNR- Diagnostic Performance of T1p Imaging and Diffusion-weighted Imaging (DWI) in Glioma IDH Mutation Status Prediction: A Pilot Study

#### Participants

Guanxun Cheng, PhD, Shenzhen, China (*Presenter*) Nothing to Disclose

Guanxun Cheng, Shenzhen, China (*Presenter*) Nothing to Disclose

#### PURPOSE

The purpose of this study is to evaluate the diagnostic performance of T1 relaxation time in a rotating frame (T1 $\rho$ ) and apparent diffusion coefficient (ADC) in glioma IDH mutation status prediction

#### METHODS AND MATERIALS

15 glioma patients (10 IDH-wild-type gliomas, 5 IDH-mutant-type gliomas) were prospectively imaged with multiparametric MRI on 3-T, including T1 $\rho$  imaging and DWI before surgery. In addition, since T1 $\rho$  relaxation time (T1 $\rho$ ) depends not only on the structure characteristics, but also on spin lock frequency (FSL), we have set up three different spin lock frequencies (FSL = 100Hz, 200Hz, 500Hz) to compare whether there are differences between them. For ADC and T1 $\rho$  measurement, place the target ROIs, avoid tumor necrosis, cysts, and hemorrhagic areas by the help of conventional MR sequences and SWI images. Statistical significance was tested by using the Mann-Whitney U test. Receiver operating characteristic curve (ROC) analysis was performed to evaluate the diagnostic performance.

#### RESULTS

Table 1 summarizes the characteristics of the evaluated tumor patients. A total of 15 glioma patients (five male and ten female) were included in this study, containing five IDH-m patients (4 with diffuse astrocytomas, WHO grade II; 1 with anaplastic astrocytoma, WHO grade III) and ten IDH-w patients (WHO grade II/III/IV, 1/2/6; 1 can't be graded due to imperfect molecular pathological detection). Differences in mean ADC values and T1 $\rho$  relaxation time (T1 $\rho$ ) between IDH-m and IDH-w groups are shown in Table 2 and depicted in Figure 1 and 2. Mean ADC values of the tumor parenchymal area of IDH-w gliomas were significantly lower than that of IDH-m gliomas ( $0.852 \times 10^{-3} \text{mm}^2/\text{s}$  vs  $1.324 \times 10^{-3} \text{mm}^2/\text{s}$ , respectively;  $p = 0.019$ ). Whether FSL (spin lock frequency) is equal to 100, 200 or 500 Hz, the T1 $\rho$  values of the tumor parenchyma of IDH-w gliomas were significantly lower than that of IDH-m gliomas (87.50/86.72/84.21ms vs 112.92/120.67/122.17ms, respectively;  $p < 0.05$ ). The AUC value of the ADC (0.880) revealed lower diagnostic performance compared with the T1 $\rho$  relaxation time. The AUC value (0.960) of the T1 $\rho$  (FSL=100Hz) was the same as that of T1 $\rho$  (FSL=500Hz). Logistic regression analysis showed that the combination of the ADC and T1 $\rho$  (FSL=500Hz) did not improve the diagnostic performance.

#### CONCLUSION

This pilot study demonstrates that the T1 $\rho$  values may be a feasible noninvasive imaging parameter for predicting the glioma IDH mutation status. Different spin-lock frequencies have similar diagnostic performance to IDH mutation status.

#### CLINICAL RELEVANCE/APPLICATION

All patients included in the study were in accordance with the ethical standards of the institutional and/or national research committee.

### 14 T5A-SPNR- A Deep Learning Framework Enables Non-invasive Detection of Tumor Mutational Burden in Brain Metastases

#### PURPOSE

Brain metastases (BM) are the most common central nervous system malignancy and are an emerging unmet need in modern oncology. While precision medicine for BM has demonstrated impressive responses, many patients are not able to benefit from this treatment paradigm given the morbidity associated with tissue sampling. Tumor mutational burden (TMB), defined as the number of non-synonymous somatic mutations per megabase (Mb), is a predictive biomarker for efficacy of immune checkpoint inhibition (ICI) for BM. Here, we present a non-invasive technique, using deep neural networks (DNN), to quantify TMB within BM to inform rational use of ICI.

#### METHODS AND MATERIALS

We conducted our experiments on 297 multiparametric MRI (mpMRI) scans of BM patients of diverse histologies from MGH/DFCI, split into 75% train : 15% validation : 10% test. Consistent with prior literature, we binarized the TMB by defining values greater than 12 per Mb as "high", and the converse as "low". We limited our initial analysis to FLAIR, T1 pre- and T1 post-contrast MRI sequences. We employed a multi-step preprocessing pipeline involving skull stripping, isotropic resampling, registration, N4 bias correction and intensity normalization. We additionally investigated several unique input strategies to our DNN that incorporated combinations of MRI sequences and slice orientations, using the corresponding maximum intensity projection (MIP) image stack. We



conducted our experiments both with and without five-fold cross validation, utilizing several classification architectures, and cross entropy loss with weighted sampling.

## RESULTS

Using a resnet18 architecture, our best performing model achieved an area under the receiver operating characteristics curve (AUROC) of 0.88 on the held-aside test set and comprised the axial FLAIR MIP image as input. Across all types of inputs and architectures investigated, our AUROCs ranged from 0.72 - 0.88. These results were consistent across each fold for the five-fold cross validation experiments.

## CONCLUSION

To fully translate clinically actionable genomic alterations within BM into clinical medicine, non-invasive biomarkers are desperately needed. To this end, we demonstrate that a DNN displays strong performance in quantifying TMB within BM. We are optimizing performance of this model with an expanded mpMRI dataset, as well as performing additional studies to noninvasively identify oncogenic drivers in BM (e.g. CDK, PI3K pathway alterations), which can help guide choice of targeted therapy.

## CLINICAL RELEVANCE/APPLICATION

We developed a deep learning model, using mpMRI, that achieves strong performance in quantifying TMB status within BM, which can augment clinical decision making through facilitating rational use of ICI in patients.

### **T5A-SPNR-2 Usefulness of Pituitary High-resolution 3D MRI using Deep-learning-based Reconstruction for Pre- and postoperative Evaluations in Patients with Pituitary Adenoma/pituitary Neuroendocrine Tumor**

Participants

Yuka Ishimoto, Hirosaki-Shi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

In the management of pituitary adenomas, an MRI sequence with high sensitivity for detecting small lesions and high precision for delineating the normal pituitary glands is desirable. The recently developed deep-learning-based reconstruction (DLR) improves the image quality of thin-slice MRI. The previous investigators applied DLR to a 2D spin-echo sequence and showed that for the postoperative evaluation of pituitary adenoma, 1-mm-slice-thickness 2D CE-T1WI with DLR (1-mm 2D T1WI with DLR) showed greater diagnostic performance than conventional 2D CE-T1WI with 3-mm slice thickness. However, there were no study which applied DLR to a 3D fast spin-echo sequence. Therefore, for contrast-enhanced (CE) MRI, we assessed the diagnostic value of T1-weighted 3D fast spin-echo sequence (CUBE) with DLR for evaluating pituitary adenoma.

## METHODS AND MATERIALS

We assessed 24 patients with pituitary or residual adenoma who underwent 3D CUBE with and without DLR (imaging time: 5 min, 7 sec), 1-mm-slice-thickness 2D spin-echo T1WI (1-mm 2D T1WI) with DLR, and 3D spoiled gradient echo sequence (SPGR) as CE-T1WI. For these MRI sequences, the depiction of the pituitary adenoma and parasellar region (cavernous sinus) was scored by two neuroradiologists, and the contrast-to-noise ratio (CNR) between the pituitary adenoma and the brain parenchyma was calculated.

## RESULTS

Scores for the depictions of pituitary or residual adenoma were significantly higher with 3D CUBE with DLR than with 3D CUBE without DLR, 1-mm 2D T1WI with DLR, and 3D SPGR ( $P < .001$ ). In one patient, 3D CUBE with DLR identified a microadenoma that was not observed on other sequences (1-mm 2D T1WI with DLR and 3D SPGR) (Figure). The score for the depiction of the boundary between the adenoma and the cavernous sinus was higher with 3D CUBE with DLR than with 1-mm 2D T1WI with DLR and 3D SPGR. For the evaluation of adenomas, 3D CUBE with DLR provided better interobserver agreement than 1-mm 2D T1WI with DLR (0.75 vs. 0.41). For the CNR, the 3D CUBE with DLR was significantly higher than that with 3D SPGR, but there were no significant differences between the 3D CUBE with DLR and the 1-mm 2D T1WI with DLR.

## CONCLUSION

For 3D evaluation of the pituitary and parasellar regions, DLR may be a useful method to shorten the acquisition time while maintaining sufficient image quality. Compared to 1-mm 2D T1WI with DLR, 3D CUBE with DLR provided better image quality for depicting pituitary adenoma, with better interobserver agreement.

## CLINICAL RELEVANCE/APPLICATION

Deep learning-based reconstruction technique can allow 3D fast spin-echo T1WI with high spatial resolution, which is superior to 1-mm-slice-thickness 2D T1WI for the pre- and postoperative evaluation of pituitary adenomas.

### **T5A-SPNR-3 Meningiomas: Correlation between Tumors' Cellularity and Recurrence**

Participants

Luiz Borella, Itatiba, Brazil (*Presenter*) Nothing to Disclose

## PURPOSE

Meningiomas are the most frequent tumors of the central nervous system. According to the World Health Organization, they can be categorized into 3 categories. There are benign tumors or grade I lesions. Secondly, grade II or atypical meningiomas (intermediate). Lastly, grade III meningiomas (malignant). In recent years, tools to predict patient's outcome have been proposed. In this study, we evaluate the meningioma's densities on CT and their mean values in ADC and correlate these variables with tumor recurrence. The main hypothesis was the greater the cellularity of the tumor (reflected by higher CT density and lower ADC mean value), more frequent tumors' recurrence.

## METHODS AND MATERIALS

We listed 32 patients of our institution with histological diagnosis of meningioma that were submitted to CT and MRI evaluation before and after surgical exploration, between 2012 and 2020. To predict tumors' cellularity, we measure their CT density and ADC mean value using the largest ROI possible to englobe the lesion.

## RESULTS

To find statistical correlation between tumors' cellularity and recurrence, we discriminated CT densities (in HU) and ADC mean values (in 10<sup>-3</sup> mm<sup>2</sup>/s) and the patient's outcome in "recurrence" and "non-recurrence". We applied two different analyses: Pearson's correlation test found that there is correlation between CT density and tumor recurrence, classified as moderated and directly proportional. Also, there is correlation between ADC mean value and tumor recurrence, classified as moderated and inversely proportional ( $r = + 0.49$ ,  $p < 0.05$ ). Logistic regression also demonstrates correlation between CT density and tumor recurrence, and between ADC mean value and tumor recurrence ( $p = 0.01$ ;). This test demonstrated ROC curve 84.4% (sensitivity = 80%, specificity = 83.3%).

## CONCLUSION

Our analysis showed moderated correlation between tumor's presumed cellularity (reflected by higher CT density and lower ADC mean value) and meningiomas' recurrence.

## CLINICAL RELEVANCE/APPLICATION

Measuring CT densities and ADC mean values, especially before surgical exploration, can be used as tools to predict meningiomas' recurrence. Tumors with higher cellularity can be submitted to follow-up exams more often than the others.

## T5A-SPNR-4 Diffusion Kurtosis Imaging in Detecting Changes in the White Matter of the Brain Non-visible on Conventional MRI in Patients with Brain Gliomas

### PURPOSE

Ki-67/MIB-1 labeling index (LI) characterizes cellular proliferation and is used in glioma grading and predicting glioma prognosis (Louis et al., 2021; Louis et al., 2007). Some researchers consider diffuse gliomas as a systemic disease of the brain rather than a local tumor. Application of antibodies specific to the R132H protein, which is present in cells of gliomas with IDH-1 mutation and absent in normal neuroglial cells, showed the presence of tumor cells in brain regions significantly distant from the glioma, including the opposite brain hemisphere (Agarwal et al., 2011; Sahm et al., 2012). The aim of this study was to assess the ability of diffusion kurtosis imaging (DKI) to find a correlation between Ki-67/MIB-1 LI of gliomas and diffusion kurtosis parameters in the normal-appearing on conventional MRI white matter of the opposite hemisphere of the brain.

### METHODS AND MATERIALS

84 patients with newly diagnosed brain gliomas underwent 3T MRI before treatment. In all cases, the diagnosis was confirmed by biopsy or surgical resection. 49 patients had high-grade gliomas (HGG), and 35 patients had low-grade gliomas (LGG). The age of patients with HGG was 43.8±14.7, and with LGG was 37.7±9.6. DKI was performed using b values of 0, 1000, and 2500 s/mm<sup>2</sup> and 60 gradient directions. The following parameters were obtained using DKI: mean kurtosis (MK), axial kurtosis (AK), radial kurtosis (RK), kurtosis anisotropy (KA), mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), fractional anisotropy (FA), relative anisotropy (RA). The Spearman correlation coefficient was calculated between Ki-67/MIB-1 LI of gliomas and diffusion kurtosis parameters in the normal-appearing on conventional MRI white matter of the opposite hemisphere of the brain ( $p < 0.05$  significance level). Conventional MRI included T1, T1+Gd, T2, T2-FLAIR weighted images.

### RESULTS

Statistically significant correlation of glioma Ki-67/MIB-1 LI was found with ( $r = -0.28$ ,  $p = 0.01$ ), RD ( $r = 0.3$ ,  $p = 0.02$ ), FA ( $r = -0.27$ ,  $p = 0.003$ ) and RA ( $r = -0.27$ ,  $p = 0.004$ ) in the white matter of the opposite hemisphere of the brain. A decrease of RK ( $p < 0.05$ ) and an increase of RD ( $p < 0.05$ ) in the white matter of the opposite hemisphere of the brain with higher Ki-67/MIB-1 LI of gliomas can be due to the decreased axonal density. A decrease of both FA ( $p < 0.05$ ) and RA ( $p < 0.05$ ) with higher Ki-67/MIB-1 LI of gliomas can reflect higher cellularity and decreased axonal density in the contralateral white matter.

## CONCLUSION

DKI demonstrated a potential to detect changes in the white matter of the brain non-visible on conventional MRI in patients with gliomas.

## CLINICAL RELEVANCE/APPLICATION

Understanding the changes occurring in brain areas distant from the tumor is crucial for treatment and patient care.

## T5A-SPNR-5 Covariance Structural Abnormalities: The Key Networks of Heterogeneous Mild Traumatic Brain Injury - A Result from Longitudinal Study with EZ-MAP for Detection of Regional FA Abnormalities

Participants

Yanan Zhu, Ankang, China (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the covariance structural abnormalities of heterogeneous mild traumatic brain injury (mTBI) at subacute phase and 1-3 months, 6-12 months post-injury.

### METHODS AND MATERIALS

: Diffusion tensor imaging tractography of whole brain and conventional MR were performed in 72 mTBI patients of subacute phase, 27 mTBI patients of 3 months and 21 mTBI patients of 6-12 months post injury. 46 age- and gender-equivalent healthy controls were also involved, 10 healthy controls and 11 healthy controls were scanned respectively 1 month, 6-12 months later. Voxelwise assessment methods of Enhanced Z-score Microstructural Assessment of Pathology (EZ-MAP) were used to detect regional FA abnormalities in each patient's fractional anisotropy (FA) maps. All subjects were administered the following neuropsychological tests: the Mini-Mental state examination (MMSE), Hamilton Depression (HAMD), Fatigue Severity Scale (FSS), Clinical Dementia Rating (CDR), Postconcussive Symptoms Scale (PSS), the Trail Making Test A, the Trail Making Test B, State Trait Anxiety Inventory (STAI-Y). Pearson's correlation coefficients between the FA values of covariance location with clinical measurements at all 3 time points post injury were calculated.

### RESULTS

Respectively, 29.17% of subacute phase, 37.03% of 3 months post injury, 38.09% of 6-12 months post injury mTBI patients had abnormal brain MRI. During the period of post injury from subacute phase to 6-12 months, general pattern of reduced FA and

/raised MD were present in various white matter tracts such as Body of corpus callosum, Splenium of corpus callosum, Fornix, Cerebral peduncle L, Anterior limb of internal capsule L, Posterior limb of internal capsule L, Anterior corona radiata L, Superior corona radiata L, Anterior limb of internal capsule R, Anterior corona radiata R, and Superior corona radiata R. In subacute phase, raised FA in Posterior limb of internal capsule L, Cerebral peduncle L, Anterior corona radiata R and Superior corona radiata R were in correlation with better clinical performance in MMSE, Traveling-A, and CDR.

## CONCLUSION

s Covariance structural abnormalities were the key networks of heterogeneous mild traumatic brain injury, serving as indicator and predictor of mTBI.

## CLINICAL RELEVANCE/APPLICATION

To assess covariance structural abnormalities provided a new method to serve as indicator and predictor of heterogeneous mTBI.

### **T5A-SPNR-6 Abnormal Functional Connectivity in Mild Traumatic Brain Injury at Subacute Phase and 1-3 Months Post-injury by Independent Component Analysis**

Participants

Yanan Zhu, Ankang, China (*Presenter*) Nothing to Disclose

## PURPOSE

To examine the resting state networks of homogeneous mTBI patients and investigate the dynamic changes of brain networks at both subacute phase and 1-3 months post-injury

## METHODS AND MATERIALS

: A total of 60 first-episode mTBI patients at subacute phase (within 21 days post-injury) were recruited from the Local Emergency Department, and 35 mTBI patients who conducted the follow-up 1-3 month post-injury were enrolled. 43 healthy volunteers who matched with age, sex, and educational level were recruited as normal controls. Neuropsychological tests and self-reported symptoms were assessed within 24 hours after MR scan for all the participants. Independent component analysis (ICA) was carried out by using Multivariate Exploratory Linear Optimized Decomposition into Independent Components (MELODIC) implemented in FSL. A dual regression approach was used to perform voxel-wise comparisons of functional connectivity between groups. the Pearson's correlation coefficients between the averaged Z score in regions and clinical measurements both at subacute and 1-3month post injury subgroup were calculated.

## RESULTS

Decreased functional connectivity within the default mode network (DMN) and increased network strengthen in the frontoparietal network (FPN) in mTBI patients at subacute phase were found, and the abnormality of the DMN function was specifically predicated by with the individual cognitive impairments. After 1-3months post-injury, increased connectivity in the DMN and decreased connectivity in the dorsal attention network (DAN) emerged. Reduced functional connectivity in the anterior cingulate cortex was correlated with aggravated syndrome of fatigue.

## CONCLUSION

s Alterations of connectivity in multiple intrinsic networks exist early after and during recovery of injury, which may underlie the mechanisms of the reduced and improved performance in neurocognitive testing.

## CLINICAL RELEVANCE/APPLICATION

Whole brain functional connectivity, especially DMN, can serve as indicator and predictor to monitor disease progression or recovery of mTBI.

### **T5A-SPNR-7 Local and Global Functional Connectome Disruption in Patients with Gliomas**

## PURPOSE

To explore the disruption of functional connectome patterns in patients with brain tumors, based on resting-state functional magnetic resonance imaging (rs-fMRI) data in patients with gliomas.

## METHODS AND MATERIALS

Fifty-four patients with newly diagnosed or recurrent gliomas were included (M = 34, Mean Age = 50.8 yr). Manual segmentation of solid lesions was performed on T1w and T2w MRI scans following RANO criteria. Rs-fMRI was acquired before surgery on a 3T scanner. Whole-brain network measures of centrality, modularity, integration and segregation were computed for a set of Regions of Interest (ROIs) including the Harvard Oxford (HO) anatomical atlas and tumor-related ROIs (i.e., edema, solid tumor, necrotic core). A  $p < 0.05$ , two-sided, FDR corrected threshold was used for statistical analysis; analysis was performed on connectivity matrices representing multiple sparsity levels ranging from 50% to 100%.

## RESULTS

In newly diagnosed patients (n = 18), we found a decrease of Integration (Degree, Global Efficiency) and Centrality (Betweenness centrality), and an increase of Segregation (Clustering Coefficient) in the tumor ROIs respect to healthy brain regions. Such an integration/segregation imbalance pattern seems to follow a gradient moving from the edema to the solid tumor and the necrotic core (i.e., less altered in the edema, more altered in the necrotic core). In the entire "Network" composed by all the brain regions of the HO atlas plus all the tumor ROIs, its indexes fit between those of the healthy grey matter (frontal poles, blue bars) and the tumor ROIs, confirming the relevance of the alteration induced by the tumor across the whole brain functioning system. In patients at recurrence (n = 36), the same pattern was found, though with a less clear separation between tissue classes within the tumor. This might be due to an altered environment caused by functional plastic rearrangement and the neurocognitive effects of multiple interventions (i.e., surgery, chemotherapy, radiation damage).

## CONCLUSION

s We found significant alteration of functional connectome measures in brain regions affected by the tumor (i.e., tumor mass, necrotic core and edema), with a decrease of network integration and an increase of network segregation measures. Notably, a

linear change in integration/segregation ratio was observed from the necrotic core to the edema, possibly reflecting tumor progression and therefore possibly capturing neuronal damage.

#### **CLINICAL RELEVANCE/APPLICATION**

Connectome-level markers of glioma functional behavior could deepen our understanding of glioma pathophysiology, provide insight on neurocognitive sequelae, as well as be investigated as a potential marker of tumor progression.

#### **T5A-SPNR-8 Value of Contrast-Enhanced T1 WI Histogram Analysis in the Differential Diagnosis of Prolactin and Non-Prolactin Pituitary Macroadenomas**

Participants

Wei Wang, Zhengzhou City, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Based on the World Health Organization's classification for pituitary neuroendocrine tumors in 2022, this study aims to investigate the value of contrast-enhanced T1 weighted imaging (CE-T1WI) histogram analysis in distinguishing prolactin pituitary macroadenomas and non-prolactin pituitary macroadenomas.

#### **METHODS AND MATERIALS**

A retrospective analysis was conducted on data from 10 patients with prolactin pituitary macroadenomas and 13 patients with non-prolactin pituitary macroadenomas who were diagnosed by histopathology. All procedures of this study were approved by the Ethics Committee of our hospital. Written informed consent was obtained from all patients. The 3D Slicer software was used to draw the region of interest (ROI) of the tumor at the best plane, followed by gray-level histogram analysis to extract seven histogram parameters including Perc.10%, Perc.90%, kurtosis, mean, median, maximum and minimum values. Independent sample T-tests or Mann-Whitney U-tests were used to compare metric data between the two groups. Receiver operating characteristic (ROC) curves were plotted, and the area under the curve (AUC) was calculated to evaluate the diagnostic performance of the relevant parameters in distinguishing prolactin pituitary macroadenomas from non-prolactin pituitary macroadenomas.

#### **RESULTS**

In CE-T1WI histogram parameters, Perc.10%, mean, minimum value, and total parameters showed significant differences between the two groups of tumors with P values of 0.014, 0.0347, 0.0057, and <0.001, respectively. Table 1 presented the mean values and standard deviations of each parameter in the two groups. The area under the ROC curve, sensitivity, and specificity for each parameter were 0.808 (0.700, 0.923), 0.769 (0.700, 0.923), and 0.892 (0.800, 0.846), respectively, indicating good diagnostic accuracy. The AUC for the total parameter model was 0.954 (0.800, 1.000), significantly higher than that of individual parameters, suggesting that the combination of multiple parameters can improve the diagnostic accuracy.

#### **CONCLUSION**

s CE-T1WI histogram analysis has certain value in the differential diagnosis of prolactin pituitary macroadenomas and non-prolactin pituitary macroadenomas, and can be used as an auxiliary method for distinguishing pituitary nerve prolactinomas.

#### **CLINICAL RELEVANCE/APPLICATION**

Since prolactin pituitary macroadenomas can be treated with medication only, while non-prolactin pituitary macroadenomas require surgery, which can be invasive, accurately differentiating between the two can help avoid unnecessary surgical trauma.

#### **T5A-SPNR-9 Effective Atomic Number as a Novel Quantitative CT Imaging Marker for Differentiating Glioblastomas, Brain Metastases and Primary Central Nervous System Lymphomas**

Participants

Tsubasa Nakano, Kagoshima, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To determine whether dual-energy CT parameters including effective atomic number (Zeff) and electron density (ED) could be quantitative imaging markers for differentiating glioblastomas (GBMs), brain metastases and primary central nervous system lymphomas (PCNSLs).

#### **METHODS AND MATERIALS**

This study included 102 consecutive patients with pathologically proven GBMs (n = 56), metastases (n = 23) and PCNSLs (n = 23). For all patients, preoperative non-contrast dual-energy CT examination was performed using a spectral detector CT scanner. Images of conventional CT (CTconv), ED, Zeff were obtained. These CT images and MR images (T2WI, FLAIR, ADC map and post-contrast T1WI) were co-registered using SPM12. For each lesion, semiautomatic tumor segmentation was performed to delineate contrast enhanced area of tumors using ITK-SNAP, and VOIs were placed on each image. The mean CTconv, ED, Zeff and ADC values were compared between 3 groups using Mann-Whitney U test. ROC curve analysis was performed to assess the diagnostic abilities of each parameter and their combinations.

#### **RESULTS**

Zeff showed significant difference across all three groups, whereas ED showed no significant between-group differences. CTconv and ADC showed significant differences between GBMs and PCNSLs and between metastases and PCNSLs, but not between GBMs and metastases. Between GBMs and metastases, only Zeff showed significant difference (P = 0.02), and the area under the ROC curve (AUC) for their differentiation was 0.667. In discriminating between metastases and PCNSLs, Zeff showed the best diagnostic performance (AUC = 0.827), followed by ADC (0.761) and CTconv (0.701). The AUC further improved up to 0.921 when Zeff was combined with ADC. Between GBMs and PCNSLs, the AUCs were 0.744, 0.681 and 0.798 for CTconv, Zeff and ADC, respectively. Although Zeff had lower diagnostic performance compared to CTconv and ADC, AUC improved up to 0.829 with the combination of CTconv, Zeff and ADC.

#### **CONCLUSION**

s Our preliminary results suggested that Zeff can be a novel quantitative CT imaging marker that captures inherent characteristics of the tumors which are not reflected in conventional images, and it may be useful for differentiating GBMs, brain metastases and

PCNSLs.

**CLINICAL RELEVANCE/APPLICATION**

The effective atomic number can be a novel quantitative CT imaging marker for differentiating GBMs, brain metastases and PCNSLs.

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## Abstract Archives of the RSNA, 2023

T5A-SPOB

### OB/Gynecology Tuesday Poster Discussions I

#### Sub-Events

#### T5A-SPOB-1 Does Abdominal Fat Distribution Impact Endometrial Cancer Prognosis

##### Participants

Kristine Fasmer, PhD, MSc, Bergen, Norway (*Presenter*) Nothing to Disclose

##### PURPOSE

To quantify abdominal fat distribution from clinically acquired computed tomography (CT) scans at primary diagnosis and at follow-up in a large endometrial cancer (EC) cohort, and to explore its relation to disease progression and prognosis.

##### METHODS AND MATERIALS

From CT images of 293 EC patients at primary diagnosis ( $n_{\text{primary}}$ ), total- (TAV), subcutaneous- (SAV), visceral abdominal fat volume (VAV), and visceral-to-total abdominal fat ratio (VAV/TAV) were derived using iNTuition (TeraRecon Inc., USA). The obesity markers were assessed in relation to body mass index (BMI) using Spearman's rank order correlation ( $\rho$ ), and to tumor histology from surgical specimen (endometrioid EC (EEC) grade 1-3, non-endometrioid EC (NEEC)) using Mann-Whitney U test. Time-dependent receiver operating characteristic curves, and Cox hazards ratios (HRs) were used to assess the obesity markers in relation to progression-free survival (PFS). Delta ( $d$ ) fat changes from primary diagnosis to follow-up 13 (2-41) [median (range)] months after diagnosis, were derived for 152/263 patients ( $n_{\text{follow-up}}$ ) with follow-up CT.  $d$ TAV,  $d$ VAV,  $d$ SAV, and  $d$ (VAV/TAV) were compared for patients with progression versus patients with no signs of progression, using Mann-Whitney U-test.

##### RESULTS

At primary diagnosis ( $n_{\text{primary}}=293$  patients), TAV, VAV, and SAV were all highly correlated to BMI ( $\rho=0.78$ ), while VAV/TAV ratio was not ( $\rho=-0.12$ ). Patients with high-risk histology (EEC grade 3/NEEC) had significantly lower TAV, SAV, and BMI ( $p=0.03$ ), while higher VAV/TAV ratio ( $p=0.001$ ) than patients with low-risk histology (EEC grade 1-2). High VAV/TAV ratio ( $=36\%$ ) predicted poor PFS both in univariable analysis ( $HR=2.4$ ,  $p=0.04$ ), and when stratified for surgicopathologic International Federation of Gynecology and Obstetrics (FIGO) stage I-IV ( $HR=2.8$ ,  $p=0.02$ ). At follow-up ( $n_{\text{follow-up}}=152$  patients), median TAV, VAV, and SAV were significantly lower than at primary diagnosis ( $p<0.001$  for all), while no significant difference was observed for VAV/TAV ratio ( $p=0.31$ ). Patients experiencing progression had a larger reduction in visceral fat compartments ( $d$ VAV= $-19\%$ ,  $d$ VAV/TAV= $-2\%$ ), than patients with no signs of progression ( $d$ VAV= $-11\%$ ,  $d$ VAV/TAV= $0\%$ ,  $p=0.04$  for both).

##### CONCLUSION

High VAV/TAV ratio, measured at primary diagnosis, is associated with high-risk histology and reduced survival in EC. Patients experiencing disease progression have a more pronounced reduction in visceral fat volume than patients with no signs of progression at follow-up.

##### CLINICAL RELEVANCE/APPLICATION

Abdominal fat distribution markers from preoperative abdominal CT predict endometrial cancer prognosis, and higher visceral fat loss during/following therapy is associated with disease progression.

#### T5A-SPOB-2 Early Treatment Response is Captured by Whole-tumor MRI Radiomics in Patient-derived Organoid Endometrial Cancer Models

##### Participants

Kristine Fasmer, PhD, MSc, Bergen, Norway (*Presenter*) Nothing to Disclose

##### PURPOSE

Radiomics can capture microscale information in medical images beyond what is visible to the naked human eye. Using a clinically relevant mouse model for endometrial cancer, the purpose of this study was to develop and validate a radiomic signature (RS) predicting response to standard chemotherapy.

##### METHODS AND MATERIALS

Mice orthotopically implanted with a patient-derived grade 3 endometrioid endometrial cancer organoid model (O-PDX) were allocated to chemotherapy (combined paclitaxel/carboplatin,  $n=11$ ) or saline/control ( $n=13$ ). During tumor progression, the mice underwent weekly T2-weighted (T2w) MRI. Segmentation of primary tumor volume (vMRI) allowed radiomic feature extraction from whole-volume tumor masks. A radiomic prediction model employing least absolute shrinkage and selection operator (LASSO) statistics for predicting treatment group (chemotherapy vs. control) was derived using endpoint images in the orthotopic O-PDX, and subsequently applied on the earlier study timepoints (RS\_O at baseline, and week 1-3). For external validation, the radiomic prediction model was further tested in a separate T2w-MRI dataset on segmented whole-volume subcutaneous tumors (RS\_S) from the same O-PDX model, imaged at three timepoints (baseline, day 3 and day 10/endpoint) after start of chemotherapy (combined paclitaxel/carboplatin) ( $n=8$  tumors) or saline/control ( $n=8$  tumors).

## RESULTS

The RS\_O yielded rapidly increasing area under the receiver operating characteristic curves (AUCs) for predicting treatment groups, from baseline until endpoint; AUC=0.38 (baseline); 0.80 (week 1), 0.85 (week 2); 0.96 (week 3) and 1.0 (endpoint). In comparison, vMRI yielded AUCs of 0.37 (baseline); 0.69 (week 1); 0.83 (week 2); 0.92 (week 3) and 0.97 (endpoint). When tested in the external validation dataset, RS\_S yielded high accuracy for prediction of treatment group at day 10/endpoint (AUC=0.85), and tended to yield higher AUC than vMRI (AUC=0.78, p=0.18). Neither RS\_S nor vMRI predicted treatment groups at day 3 in the external validation set (AUC=0.56 for both).

## CONCLUSION

We have developed and validated a radiomic signature that was able to capture treatment response prior to a decrease in tumor volume. This study supports the promising role of preclinical imaging with radiomic tumor profiling to detect early treatment response in cancer models.

## CLINICAL RELEVANCE/APPLICATION

Radiomic MRI signatures capture treatment response prior to visible decrease in tumor volume in a preclinical endometrial cancer model and represent a promising approach for capturing early treatment response.

## T5A-SPOB-3 Magnetic Resonance Imaging of Primary Ovarian Carcinosarcoma: Is the Mille-feuille Sign" Useful in Diagnosis

Participants

Yuriko Watanabe, MD, Tochigi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Primary ovarian carcinosarcoma (POC) is a rare and aggressive variant of ovarian cancer with a poorer prognosis than that of high-grade serous ovarian cancer. Thus, preoperative imaging diagnosis is crucial; however, few reports on MRI of POC exist. Kurokawa et al. proposed a new morphologic classification of ovarian tumors on imaging and reported that the mille-feuille sign, with a layered structure in the cystic tumor, indicates ovarian metastasis from colorectal carcinoma with high specificity and is useful in the differential diagnosis of primary ovarian carcinoma (*Eur J Radiol.* 2020; 124: 108823). In this presentation, we analyzed the MRI findings of 12 cases of POC and investigated the imaging features, including a new morphologic classification.

## METHODS AND MATERIALS

MRI scans of 12 POC patients were obtained. The following features were evaluated: (1) tumor size; (2) ADC values of the solid component; (3) intratumoral hemorrhage; (4) signal intensities compared to the skeletal muscle and heterogeneity of the solid component on T2WI; (5) heterogeneity of enhancement of the solid component on Gd-enhanced T1WI; and (6) tumor morphology on T2WI and Gd-enhanced T1WI, according to the following four categories: "mille-feuille sign," "solid and cystic," "multicystic without nodules," and "multicystic with nodules." Among (3)-(6), three radiologists who were blinded to prior clinical information were evaluated. In case of disagreement among the readers, the diagnosis was determined through a majority decision. Interobserver agreement for subjective image quality was calculated using the Fleiss' kappa statistic.

## RESULTS

(1) tumor size: mean, 133.7±127.5 mm, (2) ADC values: mean, 0.80±0.26×10<sup>-3</sup> mm<sup>2</sup>/s, (3) intratumoral hemorrhage: 11/12 (?=0.54), (4) heterogeneously high intensity: 12/12 (?=1), (5) heterogeneous enhancement: 12/12 (?=1), (6) tumor morphology on T2WI: solid and cystic (n=10) and mille-feuille sign (n=2) (?=0.56), tumor morphology on Gd-enhanced T1WI: solid and cystic (n=7) and mille-feuille sign (n=5) (?=0.89).

## CONCLUSION

POC shows relatively large ovarian tumors with hemorrhage, heterogeneous solid components, and low ADC values. Gd-enhanced T1WI showed solid and cystic or mille-feuille signs with excellent interobserver agreement. We considered the mille-feuille sign as a suspicious finding for POC in addition to ovarian metastasis from colorectal carcinoma.

## CLINICAL RELEVANCE/APPLICATION

Primary ovarian carcinosarcomas (POCs) are aggressive and have a poor prognosis; therefore, preoperative imaging diagnosis is crucial. The "mille-feuille sign" on Gd-enhanced T1WI can be useful to suspect POC preoperatively.

## T5A-SPOB-4 Habitat-based Radiomics Enhances the Ability to Predict Lymphovascular Interstitial Infiltration in Cervical Cancer: A Multicenter Study

## PURPOSE

As lymph-vascular space invasion (LVSI) was closely related to lymph node metastasis and prognosis, the preoperative assessment of LVSI in cervical cancer is crucial for patients. As such, we investigated the potential of habitat analysis as a novel tumor biomarker in predicting LVSI in cervical cancer.

## METHODS AND MATERIALS

This retrospective study of 300 patients with cervical cancer who had received surgical treatment at two institutions, with data from institution 1 as the training (n = 198) cohort and institution 2 as the validation (n = 102) cohort. Based on the voxel and entropy values of CE-T1WI images clustered by K-means method, the VOI was divided sub-regions and the radiomics features were extracted from the sub-regions respectively. Pearson correlation coefficient and LASSO regression methods were used for feature selection. Pearson correlation coefficient and LASSO regression methods were used for feature selection. The SVM machine learning model was used to construct prediction models for each sub-region radiomics features and the model effects were evaluated by an external test cohort.

## RESULTS

The voxels and entropy values of CE-T1WI images are clustered into 3 sub-regions. In the training cohort, AUCs of the SVM models based on the radiomics features derived from all tumor, Habitat1, Habitat2 and Habitat3 were 0.805 (95% CI: 0.745 - 0.864), 0.873(95% CI: 0.824 - 0.922), , 0.869 (95% CI: 0.821 - 0.917) and 0.870(95% CI:0.821 - 0.920), respectively. Comparing with all

tumor, the predictive performances of Habitat1-3 were higher with statistical significant. The Habitat3 model archived the highest AUC in the external test cohort (0.780 [95% CI: 0.692 - 0.869]). The difference was not statistical significant ( $p=0.073$ ). The accuracy, sensitivity, specificity, positive predictive value and negative predictive value for LVSI were 0.745, 0.741, 0.75, 0.769 and 0.720, respectively.

#### **CONCLUSION**

s A tumor sub-regional habitat-based radiomics model could obtain higher predictive performance for LVSI in cervical cancer the radiomics derived from all tumor, which might be a potential noninvasive approach to facilitate treatment decision-making in clinical settings

#### **CLINICAL RELEVANCE/APPLICATION**

Pretreatment acknowledge of LVSI status in patients with cervical cancer can facilitate personalized therapeutic strategy. The current work provided a noninvasive approach for assessing LVSI without radiation, which is very important for the women of childbearing age, who have the intention for fertility preservation.

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## Abstract Archives of the RSNA, 2023

T5A-SPPD

### Pediatric Imaging Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPPD-2 Abnormal Brain Functional Connectivity in Children with Spastic Cerebral Palsy: A Resting-state Functional Magnetic Resonance Imaging Study**

#### **PURPOSE**

Cerebral palsy (CP) is the most common dyskinesia syndrome in children, and spastic cerebral palsy (SCP) is the most common clinical type. Existing neuroimaging studies have found that there are extensive structural and functional changes in children with SCP. However, few studies focus on the intrinsic functional features of network organization throughout the brain. Therefore, the purpose of this study was to use degree centrality (DC) analysis at the voxel level to characterize the potential pattern of intrinsic connectivity disorders in the whole brain functional network in children with SCP.

#### **METHODS AND MATERIALS**

34 children with SCP and 17 demographically matched healthy controls (HCs) participated in the study. All subjects were evaluated for gross motor function and hand function, and underwent resting state functional magnetic resonance imaging. DC is a graph theory-based measure that represents the total number of functional connections between a voxel and other voxels. We used DC analysis and seed-based functional connectivity (FC) analysis to identify abnormal FC.

#### **RESULTS**

The DC values of the left supplementary motor area (SMA), bilateral medial cingulate gyrus (MCC) and left precuneus were significantly lower than the HCs group. Further seed-based FC analysis showed that, compared with the HCs group, when seed was located on the left SMA, the SCP group showed decreases connections with the left anterior cingulate gyrus, para-hippocampal gyrus, ventrolateral prefrontal cortex and right anterior cingulate gyrus, thalamus, amygdala, and putamen. When seed was located in the left precuneus, the SCP group showed decreases connections with the left thalamus, right hippocampus, precuneus, lingual gyrus, and putamen. When seed was located in the left MCC, the association with the left insula, precuneus, medial prefrontal cortex, right putamen and thalamus was reduced in the SCP group. When seed was located in the right MCC, the association between the left cuneus and the right lingual gyrus, precuneus and thalamus was reduced in the SCP group. Correlation analysis showed that the FC between the left SMA and the right putamen was negatively correlated with the hand function evaluation grade.

#### **CONCLUSION**

The brain functional network in children with SCP had extensive internal connectivity disorders, including the damage of the default brain network, the central executive network and the salient network in addition to the sensorimotor network.

#### **CLINICAL RELEVANCE/APPLICATION**

The changes of brain functional network provide a basis for understanding the pathophysiological mechanism of SCP motor and cognitive impairment, and may provide a new therapeutic target for the treatment of children with SCP.

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## Abstract Archives of the RSNA, 2023

T5A-SPPH

### Physics Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPPH-1 Assessing Coronary Artery Calcium Scoring in Lung Cancer Screening: A Dynamic Cardiac Phantom Study**

##### Participants

Chao Guo, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

Calcification of coronary arteries is strongly associated with cardiovascular diseases. Low dose lung cancer screening (LCS) is gaining popularity in practice. For asymptomatic patients, the feasibility of using LCS scans for coronary artery calcium scoring (CACs) has not been explored apart from incidental findings. We aimed to quantify the calcium score using LCS scans in comparison with the ground truth obtained by ECG gated CACs.

##### METHODS AND MATERIALS

The CIRS Dynamic Cardiac Phantom was utilized with 12 calcification inserts of various density (50, 100, 250 and 400 mg/cc) and diameters (1.2, 3 and 5 mm). Scans were performed with simulated ECG with the heart rate from 50 to 100 beats per minute, using the non-gated LCS (CTDIvol = 0.17 mGy) and gated CACs (CTDIvol = 1.74 mGy) protocols. The gated CACs scans served as the ground truth. A FOV of 200 mm was used throughout this study. Additionally, 4 seconds breath motion was added during the LCS scan for comparison purposes. Siemens SyngoVia was used to score the calcifications by individual readers.

##### RESULTS

The visibility of calcium inserts from LCS scans were affected by cardiac motion, which caused blurring and distortion, particularly for small-diameter inserts. As compared with the ground truth, Agatston scores were found lower by 39.5% to 56.7% depending on the heart rate. Within the non-gated scans, the added breathing motion generated additional score difference up to 17.6%. It was found that the calcification detectability is sensitive to the insert density. Calcifications of density higher than 250 mg/cc were detectable. However, inserts with densities 100 mg/cc or lower were not detectable at any heart rate.

##### CONCLUSION

As compared to the ground truth, CAC score using non gated LCS scans is underestimated by 39.5% to 56.7%. It was found that calcium density exceeds 250 mg/cc was detectable. However, calcifications with a density lower than 100 mg/cc cannot be scored with CACs and LCS protocols, regardless of heart rate. Although heart rate may affect the calcium scoring, major calcifications can still be accurately assessed with a significant reduction in patient dose.

##### CLINICAL RELEVANCE/APPLICATION

Using coronary artery calcium scoring as a screening tool has the potential to detect major coronary artery events. Incorporating it into lung cancer screening exams could provide an opportunity for further simultaneous diagnosis.

#### **T5A-SPPH-10 CNN-Based Metal Artifact Reduction Method with Mask for Planning CT in Radiation Treatment**

##### Participants

Won Jin Lee, Ulsan, Korea, Republic Of (*Presenter*) Nothing to Disclose

Juhyeong Ki, Ulsan, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

For radiation treatment of cancer, CT scans are essential. Metal artifacts are generated during CT scans by metal objects inserted into the body for various reasons, which make accurate dose calculation for radiation therapy impossible. Recently, many metal artifacts reduction methods applying deep learning have been proposed. However, compared to other human body parts, metal artifacts are not effectively removed by the existing methods in the head neck area, which has a relatively complex structure and has strong artifacts due to the insertion of dental filling and implant. In this study, we proposed a CNN-based deep learning model using a pre-trained mask extraction model that reduces strong metal artifacts in the head neck area.

##### METHODS AND MATERIALS

The training process was divided into two steps. In first step, a model to extract masks including bone and metal was trained using supervised contrastive learning (SCL) with 30 patients. The tissue pixel distribution includes more of patient's identity and effects of metal artifacts than the bone pixel distribution. Therefore, a bone mask was obtained by separating the tissue distribution from the bone distribution through SCL. In second step, a model for reducing metal artifacts was trained with 85 patients. Metal and bone have a wide pixel range, while tissues concentrate in narrow range of values, resulting in a more than ten-fold difference in the MSE for each area. Therefore, Instead of calculating the loss for the entire image including bones, metal, and tissues, a masked MSE was applied using the bone mask extracted in the first step. As a result, a weighted masked MSE was applied to remove metal artifacts from both tissue and bone.

## RESULTS

In the evaluation metrics for the synthetic dataset, our proposed model showed average scores of MSE, SSIM, PSNR, and PCC of 0.000106, 0.9986, 42.4130, and 0.9944. Overall evaluation values showed improved results than baseline and others. In the qualitative results, the proposed model showed higher performance compared to a commercial software and other models in real-world data.

## CONCLUSION

In this study, we proposed a CNN-based metal artifacts reduction model with weighted masked MSE. Our proposed model demonstrated the best performance on both generated and real-world data, effectively removing strong artifacts near metal as well as stripe-shaped artifacts located far from metal.

## CLINICAL RELEVANCE/APPLICATION

Our proposed model effectively resolves severe artifacts in complex structures such as head neck regions. Therefore, the proposed model is expected to be applied to CT metal artifact reduction in radiation treatment planning process, especially dose calculation for patients with metal implants inserted in the head neck where strong artifacts appear.

## T5A-SPPH-11 Reconstruction of Fast Acquisition MRI with Under-sampled K-space Data by Using Massive-Training Artificial Neural Networks (MTANNs)

Participants

Kenji Suzuki, PhD, Yokohama, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Accelerated MRI acquisitions by taking fewer samples in the K-space involves a trade-off between image quality degradation and acquisition time. We aimed to reduce artifacts in MR images reconstructed from under-sampled k-space data in fast-acquisition MRI by using our MTANN deep learning.

## METHODS AND MATERIALS

We developed a scheme consisting of several iterable cross-domain massive-training artificial neural network (MTANN) modules, namely, an MTANN in the image space (iMTANN) with multiple kernels and multiple frequency-specific MTANNs in the K-space (kMTANNs) to improve the image quality in both spaces in fast acquisition MRI with under-sampled k-space data. A public dataset used in this study contains 20 full k-space volumes of 795 images. Simulated accelerated under-sampled (1/8) MR images were created with a universal sampling pattern. Our MTANN model was trained with the simulated under-sampled MR data as input and the corresponding fully-sampled MR data as "teaching" images.

## RESULTS

To evaluate the image quality quantitatively, we used the structural similarity index (SSIM) and mean squared error (MSE) between the predicted MR and fully-sampled MR images. Compared with the state-of-the-art XPDNet, the SSIM and MSE for our scheme were improved from 0.885 and 31.95 to 0.900 and 23.97, respectively. The differences were statistically significant ( $P < 0.05$  in paired t-tests). In the comparison experiment, our hybrid MTANN preserved the anatomical structure of the knee better than XPDNet. XPDNet changed the appearance of the original anatomical structures, causing significant errors in the reconstruction of MR images, whereas our hybrid MTANN removed the artifacts substantially while preserving those important anatomical structures from the under-sampled MR images.

## CONCLUSION

Our hybrid MTANN improved the image quality by reducing truncation artifacts substantially in 8-times faster acquisition MRI, while anatomic structures were preserved well.

## CLINICAL RELEVANCE/APPLICATION

Our scheme was able to shorten the acquisition time of MRI by a factor of 8, while preserving important anatomical structures, which improves the throughput of MR exams.

## T5A-SPPH-12 Feature Map Visualization for Explaining Black-Box Deep Learning Model in Liver Tumor Segmentation

Participants

Ze Jin, PhD, Yokohama, Japan (*Presenter*) Nothing to Disclose

Tianyi Qu, Yokohama, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

A chief limitation of current artificial-intelligence (AI)-aided diagnosis is the lack of transparency in a black-box deep learning model in the AI system, it would lose radiologists' trust in AI decisions. To address this issue, we developed an explainable AI (XAI) method to visualize the functions of groups of hidden units in a massive-training artificial neural network (MTANN) model for liver tumor segmentation in CT.

## METHODS AND MATERIALS

The dataset used in this study came from the public LITS database which contained dynamic contrast-enhanced CT scans. Seven and 24 cases were selected for training and testing, respectively. To segment liver tumors, a patch-based MTANN model was trained with input liver CT images and corresponding "gold-standard" manual liver segmentation by radiologists as "teaching" images. Our proposed sensitivity-based structure optimization algorithm was applied to the trained model to obtain a compact yet comparable model from a larger one by removing "redundant" hidden units of the model. After the optimization, we grouped the hidden units into several groups of similar functions by using an unsupervised hierarchical clustering algorithm. In this way, the functions of the model were characterized by visualizing the feature maps of each group. Light, gray, and dark pixels in the feature maps indicated enhancement, doing nothing, and suppression, respectively.

## RESULTS

We used a Dice score to compare the performance of the models. The initial MTANN model with 80 hidden units (Dice = 0.714) was

optimized with our algorithm and resulted in a compact model with 9 hidden units (Dice=0.701). These 9 hidden units were clustered into three groups by using the clustering algorithm according to a distance function among the weighted feature maps of the hidden units. Their functions were revealed and explainable by visualizing the feature maps as follows: (a) enhancing the liver area, (b) suppressing non-tumor areas, and (c) suppressing the liver's boundary and reducing the false positive pixels inside the liver. In addition, our experimental analysis by tumor sizes did not change the functions of three groups, demonstrating the robustness of our method. The modified model using only groups A and B achieved a higher performance in tumor segmentation, as they showed improved agreement with the tumor region boundary.

## CONCLUSION

This study demonstrated how our optimization and clustering algorithm could be used to understand and explain the functions of the MTANN model in liver tumor segmentation. It provided a valuable tool to analyze the behavior of black-box models better.

## CLINICAL RELEVANCE/APPLICATION

Our XAI method aiming to improve the transparency of an MTANN deep learning model would help radiologists gain their trust in AI's decisions.

## T5A-SPPH-13 Weakly Supervised Deep Learning Model for Automatically Delineating the Skeleton and Soft Tissue Organs from Whole-Body Diffusion Weighted Imaging (WBDWI)

Participants

Antonio Candito, PhD, MSc, London, United Kingdom (*Presenter*) Nothing to Disclose

## PURPOSE

WBDWI is a non-invasive, radiation-free, and quantitative technique for staging and therapy response assessment in patients with malignant bone lesions and metastatic visceral disease. The technique offers excellent contrast between disease and tissue background and allows measuring the Total Diffusion Volume (TDV in millilitres) and the Apparent Diffusion Coefficient (ADC), a surrogate imaging biomarker of tumour cellularity. However, clinicians still need to perform tedious and time-consuming delineations to obtain these biomarkers. Therefore, the development of automated segmentation tools is desirable. As an initial step, we have developed a supervised deep learning model from "weak annotations" for automatically delineating the skeleton and soft tissue from WBDWI data.

## METHODS AND MATERIALS

A 3D patch-based U-Net model was developed for delineating ten body regions from WBDWI: six skeleton regions (long bones, pelvis, lumbar/thoracic/cervical spine, ribcage) and bladder, kidneys, liver and spleen. WBDWI multi-centre datasets were used to train and validate the U-Net model: a dataset of 189 patients with Advanced Prostate Cancer (APC with baseline and follow-up scans) and 35 patients with Multiple Myeloma (MM with only baseline scan). The network employed a 2-channel input (i) the ADC map and (ii)  $b=0$  s/mm<sup>2</sup> image, derived from the mono-exponential fitting of the diffusion data. Annotations were automatically defined through a set of uncertainty maps (non-binary segmentations) derived from a computationally expensive atlas-based segmentation algorithm.

## RESULTS

The trained U-Net model was able to generate the body region segmentation maps within 20 seconds on CPU (2.4 GHz Quad-Core). On average, the dice score for skeleton regions on 15 test datasets was 0.62, with precision and recall of 0.67 and 0.72, respectively. Average dice score for soft tissue organs was 0.75, with precision and recall of 0.73 and 0.78, respectively.

## CONCLUSION

Our deep learning model could facilitate the development of signal-based automated tool for delineation and quantification of malignant bone lesions and metastatic visceral disease in patients with APC and MM.

## CLINICAL RELEVANCE/APPLICATION

Our model could assist clinicians in detecting and quantifying disease from WBDWI in patients with MM, APC, advanced breast and melanoma cancer, and, for screening subjects with high-cancer risk.

## T5A-SPPH-2 Optimizing Image Quality in Breast Screening: A Medical Physics 3.0 Approach

Participants

Niall Phelan, MS, (*Presenter*) Nothing to Disclose

## PURPOSE

In order to maximize sensitivity and specificity in population based breast screening, image quality should be optimized but equally must be consistent for all women screened. Imaging optimization projects have largely been underpinned by equipment performance metrics, established by technical image quality and dose indicators from physics quality control (QC) tests. However, the correlation between phantom image quality and impact on the clinical outcome is poorly understood and tenuous in many cases. We have applied the principles of Medical Physics 3.0 to combine medical physics QC data with screening outcome data to drive optimization and consistency of technical quality in a national breast screening programme.

## METHODS AND MATERIALS

The screening programme data management system enables collection and analysis of performance data including cancer detection rate (CDR) by individual mammography system for quality audit and reporting. However the requirement to accumulate sufficient data means these reviews can only be done retrospectively. We have used CDR analysis of more than 2 million screening examinations as a proxy indicator for comparison of equipment performance, correlated with routine medical physics image quality tests to monitor and audit quality and consistency.

## RESULTS

Following a large scale imaging equipment replacement with two new mammography system types, we observed that while the performance of both systems was consistent with previous system types and exceeded programme standards for cancer detection, significant differences were observed between them. This result offered an opportunity to review and standardize technical

performance to achieve consistency across the programme. Experimental imaging and simulation studies were carried out to determine improved automatic exposure control (AEC) system set-up which was then implemented across the programme by the vendor. Operational radiation dose increased but remained lower than European (EUREF) guidelines. Subsequent retrospective analysis demonstrated convergence of technical image quality and CDR for the two systems.

## CONCLUSION

s Differences in mammography equipment technical performance were identified through medical physics QC monitoring and correlated with screening outcome data, providing an opportunity for successful optimization and quality improvement.

## CLINICAL RELEVANCE/APPLICATION

Using Medical Physics 3.0 principles to incorporate the use of aggregated screening data and clinical outcome measures in support of medical physics quality assurance processes has demonstrated potential to deliver optimization of quality for individual women and for the screened population.

### T5A-SPPH-3 Diagnostic Value of Direct Lymphangiography in Primary Chyluria: A Retrospective Study

Participants

Qi Hao, Beijing, China (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the diagnostic value of direct lymphangiography (DLG) in primary chyluria.

## METHODS AND MATERIALS

Thirty-seven patients diagnosed as primary chyluria were recruited in this retrospective study. All patients were examined by DLG. The DLG examination was performed using the American GE Innova 2000-IQ DSA machine. According to the patient's clinical condition, one side of the foot was selected for lipiodol injection, and if the patient had combined lower limb lymphedema, the healthy side of the foot was selected. The patient was placed in a supine position, and a mixture of methylene blue and 2% lidocaine (1:1) was injected intradermally and subcutaneously between the roots of the 1st to 3rd toes on one side of the foot about 1-2 ml. A blue-stained shallow lymphatic was found under the skin, and the lymphatic was entered by puncture with a lymphography needle, and a total of about 7-15 ml of lipiodol was injected at a flow rate of 6-8 ml/h. The lipiodol development and regurgitation were observed dynamically under DSA until the lipiodol entering at the end of the thoracic duct was revealed, and the observation time ranged from 1.5 to 4.0h. For DLG, the indexes were: Distribution, reflux and dilatation of abnormal lymphatic vessels in the urinary system, chest and abdomen. The DLG signs of primary chyluria patients were statistically described by composition ratio of classification variables.

## RESULTS

DLG showed ipsilateral iliac lymphatic tortuosity and dilatation in 30 cases (81.1%); contralateral iliac lymphatic reflux in 17 cases (45.9%); ipsilateral lumbar trunk tortuosity and dilatation and reflux in 19 cases (51.4%); contralateral lumbar trunk reflux in 21 cases (56.8%); ipsilateral pelvic sinus reflux in 17 cases (45.9%); contralateral pelvic sinus reflux in 21 cases (56.8%); thoracic duct reflux obstruction in 37 cases (100.0%); 7 cases (18.9%) of bronchial mediastinal trunk reflux, including 1 case (2.7%) of hilar reflux and 3 cases (8.1%) of intercostal reflux (Figure 11%); 4 cases (10.8%) of perineal reflux; 1 case (2.7%) of abdominal reflux; 21 cases (56.8%) of cervical trunk and subclavian trunk reflux.

## CONCLUSION

s DLG is able to visualize lymphatic reflux and abnormal reflux dynamically, evaluate lymphatic vessel morphology accurately, and achieve a diagnostic rate of 81.8% for primary chyluria.

## CLINICAL RELEVANCE/APPLICATION

DLG can provide an important imaging basis for the diagnosis and preoperative evaluation of primary chyluria.

### T5A-SPPH-4 Retrospective Analysis of Doses Delivered during Embolization Procedures over the Last 10 Years

Participants

Joel Greffier, PhD, Nimes, France (*Presenter*) Nothing to Disclose

## PURPOSE

This study aimed to retrospectively analyze dosimetric indicators recorded since 2012 for thoracic, abdominal or pelvic embolizations to evaluate the contribution of new tools and technologies in dose reduction.

## METHODS AND MATERIALS

Dosimetric indicators (dose area product (DAP) and air kerma (AK)) from 1449 embolizations were retrospectively reviewed from August 2012 to March 2022. A total of 1089 embolizations were performed in an older fixed C-Arm system (A1), 222 in a newer fixed C-Arm system (A2) and 138 in a 4DCT system (A3). The embolization procedures were gathered to compare A1, A2 and A3.

## RESULTS

DAP were significantly lower with A2 compared to A1 for all procedures (median -50% +/- 5%,  $p < 0.05$ ), except for uterine elective embolizations and gonadal vein embolization. The DAP values were significantly lower with A3 than with A1 ( $p < 0.001$ ). CT scan was used for guidance in 90% of embolization procedures.

## CONCLUSION

s This monocentric retrospective analysis of the doses delivered during thoracic, abdominal and pelvic embolization procedures over a 10-year period showed the contribution of the new IR tools in dose reduction and patient management. The last C-arm technology reduced the image noise and improved image quality, allowing a 50% reduction of the air kerma and showing a significant dose reduction. The implementation of a CT scan inside the IR room allowed a more precise 3D guidance without increasing the dose delivered to the patients.

## CLINICAL RELEVANCE/APPLICATION

The last C-arm technology reduced the image noise and improved image quality, allowing a 50% reduction of the air kerma and showing a significant dose reduction. The implementation of a CT scan inside the IR room allowed a more precise 3D guidance without increasing the dose delivered to the patients.

## T5A-SPPH-5 Relationship between Presurgical DTI Motor Tract Maps and Intraoperative Evoked Potentials

Participants

Juan José Sanchez Fernandez, DPhil, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

### PURPOSE

To study the accuracy of DTI in the presurgical identification of the motor tract and its correlation with evoked potentials obtained during brain tumor surgery.

### METHODS AND MATERIALS

54 pyramidal tractographies based on DTI images were performed before and after surgery in patients with glioma tumours histologically confirmed (17 diffuse anaplastic gliomas, 8 oligoastrocytomas and 29 multiform glioblastoma) which were immediately adjacent or in direct contact to the pyramidal tract. During surgery, central sulcus was identified and confirmed by evoked potentials. For evoked potential a direct phase technique for cortical stimulation with high frequency (250Hz) monopolar electrodes was used. For cortical stimulation an 8 contacts electrode was used whereas a current waveform with eight electromyograms was used for evoked potentials continuous monitoring. When resection approaches the pyramidal tract, subcortical stimulators were used and the electromyographic response was observed after subcortical stimulation. The minimum distance ratio between the resection cavity and subcortical stimulation intensity, in relation to the pyramidal tract, was studied using regression and ANOVA correlation analysis. The p-value was considered as  $p < 0.05$

### RESULTS

The distance between the resection cavity and the motor tract in tractographic sequences postoperatively were 2.5 to 23.7 mm. The results were correlated with data obtained from cortical evoked potentials monitored during surgery. There was a significant linear correlation of 1.08 by applying a regression test between distance and stimulus intensity ( $R^2 = 0.8202$ ,  $P < 0.001$ ).

### CONCLUSION

Correlation was demonstrated between the electrophysiological and DTI in the analysis of the pyramidal tract by imaging based on the use of direct subcortical stimulation. The DTI should be systematically included in the standard imaging protocol for the study of brain tumours both for etiologic diagnosis to treatment planning in order to preserve the maximum motor tract as possible.

## CLINICAL RELEVANCE/APPLICATION

The identification by DTI of the corticospinal tract prior to brain glioma surgery allows the neurosurgeon an accurate planning of the maximum tumour removal with motor tract preservation. Monitorization with intraoperative evoked potentials showed correlation with presurgical tractography MR studies.

## T5A-SPPH-6 CRLM-GAN: The Optimization Effect on Automatic Segmentation of T2-weighted Images for Colorectal Liver Metastases Combining with Transfer Learning and Generative Adversarial Network under Small-scale Sample

### PURPOSE

Colorectal cancer liver metastase (CRLM) is a ubiquitous digestive tract tumor, it is estimated that more than 50% colorectal cancer patients will eventually develop liver metastases during the course of illness. As for the diagnosis of CRLM, T2WI can serve as an important supplementary modality beyond the conventional examination of contrast-enhanced CT or DWI MRI. In this study, we proposed a modified hybrid auto-segmentation model based on transfer learning (TL) and generative adversarial network (GAN), i.e. CRLM-GAN, to explore the optimization effect under small-scale sample, thus expanding the application potential of T2WI images in intelligent diagnosis for CRLM.

### METHODS AND MATERIALS

A retrospective cohort was enrolled involving 70 patients with pathologically confirmed CRLM. All the images were acquired by the axial fast recovery, fast spin-echo and T2WI sequence, sourced from a 1.5-T MRI scanner using an 8-channel phased array body coil. In the fore-end of the network, UNet++ was employed as the generator to initially segment probabilistic maps. Then the generated probabilistic maps and real labels were multiplied with the original images respectively, resulting in the predicted tumor and the real tumor images. Both of them were input into the discriminator-a pre-trained ResNet-50 to extract and fuse the deep convolutional features. Ultimately, a comprehensive loss function was computed by combining the binary cross-entropy, Dice, and the multiscale loss. Moreover, Tversky Loss was incorporated into the training to optimize the final results.

### RESULTS

20% of the patients were used for the independent testing, and the model performance was assessed by five typical metrics, with Dice, Jaccard, Recall, Precision, F1-score of 0.7163, 0.5580, 0.5898, 0.9118, 0.7040. Our method achieved an average improvement of 6.23%, 4.32%, and 4.32% for the Dice, Jaccard, and F1-score compared with UNet. In contrast to UNet++, the three indicators increased by 2.29%, 1.91%, and 1.86%, respectively. When taking into account the addition of the Tversky loss, the Dice and Jaccard still improved by 0.16% and 0.20%, separately.

### CONCLUSION

This study designed a novel segmentation network based on TL and GAN. The results demonstrated that it can significantly enhance the accuracy under small-scale sample. Future work will focus on the generalization of the model in multi-center and medium-sized samples, so as to further expand the application scope.

## CLINICAL RELEVANCE/APPLICATION

The work provides a relatively reliable auto-segmentation tool for radiologists in the case of small samples. Besides, it also extends the application value of T2WI images in intelligent diagnosis on CRLM, compared to the auto-segmentation of routine image

modalities such as CT or DWI.

## **T5A-SPPH-7 Two-stage Few-shot Segmentation Framework on Lung Nodule CT Images**

Participants

Mengxiao Geng, Shenzhen, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

Although deep learning has demonstrated remarkable results for lung nodules, it is limited by the need for extensive manual labeling and high computational costs. Similarly, traditional active contour-based methods require manual adjustment and can be sensitive to the selection of initial contours. As such, there is a need for novel segmentation frameworks that address these challenges.

### **METHODS AND MATERIALS**

Our proposed few-shot segmentation framework (FSSF) combines deep learning with an optimized active contour model to segment lung nodules. First, deep learning is used to obtain prior position information based on a small amount of data. This prior information is then input as the initial contour into the optimized active contour model (OACM), which significantly enhances the segmentation accuracy of the deep network for lung nodules in small sample situations. Specifically, the active contour model includes heat kernel convolution to reduce computational complexity, while adaptive weighted functions and high-order total variation maintain segmentation accuracy. To solve the model efficiently, we used the alternating direction method of multipliers to split it into subproblems. In the experiment, the clinical CT dataset was acquired from Guangdong Provincial People's Hospital using a Siemens CT scanner (SENSATION 16 SLICE). The dataset included 199 subjects (102 males and 97 females, aged  $58.9 \pm 11.89$  years [range of 32-89]) who were collected from January to December 2020. To evaluate the proposed few-shot segmentation method, lung CT images from 10 patients were used for presegmentation model training, with 20 slices selected as test images.

### **RESULTS**

Our proposed method was compared against state-of-the-art methods such as U-Net, WBHV, WBHV+, ICTM, and ICTM+ in terms of their segmentation effectiveness. The results demonstrate that our proposed method showed significant improvement compared to other methods, with Dice improving by 6.9%, JS improving by 9.9%, and  $\delta$  improving by 7.0%. Compared to the state-of-the-art methods, our method still achieves much better performance.

### **CONCLUSION**

Compared to other segmentation methods, our proposed method demonstrates superior performance in both visual and quantitative evaluations.

### **CLINICAL RELEVANCE/APPLICATION**

CT image segmentation of pulmonary nodules is a useful technique for early detection, quantitative evaluation, and monitoring of lung cancer and other diseases. This technique separates nodules from surrounding tissue and calculates morphological features, providing support for clinical medicine.

## **T5A-SPPH-8 Improving Image Quality in Low-dose Abdominal and Pelvic CT Angiography Using Deep Learning Image Reconstruction: Comparison with Filtered Back-projection and Iterative Reconstruction**

### **PURPOSE**

To evaluate image quality among the traditional FBP, adaptive statistical iterative reconstruction (ASIR-V) and deep learning image reconstruction (DLIR, TrueFidelity) algorithms in low-dose abdominal and pelvic CT angiography (CTA).

### **METHODS AND MATERIALS**

Forty-six abdominal and pelvic CTA patients were included. All patients underwent low-dose CTA with 80kVp and smart tube current modulation (100-720mA). Images were reconstructed using FBP, ASIR-V with strength of 50% (AV-50) and 100% (AV-100), TrueFidelity with medium (TF-M) and high (TF-H) strength. The CT value and standard deviation (SD) value of abdominal aorta, psoas major muscle and subcutaneous fat were measured, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. The CT value skewness in psoas major muscle with uniform density was also measured to reflect the image texture change. A 5-point scoring method was used to evaluate the granularity, fuzziness and beam hardening artifacts of all images. The above indexes of the five image groups were compared.

### **RESULTS**

The volume CT dose index was low at  $1.09 \pm 0.37$  mGy. CT values were all similar among the five groups ( $P > 0.05$ ). But, SD values were different among groups with FBP being the largest and AV-100 the smallest which resulted in different SNR and CNR values opposite of the SD values. AV-100 and TF-H also had the best score in granularity while FBP had the worst. However, AV-100 had significantly higher skewness and fuzziness than other four groups ( $P < 0.001$ ), with FBP and DL-M had the smallest and TF-H marginally higher. The TF-H group had the best beam hardening artifact score while FBP and AV-50 group had the worst ( $P < 0.001$ ).

### **CONCLUSION**

Compared with FBP and ASIR-V, TrueFidelity reconstruction algorithm better balances image noise, smoothness, image texture, and artifacts in low-dose abdominal and pelvic CTA, with TF-H provides the best overall image quality.

### **CLINICAL RELEVANCE/APPLICATION**

TrueFidelity with high (TF-H) strength reconstruction algorithm provides the best image quality in low-dose abdominal and pelvic CTA.

## **T5A-SPPH-9 Metal Artifact Reduction for Head and Neck CBCT with Attentional Dual Encoder Fusion UNet**

Participants

Jungmok Lee, Ulsan, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **PURPOSE**

Since the insertion of metallic implants in surgical method has been grown, there also have been severe metal artifact in CT and CBCT. So the metal artifact reduction methods became on the rise. In addition, the application of convolutional neural network based structure in metal artifact reduction has shown a great performance, still it lacks of extracting features which both efficiently removes artifact and restores the tissue structure. In this study, we propose the dual encoder fusion UNet structure for effective cone-beam CT metal artifact reduction, which can extract both the artifact removal feature and tissue structure feature through dual encoder network.

## **METHODS AND MATERIALS**

Our model architecture is based on UNet architecture with two encoders. The first encoder mostly focuses on removing metal artifact rather than restoring the tissue structure, and the second encoder focuses on restoring the tissue structure instead of removing metal artifacts. Two bottleneck features are fused through attentional fusion, which consist of spatial and global attention. Similar to bottleneck feature fusion, the encoder features for skip connection is fused using attentional fusion. Our model was trained in generated synthetic dataset for 100 epochs with mean squared error and auxiliary loss. Auxiliary loss was calculated by direct mean squared error between the encoder feature and target. And our model was evaluated on mean squared error(MSE), peak signal-to-ratio(PSNR), pearson correlation coefficient(PCC), and structural similarity(SSIM). The quantitative analysis has also done in real patients.

## **RESULTS**

Compared to single encoder architectures with similar parameter numbers, our model has shown the noticeable performance in both synthetic data real patients without ground truth. The evaluation metric(MSE, PSNR, PCC, SSIM) in synthetic data is 0.000086, 41.859071, 0.993072, 0.993681. Our model has removed the metal artifact effectively, and shown the best structure restoration in real patients while other models has made the greyish artifacts for the restoration.

## **CONCLUSION**

s In this study, we proposed the dual encoder UNet architecture for effective metal artifact reduction, and it has shown that model can focus on both effective artifacts reduction and tissue structure restoration. We also showed that attention-fused features helps in performance of artifact removal and tissue restoration.

## **CLINICAL RELEVANCE/APPLICATION**

We expect that our proposed model can be successfully applied to the metal artifact reduction especially in CBCT for radiation treatment, since there is no artifact reduction software for CBCT at this moment.

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## Abstract Archives of the RSNA, 2023

T5A-SPRO

### Radiation Oncology Tuesday Poster Discussions I

#### Sub-Events

#### **T5A-SPRO-1 The Application Value of Energy Spectrum CT Iodine-water Scatter Plot in Predicting Surgical Margins of Pancreaticoduodenectomy**

#### **PURPOSE**

To predict the surgical margins of pancreaticoduodenectomy by analyzing the energy spectrum CT iodine-water scatter plot of patients with duodenal malignant tumors and adjacent normal tissues, and to guide the optimal selection of clinical surgical targets.

#### **METHODS AND MATERIALS**

28 patients with duodenal malignant tumor were selected as research objects, and the patients were retrospectively collected with surgical pathological confirmation and complete energy spectrum CT scan data before surgery, and multi-point delineation and analysis of iodine-water scatter plots were performed in the solid part of duodenal malignant tumor and the area of interest of surgical margin. Statistical analysis of iodine-water scatter plot and postoperative pathology diagnosis rate.

#### **RESULTS**

There was a clear demarcation between the solid part of the lesion and the iodine-water scatter plot of the surgical margin, and the diagnosis rate with the postoperative pathology was 100%, with a statistically significant difference ( $p < 0.05$ ).

#### **CONCLUSION**

s The negative/positive surgical margins of pancreaticoduodenectomy can be distinguished by using energy spectrum CT iodine-water scatter plot to maximize the preservation of normal tissues around the margins.

#### **CLINICAL RELEVANCE/APPLICATION**

The application value of energy spectrum CT iodine-water scatter plot in predicting surgical margins of pancreaticoduodenectomy

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## Abstract Archives of the RSNA, 2023

T5A-SPVA

### Vascular Imaging Tuesday Poster Discussions I

#### Sub-Events

#### T5A-SPVA-1 Magnetic resonance Lymphangiography - An Initial Clinical Experience

##### PURPOSE

Lymphedema is defined by chronic accumulation of fluid in soft tissue. Due to an increasing number of lymphonectomies associated with breast or pelvic surgery in the past years, secondary lymphedema has become more prevalent. Many patients fail conservative treatment and need surgery, e.g. lymphaticovenous anastomosis (LVA). For surgical treatment planning, visualization of lymphatic vessels is crucial. Established lymphography procedures like lymphoscintigraphy and indocyanine lymphography suffer from poor spatial resolution or in case of conventional lymphangiography require surgical isolation. Magnetic resonance lymphangiography (MRL) is an emerging imaging technique, allowing non-invasive visualization of lymphatic vessels. We report on our initial experience with MRL in patients with suspected lymphedema including patients after microsurgical therapy.

##### METHODS AND MATERIALS

11 consecutive patients (11 female; mean age 46 years) undergoing MRL between 05-2022 and 04-2023 were included. In 10/11 (91%) patients with suspected lymphedema final work-up confirmed the diagnosis. 9/10 had secondary lymphedema (7 after lymphonectomy, 1 after liposuction; 1 postpartum) and 1/10 patients had idiopathic lymphedema. The remaining patient suffered from chronic venous obstruction. 10/11 (91%) showed edema in the lower extremities, 1/11 (9%) in the upper extremities. 3 patients underwent LVA-surgery prior to MRL resulting in a total of 10 anastomoses. MRL was performed on a 1.5 T system. For evaluation of the extent of edema a T2w TSE DIXON was obtained. To visualize the lymphatic system a T1w GRE with fatsat was obtained after interstitial transpedal injection of a gadolinium-based contrast agent (Gadobutrol). Analysis included location and extent of edema, technical success rate and qualitative assessment of the MRL images.

##### RESULTS

In all patients MRL was technically successful without complications and allowed direct visualization of the lymphatic vessels. 8/10 LVAs were identified on MRL. In one patient, lymphatic inflow to iatrogenic lymphoceles after liposuction was directly visualized by MRL. Based on MRL 9/10 patients were correctly diagnosed with lymphedema. MRL correctly identified the one patient with chronic venous obstruction. MRL led to either performed or scheduled LVA surgery in 6/10 cases. Three patients continued to be treated conservatively.

##### CONCLUSION

MRL appears to be a safe and precise for diagnosis of lymphedema and allows reliable visualization of the lymphatic vessels including LVAs.

##### CLINICAL RELEVANCE/APPLICATION

MRL seems to be a promising addition to established lymphography procedures, particularly for treatment planning in patients scheduled for LVA or for postoperative follow-up after LVA.

#### T5A-SPVA-2 Validation of Correlation between Signal Intensity Gradient from Time-of-flight Magnetic Resonance Angiography and Wall Shear Stress by Phase-contrast Magnetic Resonance

##### PURPOSE

Arterial wall shear stress (WSS) contributes to atherosclerosis from its inception, progression, and disruption of plaque. However, there is no useful, non-invasive clinically accessible screening tool to measure arterial WSS. We aimed to investigate whether the signal intensity gradient (SIG) from Time-of-Flight Magnetic Resonance Angiography (TOF MRA) is associated with WSS determined by phase contrast Magnetic Resonance (PC MR), using both an experimental and human studies for both carotid and vertebral arteries.

##### METHODS AND MATERIALS

For the experimental study, we measured WSS in 4-sized tubes (4 to 11 mm diameters) with variable flow rates using both PC MR and TOF MRA. For the human study, all subjects were examined with the TOF MRA and PC MR in the carotid and vertebral arteries, and their arterial WSS and SIGs were determined in the same segment. The viscosity of water was set as 1 centiPoise (cP, 20?), and whole blood viscosity was calculated subject-specifically using hematocrit. Pearson's correlation coefficients, and line fitting equations were used for statistical analysis.

##### RESULTS

The experimental study applied various flow rates of water, ranging from 0.06 to 12.75 mL/s. The WSS ranged from 0.1 to 1.6 dyne/cm<sup>2</sup>. The correlation between WSS from PC MR and SIG of TOF MRA was significant, showing a coefficient 0.86, (p<0.001, R<sup>2</sup>=0.75). For the WSS in human arteries, 28 subjects were enrolled (11 females, mean age of 62 years). The arterial WSS ranged from 1.9 to 21.0 dyne/cm<sup>2</sup>. Both carotid and vertebral arteries showed significant correlations between WSS and SIG, with coefficients of 0.85, 0.86, 0.91, and 0.81 in the right, left carotid and vertebral arteries, respectively).

## CONCLUSION

s TOF MRA SIG provides in vivo hemodynamic information that measures arterial shear stress concurrently. Future studies are needed for a feasibility of generalization in various MR machines and persons of different races and ethnicity.

## CLINICAL RELEVANCE/APPLICATION

The SIG is a surrogate measure of arterial WSS and it could be obtained from TOF MRA. There is no technical hurdle to get it, unlike the cardiac pacing and velocity encoding (VENC), and it usually takes less than 5 minutes for the whole arteries examined. The signal intensity of TOF MRA contains hemodynamic information including arterial WSS. We authors believe there can be a pragmatic application of SIG in clinical and experimental fields in the future.

## T5A-SPVA-3 Single-phase Steady-state Ferumoxytol-enhanced MR Angiography of Neck, Chest, Abdomen, and Pelvis: A Feasibility Study

### Participants

Soheil Kooraki, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Comprehensive vascular imaging is often required as part of the pre-multi visceral transplant workup. This study aimed to assess the feasibility of single-phase steady-state Ferumoxytol-enhanced (Fe-MRA) for vascular mapping of neck, chest, abdomen and pelvic arteries and veins.

## METHODS AND MATERIALS

In this IRB-approved, HIPAA-compliant, single-center study, eleven patients (5 females, median age of 24 years, ranging from 5-93) underwent a single-phase Fe-MRA of neck, chest, abdomen, and pelvis as part of the pre-multi visceral transplant assessment. The Fe-MRA was achieved by slow intravenous infusion of 4 mg/kg ferumoxytol and using a 1.5 or 3 Tesla MR scanner. The time from localizer image acquisition to completion of the angiographic acquisition was measured. Two radiologists independently scored images for overall quality, motion artifact, diagnostic confidence for assessment of arterial and venous segments, using a 5-point Likert scale (5: excellent, 4: good, 3: diagnostic, 2: limited, 1: non-diagnostic). Inter-observer agreement was assessed using Intraclass Correlation Coefficient.

## RESULTS

The scans were technically successful, with an average scan time of 11 minutes (ranged 5-25 minutes) and without any major adverse effects. The overall image quality was excellent in 7, good in 3 and diagnostic in one patient(s), and there were no non-evaluable vascular segments in any of the scans. A total of 545 named vascular segments were scored, of which the image quality for diagnostic confidence was good to excellent in 91.7% (500/545). There were not any motion artifacts to impede the diagnostic assessment (all scores = 3). There was excellent inter-reader agreement for scoring diagnostic confidence in each vascular segment (all  $\kappa > 0.9$ ).

## CONCLUSION

s This study demonstrated the feasibility, high image quality and diagnostic confidence of Fe-MRA for comprehensive vascular mapping in pre-multi visceral transplant workup. The scan can be completed in as little as 5 minutes.

## CLINICAL RELEVANCE/APPLICATION

Non-nephrotoxic Fe-MRA is a quick and feasible method for comprehensive vascular mapping in patients who are undergoing multi-visceral transplant, with the advantage of obtaining both arteriogram and venogram in a single-phase image.

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## Abstract Archives of the RSNA, 2023

T5B-SPBR

### Breast Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPBR-1 Artificial Intelligence DWI without Segmentation Has Comparable Diagnostic Performance with Standard Breast MRI in the Differentiation of Malignant and Benign Breast Tumors**

##### Participants

Mami Iima, MD, PhD, Kyoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Our aim was to develop a machine-learning model that can differentiate benign and malignant breast tumors using diffusion-weighted MRI.

##### METHODS AND MATERIALS

This prospective study included 530 breast lesions. 334 breast lesions with confirmed histology or no enlargement on follow-up were analyzed. The data was divided into dataset for train and 10-fold cross-validation (139 malignant 67 benign) and test dataset (85 malignant, 43 benign) with no overlap of patients. 3T breast MRI DWI was acquired with 5 b values up to 1500 s/mm<sup>2</sup> in addition to DCE-MRI. Only the lesion slice was selected without lesion segmentation. To develop a deep-learning model that can differentiate between benign and malignant tumors, we compared various combinations of basic data augmentations: A: random elastic deformation, B: random affine transformation/random noise, and C: mix-up. The small 2D CNN model was also compared to 3D CNN and ResNet18. The diagnostic performance of the deep learning model obtained from DW images and standard breast DCE MRI based on BI-RADS was evaluated using ROC analysis.

##### RESULTS

The augmentations improved accuracy in all experiments (AUC:0.86-0.90 VS. 0.86 in validation dataset, and AUC:0.85-0.88 VS. 0.87 in test dataset) except augmentation C (AUC:0.86 and 0.83). The result using 2D CNN resulted in a better AUC than 3D CNN (AUC:0.88-0.90 VS. 0.72-0.75). All results of 10-fold cross validations showed small 2D CNN with data augmentation A and B to be the best model (AUC: 0.90), and it was also the best against test dataset (AUC:0.88) that was comparable to standard breast MRI (0.89 and 0.87). Specificity tended to be higher in the deep learning model with 2D CNN from DW images than in standard breast MRI (85% VS. 81% in validation dataset, and 81% VS. 74% in test dataset), with higher sensitivity in standard breast MRI (80% VS. 98% in validation dataset, and 86% VS. 99% in test dataset).

##### CONCLUSION

While some studies evaluated the diagnostic performance of breast MRI using deep learning, so far as we know, no study has yet evaluated using only breast DWI with a deep learning model. AI can achieve good performance comparable to standard breast MRI for differentiating between malignant and benign breast tumors. DWI-AI provided better specificity than standard breast DCE-MRI, while the sensitivity was slightly inferior. Those results underline the great potential of supplementing the diagnostic performance of standard breast MRI with variable specificity, without additional reading time by breast radiologists, and beneficial in patients who are allergic to contrast agents.

##### CLINICAL RELEVANCE/APPLICATION

A machine-learning model with diffusion-weighted MRI has the potential to improve specificity in distinguishing between benign and malignant breast tumors.

#### **T5B-SPBR-3 Breast Lesion Morphology Assessment with High and Standard b Values in Diffusion-weighted Breast MRI at 3.0 Tesla**

##### Participants

Sara Christner, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

This investigation compared diffusion weighted imaging (DWI) with b values of 800 and 1600 s/mm<sup>2</sup> to dynamic contrast-enhanced imaging (DCE) for lesion morphology assessment in high-resolution breast MRI at 3.0 Tesla - an area that has been occupied traditionally by DCE.

##### METHODS AND MATERIALS

Multiparametric breast MRI was performed in 91 patients with 93 histopathologically proven lesions (31 benign, 62 malignant). Two radiologists evaluated three datasets per patient independently and assessed lesion visibility and BIRADS morphology criteria. Bland-Altman analyses were conducted for lesion size comparisons. In addition, diagnostic accuracy was calculated for each reader and dataset.

##### RESULTS

The overall diagnostic accuracy for lesion morphology assessment was significantly higher for DWI 800 (0.88) and DWI 1600 (0.89) than for DCE (0.78) (p < 0.001).

The visibility of carcinomas was considered better compared to benign findings in both DWI800 and DWI1600 ( $p < 0.001$ ) with no  $b$  value-dependent difference. Similarly, mass lesions were easier assessable compared to non-mass lesions, irrespective of the DWI images'  $b$  value ( $p < 0.001$ ). Intra-reader reliability for the analysis of morphologic BIRADS criteria among DCE and DWI datasets was at least moderate ( $\kappa = 0.557$ ), while at least substantial inter-reader agreement was ascertained over all assessed categories ( $\kappa = 0.776$ ). In pairwise Bland-Altman analyses, the measurement bias between DCE and DWI800 was 0.7 mm, whereas the difference between DCE and DWI1600 was 2.8 mm. DWI1600 images allowed for higher specificity than DCE ( $p = 0.007/0.062$ ).

## CONCLUSION

s DWI can be employed for reliable morphologic lesion characterization in high-resolution breast MRI. The use of high  $b$  values increases diagnostic specificity, while lesion size assessment is more precise with standard 800 s/mm<sup>2</sup> images.

## CLINICAL RELEVANCE/APPLICATION

Given ongoing concerns regarding the safety of Gd-based contrast media and continuing efforts on abbreviated breast MRI protocols, morphology assessment using DWI shows promising results in the differentiation of malignant from benign breast lesions.

## T5B-SPBR-4 Association of Preoperative MRI with Breast Cancer Treatment and Survival: A Single Institution Observational Study

Participants

Berat Bersu Ozcan, MD, Dallas, TX (Presenter) Nothing to Disclose

## PURPOSE

To evaluate the association between preoperative breast MRI with surgery type, contralateral cancer, recurrence-free (RFS) and overall survival (OS) in women with early stage breast cancer.

## METHODS AND MATERIALS

In this single institution, retrospective study, we identified women with Stage I-III breast cancer diagnosed between 03/01/2014-03/31/2021 with available follow-up. Patient and tumor characteristics were recorded. Two cohorts were created based on the use of preoperative MRI (PMRI) versus not (NoMRI) with Wilcoxon signed-rank and  $\chi^2$  tests utilized for cross-group comparisons. Kaplan-Meier method and log-rank tests were used to compare RFS and OS in women with and without MRI. Multivariable Cox proportional hazards model analysis was performed to evaluate RFS and OS by preoperative MRI status while controlling for other variables that could adversely impact outcomes.

## RESULTS

593 eligible patients were included [322 (54.3%) with PMRI, 271 (45.7%) noMRI]. Mean patient age was younger (53.8±11.8 vs 59.3±12.6 years,  $p < 0.001$ ) and dense breasts more common (51.4% vs 22.0%,  $p < 0.001$ ) in PMRI group. Seventeen bilateral cancers (2.9%) were in PMRI (14/17, 82.4% only detected on MRI) vs 10 (1.7%) in no-MRI ( $p = 0.34$ ). No significant difference between clinical Tstage rates (cT0-2 88.8% ; 91.9% ,  $p = 0.22$ ) or invasive molecular subtype (luminal A, 22.7% vs 28.5%; luminal B, 56.3% vs 46.6%; HER2, 5.4% vs 4.1%; triple negative, 15.5% vs 20.7%,  $p = 0.13$ ) in MRI vs no-MRI groups, respectively. PMRI group had higher rates of cN+ (27.3% vs 18.1%,  $p < 0.01$ ), and neoadjuvant therapy (41.3% vs 18.8%,  $p < 0.001$ ). Total mastectomy (57.8% vs 51.3% ,  $p = 0.12$ ), margin positivity (6.2% vs 7.4%,  $p = 0.57$ ), recurrence (10.2% vs 7.0%,  $p = 0.17$ ) and death rates (8.1% vs 7.7%,  $p = 0.88$ ) were similar in PMRI vs noMRI, respectively. At median follow-up of 69 months (IQR, 61-75), time to recurrence was [24 (IQR, 18-48) vs 23 (IQR, 9-30) months,  $p = 0.05$ ] . Mastectomy rates remained comparable after adjusting for age and breast density ( $p = 0.28$ ). Contralateral cancers were identified sooner and more frequently in the no-MRI group [4 (2.1%) vs 2 (0.9%) cancers, 21±20 vs 48±13 months].

## CONCLUSION

s In this single-institution retrospective study, the use of preoperative MRI is not associated with improved surgical margin, RFS or OS. At surveillance contralateral cancers are identified earlier and more frequently in the noMRI group.

## CLINICAL RELEVANCE/APPLICATION

Detecting clinically and mammographically occult contralateral breast cancers on preoperative MRI may help decrease contralateral cancer events at early surveillance.

## T5B-SPBR-5 Delineating Benign from Malignant Breast Lesions with Tumor Subregion Complexity using Fractal Analysis

## PURPOSE

To assess the feasibility of using fractal analysis in habitat analysis for the differential diagnosis of benign and malignant breast lesions, and to evaluate its diagnostic performance compared to conventional heterogeneity features extracted from the whole tumor.

## METHODS AND MATERIALS

A retrospective study was conducted on 97 patients with histologically confirmed breast lesions (75 malignant, 22 benign). Diffusion-weighted imaging (DWI) and dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) were acquired, and three tumor habitats were defined based on perfusion and cellularity characteristics. Fractal dimensions (FDs) were calculated for each habitat, and diagnostic performance was compared using the area under the receiver operating characteristic curve (AUC).

## RESULTS

The FD of hypervascular habitat (FD 1) showed a statistically significant difference ( $p < 0.001$ ) between malignant and benign lesions. The AUC of FD 1 (0.925, 95% CI 0.854 - 0.969) was higher than that of the conventional heterogeneity of the whole lesion (0.671, 95% CI 0.568 - 0.763), indicating improved diagnostic performance. Hypervascular cellular habitat, characterized by relatively low ADC and high wash-in, demonstrated a remarkable ability to discriminate breast cancer from benign lesions.

## CONCLUSION

s This pilot study reveals that FD features generated by habitat analysis could better differentiate benign from malignant breast

lesions compared to conventional heterogeneity features extracted from the whole tumor. The predictive model combining tumor habitats MRI and fractal analysis could prove useful as a screening tool, suggesting that fractal analysis may play an essential role in identifying patients whose breast lesions are more likely to behave aggressively.

#### **CLINICAL RELEVANCE/APPLICATION**

Fractal analysis of MRI tumor habitats enhances differential diagnosis of breast lesions, aiding in personalized treatment decisions.

#### **T5B-SPBR-6 Utilizing a Continuous Time Random Walk Diffusion Model to Differentiate Benign and Malignant Breast Lesions and Predict Prognostic Factors**

##### **PURPOSE**

This exploratory study aimed to assess the potential of a Continuous Time Random Walk (CTRW) diffusion model in distinguishing between benign and malignant breast lesions and to examine the relationships between CTRW parameters and pathologic factors.

##### **METHODS AND MATERIALS**

Eighty five patients with histopathologically confirmed breast lesions (88 breast lesions, 70 malignant and 18 benign lesions) were included in this prospective study. MRI examinations were conducted with a 3.0T scanner (uMR 790, United Imaging Healthcare, Shanghai, China) to acquire 16 b value (0, 10, 20, 30, 50, 70, 100, 150, 200, 400, 800, 1200, 1500, 2000, 2500, 3000 s/mm<sup>2</sup>) DWI. The CTRW parameters (Dm, a, and β) and ADC were compared between benign and malignant lesions using the Mann Whitney U test. Spearman correlation was employed to assess the relationships between the parameters and prognostic factors. Additionally, binary logistic regression and receiver operating characteristic (ROC) curve analysis were used to evaluate the diagnostic performance of individual ADC or CTRW parameters and their combinations. A P value < 0.05 was considered significant.

##### **RESULTS**

Malignant lesions had a significantly lower ADC value ( $1.078 \pm 0.254 \times 10^{-3}$  mm<sup>2</sup>/sec) compared to benign lesions ( $1.418 \pm 0.296 \times 10^{-3}$  mm<sup>2</sup>/sec) (P < 0.001). The CTRW parameters Dm, a, and β were also significantly lower (P<0.001, P<0.001, and P=0.024, respectively) in malignant lesions ( $1.019 \pm 0.285 \times 10^{-3}$  mm<sup>2</sup>/sec,  $0.852 \pm 0.092$ , and  $0.843 \pm 0.088$ , respectively) relative to benign lesions ( $1.437 \pm 0.307 \times 10^{-3}$  mm<sup>2</sup>/sec,  $0.948 \pm 0.065$ , and  $0.886 \pm 0.054$ , respectively). ROC analysis revealed that combining all the CTRW parameters (Dm, a, and β) yielded the best AUC of 0.833 and the highest sensitivity (94.3%) for differentiation of malignant lesions. Spearman correlation analysis demonstrated that β had a significantly positive association with Ki 67 expression (r = 0.263, P = 0.028) and a significantly negative correlation with ER and PR expression (r = -0.363, P = 0.002 and r = -0.413, P < 0.001, respectively). Additionally, Ki 67 expression was negatively correlated with Dm and ADC (r = -0.326, P = 0.006, and r = -0.313, P = 0.008, respectively), while PR expression was positively correlated with Dm and ADC (r = 0.282, P = 0.018 and r = 0.253, P = 0.034, respectively).

##### **CONCLUSION**

Our study highlighted the significant diagnostic value of the advanced non Gaussian CTRW model in breast cancer malignancy and prognostic factors, enhancing diagnostic performance for breast lesions.

#### **CLINICAL RELEVANCE/APPLICATION**

CTRW parameters could serve as noninvasive quantitative imaging markers to evaluate malignancy and prognostic factors of breast lesions.

#### **T5B-SPBR-7 Do Breast Oedema and Shrinkage Pattern during NAC Provide Additional Value for Predicting Treatment Response in Locally Advanced Luminal Breast Cancer?**

##### **PURPOSE**

To explore the predictive value of oedema and shrinkage patterns for the neoadjuvant chemotherapy (NAC) response in luminal breast cancer and whether they have added value when combined with traditional MRI features such as tumour size and apparent diffusion coefficient.

##### **METHODS AND MATERIALS**

Patients with luminal breast cancer were consecutively enrolled in this retrospective study to assess the relationship between MRI features and treatment response (including pCR and Miller-Payne [M-P] grade). Patients were classified into the development cohort and validation cohort. The traditional MRI features, breast oedema and shrinkage pattern were assessed before and early NAC (within 2 cycles of NAC). Oedema was divided into four categories (grade 1: no oedema, grade 2: peritumoral oedema, grade 3: prepectoral or subcutaneous oedema, grade 4: diffuse oedema), and regression was refined into two categories (concentric shrinkage and eccentric shrinkage). Univariate and multivariable analyses were used to identify independent imaging markers for pCR and MP grade. Prediction models were developed and evaluated for discrimination, calibration, and clinical applicability.

##### **RESULTS**

In total, 267 eligible patients were consecutively enrolled and divided into the development cohort (n=187) and validation cohort (n=81). Early diffuse oedema was a shared unfavourable biomarker in the prediction of both M-P grade and pCR (OR = 0.36 and 0.27). Peritumoral oedemas before and early NAC were another predictors of non-pCR (OR = 0.69 and 0.23), while unchanged or increased oedema grade during NAC (OR = 0.25 and 0.20) were another predictors of ineffective treatment, respectively. The addition of oedema improved the predictive value of tumour size for M-P grade (AUC from 0.64 to 0.71) and pCR (AUC from 0.67 to 0.74). The shrinkage pattern showed potential predictive value for M-P grade (P = 0.049) and pCR (P = 0.041) in the univariate analysis but was not an independent indicator. Prediction models showed comparable performance for predicting M-P grade and pCR in both the development (AUC = 0.82 and 0.81) and validation cohorts (AUC = 0.79 and 0.78).

##### **CONCLUSION**

Breast oedema is a valuable predictor of treatment response in luminal breast cancer in that it improves the performance of tumour size. The predictive value of the shrinkage pattern remains to be further studied.

#### **CLINICAL RELEVANCE/APPLICATION**

The goal of this work is to develop an MRI-based model for a more accurate prediction of response to NAC in patients with luminal

breast cancer. The model utilizes conventional MRI features instead of radiomics and novelty is introduced to the model by describing four types of edema that have long been shown to be predictive and prognostic that are readily available in clinics.

### **T5B-SPBR-8 Diagnosis of Breast Lesions on MRI using BI-RADS and Kaiser Scores in Mass and Non-Mass Enhancement: Benefit of KS and KS+ for Readers with Different Experience Levels**

Participants

Jiejie Zhou, PhD, MD, Wenzhou, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Kaiser score (KS) is a machine learning-derived clinical decision rule based on MRI BI-RADS descriptors, which provides the structure of an intuitive flowchart to guide the reader through a stepwise lesion assessment. The main considered features are root sign, DCE pattern, internal enhancement, and peritumoral edema. This study is aiming to: (1) compare the diagnostic performance of three readers with different experiences for breast cancer using BI-RADS and KS systems; (2) evaluate the benefit of the modified KS+ when diffusion was considered; and (3) separately assess the diagnostic performance in mass and NME lesions.

#### **METHODS AND MATERIALS**

A total of 630 patients including 393 malignant and 237 benign pathological confirmed lesions were analyzed. Based on the morphology, the cases were separated into 458 masses and 172 NMEs. Three radiologists with different levels of experience in breast MRI (3, 6, and 13 years) reviewed the cases to make a diagnosis using BI-RADS descriptors and KS. Of the 630 cases, 596 cases (434 mass and 162 NME) had DWI, and the apparent diffusion coefficient (ADC) was measured to modify KS to KS+. For lesions with  $ADC = 1.4 \times 10^{-3} \text{ mm}^2/\text{s}$ , the KS was reduced by 4. The diagnostic AUC of KS and KS+ made by three readers in mass and NME were compared to evaluate the benefit of KS+.

#### **RESULTS**

The diagnostic performance increased with years of experience among three readers. When using BI-RADS, AUC was 0.878, 0.915, and 0.941 for mass, and 0.771, 0.838, 0.902 for NME for Reader-1, 2, and 3, respectively (Table 1). When using KS compared to BI-RADS, the AUC was improved for the less experienced Readers. For Reader-1, AUC was increased from 0.878 to 0.916 for mass ( $p=0.005$ ), and from 0.771 to 0.822 for NME ( $p=0.124$ ). For Reader-2, AUC was about the same for mass (0.915 to 0.921) and increased from 0.838 to 0.883 for NME ( $p=0.114$ ). For the most experienced Reader-3, the results made by BI-RADS and KS were about the same. When ADC was considered to change to KS+, the AUC was significantly improved for all three readers for the mass lesions, but AUC was about the same for NME.

#### **CONCLUSION**

The benefit of KS was more remarkable for mass than for NME, especially for the less experienced reader. The root sign and internal enhancement were not well defined for NME, and since many NMEs would show the plateau DCE pattern, this feature was not helpful either. When considering ADC to modify KS to KS+, again, the benefit was mostly seen for mass, possibly due to the use of the cut-off threshold of  $1.4 \times 10^{-3} \text{ mm}^2/\text{s}$  developed from mass lesions.

#### **CLINICAL RELEVANCE/APPLICATION**

Kaiser Score provides an intuitive method for lesion interpretation, which is mostly helpful for mass lesions read by less experienced readers. KS+ is mainly applicable to mass lesions. For NME, the KS criteria need to be improved.

### **T5B-SPBR-9 A Pilot Study on the Correlation between the Parameters of Oscillating Gradient Spin Echo based Diffusion Weighted MRI and Pathological Lymphatic Vessel Invasion in Breast Cancer**

Participants

Lanqing Yang, Chengdu, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To explore the value of oscillating gradient spin echo (OGSE) based diffusion weighted MRI in predicting the lymphatic vessel invasion (LVI) status in patients with breast cancer.

#### **METHODS AND MATERIALS**

22 biopsy proved breast cancer patients were prospectively enrolled in this study. They all received preoperative clinical routine breast MRI, including T2 weighted imaging (T2WI), T1 weighted imaging (T1WI), diffusion weighted imaging (DWI), and contrast dynamic enhancement (DCE); and OGSE DWI sequences, including pulsed gradient spin echo (PGSE), OGSE(N=1), and OGSE (N=2). Patients were grouped into LVI negative (n=16) and positive (n=6) groups, with reference to pathological reports of surgical specimens. ROIs delineation was independently performed by two radiologists on three largest slices of tumor on  $b=1000 \text{ s}/\text{mm}^2$  images. Then, four quantitative parameters of Vin (intracellular volume fraction), Dex (mean extracellular diffusivity), D (mean cell size) and cellularity were derived from MATLAB software. Interobserver agreement assessment, independent t test, Mann-Whitney U test, ROC analysis, and spearman correlation analysis were used for statistical analyses.

#### **RESULTS**

The overall interobserver agreement was excellent for two radiologists of Dex value (intraclass correlation coefficient,  $ICC=0.865$ ). Patients with LVI positive status had significantly lower Dex value compared with LVI negative group ( $1.686 \pm 0.170$  vs.  $2.107 \pm 0.183 \times 10^{-3} \text{ mm}^2/\text{s}$ ,  $P=0.007$ ). ROC results showed that Dex presented a high AUCs of 0.958 in predicting LVI status. In addition, there was also significant strong negative correlation between LVI status and the value of Dex, with a spearman rank correlation coefficient of 0.710 ( $P=0.014$ ). Other parameters including Vin, D, and cellularity showed no significant difference between two groups.

#### **CONCLUSION**

Dex (mean extracellular diffusivity) value calculated from OGSE DWI sequences could help to predict the LVI status of breast cancer.

#### **CLINICAL RELEVANCE/APPLICATION**

lymphatic vessel invasion (LVI) is a high-risk factor for blood metastasis of breast cancer, which suggests that breast cancer

patients have a higher risk of recurrence and metastasis, and a poor prognosis. Preoperative evaluation of LVI status with MRI could help risk stratification, thus may guide the clinical management of patients with breast cancer.

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## Abstract Archives of the RSNA, 2023

T5B-SPCA

### Cardiac Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPCA-1 Vascular Enhancement and Radiation Dose on 256-slice CT Angiography with Reduced Iodinated Contrast Volume for Pre-operative TAVI: Comparison of 64-slice CT Angiography with Standard Iodinated Contrast Volume**

Participants  
Takayuki Yoshiura, BA, RT, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Multi-slice CT is now the standard noninvasive imaging method for preoperative evaluation of transcatheter aortic valve implantation (TAVI). The purpose of this study is to evaluate the vascular attenuation and radiation dose on 256-slice CT with reduced iodinated contrast volume for pre-operative TAVI as compared to 64-slice CT with standard iodinated contrast volume.

#### METHODS AND MATERIALS

The study included 52 patients who underwent pre-TAVI CT scan with the 64-slice CT (Lightspeed VCT; GE Healthcare, Milwaukee, Wisconsin) and 47 patients who underwent pre-TAVI CT scan with the 256-slice CT (Revolution Apex; GE Healthcare, Milwaukee, Wisconsin). A contrast dose was injected at 450 mgI/kg over 22 seconds on 64-slice CT and 300 mgI/kg over 20 seconds on 256-slice CT, respectively. Measurements were performed on the CT enhancement of the ascending aorta (AAO), abdominal aorta (Abd AO), both subclavian arteries (SCA), and both femoral arteries (FA) as well as for the image noise of muscle tissue; then the contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were calculated. The volume CT dose index (CTDIvol) and dose length product (DLP) were recorded for both CT scans.

#### RESULTS

Despite the reduced iodinated contrast volume on 256-slice CT, the vascular enhancement of both SCA were significantly higher than those for 64-slice CT ( $p < 0.01$ ), with no significant differences in the other access routes in both CT scans. The CNR for AAO, Abd AO and both SCA was significantly higher the 256-slice CT, with no significant differences in the other access routes ( $p > 0.01$ ). The SNR was significantly higher the 256-slice CT for Abd AO and both SCA, with no other significant differences. The radiation dose for 64-slice and 256-slice CT scans were 82.4 mGy and 68.3 mGy for CTDIvol, and 2342.9 mGy-cm and 2066.7 mGy-cm for DLP, respectively. The radiation dose with 256-slice CT was obtained lower values.

#### CONCLUSION

The 256-slice CT with reduced iodinated contrast volume for pre-operative TAVI resulted in reduction of radiation dose and maintained or improved the vascular enhancement of the aortic annulus and access route vessels, compared to 64-slice CT, despite using approximately 52% less iodinated contrast volume.

#### CLINICAL RELEVANCE/APPLICATION

256-slice CT with reduced iodinated contrast volume for pre-operative TAVI maintains image quality and reduced radiation dose.

#### **T5B-SPCA-2 Estimation of High Coronary Artery Calcium (CAC) Score from Aortic Arch Calcification: An Efficient Tool for Selection of Non-optimal Candidates for Coronary CTA?**

Participants  
Pietro Giacomo Lacaita, MD, Innsbruck, Austria (*Presenter*) Nothing to Disclose

#### PURPOSE

Overutilization of healthcare resources is causing a high economic burden. Patients with high-CAC scores  $>1000$  AU are not optimal candidates for coronary CTA and can be more efficiently examined with other modalities (myocardial perfusion testing or a direct-to-ICA strategy). Therefore the objective of our study was to evaluate whether a 4-scale aortic arch calcification severity score predicts high-CAC scores ( $>1000$  AU and  $>800$  AU).

#### METHODS AND MATERIALS

162 patients referred to coronary/aortic CT Angiography and non-enhanced CAC score were enrolled (age 76.3 years, 45% females). Patients with prior PTCTI/STENT and CABG were excluded. The severity of aortic arch calcification was scored on a 4-point scale as 0=absent, 1=minimal ( $<25\%$  of circumference), 2=mild (25-50%), 3=moderate (50-75%) and 4=severe (100% of circumference) on thoracic CT (coronal MPR reformations).

#### RESULTS

In 130 patients, the absence of aortic arch calcification was highly accurate to rule out  $CAC > 1000$  AU (sens. 100%). No or minimal (grade 1) calcification had a high NPV of 95.6%, and no, minimal and mild (grade 1+2) a NPV of 86.96% to rule out  $CAC > 1000$  AU. There was a moderate correlation between grading of aortic arch calcification severity and CAC ( $r = 0.663$ ,  $p < 0.001$ ) by CT. In

patients with severe aortic arch calcium (grade 4), the prevalence of CAC >1000 was with 32/45 (71.1%) significantly higher as compared to other groups with 13/45 (28.8%)( $p < 0.001$ ). The AUC for the 4-scale aortic arch calcium severity score to predict CAC >1000 was  $c = 0.84$  ( $p < 0.001$ ; 95%CI:0.771-0.91) and similar for prediction of CAC>800 AU with  $c = 0.813$  ( $p < 0.001$ ;95% CI:0.686-0.865). AUC for prediction of CAC >1000 was slightly lower with  $c = 0.792$  for moderate-to-severe (grade 3+4) and  $c = 0.775$  for severe (grade 4) aortic arch calcification ( $p < 0.001$  for both).

## CONCLUSION

s Patients with moderate-to-severe aortic arch calcium have a high probability of CAC >1000 AU, but not those with no, minimal and mild calcifications. The absence of aortic arch calcium rules out CAC>1000 AU.

## CLINICAL RELEVANCE/APPLICATION

Estimation of aortic arch calcium severity is a valuable tool for a quick decision-making on the optimal non-invasive testing strategy (coronary CTA vs myocardial perfusion testing or a direct-to-ICA approach) for coronary artery disease in clinical routine.

## T5B-SPCA-3 Using 7.0T Cardiac MR to Explore Cangai Volatile Oil Treat Different Degrees of Myocardial Hypertrophy in Rats Exposed to Chronic Hypobaric Hypoxia at Plateau

Participants

Boshen Liang, Chengdu, China (*Presenter*) Nothing to Disclose

## PURPOSE

This study was intended to investigate whether cardiovascular magnetic resonance (CMR) imaging could reveal the protective effect of Cangai volatile oil (CAVO) on the heart of rats with chronic hypobaric hypoxia at plateau. On this basis, further explore the therapeutic effect of CAVO on isoproterenol induced myocardial hypertrophy in rats.

## METHODS AND MATERIALS

Seventy rats were randomized into the Control group (CON), plateau group (P group), P+ CAVOh (plateau + CAVOh), P+ CAVOI(plateau + CAVOI), P+MH (plateau+ myocardial hypertrophy,PM), P+MH+CAVOh(PM+ CAVOh), P+MH+CAVOI (PM+CAVOI). Except the Control group (altitude: 500 m), rats in other groups were transported to Yushu (altitude: 4,250m) for two months, where the group of PM,PM+CAVOh,PM+CAVOI were underwent intraperitoneal injection of ISO (3 mg/kg for 14 days) and P, P+CAVOh,P+CAVOI group were underwent intraperitoneal injection of saline in the same time. Left ventricular function, global strain of the rats can be measured by 7.0T high-field CMR and analyzed using the cine tissue tracking. Biochemical tests, histopathology and electronic microscopy were used to evaluate the protective effect of CAVO on the heart tissue of cardiac damage rats exposed to a high-altitude environment.

## RESULTS

The left ventricular ejection fraction (LVEF) and global strains were improved in all group after treat by CAVO compared with the Hypobaric Hypoxia group ( $p < 0.05$ ). Furthermore, the oxidative stress injuries were after CAVO treatment, evidenced by the increases of SOD, GSH-Px, while the decreases of MDA and LDH contents (all  $p < 0.05$ ). The results of western blot indicated that CAVO treatment dramatically restrained Keap-1, COL-1,  $\alpha$ -SMA protein expressions in cardiac tissues of mice, NRF2, HO-1 protein expression increased.

## CONCLUSION

s CAVO can reduce cardiac damage caused by hypobaric hypoxia and ventricular hypertrophy induced by Isoprenaline (ISO) at plateau through oxidative stress-related indicators, this effect can be measured by 7.0T high-field CMR.

## CLINICAL RELEVANCE/APPLICATION

This experiment provides a new treatment approach for different degrees of ventricular hypertrophy in plateau for clinical practice.

## T5B-SPCA-4 Feasibility Analysis of Non-ECG-triggered Chest LDCT using a kV-independent Reconstruction Algorithm for Predicting Cardiovascular Disease Risk in Patients Receiving Maintenance Hemodialysis

## PURPOSE

This study aimed to explore the feasibility and accuracy of non-electrocardiogram (ECG)-triggered chest low-dose computed tomography (LDCT) with a kV-independent reconstruction algorithm in assessing the degree of coronary artery calcification (CAC) and the risk of cardiovascular diseases in patients receiving maintenance hemodialysis (MHD).

## METHODS AND MATERIALS

181 patients receiving MHD who needed chest CT and coronary artery calcium score (CACS) scans underwent non-ECG-triggered, automated tube voltage selection, high-pitch chest LDCT scan using a kV-independent reconstruction algorithm (research scan) and ECG-triggered standard CACS scan (standard scan) sequentially. The image quality, radiation doses, CACS and cardiac risk classifications of the two scans were compared.

## RESULTS

Among the 181 patients, 89, 83, and 9 underwent scanning at 100, 110, and 120 kV, respectively. Excluding those scanned at 120 kV, 172 patients were enrolled. The Visual Scores (VSs) of the research scan showed high interobserver agreement (ICC = 0.944; 95% CI: 0.925-0.958). A significant difference was observed between the non-ECG-triggered VS and the standard CACS Agatston score (AS) on cardiac risk classification ( $\chi^2 = 34.333$ ,  $P < 0.001$ ; weighted kappa value = 0.813; 95% CI: 0.756-0.869). The accuracy of cardiac risk classification of non-ECG-triggered VS was 77.91% (134/172), considering the cardiac risk classification of standard CACS AS as the gold standard. Although the ASs obtained from the research scan were lower than those obtained from the standard scan ( $739.90 \pm 1098.38$  vs  $801.56 \pm 1129.60$ ;  $P < 0.001$ ), the agreement and correlation of them were excellent, and ICCs and Pearson's correlation coefficients were both  $> 0.96$ . No significant difference was observed in cardiac risk classifications between the two scans ( $\chi^2 = 3.933$ ,  $P = 0.269$ ), and the agreement was excellent (weighted kappa value = 0.936; 95% CI: 0.903-0.970). The accuracy of cardiac risk classification based on non-ECG-triggered AS was 92.44% (159/172). The effective radiation doses (ED) of the standard scan and the research scan were  $1.34 \pm 0.74$  mSv and  $1.04 \pm 0.35$  mSv. With the equivalent image quality, the average ED and CTDIvol of the research scan were reduced by 21.77% and 59.93%, respectively.

## CONCLUSION

s A CT protocol using the non-ECG-triggered, automated tube voltage selection, high-pitch chest LDCT protocol with a kV-independent reconstruction algorithm can accurately demonstrate the degree of CAC, maintain the overall cardiac risk classification and significantly reduce the radiation exposure of patients.

## CLINICAL RELEVANCE/APPLICATION

This protocol can implement one-stop scanning of the chest and CACS and significantly reduce the radiation dose.

### **T5B-SPCA-5 The feasibility of Free-breathing, Non-ECG with Cardiovascular Magnetic Resonance Multitasking for the Assessment of Left Ventricular Function**

#### PURPOSE

To evaluate the feasibility of cine images acquired through cardiac magnetic resonance (CMR) Multitasking, free of ECG gating and breath holding, in measuring left ventricular (LV) volume indexes and mass, compared with those measured through multi-breath-hold bSSFP sequence in clinical setting.

#### METHODS AND MATERIALS

A total of 30 healthy volunteers and 20 patients were enrolled for CMR examination. Each subject underwent bSSFP sequence with multiple breath-hold and Multitasking sequence under free breathing respectively. LV function indexes were measured on both images and compared with two sequences. Image quality was assessed by image quality score and contrast-to-noise (CNR).

#### RESULTS

LV ejection fraction (EF) was not significantly different between the two sequences in both healthy volunteers ( $p=0.451$ ) and patients ( $p=0.709$ ). However, LV end-diastolic mass (EDM) was overestimated by Multitasking in both healthy volunteers (bSSFP:  $56.2 \pm 9.3$  g, Multitasking:  $58.3 \pm 9.1$  g,  $p=0.005$ ) and patients (bSSFP:  $65.6 \pm 13.5$  g, Multitasking:  $67.9 \pm 14.1$  g,  $p=0.013$ ). CNR of the myocardium and the blood pool showed no difference between Multitasking and bSSFP sequences ( $p=0.478$ ). Moreover, both sequences achieved acceptable and comparable image quality score in LV function measurements.

#### CONCLUSION

s The feasibility of Multitasking for quantification of the LV functions without ECG gating or breath holding was tested successfully in healthy volunteers and patients.

## CLINICAL RELEVANCE/APPLICATION

Multitasking may become an alternative technique to bSSFP in certain conditions.

### **T5B-SPCA-6 Novel Technique of Multi-slice Acquisition of Simultaneous Myocardial T2-weighted Imaging (T2WI) and Multi-echo T2 Mapping using Deep Resolve Reconstruction (MS-T2WI/Map)**

#### Participants

Yui Tanaka, RT, Suita Osaka, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Myocardial T2-weighted image (T2WI) and T2 mapping, which are used to assess the edema and inflammation, require the long acquisition time, and mapping is acquired only single slice per single breath hold. Deep Resolve (DR) technique, which is novel reconstruction with denoising and increased sharpness based on deep learning architecture, permit the shortening scan time with maintaining image quality. The aim was to evaluate the feasibility of multi-slice acquisition of simultaneous T2WI and T2 mapping using DR technique (MS-T2WI/Map) for myocardial T2 characterization.

#### METHODS AND MATERIALS

We obtained the MS-T2WI/Map and conventional single-slice T2 map and T2WI in 10 volunteers and 14 patients with cardiomyopathy at short-axial slice, and volunteers underwent in repeated three times. MS-T2WI/Map consists of triple-contrast spin-echo (TE=13, 56 and 107 msec) with black-blood and fat suppression, and can acquire simultaneously 3 slices in a single breath-hold. The obtained images were reconstructed using DR method. T2 map was obtained using 3 TE images. Further, images with TE=56 msec yield T2WI. In T2WI, image quality using the 4-point scale and contrast ratio (CR) between myocardium and muscle were evaluated. In T2 map, we measured the T2 values at septal wall and obtained coefficient of variation (CV) in three times. In patients, the detection of focal abnormality in T2WI and T2 value (defined as  $>2SD$  of normal) were also evaluated.

#### RESULTS

The mean acquisition time of MS-T2WI/Map was 26 sec, which was 75% shorter than the conventional scans. There were no significant differences in image quality of T2WI between both scans. CR in MS-T2WI/Map showed good correlation with that in reference (volunteers:  $r=0.68$ , patients:  $r=0.86$ ). T2 values obtained from MS-T2WI/Map underestimated compared with conventional T2 map, but there were good correlation and agreement between two methods (volunteers:  $r=0.94$ , patients:  $r=0.65$ ). Further, CV in MS-T2WI/Map showed comparable reproducibility with conventional map. Abnormal myocardial changes were identified in all participants with MS-T2WI/Map in similar to conventional T2-based imaging.

#### CONCLUSION

s MS-T2WI/Map with DR is a promising tool for shortening acquisition time with equivalent image quality and T2 measurement to conventional sequences, enabling the multi-slice simultaneous myocardial T2 characterization in single-breath-hold.

## CLINICAL RELEVANCE/APPLICATION

MS-T2WI/Map permits the simultaneous myocardial T2WI and T2 map with equivalent image quality and quantification to conventional methods, enabling multi-slice assessment of focal disease. Our proposed method is useful and practical approach for the reduction of acquisition time and the integrated assessment of both T2WI and T2 map.

### **T5B-SPCA-7 Improving In-stent Stenosis Visibility for Prototype Photon Counting Detector CT with High-**

## resolution Plaque Kernel

### Participants

Yoshinori Funama, PhD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

### PURPOSE

Photon counting detector CT (PCD-CT) with dedicated high-resolution (HR) plaque kernel is newly introduced for improving in-stent stenosis visibility in coronary CT angiography. PCD-CT with HR-plaque kernel enable improved visualization and accurate assessment of coronary plaques. The present study aimed to investigate the performance of PCD-CT with HR-plaque kernel as compared with conventional energy-integrating detector CT (EID-CT) in terms of lumen size and in-stent stenosis visibility.

### METHODS AND MATERIALS

A vessel tube with non-calcified plaque in a 3.0-mm stent was scanned by using EID-CT (FUJIFILM Healthcare Corporation, Tokyo, Japan) and prototype PCD-CT (Ultra-High Resolution mode, FUJIFILM Healthcare Corporation) with HR-plaque kernel at 3 stent directions (0, 45, and 90 degrees). The tube voltage and tube current-time product were set at 120 kVp and 300 mAs. A rectangular region of interest was set across both sides of the stent struts with a 50% stenotic portion on multiplanar reformation (MPR) images. The profile curves were obtained from two types of PCD- and EID-CT images. The lumen size was calculated from the distance between the inner strut positions. The 50% stenotic portion was also measured using the profile curve.

### RESULTS

The lumen sizes for PCD-CT and EID-CT images were 2.13 and 1.80 mm at 0 degree, 2.20 and 1.17 mm at 45 degrees, 2.27 mm and 1.67 mm at 90 degrees. The lumen sizes for PCD were wider than those for EID-CT regardless of the stent directions. The measurements of in-stent stenosis were 67.6% - 72.7% at 0 - 90 degrees in PCD-CT. For EID-CT, the measurements of in-stent stenosis were 90.7% - 90.0% at 0 - 90 degrees. The stenotic portion for PCD-CT images enabled more accurate measurements than that for EID-CT. PCD-CT images and MPR images showed fewer blooming artifacts and better plaque conspicuity and iodine enhancement than EID-CT images.

### CONCLUSION

s PCD-CT images with HR-plaque kernel showed improved lumen size and accurate measurements of in-stent stenotic portion as compared with conventional EID-CT images regardless of the stent directions.

### CLINICAL RELEVANCE/APPLICATION

The PCD-CT with HR-plaque kernel provide better visibility of the coronary plaque and iodine enhancement and accurate assessment of the stenotic portion on coronary CT angiography.

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## Abstract Archives of the RSNA, 2023

T5B-SPCH

### Chest Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPCH-1 A Study Design for Quantitative Characterization of Pulmonary Gas Exchange in Long COVID Using Hyperpolarized <sup>129</sup>Xe MRI**

##### Participants

Aiah Alatoum, MBBS, Iowa City, IA (*Presenter*) Nothing to Disclose

##### PURPOSE

The use of hyperpolarized Xenon (HP-Xe) was approved by the FDA (Xenoview™) for MRI-based evaluation of lung function in adults and pediatric patients over 12 years. Quantitative characterization of ventilation and gas exchange metrics is critical in ensuring the accuracy and reliability of HP-Xe MRI as a diagnostic tool. This study provides a framework for quantitative validation using dual-energy computed tomography (DECT).

##### METHODS AND MATERIALS

15 participants with a history of COVID-19 (diagnosed 17+–5 months prior) of varying severity, were recruited. HP-Xe imaging of regional ventilation and gas exchange and contrast-enhanced perfusion imaging was performed on a 3T scanner. Gas exchange HP-Xe using a 1-point Dixon technique was used to estimate Xenon transfer into the pulmonary tissues and plasma (Membrane), as well as the red blood cells (RBC). The ratio of these signals, (RBC: Membrane), was used as the surrogate marker for gas exchange. The participants also underwent ventilation/perfusion (V/Q) imaging on DECT using non-contrast Total Lung Capacity (TLC) to virtual non-contrast Functional Residual Capacity (FRC) warping for V and DECT perfused blood volume (PBV as a surrogate for Q) at FRC. The heterogeneity of gas exchange was characterized using the 2nd moments of the normalized V and PBV distributions vs. V/Q ratio in the log scale (lnSDV and lnSDQ) in a 50-compartment model, similar to classical techniques for VQ matching. These metrics rely on absolute quantification of true ventilation and perfusion and have been adapted to the normalized CT-derived datasets.

##### RESULTS

Our study confirmed, as shown in previous literature, the correlation between RBC: Membrane from HP Xenon MRI and DLCO ( $R^2 = 0.74$ ,  $p=0.0005$ ) in our 15 participants. The baseline data from the 7 participants in the preliminary analysis showed that the RBC: Membrane ratio from HP-Xe MRI was significantly correlated to the CT-derived lnSDQ ( $R^2 = 0.58$ ,  $p=0.047$ ), indicating agreement between modalities in assessing heterogeneity of gas exchange.

##### CONCLUSION

Preliminary data supports quantitative comparisons between hyperpolarized Xe MRI and CT-derived assessments of gas exchange. Cross-sectional analyses using disease severity at diagnosis, longitudinal follow-up, and comprehensive assessment of spatially-matched ventilation and perfusion distributions are in process for direct regional comparisons between modalities.

##### CLINICAL RELEVANCE/APPLICATION

Hyperpolarized Xe imaging provides a non-ionizing alternative to DECT, allowing for regular follow-up in patients with persistent symptoms beyond their initial diagnosis.

#### **T5B-SPCH-2 Quantitative Chest of Marijuana Use**

##### PURPOSE

Recreational and medical marijuana use has increased in recent years, in part due to legalization driven by arguments that marijuana is relatively safe and with numerous health benefits. We aimed to investigate marijuana's effect on the lungs through quantitative analysis as well as image review.

##### METHODS AND MATERIALS

By searching the electronic medical record, we identified patients who were marijuana users who never smoked; current smokers; and non-marijuana never smokers, who underwent chest CT in our healthcare system in 2019. We generated a random sample of 100 marijuana users as well as 100 each age- and sex- matched controls from the current smoker and never smoker groups. Quantitative CT lung density analysis was performed to measure total lung volume (TLV) and percent high attenuation area (HAA, -600 to -250 HU). We defined >3% HAA as abnormal. A thoracic radiologist reviewed chest CTs in a blinded fashion for presence of emphysema.

##### RESULTS

TLV was higher in smokers than marijuana users and non-smokers ( $p<.01$  for both). By visual analysis, 62% of smokers had emphysema versus 4% of marijuana users ( $p<.001$ ). Marijuana users were more likely to have increased HAA (18%) compared to smokers (7%) or non-smokers (9%),  $p=0.04$ . In a multivariable analysis, larger pulmonary artery (PA) size (OR 1.1 per mm,  $p=0.01$ ) and marijuana use (OR 3.5 versus smoking,  $p=0.02$ ) were associated with increased HAA.

## CONCLUSION

s While emphysema and hyperinflation were common in smokers, they were rare in marijuana users. However, marijuana users had more high-attenuation, which also correlated with enlarged pulmonary arteries, suggesting a vasoactive effect of marijuana on the pulmonary arterial system.

## CLINICAL RELEVANCE/APPLICATION

While it does not appear to cause emphysema, marijuana use does affect the lungs, potentially through the pulmonary arterial system, and may not be as safe as initially assumed.

## T5B-SPCH-3 High Spatial Resolution Data Improves Diagnostic Performance of Machine-Learning Radiomics Model: Prediction for Invasive Adenocarcinoma of the Lung

Participants

Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

First, to construct two machine-learning radiomics models to predict invasive adenocarcinoma (IVA) using training data from normal-spatial resolution (NR) and high spatial resolution (HR), respectively. Second, in another test cohort, to validate diagnostic performance of two models (model-NR and -HR) while comparing results by two independent radiologists with and without model-HR.

## METHODS AND MATERIALS

Enrolled were 447 patients with 465 nodules (n=97, non-IVA; and n=368, IVA) who underwent 160-row high-spatial-resolution CT (Aquilion Precision, Canon Medical Systems). All CT images were reconstructed using iterative reconstruction method with NR data (512×512 matrix size, 0.5-mm slice thickness) and HR data (2048×2048 matrix size, 0.25-mm slice thickness), respectively. 465 nodules were divided into the training set (n=61, non-IVA; n=165, IVA) and the test set (n=36, non-IVA; n=203, IVA). Two models were developed by selecting 15 significant factors from 172 radiomics features in the training set, using correlation analysis and variance inflation factor, and establishing a random forest. In the test set, the area under the receiver operator characteristic curves (AUC) were statistically analyzed using DeLong's test to compare between model-NR and -HR. To compare accuracy (acc), sensitivity (sen), and specificity (spc) of two radiologists (R1, R2) with and without model-HR using McNemar test. P values <0.05 were considered significant.

## RESULTS

In the training set, AUC of the model-HR (0.839) was significantly higher than model-NR (0.723) (p<0.05). In the test set, AUC of the model-HR (0.863) was also significantly higher than model-NR (0.718) (p<0.05). Without the model-HR, acc, sen, and spc of the radiologists were as follows: R1, 77.0%, 79.3%, and 63.9%; and R2, 83.7%, 85.7%, and 72.2%, respectively. With the model-HR, acc, sen, and spc of the radiologists were as follows: R1, 86.6%, 93.1%, and 52.8%; and R2, 83.7%, 86.7%, and 66.7%, respectively. Acc and sen of R1 was significantly higher with than without the model-HR (p<0.0001). Acc and sen of R2 was equal or higher with than without the model-HR, but not significant (p>0.50). Spc of R1 and R2 tended to decrease with AI, but not significant (p>0.21).

## CONCLUSION

s High spatial resolution significantly improved diagnostic performance of IVA by the machine-learning radiomics model. When used by radiologists, the present model tended to increase the accuracy and sensitivity of IVA diagnosis at the expense of specificity.

## CLINICAL RELEVANCE/APPLICATION

Machine-learning radiomics model trained by high spatial resolution data can greatly enhance diagnostic performance of invasive adenocarcinoma, providing support to radiologist, especially in improving accuracy and sensitivity.

## T5B-SPCH-4 Radiological-Histological Correlation on Ultra-High-Resolution CT Using Cadaveric Human Lungs: Nodule and Airway Analysis

Participants

Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the performance of ultra-high-resolution CT (UHR-CT) to evaluate nodules and airways (bronchioles and bronchi) compared with conventional CT (C-CT) using cadaveric human lungs.

## METHODS AND MATERIALS

Image data of 20 cadaveric lungs were acquired by C-CT and UHR-CT at radiation dose with a noise level equivalent to the diagnostic reference level image (CTDIvol: 9.1mGy). C-CT images were reconstructed with 512 matrix, 0.5 mm thickness, and hybrid iterative reconstruction (hIR). UHR-CT images were reconstructed with three settings; UHR-512: same as C-CT; UHR-DLR: 1024 matrix, 0.25 mm thickness, and DLR; UHR-2048: 2048 matrix, 0.25 mm thickness, and hIR. Two specimens per lung were obtained and examined using hematoxylin and eosin stains. The CT images were evaluated for nodules and airways on a 5-point scale comparing with histology (1=Not identifiable, 2=Barely identifiable, 3=Identifiable, but difficult to assess detail, 4=Partially consistent with histology, 5=Nearly consistent with histology). For identifiable nodules, error rates were calculated as the absolute difference between diameters on CT and true diameters on histology divided by the true diameters. Objective noise was evaluated by measuring standard deviation. The Wilcoxon signed-rank test with Bonferroni correction was used for statistical analyses.

## RESULTS

In total, 70 nodules (median 1195  $\mu$ m, range 235 - 8803  $\mu$ m) and 91 airways (median 855  $\mu$ m, range 204 - 3324  $\mu$ m) in 40 specimens were evaluated. In terms of nodules, UHR-2048, UHR-DLR, UHR-512, and C-CT scored significantly higher in that order (C-CT, 2.6±1.1; UHR-512, 2.9±1.2; UHR-DLR, 3.4±1.4; UHR-2048, 3.6±1.5; all p<0.002). The error rate on UHR-CTs tended to be lower than that of C-CT, but there was no significant difference (C-CT, 0.17±0.13; UHR-512, 0.13±0.16; UHR-DLR, 0.12±0.13; UHR-2048, 0.12±0.10; all p>0.05). In terms of airways, UHR-DLR and UHR-2048 scored significantly higher than C-CT and UHR-512

(C-CT,  $1.9 \pm 1.5$ ; UHR-512,  $2.1 \pm 1.5$ ; UHR-DLR,  $2.9 \pm 1.7$ ; UHR-2048,  $2.7 \pm 1.7$ ). UHR-DLR tended to score higher than UHR-2048, but there was no significant difference ( $p=0.022 > 0.0083$  [Bonferroni correction]). Objective noise was significantly larger for UHR-2048, UHR-512, UHR-DLR, and C-CT in that order (C-CT,  $21 \pm 4$ HU; UHR-512,  $41 \pm 5$ HU; UHR-DLR,  $33 \pm 6$ HU; UHR-2048,  $50 \pm 4$ HU; all  $p < 0.001$ ).

## CONCLUSION

s UHR-CT images with high resolution reconstruction setting outperformed C-CT in the assessment of nodules and airways. Hybrid IR with 2048 matrix showed a better score than DLR with 1024 matrix for nodule assessment.

## CLINICAL RELEVANCE/APPLICATION

UHR-CT is suitable for the assessment of nodules and airways in detail. Hybrid IR with 2048 matrix may be the most advantageous for the assessment of the fine morphology of nodules.

## T5B-SPCH-5 Comparison of Sensitivity of Spectral CT Iodine Substance Map and Conventional CTPA in Detecting Subsegmental Thrombus

### PURPOSE

To compare the sensitivity of spectral CT iodine-based substance map and conventional CTPA in detecting arterial emboli below the pulmonary segment.

### METHODS AND MATERIALS

20 patients with pulmonary embolism were examined by energy spectrum CT material separation technique. The iodine-based substance map and CTPA map (including MPR, MIP, and VRT) were reconstructed on the post-processing workstation by using the volume data on the post-processing workstation, and the number of pulmonary emboli in the area with reduced iodine content on the iodine-based substance map was found correspondingly, which was consistent with CTPA. The number of emboli found on the map was compared, and statistical software was used to analyze the difference between the two.

### RESULTS

Among the 20 patients with pulmonary embolism, a total of 160 areas with reduced iodine content were found on the iodine-based map in the vascular distribution area by segment and sub-segment (a total of 121 emboli were found directly, and only 39 indirect emboli in the area with reduced iodine content were found); In contrast, 126 emboli were directly displayed on the CTPA map; a total of 160 emboli were found through the combined observation of the iodine-based map and CTPA. Using paired T test, it was found that the comparison between the iodine-based map and the CTPA map and between the two groups' combined application and CTPA was statistically significant ( $P < 0.05$ ); while the iodine-based map and the combined application of the iodine-based map and CTPA map There was no statistical difference between the two ( $P > 0.05$ ).

## CONCLUSION

s Spectral CT iodine-based substance map is better than CTPA in detecting emboli in patients with pulmonary embolism below the lung segment, The combined application of the two can significantly improve the detection rate of emboli in pulmonary embolism below the lung segment.

## CLINICAL RELEVANCE/APPLICATION

Spectral CT iodine-based substance map is better than CTPA in detecting emboli in patients with pulmonary embolism below the lung segment, The combined application of the two can significantly improve the detection rate of emboli in pulmonary embolism below the lung segment.

## T5B-SPCH-6 Motion Artifact Correction using a New Deep Learning Reconstruction (MC-DLR) in the Chest Computed Tomography

Participants

Yoichiro Ota, RT, Yokohama, Japan (*Presenter*) Nothing to Disclose

### PURPOSE

A new motion correction method, motion correction - deep learning reconstruction (MC-DLR), has been developed using a deep learning framework to estimate patient motion in chest computed tomography (CT). This study aimed to assess the effect of MC-DLR in emergencies.

### METHODS AND MATERIALS

This single-institution retrospective study was approved by our institutional review board. The requirement for written informed patient consent was waived. The subjects included 20 emergency cases (15 of whom were male patients, with a median age of 78) during July and August 2022. All CT scans were obtained using a 320-row CT scanner (Aquilion One Genesis, Canon Medical Systems, Otawara, Tochigi, Japan) at 120 kVp using automatic exposure control. Two types of images were reconstructed, with and without MC-DLR, both with a  $512 \times 512$  matrix size and 0.5-mm slice thickness. A technologist developed a multi-planer image obtained at the sino-tubular junction of the ascending aorta in each CT image (Fig.1). Six radiologists and six technologists measured the maximum aortic diameter and its perpendicular diameter on each image, in a randomized and independent manner, without any prior information. Additionally, they scored the motion artifact of the aorta using a four-step scale (0 = none, 1 = slight, 2 = mild, 3 = severe). Three certified chest radiologists compared all CT images with and without MC-DLR sets side by side and graded the motion artifact in the ascending aorta, coronary arteries, the left lower lobe of the lung, and other areas of the lung using a four-step scale. The total artifact score was determined as the sum of these individual scores. We compared these aortic diameters and scores using a paired t-test.

### RESULTS

The mean artifact score in the MPR image evaluation decreased significantly from  $1.64 \pm 0.96$  in the image without MC-DLR to  $1.32 \pm 1.03$  in the image with MC-DLR ( $p < 0.001$ ). The mean aortic diameter did not differ significantly between the two image sets, measuring  $33.0 \pm 3.3$  mm without MC-DLR and  $33.0 \pm 3.5$  mm with MC-DLR. However, the mean perpendicular diameter increased significantly, measuring  $30.7 \pm 3.3$  mm without MC-DLR and  $31.4 \pm 3.5$  mm with MC-DLR ( $p < 0.001$ ). When CT images were

evaluated by certified radiologists, the total motion artifact score decreased significantly from  $6.8 \pm 2.8$  in the images without MC-DLR to  $4.6 \pm 2.9$  in those with MC-DLR ( $p < 0.001$ ).

## CONCLUSION

s MC-DLR, a new motion correction method, decreases motion artifacts in chest CT images.

## CLINICAL RELEVANCE/APPLICATION

Obtaining high-quality CT images is often challenging in emergency cases. MC-DLR effectively reduces motion artifacts in post-processed images, improving the image quality.

## T5B-SPCH-7 A Two-stage Deep-learning Framework in CT Denoising Based on Structure-unaligned Paired Dataset in Real World

### PURPOSE

In real world, soft tissue is hardly appreciable during lung cancer low-dose CT (LDCT) screening due to significant noise. Currently, deep learning-based LDCT denoising methods have achieved promising results, but they are mostly performed based on structurally aligned synthesized paired datasets, thus cannot be translated into real clinical practice. In this paper, we propose an LDCT denoising method based on clinically structure-unaligned but paired datasets (LDCT and normal dose CT (NDCT) in the same patient) in real world to improve the lesion detection and characterization.

### METHODS AND MATERIALS

An initial cohort of 64 patients who had received consecutive LDCT and NDCT was enrolled in this study, and they were randomly divided into training (46) and testing (18) cohorts. We propose a two-stage training approach. A Gaussian noise perturbation was first added to the NDCT to generate structurally aligned simulated LDCT and used for the training of generator. In the second stage, the model is trained on a clinically structure-unaligned paired dataset using the Wasserstein generative adversarial network (WGAN) framework, with the initial weights of the generator obtained in the first stage of training. In addition, we introduce an attention mechanism in the proposed network to capture richer context dependencies to improve the quality of the CT.

### RESULTS

Validated on a clinical CT dataset, our proposed method outperformed other available methods [CycleGAN, Pixel2Pixel, block-matching and 3D filtering (BM3D)], in noise removal and detail retention, and also peak signal-to-noise ratio (PSNR), structural similarity index measure (SSIM) and root mean square error (RMSE) metrics. The probability density profile of the denoised CT using our method best fits the reference NDCT. Also, our two-stage model outperforms one-stage WGAN-based model in both objective and subjective evaluations, which further demonstrates the higher effectiveness of the two-stage training approach.

## CONCLUSION

s The proposed method removes noise from LDCT well and has good detail retention, which will potentially enhance the lesion detection and characterization in surrounding soft-tissues in the lung cancer LDCT screening. In both qualitative and quantitative evaluation, the proposed method outperforms the comparison method.

## CLINICAL RELEVANCE/APPLICATION

Although lung nodules can be sensitively detected in LDCT, soft tissue lesions are hardly appreciable due to significant noise. From the perspective of health economics, if the noise levels of LDCT can be further reduced without increasing the radiation dose, more lesions could be detected in the same test, which will be of great significance to the whole lung cancer screening population, collectively.

## T5B-SPCH-8 Assessment of Lung Perfusion using Dynamic Digital Radiography and Comparison with Nuclear Medicine Lung Scintigraphy

### PURPOSE

Assessment of lung perfusion is an important element in the preoperative evaluation of patients being considered for lung transplant or resection. Dynamic digital radiography (DDR) is a newer radiographic technique acquiring rapid sequential diagnostic radiographs of the chest throughout multiple respiratory cycles. The regional lung perfusion can be estimated using DDR by assessing pixel signal changes throughout the cardiac cycle. This study will compare the results of the differential lung perfusion estimated using DDR with the same results obtained from Nuclear Medicine (NM) lung scintigraphy, a conventional imaging modality.

### METHODS AND MATERIALS

A retrospective review of patients evaluated with both nuclear medicine lung scintigraphy and DDR was performed. The DDR examinations were performed between January 14, 2022 and April 25, 2023. Each patient had a lung scintigraphy perfusion study within 6 months of the DDR examination. The percent differential of perfusion between the lungs was calculated using both modalities and the results were analyzed for statistical correlation.

### RESULTS

Results for 53 patients were reviewed (mean age - 56 years, 21 females). The mean absolute percent differential in perfusion between the right and left lungs was ( $14.6 \pm 24.9\%$ ) using DDR and ( $16.4 \pm 25.7\%$ ) using lung scintigraphy. There was only one patient in which there was a discrepancy between the two modalities in determining which lung was better perfused. The perfusion results obtained using the two modalities were strongly correlated ( $r = 0.923$ ,  $p < .001$ , 95% CI [0.870, 0.955]).

## CONCLUSION

s Differential lung perfusion estimated by DDR is strongly correlated with the same result obtained using lung scintigraphy. The speed and cost effectiveness of DDR make it an attractive option for clinicians, potentially reducing wait times and healthcare cost for patients.

## CLINICAL RELEVANCE/APPLICATION

Dynamic digital radiography (DDR) is a novel functional imaging modality for assessment of lung perfusion, with strong correlation to



nuclear medicine lung scintigraphy making it a faster and more cost-effective option for preoperative evaluation of lung transplant/resection candidates.

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## Abstract Archives of the RSNA, 2023

T5B-SPER

### Emergency Radiology Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPER-1 Triple-rule-out CT Angiography with Dual-energy Spectral Imaging for Evaluation of Acute Chest Pain: Improving Image Quality Monochromatic Images at Optimal Energy Level**

##### **PURPOSE**

To evaluate the clinical value of using monochromatic images in dual-energy spectral CT in triple-rule-out CT angiography (CTA).

##### **METHODS AND MATERIALS**

Thirty consecutive patients with acute chest pain (HR<65BPM) underwent prospective ECG-triggered triple-rule-out CTA with spectral mode on a Discovery CT750HD scanner. A biphasic contrast injection (Iohexol, 350mgI/ml) was used for enhancement scans: 0.8ml/kg at 4.5ml/s flow rate in 1st phase and 20ml at 3.0ml/s in 2nd phase, followed by 30ml of saline. Monochromatic images were reconstructed with 50%ASiR and analyzed using Gemstone Spectral Imaging (GSI) viewer on an AW4.6. Region-of-interest was placed on coronary artery, pulmonary artery, thoracic aorta and muscle to measure CT number and standard deviation, and to calculate the contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) as function of energy for arteries. The optimal energy levels (in keV) for obtaining the best CNR for the arteries were obtained. CNR values at the optimal energy were compared with those at 70keV (simulating 120kVp imaging). Two senior radiologists also evaluated the image quality at these two energies using a 5-point scoring system in consensus. The measurements between the two energies were statistically compared.

##### **RESULTS**

The optimal energies for achieving the highest CNR for coronary artery, thoracic aorta and pulmonary artery were 65.9±1.06keV, 65.2±1.86keV and 62.7±1.51keV, respectively. SNR and CNR values at the optimal energies for these arteries values were significantly higher than the corresponding values in the 70keV images (all p<0.05). Image quality scores for these 3 arteries at the optimal energies were also judged to be better than those at 70keV for coronary artery, aorta pulmonary artery (all p<0.05).

##### **CONCLUSION**

s Monochromatic images at 65keV in triple-rule-out CTA with spectral imaging yielded the highest CNR for coronary artery and thoracic aorta. Monochromatic images at 62keV in triple-rule-out CTA with spectral imaging yielded the highest CNR for pulmonary artery and highest diagnostic confidence.

##### **CLINICAL RELEVANCE/APPLICATION**

Dual-energy spectral CT with optimal energy level selection may improve image quality for imaging coronary artery, pulmonary artery and thoracic aorta in triple-rule-out CTA.

#### **T5B-SPER-2 Prediction Of Enhancement Peaking Time Of Pulmonary Artery Computed Tomography Angiography: Based On Physiological Data And Random Forest Model**

##### Participants

Tuo He, Xi'an, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

To develop and validate a random forest model for preoperative prediction of contrast peaking time in pulmonary computed tomography angiography using patient physiological data.

##### **METHODS AND MATERIALS**

A total of 511 patients with 53 sets of physiological data (including baseline, clinical, hemodynamic, radiographic structural) and pulmonary artery contrast peaking time were enrolled. Peaking times were extracted from time-density curves obtained from previous low-dose contrast tests performed with pulmonary CTA. The region of interest was placed in the pulmonary artery trunk. The prediction model was developed in a primary cohort that consisted of 409 patients. Least absolute shrinkage and selection operator (LASSO) regression model was used for data feature selection, and signature building. Random forest method was used to develop the predicting model. An independent validation cohort contained 102 consecutive patients, 10-fold cross-validation was used to validate the peaking time prediction model. The predictive efficacy of the model was assessed using the area under the receiver operating characteristic (ROC) curve (AUC), sensitivity, and specificity in primary and validation cohort. All examinations were performed on a 256-row Revolution CT. Statistical analysis was conducted with R software. The reported statistical significance levels were all two-sided, with statistical significance set at 0.05.

##### **RESULTS**

16 selected feature variables including COPD history, cardiac function classification (NYHA), hypothyroidism, hypertension classification and risk stratification, coronary heart disease history, valvular disease history, Injection site, Sex, Age, Contrast agent does, Superior vena cava size (long diameter and short diameter), Pulmonary artery width, Pulse rate and Diastolic pressure were significantly associated with peaking time. The AUC, sensitivity and specificity of the peaking time prediction based on the

proposed model was 0.795, 0.047, 0.997 in the primary cohort, and 0.738, 0.056, 0.796 in the validation cohort.

#### **CONCLUSION**

s A random forest model that incorporates various physiological data may be used to preoperatively predict contrast peaking time to optima contrast use in pulmonary CTA.

#### **CLINICAL RELEVANCE/APPLICATION**

The empirical time method, small-dose contrast agent test method, and the dynamic tracking threshold trigger method are commonly used in the current peak time calculation for contrast-enhanced examinations. However, these methods have the disadvantages of insufficient accuracy, increased contrast injection and increased radiation dose to the patient, respectively. In contrast, the prediction of peak time by random forest models can perfectly solve these drawbacks mentioned above.

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## Abstract Archives of the RSNA, 2023

T5B-SPGI

### Gastrointestinal Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPGI-1 High Resolution CT Imaging with a 1024 Matrix: Impact of Matrix Size, Slice Thickness, Reconstruction Algorithm, and Reslicing on Radiomic Feature Quantification in Hepatocellular Carcinoma**

##### Participants

Masatoshi Hori, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation

##### PURPOSE

Following the emergence of ultra-high-resolution (UHR) CT or photon-counting CT systems, 1024-matrix abdominal imaging has become clinically relevant. These depictions offer superior spatial resolution compared to conventional images. However, the impact of matrix size, slice thickness, reconstruction algorithm, and reslicing on radiomic evaluations remains poorly understood. The aim was to elucidate the consequences of these parameters on CT radiomic feature quantification in hepatocellular carcinoma (HCC).

##### METHODS AND MATERIALS

This retrospective analysis involved 29 subjects (16 males, 13 females; median age, 73 years) diagnosed with HCC, who underwent contrast-enhanced CT during late arterial and portal venous phases employing super-high-resolution mode with a UHR CT scanner (Aquilion Precision; Canon). Lesions exhibited a median diameter of 32.6 mm (range, 11.1-113.6mm). UHR CT images with a 1024-matrix were reconstructed utilizing filtered back projection and hybrid iterative reconstruction. Slice thicknesses comprised 0.5, 1.0, and 5.0 mm. CT images with a 512-matrix were also reconstructed with the normal-resolution simulation algorithm. A representative tumor was three-dimensionally segmented per patient. Subsequently, 120 radiomic features, with and without reslice at 1-mm voxel, were calculated in three dimensions for each image set. Features were categorized as first-order (n=19), shape (n=26), and texture (n=75). A linear mixed-effects model evaluated the impact of imaging parameters on features, deeming P-value < 0.05 divided by 120 for Bonferroni correction significant.

##### RESULTS

Within both arterial and portal venous phases, among 120 features, slice thickness significantly impacted 30 (25.0%) and 28 (23.3%) features, respectively. The 1024-matrix affected 19 (15.8%) and 18 (15.0%) features, whereas reslicing influenced 14 (11.7%) and 16 (13.3%) features, respectively. Conversely, the reconstruction algorithm exerted minimal effect on 2 (1.7%) and 0 (0.0%) features.

##### CONCLUSION

Slice thickness emerged as the most influential factor affecting the measurement values of features. Subsequently, when employing UHR images (1024 matrix) compared to conventional-resolution images (512 matrix), significant differences were observed in 15-16% of feature measurements in both arterial and portal venous phases. The effects of reslicing were discernible in approximately 10% of features, while the impact of the reconstruction algorithm was minimal.

##### CLINICAL RELEVANCE/APPLICATION

Radiomic features procured from UHR CT employing a 1024 matrix diverge from those garnered through conventional CT. Slice thickness prevails as the primary determinant, with the 1024-matrix as the subsequent influencer.

#### **T5B-SPGI-2 Predictive Value of LI-RADS v2018 Combined ADC for Hepatocellular Carcinoma and Other Primary Hepatic Malignancies in the LI-RADS M Classification**

##### PURPOSE

To investigate the predictive value of LI-RADS v2018 MR imaging features, ADC values to identify hepatocellular carcinoma (HCC) and other hepatic primary malignancy (OM) in the LI-RADS M (LR-M) classification.

##### METHODS AND MATERIALS

MR imaging of 142 patients with primary liver cancer were classified as LR-M by two radiologists, 62 in the HCC group and 80 in the OM group. Comparing ADC and general clinical data including age, gender, location, AFP, CA19-9, length diameter of patients between the two groups, as well as LI-RADS MR imaging features: nonperipheral "washout", enhancing "capsule", nodule-in-nodule, mosaic architecture, blood products in mass, fat in mass, rim APHE, peripheral "washout", delayed central enhancement, targetoid restriction, bile duct dilatation. ADC were converted to dichotomous variables by ROC curves, and the independent predictors of HCC and OM in LR-M were screened by single-factor and multi-factor regression analysis, and the predictive value of each independent predictor and predictive model was analysed by ROC curves.

##### RESULTS

Elevated AFP (42/62, 67.7%), enhancing "capsule" (41/62, 66.1%) and blood products in mass (13/62, 21%) were seen in a higher rate in the HCC group, with ADC =  $1.083 \times 10^{-3}$  mm<sup>2</sup>/s. The OM group showed elevated CA19-9 (42/80, 52.5%), a higher rate of

delayed central enhancement(51/80,63.8%), targetoid restriction (41/80,51.3%) and bile duct dilatation (41/80,51.3%), and ADC  $>1.083 \times 10^{-3} \text{ mm}^2/\text{s}$ . The differences in these parameters were statistically significant ( $P < 0.05$ ). Multi-factor regression analysis showed that AFP, enhancing "capsule", ADC classification, and bile duct dilatation were independent predictors of the HCC and OM groups, and ROC curves showed the highest AUC of 0.950 for the prediction model, with a sensitivity of 85.5% and a specificity of 91.2%.

## CONCLUSION

The ADC classification is an independent predictor for differentiating HCC and OM in the LR-M classification. Combined with elevated AFP, enhanced capsule, and bile duct dilatation, ADC classification can effectively improve the ability to distinguish HCC from OM.

## CLINICAL RELEVANCE/APPLICATION

LI-RADS v2018 combined with ADC values can effectively predict hepatocellular carcinoma (HCC) and other hepatic primary malignancy (OM) in the LR-M classification.

## T5B-SPGI-3 Association of CEUS and CT/MRI LI-RADS Major Feature with Hepatocellular Carcinoma: Comparison of Cirrhosis and Hepatitis B Risk Factors using Individual Participant Data Meta-analysis

Participants

Robert Adamo, Toronto, ON (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the association of LI-RADS major features with HCC and positive predictive value (PPV) for HCC of LI-RADS categories in patients with cirrhosis, HBV-related cirrhosis, and non-cirrhotic chronic-HBV using Individual Participant Data (IPD) meta-analysis.

## METHODS AND MATERIALS

IPD was extracted from studies evaluating CT, MRI and contrast-enhanced ultrasound (CEUS) for diagnosis of HCC using LI-RADS (v2014-2022) (protocol link). Mixed models were applied. Odds ratios (ORs) for each major feature and PPV for each LI-RADS category were determined using multivariable logistic regression in three subgroups: Group-A (cirrhosis), Group-B (HBV-related cirrhosis), and Group-C (HBV without cirrhosis). Risk of bias was assessed using QUADAS-2.

## RESULTS

29 studies (3453 patients) were included: Group-A (3453/4448 patients/observations), Group-B (1106/1232), and Group-C (721/781). CT/MRI major features [threshold growth not assessed, low data] were all associated with HCC: Group-A OR ranges 1.84-5.25; Group-B OR ranges 2.36-8.18; Group-C OR ranges 2.63-5.92. CEUS features associated with HCC: Group-A OR ranges 2.78-6.90, Group-B OR 9.88, and Group-C insufficient data ( $n=44$ ). In CT/MRI and CEUS, the PPVs were comparable for LI-RADS categories 4 (LR-4) and 5 (LR-5) between Group-A, Group-B, and Group-C. Twenty-two studies (79%) had high risk of bias in at least one QUADAS-2 domain.

## CONCLUSION

CT/MRI, LI-RADS major features (other than TG) were independently associated with HCC in patients with non-HBV cirrhosis, HBV-cirrhosis, and non-cirrhotic HBV, suggesting that LI-RADS major features are applicable in patients with HBV, regardless of cirrhosis status. CEUS, there were insufficient data to evaluate differences among groups. CT/MRI and CEUS, PPV was comparable between groups for LR-4 and LR-5.

## CLINICAL RELEVANCE/APPLICATION

The CT/MRI LI-RADS major features show similar independent associations with HCC, and the positive predictive value (PPV) for LR-4 and LR-5 in CT/MRI and CEUS is comparable between cirrhosis (Group A), HBV-related cirrhosis (Group B), and non-cirrhotic HBV (Group C) patients. Therefore, this study supports the current LI-RADS v2018 approach, which does not adjust major imaging features based on different patient populations.

## T5B-SPGI-4 Nontarget Y90 Transarterial Radioembolization (TARE): Can It Affect Post-Treatment HCC Localization and LIRADS-Treatment Response Algorithm (LR-TRA)?

Participants

Charis Wang, BA, (*Presenter*) Nothing to Disclose

## PURPOSE

In a prior study, we assessed the accuracy of the LIRADS-TRA in categorizing post-therapy response of HCC treated with TARE with yttrium-90, using liver explant pathology as the reference standard. However, Y90 TARE can cause variable non-target/background liver radiation features, confounding congruent LR-TRA assessment between readers. This study aimed to assess multireader variability of post-treatment lesion localization and the confounding effect of non-target radiation on the LR-TRA.

## METHODS AND MATERIALS

96 patients who had liver explant pathology after Y90 treatment for HCC between Oct 2015 and Oct 2021 were identified using data science tools. Patients with less than 90 days between Y90 treatment and pre-transplant MRI or CT were excluded due to immediate post-treatment enhancement confounding LR-TRA assessment. From the remaining 69 patients, there were 64 MRIs and 5 CTs completed before liver transplant, with 9 excluded for technical issues. Using post-contrast sequences, three readers independently reviewed each patient's exams and indicated the location of the pre-treatment lesion on the post-treatment image with an arrow. Arrow locations were compared and marked as congruent or noncongruent. Fisher's exact test was used to analyze interreader congruency of post-treatment lesion localization LR-TRA assessments of treatment response, and the respective correlations with the presence of non-target post-radiation changes.

## RESULTS

Lesion localization data was obtained for 60 exams. Among the 34 patients without nontarget changes, 32 (94.1%) demonstrated lesion localization congruency; while among the 26 patients without nontarget changes, only 13 (50%) were congruent ( $p < 0.001$ ). For LIRADS TRA classification, 76.5% (26/34) were congruent on exams without nontarget changes, while 42.3% (11/26) were

noncongruent. ( $p=0.05$ ). LR-TRA classification noncongruency was highest for the equivocal vs nonviable subcohort (30.8%; 8/26).

## CONCLUSION

s Although non-target/background liver post-treatment (Y90) radiation changes can be variable, its presence can significantly impact interreader congruency for lesion localization and LIRADS-TRA classification.

## CLINICAL RELEVANCE/APPLICATION

The effect of non-target radiation changes on accurate lesion localization and LR-TRA classification should be taken into account when assessing therapeutic response of HCC treated with TARE with Y90.

## T5B-SPGI-5 LI-RADS Treatment Response Algorithm v2023 versus v2018: Assessing Diagnostic Performance and Inter-reader Agreement in Patients with Hepatocellular Carcinoma Treated with Stereotactic Body Radiotherapy

### PURPOSE

To evaluate the accuracy and inter-reader agreement of the updated LI-RADS Treatment Response Algorithm (LR TRA) v2023 for assessing tumor viability of hepatocellular carcinoma (HCC) treated with stereotactic body radiotherapy (SBRT) using explant as the gold standard.

### METHODS AND MATERIALS

This retrospective IRB approved study included patients who underwent SBRT for treatment of HCC between 2008 and 2021 with subsequent liver transplantation. Five readers independently reviewed all treated lesions according to LR TRA v2023, LR TRA v2018 and mRECIST. Observations were characterized as Viable, Non-viable, Nonprogressing (using v2023), or Equivocal (using v2018) based on LR TRA and complete response, partial response, stable disease, or progressive disease based on mRECIST. Predictive values for Viable and Nonviable categories were compared to pathology results using 100% as complete pathologic necrosis and less than 100% as incomplete pathologic necrosis. Performance metrics for assessing Viability and Nonviability of treated observation were calculated for each reader and reader agreement was determined for v2023 and v2018.

### RESULTS

44 lesions in 27 patients (median age: 63 [59-65 years]; 25 males) were included. Overall reader agreement for final category was 33%, 31%, and 30% for v2023, v2018 and mRECIST, respectively. Reader agreement amongst faculty and trainees for v2023, v2018 and mRECIST was 33%, 29%, and 31% and 42%, 33%, and 41%, respectively. There was increased reader agreement amongst faculty assigning Viable category from v2018 to v2023 (v2018: 25%; v2023: 35%) compared to Non-viable and Equivocal/Nonprogressing category (Nonviable v2018 to v2023: 37% to 37% and Equivocal v2018 to Nonprogressing v2023: 22% to 28%, respectively). Sensitivity and negative predictive value for predicting complete necrosis was 69% and 71% (v2023) and 63% and 70% (v2018), respectively, when Nonprogressing/Equivocal category were treated as Viable, accounting for subject clustering. Sensitivity and positive predictive value for predicting incomplete necrosis was 96% and 62% (v2023) versus 94% and 62% (v2018), respectively, when the Nonprogressing/Equivocal category was treated as Nonviable.

### CONCLUSION

s LR TRA v2023 demonstrates improvement in reader agreement using newly defined terminology for persistently enhancing SBRT-treated HCC. LR TRA v2023 demonstrates similar diagnostic performance compared to v2018 for predicting incomplete and complete necrosis.

## CLINICAL RELEVANCE/APPLICATION

SBRT-treated HCC undergo slow necrosis and show persistent post-treatment APHE which should not be retreated. LR-TR Nonprogressing is a new category aiming to improve reporting consistency to reduce unnecessary early retreatment.

## T5B-SPGI-6 Intelligent Radiomics for Individualized Evaluation of Target in Patients with Advanced Hepatocellular Carcinoma

Participants

Mingguang Yang, Chongqing, China (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the use of intelligent imaging methods to develop intelligent imaging markers based on CT images and construct a visualization Nomogram to individually predict the efficacy of ronvatinib in patients with advanced hepatocellular carcinoma.

### METHODS AND MATERIALS

This study retrospectively analyzed 168 patients with hepatocellular carcinoma treated with ranvastinib and divided them into two independent study cohorts. First, image features were extracted from baseline CT images of 79 patients in cohort 1 using image omics analysis. A nested 10-fold cross-validation and Cox proportional hazard regression model were used to construct intelligent image omics markers combined with LASSO algorithm to predict treatment failure time TTF and overall survival OS in advanced HCC patients receiving targeted therapy. The efficacy of intelligent imaging markers was verified in a cohort of 89 patients.

### RESULTS

The nested 10-fold cross-verified training was repeated for 100 rounds, and the average consistency index C-index was 0.682 (t test  $P < 0.001$ ). Ultimately, intelligent imaging markers consisting of eight image features were significantly associated with TTF and OS ( $P < 0.001$ ), and were able to classify advanced HCC patients receiving targeted therapy into low-risk and high-risk groups, with 1-year treatment failure rates of 53.2% and 6.8%, respectively. The 2-year survival rates were 62.3% and 15.6%, respectively. Multivariate analysis showed that smart imaging markers were independent prognostic factors for TTF (HR: 4.840, 95%CI: 2.554-7.468,  $P < 0.001$ ) and OS (HR: 4.325, 95%CI: 2.034-11.225,  $P < 0.001$ ). A Nomogram integrated with intelligent imaging markers and clinicopathological parameters further improves the prediction performance.

### CONCLUSION

s Intelligent imaging markers based on CT images can effectively predict treatment failure time and overall survival in advanced HCC

patients receiving targeted therapy with ranvatinib. A Nomogram model was synthesized by fitting intelligent imaging markers and clinicopathological parameters to guide individualized targeted therapy for patients with advanced HCC.

#### **CLINICAL RELEVANCE/APPLICATION**

In this study, intelligent imaging markers based on CT images combined with artificial intelligence technology can be used to guide individualized targeted therapy for patients with advanced HCC.

#### **T5B-SPGI-8 Machine Learning for Malignant versus Benign Focal Liver Lesions on US and CEUS: A Systematic Review and Meta-Analysis**

Participants

Carlos Alberto Campello Jorge, MD, Campo Grande, MS (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To perform a meta-analysis of the diagnostic performance of learning (ML) algorithms (conventional and deep-learning algorithms) for the classification of malignant versus benign focal liver lesions (FLLs) on US and CEUS.

#### **METHODS AND MATERIALS**

Available databases were searched for relevant published studies through September 2022. Studies met eligibility criteria if they evaluate the diagnostic performance of ML for the classification of malignant and benign focal liver lesions on US and CEUS. The pooled per-lesion sensitivities and specificities for each modality with 95% confidence intervals were calculated.

#### **RESULTS**

A total of 8 studies on US, 11 on CEUS, and 1 study evaluating both methods met the inclusion criteria with a total of 34,245 FLLs evaluated. The pooled sensitivity and specificity of ML for the malignancy classification of FLLs were 81.7% (95% CI, 77.2-85.4%) and 84.8% (95% CI, 76.0-90.8%) for US, compared to 87.1% (95% CI, 81.8-91.0%) and 87.0% (95% CI, 83.1-90.1%) for CEUS. In the subgroup analysis of studies that evaluated deep learning algorithms, the sensitivity and specificity of CEUS (n=4) increased to 92.4% (95% CI, 88.5-95.0%) and 88.2% (95% CI, 81.1-92.9%). Studies assessing multiple malignant and benign etiologies for FLLs had no lower diagnostic performance than those comparing only one etiology in each group for both methods.

#### **CONCLUSION**

s The diagnostic performance of ML algorithms for the malignant classification of FLLs was high for both US and CEUS with overall similar sensitivity and specificity. The similar performance of US may be related to the higher prevalence of DL models in that group.

#### **CLINICAL RELEVANCE/APPLICATION**

Machine learning algorithms applied for the classification of focal liver lesions demonstrated high accuracy for both CEUS and US.

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## Abstract Archives of the RSNA, 2023

T5B-SPGU

### Genitourinary Imaging Tuesday Poster Discussions II

#### Sub-Events

#### T5B-SPGU-1 Global Variation in Magnetic Resonance Imaging of the Prostate using PI-QUAL: A Multicentre Study

##### Participants

Francesco Giganti, MD, PhD, London, United Kingdom (*Presenter*) Nothing to Disclose

##### PURPOSE

High variability in prostate MRI quality reduces the accuracy of this technique in the detection of prostate cancer. The Prostate Imaging Quality (PI-QUAL) score is the first standardised scoring system that evaluates image quality using five points, where a score of 5 means the scan is of optimal diagnostic quality and a score of 1 means that all sequences are below the minimum standard for diagnostic quality. We aimed to assess prostate MRI quality following the application of PI-QUAL in the scans from different centres across the world undergoing quality control as part of an ongoing trial. We determined whether appropriate modifications to MRI protocols could optimise their diagnostic quality.

##### METHODS AND MATERIALS

For each scanner, centres submitted 5 consecutive MRI scans and the MRI protocols (Phase 1). Submitted data were evaluated in consensus by two expert genitourinary radiologists using PI-QUAL. Feedback was provided for scanners not reaching PI-QUAL 5, and centres were invited to resubmit a new study using the modified protocol (Phase 2).

##### RESULTS

In Phase 1, 41 centres from 18 countries submitted a total of 355 MRI images from 71 scanners, with 9 (13%), 39 (55%) and 23 (32%) scanners scoring a PI-QUAL score of 3, 4 and 5, respectively. Of the 48/71 (68%) scanners which received feedback to improve, the dynamic contrast enhanced sequences were those with the highest variability (44/48, 92%), followed by diffusion-weighted imaging (20/48, 42%) and T2-weighted imaging (19/48, 40%). 36 centres from 17 countries resubmitted revised studies, resulting in a total of 62/64 (97%) scanners completing Phase 2, scoring PI-QUAL 5.

##### CONCLUSION

We observed significant variation in prostate MRI quality, particularly with dynamic contrast enhanced sequences. Basic evaluation and modifications to MRI protocols using PI-QUAL can lead to substantial improvements in the global quality of prostate MRI.

##### CLINICAL RELEVANCE/APPLICATION

There is significant global variation in prostate MR image quality, particularly in the dynamic contrast enhanced sequences. However, quality can be optimised with basic modifications to MRI protocols. Basic changes using the PI-QUAL score (that includes adherence to technical recommendations outlined in the PI-RADS guidelines) markedly improved the quality of scanners, with 97% and 3% of scans obtaining a PI-QUAL score of 5 and 4, respectively.

#### T5B-SPGU-2 More with Less: A Quality Improvement Initiative to Evolve Multiparametric MR Prostate Imaging beyond the Endorectal Coil

##### PURPOSE

To establish a consistent, efficient, and patient-friendly 3 Tesla MRI protocol for performing high-quality prostate MRI without an endorectal coil (ERC).

##### METHODS AND MATERIALS

As part of the ACR Prostate MR Image Quality Improvement Collaborative, this single-center quality improvement (QI) project audited image quality across three project phases: pre-improvement, improvement, and post-improvement. Approximately 30 exams were audited each week (1114 exams total). All prostate exams were obtained on a 3T Siemens Magnetom Skyra (Syngo MR E11, Siemens Healthineers, Erlangen, Germany) with multiplanar T2-weighted imaging, DWI and ADC maps, and DCE imaging series following PI-RADS v2/2.1 guidelines. During the pre-improvement phase, our QI team regularly observed the imaging department using Gemba Walks, mapped out the imaging process, performed current state analysis, investigated root causes, and identified key drivers. Four months of pre-improvement exams were audited to quantify baseline performance and establish our SMART goal: achieving PI-QUAL = 4 for 85% of non-ERC MRI exams by the end of the 9-month Collaborative. In the improvement phase, interventions were implemented in rapid Plan-Do-Survey-Act cycles. A prostate phantom was developed for intervention testing to minimize the effects of patient variability. Progress was tracked on a run chart plotting the percentage of cases achieving PI-QUAL = 4. During the post-improvement phase, we tracked image quality to see how well the results were sustained. Educational materials for training technologists were developed by comparing image quality between ERC and non-ERC exams.

##### RESULTS

Pre-improvement, 64.8% (318/491) of baseline exams achieved PI-QUAL = 4. Performance improved to 79.4% (181/228) after



introducing a 200-lb. weight-limit for ERC usage and switching to R/L phase encoding. This increased further to 89.1% (212/238) after enabling the abdomen shimming mode and expanding the shim box to encompass the full pelvis. Following the Collaborative, these improvements have been sustained for three months with 93.9% (245/261) of exams achieving PI-QUAL = 4.

## CONCLUSION

Following the structured and data-driven QI process laid out by the ACR Learning Network, we can now routinely obtain high-quality prostate MRI without an ERC, and in some cases, forgoing the ERC even offers advantages.

## CLINICAL RELEVANCE/APPLICATION

While providing prostate MRI exams without an ERC offers clear advantages for patients, staff, and clinical workflow, it's crucial to ensure sufficient image quality for accurate diagnosis. Therefore, transitioning away from ERC usage in prostate MRI requires a thoughtful and evidence-based improvement process.

## T5B-SPGU-3 Association of Quantitative Multiparametric MRI Parameters and Aggressive Prostate Cancer Morphologies

Participants

Daniel Kim, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the relationship between 3 Tesla quantitative multiparametric magnetic resonance imaging (qmpMRI) and pathologic features of aggressive prostate cancer (PCa) including cribriform morphology and intraductal carcinoma (IDC).

## METHODS AND MATERIALS

This IRB-approved, HIPAA compliant study involved patients with PCa who underwent robotic radical prostatectomy between 2019 and 2022 and pre-operative mpMRI. Both mpMRI and whole mount histopathology (WMHP) were re-reviewed during a multidisciplinary meeting to assess imaging and pathology lesion matching and the presence of cribriform and IDC. All UCLA and PIRADSV2.1=3 lesions on mpMRI were contoured and the following quantitative parameters were extracted: mean apparent diffusion coefficient (ADC,  $\times 10^{-6} \text{mm}^2/\text{s}$ ) and perfusion parameters including  $K_{\text{trans}}$  (min-1),  $K_{\text{ep}}$  (min-1),  $i\text{AUC}$  (mMsec). The cohort was divided into three subcohorts with increasing aggressiveness: (1) cribriform-/IDC-, (2) cribriform+/IDC-, and (3) cribriform+/IDC+. The cohort was also divided a binary manner into cribriform-/IDC- (subcohort 1) and cribriform+/IDC $\pm$  (subcohort 2 and 3). We used one-way ANOVA to assess group differences, Jonckheere test to evaluate trends, and a classification and regression tree (CART) model to estimate the discrimination ability by using all qmpMRI parameters.

## RESULTS

The study cohort comprised of 130 patients (mean age and PSA:  $62.6 \pm 7.2$  years and  $9.3 \pm 6.2$  ng/mL) with 141 PCa lesions on mpMRI with 41/141, 49/141, and 51/141 in subcohorts 1, 2, and 3, respectively. The mean ADC and  $i\text{AUC}$  were  $892 \pm 202$  and  $5.4 \pm 2.5$ ,  $826 \pm 209$  and  $6.7 \pm 3.0$ ,  $763 \pm 163$  and  $6.9 \pm 3.5$  in subcohorts 1, 2, and 3, respectively (mean ADC,  $p=0.007$ ;  $i\text{AUC}$ ,  $p=0.037$ ). The mean ADC,  $K_{\text{ep}}$ , and  $i\text{AUC}$  of cribriform+/IDC $\pm$  (subcohort 2 and 3) were  $794 \pm 188$ ,  $1.9 \pm 1.3$ , and  $6.8 \pm 3.2$  which were significantly different compared to cribriform-/IDC- (subcohort 1) with  $p=0.007$  (mean ADC),  $p=0.019$  ( $K_{\text{ep}}$ ),  $p=0.011$  ( $i\text{AUC}$ ). As aggressive PCa hosts increased cellularity and increased vascularity leading to low diffusion and high perfusion parameters, the Jonckheere test confirmed that mean ADC ( $p=0.004$ ) was negatively correlated, and  $K_{\text{ep}}$  ( $p=0.048$ ) and  $i\text{AUC}$  ( $p=0.037$ ) were positively correlated with increasing PCa aggressiveness. Using mean ADC and  $i\text{AUC}$  cutoffs of 893 and 5.7, the CART model correctly allocated 62%, 60%, and 45% of PCa lesions to subgroups 1, 2, and 3.

## CONCLUSION

3T qmpMRI diffusion and perfusion parameters were significantly correlated with increasingly aggressive PCa histological findings including presence of cribriform and IDC.

## CLINICAL RELEVANCE/APPLICATION

Quantitative mpMRI parameters show significant association with aggressive prostate cancer morphologies aiding to the diagnostic performance of mpMRI.

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## Abstract Archives of the RSNA, 2023

T5B-SPHN

### Head & Neck Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPHN-1 Diagnosing Cervical Lymph Node Metastasis in Oral Squamous Cell Carcinoma based on Third-generation Dual-source, Dual-energy Computed Tomography**

#### **PURPOSE**

To investigate the potential of dual-energy computed tomography (DECT) parameters in identifying metastatic cervical lymph nodes in oral squamous cell carcinoma (OSCC) patients and to explore the relationships between DECT and pathological features.

#### **METHODS AND MATERIALS**

Clinical and DECT data were collected from patients who underwent radical resection of OSCC and cervical lymph node dissection between November 2019 and June 2021. Microvascular density was assessed using the Weidner counting method. The electron density (ED) and effective atomic number (Z<sub>eff</sub>) in non-contrast phase and iodine concentration (IC), normalized IC, slope of the energy spectrum curve (?HU), and dual-energy index (DEI) in parenchymal phase were compared between metastatic and non-metastatic lymph nodes. Student's t-test, Pearson's rank correlation and receiver operating characteristic curves were performed.

#### **RESULTS**

The inclusion criteria were met in 399 lymph nodes from 103 patients. Metastatic nodes (n=158) displayed significantly decreased ED, IC, normalized IC, ?HU, and DEI values compared with non-metastatic (n=241) nodes (all p < 0.01). Strong correlations were found between IC (r = 0.776), normalized IC (r = 0.779), ?HU (r = 0.738), DEI (r = 0.734), and microvascular density. Area under the curve (AUC) for normalized IC performed the highest (0.875) in diagnosing metastatic nodes. When combined with the width of nodes, AUC increased to 0.918.

#### **CONCLUSION**

s DECT parameters IC, normalized IC, ?HU, and DEI reflect pathologic changes in lymph nodes to a certain extent, and aid for detection of metastatic cervical lymph nodes from OSCC.

#### **CLINICAL RELEVANCE/APPLICATION**

1. Electron density, iodine concentration, normalized iodine concentration, ?HU, and dual-energy index values showed significant differences between metastatic and non-metastatic nodes. 2. Strong correlations were found between iodine concentration, normalized iodine concentration, slope of the spectral Hounsfield unit curve, dual-energy index, and microvascular density. 3. DECT qualitative parameters reflect the pathologic changes in lymph nodes to a certain extent, and aid for the detection of metastatic cervical lymph nodes in patients with OSCC and aid clinical decision-making.

#### **T5B-SPHN-2 To Evaluate the Role of the 18 F FDG PET/CT in the Evaluation of the Post Head and Neck Surgery Prognosis and Survival**

#### **PURPOSE**

The aim of the study was to evaluate the various clinical and preoperative PET/CT findings in evaluation of the overall survival (OS) and for the evaluation of the distant metastasis for the diagnosis of the disease free survival (DMFS) in the cohort of head and neck squamous cell carcinoma patients who were treated with surgery. This study also correlates the prognostic model of OS and DMFS, by which there can be validation of the prognostic model with an independent cohort.

#### **METHODS AND MATERIALS**

This was the retrospective study comprising of the 382 patients who had diagnosed head and neck squamous cell carcinoma, and this was further divided into training (n=?318) and validation (n=?64) cohorts. This was based on the various parameters like various PET/CT parameters which were analysed: clinical parameters, SUV<sub>max</sub>, SUV<sub>mean</sub>, metabolic tumor volume (MTV), total lesion glycolysis, and distance parameters for the primary tumor and lymph nodes and these were defined by 2 segmentation methods (relative SUV<sub>max</sub> threshold and absolute SUV threshold). The Cox analyses was also performed for OS and DMFS in the training cohort. The concordance index (c-index) was used to identify highly prognostic parameters in this study. All these prognostic parameters were externally tested in the validation cohort and were validated.

#### **RESULTS**

In multivariable analysis, the various important parameters for OS were T stage and nodal MTV, with a c-index of 0.64 (P?<?0.001). For the DMFS, the various parameters were T stage, nodal MTV, and maximal tumor-node distance, with a c-index of 0.76 (P?<?0.001). There were many combinations of parameters and all this were validated externally with c-indices of 0.63 (P?<?0.001) and 0.71 (P?<?0.001) for OS and DMFS, respectively.

#### **CONCLUSION**

s The nodal MTV and the maximal tumor-node distance was significantly correlated with the risk of DMFS. And this parameter was associated with significant increase in the higher risk of death. These all prognostic factors will be used as tailor-made concept for

the individualized treatment

#### **CLINICAL RELEVANCE/APPLICATION**

PET-CT is the important modality for the evaluation of the post operative status of the head and neck cancers

#### **T5B-SPHN-3 Multi-parametric MRI-based Radiomics Approach with Deep Transfer Learning for Preoperative Prediction of Ki-67 Status in Sinonasal Squamous Cell Carcinoma**

Participants

Naier Lin, MS, Shanghai, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Preoperative prediction of Ki-67 status in sinonasal squamous cell carcinoma (SNSCC) is critical for individualized treatment. Based on comparison of different machine learning (ML) models, we developed the model that integrates traditional hand-crafted (HC) features and deep transfer learning (DTL) features from multi-parametric MRI to predict Ki67 status in SNSCC.

#### **METHODS AND MATERIALS**

231 SNSCC patients were retrospectively reviewed [training cohort (n= 185), test cohort (n = 46)]. Clinical data and conventional MRI characteristics were analyzed to choose the independent predictor. HC and DTL radiomics features were extracted from fat-saturated T2-weighted imaging, contrast-enhanced-T1WI and apparent diffusion coefficient map. In this study, ResNet50 was chosen as the pretrained CNN model and it was trained on the ILSVRC-2012 dataset. Then, HC and DTL features were fused to formulate the deep learning-based radiomics (DLR) features. After features selection and radiomics signature (RS) building, we compared the predictive ability of RS-HC, RS-DTL and RS-DLR.

#### **RESULTS**

No independent predictors were found based on clinical and conventional MRI characteristics. After features selection, 42 HC and 10 DTL radiomics features were retained. The ML algorithm of Support Vector Machine (SVM), LightGBM and ExtraTrees (ET) were the best classifier for RS-HC, RS-DTL and RS-DLR, respectively. In the training cohort, the predictive ability of RS-DLR was higher than those of RS-DTL and RS-HC. In the test set, the area under curve (AUC) of RS-DLR was also the highest (AUC = 0.817, 95% CI: 0.697 - 0.937), better than those of RS-DTL (AUC = 0.650, 95% CI:0.487 - 0.812) and RS-HC (AUC = 0.803, 95% CI: 0.679 - 0.927).

#### **CONCLUSION**

s Based on ET algorithm classifier, the integrated RS-DLR, which combine the HC and DTL features from multiple MR sequences, yielded more biological information about tumor and showed great potential in improving the prediction of Ki67 status in SNSCC.

#### **CLINICAL RELEVANCE/APPLICATION**

As a noninvasive and convenient method, the integrated RS-DLR represented an opportunity to advance precise prediction for the proliferation status in SNSCC preoperatively and benefit individualized treatment.

#### **T5B-SPHN-4 The Value of Synthetic MRI in Differentiating Metastatic and Non-metastatic Lymph Nodes in Nasopharyngeal Carcinoma, Compared with Size Criteria**

#### **PURPOSE**

The accurate diagnosis of metastatic lymph nodes (LNs) affects the target delineation and dose distribution of radiotherapy in nasopharyngeal carcinoma (NPC). The purpose was to explore the potential value of synthetic MRI (SyMRI) combined with histogram analysis in diagnosing LN metastasis (LNM) and how it compares to size criteria.

#### **METHODS AND MATERIALS**

Fifty-three consecutive patients with pathologically proven NPC were enrolled in this prospective study, and 377 cervical LNs with a maximum short axis diameter (MSAD) = 4 mm were evaluated. All patients underwent standard treatment and the median follow-up time after treatment was 36.13 (17.62, 42.19) months. Two senior radiologists (with 21 and 18 years of tumor-imaging experience) independently evaluated and labelled LNs, and any disagreement was resolved by discussion. A cervical LN was considered to be metastatic if it resolved after the patients completed treatment or showed stable size after treatment but progressed during the follow-up MRI. A cervical LN was considered to be non-metastatic if it showed stability in size after the completion of treatment and the patient remained disease-free during the follow-up MRI (Fig.1). Therefore, 297 and 80 LNs were diagnosed with metastatic and non-metastatic. Histogram features were extracted from the T1, T2, and proton density (PD) maps and MSAD was recorded. According to the Size criteria for cervical LNs, MASD of LNs = 5 mm in the retropharyngeal region, = 11 mm in level II and = 10 mm in other levels of neck were considered metastatic, otherwise, LNs were divided into the non-metastatic group. The dataset was assigned in a 7:3 ratio to either training group or validation group. Multivariate logistic regression analysis and ROC analysis were used to explore the performance in the diagnosis of cervical LNs and level II LNs. Then the DeLong test was used, and nomogram and calibration curves were constructed.

#### **RESULTS**

T1\_10th Percentile, T1\_Variance, PD\_10th Percentile, and PD\_Minimum were used to construct SyMRI model (AUC: 0.895 and 0.903 in the train and validation group), which is higher than Size criteria model (AUC: 0.824 and 0.797), with both P = 0.023. Moreover, SyMRI + Size criteria model showed the highest performance (AUC: 0.941 and 0.938) compared with SyMRI model only (both P = 0.043) and Size criteria model only (both P = 0.007).

#### **CONCLUSION**

s SyMRI derived histogram parameters could effectively differentiate metastatic from non-metastatic whether in cervical LNs or level II LNs. Moreover, the combination of SyMRI and Size criteria could significantly improve diagnostic performance.

#### **CLINICAL RELEVANCE/APPLICATION**

The model built by SyMRI makes it possible to effectively evaluate individual LN within the MRI scan.

## **T5B-SPHN-5 Uniting Dual-Modal MRI/Chemiluminescence Nanotheranostics: Spatially and Sensitive Self-Reporting Photodynamic Therapy in Oral Cancer**

### **PURPOSE**

In order to achieve precise and efficient diagnosis and treatment of tumors, the integrated nanosystem has been recognized by many interdisciplinary fields and has broad development prospects. However, there are still many challenges in real-time monitoring of targeted delivery and efficacy control of nanomedicines. Firstly, the unpredictable in vivo behaviors of nanotheranostics, that is, real-time tracking where, when, and how nanodrugs delivered. Next, limited by the uncontrollability of the therapeutic dose, how to monitor the treatment behavior and control the curative effect is the main bottlenecks. Therefore, inspired by the Boolean logic idea, designing sequence-activated nanotheranostics strategy is expected to become a breakthrough to solve the above difficulties and realize high-performance diagnosis and treatment applications.

### **METHODS AND MATERIALS**

A sequence-responsive MRI/chemiluminescence (CL) dual-mode strategy was constructed through uniform spatio-temporal resolution. The nanotheranostics system Pa-MnCH-A@P was prepared by combining the Mn<sup>2+</sup> chelated photosensitizer (Pa) and the CL molecule (CH-A) through FNP technology. Then we explored the structural characterization, spectral properties, MR properties and CL properties of the nanomaterials. The human oral squamous cell carcinoma cell CAL27 was selected as cell model of the tumor to further explore the PDT properties and CL imaging to further explore the photodynamic properties and chemiluminescence imaging properties in cells, as well as the dual-modality imaging were performed in tumor model of oral cancer in mice.

### **RESULTS**

We innovatively combined MR and CL imaging through FNP (flash nanoprecipitation) technology to quantitatively monitor in vivo distribution and PDT performance, overcoming the dilemma between spatial resolution and sensitivity.

### **CONCLUSION**

Based on near-infrared fluorescence imaging, chemiluminescence imaging, magnetic resonance imaging and photodynamic therapy, this research combined diagnosis and treatment to construct nanotheranostics system. We successfully designed nanoprobe Pa-MnCH-A@P to real-time tracking unpredictable biological distribution and behavior in vivo and PDT feedback, which expanded the application of sequence-activated nanotheranostics system.

### **CLINICAL RELEVANCE/APPLICATION**

Integration of diagnosis and treatment of oral cancer.

## **T5B-SPHN-6 The Impact of the COVID 19 Pandemic on Nasopharyngeal Carcinoma Extent at FDG PET/MR Staging: The NPCOVIPET Study**

### **PURPOSE**

To evaluate the impact of coronavirus disease 2019 (COVID-19) pandemic on disease extent in nasopharyngeal carcinoma (NPC) patients using 18 fluorodeoxyglucose (FDG) positron emission tomography (PET)/magnetic resonance imaging (MRI) staging as surrogate measure.

### **METHODS AND MATERIALS**

Retrospective observational study including biopsy-proven, newly diagnosed NPC patients using whole-body FDG PET/MR staging in two selected intervals: May 1, 2017 to January 31, 2020 (Group A), and February 1, 2020 to June 30, 2021 (Group B). Data regarding primary tumour, regional lymph nodal (N) status and number of involved regional lymph nodal stations, and presence and number of distant metastases (M) were collected.

### **RESULTS**

Three hundred ninety patients were included (201 in Group A vs 189 in Group B, respectively). The median intervals to PET/MR from the initial symptom in group A and group B were 2.5 (0.1-60.4) and 3.4 (0.2-56.3) months, respectively ( $p>0.05$ ). The median intervals to treatment from the initial symptom in group A and group B were 2.8 (0.2-60.5) and 3.6 (0.3-56.3) months, respectively ( $p>0.05$ ). No significant difference was observed in terms of T classification, N classification, overall stage, N stations and M stations between the two groups ( $p>0.05$ ). For the the involved neck node levels, more patients had developed level Vc metastasis in the group B ( $p=0.044$ ).

### **CONCLUSION**

For NPC, staging by PET/MR and therapy were not significantly delayed after quarantine restrictions initiated. Although the overall stage was not affected, more NPC patients had developed level Vc metastasis in the era of COVID-19.

### **CLINICAL RELEVANCE/APPLICATION**

None

## **T5B-SPHN-7 Use of 18F-FDG PET/MR as an Initial Staging Procedure for Nasopharyngeal Carcinoma**

### **PURPOSE**

The purpose of this study was to determine the clinical value and cost-effectiveness of PET/MR as an initial staging procedure for nasopharyngeal carcinoma (NPC) compared with the conventional work-up (CWU).

### **METHODS AND MATERIALS**

From May 2018 to March 2021, 1020 consecutive patients with biopsy-proven, newly diagnosed NPC in our center were enrolled in this study. Among them, 343 patients underwent PET/MR before treatment and the remaining 677 patients only underwent CWU. For PET/MR and CWU, charges were used as issued in 2021 by the Medical Insurance Administration Bureau of Zhejiang, China. Incremental cost-effectiveness ratio (ICER) measured cost of using PET/MR per percent of patients who avoided a false-positive (FP).

## **RESULTS**

For the whole group, the de novo metastatic disease rate was 5.2% (53/1020). A total of 187 patients with FP results were observed. More patients with FP results were observed in the CWU group (25.6% vs. 4.1%,  $p < 0.001$ ). The mean interval from pathological diagnosis to initiation of treatment was 13.1 days in the CWU group versus 7.9 days in the PET/MR group ( $p < 0.001$ ). Mean cost per patient was \$417 for CWU and \$1585 for PET/MR. The ICER was \$54 for each percent of patients who avoided a FP.

## **CONCLUSION**

s Compared with CWU, PET/MR reduced FP risk and decreased workup of incidental findings, allowing for earlier treatment start. PET/MR may be cost-effective in initial staging procedure for NPC.

## **CLINICAL RELEVANCE/APPLICATION**

None

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## Abstract Archives of the RSNA, 2023

T5B-SPIN

### Imaging Informatics Tuesday Poster Discussions II

#### Sub-Events

#### T5B-SPIN-1 Knee Osteoarthritis Deep Learning Models Demonstrate Greater Biases Based on Sex Than Race

##### Participants

Bardia Khosravi, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

##### PURPOSE

Deep learning (DL) models for chest x-ray (CXR) diagnosis have demonstrated biases against historically disadvantaged groups across sex, and race, raising concerns about the equitable use of these tools. It is unclear, however, if similar biases exist for DL models in other body parts like the knee. The purpose of our study was to evaluate for sex and race-based bias in a DL model for knee osteoarthritis (OA) severity grading.

##### METHODS AND MATERIALS

We used the Osteoarthritis Initiative (OAI) dataset of weight-bearing AP knee radiographs for DL model development and testing. We first trained a YOLO-v5 object detection model to localize the right and left knees using 4,490 bilateral knee radiographs with bounding box annotations split at the patient-level into 70%/10%/20% splits for training/validation/test sets. We then used this localization model to crop knee joints from 19,777 knee radiographs used to train and test the knee OA severity grading (groundtruth Kellgren-Lawrence grades [KLG] provided by OAI); there were 42% males and 81% white patients. These images were split based on race and sex at the patient level, using 20% for testing and the rest for five-fold cross-validation (Figure 1A). The model's performance was evaluated on the test set with AUROC subgroup analysis based on sex and race (white vs. not white).

##### RESULTS

The knee joint localization model achieved a mean average precision (mAP) of 0.97. The OA grading model had an average AUROC of 0.91 on the five validation folds and an AUROC of 0.90 on the entire test set. Subgroup analysis showed biases favoring males for all KLG groups, except for KLG 3, which favored females; for example, for KLG 1 grading, AUROC for males was 0.8 compared to 0.76 for females (Figure 1B). Race-based bias was less pronounced, with no difference in AUROC between white and non-white patients for KLG 0 and 2, and differences of 0.02 for KLG 1, 3, and 4 (Figure 1C).

##### CONCLUSION

Our DL OA severity grading model performed at a state-of-the-art level, but demonstrated sex-based biases favoring males in 4/5 KLG categories, echoing previous findings for DL models for CXR diagnosis. The model demonstrated less pronounced race-based biases, however, indicating that demographic-based biases in DL models may vary between specific diagnostic use cases and body parts. We recommend further study to elucidate the mechanisms behind these demographic biases in DL models in radiology.

##### CLINICAL RELEVANCE/APPLICATION

We show that deep learning models can diagnose knee osteoarthritis with high accuracy, but can also exhibit biases based on sex and, to a lesser extent, race. Evaluation of demographic bias is critical to ensure the equitable use of these exciting technologies that hold much promise to transform medical imaging.

#### T5B-SPIN-2 Radiobiometry": Deep-learning-based re-identification of Patients from De-identified Medical Images

##### PURPOSE

When two radiographs are presented for follow-up evaluation, a radiologist must ensure they are from the same patient, which is not a trivial task. In some cases, patients may be misregistered, potentially leading to a medical error. Thus, the purpose of the study was to develop and assess a deep-learning "radiobiometry" method to determine whether two radiographs are from the same or different patients.

##### METHODS AND MATERIALS

Convolutional Neural Networks (CNN) were trained with contrastive learning to distinguish radiographs of different patients. Using the MIMIC-CXR dataset, CNNs for frontal chest radiographs and multi-view chest radiographs (frontal and lateral) were trained. Additionally, CNNs were trained on radiographs from the Osteoarthritis Initiative (OAI) for 4 other anatomic regions: pelvis, bilateral knees, bilateral hands, and right hand.

##### RESULTS

After preprocessing, 247,522 frontal chest radiographs from 64,564 patients of the predefined MIMIC-CXR training set were used to train the frontal chest-radiograph CNN. This model was tested on 3,630 images from 292 patients of the internal test set, as well as the test set of the ChestX-ray8 dataset consisting of 25,596 images from 2,797 patients. A further 120,973 lateral chest radiographs from MIMIC-CXR were used in combination with the frontal radiographs above to train the multi-view chest-radiograph CNN. This was similarly evaluated on the internal test set with an additional 1,501 lateral images. For CNNs trained on OAI data, 4-fold cross-validation was performed on 26,524, 11,357, 6,165, and 1,799 radiographs of bilateral knees, pelvis, bilateral hands, and

right hand, from 4,796, 4,763, 3,504, and 1,000 patients, respectively. In all-pairs-similarity evaluation, all models achieved a test AUROC and rank-1 accuracy in excess of 0.99. Despite a minor drop in performance, the multi-view chest-radiograph CNN maintained an AUROC and rank-1 accuracy of over 0.99 when matching radiographs of differing laterality.

## CONCLUSION

While falling short of mature biometric modalities with enormous and specialized datasets, initial results using modestly sized medical imaging datasets demonstrate the potential for radiographs as a novel biometric modality for identification and authentication systems. While radiobiometry can be useful for verifying patients in radiology clinical practice, it may also raise concerns for the re-identification of public anonymized medical imaging data.

## CLINICAL RELEVANCE/APPLICATION

"Radiobiometry" systems for identifying patients from radiographs can help to reduce bookkeeping errors in clinical follow-up evaluation, protecting against misdiagnoses while consolidating mislabeled imaging records.

## T5B-SPIN-3 Efficient Deformable Registration with Local Self-similarity for Multi-Phase Abdominal CT Images

Participants

Tony C. W. MOK, ??, China (*Presenter*) Nothing to Disclose

## PURPOSE

We developed a fast deformable multi-phase abdominal CT registration algorithm, which addresses the non-linear misalignment of the intra-patient multi-phase abdominal CT images in real time.

## METHODS AND MATERIALS

Our model is a learning-based method. The training data includes 1,503 cases of three-phase (non-contrast, arterial, and venous) CT volumes from one hospital, including 399 with pancreatic ductal adenocarcinoma (PDAC), 751 with non-PDAC, and 353 normal. We trained the model in a semi-supervised manner. To address the large non-linear misalignment and inhomogeneous image intensity across multi-phase CT, we developed a novel multi-level convolutional neural network to learn to maximize the local self-similarity of the images. To further improve the registration accuracy, we leverage anatomical delineations segmented by a robust multi-organ segmentation model to co-supervise the registration model. The model was independently evaluated on a combined internal test set of 25 cases (5 PDAC, 15 non-PDAC, and 5 normal).

## RESULTS

The registration accuracy, robustness and smoothness of the deformation field are quantified with the Dice coefficient (DSC) of six anatomical delineations (Left and right kidneys, spleen, liver, stomach, and pancreas), the 30% lowest DSC (DSC30), and the standard deviation of the Jacobian determinant (SDLogJ), respectively. In arterial to non-contrast phase registration, our method's registration accuracy (DSC 93.6%) and robustness (DSC30 91.5%) are higher than the mean performance (DSC 92.7% and DSC30 88.8%) of the best-performing conventional multi-modal registration tool (DEEDs). Similar trends are observed in the venous to non-contrast phase registration. Our method outperforms the conventional image registration by a significant margin of 1.2% and 1.4% in DSC and DSC30, respectively, while maintaining a comparable smoothness in the solution (SDLogJ 0.152 vs 0.154). Our method circumvents the costly iterative optimization in the conventional method, which requires a mean running time of 119.5 seconds, and achieves real-time registration (0.33 sec per registration) for multi-phase CT images.

## CONCLUSION

Our method can efficiently register multi-phase abdominal CT images, outperforming the registration performance of the conventional method by a significant margin.

## CLINICAL RELEVANCE/APPLICATION

Our time-efficient registration method can be used in image fusion of multi-phase abdominal images, facilitating daily work of radiologists in imaging reading across multiple phases, and aggregating diverse image features for learning-based diagnostic systems. Our work suggests good feasibility in high-throughput environments that need to process dozens to thousands of multi-phase CT scans.

## T5B-SPIN-4 Identifying Metastatic Lymph Node Stations using a Local-Global Deep Hybrid Network with Prior-guided Supervision in Esophageal Cancer Patients

Participants

Dazhou Guo, New York City, NY (*Presenter*) Nothing to Disclose

## PURPOSE

The diagnosis of lymph node (LN) metastasis in computed tomography (CT) is an essential yet challenging task in esophageal cancer staging and treatment planning. Although criteria (e.g., RECIST, morphological/texture features) are proposed to predict LN metastasis, the diagnostic accuracy remains low with sensitivity <50% and specificity <75%, as reported in previous studies. Deep learning (DL) has the potential to address this issue by learning from large-scale labeled data. However, due to the practical surgery procedure in LN dissection, it is difficult to pair the metastasis of individual LN reported in the pathology report to the LN instance found in the CT image. Hence, in this study, we first use pathology reports to determine the lymph node station (LNS) metastasis, then develop a multiple instance deep learning (MIDL) model to predict LNS metastasis.

## METHODS AND MATERIALS

We collected data from 1,205 esophageal cancer patients who underwent preoperative contrast-enhanced CT scans. Using a recently developed automatic mediastinal LNS segmentation model, we segmented LNS 1 to 8 based on the IASLC protocol. For each LNS, we cropped the local CT region of interest (ROI) to generate station-wise CT patches, labeling the LNS as metastatic if at least one metastatic LN was indicated in the pathology report. We trained a 3D CNN-Transformer hybrid network using these CT patches. To incorporate LN position priors, we segmented LN instances (with a short axis =5mm) and added them as auxiliary input to the MIDL model. We also proposed a lymph node prior attention loss to supervise the transformer's attention map using LN instance masks. We conducted a five-fold cross-validation to evaluate the MIDL model's performance, reporting sensitivity, specificity, and AUC as classification metrics.

## RESULTS

The proposed MIDL model exhibited an overall AUC of 0.8574, significantly outperforming the second best comparing method (MobileNetV2) by 4.78% (0.8574 vs. 0.8096). The specificity was assessed at a threshold yielding a recall of 0.8, at which point the MIDL model achieved a specificity of 0.7735 (MobileNetV2: 0.6553). Additionally, the sensitivity was evaluated at a threshold leading to a specificity of 0.8, where the MIDL model obtained a sensitivity of 0.7719 (MobileNetV2: 0.6309).

## CONCLUSION

s The proposed MIDL model can substantially improve the LNS metastasis prediction and has the potential to play an essential role in cancer staging, treatment planning, and prognostic analysis.

## CLINICAL RELEVANCE/APPLICATION

The proposed algorithm can identify the metastasis lymph node stations in CT scan with high accuracy. The model may be applied in the clinical workflow to assist the diagnosis and treatment for esophageal cancer patients.

## T5B-SPIN-5 Fully Automated CT-Based Body Composition Tools Identify Increased Risk Factors for Adverse Health Outcomes in Socioeconomically Disadvantaged Individuals

Participants

Matthew Lee, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

## PURPOSE

Socioeconomic disadvantage is associated with adverse health outcomes. The purpose of this study is to evaluate the relationship between socioeconomic disadvantage and CT-based body composition (BC) measures derived from a panel of fully automated artificial intelligence (AI) tools to identify individuals at increased risk for death and major adverse cardiovascular events (MACE).

## METHODS AND MATERIALS

A fully automated panel of AI body composition tools quantifying abdominal aortic calcium (AoCa, Agatston score), abdominal fat (visceral adipose tissue area [VAT], visceral-to-subcutaneous fat ratio [VSR]), and muscle attenuation (muscle HU; mean at L3 level) was applied to non-contrast CT examinations in asymptomatic adults undergoing screening CT colonography (CTC). Patients were partitioned into 5 socioeconomic groups based on the national area deprivation index (ADI). One-way analysis of variance was used to compare means across groups. Odds ratios (ORs) were generated from high specificity (90% specificity) BC thresholds with more disadvantaged groups being compared to the least disadvantaged group (ADI<20) for each body composition measure.

## RESULTS

7785 asymptomatic adults (mean age, 57 years; 4361:3424 F:M) underwent screening CTC from April 2004-December 2016. Median ADI was 31 (IQR 22-43). Significant correlation was observed for all measures (all  $p<0.001$ ). More socioeconomically disadvantaged groups had significantly higher AoCa, higher VAT, higher VSR, and lower muscle attenuation. Compared with the least disadvantaged group, mean differences for the most disadvantaged group (ADI>80) were: AoCa=567, VAT=27 cm<sup>2</sup>, VSR=0.1, and muscle HU=-6 HU (all  $p<0.05$ ). Compared with the least disadvantaged group, the most disadvantaged group had significantly higher odds of having high-risk body composition measures: AoCa OR=3.8, VAT OR=2.5, VSR OR=2.0, and muscle HU OR=3.1 (all  $p<0.001$ ).

## CONCLUSION

s Fully automated CT-based AI body composition tools show that socioeconomic disadvantage is associated with high-risk BC measures and can be used to identify individuals at increased risk for death and MACE.

## CLINICAL RELEVANCE/APPLICATION

Fully automated AI body composition tools are promising for opportunistic screening to identify markers of increased risk of death and MACE associated with socioeconomic disadvantage using data that typically go unused in clinical practice offering added value without additional patient time or dose.

## T5B-SPIN-6 Deep learning-based Model for Prediction of Hepatocellular Carcinoma Recurrence in Pre-operative Computed Tomography after Curative Surgery

## PURPOSE

Curative surgery is the treatment of choice for early-stage hepatocellular carcinoma (HCC) yet recurrence occurs in over 70% of cases. Recurrence, particularly within the first 5 years, is associated with poor prognosis and currently, few clinical risk scores can accurately predict recurrence. While histological microvascular invasion (MVI) predicts recurrence, it can only be confidently ascertained from surgical specimens thus unable to provide pre-treatment prognostication. Here, we developed a deep learning-based model for the prediction of HCC recurrence.

## METHODS AND MATERIALS

Chinese patients with resected histology-confirmed HCC were recruited from 5 centers in Hong Kong. They were randomly divided in an 8:2 ratio to training and internal validation. A residual-network deep learning-based model to predict HCC recurrence was developed through the training-validation-testing approach utilizing pre-operative CT and clinical data (age, sex, comorbidities, and baseline blood tests). The model was externally tested using an independent cohort from Taiwan. Area-under-curve (AUC), positive and negative predictive values (PPV/ NPV) were calculated and survival analyses were also performed and compared with tumour MVI status.

## RESULTS

This interim analysis included 1,254 patients (82.9% male, age 62.2 +/- 10.8 years, median follow-up 7.8 [5.8-10.0] years), with 368 (29.3%) and 710 (56.6%) developing recurrence within 1 and 5 years respectively. Of those, 551 (43.9%), 140 (11.2%), and 563 (44.9%) patients were included in the training, internal validation, and external testing cohorts. The model was trained for 42 epochs and the model achieved AUCs of 0.855 (95% CI 0.682-0.907; PPV 75.4%; NPV 84.3%) and 0.803 (95% CI 0.631-0.859; PPV 89.7%; NPV 55.1%) for predicting HCC recurrence at 1 and 5 years. In the external testing cohort, the deep learning-based model achieved AUCs of 0.775 (95% CI 0.536-0.840; PPV 49.7%; NPV 85.2%) and 0.733 (95% CI 0.539-0.766; PPV 87.0%; NPV 45.8%)



for HCC recurrence at 1 and 5 years, significantly higher than MVI (AUCs 0.617 [0.496-0.725]; PPV 32.9%; NPV 88.5% and 0.560 [0.418-0.688]; PPV 67.9%% NPV 46.4%) respectively. Furthermore, the deep learning-based model had superior discriminative ability on 1 and 5-year recurrence risk compared with MVI (49.7% vs 32.9% and 87.0% vs 67.9% respectively, both  $p < 0.05$ ).

#### **CONCLUSION**

s Our deep learning-based model can accurately predict HCC recurrence after curative surgery in early-stage HCC outperforming MVI in risk stratification.

#### **CLINICAL RELEVANCE/APPLICATION**

Deep Learning can combine radiological images and clinical data and develop models that have the potential to become novel tools for pre-treatment prognostication for short- and intermediate-term outcomes in HCC.

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## Abstract Archives of the RSNA, 2023

T5B-SPIR

### Interventional Radiology Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPIR-1 Timing Matters: Which CT Phase for Colorectal Liver Metastasis Segmentation is Better for Ablative Margin Quantification in Predicting Local Outcomes?**

##### Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the use of three-dimensional minimal ablative margin (MAM) quantified by tumor segmentation using hepatic arterial (HAP) versus portal venous (PVP) phases CT for predicting residual tumor and local tumor progression (LTP) following colorectal liver metastasis (CLM) thermal ablation.

##### METHODS AND MATERIALS

This two-institution retrospective study included patients undergoing microwave and radiofrequency ablation between 2010 and 2021 with intraprocedural pre-ablation HAP and PVP and post-ablation PVP CT. Patients with follow-up less than one year without residual tumor or LTP were excluded. Tumors were segmented on pre-ablation HAP and PVP CT and ablation zones were segmented on post-ablation PVP CT. MAMs were quantified by a biomechanical deformable image registration method. Prognostic value of MAM in predicting residual tumor and one-year LTP was investigated using area under the receiver operating characteristic curve (AUC) and the association with LTP was tested using Fine-Gray subdistribution hazard regression model.

##### RESULTS

A total of 80 patients (mean age, 60 years  $\pm$  12 [SD]) with 151 CLMs were included. During a median follow-up of 27.3 months, 5 residual tumors were noted, and the LTP rate was 15.7% (23/146). The median tumor volume was 1.6 mL and 1.2 mL segmented on HAP and PVP CT, respectively ( $P=0.006$ ), with corresponding median MAM of 2.2 mm and 4.0 mm, respectively ( $P=0.007$ ). The AUC in predicting residual tumor and one-year LTP by HAP and PVP were 0.75 (95% confidence interval [CI]: 0.67, 0.84) and 0.81 (95% CI: 0.74, 0.89), respectively ( $P=0.006$ ). MAM of 0 mm on PVP CT was an independent predictor of LTP with a subdistribution hazard ratio of 7.7 (95%CI: 3.0, 19.6;  $P<0.001$ ), compared to 4.7 (95%CI: 1.8,12.0,  $P=0.001$ ) on HAP CT.

##### CONCLUSION

Ablative margin quantification using intraprocedural portal venous phase CT for colorectal liver metastasis segmentation significantly outperformed arterial phase CT in predicting ablation outcomes.

##### CLINICAL RELEVANCE/APPLICATION

Ablative margins should be quantified on intraprocedural portal venous phase CT instead of arterial phase CT, as the latter may overestimate tumor size.

#### **T5B-SPIR-2 Microwave Ablation in Hepatocellular Carcinoma: Dynamics of Extracellular Vesicles and Immunological Response**

##### Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

To characterize extracellular vesicles by liquid biopsy in preinterventional patients with primary and secondary hepatic malignancies treated with microwave ablation (MWA).

##### METHODS AND MATERIALS

Blood samples of 38 HCC patients and 15 patients with hepatic metastases were collected immediately pre and postinterventional. Subsequently, the characterization of 37 surface epitopes of EVs by magnetic bead-based particle sorting and fluorescence-associated cell scanning (FACS) was conducted.

##### RESULTS

The HCC-group before intervention revealed an activation of T-cell-associated EV protein expressions with significantly increased CD40, CD86 and CD8, ( $p=0.022$ ;  $p=0.003$  and  $p=0.024$ , respectively) vs. the non-HCC group. Additionally, the pre- and post-interventional HCC group showed an increment of the B-cell associated marker CD20 vs. the non-HCC group,  $p=0.005$  and  $p=0.014$ , respectively. The tumor cell associated surface epitopes, CD44, CD133 and CD24 were significantly higher expressed in the pre-interventional HCC vs. non-HCC group ( $p=0.029$ ,  $p=0.009$ ,  $p=0.004$ ). Regarding the clinical parameters, the HCC group showed a significantly higher expression of CD9 in patients with recurrent HCC, nonalcoholic steatohepatitis (NASH)-related HCC and cirrhotic HCC. Furthermore, the subgroup analysis of HCC patients showed a significantly lower expression of CD44 in NASH-related HCC and cirrhotic HCC. Pre-interventional cytokine levels of TH1 and Treg cells (IL2 and IL17) correlated strongly with elevated CD44 levels

in HCC patients. Additionally, pre-interventional IL6 levels correlated strongly with a high expression of CD19 and CD86. Regarding the post-interventional changes increased CD19, CD20 and CD44 levels correlated strongly with an elevated CD4/CD8 ratio and negatively correlated with CD4/CD8 ratio changes.

#### **CONCLUSION**

s EV surface expressions correlated with cytokine levels in pre-interventional HCC patients showed a CD4+ TH1 response, associated with CD44 expression.

#### **CLINICAL RELEVANCE/APPLICATION**

EV surface expressions can be used as a prognostic parameter in MWA of HCC.

### **T5B-SPiR-3 Microwave Ablation versus Laser-induced ThermoTherapy in the Treatment of Hepatocellular Carcinoma: Evaluation of Therapy Response and Survival Rates**

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To retrospectively compare CT-guided microwave ablation (MWA) with MR-guided laser-induced thermal ablation (LITT) of hepatocellular carcinoma (HCC) regarding therapy response and overall survival (OS)

#### **METHODS AND MATERIALS**

In total, 303 patients (64f, 239m) were treated with 521 sessions of thermal ablation: 250 patients (52f, 198m; mean: 66±10 years) with 445 CT-guided MWAs and 53 patients (12f, 41m; mean: 67.5±8 years) with 76 MR-guided LITTs. Diameter of HCC lesions, technical success, complete ablation, local tumor progression and OS rates were evaluated in all cases.

#### **RESULTS**

Mean tumor diameter was 2.16 cm in the MWA group vs. 2.4 cm in the LITT group. Technical success was achieved in all ablations in both groups. Complete ablation was achieved in 97.7% of the tumors in the MWA group and in 98.7% in the LITT group. In the MWA group 6% of the patients and in the LITT group 3.8% developed local tumor progression. The 1-, 3-, and 5-year OS rates starting at the date of ablation were 86.6%, 53.4% and 40.4% in the MWA group and 85%, 37.7% and 17% in the LITT group, respectively. (p-value:0.001). No peri-procedural deaths were reported in both groups.

#### **CONCLUSION**

s Image-guided thermal ablation like LITT and MWA are both effective and safe for the local treatment of HCC. Patients in the MWA group had an overall longer survival time, but with higher rate of local tumor progression than the patients in the LITT-group.

#### **CLINICAL RELEVANCE/APPLICATION**

Both MWA and LITT provide long OS with low complication rates in patients with HCC

### **T5B-SPiR-4 Transarterial Chemoembolisation (TACE) for Unresectable or Recurrent Hepatic Cholangiocarcinoma: Added Value of Local Thermal Ablation**

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To retrospectively evaluate the local tumor control and survival rates after targeted local therapy using transarterial chemoembolisation (TACE) with or without local thermal ablation in patients with unresectable or recurrent hepatic cholangiocarcinoma (CCA).

#### **METHODS AND MATERIALS**

From January 2007 to December 2017, 152 patients (69 males and 83 females; mean: 58.7 years) with cholangiocarcinoma (CCA) were retrospectively evaluated. The study included patients with both unresectable (80.2%) and recurrent lesions (19.8%). Patients were treated with at least three therapeutic cycles of TACE (3-26 cycles). 32 patients received combined TACE and local thermal ablation. Local tumor response was assessed by contrast-enhanced magnetic resonance imaging (CE-MRI) based on the modified RECIST criteria (mRECIST) and the survival evaluated using the Kaplan-Meier method.

#### **RESULTS**

The mean survival for all patients was 28.7 months (CI:21.8-35.7). Patients who received additional ablation sessions showed significantly longer survival compared to those who received only TACE (median 28 and 18 months respectively; P< 0.007). The tumor response after three cycles of TACE was either stable (35.5%), partial response (41.4%) progressive (23%) or complete response (0%) and the response at the last follow up was 25.7%, 15.2%, 59.2% and 3.5 % respectively. The following significant prognostic factors were found: nodal and/or systemic metastases, pre-therapeutic tumor load, initial local tumor response and associated application of local thermal ablation.

#### **CONCLUSION**

s Targeted therapy of unresectable or recurrent CCA using TACE with an added value of thermal ablation treatment may provide a therapeutic option for local tumor control and may improve patient's survival.

#### **CLINICAL RELEVANCE/APPLICATION**

TACE is a relevant targeted therapy tool in the regional treatment of CCA.

## **T5B-SPIR-5 KRAS Gene Mutation Influence after Ablation of Colorectal Cancer Lung Metastases: Prediction of Local Recurrence and Chemotherapy-free Survival Time**

### **Participants**

Marcelo Liberato Coelho Mendes De Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **PURPOSE**

The primary objectives of the study were to evaluate if KRAS gene mutation predicts local recurrence in patients undergoing ablation of colorectal cancer lung metastases and to evaluate the chemotherapy-free interval of these patients. The secondary objective was to assess overall survival rate of these patients.

### **METHODS AND MATERIALS**

This is a retrospective observational study of the medical records of patients who underwent lung ablation of colorectal cancer metastases, performed at a quaternary hospital. Radiofrequency (RFA) and microwave (MWA) ablations were used. Intraoperative planning and overlaps were defined by the assistant team of interventional radiologists, based on the size and location of the metastases. A review of pre-, intra-, and post-procedure images was performed by one of the authors. The data were then charted in Microsoft® Excel® and exported for statistical analysis to IBM® SPSS® Statistics version 20. Statistical significance was evaluated using Fisher's exact test.

### **RESULTS**

Data were obtained from the medical records of 59 patients who underwent ablation of lung metastases from colorectal cancer. The gender distribution was homogeneous (30 men and 29 women), and mean age was 60.8 years. In 31 cases the initial location of the cancer was in the rectum, in 17 in the sigmoid, and in 11 in the colon and cecum. Before ablation, 50 patients had had a chemotherapy cycle, and 11 had had a surgical resection. RFA was performed in 58 patients, and MWA in 1. There were no complications in 55 patients, and 4 had pneumothorax. The number of nodules ablated varied, as follows: 1 nodule in 40 patients, 2 in 10 patients, 3 in 4 patients and 4 in 5 patients. There was recurrence in 27 patients: 2 local and 25 distant. There was no statistically significant association between KRAS gene mutation and local (p 0.407), distant (p 0.710) or global (p 0.999) recurrence. There was no statistically significant association between local recurrence (p 0.999) and proximity to the bronchi or vessels. The chemotherapy-free interval was 19.3 months (95% CI: 14.8-23.8), and overall survival (OS) at 67 months of follow-up was 49.3% (1-year OS: 93%; 3-year OS: 80%).

### **CONCLUSION**

Ablation of lung metastases is an effective and safe method. Mutation of the KRAS gene did not show to be a predictive factor in the rate of recurrence of lung metastases from colorectal cancer. Ablation allows an overall survival similar to surgical treatment. The longer chemotherapy-free interval provides better quality of life for patients.

### **CLINICAL RELEVANCE/APPLICATION**

Mutation of the KRAS gene determines a higher rate of local recurrence after liver ablations, but there was no description in the literature about its influence in pulmonary ablative treatments.

## **T5B-SPIR-6 Percutaneous Cryoablation of Progressing Extra-abdominal Desmoid Tumors (DT)**

### **Participants**

Andrea Vanzulli, MD, Tradate, Italy (*Presenter*) Nothing to Disclose

### **PURPOSE**

To evaluate the efficacy of percutaneous cryoablation of extra-abdominal desmoid tumors (DT) progressing after first-line treatments, including active surveillance, non-steroidal anti-inflammatory drugs and chemotherapy.

### **METHODS AND MATERIALS**

We retrospectively evaluated baseline and post-treatment MRI and/or CT imaging of 19 patients with progressing extra-abdominal DT (average diameter 80,2 mm; range 40-125 mm) treated with percutaneous cryoablation at our Institution between May 2021 and November 2022, with a median imaging follow-up time of 149 days. Response to treatment was evaluated both with standard and modified (m) RECIST1.1 criteria, as tumor shrinkage alone does not take into account tissue viability/necrosis and therefore incompletely describes responses to local treatments. Tumor locations included the cervical district (3), the thoracic (3) and abdominal wall (11), the lumbo-sacral (1) and gluteal region (1).

### **RESULTS**

Both standard and modified RECIST1.1 criteria classified all 19 patients as non-progressive. According to standard RECIST 1.1, 16 patients showed stable disease (SD) and 3 patients displayed a partial response (PR). According to modified RECIST criteria, 9 patients presented with SD, 4 patients with PR and one patient with a complete response (CR), with 2 RECIST-SD patients being reallocated to PR and CR categories, respectively. Five patients didn't have adequate pre-treatment imaging and couldn't therefore be categorized with mRECIST. No major periprocedural complications were registered, with 84% of patients reporting significant improvement of symptoms and quality of life.

### **CONCLUSION**

Desmoid tumors are rare (5-6 cases/million/year), locally aggressive fibroblastic proliferations characterized by infiltrative growth and a tendency to local recurrence. Although unable to metastasize, DT can cause significant morbidity through invasion of surrounding structures, causing chronic pain, functional impairment, and deformities. Due to high rates of recurrence after surgery and frequent spontaneous regression or stabilization, active surveillance generally represents the first-line treatment. Available therapeutic strategies achieve poor response rates, with many patients suffering from disease progression. In such context, cryoablation is emerging as a feasible and effective treatment to reduce tumor burden of extra-abdominal DT progressing after multiple lines of treatment. Furthermore, we report that mRECIST outperform standard RECIST1.1 criteria to evaluate DT response to cryoablation.

### **CLINICAL RELEVANCE/APPLICATION**

To the best of our knowledge, this study represents one of the biggest case series of progressing extra-abdominal DT treated with

percutaneous cryoablation.

## **T5B-SP1R-7 Response Post Local Tumor Ablation in HCC is Dependent Upon Interferon-gamma Linked Pathways with Associated C-X-C Chemokine Ligand Family Proteins**

### **Participants**

Matthias Stechele, MD, Munich, Germany (*Presenter*) Nothing to Disclose

Maurice Heimer, MD, Munich, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

To uncover post-therapeutic systemic pathways and their potential as biomarkers in HCC patients treated by CT-guided local tumor ablation.

### **METHODS AND MATERIALS**

Twenty-four consecutive HCC patients treated with CT-guided high-dose rate brachytherapy (HDR-BT) (1x15 Gy) were included in this prospective IRB-approved study. Ninety-two proteins were quantified in blood samples acquired at baseline and 48hr post-HDR-BT and analyzed with a multimarker tool (Olink proteomics Target 96 immuno-oncology panel with Proximity Extension Assay technology). Ratios post-therapy in comparison to baseline (reported as fold change; FC) were calculated to detect a threshold of 30 % elevation or decrease. Patients were classified as responders (R, n=12) in absence of local progression within 6m and no systemic progression within 2yr observed on follow-up MRI or CT imaging. Non-responders (NR, n=12) had recurrence within 6m and/or tumor progression with more than 3 nodules or individual lesion diameter more than 3 cm or extrahepatic disease within 2yr. Statistical analyses was performed comparing the two groups using paired and unpaired t-tests.

### **RESULTS**

For all patients regardless of outcome, the most prominent pathway change was a decrease in interferon-gamma (IFN- $\gamma$ , FC 0.48, p=0.001) and 2 downstream members of the CXC family (CXCL9 FC 0.73, p=0.001 and CXCL10 FC 0.65, p=0.001). Moreover, non-responders showed increased values in pro-neutrophil and angiogenic CXCL5 in comparison to a decrease for responders (NR FC 1.51, R FC 0.78, p=0.043) and increased values in pro-tumorigenic CXCL12 in comparison to responders (NR FC 1.06, R FC 0.89, p=0.042). Accompanying CXCL5, granzyme-B, an additional neutrophil marker was significantly decreased in responders (FC 0.57, p=0.003), but unchanged in non-responders (FC 1.01, p=0.942). No significant differences were seen between responders and non-responders for other IFN- $\gamma$  pathway-associated proteins including CXCL1, CXCL9, CXCL10, CXCL11 and CXCL13.

### **CONCLUSION**

s HDR-BT induces decreases of circulating IFN- $\gamma$  and associated pathway chemokines potentially contributing to inhibition of immune cell infiltration, alteration of neutrophil activation, and angiogenesis post-therapy. Chemokine ligands CXCL5 and CXCL12 may enable differentiation between responders and non-responders post-therapy and potentially serve as biomarkers for response prediction.

### **CLINICAL RELEVANCE/APPLICATION**

Elucidating the molecular pathways associated with interventional oncologic therapies can potentially generate biomarkers predicting outcome and offer rational targets for combination adjuvant therapy.

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## Abstract Archives of the RSNA, 2023

T5B-SPMK

### Musculoskeletal Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPMK-1 High-Resolution Bone Image from Shoulder MRI using Deep Neural Network on 3-D Accelerated Dixon GRE (CAIPIRINHA Dixon)**

#### Participants

Jooyeon Kim, MD, Seoul, Korea, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

To test the feasibility of generating high-resolution bone image resembling CT from shoulder 3-D CAIPIRINHA Dixon MRI data using deep neural network.

#### METHODS AND MATERIALS

In this IRB-approved retrospective study, patients with 3.0T MRI for shoulder pain were enrolled. Those without CT or 3D VIBE CAIPI-DIXON were excluded. The 3D VIBE CAIPI-DIXON protocol was ; TR/TE 12.7 /2.5,+3.6ms; FA 10°; FOV 159 x 159 mm; spatial resolution 0.4x0.4 mm<sup>3</sup>; acquisition time 3.02 min (Magnetom Vida, Siemens Healthineers, Germany). The dicom files were reconstructed using a commercially available DNN-based denoising and resolution enhancement algorithm (SwiftMR, AIRS Medical, Korea). The in-phase and opposed phase CAIPI-Dixon original PACS image ("CAIPI-i-ori", "CAIPI-o-ori"), and the corresponding CAIPI-Dixon after DNN processing images ("CAIPI-i-dn", "CAIPI-o-dn") were viewed after gray-scale inversion, and quantitatively and qualitatively evaluated by two radiologists. The images were first orthogonally rotated to measure the diameters of the glenoid. Studies were scored from 1 to 5 for the clarity of the cortical outline and trabecular bone of the humeral head and glenoid, any pseudolesion, visibility of fractures. The humeral head, glenoid neck, deltoid, and infraspinatus muscles were marked with regions of interest. ROIs were drawn on vacant quadrants for noise. CT was used to compare the glenoid dimension measurements, ROI values, SNR, and CNR. For statistical analysis, Kruskal-Wallis and Spearman tests were used ( $p < 0.05$ ).

#### RESULTS

Final group included 10 patients (4 females, mean age 60.6 years). The glenoid diameters measured from CAIPI-i-dn, o-dn, CAIPI i-ori, o-ori, and CT did not differ significantly ( $p > 0.05$ ). CAIPI-i-dn, o-dn, and CAIPI-o-ori had higher humerus cortical scores than CAIPI-i-ori (4.94±0.236, 3.611±0.195, 4.39±0.916, vs 3.00±0.29). CAIPI-i-o-dn showed higher glenoid cortical scores than CAIPI-i-o-ori (4.17±1.043 than 3.56±1.247,  $p < 0.05$ ). SNR of humerus and glenoid significantly improved with CAIPI-dn compared to CAIPI-ori (4 from 1.07,  $p < 0.05$ ). CT density negatively correlated with CAIPI-o-dn ROI in the humerus and glenoid (correlation coefficient -53.3, and -60.3,  $p < 0.05$ ). ICC value of the semiquantitative scores of CAIPI-i- o-dn (eg. cortical and trabecular outline) was 79.5 among the two readers. ICC value of quantitative scores (eg. ROI) was 96.4 ( $p < 0.05$ ).

#### CONCLUSION

s Combining 3D VIBE CAIPI-DIXON MRI and the DNN algorithm enabled high resolution cortical and trabecular bone imaging.

#### CLINICAL RELEVANCE/APPLICATION

High resolution CT-like bone images could be generated from 3D MRI with DNN processing. Cortical and trabecular information can be obtained. Quantification may be comparable to that of CT.

#### **T5B-SPMK-2 Multivariable Logistic Regression Analysis of Risk Factors for Pericollapse Stage of Osteonecrosis of the Femoral Head: Collapse-related Changes with CT and MRI**

#### PURPOSE

We aimed to determine the diagnostic values of collapse-related changes to distinguish between Association Research Circulation Osseous (ARCO) stage 2 and 3A (named as pericollapse stage) in patients with osteonecrosis of the femoral head (ONFH).

#### METHODS AND MATERIALS

A retrospective analysis was conducted in 124 hips with ONFH of either ARCO stage 2 (n = 49; 23 females; mean age, 50.7 years) or 3A (n = 75; 20 females; mean age, 53.2 years), in patients who underwent CT and MRI from May 2017 to August 2022 in our hospital. We assessed four types of collapse-related changes; on CT- 1) bone resorption area, 2) cystic change, and on MRI- 3) bone marrow edema, 4) joint effusion. We compared these collapse-related changes between stage 2 and 3A, analyzed the diagnostic performance of each variable for detecting stage 3A, and finally performed multivariate analysis to find the best predictor variable for stage 3A. ARCO stage 3A referred to the pericollapse stage as a period from the occurrence of subchondral fracture to early collapse (=2mm).

#### RESULTS

All four types of collapse-related changes were significantly more common in stage 3A than in stage 2 (bone resorption area [72.0% vs. 4.1%]; cystic change [52.0% vs. 0.0%]; bone marrow edema [93.5% vs. 43.6%]; joint effusion [76.0% vs. 24.5%],  $p < 0.001$  in all). The sensitivity, specificity, and diagnostic accuracy for stage 3A were 72.0%, 96.0%, and 81.0% for bone resorption area;

52.0%, 100%, and 71.0% for cystic change; 93.0%, 56.0%, and 76.0% for bone marrow edema; and 76.0%, 76.0%, and 76.0% for joint effusion. In the multivariate analysis, bone resorption area (OR=32.952, p=0.002), cystic change (OR=26.281, p=0.008), and joint effusion (OR=9.603, p=0.004) were independent predictors of stage 3A. Combination model of bone resorption area and cystic change showed the best area under the curve (AUC, 0.900) for stage 3A.

## CONCLUSION

s Collapse-related changes were significantly more frequent in stage 3A than in stage 2. Bone resorption area and cystic change were highly specific findings favoring stage 3A, while bone marrow edema and joint effusion were highly sensitive findings for stage 3A. Among them, bone resorption area was the best single predictor for stage 3A by multivariate logistic regression analysis. Combination of bone resorption area and cystic change was the best model in diagnosis of stage 3A with AUC of 0.900.

## CLINICAL RELEVANCE/APPLICATION

The accurate diagnosis of ARCO stage 3A is essential for future treatment plan in ONFH. It is often difficult to clearly distinguish this pericollapse stage by subchondral fracture alone. Imaging findings of collapse-related changes on CT and MRI can help to detect stage 3A as pericollapse period.

## T5B-SPMK-3 Application of Deep Learning Reconstruction Algorithm (AiCE) in Low-dose CT Scanning of Sacroiliac Joints

### PURPOSE

To explore the effect of deep learning reconstruction(DLR) in improving the image quality and reducing radiation dosage of low-dose sacroiliac joint CT scans by comparing with hybrid iterative reconstruction(HIR).

### METHODS AND MATERIALS

A total of 76 patients who underwent sacroiliac joint CT scans in our hospital from May 2021 to March 2022 were prospectively included. All patients gave written informed consent for the acquisition of low-dose CT(LDCT) after a clinically indicated standard-dose CT(SDCT). The SDCT series were reconstructed with HIR and the LDCT were reconstructed with DLR and HIR. The effective dose(ED) and size-specific dose estimate(SSDE) were calculated. All images were evaluated objectively, including the background noise(BN) of images, signal to noise ratio(SNR) and contrast to noise ratio(CNR) of the first sacral vertebra and iliac bone. Subjective 5-point Likert scale was used to score the reconstructed images of the three groups, and bilateral sacroiliac joints were grade according to the New York classification standard. All patients were divided into 3 groups(normal weight, overweight and obese groups) according to the BMI. The differences of objective and subjective evaluation were compared among the 3 kinds of reconstructed images.

### RESULTS

The ED and SSDE of LDCT were significantly lower than those of SDCT (p<0.001) and the reduction rates of ED and SSDE increased with the increase of the BMI. The BN, SNR, CNR and subjective scores showed significant differences (p<0.001) among SD-HIR, LD-HIR and LD-DLR images. The BN values were lower, and SNR and CNR values were higher on LD-DLR than those of SD-HIR and LD-HIR images (p<0.05). The subjective scores of LD-DLR images were significantly higher than those of LD-HIR images (p<0.001), and had no significant differences compared with SD-HIR (p=0.808). In addition, the diagnostic consistency of SD-HIR and LD-DLR images for sacroiliac arthritis grading was superior with Kappa value=0.888 (p<0.001).

## CONCLUSION

s The use of DLR can reduce the radiation dose and improve the image quality of sacroiliac joint CT, with comparable efficacy of diagnosis to HIR. Thus, DLR algorithm is helpful to improve the safety of CT scanning of sacroiliac joint.

## CLINICAL RELEVANCE/APPLICATION

The DLR algorithm, Deep Learning Reconstruction algorithm(AiCE), can help improve image quality and detect sacroiliac joint diseases with extremely low radiation dose for pelvis area of patients.

## T5B-SPMK-4 Anatomic Variants of the Acetabular Labrum of the Hip

### Participants

Brandon Knight, BS, Houston, TX (*Presenter*) Nothing to Disclose

### PURPOSE

The acetabular labrum is a ring of fibrocartilaginous tissue continuous with the distal edge of the acetabulum and completed inferiorly in its arc by the transverse acetabular ligament. Tears of the acetabular labrum can occur due to various factors and are diagnosed by clinical signs and imaging. Because of their similar appearance on imaging to non-pathologic labral variants, such as labral sulci, proper differentiation of labral tears from non-pathologic anatomic variants is essential for correct diagnosis and prevention of unnecessary treatment. However, few studies have collected observational data on labral sulci. This study aimed to observe the prevalence and locations of non-pathologic anatomic variants of the acetabular labrum, including sublabral sulci and transverse sulci. Teaching points will also be highlighted in the identification of sulci.

### METHODS AND MATERIALS

Hip MR imaging from 109 patients who presented to our hospital system for hip arthroscopy was retrospectively analyzed. Surgical findings were used to determine the presence of labral tears, while MR imaging was available and reviewed for all cases to determine the presence of labral sulci, which was then confirmed by surgical findings of labral sulci or by a lack of abnormal surgical findings at that location (with imaging findings being analyzed alongside surgical findings when available). Prevalence, location, and other attributes were observed of these anatomic variants, as well as of labral tears and paralabral cysts.

### RESULTS

After retrospective analysis, 130 acetabular labral tears out of 135 total cases were found in surgery, with 19% of those cases associated with paralabral cysts. A total of 43% of the patient population was observed to have at least one sublabral sulcus. The majority of sulci were found in the posteroinferior quadrant. Among all patients a total of 64 sublabral sulci were found, with some patients presenting with multiple sulci unilaterally or bilaterally. In 44% of cases, 49% of patients displaying at least one transverse

sulcus were found on imaging.

## CONCLUSION

s Normal anatomic variants occur commonly in the hip joint, including sublabral sulci and transverse sulci, and may be mistaken on imaging for acetabular labrum tears. Understanding their prevalence improves the proper differentiation of these anatomic variants from labral tears, increasing the specificity of acetabular labral tear diagnosis and thus decreasing false positive rates and improving patient outcomes.

## CLINICAL RELEVANCE/APPLICATION

Acetabular labral tears account for a large proportion of groin/hip pain patients and may be mistaken for sulci on imaging. Properly differentiating labral sulci and labral tears on imaging increases the specificity of labral tear diagnosis.

## T5B-SPMK-5 Additional Pain Generators on Lumbosacral Plexus Magnetic Resonance Neurography

### PURPOSE

Pain in sciatic nerve distribution is a common cause of disability worldwide with a reported prevalence of 43%. Identifying the cause of sciatica-type symptoms is clinically problematic, particularly when the symptoms are non-discogenic in origin. Magnetic resonance imaging (MRI) of the lumbosacral plexus has become a study of choice for sciatica, providing excellent anatomic detail and allowing comprehensive assessment of peripheral nerves, however, it demonstrates positive nerve findings in only 36-45% of patients according to literature. Our aim was to evaluate the prevalence of additional pain generators in patients undergoing lumbosacral plexus MRI, that commonly contribute to sciatica symptoms.

### METHODS AND MATERIALS

A retrospective review of 125 lumbosacral plexus MRI examinations performed from September 2015 through September 2022 on a 3T scanner was undertaken. The studies were independently reviewed in a blinded fashion by 3 radiologists. The findings were graded on a 0-3 scale depending on the presence or absence of particular non-neurologic pain confounders and the diagnostic quality of the study. Fleiss' Kappa (FK) was used to evaluate the interreader agreement.

### RESULTS

The presence of additional pain generators was demonstrated in 91% of examinations. Common etiologies observed included labral tears (62.4%, FK 0.7), hamstring tendinopathy/tears (57.6%, FK 0.72), gluteus tendinopathy/tears (56%, FK 0.63), greater trochanteric bursitis (40%, FK 0.65), ischiofemoral impingement (20.8 %, FK 0.75), sciatic nerve compression or variant anatomy (11.2%, FK 0.77), paralabral cysts (8%, FK 0.8), and moderate/severe hip osteoarthritis (8%, FK 0.72). Other incidental findings observed included disc herniation with nerve root compression (4%), sacral insufficiency fractures (1.6%), femoral head avascular necrosis (0.8%), and calcific tendinosis (0.8%). Of note, lumbosacral nerve abnormalities were only detected in 48% of the study group.

### CONCLUSION

s Lumbosacral plexus MRI examinations permit accurate detection and localization of additional pain generators in patients with non-discogenic sciatica. Our study demonstrated substantial interreader agreement regarding the presence or absence of sciatica/buttock pain confounders and a high level of confidence in their detection by radiologists.

## CLINICAL RELEVANCE/APPLICATION

Extra-neural causes of sciatica can be consistently identified on lumbosacral plexus MR neurography studies, both on conventional T1/T2-weighted and lumbosacral plexus-specific series. This becomes particularly important when no nerve pathology is detected, as it can serve as a cost-effective initial imaging strategy.

## T5B-SPMK-6 Deep Learning-based Fully Automated Fat Quantification of the Supraspinatus Muscle on MRI

Participants

Woonyoung Baek, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

The purposes were to (1) measure the total volume and fat-fraction (FF, %) of the supraspinatus muscle (SSm) with deep learning (DL)-based fully automated fat quantification algorithm from a 6-point Dixon sequence according to retraction grade and tear severity; and (2) determine the whether the standard assessment for muscle fatty infiltration at a single image slice is representative.

### METHODS AND MATERIALS

Between December 2020 and November 2022, 107 patients were retrospectively enrolled in this study with extended oblique sagittal T1-weighted images and FF map generated from 6 point Dixon sequence including total SSm. A DL-based fully automated muscle segmentation using a FF map was developed by modifying our institute's previously developed muscle segmentation method. The total volume and fat content of SSm were obtained from this algorithm. The FF at a single image slice was measured by manually drawing an ROI at a Y view or Fossa view (2~3 slices medial to Y view). Then, the FF of SSm at a single slice image (FFy or FFfo) and total MR slices (FFt) were compared. The influence of retraction grade and tear severity was evaluated.

### RESULTS

Total supraspinatus volume and fat fraction were easily measured with a DL-based fully automated segmentation algorithm using a FF map. A comparison of FFy, FFfo and FFt was done by using the Wilcoxon signed rank test ( $P < 0.001$ ). There was significant difference if FFy was included, and no significant difference between FFfo and FFt. Dividing the patients by retraction grade and fat degeneration grade, there was significant difference in grade 0 of retraction ( $P < 0.001$ ) and grade 1 of fat degeneration ( $P < 0.001$ ). Dividing by tear severity, there was significant difference in patients with no tear ( $P < 0.001$ ) and partial tear ( $P = 0.014$ ). Regarding the FFt as the gold standard, we verified the value of Y view and the proposed method (fossa view). Both methods showed high correlation with FFt (Y-view correlation coefficient=0.894 ( $P < 0.001$ ) and fossa view correlation coefficient=0.874 ( $P < 0.001$ )). But the precision is slightly decreased at proposed method, referring to Bland-Altman plot.

### CONCLUSION



s Regardless of retraction grade and fat degeneration, the FF evaluated through the proposed method provides a better representation of the total FF of the entire SSm than the conventional method with high accuracy. However, the precision was slightly lower than Y view.

#### **CLINICAL RELEVANCE/APPLICATION**

DL based automatic quantification could allow accurate and rapid fat quantification of total SSm. If we should choose to pick one MR slice instead of measuring the fat fraction of the entire SSm, fossa view could be a better representation than conventional view. It could be a more accurate preoperative factor to predict surgical outcome.

#### **T5B-SPMK-7 CT with Tin-filtration for Bone Imaging: Dose Optimization using an Ex-vivo Pig Model**

##### **PURPOSE**

CT via tin-filtration (CTTF) is an effective strategy in reducing radiation dose without sacrificing image quality. A parametric study via an ex-vivo pig model may be the most clinically relevant approach to better understand the trade-off between image quality and radiation dose. As skeletal assessment is a common clinical application for CT, we began by optimizing CTTF for bone imaging. As such, the objective of this study was to utilize an ex-vivo pig model to characterize the image quality of CTTF as a function of radiation dose for bone imaging.

##### **METHODS AND MATERIALS**

We imaged a pig shoulder (1.7 kg) using Siemens SOMATOM Force dual-source CT scanner at different volume CT dose index (CTDIvol). The following parameters were used for image acquisition: tube voltage of 100kV with the tin filter (100Sn), rotation time of 250 ms, and ultra-high pitch of 2.45, and slice thickness of 3 mm. We conducted a parametric study by adjusting the mAs settings to achieve 5 different levels of CTDIvol. Specifically, we used the following five mAs settings: 242, 182, 122, 60, and 30. Reconstruction kernel Br69, ADMIRE strength of 3 were used for bone image reconstruction. We used the 3D slicer software to generate the 3D volume renderings. For the CTTF images acquired at each CTDIvol, we calculated the contrast-to-noise ratio (CNR) of the bone-to-muscle; and judged the CTTF image quality based on the following three subjective criteria: (1) clarity of the depicted anatomy (i.e., foreground bone versus background soft tissue); (2) image noise; and (3) contours of the 3D surface renderings.

##### **RESULTS**

The CNRs of bone-to-muscle were 6.9, 6.2, 4.8, 3.4, and 2.9 at CTDIvol dose levels of 0.8 mGy, 0.6 mGy, 0.4 mGy, 0.2 mGy, and 0.1 mGy, respectively. However, despite this decreasing CNR, we found that the CTTF images at radiation doses as low as 0.2 mGy were deemed of comparable subjective quality to the CTTF images at the maximum dose of 0.8 mGy.

##### **CONCLUSION**

s Based on our parametric study, we conclude that there was no substantial deterioration in subjective image quality of CTTF when the radiation dose was reduced down to CTDIvol = 0.2 mGy. We postulated that the inherent high contrast between the foreground bone and the background soft tissue combined with a strong non-linear dose reduction by ADMIRE was able to overcome the decreasing CNR to maintain diagnostic image quality at ultra-low radiation dose during CTTF bone imaging.

#### **CLINICAL RELEVANCE/APPLICATION**

The results of our study are the initial steps in optimizing CT with tin-filtration for bone imaging.

#### **T5B-SPMK-8 Clinical and MRI-based Radiomics Models for Predicting Hidden Blood Loss during Surgery for Spinal Metastasis**

Participants

Weili Zhao, Beijing, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

To evaluate the role of clinical and MRI-based radiomics models for predicting the risk of hidden blood loss (HBL) in patients undergoing spinal metastasis surgery.

##### **METHODS AND MATERIALS**

Consecutive patients who underwent surgery for spinal metastasis between January 2018 and December 2021 at our institution were retrospectively analyzed. Baseline demographic, clinical, and surgical data were collected. HBL was calculated using the Gross formula. Potential clinical risk factors were accessed using univariate and multivariate logistic regression analyses. Radiomics features were extracted from sagittal T1-weighted and fat-suppressed T2-weighted imaging sequences, and manual delineation was performed by two radiologists. The datasets were Z-score normalized, and features with intraclass correlation coefficient values  $\leq 0.80$  were excluded. The least absolute shrinkage and selection operator method was employed for optimal feature selection. Clinical, radiomics, and combined clinical-radiomics models were established. Clinical utility of the best prediction model was evaluated using calibration and decision curves.

##### **RESULTS**

A total of 202 patients were included, 149 and 53 of whom were classified as low and high HBL. Extraspinal metastases, New York Heart Association grade, operation site, and operation time were identified as independent predictors of high HBL ( $P < 0.05$ ). The best predictive efficacy was shown in the combined clinical and T2WI-based radiomics model (AUC value of 0.893 and 0.816, and ACC of 80.2% and 77.3% respectively in the training and validation cohort). Additionally, the proposed clinical-radiomics nomogram demonstrated good clinical utility.

##### **CONCLUSION**

s Our combined clinical-radiomics model may serve as a promising prediction tool for the risk of HBL in patients undergoing spinal metastasis surgery, and guide perioperative planning to improve surgical outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

- Our study aimed to develop and evaluate the predictive efficacy of clinical and MRI-based radiomics models for high HBL during

spinal metastasis surgery. • The combined clinical and T2WI-based radiomics model achieved the best predictive performance in both the training and testing cohorts. • Our proposed clinical-radiomics nomogram demonstrated promising clinical utility in guiding the indications of preventative and treatment interventions in such patients.

### **T5B-SPMK-9 Musculoskeletal Diffusion Tensor Imaging in Adolescent Elite Rowers and Association of Imaging Findings with Rowing Technique**

Participants

Jonas Alexander Leppig, MD, 10247 Berlin, Germany (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Muscular overuse injuries are a common health issue in elite athletes. Changes in the muscular microenvironment can be depicted by Diffusion Tensor Imaging (DTI). We hypothesize that the biomechanics of different rowing techniques plays a role in tissue injury and tested our hypothesis by examining the lumbar spine muscles of adolescent rowers using DTI.

#### **METHODS AND MATERIALS**

Sixteen male elite rowers underwent 3 Tesla multiparametric MRI of the lumbar spine 6 hours after cessation of training. Axial diffusivity (AD), radial diffusivity (RD), apparent diffusion coefficient (ADC), and fractional anisotropy (FA) were calculated for the erector spinae (ES) and multifidus (MF) muscles. These DTI parameters were correlated with demographic data, training data, and low back pain (LBP) questionnaire scores.

#### **RESULTS**

ADC values in ES and MF were significantly higher ( $p = 0.039$ ) and FA values significantly lower ( $p < 0.001$ ) in sweep rowers compared to scull rowers. Training-related LBP episodes in the last 12 months were reported by 88.9% of participants. There was no significant association between DTI parameters and training volume or LBP questionnaire scores.

#### **CONCLUSION**

s Our DTI results show that lumbar spine muscle diffusivity is higher in sweep rowers than in scull rowers. Altered muscle diffusivity is suggestive of microscopic tissue disruption and might be attributable to biomechanical differences between rowing techniques.

#### **CLINICAL RELEVANCE/APPLICATION**

The differences identified with DTI are not detectable with conventional MRI techniques. Therefore, DTI might have a role in the early noninvasive detection of overuse injuries in athletes before symptoms develop.

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## Abstract Archives of the RSNA, 2023

T5B-SPMS

### Multisystem Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPMS-1 Virtual Non-calcium Imaging for Qualitative and Quantitative Assessment of Bone Marrow Involvement in Multiple Myeloma: Our Experience with Dual-energy Computed Tomography**

#### Participants

Alessandro Onori, MD, Rome, Italy (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The aim of this study was to compare the diagnostic performance of virtual non-calcium imaging (VNCA) and Conventional Computed Tomography imaging (CCT) in the evaluation of bone marrow (BM) involvement in patients affected by multiple myeloma and to investigate the impact of VNCA values on patients' prognoses.

#### **METHODS AND MATERIALS**

In this mono-centred retrospective study, consecutive patients with MM who underwent Dual Energy Computed Tomography (DECT) in the last 12 months were enrolled. Two readers randomly and independently reviewed two datasets of images per patient (VNCA and monochromatic 120kVp-like) for the presence of BM involvement. The number and dimension of BM lesions were compared on a per segment analysis. CT numbers of BM lesions and unaffected bone were measured on VNCA images. Results were stratified according to the disease status (stable or progression).

#### **RESULTS**

Significantly more lesions (n=748) were identified on VNCA images compared to CCT (n=502) (p<0,0001). No significant differences were observed for lesions' dimensions (18,72±9,68 mm, p=0,6352). VNCA CT numbers showed a significant difference between lesions in patients with stable disease and lesions in patients with progressive disease (-143,67±202,63 HU vs 4,54±51,95 HU; p=0,0087). There was almost perfect agreement for both number and dimension of the lesions among readers (ICC = 0.93 [95% CI 0.84-0.71] and ICC = 0.89 [95% CI 0.75-0.96], respectively).

#### **CONCLUSION**

s VNCA is superior to CCT in identifying BM involvement in MM and ROI-based analysis of the lesions could also be an interesting tool for its prognostic implications.

#### **CLINICAL RELEVANCE/APPLICATION**

VNCA imaging may be a promising technique to easily assess with good confidence the presence of bone lesions in patients with MM. Quantitative analysis and its prognostic implications may be useful for risk stratification and for personalized therapeutical planning.

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## Abstract Archives of the RSNA, 2023

T5B-SPNMMI

### Nuclear Medicine & Molecular Imaging Tuesday Poster Discussions II

#### Sub-Events

**T5B-SPNMMI-1** **Semi-quantification Approach of Amyloid PET: A Study of Familial Alzheimer's Disease Associated with Heterozygous NPC1 Mutation**

#### PURPOSE

Many studies try to develop model to compare and integrate visual reading of amyloid PET with independent semi-quantification methods. Here we describe new semi-quantification approach of amyloid PET in a family with apparently autosomal dominant Alzheimer's disease (AD) harbouring a novel NPC1 mutation in heterozygous state.

#### METHODS AND MATERIALS

All 5 living siblings were evaluated. We performed clinical assessment, neuropsychological tests, genetic analysis, assessment of cerebrospinal fluid markers. Patients n. 1, 2, 4 and 5 underwent early and late amyloid PET that should be read using qualitative analysis but also investigated by innovative visual and automatic semi-quantification analyses using: Standardized Uptake Values Ratio, the ratio of counts in one or more regions of interest to a reference region; Evaluation of Brain Amyloidosis, evaluates the geometric distribution of contrast without fixed, reference or segmentation ROIs and measures the geometric properties of the iso-intensity surfaces, the changes are related to the amyloid burden; Time-delayed ratio, a level of contrast between early and late scans; uptake and baseline ROIs are extrapolated from the early scan and track high-flow districts.

#### RESULTS

In 4 of them, a diagnosis of AD was defined according to biomarkers (A+, T+, N+) and serum oxysterol analysis. Early PET images of patients n.1 and 2 showed rather severe hypoperfusion in bilateral temporal, posterior parietal, posterior cingulate and precuneus cortices. In these patients, late amyloid PET images detected high rate of amyloid burden in bilateral frontal, temporal, posterior parietal, precuneus and posterior cingulate areas and final likelihood for positive scan. In patient n.4, early PET scan showed a mild hypoperfusion in left temporal, left posterior parietal and right precuneus cortices. In this patient, late amyloid PET images showed a moderate amyloid accumulation in left temporal, left posterior parietal and left frontal cortices with a positive scan. Finally, slight amyloid accumulation in frontal cortex consistent with negative scan without clear perfusion pattern of AD was found in patient n.5.

#### CONCLUSION

The present results demonstrated that early and late acquisitions images supported use of amyloid PET to study cerebral perfusion and amyloid deposition. Finally, the new semi-quantitative approach of amyloid PET provides data on the regional amyloid deposition allowing a better longitudinal evaluation of patients that could benefit from already available drugs against NPC1.

#### CLINICAL RELEVANCE/APPLICATION

This study supports use of early amyloid PET acquisitions and of this novel semi-quantitative approach on regional amyloid deposition to improved longitudinal assessment of patients.

**T5B-SPNMMI-2** **In Vivo Assessment of Regional Tau Deposition, Gray Matter Volume and Cognition in Alzheimer Disease: A Head-to-head 18F-flortaucipir PET/MR study**

#### PURPOSE

Despite the associations of A $\beta$  deposition with connectivity alterations, atrophy, and cognition, the exact role of tau and regional atrophy on cognition in Alzheimer's disease remains unclear. This study aimed to investigate the relationship between regional tau pathology, gray matter volume in vivo and their effects on cognitive function improving effective clinical trials and future therapeutic strategies for AD.

#### METHODS AND MATERIALS

Thirty-four patients with amyloid-positive mild cognitive impairment or dementia and 23 healthy controls underwent standardized clinical and neuropsychological assessments followed by 18F-flortaucipir positron emission tomography imaging and 3D T1-weighted magnetic resonance imaging. The regional tau standardized uptake value ratio and gray matter volumes (GMV) were measured. Group differences in the two imaging modalities were compared. Partial correlations and mediation analysis were then performed in brain regions showing an association between cognition and both 18F-flortaucipir uptake and gray matter volume.

#### RESULTS

The 18F-flortaucipir retention was observed in the entorhinal cortex, hippocampus, parietal lobe, temporal lobe, precuneus and posterior cingulate. The regional tau deposition was associated with GMV in medial temporal and lateral temporal regions (range standardized  $\beta$ s of residual=-0.45--0.77,  $p<0.05$ ) in MCI/AD patients. Both increased 18F-flortaucipir SUVR and decreased GMV in the medial temporal lobes and medial parietal lobes were related to cognitive impairment. The GMV of the entorhinal cortex and medial parietal lobes mediated the effect of local region 18F-flortaucipir SUVR on cognitive impairment (mediation effect=0.54,0.93; explained variance=32.86%, 37.94%, respectively). The GMV of the medial parietal lobes and medial temporal lobes mediated the

effect of distant region 18F-fortaucipir SUVR on cognitive impairment (mediation effect=0.75-0.85; explained variance=57.01%-58.14%).

## CONCLUSION

s Tau pathology was associated with local and distant areas of brain atrophy in the brains of MCI and AD patients. The mediation analysis enabled data fusion across multiple imaging modalities (PET and MRI), local and distant atrophy played a mediating role between tau binding and cognitive impairment in these patients.

## CLINICAL RELEVANCE/APPLICATION

tau PET/MR can be a potentially useful imaging biomarker for predicting the risk of developing clinical AD based on more than one pathology and determining when is the optimal time for anti-tau target treatment.

## T5B- SPNMMI-3 Validation of SSTR2 Expression and Assessing Correlation of Variable F18-FDG PET/CT Parameters in EBV Associated Nasopharyngeal Cancer

Participants

Thangalakshmi Sivathapandi, MD, Johns Creek, GA (*Presenter*) Nothing to Disclose

## PURPOSE

Epstein-Barr virus (EBV), a known nasopharyngeal carcinoma (NPC) driver, promotes somatostatin receptor 2 (SSTR2) expression via NFkB, detectable by immunohistochemistry. To assess the correlation of EBV associated NPC and SSTR2 expression and evaluate the association between F18-FDG PET CT parameters and EBV associated NPC

## METHODS AND MATERIALS

In this retrospective study done between 2017-2022, SSTR2 immunohistochemistry on our cohort of EBV NPC (n=15), HPV-positive sinonasal SCC (n=7, HPVSCC), and virus-negative sinonasal SCC (n=8, VNSCC), reviewed by two board-certified pathologists. The F18-FDG PET/CT was reviewed by two board-certified nuclear medicine physicians. Histopathology was scored as positive or negative in a binary system. H-score was calculated using the intensity and extent of tumor staining. The association between various parameters of F18-FDG PET/CT (primary tumor and nodes) and SSTR2 expressing EBV positive nasopharyngeal carcinoma were analyzed

## RESULTS

Using a positive/negative system, 93.3% EBVNPC (n=14/15), 14% HPVSCC (n=1/7), and 25% VNSCC (n=2/8) demonstrated multifocal to diffuse strong SSTR2 expression. The sensitivity, specificity, negative predictive value, and positive predictive values for SSTR2 IHC were 93.3%, 80%, 92.3%, and 82.4%, respectively. The median H-score for EBVNPC was 180 (range 12-295; mean 179), whereas the median H-scores for HPVSCC and VNSCC were 0 (range 0-56; mean 8) and 0 (range 0-125; mean 31), respectively (p<0.001). No significant association was found between SUV max, metabolic tumor volume (MTV) and total lesion glycolysis (TLG) between EBV associated and other types of HNSCC (p value>0.005). The SUV max range for primary tumor was found to be 6.67-29.95 and SUV max range for metastatic nodes was 4.11-25.53. Among the 15 EBVNPC patients 53% of patients had overlap of primary tumor uptake with physiologic FDG brain activity

## CONCLUSION

s EBV associated NPC showed stronger expression of SSTR2 comparing to HNSCC in other subsites. No significant difference in F18-FDG PET/CT parameters between EBV positive NPC and other types of HNSCC. Future directions would include assessing the role of Cu64-DOTATATE PET/MRI in evaluation of EBV positive NPC and its impact on radiation therapy planning.

## CLINICAL RELEVANCE/APPLICATION

The strong correlation between EBV positive NPC and SSTR2 expression infers that Ga68/Cu64- DOTATATE PET imaging could be a valuable tool in accurate staging, therapy planning and surveillance of these patients. Peptide receptor radionuclide therapy (PRRT) using therapeutic nuclide-labeled DOTA-peptide may be a potential therapeutic tool in these patients with metastases

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## Abstract Archives of the RSNA, 2023

T5B-SPNPM

### Noninterpretive Skills (Beyond Imaging) Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPNPM- Radiologist's Impact on the Frequency of Pediatric Head CT for Trauma: A Machine Learning Model Analysis using a Nationwide Claims Database** 1

##### Participants

Kanako Kumamaru, MD, PhD, Tokyo, Japan (*Presenter*) Research Grant, General Electric Company

##### PURPOSE

The purpose of this study is to develop a machine-learning model that can predict factors that independently affect the frequency of pediatric head CT for trauma (pHCTT). The study also aims to evaluate the impact of the number of radiologists per population (radiologist density) on the frequency of pHCTT.

##### METHODS AND MATERIALS

The study used data on the number of outpatient pHCTT performed in 254 medical areas in Japan for the fiscal year 2020, extracted from the national open database of health insurance claims. Over a hundred regional variables, such as population, number of hospitals, and number of pediatricians, were used to train 34 algorithms to predict the number of pHCTT per 10,000 child population, without including radiologist density measure. The best-performing machine-learning algorithm, based on poisson deviance ranking, was then identified. We compared the radiologist density between medical areas that exceeded the predicted pHCTT frequency and those that fell below the prediction, as an indicator of radiologist's impact on pHCTT frequency.

##### RESULTS

A total of 18,313 outpatient pHCTT were performed in 2020 in Japan, with a large variability in the number of pHCTT per 10,000 child population across medical areas (range: 0-114, median: 2.94). The random forest regressor model showed the highest prediction power with a poisson deviance of 11.61 on cross-validation, identifying total population density, the proportion of elderly people, the total number of stroke care units, growing care units, and CT examinations per population as strong predictors. The number of doctors working in clinics per population also had a significant influence on the prediction. The radiologist density was significantly lower in the medical areas where pHCTTs were performed more frequently than predicted, compared to the medical areas where pHCTTs were performed below the prediction (radiology density, median (IQR): 27.5 (19.5, 49.5) vs. 48 (22, 76),  $p=0.037$ ).

##### CONCLUSION

The number of pHCTT per child population varied significantly across different medical areas. In medical areas where pHCTTs were performed more frequently than predicted by the machine-learning algorithm, the radiology density was lower, which may suggest the impact of radiologists on appropriate pediatric imaging.

##### CLINICAL RELEVANCE/APPLICATION

Increasing the number and involvement of radiologists may reduce the variability in the frequency of pediatric head CT for trauma and promote appropriate utilization.

#### **T5B-SPNPM- Computed Tomography-based Sarcopenia: Diagnostic Cutoff Values in Patients with Chronic Liver Disease and Mortality: A systematic Review and Meta-analysis** 2

##### Participants

Joao Rafael Vicentini, MD, (*Presenter*) Nothing to Disclose

##### PURPOSE

Sarcopenia is a known complication of patients with Chronic Liver Disease (CLD). The assessment of psoas muscle mass by Computed Tomography (CT) can be done using the Psoas Muscle Index (PMI). This method is easy to perform using regular CT scans and not easily altered by ascites. We aimed to investigate the influence of sarcopenia diagnosed by CT using the PMI method as a predictor of mortality in patients with CLD after liver transplantation.

##### METHODS AND MATERIALS

The protocol was registered with the international prospective register of systematic reviews (PROSPERO CRD42022370684). We systematically searched PubMed, Scopus, and Cochrane Central Register of Controlled Trials from inception to November 2022 with the following search terms: (sarcopenia OR muscle mass OR psoas muscle) AND (chronic liver disease OR CLD OR cirrhosis OR liver transplantation OR liver transplant) AND (Computed Tomography OR CT OR psoas muscle). Cochran's Q test and I<sup>2</sup> statistics were used to assess for heterogeneity; P values inferior to 0.10 and I<sup>2</sup>>25% were considered significant for heterogeneity. We used a fixed-effect model for outcomes with low heterogeneity (I<sup>2</sup> < 25%). We calculated standard effect estimates and random effects (odds ratio) for meta-analysis with binary outcome data. Clustering was performed by the Mantel-Haenszel method.

##### RESULTS

The initial search yielded 1,414 results. After removal of duplicate records and ineligible studies, 163 remained and were fully reviewed based on inclusion criteria. Of these, a total of 11 studies were included in qualitative synthesis and 4 studies were included in quantitative analysis (meta-analysis) comprising 382 patients. Patients diagnosed by CT scan using the PMI method with muscle mass loss after liver transplantation had a 4.1 times higher risk of death than non-sarcopenic patients (Random effects model OR 4.1386; 95% CI 2.4215- 7.0730; P< 0.0001). Heterogeneity among studies was assessed by visual inspection of the graphs, the I2 statistic, Cochran's Q test, and Tau2. Interpretatively, a scale with an I2 value close to 0% indicates no heterogeneity. The other criteria also did not reject the hypothesis of homogeneity among the articles.

## CONCLUSION

s Patients with sarcopenia diagnosed by CT using the PMI method had a fourfold increase in mortality risk after liver transplantation.

## CLINICAL RELEVANCE/APPLICATION

The findings reinforce the need to identify sarcopenic patients preoperatively to optimize liver transplantation outcomes. Opportunistic diagnosis by CT using Psoas Muscle Index (PMI) can be helpful in this setting.

## T5B-SPNPM- Autonomous AI-based CXR Interpretation for Predicting Congestive Heart Failure: A Multicenter Study

### Participants

Emiliano Garza Frias, MD, Monterrey, NL (*Presenter*) Nothing to Disclose

## PURPOSE

Favorable treatment outcomes of a progressive disease like heart failure (HF) depend on early detection. We conducted a multicenter study to assess if an autonomous AI model can help identify chest radiography (CXR) signs of HF in patients without a previous cardiovascular history or diagnosis.

## METHODS AND MATERIALS

Our retrospective, standalone study included 1455 patients (age range 69 +- 13 years; M:F 670:785) with an AP/PA CXR. A total of 751 patients had the CXR taken within one year before their HF diagnosis. The rest (n= 704) of the CXR were selected from patients without any NT-proBNP exam, echocardiography or HF diagnosis after the radiological examination date. All patients belong to 17 sites including two quaternary care hospitals and 15 community hospitals and outpatient clinics. 1455 deidentified CXRs were processed with the AI algorithm for HF (qXR-HF, Qure.AI) to obtain information on enlarged cardiac silhouette, pleural effusion, and an HF-index. CXRs were stratified based on their lead time from HF diagnosis (<3 months, 3-6 months, 7-9 months, 9-12 months). Data were analyzed using R version 3.6.2 to derive accuracy, sensitivity, specificity, and area under the curve (AUC) for the receiver operating characteristics (ROC).

## RESULTS

Among the 1455 patients, 751 patients had HF while the remaining 704 patients did not have HF. We report 0.80 ROC AUC (95% CI 0.78-0.82), 0.70 accuracy, 0.57 sensitivity, and 0.83 specificity for the overall AI performance for predicting HF. AI AUCs (< 3 months: 0.83; 4-6 months: 0.81, 7-9 months: 0.79, 10-12 months: 0.79), specificity (constant: 0.83) and accuracy (0.77-0.78) remained stable, but sensitivity declined with increasing lead time from HF diagnosis (< 3 months: 0.6; 10-12 months: 0.5). The performance of CXR-AI derived HF index was significantly higher compared to enlarged cardiac silhouette (0.75) and pleural effusion (0.74, p<0.01).

## CONCLUSION

s Our autonomous AI model can help identify signs of HF up to 12 months prior to the clinical diagnosis of HF with a high and consistent AUC and accuracy, regardless of patient gender, age group (>45 years), and imaging site.

## CLINICAL RELEVANCE/APPLICATION

Detection of HF signs with an autonomous CXR-based AI algorithm can help in early diagnosis and treatment of unsuspected HF.

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## Abstract Archives of the RSNA, 2023

T5B-SPNR

### Neuroradiology Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPNR-1 Systematic Review of the Determination of EGFR Status in Glioblastomas by Feature Characterization on MR**

##### **PURPOSE**

Glioblastoma (GBMs) is the most common and deadly type of adult brain tumor. The clinical treatment for GBMs varies depending on genetic profile. There has been a push to identify imaging markers of genes implicated in GBMs. Epidermal growth factor receptor (EGFR) represents one such gene. Multiple studies have described relative cerebral blood volume (rCBV) as a potential marker for EGFR status, but a systematic review of those studies has not been performed. The objective of this review is to objectively summarize the current literature on the potential for rCBV to serve as a marker for EGFR status in patients with diagnosed GBM.

##### **METHODS AND MATERIALS**

A systematic review was conducted following PRISMA guidelines with a strategy to identify articles pertaining to radiologic markers of GBM. Examples of pertinent MeSH terms to be used are as follows: "glioma", "glioblastoma", "EGFR", "epidermal growth factor receptor", and "magnetic resonance imaging." Studies were included or excluded based on pre-established criteria. A primary review will be conducted by two separate independent researchers blinded to each other's results to determine which papers meet inclusion/exclusion criteria. Discrepancy between reviewers will be resolved via consensus. The bias of studies will be assessed via QUADAS2 bias assessment tool.

##### **RESULTS**

A preliminary review was conducted to collect papers from Pubmed and Scopus databases. This search resulted in 14 papers eligible for primary review, including 1864 of tumors, with (818) EGFR amplified and (1046) EGFR wild type tumors. Chi square analysis will be done to compare cerebral blood volumes and/or tumor location. Odds ratios and forest plots will be generated for inter group comparisons.

##### **CONCLUSION**

Based on preliminary review, a direct correlation is expected to be observed between EGFR amplification and increased rCBV. Significant differences in location, diffusion coefficient, transfer coefficient, and relative plasma volume may also be shown.

##### **CLINICAL RELEVANCE/APPLICATION**

Identifying rCBV as a radiologic marker of EGFR status in GBM patients will allow for non-invasive and faster identification of the best treatment plan.

#### **T5B-SPNR- BT-RADS Posttreatment Brain Tumor Response: An Interobserver Agreement Analysis**

10

#### Participants

JEAN LEVI RIBEIRO DE PAIVA, CAMPINAS, Brazil (*Presenter*) Nothing to Disclose

##### **PURPOSE**

In recent years, synoptic reporting has been shown to improve the consistency, reproducibility, quality, readability, and clarity of radiological reports; which is supported by the success of previous models such as BI-RADS. In light of these favorable results, Weinberg et al proposed a brain tumor reporting data system (BT-RADS) to assess the treatment response of brain tumors. In this study, we evaluate the consistency of the BT-RADS model by measuring the agreement of the reports between two radiologists.

##### **METHODS AND MATERIALS**

We compiled a list of brain MRI studies from patients with brain tumors, along with relevant medical records, and provided it to two radiologists for categorization. The first one had one year of experience as a radiologist, while the second one, a university professor specialized in neuroradiology, had over thirteen years of experience. For each study, the radiologists gave a report based on the BT-RADS model unbeknownst to the score given by their peers in the same studies.

##### **RESULTS**

Both radiologists reviewed 85 exams, of which 23 were BT-RADS 0 by default. The BT-RADS 0 score is meant for studies that will serve as a baseline for future studies; this includes the first study after surgery or before chemoradiotherapy. Sixty-two studies remained for analysis. We applied Cohen's Fleiss' kappa to measure inter-rater reliability between the two radiologists. The Cohen's kappa value was equal to 0.94, with a confidence interval of 95% and an alpha value of  $p=0.05$ . The lower bound was 0.88, while the upper bound was 0.99. We also calculated Fleiss' kappa for each category, and each showed a high agreement rate, except for category 3c.

##### **CONCLUSION**

Our analyses showed a strong inter-rater reliability agreement despite the difference in experience between the two observers.



## CLINICAL RELEVANCE/APPLICATION

The BT-RADS demonstrated a high inter-observer agreement rate, despite the experience gap between the two radiologists. This finding is promising for the validation of BT-RADS for future broad use. The BT-RADS model is still in development, so some changes in its protocol are still expected to happen.

## T5B-SPNR-11 Leveraging CT Imaging and Machine Learning: Enhancing Prognostic Accuracy for Functional Outcomes in Anterior Circulation Large Vessel Occlusion Stroke Patients

Participants  
Burak Ozkara, MD, Houston, TX (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to predict the functional outcome of acute ischemic stroke patients with anterior circulation large vessel occlusions (LVOs) using only imaging parameters in machine learning (ML) models, regardless of how they were treated or the severity of the stroke at admission, and to investigate the precision of imaging parameter utilization in ML models.

### METHODS AND MATERIALS

Patients with acute ischemic stroke (AIS) due to anterior circulation LVO, as confirmed by computed tomography angiography (CTA) and CT perfusion (CTP) scans, were screened in this retrospective study. Demographic and clinical data, such as sex, age, race, admission NIHSS score, modified Rankin Score (mRS) at 90 days, and treatment information, were extracted. Radiological variables were collected by a neuroradiologist, who recorded the spatial location, and assessed the baseline ASPECTS, occluded vessel, occluded segment, occlusion laterality, and presence of hyperdense MCA. Additional data, such as rCBF, T<sub>max</sub>, CBV, mismatch volume, mismatch ratio, hypoperfusion index, DSA collateral score, clot burden score, single-phase CTA collateral score, and multiphase CTA collateral score, were extracted. These data were used as input, and the outcome was mRS at 90 days, which was dichotomized as mRS 0-2 (good outcome) and mRS 3-6. To address missing data, imputation techniques were employed for both infinite values and missing values using k-nearest neighbor imputation. The sample was divided into training (60%), validation (20%), and test (20%) sets. CatBoost, XGBoost, and Random Forest ML algorithms were employed. The SHAP method was employed to determine the relative importance of predictor elements.

### RESULTS

180 patients were included. 88 patients had an mRS between 3-6 and 92 had an mRS between 0-2. The best algorithm was XGBoost, with an area under the receiver operating characteristic curve of 0.907 (95% CI: 0.686 - 0.979) and an area under the precision recall curve of 0.827 (95% CI: 0.703 - 0.951). The top three most significant features were multiphase CTA collateral score, CBV < 42%, and mismatch volume.

### CONCLUSION

Our model was highly accurate using only imaging parameters, indicating that imaging parameters may be as accurate as conventional predictors. The multiphase CTA collateral score was the most predictive variable, highlighting the importance of collaterals and demonstrating that incorporating them into ML models could lead to accurate prediction.

## CLINICAL RELEVANCE/APPLICATION

This study emphasizes the importance of imaging parameters, particularly collateral circulation markers, in predicting functional outcomes for AIS patients, regardless of stroke severity at admission or treatment method that physicians can tailor to improve patient prognosis.

## T5B-SPNR-12 Decoding the Enigma of Distal Medium Vessel Occlusions: Harnessing Machine Learning for Prognostic Predictions in Acute Ischemic Stroke Patients

Participants  
Burak Ozkara, MD, Houston, TX (*Presenter*) Nothing to Disclose

### PURPOSE

We hypothesized that machine learning (ML) algorithms using CT perfusion (CTP) and clinical variables as input parameters can successfully predict the outcome in distal medium vessel occlusion (DMVO) acute ischemic stroke (AIS) patients regardless of the preferred treatment method, given CTP's expected impact on stroke diagnosis and management.

### METHODS AND MATERIALS

DMVO-AIS patients with available CTP scans were screened in this retrospective cohort study. Demographic, clinical, and radiologic data were collected, including blood samples and radiologic variables such as occlusion location, ASPECTS, rCBF, T<sub>max</sub>, CBV, mismatch volume, hypoperfusion index, and diffusion-weighted imaging (DWI) volume on follow up MRI within seven days of symptom onset. These data were used as input, and the outcome was National Institutes of Health Stroke Scale (NIHSS) shift score (admission NIHSS score - discharge NIHSS score). Patients with an NIHSS shift score above the median score and patients with an NIHSS shift score below the median score were assigned to the favorable outcome group and the unfavorable outcome group, respectively. Since admission and discharge NIHSS scores are directly related with our outcome, NIHSS shift, they were not included in the predictor variables. Data preprocessing involved imputation of missing values, scaling of continuous variables, normalization, and encoding of categorical variables. Recursive feature elimination (RFE) was used for feature selection. Five supervised machine learning algorithms were employed. SHAP were used to examine the relative weights of predictor variables.

### RESULTS

There were 35 patients who had a favorable outcome and 34 patients who had an unfavorable outcome. RFE produced ten features, the top three most important of which were mismatch volume, T<sub>max</sub> > 6s, and DWI volume. XGBoost showed the best performance in predicting unfavorable outcome with an area under the curve of receiver operating characteristic curve of 0.865 and an area under the precision-recall curve of 0.811.

### CONCLUSION

In patients with DMVO-AIS, our ML model trained on baseline quantitative CTP parameters and laboratory data was able to

predict the short-term outcome, NIHSS shift score. The most important variable was the mismatch volume in the best-performing model. Notably, neither the admission NIHSS score nor the patient's age were used in our model to predict the prognosis of AIS patients, despite the fact that these factors are normally very important predictors of prognosis.

#### **CLINICAL RELEVANCE/APPLICATION**

We were able to accurately predict the prognosis of DMVO-AIS patients using CT perfusion parameters, demonstrating the importance of imaging. These preliminary findings may aid clinicians in predicting patient prognoses.

#### **T5B-SPNR-13 Effect of Statins on Different Intracranial Plaques Its Influencing Factors: A High-Resolution Magnetic Resonance Vessel Wall Imaging Study**

##### **PURPOSE**

High-resolution magnetic resonance vessel wall imaging (HRMR-VWI) is a non-invasive examination that can evaluate intracranial atherosclerotic plaque stability. This study applied HRMR-VWI to evaluate the effect of statins on vulnerable and stable intracranial plaques and explore the influencing factors of statin therapy.

##### **METHODS AND MATERIALS**

Between July 2017 and August 2021, patients with intracranial atherosclerosis treated with statins underwent HRMR-VWI. The plaque characteristics were measured using PACS system and Vessel Explorer software, including plaque length, thickness, burden, luminal stenosis, plaque enhancement, and plaque location. According to the baseline plaque enhancement, each plaque was classified into a vulnerable plaque group or stable plaque group. The plaque characteristics before and after treatment were compared by using the signed-rank test and paired-samples t-test. The plaque characteristics after treatment between the two groups were compared by using Wilcoxon rank sum test. According to the tri-sectional quantiles of plaque enhancement rate change, each plaque was classified into a good or poor effect group. The baseline plaque characteristics between the two groups were compared by using the independent-samples t-test or Wilcoxon rank sum test. Multiple linear regression was used to investigate the relationship between baseline plaque characteristics and the effect of statin therapy.

##### **RESULTS**

This study included 53 patients with a total of 107 plaques, including 61 stable plaques and 46 vulnerable plaques. In the vulnerable plaque group, plaque enhancement ( $P < 0.001$ ), plaque burden ( $P < 0.023$ ), and luminal stenosis ( $P < 0.027$ ) in the follow-up period were significantly reduced compared to baseline. The extent of reduction in plaque enhancement was significantly higher in the vulnerable plaque group than that in the stable plaque group ( $P < 0.025$ ). Compared with the poor effect group, the baseline plaque burden was greater ( $P < 0.025$ ) and luminal stenosis was higher ( $P < 0.024$ ) in the good effect group. Multiple linear regression showed that plaques located in anterior circulation ( $B = 0.16$ ,  $P = 0.014$ ) and those with obvious enhancement at baseline ( $B = -0.0218$ ,  $P = 0.007$ ) were positively correlated with a decreased rate of plaque enhancement after statin treatment.

##### **CONCLUSION**

This study confirmed by HRMR-VWI that statins have certain effects on vulnerable plaques, and their efficacy is better than that on stable plaques. The treatment benefit may be greater for plaques located in the anterior circulation and have a higher baseline enhancement degree.

#### **CLINICAL RELEVANCE/APPLICATION**

This result may provide a theoretical basis for individualized treatment for patients with intracranial artery stenosis.

#### **T5B-SPNR-14 Automated Machine Learning Based on Clinical Factors and Multimodal Radiomics of Diffusion Kurtosis Imaging and Conventional Magnetic Resonance Imaging Predicts the Functional Outcome of Acute Ischemic Stroke**

##### **PURPOSE**

This study aimed to investigate the predictive value of the radiomics from diffusion kurtosis imaging (DKI) for the functional outcome of acute ischemic stroke (AIS) patients and develop a prediction model based on radiomics and clinical factors using automated machine learning to accurately predict the functional outcome.

##### **METHODS AND MATERIALS**

The clinical and imaging data of 203 patients with AIS were retrospectively collected and randomly divided into the training cohort ( $n = 163$ ) and testing cohort ( $n = 40$ ). Based on the modified Rankin Scale (mRS) at three months after hospital discharge, the functional outcome was dichotomized into good (mRS = 2) and poor (mRS > 2). Radiomics features were extracted from DKI parametric maps, T2 fluid-attenuated inversion recovery (FLAIR), diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) maps and categorized into four feature sets (set 1: DWI and ADC maps; set 2: T2 FLAIR, DWI and ADC maps; set 3: DKI parametric maps including mean diffusivity, mean kurtosis and fractional anisotropy maps; set 4: all of the above features). The tree-based pipeline optimization tool (TPOT) was applied to establish the prediction models based on the simple feature sets and the combination of the radiomics score and clinical factors, respectively. For each feature set, TPOT was repeated 10 times to obtain a best model. Then the best models were validated on the testing cohort. The area under the curve (AUC), average precision, accuracy, sensitivity and specificity were used to evaluate the performance of the models.

##### **RESULTS**

Four radiomics models and four radiomics-clinical models were developed by TPOT. The models combining radiomics score from DKI parametric maps and clinical factors achieved the best performance in the testing cohort (AUC = 0.923, average precision = 0.896, accuracy = 0.775, sensitivity = 0.800, specificity = 0.760). The 5 most important factors were radiomics score, baseline National Institute of Health stroke scale score, age, infarct volume and baseline mRS. In addition, the AUC of DKI-based radiomics model was higher than the models based on conventional magnetic resonance imaging.

##### **CONCLUSION**

The DKI-based radiomics could further improve the performance for predicting the AIS outcome compared with conventional magnetic resonance imaging. The models developed by TPOT based on radiomics score from DKI parametric maps and clinical factors could predict the functional outcome of AIS patients with a high discriminatory accuracy.

## CLINICAL RELEVANCE/APPLICATION

The model developed by TPOT could assist clinicians to accurately predict the outcome of AIS patients and formulate individual treatment plans at the early stage of onset, which may improve the prognosis of AIS patients.

### **T5B-SPNR-2 Double Expressor Lymphoma Subtype in Primary Central Nervous System Lymphoma: Its MR Imaging Features and Clinical Relevance**

Participants

Goh Sasaki, PhD, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Unlike most B-cell lymphomas, double-expressor lymphomas (DELs) can lead to increased risk of relapse and worse prognosis. To date, there are no studies evaluating MRI findings in primary central nervous system lymphoma (PCNSL) patients with DEL (PCNSL-DEL). We aimed to determine whether PCNSL-DEL has MR imaging and clinical features compared to non-DEL.

## METHODS AND MATERIALS

This retrospective study included 36 patients with PCNSL, 16 of whom were pathologically confirmed with DEL and 20 with non-DEL. All patients underwent preoperative 3-T MRI including diffusion-weighted imaging (DWI) and dynamic susceptibility contrast (DSC) perfusion studies. Cerebral blood volume (CBV), leakage-corrected CBV (cCBV) and K2 were calculated by using a block-circulant deconvolution method. The regions of interest (ROIs) were placed at enhancing lesions with high DWI intensity, while control ROIs were set at the contralateral portions. Mean apparent diffusion coefficient (ADC), CBV, cCBV ratios and K2 value were compared between DEL and non-DEL groups using the Mann-Whitney U test. The Kaplan-Meier method was used to estimate progression-free survival (PFS) differences.

## RESULTS

Compared with non-DEL group, DEL group had significantly lower mean CBV ratio ( $0.23 \pm 0.55$  vs.  $0.25 \pm 0.27$ ,  $p = 0.016$ ) and cCBV ratio ( $1.48 \pm 0.98$  vs  $2.08 \pm 0.80$ ,  $p = 0.028$ ). There was no significant difference in ADC ratio ( $1.07 \pm 0.23$  vs  $0.97 \pm 0.22$ ,  $p = 0.14$ ) and K2 ( $481 \pm 287$  vs  $421 \pm 276$ ,  $p = 0.336$ ) between the two types of PCNSL. PFS was shorter for DEL than non-DEL, but there was no significant difference.

## CONCLUSION

s In PCNSL, DEL has lower CBV and cCBV and tends to have shorter PFS than non-DEL.

## CLINICAL RELEVANCE/APPLICATION

DSC perfusion imaging is a promising tool for identifying DEL, a subtype of PCNSL.

### **T5B-SPNR-3 MRI Histogram Analysis of TERT Mutation Status in Patients with IDH-wildtype Glioblastoma**

## PURPOSE

TERT mutation is an important predictor of poor prognosis in IDH wild-type glioblastoma patients. To investigate the value of MRI histogram analysis in predicting TERT mutation status of IDH wild-type glioblastoma.

## METHODS AND MATERIALS

POPULATION and SEQUENCE: T1WI contrast-enhanced (T1C) and T2WI images of 182 patients with IDH-wildtype glioblastoma confirmed by surgery and molecular pathology were retrospectively collected. IMAGE ANALYSIS: Two radiologists imported images in the Dicom format into Firevoxel (current version: 416C, NYU School of Medicine, NY, <https://wp.nyu.edu/firevoxel/downloads/>) to independently analyze the entire lesion. Subsequently, the largest lesion slice was selected. Based on the T1WI and T2WI images, two radiologists manually traced the ROIs in all 182 GBM margin along the axial T1C without the surrounding brain tissue, and oedema. The software automatically generated a grayscale histogram of the ROI. Histogram analysis was performed using the largest slices to obtain the following histogram parameters: maximum, minimum, mean, standard deviation (SD), variance, coefficient of variation (CV), skewness, kurtosis, entropy, and 1st-99th percentiles. The necrotic/necrotic ratio of the maximum tumor layer was calculated by delineating the necrotic/necrotic area. STATISTICAL TESTS: Pearson's and Spearman's - rho correlation analysis was used to analyze the correlation. Receiver operating characteristic (ROC) analysis was used to evaluate the utility of the T1C histogram parameter in the TERT mutation state. All statistical analyses were performed using SPSS (IBM SPSS Statistics version 25.0; Chicago, IL, USA) software.

## RESULTS

In the T1C histogram features, the maximum value, standard deviation, variance, 99th percentile and coefficient of variation (CV) were positively correlated with TERT mutation status ( $P < 0.05$ ). ROC curve analysis showed that when  $CV=0.319$ , the AUC value was the highest (0.775; 95% confidence interval (CI) :0.702-0.848), and the sensitivity and specificity were 0.803 and 0.729, respectively. In addition, CV was positively correlated with the ratio of maximum level necrosis to cystic degeneration.

## CONCLUSION

s Preoperative T1C histogram analysis has predictive value for TERT mutation status in IDH wild-type GBM patients.

## CLINICAL RELEVANCE/APPLICATION

CV in the T1C histogram can objectively and comprehensively reflect the intrinsic heterogeneity of the tumor, and can predict the TERT mutation status of IDH wild-type glioblastoma before surgery. We performed interpretative analysis of the histogram characteristic parameters and concluded that CV was positively correlated with the ratio of necrosis to cystic degeneration at the maximum tumor level.

### **T5B-SPNR-4 Impaired Peritumoral Cerebrovascular Reactivity Measured with Arterial Spin Labeling in Gliomas. Emerging Techniques in the Pre-surgical Workup of Brain Tumors**

Participants

Marta Calvo-Imirizaldu, MD, Pamplona, Spain (*Presenter*) Research Grant, Siemens AG

## PURPOSE

The purpose of our study was to evaluate the feasibility of cerebrovascular reactivity (CVR) mapping with arterial spin labeling (ASL) technique using a breath-holding task, and its potential to depict infiltrative tumor beyond the limits of contrast enhancement and non-enhancing components.

## METHODS AND MATERIALS

16 newly diagnosed patients with grade 4 brain gliomas (WHO 2021, biopsy confirmed) who underwent presurgical brain MRI were prospectively recruited. A non-invasive PCASL sequence with apnea challenge consisting of 10 cycles of 21s of apnea/breath-hold task and 42s of normal breathing was added to the clinical protocol, for CVR mapping. All studies were performed in a 3T Siemens Skyra MRI scanner with 32-channel head coil. Informed written consent was obtained. Automatic segmentation masks of gray matter (GM), white matter (WM), were obtained in SPM, with a threshold of 0.9. Contrast enhanced tumor (CE) and non-contrast enhanced tumor (nCE) masks were manually drawn by an experienced neuroradiologist on each patient T1 weighted image. Several expanding volume-of-interest (VOI) rings of 6 mm width were evaluated in the peritumoral area to assess the infiltrative lesion. Cerebral blood flow (CBF) and CVR of the affected side, contralateral hemisphere, tumor lesion (merging CE and nCE components when applicable) and in the perilesional expanding VOIs were recorded. CVR was evaluated as percentage signal change (PSC) in CBF. Data were analysed for normality using Shapiro-Wilk test. Differences in CBF were assessed in the tumor lesion versus the homologous contralateral region, with paired T-test. Differences in CVR were assessed for the tumor and perilesional VOIs with paired T-test, corrected for multiples comparisons using false discovery rate test.

## RESULTS

A total of 16 patients were included (11 men, mean age  $56.19 \pm 10.73$  years). Mean CBF in the tumor was  $57.62 \pm 38.12$  ml/100g/min, significantly higher compared to the contralateral side ( $p = 0.021$ ). CVR in the tumor was decreased compared to the contralateral homologous region (ipsilateral PSC =  $22.03 \pm 14.25$  vs contralateral PSC =  $31.94 \pm 11.04$  PSC;  $p = 0.028$ ). Perilesional CVR was also impaired in the periphery of the tumor, reaching a plateau in the last two VOIs (18 to 24 mm from the tumor). Significant differences in CVR between the contralateral and ipsilateral VOIs were found ( $p$ -values, VOI 6mm = 0.009, VOI 12mm = 0.028, VOI 18mm = 0.029, VOI 24mm = 0.045).

## CONCLUSION

s CVR mapping is feasible with ASL and can provide information about the perilesional environment of the tumor that may help to detect infiltrative disease.

## CLINICAL RELEVANCE/APPLICATION

Trying to precisely delineate the infiltrative glioma region for an accurate complete resection is a challenge in glioma imaging.

## T5B-SPNR-5 The Cavernous Sinuses Lesions - A South Brazilian Experience

### PURPOSE

We aim to present our experience at South Brazil of the various and unusual pathologies that can affect the cavernous sinuses. They have great clinical importance, and this review and iconographic essay help us to keep these conditions in mind at the moment we face them in our daily practice.

### METHODS AND MATERIALS

This is a cross-sectional retrospective study performed at two large institutions in South Brazil. We did a research from April 2013 to April 2023, then selected a miscellanea of 16 very illustrative and representative cases of the variable conditions that can affect the cavernous sinuses.

### RESULTS

Our research showed as results inflammatory/infectious, neoplastic, vascular, and cryptogenic pathologies, as we illustrate: fusiform aneurysm, carotid cavernous fistula, septic thrombosis, hemangioma, dermoid cyst,, adenoid cystic carcinoma, hypertrophic pachymeningitis, macroadenoma, lymphoma, meningioma, plexiform neurofibroma, mucormycosis, oculomotor mononeuropathy, and Tolosa-Hunt.

### CONCLUSION

s The cavernous sinuses are interconnected venous plexuses situated in the floor of the middle cranial fossa on either side of the sella turcica and sphenoid sinus. They can communicate with the orbit, pterygopalatine fossa, infratemporal fossa, nasopharynx and posterior cranial fossa through various foramina, fissures and channels at the base of the skull. In addition, it contains important vascular and nerve structures, including the internal carotid arteries, the oculomotor and abducens cranial nerves, and the ophthalmic and maxillary branches of the trigeminal nerve. These pathological conditions can have similar clinical manifestations, so imaging plays a crucial role in the diagnosis, assessment of the extent of the disease, biopsy planning, when necessary, and aid in the decision of the best therapeutic strategy to be followed, including radiotherapy, microsurgery or clinical treatment.

### CLINICAL RELEVANCE/APPLICATION

Because of all these reasons, the diagnosis may be very challenging and knowing these possibilities in advance must make us aware to keep them in mind for prompt suspicion.

## T5B-SPNR-6 Clinical Significance of Apparent Diffusion Coefficient in Differential Diagnosis of Primary Central Nervous System Lymphoma and Meningioma

### PURPOSE

To analyze the clinical significance of apparent diffusion coefficient in differential diagnosis of primary central nervous system lymphoma and meningioma.

### METHODS AND MATERIALS

Thirty-five patients with primary central nervous system lymphoma and 35 patients with meningioma confirmed by surgery and pathology were selected as Group A and Group B respectively. The average ADC value, the minimum ADC value, the maximum ADC

value and the contralateral normal white matter, the average (contralateral) ADC value were obtained, logistic regression analysis and ROC curve were used to analyze the diagnostic efficacy of each index.

## RESULTS

The mean ADC value, minimum ADC value, maximum ADC value and contralateral ADC value in group A were statistically different ( $P < 0.05$ ); the minimum ADC value and contralateral ADC value in group B were not statistically different ( $P > 0.05$ ), while the rest of items were statistically different ( $P < 0.05$ ); the mean ADC value, minimum ADC value and maximum ADC value in group A were lower than those in group B ( $P < 0.05$ ). The logistic regression analysis showed that the maximum ADC value was an independent risk factor, while the mean ADC value and the minimum ADC value were protective factors ( $P < 0.05$  and  $P < 0.01$ , respectively). The AUC of the combined indices was 0.926, with an accuracy of 93.5%, sensitivity of 90.3%, and specificity of 94.7% ( $P = 0.000$ ).

## CONCLUSION

Different ADC values in tumor parenchyma provide the molecular imaging basis for noninvasive differential diagnosis of primary central nervous system lymphoma and meningioma, and the combined diagnosis of the three parameters can effectively improve the diagnostic efficiency by using logistic regression model.

## CLINICAL RELEVANCE/APPLICATION

Accurate differential diagnosis of primary central nervous system lymphoma and meningioma is essential for early intervention and survival. Conventional MRI findings of some primary central nervous system lymphoma often overlap with meningiomas and are difficult to differentiate. Diffusion-weighted imaging (DWI) can reflect the characteristics of the lesions from the molecular diffusion level before the morphology. The apparent diffusion coefficient (ADC) of DWI can quantitatively reflect the density and malignant degree of the tumor cells. This study was to investigate the value of ADC in the differential diagnosis of primary central nervous system lymphoma and meningioma, and to provide valuable reference for the early diagnosis and early intervention of the two diseases.

## T5B-SPNR-7 Comparison between Postcontrast T1-weighted Thin-slice 2D Spin Echo and 3D SPACE Sequences in the Detection of Brain Metastases at 1.5T and 3T

### PURPOSE

The accurate detection of metastatic brain lesions (MBL) before radiotherapy is critical. Although spin echo (SE) are superior to gradient echo sequences in detecting small MBL, thin-slice whole-brain coverage is time consuming. The sampling perfection with application optimized contrasts using different flip angle evolution (SPACE) sequence shares many advantages with SE, but with faster acquisition and greater resolution while achieving whole-brain coverage.

### METHODS AND MATERIALS

Fifty-six patients with MBL were included and underwent a standard protocol (1.5T  $n = 37$ , 3T  $n = 19$ ), including postcontrast T1-weighted SE and SPACE (postcontrast order: SE first  $n = 26$ , SPACE first  $n = 30$ ). Rating was performed by 3 raters in 2 sessions  $> 6$  weeks apart; images were de-identified and order randomized, only SE or SPACE per-subject per-session. The true number of MBL was determined using all available imaging including follow up. Intraclass correlations were determined; consistency for intra-rater (SE vs. SPACE) and agreement for inter-rater (same sequence). A paired t-test was used to evaluate postcontrast sequence order.

### RESULTS

A total of 135 MBL were identified (mean/subject 2.41, SD 6.4). Relatively fewer lesions were identified on the first postcontrast sequence (SE/SPACE), however the difference was not significant ( $p = 0.08$ ). Intra-rater consistency (SE vs. SPACE) was excellent (ICC: R1, 0.984; R2, 0.971; R3, 0.946), as was inter-rater agreement, with ICC values of 0.984 and 0.969 for SE and SPACE sequences, respectively. Finally, agreement between individual sequences and the true number of lesions was excellent (SE ICC: R1, 0.981; R2, 0.973; R3, 0.977; SPACE ICC: R1, 0.984; R2, 0.971; R3, 0.965).

### CONCLUSION

The emergence of fast computer-assisted treatment planning of targeted radiosurgery techniques in the management of MBL requires precise, fast and reliable MRI workup. The reliable detection of MBL with MRI depends on a number of factors, particularly pulse sequence and contrast agent type, dose and application delay. Although SE sequences are superior to gradient echo sequences in the detection of small brain metastases, they have relatively long acquisition times and are prone to artifacts. To our knowledge this is the first comparison between thin-slice T1-weighted SE and SPACE sequences in the detection of brain metastases at 1.5 Tesla and 3 Tesla. Our results show that T1-weighted SPACE is not inferior to standard thin slice SE sequences in the detection of brain metastases.

### CLINICAL RELEVANCE/APPLICATION

The T1-weighted SPACE sequence has several advantages over other sequences commonly used in the detection of metastatic brain lesions while maintaining excellent consistency with ratings on standard thin-slice spin echo images.

## T5B-SPNR-8 Predicting IDH-Mutation in Low Grade Glioma using Different MRI Sequences

### PURPOSE

Low grade gliomas are classified by analyzing molecular characteristics such as IDH mutation status. In this retrospective study we applied radiomics to different MRI sequences to determine which one is the most suitable.

### METHODS AND MATERIALS

In our retrospective study, we used MR images of 106 patients with histologically confirmed glioma. All MR images were acquired with four MRI sequences each: T1 without and with administration of a contrast agent (T1 native and T1 CE), T2 and Flair. We performed image segmentation of the tumours semi-automatically using the open-source software platform 3D Slicer and extracted a total of 107 radiomic features from each of the images. We subsequently tested different conventional machine learning algorithms and a neural network to predict the IDH mutation status and to find the most suitable MR sequence for this task.

### RESULTS

In our analyses, the T1 CE sequence was found to be the most suitable for predicting IDH mutation status. Using independent test data and a 9-feature model constructed with Lasso (Least Absolute Shrinkage and Selection Operator) regression, we achieved an AUC of 0.849, an accuracy of 0.801, a sensitivity of 0.849, and a specificity of 0.704. The second-best results were achieved with the Flair sequence, and the T2 sequence proved to be the most unsuitable.

## CONCLUSION

Although radiomics applied to different MRI sequences is suitable to predict the IDH mutation in low grade gliomas, the most accurate results were achieved analyzing T1 CE sequences.

## CLINICAL RELEVANCE/APPLICATION

MRI based radiomics helps predicting molecular status of low grade gliomas.

## T5B-SPNR-9 Tumor Characteristics, Brain Functional Activity and Connectivity of Tinnitus in Patients with Vestibular Schwannoma: A Pilot Study

Participants

Jiayu Huang, Beijing, China, China (*Presenter*) Nothing to Disclose

## PURPOSE

Tinnitus in patients with vestibular schwannoma (VS) can negatively affect their mental health, focus, sleep quality, and social life. However, the mechanism of tinnitus is still unclear. Therefore, this study aims to explore the correlation between preoperative clinical characteristics of VS, postoperative changes in brain function, and tinnitus in patients with VS.

## METHODS AND MATERIALS

We collected data from 80 VS patients before surgery and from 28 VS patients before and after surgery, and recruited 28 healthy controls. We used paired t-tests to identify brain regions where patients had significant changes in amplitude of low frequency fluctuations (ALFF) and regional homogeneity (ReHo) after surgery. Tinnitus severity was evaluated using the Tinnitus Handicap Inventory (THI) and Visual Analog Scale (VAS). And Pearson correlation were applied to assess the relationship between the changes in ALFF and ReHo and the changes in THI and VAS scores postoperatively. Finally, we also conducted seed- and ROI-based functional connectivity (FC) analyses.

## RESULTS

Prior to surgery, VS patients with tinnitus had smaller tumors ( $t = 3.293$ ,  $p < 0.001$ ), more solid tumor ( $p = 0.033$ ), and less extrusion into the cerebellum brain stem ( $p = 0.001$ ) than those without tinnitus. After surgery, 28 VS patients showed a significant reduction in ALFF in the left cerebellum crus 2 (ROI 1) and a significant reduction in ReHo in the left cerebellum crus 1 (ROI 2) and the right precuneus (ROI 3). Conversely, ReHo was significantly increased in the right precentral gyrus (ROI 4) (cluster-level  $p$  value family-wise error [pFWE]  $< 0.05$ ). Additionally, the changes in ALFF values were negatively correlated with changes in the VAS score on the left side ( $r = -0.32$ ,  $p < 0.05$ ). Moreover, the FC strengths of patients between ROI 2 and the left and right posterior cingulate gyrus respectively were significantly decreased after the surgery (FDR correction,  $p < 0.05$ ).

## CONCLUSION

Preoperative tinnitus in patients with VS may be influenced by tumor size, tumor nature, and degree of extrusion into the cerebellum brain stem. Additionally, the functional activities of the default mode network, the somatomotor network, and the cerebellum are altered postoperatively. Notably, the changes in ALFF in the left cerebellum are correlated with tinnitus severity.

## CLINICAL RELEVANCE/APPLICATION

Clinical characteristics and brain regions related or unrelated to hearing can influence tinnitus symptom in VS patients, which may be potential therapeutic targets for tinnitus in VS patients.

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## Abstract Archives of the RSNA, 2023

T5B-SPOB

### OB/Gynecology Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPOB-1 Uterine Sarcoma or Degenerating Fibroid? Validating the New Consensus MRI Algorithm for Evaluating Atypical Uterine Masses**

##### Participants

Aja Green Walker, BS, Chicago, IL (*Presenter*) Nothing to Disclose

##### PURPOSE

The purpose of our study is to evaluate the validity of a recently published consensus MRI diagnostic algorithm (PMID: 36194109) for differentiating benign degenerating leiomyomas and malignant uterine sarcomas.

##### METHODS AND MATERIALS

Atypical uterine masses on pelvic MRI were identified through the Radiology information system and report search engine using "atypical leiomyoma", "atypical fibroid", and "sarcoma", and the electronic medical record was reviewed for pathologic proof. Two radiologists blinded to clinical, surgical, and pathologic reports retrospectively and independently reviewed 40 pelvic MRI examinations dated 1/2007-9/2022 to determine if the masses by imaging were benign or malignant, using the 2022 consensus atypical uterine mass flow chart. Imaging features assessed included: peritoneal metastases, abnormal lymph nodes, intermediate/high signal intensity (SI) at T2-weighted imaging, high DWI SI (equal or higher SI than endometrium or lymph nodes on high b value imaging), and ADC value =  $0.905 \times 10^{-3}$  mm.

##### RESULTS

Of the 40 atypical uterine mass cases, 24 masses were benign (22 leiomyomas, 1 adenomyoma, and 1 borderline ovarian tumor) and 16 masses were malignant (6 leiomyosarcomas, 6 carcinosarcomas, 3 endometrial sarcomas, and 1 low grade uterine sarcoma). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) to determine if masses were benign or malignant were 75%, 95.8%, 92.3%, and 85% for reader 1, and 81.2%, 91.7%, 86.7%, and 88% for reader 2 respectively. Interreader agreement was strong, kappa: 0.89. Endometrial sarcomas had higher T2 signal and higher ADC values than leiomyosarcomas.

##### CONCLUSION

The new consensus pelvic MRI algorithm for evaluating atypical uterine masses has good specificity, sensitivity, PPV, and NPV for determining malignancy, particularly for uterine sarcomas that are predominantly myometrial origin (leiomyosarcoma), with ADC =  $0.905 \times 10^{-3}$ mm. However, if ADC is near but not below  $0.905 \times 10^{-3}$ mm, the mass may be malignant, especially if using b value lower than 1000. If the atypical uterine mass is predominantly endometrial, morphology should guide suspicion.

##### CLINICAL RELEVANCE/APPLICATION

The 2022 consensus algorithm to distinguish benign from malignant atypical uterine masses has important clinical implications, as surgical and medical management for degenerating fibroids is very different from uterine sarcomas.

#### **T5B-SPOB-2 Comprehensive Assessment of Postoperative Recurrence and Survival in Patients with Cervical Cancer: Nomograms**

##### PURPOSE

To investigate the value of nomograms based on clinical parameters, inflammatory indicators, intravoxel incoherent motion diffusion weighted imaging (IVIM-DWI) and MRI-derived radiomics in predicting recurrence-free survival (RFS), disease-free survival (DFS), cancer-specific survival (CSS) and overall survival (OS) in cervical cancer patients after surgery.

##### METHODS AND MATERIALS

A retrospective analysis of 181 cervical cancer patients operated at our hospital between January 2015 and January 2021 with continuous follow-up was completed. The parameters of IVIM-DWI and radiomics were measured, analyzed and screened. The logistic regression with LASSO regularization was used to calculate radiomics score (Rad-score). Multivariate Cox regression analysis was used to construct nomogram models for predicting postoperative RFS, DFS, CSS and OS in cervical cancer patients, with internal and external validation.

##### RESULTS

Clinical stage, parametrial infiltration, internal irradiation, D-value and Rad-score were independent prognostic factors for RFS; Squamous cell carcinoma antigen, internal irradiation, D-value, f-value and Rad-score were independent prognostic factors for DFS; Maximum tumor diameter, lymph node metastasis, platelets, D-value and Rad-score were independent prognostic factors for CSS; Lymph node metastasis, systemic inflammation response index, D-value and Rad-score were independent prognostic factors for OS. The AUCs of each model predicting RFS, DFS, CSS and OS at 1, 3 and 5 years were 0.985, 0.929, 0.910 and 0.833, 0.818, 0.816 and 0.832, 0.863, 0.891 and 0.804, 0.812, 0.870, respectively.

## CONCLUSION

s Nomograms based on clinical and imaging parameters showed high clinical value in predicting postoperative RFS, DFS, CSS and OS of cervical cancer patients and can be used as prognostic markers.

## CLINICAL RELEVANCE/APPLICATION

The model may help predicting postoperative RFS, DFS, CSS and OS of cervical cancer patients.

### **T5B-SPOB-3 Cer-ConvN3Unet: An End-to-end Multimodal Pipeline for Auto-detection and Auto-segmentation of Cervical Cancer based on ConvNeXt and Double U-Net**

## PURPOSE

Cervical cancer is a common gynecological pelvic tumor with an incidence rate of 3.1% and mortality rate of 3.4%, ranking eighth and ninth among all cancers worldwide. The routine MRI examination typically includes multi-planar T2WI, DWI and CE-T1WI. Hence, it is of paramount importance to extract the multimodal information for subsequent volume calculation, radiomics analysis, radiotherapy dose optimization, surgical preparation, and etc. In this study, we proposed an innovative two-phase pipeline for auto-detection and auto-segmentation on multimodal cervical cancer MRI images, which integrated the advantages of ConvNeXt and Double U-Net, thereby providing an end-to-end multimodal outlining tool for gynecologists.

## METHODS AND MATERIALS

Totally 100 patients underwent pelvic MRI examinations consisting of T2WI, DWI and CE-T1WI. Patients with no contraindications received an intramuscular injection of 10mg raceanisodamine hydrochloride before image acquisition to reduce bowel motion artifacts. 2533 DWI slices, 2448 T2 slices, and 7176 CE-T1 slices were obtained by extracting 3D MRI images layer-by-layer from axial plane. In the auto-detection phase, a six-classifier was designed based on ConvNeXt blocks for the multimodal recognition. In the second stage, the whole identified tumor slices were separately input into auto-segmentation module developed by 3-channel Double U-Nets. The accuracy, precision, recall, Kappa and F1-score were used to evaluate the classification performance, while DSC and Jaccard were applied to quantitative analysis the segmentation performance.

## RESULTS

20 patients were excluded from the modeling process for independent testing. The initial auto-detection module achieved the average results of 92.37%, 83.60%, 77.65%, 75.70%, 0.8045 for accuracy, precision, recall, Kappa and F1-score. And no error occurred in the distinguishment between the three modalities. Entering into segmentation stage, the mean values of DSC and Jaccard on DWI, T2, CE-T1 were (83.25%, 71.49%), (78.62%, 65.17%), (73.62%, 58.81%), respectively.

## CONCLUSION

s Strict independent experiments demonstrated that the end-to-end multimodal pipeline was capable of getting high recognition and segmentation accuracy with less manual intervention. In the future, the clinical utility will be further optimized in large-sample and multi-center prospective cohorts and generalized to more MRI modalities.

## CLINICAL RELEVANCE/APPLICATION

The pipeline has high potential to be an alternative tool for gynecologists in routine MRI image reading and processing of cervical cancer. Meanwhile, it can also serve as the basis for a series of scientific research works related to tumor lesions, liberating from labor-intensive manual delineation.

### **T5B-SPOB-4 Intratumoral and Peritumoral MRI Radiomics Nomogram for Predicting Parametrial Invasion in Patients with Early-stage Cervical Adenocarcinoma and Adenosquamous Carcinoma**

Participants

Le Fu, Shanghai, China (*Presenter*) Nothing to Disclose

## PURPOSE

To develop a comprehensive model based on MRI intra- and peritumoral radiomics signatures and independent risk factors for predicting parametrial invasion (PMI) in patients with early-stage cervical adenocarcinoma (AC) and adenosquamous carcinoma (ASC).

## METHODS AND MATERIALS

In total, 747 patients with IB to IIB cervical AC and ASC who underwent radical trachelectomy/hysterectomy were retrospectively reviewed and divided into the primary, internal validation cohort, and external validation cohorts. The original (Ori) and original-wavelet (Ori-Wav) feature-based radiomics signatures from the primary tumor (RST) and 3 mm- and 5 mm-peritumoral regions (RS3 and RS5) were respectively built to investigate their diagnostic values in predicting PMI. The feature selection includes the following steps: 1) feature reproducibility assessment; 2) Pearson correlation test; 3) maximum relevance and minimum redundancy (mRMR); 4) the least absolute shrinkage and selection operator (LASSO). Finally, a nomogram was constructed by integrating optimal intra- and peritumoral signatures and independent risk factors.

## RESULTS

FIGO stage, disruption of the cervical stromal ring (DCSRMR), parametrial invasion on MRI (PMSMR), and serum CA-125 were found to be independent risk factors. The combined nomogram constructed by integrating independent risk factors, Ori-Wav features-based RST, and RS5 yielded AUCs of 0.874 (0.810-0.922), 0.885 (0.834-0.924) and 0.966 (0.887-0.995) for assessing PMI in the primary, internal and external validation cohorts, respectively. Furthermore, the combined nomogram was significantly superior to radiomics signatures and clinical models for assessing PMI in the three cohorts.

## CONCLUSION

s This study demonstrated that the combined nomogram can preoperatively, accurately, and noninvasively identify PMI in patients with early-stage cervical AC and ASC

## CLINICAL RELEVANCE/APPLICATION

As important parts of cervical cancer, AC and ASC have an increasing incidence and mortality, especially in young women. The



As important parts of cervical cancers, AC and ASC have an increasing incidence and mortality, especially in young women. The preoperative and accurate identification of PMI can facilitate precise treatment decisions of chemoradiotherapy or radical hysterectomy in patients with early-stage cervical AC and ASC. The combined nomogram integrating independent risk factors, Ori-Wav features based RST, and RS5 can preoperatively, accurately, and noninvasively identify PMI in patients with early-stage cervical AC and ASC.

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## Abstract Archives of the RSNA, 2023

T5B-SPPD

### Pediatric Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPPD-1 Radiation Dose Reduction of Newborns without Anti-scatter Grids in X-ray Fluoroscopic Imaging Systems with Flat Panel Detectors: A Newborn Whole Body Phantom Study of Dosimetry and Visual Assessment**

#### **PURPOSE**

Anti-scatter grids (ASG) effectively improve image contrast by absorbing scattered X-ray caused by a thick adult body. We hypothesized that removal of ASG would reduce radiation dose of a thin newborn body without loss of diagnostic value in X-ray fluoroscopic examinations. Our purpose was to compare radiation dose and visibility of image findings of a peripherally inserted central catheter (PI catheter), a nasogastric tube (NG tube) and contrast agent using a newborn whole body phantom between with and without ASG in X-ray fluoroscopic imaging systems with flat panel detectors.

#### **METHODS AND MATERIALS**

This study consisted of dosimetry and visual assessment. A newborn whole body phantom was used. In the dosimetry, continuous fluoroscopy for 300 seconds and twenty consecutive radiographs were performed with and without ASG. The entrance surface dose (ESD) of each dosimetry was measured by dosimeters placed on the chest and abdomen of the phantom, respectively. In visual assessment, the PI catheter and NG tube with and without inserting guidewire were placed on the phantom, respectively. Cylinders filled in contrast agent diluted by water (1/2, 1/4, 1/6, 1/8 and 1/10 dilutions) were inserted into the rectum of the phantom. Images of the PI catheter, NG tube and contrast agent were obtained by performing fluoroscopy and radiography with and without ASG, respectively. The obtained images were visually scored on a four-point scale by two observers (a board-certified diagnostic radiologist and a radiological technologist). We used the Wilcoxon signed-rank test to identify any significant differences between with and without ASG in the mean ESD and the mean visual scores. A P-value less than 0.05 was considered significant. Inter- and intra-observer agreement were calculated by weighted kappa statistics.

#### **RESULTS**

There were significant differences in the mean ESD between with and without ASG in both the fluoroscopy (chest, 1.7 vs. 1.1 mGy; abdomen, 2.0 vs. 1.3 mGy) and the radiography (chest, 3.5 vs. 2.0 mGy; abdomen, 4.1 vs. 2.4 mGy), respectively ( $P < .05$ ). There was no significant difference in the visual scores between with and without ASG in all comparisons of two observers ( $P > .05$ ). Inter- and intra-observer agreement were almost perfect in all comparisons (range, 0.87-1.00).

#### **CONCLUSION**

Removal of ASG significantly reduced radiation dose of a newborn phantom with acceptable image quality in X-ray fluoroscopic imaging systems with flat panel detectors.

#### **CLINICAL RELEVANCE/APPLICATION**

Radiation dose reduction of newborn infants could be achievable in X-ray fluoroscopic examinations without loss of diagnostic value by removal of ASG.

#### **T5B-SPPD-2 Cranial Suture Ultrasound: Its Value in the Diagnosis and Radiation-reduction Potential of Suspected Craniosynostosis**

#### Participants

Sara Albort Verges, MD, Vigo, Spain (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

T5B-SPPH

### Physics Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPPH-1 Simultaneous Denoising and Super Resolution in Clinical CT Images using Deep learning with Simulated Training Data**

##### Participants

Muhan Shao, Niskayuna, NY (*Presenter*) Nothing to Disclose

Bruno De Man, PhD, MSc, Niskayuna, NY (*Presenter*) Employee, General Electric Company

##### PURPOSE

Improved CT image resolution and noise characteristics can improve visualization of small anatomical structures, including small lung nodules and coronary artery calcifications. This work reports a deep learning (DL)-based simultaneous denoising and super-resolution approach and its initial evaluation on clinical images.

##### METHODS AND MATERIALS

A challenge for DL-based denoising and super-resolution applied to clinical images is the lack of easy ways to generate high quality training data. We propose a method to build super-resolution digital phantoms based on sharpened and denoised clinical patient images, and then simulate the CT imaging chain and generate the relatively low-resolution training inputs. We also shrink the image voxel size of the phantom to introduce miniature anatomical structures beyond the intrinsic resolution of the clinical image. Here, we report initial evaluation of the method as applied to clinical data. Thirteen patient cardiac images were acquired using clinical settings. Ten cases were used for training a deep convolutional neural network (CNN), one for validation, and two for evaluation. During inference, the network was applied to patient CT images reconstructed with filtered back-projection (FBP) images for a 20 cm field of view.

##### RESULTS

The CNN network was tested on two datasets. The first contains the held-out testing cases where low-resolution data were simulated from the high-resolution phantoms. The second is composed of the real CT images acquired using clinical settings. In both cases, the enhanced images produced by the CNN network are visually sharper and contain less noise than their corresponding input images. Compared to the real CT input image, the network output improves the full width at half maximum by ~20% along a small blood vessel. The contrast-to-noise ratio between ascending aorta and the surrounding tissue is increased by ~32% (from 52.2 dB to 69.1 dB).

##### CONCLUSION

Simultaneous CT image denoising and resolution enhancement was achieved by using a DL method on clinical cardiac data. To overcome the difficulty in acquiring high quality data as training labels, we trained the model on simulation data and adapted the model to images reconstructed using standard clinical settings. This technique greatly facilitates the creation of high-resolution, low noise CT images in clinical applications.

##### CLINICAL RELEVANCE/APPLICATION

Deep learning-based denoising and super-resolution approach may provide improved image quality and clinical diagnosis confidence for CT imaging.

#### **T5B-SPPH-10 Improving Image Quality by Comparing Two Magnetic Resonance Imaging Sequence in Chest: Free-breathing T1-weighted STAR-VIBE and Breath-holding T1-Weighted 3D VIBE Dixon**

##### Participants

Zhanli Ren, Xianyang, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To explore the feasibility of magnetic resonance imaging (MR) with free-breathing T1-weighted STAR-VIBE sequence for improving image quality in chest compared with breath-holding T1-weighted 3D VIBE-dixon sequence.

##### METHODS AND MATERIALS

Thirty patients for chest MR examination were prospectively collected in our hospital. All patients underwent MR examination (MAGNETOM 3.0T SKYRA MR scanner, Siemens Healthcare, Germany), which included T1-weighted breath-holding 3D VIBE-dixon sequence (3D-VIBE) and free-breathing T1-weighted STAR-VIBE (STAR-VIBE). The signal intensity (SI) and standard deviation (SD) of ascending aorta, main pulmonary artery and descending aorta were measured at the level of main pulmonary artery. The signal-to-noise ratio ( $SNR=SI/SD$ ) and coefficient of variation ( $CV=SD/SI$ ) of signal intensity were calculated. The image quality was subjectively scored double-blindly using a 5-point scoring system by two radiologists who had five or more years of working experience.

##### RESULTS

There was no significant difference in population characteristics between STAR-VIBE sequence and 3D-VIBE sequence ( $P > 0.05$ ). The signal-to-noise ratio (SNR) of ascending aorta, pulmonary artery and descending aorta with free-breathing T1-weighted STAR-VIBE sequence were significantly higher than those with breath-holding T1-weighted 3D VIBE-dixon sequence ( $P < 0.05$ ), while the coefficient of variation of signal intensity with free-breathing T1-weighted STAR-VIBE sequence were significantly lower than those with breath-holding T1-weighted 3D VIBE-dixon sequence ( $P < 0.05$ ). The subjective scores of image quality by the two MR radiologists had excellent consistence (kappa value  $> 0.80$ ,  $P < 0.05$ ), the subjective score of free-breathing T1-weighted STAR-VIBE sequence were significantly higher than those of T1-weighted breath-holding 3D VIBE-dixon sequence ( $P < 0.05$ ).

## CONCLUSION

s Magnetic resonance imaging with free-breathing T1-weighted STAR-VIBE sequence can significantly optimize and improve image quality in chest compared with breath-holding T1-weighted 3D VIBE-dixon sequence.

## CLINICAL RELEVANCE/APPLICATION

In thoracic magnetic resonance imaging, free-breathing T1-weighted STAR-VIBE sequence can be used to improve image quality for those patients with dyspnea, which can obtain better image quality.

## T5B-SPPH-11 Quantitative Evaluation of the Accuracy of MR Thermometry in the Presence of RNS Using a 3D Printed Realistic Head Phantom

Participants

Chen Lin, PhD, Jacksonville, FL (*Presenter*) Nothing to Disclose

## PURPOSE

The Responsive Neurostimulator (RNS), a device for seizure treatment, is implanted on the skull. It can cause severe artifacts in brain MRI, including MR thermometry, which is used for monitoring tissue temperature change during intervention procedures such as laser interstitial thermal therapy (LITT). The purpose of this study is to evaluate the impact of temperature mapping in the brain due to RNS.

## METHODS AND MATERIALS

To simulate MR-guided LITT of brain lesions in the presence of RNS, a realistic head phantom was 3D printed based on head CT images. Two indentations for mounting RNS were created at clinically appropriate locations. The inside of head phantom was filled with polyacrylic acid (PAA) gel per ASTM F2182 standards to mimic brain tissue. Black ink was when preparing the gel to increase the absorption of laser light. MR-guided LITT was performed on the phantom using a Philips 1.5T MR scanner with the Visualase™ MRI-guided laser ablation system and a laser probe with a 15mm diffuser. In each LITT session, the laser was turned on for 2 minutes at 50% of the maximum power of 10 watts. Four NetOptix fiber optic temperature sensors (FOTS) were placed 10mm away and shielded from direct laser exposure. Temperature maps (TMAP) were acquired with a 4ch flex coil and a 3D GRE sequence with receiver bandwidth of 100Hz/pixel. Five LITT sessions were performed with cooling periods in between. In sessions 1 and 5, no RNS was present in order to evaluate the accuracy and reproducibility of MR thermometry. In sessions 2 and 3, the RNS was implanted on the ipsilateral side of the ablation zone with different distances from the region of temperature mapping. In session 4, the RNS was moved to the contralateral side.

## RESULTS

The temperature changes at the tips of the four FOTS measured by both FOTS and MR thermometry, were plotted and compared. Both FOTS and TMAP were reproducible in sessions 1 through 5. The differences in the measured temperature change in MR thermometry without and with RNS appeared to be within the variation of MR thermometry itself. Good correlations of TMAP results without and with RNS at ipsilateral side close to ablation zone and the TMAP results between the first and last sessions both without RNS were observed. There was a large systematic difference between FOTS and TMAP for each session. The sources of such a difference require further investigation as subsequent testing and calibration of FOTS found them to be accurate.

## CONCLUSION

s Despite the systematic difference between FOTS and TMAP, MR thermometry results are consistent without and with RNS at clinically acceptable locations.

## CLINICAL RELEVANCE/APPLICATION

MR thermometry at 1.5T is relatively robust with regard to the potential artifact and impact from RNS.

## T5B-SPPH-12 Four Different Iterative Reconstruction Algorithms on Abdominal CT Image: A Comparative Study on Image Quality of Inferior Vena Cava

Participants

Chunyu Gu, Xianyang, China (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the image quality of inferior vena cava in abdominal CT reconstructed with 4 algorithms, filtered back projection (FBP), adaptive statistical iterative reconstruction (ASIR) and a new model-based iterative reconstruction (MBIRn) with noise reduction setting (MBIRNR40) and with setting balancing both noise and spatial resolution (MBIRSTND).

## METHODS AND MATERIALS

40 adult patients underwent standard-dose upper abdominal enhancement scan on a Discovery™ CT750 HD. Images in the 180s delay phase were reconstructed by FBP, 40%ASIR (40% ASIR and 60% FBP blends), MBIRNR40 and MBIRSTND algorithms at 0.625mm image thickness. The CT value and SD value of the subcutaneous fat of the anterior abdominal wall, left erector spinae muscle, inferior vena cava and hepatic veins (left branch and right branch) were measured to calculate the contrast-to-noise ratio (CNR) of the inferior vena cava and hepatic veins, using those of 40%ASIR as the reference standard. Two radiologists with more than 10 years of experience used 5-point scoring system to assess the subjective noise and smoothness of the inferior vena cava and hepatic veins.

## RESULTS

The CT values of FBP, ASIR, MBIRNR40 and MBIRSTND were not statistically different. Image noises (in HU) in the inferior vena cava were  $31.1 \pm 5.15$ ,  $23.39 \pm 3.77$ ,  $10.75 \pm 1.45$ ,  $6.14 \pm 1.32$  with FBP, 40%ASIR, MBIRSTND and MBIRNR40, respectively ( $P < 0.05$ ); The corresponding CNR values were  $10.53 \pm 2.95$ ,  $13.29 \pm 3.62$ ,  $16.25 \pm 4.79$  and  $23.3 \pm 17.39$  ( $P < 0.05$ ). The subjective image scores of MBIRNR40 and MBIRSTND were significantly higher than 40%ASIR ( $P < 0.05$ ).

## CONCLUSION

s Under the condition of standard-dose abdominal scanning, MBIRNR40 and MBIRSTND were higher than ASIR in subjective noise and vascular smoothness scores, with MBIRNR40 image having the highest subjective noise score and MBIRSTND image having the highest degree of vascular smoothness.

## CLINICAL RELEVANCE/APPLICATION

MBIRNR40 and MBIRSTND reconstruction algorithms can improve the CT image quality for inferior vena cava and hepatic veins.

## T5B-SPPH-13 Longitudinal Relaxivity Estimation of Gadolinium-Based Contrast Agents at 64 mT

### PURPOSE

Point of care (POC) MRI scanners have been shown to improve accessibility to imaging for patients in different clinical environments, particularly in the neurocritical care units<sup>1</sup>. The use of contrast agents is prevalent at conventional field strengths (e.g., 1.5 and 3 T) for enhancing visualization and characterization of pathologies. However, the use of contrast agents at ultra-low-field (ULF) has not been characterized to the same extent as at conventional field strengths. Gadopixelenol is a high relaxivity gadolinium-based contrast agent (GBCA) that has demonstrated similar pathology enhancement compared to other commercially available GBCAs at half the dose<sup>2</sup>. The aim of this study is to estimate the longitudinal relaxivity of gadopixelenol at 64mT.

### METHODS AND MATERIALS

The study was performed using a 64 mT portable MR system (Swoop®, Hyperfine, Inc., Guilford, CT) fitted with a standard head coil and two phantoms, each comprised of different concentrations of gadolinium-based contrast agents (GBCAs) namely gadobutrol (Gadavist, Bayer HealthCare Pharmaceuticals, Whippany, NJ), and gadopixelenol (Elucirem, Guerbet LLC, Princeton, NJ). Data were obtained using an inversion recovery fast spin-echo (FSE) sequence with TR = 4 s, TE = 5.9 ms, voxel size = 1.56 mm x 1.56 mm x 5.0 mm, and inversion times (TI) in 12 intervals ranging from 100 ms to 800 ms. Longitudinal relaxation rates (R1) were calculated using a three-parameter nonlinear curve fitting algorithm (MATLAB, Natick, MA) of the median signal magnitude as a function of TI. Longitudinal relaxivity ( $r_1$ ) was obtained as the rate of change of R1 with respect to GBCA concentration. The median signal magnitude values were used for quantitative analysis to mitigate the influence of outliers.

### RESULTS

The average longitudinal relaxivities of gadopixelenol and gadobutrol were  $32.6 \text{ mM}^{-1} \cdot \text{s}^{-1}$  and  $8.7 \text{ mM}^{-1} \cdot \text{s}^{-1}$ , respectively. These values of  $r_1$  for gadopixelenol were observed to be higher at 64 mT than those reported at 0.47 T and 1.5 T<sup>2</sup>.

## CONCLUSION

s The relaxivity of gadopixelenol was observed to be greater than 3 times that of gadobutrol. These values indicate that optimizing sequence parameters would enable a significant improvement in contrast to noise (CNR) ratio when using gadopixelenol, with the potential to enhance visualization of pathologies, such as metastatic tumors and multiple sclerosis, using POC MRI.

## CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced POC MRI critically ill patients for whom conventional imaging would not be possible.

## T5B-SPPH-2 Quantifying Accuracy in Deformable Image Registration: An Informed Selection of CT Image Pairs with Applications in Longitudinal Imaging

### PURPOSE

Image registration to align images for comparison reads has broad applications in assessment for interval change, including cancer screening and treatment response assessment. The accuracy of this registration has a meaningful impact on the validity of downstream image processing and automated tasks such as new lesion detection and lesion monitoring. We compare 3 metrics of deformable registration accuracy to inform the selection of a CT image pair (simulated baseline/follow-up) and evaluate CNN performance in new liver lesion detection in simulated longitudinal CT.

### METHODS AND MATERIALS

We used two public CT datasets: 1) diseased liver (DL) a subset of DeepLesion [1] 2) healthy liver (HL) from potential liver donors [2]. We registered each DL scan with each HL scan using sequential translation, affine, and B-spline transformations, creating image pairs that simulate a new liver lesion from healthy baseline. We utilized 3 metrics to define 3 subsets of the registered image-pairs; each metric informed the selection of one simulated baseline from a pool of candidate healthy scans. Our metrics: 1) Dice Similarity Coefficient (DSC) on liver segmentations 2) the product of DSC and mutual information in liver only (DSC-MI-liver), and 3) the product of DSC and mutual information in full CT (DSC-MI-full). We trained 3 models (ResNet50 architecture), one on each data subset, and compared performance on an image classification task that relies on quality registration: automated new lesion detection in paired image-patches. 5-fold cross validation and one-way ANOVA compared AUC. Ref: 1. doi: 10.1117/1.JMI.5.3.036501; 2. Med Image Anal 69 (2021) 101950

### RESULTS

Of 10,594 CT studies (4,427 patients) in DeepLesion, we registered 1595 DL scans (819 patients with liver lesions < 3cm longest diameter) with each of 20 registered HL scans (20 patients), creating 31,804 registered image pairs. Each metric selects a data subset of 1595 HL/DL image pairs, simulating baseline/follow-up. The model using the DSC metric outperformed the DSC-MI-liver and DSC-MI-full models, with AUC 0.928, 0.916, and 0.901, respectively ( $p=0.0379$ ).

## CONCLUSION

s When comparing similarity metrics for quantifying image registration accuracy, DSC outperformed DSC-MI-liver and DSC-MI-full in the selection of simulated baseline/follow-up CT images for new liver lesion detection.

## CLINICAL RELEVANCE/APPLICATION

In longitudinal imaging, image registration supports the assessment for interval change, including treatment response assessment. The quantification of registration accuracy can inform the selection of a comparison study.

### T5B-SPPH-3 Evaluation of Deep Learning Denoising Algorithms for Digital Mammography by Assessing Objective Task-based Performance using Computer Simulations

Participants

Stephen Glick, PhD, (*Presenter*) Nothing to Disclose

#### PURPOSE

Recent research suggests that degradation of image quality with reduced radiation exposure in full-field digital mammography (FFDM) can be mitigated by post-processing mammograms with denoising algorithms based on convolutional neural networks. In this work we use an in silico study to assess a deep learning denoising method and evaluate microcalcification detection accuracy when denoising is applied to scans of reduced dose.

#### METHODS AND MATERIALS

A previously published deep learning denoiser was trained and tested using an anthropomorphic breast phantom and simulated Monte Carlo mammography images containing small (100-240 micron) microcalcifications within a cluster containing 5-10 microcalcifications. Two different algorithms were tested, one with training on a dataset composed of 100% signal absent (SA) images (i.e., no MCC cluster), and one with training on a dataset composed of 50% signal absent (SA) and 50% signal present (SP). Human reader studies were conducted to assess and compare image quality in a set of binary signal detection 4-AFC experiments, with 4-AFC proportion of correct (PC) responses being the performance metric.

#### RESULTS

Microcalcification detection accuracy was decreased significantly when reducing the phantom dose from a full-dose level to a half-dose level. Deep learning denoising visually reduces the noise in the half-dose images, with a similar appearance to the full-dose images. For the algorithm trained on 100% SA images, no improvement in task-based performance (i.e., PC) was observed between half-dose images and denoised half-dose images. However, a statistically-significant improvement in PC was observed when using the algorithm trained on 50% SA and 50% SP. (see Figure below)

#### CONCLUSION

Deep-learning denoising algorithms applied to FFDM produced visually appealing images and improved global similarity metrics of MSE and SSIM. However, task-based assessment of microcalcification detection shows that deep-learning denoising applied to half-dose FFDM images resulted in decreased performance compared to that with full-dose FFDM images. In addition, our findings conjecture that deep learning denoising algorithms may benefit from enriching training datasets with signal-present regions of interest, at least in cases involving the detection of microcalcification clusters with smaller size microcalcifications.

## CLINICAL RELEVANCE/APPLICATION

A study of Deep Learning denoising shows; 1) global metrics such as MSE and SSIM might not correlate with task-based performance; and 2) the importance of adequately including images with features of diagnostic interest when training the network.

### T5B-SPPH-4 Fast and Robust Ring Artifact Correction in Photon-counting CT using a Conditional Score-based Diffusion Model with Hijacked Reverse Diffusion

#### PURPOSE

Diffusion models have emerged as the current state-of-the-art, outperforming even generative adversarial networks (GANs), for a wide range of image generation tasks and show great potential for denoising and artifact correction in medical imaging. However, long inference times have so far been a limiting factor. We propose an accelerated conditional score-based diffusion model and evaluate its performance for the task of image-domain ring artifact correction in photon-counting CT.

#### METHODS AND MATERIALS

Diffusion models exhibit an inherent tradeoff between speed and image quality negotiated by the number of steps, or noise scales, in the diffusion process. We suggest mitigating this tradeoff by "hijacking" the reverse diffusion at some step  $n$ . For a total number of steps  $N$ , we inject the condition image diffused  $N-n$  steps into step  $n$  of the reverse diffusion. We demonstrate the clinical utility of diffusion models and our suggested hijacking approach for the task of ring artifact correction in photon-counting CT. A conditional score-based diffusion model (cSBDM) is trained on 2576  $512 \times 512$  slices from 6 neuro patients scanned by CT systems from various vendors. Artificial ring artifacts are injected directly in the image domain to generate paired data. The NCSN++ network was trained to estimate the time-dependent conditional score function on extracted  $256 \times 256$  patches, with a batch size of 32, and  $N=2000$ , on one A6000 GPU for 150000 iterations. The predictor-corrector scheme was used for sampling. The network is evaluated on  $1024 \times 1024$  images of skull, water, and Lungman phantoms scanned by a prototype photon-counting system from GE HealthCare with the default ring correction disabled.

#### RESULTS

Our results indicate strong performance across the phantoms considered. On a A6000 GPU with batch size 1, cSBDM\_2000 (full diffusion) takes about 11 minutes and cSBDM\_5 (hijacked at step 1995) takes about 1.6 seconds. In other words, our suggested method achieves 400 times faster sampling. This gain in evaluation speed appears to come with a negligible drop in performance and image quality.

#### CONCLUSION

This work has suggested a ring artifact correction technique in photon-counting CT using a conditional score-based diffusion model. By hijacking the reverse diffusion, we achieve 400 times faster sampling than a vanilla cSBDM, with negligible drop in performance, pushing the required time on a medium range GPU from 11 minutes to 1.6 seconds per slice and thereby making the approach clinically viable. The method is robust to previously unseen anatomy.

## CLINICAL RELEVANCE/APPLICATION

With photon-counting CT scanners now clinically available, the proposed method improves workflow by correcting for ring artifacts without the need for time-consuming detector calibration.

### **T5B-SPPH-5 Deep Learning Image Reconstruction Algorithm to Improve the Quality of Vascular Imaging during the Peak Phase of Brain CT Perfusion**

Participants

Fang Wang, Yinchuan, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To explore the degree of deep learning image reconstruction (DLIR) algorithm to improve the peak arterial quality of CT perfusion (CTP) images in acute stroke cases.

#### **METHODS AND MATERIALS**

Clinically suspected acute stroke patients were selected for one-stop CTP imaging and randomly divided into two groups. The scanning tube voltage was 80 kV, and the current of low and high dose tube was set to 50 and 150 mA, respectively. Low dose scan data image reconstruction used DLIR 3 different intensities (low, medium and high), and only FBP was used for high dose scan data images reconstruction. Objective evaluation and subjective evaluation (point system) Image quality: The objective evaluation mainly measures the normal measurement of arterial peak period, the CT value and noise of the middle cerebral artery, calculates the signal-to-noise ratio (SNR) and the contrast noise ratio (CNR); the subjective evaluation uses arterial reinforcement, small artery detail display, image noise and venous pollution, each with 0-2 points: 0, poor; 1, medium; 2 points, good. Radiation dose was compared by t-test and image objective score by one-way ANOVA (ANOVA). The subjective scores of image quality were compared using the Kruskal-Wallis test.  $P < 0.05$  were considered to be statistically significant.

#### **RESULTS**

The mean effective radiation dose between the high dose and low dose scanning regimen was 3.25 and 1.08 mSv, respectively, significant ( $t = -1303.629$ ,  $P < 0.001$ ). The image obtained at low dose gradually decreased with the increase of DLIR intensity, and the image SNR and CNR were gradually increased ( $F = 5.397, 3.450, 2.934$ ,  $P < 0.05$ ). The noise of high-intensity DLIR images and high-dose FBP images was ( $33.9 \pm 2.7$ ), ( $40.5 \pm 11.3$ ), SNR ( $14.3 \pm 6.8, 12.2 \pm 1.9$ ), and CNR ( $13.1 \pm 6.5$  and  $10.6 \pm 1.8$ ), respectively. The differences were statistically significant (t-values were -1.961, -0.989, -1.288, and P-values  $< 0.05$ ). The subjective scores of high intensity DLIR images and high dose FBP images were ( $6.17 \pm 0.4$ ) and ( $4.31 \pm 0.5$ ), respectively, which were statistically significant ( $Z = -4629$ ,  $P < 0.001$ ).

#### **CONCLUSION**

The application of high-intensity DLIR algorithm is beneficial to achieve low-dose brain CTP, which can significantly improve the image quality and improve the peak period vascular assessment.

#### **CLINICAL RELEVANCE/APPLICATION**

Deep learning algorithm improves the quality of vascular imaging in the peak period of low-dose cerebral perfusion artery, and provides clinical basis for the realization of one-stop cerebrovascular and cerebral perfusion imaging.

### **T5B-SPPH-6 Class-wise Combination of Data Augmentation Can Enhance Learning on Class Imbalanced Dataset**

Participants

Helen Hong, PhD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Data augmentation (DA) plays an essential role in enhancing learning efficiency and avoiding overfitting in medical image analysis, particularly faced with limited training data or class imbalance. However, recent studies indicate that the effect of DA can differ among classes. We investigated the individual class effects of MixUp and AugMix DAs on focal liver lesions (FLLs) classification in CT images, and proposed a class-wise combination of these DAs with different ratios for each class to address class imbalance.

#### **METHODS AND MATERIALS**

Our dataset included CT scans from 502 colorectal cancer patients with 1290 FLL images with 676 cysts, 130 hemangiomas, and 484 metastases. We proposed a class-wise combination of MixUp and AugMix DAs by applying them at different rates for each class. For the major classes, cyst and metastasis, MixUp and AugMix are applied at an equal ratio of 50% each, while for the minor class, hemangioma, the rate is adjusted to 75% MixUp and 25% AugMix. We trained a VGG-16 network on these augmented training images to classify FLLs. To evaluate the effectiveness of our method in class imbalance learning, we assessed the accuracy, F1 score, sensitivity, and specificity and analyzed the t-SNE feature distribution of the classification results.

#### **RESULTS**

Our performance evaluation and feature distribution analysis showed that MixUp improved the sensitivity of the major classes by augmenting the data in the boundary area between classes, while AugMix enhanced the sensitivity of the minor class by augmenting the data within the class itself. By applying these two DAs in different ratios for each class, our method improved the F1 score and the sensitivity for cyst and hemangioma compared to using MixUp and AugMix alone.

#### **CONCLUSION**

We observed that MixUp and AugMix had different effects on each class within the class imbalanced dataset for FLL classification in CT images. By applying these two DAs at different ratios for each class, our method enhanced the learning efficiency for both major and minor classes in class imbalance learning. (This work was supported by the National Research Foundation of Korea Grant funded by the Korea government (No. RS-2023-00207947))

#### **CLINICAL RELEVANCE/APPLICATION**

Our proposed method can be applied to various medical image analysis tasks to enhance learning efficiency by utilizing multiple DA methods.

## **T5B-SPPH-8 Evaluation of Extracellular Volume Changes using Conductivity Tensor Imaging**

### **PURPOSE**

Changes in extracellular volume (ECV) could be an effective biomarker of a disease state, such as fibrosis, edema, and cell swelling. Conductivity tensor imaging (CTI) using MRI has been developed to improve the limitations of existing MR-based conductivity imaging. Without injecting currents into the imaging object, CTI utilizes information on intracellular and extracellular compartments to produce both low-frequency and high-frequency conductivity images. The ECV fraction is one of the parameters that needs to be measured in CTI. In addition, it would have clinical utility if it can be measured reliably. The purpose of this study was to experimentally verify CTI parameters, with a specific focus on ECV fraction, by using a phantom with position-dependent ECV fractions.

### **METHODS AND MATERIALS**

Giant vesicle suspension (GVS) was prepared using the reverse phase method. An acrylic phantom was used for the CTI imaging experiment. The changes in ECV were controlled by the GVS chambers with four different densities: electrolyte only and low (GVS #1), middle (GVS #2), and high (GVS #3) densities of GVS. The CTI experiment was performed using a 9.4T MR scanner with a single-channel body coil. A multi-echo spin-echo MR pulse sequence was applied to the phantom to acquire B1 phase maps to reconstruct high-frequency conductivity (sH) images. The single-shot spin-echo echo-planar imaging sequence was used for multi-b-value diffusion-weighted imaging

### **RESULTS**

Figure 1 shows the CTI parameters obtained from the imaging experiment of the GVS phantom. MR image shows the morphology of the phantom. The signal intensity was found to be highest in the chamber with electrolyte only, but there was no clear difference in signal intensity between the chambers with different GVS densities. The sH image did not show a clear difference in terms of contrast between the four different densities of GVS. However,  $a$ ,  $d_{\text{ew}}$ , and  $sL$  all showed clear differences in contrast depending on the densities of GVS. Specifically, the contrast of these parameters was decreased as the density of GVS increased. Meanwhile, the contrast of  $d_{\text{iw}}$  was slightly increased with increasing of GVS density. There was no contrast in the chamber of electrolyte only due to the absence of GVS.

### **CONCLUSION**

The ECV fraction is a key parameter for measuring CTI because the electrolytes inside and outside of the giant vesicle have similar ionic concentrations. As the vesicle density increased, the ECV decreased, resulting in decreased low-frequency conductivity.

### **CLINICAL RELEVANCE/APPLICATION**

Changes in the extracellular space can be indicators of disease progression, such as fibrosis, edema, and cell swelling. CTI can provide information about changes in the extracellular space, such as the ECV fraction.

## **T5B-SPPH-9 Explore the Influence of Different Strength of Iterative Reconstruction on Image Quality: A Comparative Volume Model Experiment**

### **PURPOSE**

To explore the influence of different strength of adaptive statistical iterative reconstruction Veo (ASiR-V) for image resolution and noise using Japanese Industry Standards Phantom (JIS Phantom) on GE Revolution APEX.

### **METHODS AND MATERIALS**

No GSI scanning experiments were performed on JIS phantom based on GE Revolution APEX CT. The image spatial/density resolution parts of the phantom were selected for the comparative study of different reconstruction algorithms. The scan tube voltage was 120kV, the speed was 0.5s, the detector width was 80mm, the helical pitch was 0.992, and the layer thickness was 0.625mm. The scanning dose is 11.5 (CTDIvol, mGy). Reconstruction was performed using with different ASiR-V weights (0%, 30%, 60% and 90%). For the image spatial resolution/density resolution parts of the body model, AdvancedWorkstation 4.7 (GE Healthcare) were used for objective assessment (SD) and subjective scoring (5-point scale for noise and resolution, respectively, with 1 being the worst, 5 being the best, and 3 or more being used for diagnosis) with  $P < 0.05$  considered as statistically significant difference.

### **RESULTS**

The SD of the different strength of ASiR-V were (18.30±1.79, 14.98±1.48, 11.37±1.21, 8.07±0.98)HU for ASiR-V 0, 30, 60 and 90%, with significant differences between the groups ( $p < 0.05$ ). The image spatial resolution score of (3,3,2,2); The image density resolution score of (3,3,3,2); The subjective scores of noise of (2,2,3,4). From the subjective results, the image resolution decreased with increasing weight of ASiR-V. Subjective and objective assessments both showed that noise decreased with increasing weight of ASiR-V. When the ASiR-V rises to 90%, the spatial resolution and the density resolution decreased. When ASiR-V 60, It can effectively reduce the noise while maintaining the resolution. The ASiR-V 60 image quality is significantly better than other reconstruction algorithms.

### **CONCLUSION**

In the non-spectral scan of Revolution APEX CT, 60% ASiR-V performs the best in image quality (resolution and noise).

### **CLINICAL RELEVANCE/APPLICATION**

The images obtained with 60% ASiR-V are more advantageous than the different ASiR-V weights (0%,30%, 90%), especially to effectively reduce the noise while maintaining the image resolution, providing a wider range of clinical application scenarios.



## Abstract Archives of the RSNA, 2023

T5B-SPRO

### Radiation Oncology Tuesday Poster Discussions II

#### Sub-Events

#### T5B-SPRO-1 Models for Assessing Postoperative Risk Factors in Patients with Cervical Cancer

##### PURPOSE

To develop and evaluate the nomogram models based on clinical parameters, inflammatory indicators, intravoxel incoherent motion diffusion weighted imaging (IVIM-DWI) and MRI-radiomics that assist in the assessment of parametrial infiltration (PI), lymph node metastasis(LNM), deep myometrial invasion (DMI), lymphovascular space invasion(LVSI), type of pathology, degree of differentiation and Ki-67 expression levels in cervical cancer patients accurately before the operation.

##### METHODS AND MATERIALS

Between December 2016 and December 2022, a total of 180 cervical cancer patients operated at our hospital and continuously followed-up were enrolled and randomly divided into a training cohort (n=120) and a validation cohort(n=60). The parameters of IVIM-DWI (ADC, D, D\* and f) and radiomics features were extracted from the pretreatment axial T2WI and sagittal LAVA-FLEX sequences for each patient. Logistic regression with the least absolute shrinkage and selection operator (LASSO) penalty was applied to select key features and construct radiomic score (Rad-score). Multivariate logistic regression analysis was used to develop the nomogram models for predicting pathology outcomes preoperatively in cervical cancer patients and then the models were validated internally and externally.

##### RESULTS

The diagnostic efficacy of the combined models incorporating clinical and imaging parameters was significantly better than the MRI alone. The AUCs of the combined model and MRI were 0.981 vs 0.868, 0.848 vs 0.639 and 0.896 vs 0.780 for the assessment of parametrial infiltration (PI), lymph node metastasis (LNM) and deep muscular invasion (DMI), respectively. Moreover, The combined model based on the clinical and imaging parameters performed equally well in assessing lymphovascular space invasion (LVSI), type of pathology, degree of differentiation and Ki-67 expression levels, with AUCs of 0.796, 0.854, 0.806 and 0.839; 0.840, 0.856, 0.810 and 0.832 in the training and validation sets respectively.

##### CONCLUSION

The nomogram models based on clinical and imaging parameters outperformed MRI in preoperative risk assessment in patients with cervical cancer and can be used as early biomarkers for predicting preoperative pathology outcomes, which can facilitate further clinical decision-making.

##### CLINICAL RELEVANCE/APPLICATION

The nomogram models based on clinical and imaging parameters can be used as early biomarkers for predicting preoperative pathology outcomes, which can facilitate further clinical decision-making.

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## Abstract Archives of the RSNA, 2023

T5B-SPVA

### Vascular Imaging Tuesday Poster Discussions II

#### Sub-Events

#### **T5B-SPVA-1 Comparison of 4D Flow MRI-derived Aortic Flow Profiles in Patients with Abdominal Aortic Aneurysms below and above Intervention Threshold**

##### **PURPOSE**

To compare 4D flow MRI-derived aortic flow profiles in patients with abdominal aortic aneurysms (AAA) below and above intervention threshold.

##### **METHODS AND MATERIALS**

We prospectively performed 4D flow MRI of the abdominal aorta at 3T in 22 male AAA patients (72±9 years). Maximum aneurysm diameters were assessed using non-contrast 3D MR angiography. Based on the threshold for intervention, patients were divided into two groups: patients under surveillance with aortic diameters <5.5 cm (n=11) and ii) patients with diameters ≥5.5 cm with indication for therapeutic intervention (n=11). 4D flow MRI-derived flow rates and velocities were determined at the level of the maximum aneurysm diameter. Presence or absence of vortical flow in the infrarenal aorta was evaluated using a 3-point scale (0: no vortex, 1: local vortex, 2: global vortex). Data were statistically compared using unpaired Mann-Whitney U tests.

##### **RESULTS**

Mean AAA diameters of patients above intervention threshold were significantly higher as compared to patients under surveillance (4.3±0.7 cm vs. 5.8±0.5, p<0.001). Peak flow rate was significantly higher in patients above intervention threshold when compared to patients under surveillance (165±40ml vs. 108±37, p<0.05). Forward and backward stroke volume of patients above intervention threshold were also significantly higher as compared to patients under surveillance (50 ±18 ml vs. 30±16 ml and -16±8 vs. -10±0.9 ml, both p<0.008). Pathological vortical flow patterns were present in all (11/11) patients (100%) above surgical threshold as compared to 6/11 patients (55%) under surveillance, resulting in average vortical flow ratings of 1.5±0.5 vs. 0.9±1.0.

##### **CONCLUSION**

s Quantitative and qualitative 4D flow MRI-derived blood flow profiles are significantly altered in AAA patients above intervention threshold when compared to AAA patients under surveillance.

##### **CLINICAL RELEVANCE/APPLICATION**

Our 4D flow MRI study revealed in about half of the patients under surveillance pathological flow profiles, warranting to investigate if these pathological flow profiles may serve an imaging biomarker to predict future aortic dilation.

#### **T5B-SPVA-2 Micro-vascularity of the Feet and Toes using Non-contrast MR Perfusion**

Participants

Mitsue Miyazaki, PhD, La Jolla, CA (*Presenter*) Nothing to Disclose

##### **PURPOSE**

To develop novel non-contrast 3D MR perfusion techniques for assessing micro-vascularity of the feet and toes in human subjects.

##### **METHODS AND MATERIALS**

All experiments were performed on a clinical 3T scanner using non-contrast MR perfusion using arterial spin labeling (ASL). Seven healthy subjects (30 to 72 years old, 5 males and 2 females) were enrolled and bilateral feet were imaged with tag-on and tag-off alternating inversion recovery spin labeling for determining perfusion in micro-vascularity. We compared an ASL technique with 1-tag pulse against 4-tag pulses. For perfusion, we determined signal increase ratio (SIR) at varying inversion times (TI) from 0.5 to 2 sec. SIR versus TI data were fit to determine perfusion metrics of peak height (PH), time to peak (TTP), mean transit time (MTT), apparent blood volume (aBV) and apparent blood flow (aBF) in the distal foot and individual toes. Using analysis of variance (ANOVA), effects of tag pulse and ROI on the mean perfusion metrics were assessed.

##### **RESULTS**

Using MR perfusion techniques, SIR versus TI data showed well-defined leading and trailing edges, with a peak near TI of 0.75 to 1.0 sec and subsiding quickly to near zero by TI of 2 sec, particularly when 4-tag pulses were used. In our normal subjects imaged with 1-tag pulse, the overall (of all ROIs and subjects) mean ± standard deviation values of PH, TTP, MTT, aBV, and aBF were 6.5±4.5%, 0.65±0.26 sec, 0.60±0.23 sec, 8.4±4.6 %·sec, and 15.0±9.0 %, respectively. When imaged with 4-tag pulse sequence, we found a significantly greater values in PH (13.4±7.3 %, p<0.00001), TTP (0.60±0.25 sec, p=0.005), aBV (13.7±6.3 %·sec, p<0.00001), and aBF (25.4±16.1 %, p=0.008).

##### **CONCLUSION**

s Feasibility of MR perfusion imaging of the distal foot was studied, and advantages of the 4-tag pulse technique were studied, showing greater SIR and perfusion metrics compared to 1-tag pulse technique. This will likely benefit those with low perfusion due

to aging or diseases such as PAD and diabetic foot.

**CLINICAL RELEVANCE/APPLICATION**

Our study demonstrated the feasibility of a novel application of a 3D ASL technique for the feet and toes, with a greater possibility of evaluation of diabetic foot.

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## Abstract Archives of the RSNA, 2023

W2-SPBR

### Breast Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPBR-1 Differentiation of Benign and Malignant Breast Lesions Using Diffusion-Weighted Imaging with a Fractional Order Calculus Model

##### PURPOSE

Purpose: The purpose of this study is to demonstrate the efficacy of a new set of parameters ( $D$ ,  $\beta$ , and  $\mu$ ) obtained from a fractional order calculus (FROC) diffusion model in improving the accuracy of differentiating between benign and malignant breast lesions.

##### METHODS AND MATERIALS

Materials and Methods: A total of 103 patients were recruited, and MR measurements were performed using a 3-T MR scanner (uMR790, United Imaging Healthcare, Shanghai, China). The MRI protocol included T2WI, contrast-enhanced T1WI, and DWI with 12  $b$  values (0, 50, 100, 200, 400, 600, 800, 1200, 1600, 2000, 2500, and 3000  $s/mm^2$ ). FROC-DWI derived metrics were calculated using a fitting formula previously reported. The metrics were then statistically compared between two subgroups with the Mann-Whitney U test, and receiver operating characteristic (ROC) analysis was performed to assess the performance of individual parameters in diagnosing malignant breast lesions.

##### RESULTS

Results: The statistical results of each FROC-derived metric were shown in Table 1, with  $D$  and  $\beta$  values significantly lower in malignant lesions than in benign lesions ( $P < 0.001$ ), and  $\mu$  values significantly higher in malignant lesions than in benign lesions ( $P < 0.001$ ). The AUCs of  $D$ ,  $\beta$ , and  $\mu$  for diagnosing malignant lesions were 0.84, 0.79, and 0.77, respectively, with  $D$  showing significantly higher AUC than  $\beta$  and  $\mu$ . The combination of  $D$  and  $\beta$  values exhibited better diagnostic efficiency than individual parameters in differentiating benign from malignant lesions (AUC: 0.86, 95% CI 0.77-0.92, sensitivity: 93.88%, specificity: 68.52%) (Fig 1).

##### CONCLUSION

Conclusion: In conclusion, this study demonstrates the feasibility of using FROC-derived diffusion parameters to differentiate between benign and malignant breast lesions, with  $D$ ,  $\beta$ , and  $\mu$  showing significant differences between the two subgroups. The combination of  $D$  and  $\beta$  values resulted in the highest diagnostic accuracy in terms of AUC for predicting malignancy.

##### CLINICAL RELEVANCE/APPLICATION

This study demonstrates the efficacy of a new set of parameters ( $D$ ,  $\beta$ , and  $\mu$ ) obtained from a fractional order calculus (FROC) diffusion model in improving the accuracy of differentiating between benign and malignant breast lesions.

#### W2-SPBR-2 Preoperative Diagnosis of Multifocal, Multicentric and Contralateral Breast Cancer: Additional Benefit of Diffusion-Weighted Magnetic Resonance Imaging

##### Participants

HAJUNG KIM, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the diagnostic performance of dynamic contrast enhanced (DCE) MRI and diffusion weighted (DW) MRI, named multi-parametric MRI, for the diagnosis of multifocal, multicentric and contralateral breast cancer in patients with newly diagnosed breast cancer.

##### METHODS AND MATERIALS

Between June 2019 to June 2021, our database search identified consecutive women who were diagnosed with invasive breast cancer, underwent MRI, and had at least one DCE MRI detected additional lesion. Two experienced breast radiologists retrospectively measured apparent diffusion coefficient (ADC) values. A BI-RADS category = 4 was considered positive result. The reference standard was histopathology or 1-year follow-up. The ADC cut-off for differentiation between benign and malignant lesions was calculated and performance measures of DCE MRI alone and multi-parametric MRI were compared. In addition, we validated ADC value of  $1.3 \times 10^{-3} mm^2/s$ , recommended by the European Society of Breast Radiology (EUSOBI) guideline.

##### RESULTS

Among finally included 219 patients (mean age, 50.9 years) with 298 lesions, 169 (57%) were benign (mean size, 1.4cm) and 129 (43%) were malignant (mean size, 1.7cm). There were 45 masses (27%) and 124 nonmass (73%) among benign lesions and 33 (26%) masses and 76 (74%) nonmass among malignant lesions. The median ADC of benign lesion was  $1.23 \times 10^{-3} mm^2/s$  and median ADC of malignant lesion was  $0.88 \times 10^{-3} mm^2/s$  ( $P < .001$ ). The best ADC cut-off to differentiate benign from malignant lesions determined using ROC-curve was  $1.0 \times 10^{-3} mm^2/s$ , which yielded sensitivity of 74.4% and specificity of 76.9%. The area under the ROC curve was 0.80 (95% CI: 0.75-0.86). With DCE MRI alone, sensitivity was 98.5% (127 of 129, 95% CI: 96.3, 100.0),

specificity was 29.6% (50 of 169, 95% CI: 22.7, 36.5) and accuracy was 59.4% (177 of 298, 95% CI: 53.8, 64.9). In comparison, multi-parametric MRI showed decreased sensitivity of 75.2% (97 of 129, 95% CI: 67.7, 82.6;  $P = .01$ ), but improved specificity of 76.3% (129 of 169, 95% CI: 69.9, 82.7;  $P < .001$ ) and accuracy of 75.8% (226 of 298, 95% CI: 70.9, 80.7;  $P < .001$ ). With ADC value of  $1.3 \times 10^{-3}$  mm<sup>2</sup>/s, sensitivity of 96.2% (124 of 129; 95% CI: 92.8, 99.4), specificity of 38.5% (65 of 169, 95% CI: 31.1, 45.8) and accuracy of 63.4% (189 of 298, 95% CI: 57.9, 68.9) were observed.

## CONCLUSION

s Multi-parametric MRI can increase the specificity and maximize accuracy of DCE MRI detected additional lesions in patients with newly diagnosed breast cancer.

## CLINICAL RELEVANCE/APPLICATION

In patients with newly diagnosed breast cancer, multi-parametric MRI with implementation of DW MRI can help increase specificity and accuracy of DCE MRI detected additional lesions.

### W2-SPBR-3 The Application Value of Synthetic MRI in the Diagnosis of BI-RADS 4 Breast Lesions

Participants

Hua He, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

In recent years, quantitative research on T1 and T2 relaxation time in breast MRI has become a hot topic in breast imaging. Synthetic MRI (syMRI) can simultaneously obtain quantitative T1, T2 relaxation times, and proton density (PD), and provide quantitative indicators for distinguishing benign and malignant breast lesions. However, the diagnostic efficacy of this technology in BI-RADS 4 lesions is still unclear. This study aims to explore the application value of synthetic MRI imaging technology in the diagnosis of BI-RADS 4 solid lesions by comparing the relaxation time of benign and malignant breast lesions.

## METHODS AND MATERIALS

Retrospectively analyzed 79 patients with BI-RADS 4 solid lesions confirmed by biopsy or surgery, including 56 malignant and 23 benign lesions. Preoperative breast MRI T1WI, T2WI, DWI, DISCO enhancement, and MAGIC examination were performed. The relaxation values and standard deviation (SD) of T1, T2, PD, R1, and R2 were measured for each lesion. Independent-samples t-test (normal distribution data) or Mann-Whitney U test (skewed distribution data) was used to compare the differences in MAGIC parameters between benign and malignant lesions. The receiver operating characteristic (ROC) curves were used to evaluate the diagnostic value of statistically significant parameters for BI-RADS 4 lesions.

## RESULTS

The SD of T2 and T2 values of malignant BI-RADS 4 lesions were lower than those of benign lesions, and the R2 value was higher than that of benign lesions, with statistically significant differences ( $P < 0.05$ ). There was no statistically significant difference in T1, PD, R1 values and their SD values between benign and malignant lesions ( $P > 0.05$ ). The area under the ROC curve (AUC) of T2's SD for distinguishing BI-RADS 4 lesions was 0.703, higher than that of T2 values (AUC=0.659) and R2 (AUC=0.654).

## CONCLUSION

s This study also showed that the quantitative relaxation time values of T2, T2's SD, and R2 provided by SyMRI have good reproducibility among different observers and the same observer, which can serve as effective indicators for long-term follow-up studies or multi-center studies of BI-RADS 4 lesions.

## CLINICAL RELEVANCE/APPLICATION

This study used SyMRI for imaging and preoperative quantitative diagnosis of BI-RADS 4 breast lesions, and the MAGIC sequence could obtain five quantitative spectra and multiple contrast images in one scan, which met the requirements of routine clinical morphological evaluation and tissue quantitative diagnosis. This approach significantly shortened the examination time for patients and is suitable for routine clinical examination promotion.

### W2-SPBR-4 The Value of Different Delineation Methods for the Region of Interest in SyMRI and DWI Quantitative Discrimination Diagnosis: Providing Support for Standardized Measurement Schemes of Breast Lesions

Participants

Zhijun Wang, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

Breast cancer is a highly heterogeneous disease, and different region of interest (ROI) selection methods may affect the measurement results of quantitative parameters. This study aims to explore the diagnostic value of three different ROI delineation methods in measuring SyMRI and DWI quantitative parameters for discriminating between benign and malignant breast lesion types.

## METHODS AND MATERIALS

122 patients diagnosed with mass lesions by breast MRI received routine MRI and SyMRI examination before surgery. Two physicians used three ROI delineation methods: whole-volume method, maximum layer method, and tumor-enhancing region method. The first physician repeated the measurements one month later. The inter-class correlation coefficient (ICC) was calculated to evaluate the reproducibility of the measurement results. The differences in various parameters between benign and malignant breast lesions were compared, and the receiver operating characteristic (ROC) curve was used to evaluate the diagnostic efficacy of SyMRI, DWI, and the combination of the two for differentiating benign and malignant lesions. The comparison of AUCs was performed using the Delong test.

## RESULTS

The ADC values, T1 values, T2 values, and PD values measured by the same radiologist twice and by different radiologists had good repeatability (ICC range: 0.929-0.992) using different ROI delineation methods. Multivariate logistic regression analysis indicated that ADC<sub>local</sub>, T2<sub>tumor</sub>, and PD<sub>local</sub> were independent predictors of breast cancer, with odds ratios (ORs) of 0.001, 0.917, and 1.267, respectively, and P-values of 0.013, 0.039, and 0.043, respectively. The ROC curve analysis showed that the ADC<sub>local</sub> +

T2tumor + PDlocal had the highest AUC (0.953) for discriminating between benign and malignant breast lesion types, with a sensitivity of 95.2%, a specificity of 84.2%, an accuracy of 91.0%, a positive predictive value of 93.0%, and a negative predictive value of 88.8%. There was no statistically significant difference in the diagnostic performance between ADClocal + T2tumor + PDlocal and ADClocal alone (AUCs of 0.953 and 0.942, respectively,  $P=0.143$ ).

## CONCLUSION

s Different measurement methods for the region of interest in SyMRI and DWI sequences will affect the quantitative diagnosis results of breast lesions. ADClocal, T2tumor, and PDlocal are independent predictors of breast cancer, and the multi-parameter combined diagnostic model (ADClocal+T2tumor+PDlocal) has the highest diagnostic performance for discriminating between benign and malignant breast lesion types.

## CLINICAL RELEVANCE/APPLICATION

The results of this study provide a theoretical basis for standardizing the measurement scheme of the region of interest for breast lesion assessment.

### **W2-SPBR-5 Multiparametric MRI Model with Synthetic MRI, DWI Multi-quantitative Parameters and Differential Sub-sampling with Cartesian Ordering (DISCO) Enables BI-RADS 4 Lesions Diagnosis with High Accuracy**

Participants  
Zhijun Wang, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

In the 5th edition of the Breast Imaging Reporting and Data System (BI-RADS), BI-RADS4 lesions are considered suspicious for malignancy, with a wide range of malignant transformation and malignancy ranging from 2% to 95%, and clinical doctors are advised to perform biopsy or surgical resection. The accuracy of conventional MRI using morphological features and TIC for diagnosis is low, leading to unnecessary invasive treatments for some benign lesions, which increases the economic and psychological burden on patients. This study aims to observe the value of synthetic MRI combined with diffusion-weighted imaging (DWI) and DISCO-enhanced imaging for distinguishing between benign and malignant BI-RADS4 lesions.

## METHODS AND MATERIALS

A retrospective analysis was conducted on 79 cases of breast tumors confirmed by biopsy or surgical pathology, with a total of 89 BI-RADS4 lesions diagnosed by preoperative breast synthetic MRI (using MAGIC technology), DWI, and DISCO-enhanced imaging, including 63 malignant lesions (malignant group) and 26 benign lesions (benign group). The differences in MAGIC parameters, apparent diffusion coefficients (ADC), DISCO-enhanced imaging morphological characteristics, and time-intensity curves (TIC) were compared between the groups. Logistic regression analysis and receiver operating characteristic (ROC) curve were used to evaluate the efficacy of MAGIC, DWI, DISCO-enhanced parameters, and the combination of the three in distinguishing between benign and malignant BI-RADS4 lesions.

## RESULTS

There were significant differences in lesion morphology, internal enhancement features, TIC, ADC, T2, and R2 values between the groups (all  $P<0.05$ ), while the difference in other parameters was not statistically significant (all  $P>0.05$ ). After logistic regression analysis, among the relevant parameters, ADC had the highest efficacy in distinguishing between benign and malignant BI-RADS4 lesions, with an area under the curve (AUC) of 0.845; while the MAGIC+ADC+DISCO model had the highest diagnostic efficacy, with an AUC of 0.908.

## CONCLUSION

s SynMRI combined with DWI and DISCO-enhanced imaging have a certain value for distinguishing between benign and malignant BI-RADS4 lesions, and the diagnostic efficacy is better when the three are combined.

## CLINICAL RELEVANCE/APPLICATION

The application of MAGIC, DWI, and DISCO-enhanced quantitative parameters for preoperative quantitative diagnosis of BI-RADS4 breast lesions can significantly improve the diagnostic efficacy of benign and malignant lesions and reduce the probability of unnecessary surgery in benign patients.

### **W2-SPBR-6 MR Imaging Features Associated with High and Low Expression of Tumor-Infiltrating Lymphocytes: Stratified Analysis According to Molecular Subtypes**

Participants  
Jiejie Zhou, PhD, MD, Wenzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

It is known that the expression of tumor-infiltrating lymphocytes (TILs) is different in different molecular subtypes of breast cancer (BC); and thus, the studies analyzing the mixed subtypes would be heavily dependent on the composition of subtypes, and the obtained results are not generalizable. To investigate the association of MRI features with TILs and subtypes, three analyses were performed: (1) Comparison of the rate of high vs. low TILs in 3 subtypes: Hormonal-Receptor positive, HER2 negative (HR+/HER2-), HER2 positive (HER2+), and Triple negative (TN); (2) Comparison of the MR imaging features among 3 subtypes; (3) In each subtype, the comparison of imaging features between high vs. low TILs cases.

## METHODS AND MATERIALS

A total of 457 patients with pathologically diagnosed BC were included in this study. Breast MRI with 3.0 T scanner was performed, including T2, DWI, and DCE-MRI. The expression of TILs was evaluated on HE-stained slides according to the recommendations by an International TILs Working Group 2014. The percentage of TILs in the stroma adjacent to the tumor cells was assessed, stratified as low ( $< 10\%$ ) and high ( $= 10\%$ ). MRI features, including morphology as mass or non-mass enhancement (NME), shape, margin, internal enhancement, peritumoral edema, and the DCE kinetic pattern were assessed and compared between groups.

## RESULTS

Of the 241 HR+/HER2- cases, 82% had low TILs, and only 18% had high TILs. There were 134 HER2+ cases, 63% low TILs and 37% high TILs. Of the 82 TN, 56% had low TILs and 44% had high TILs. The composition of high TILs was significantly increased from HR+ to HER2+ to TN ( $p < 0.001$ ). For MRI features among the 3 subtypes (Table 1), the size was smaller for HR+/HER2- ( $p < 0.001$ ); HER2+ was more likely to present as NME ( $p = 0.031$ ); homogeneous enhancement was more seen in HR+ ( $p < 0.001$ ); and the peritumoral edema was present in 45% HR+, 71% HER2+, and 80% TN ( $p < 0.001$ ). The MRI features between low and high TILs in each subtype are listed in Table 2. In HR+/HER2-, the peritumoral edema was more likely to be present in high TILs (70%) than in low TILs (40%,  $p < 0.001$ ). In TN, high TILs were more like to present a regular shape (33%) than low TILs (13%,  $p = 0.029$ ); and more like to present the circumscribed margin (19%) than low TILs (2%,  $p = 0.009$ ).

## CONCLUSION

s HER2+ and TN cancers have significantly higher TILs compared to HR+ cancers. In HR+, high TILs cases were more likely to present peritumoral edema. In TN, high TILs cases were more likely to present regular shapes and circumscribed margins.

## CLINICAL RELEVANCE/APPLICATION

TILs expression increases from HR+ to HER2+ to TN. MRI features in different molecular subtypes show substantial variations. When building MR radiomics models to predict TILs, different models should be built for different subtypes.

## W2-SPBR-7 Interpretation of Unenhanced Breast MRI with Diffusion-Weighted Imaging for Breast Cancer Detection: Effect of Training on the Performance and Agreement of Radiologists

Participants

Su Min Ha, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate whether training improves the performance and agreement of radiologists interpreting unenhanced breast magnetic resonance imaging (MRI) with diffusion-weighted imaging (DWI).

## METHODS AND MATERIALS

A reader study of 96 breasts (35 screening-detected cancer cases and 61 benign or negative cancer cases) of 48 asymptomatic women was performed. High-resolution DWI (in-plane resolution  $< 1.3 \times 1.3$  mm) was performed using a 3.0-T system and b values of 0, 800, and 1200 sec/mm<sup>2</sup>. Sixteen breast radiologists independently reviewed DWI, apparent diffusion coefficient maps, and T1-weighted MRI and recorded the Breast Imaging Reporting and Data System (BI-RADS) assessment category for each breast. After a 2-hour training session and 5-month washout period, they re-evaluated the BI-RADS assessment categories. A BI-RADS category of 4 or more was considered a positive reading. The diagnostic performance of each reader for each breast during the first review and that during the second review were compared. Inter-reader agreement regarding the final assessment was evaluated using a multi-rater  $\kappa$  analysis.

## RESULTS

Before training, the mean sensitivity, specificity, and accuracy of 16 readers who performed unenhanced MRI assessments were 70.7% (95% confidence interval [CI]: 59.4-79.9), 90.8% (95% CI: 85.1-94.2), and 83.5% (95% CI: 78.6-87.4), respectively. After training, significant improvements in specificity (95.2%; 95% CI: 90.8-97.5;  $P = 0.001$ ) and accuracy (85.9%; 95% CI: 80.9-89.8;  $P < 0.001$ ) were observed, but no difference in sensitivity (69.8%; 95% CI: 58.1-79.4;  $P = 0.58$ ) was observed. Regarding inter-reader agreement, the  $\kappa$  values were 0.57 (95% CI: 0.52-0.63) before training and 0.68 (95% CI: 0.62-0.74) after training, with a difference of 0.10 (95% CI: 0.02-0.18), which was statistically significant ( $P = 0.01$ ).

## CONCLUSION

s Minimal training improved the performance and agreement of interpretations by radiologists using unenhanced MRI with DWI.

## CLINICAL RELEVANCE/APPLICATION

To use DWI as an effective screening tool, besides the need for standardization of DWI acquisition, training for standardized interpretation is required.

## W2-SPBR-8 Standardizing Qualitative and Quantitative Breast Parenchymal Enhancement Assessment in Breast MRI

Participants

Gustav Mueller-Franzes, MSc, Aachen, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

Despite being a crucial research focus in the field of breast cancer studies, Background Parenchymal Enhancement (BPE) lacks standardized qualitative and quantitative assessments, which poses an obstacle in its evaluation as a breast cancer risk marker. The purpose of this study was to examine the relationship between and to compare qualitative and quantitative assessments of BPE.

## METHODS AND MATERIALS

In this retrospective study of 5773 breast MRI examinations from 3207 women acquired between January 2010 and December 2019, the BPE was rated as part of the clinical routine as minimal, mild, moderate, and strong following the ACR BI-RADS guidelines. For the quantitative assessment of BPE, the fibroglandular tissue (FGT) was segmented in the pre- and post-contrast T1-weighted sequences. Four quantitative BPE calculation methods were identified as most commonly used by previous studies and were applied to the given dataset. Correlation and agreement between qualitative and quantitative assessments were calculated using the Spearman correlation ( $r$ ) coefficient.

## RESULTS

The mean age of the patients was 60 years  $\pm$  10 [SD] and the average volumetric fraction of FGT to the full breast was 17%  $\pm$  12 [SD]. Radiologists rated the BPE in 3787 (66%) of the examinations as minimal, 1380 (24%) as mild, 543 (9%) as moderate, and 63 (1%) as marked. Among the four quantitative BPE definitions tested, the definition that measured the relative difference in the

signal intensity before and after contrast agent injection had the highest correlation to human rating with  $r=0.56$ . The lowest correlation ( $r=0.50$ ) to expert radiologists was found for the BPE definition that measured the ratio of the enhancing FGT volume to the entire breast volume.

## CONCLUSION

The agreement between qualitative and quantitative BPE assessments was found to be, at most, fair. Further studies are needed to investigate the consequences of differences between qualitative and quantitative assessment as well as the differences among quantitative definitions on the prognostic value as a diagnostic marker for breast cancer and treatment response.

## CLINICAL RELEVANCE/APPLICATION

Given the at most fair agreement between qualitative and four quantitative assessments of BPE demonstrated in our study, and the known relation between BPE and breast cancer risk, it is essential to further research the relation between breast cancer risk and quantitative BPE measurements.

## W2-SPBR-9 Optimising Axillary Management following Neoadjuvant Chemotherapy in Patients with Breast Cancer

Participants

Anum Pervez, MBBS, FRCR, BSc, London, United Kingdom (*Presenter*) Nothing to Disclose

## PURPOSE

Optimal management of the axilla in breast cancer following neoadjuvant chemotherapy (NAC) remains uncertain. Current practice at our institution is dictated by the initial nodal burden. For N1 disease (=3 nodes), a sentinel lymph node biopsy (SLNB) is performed and in N2 disease (=4 nodes) patients proceed to an immediate axillary nodal clearance (ANC). However, this pathway fails to take into account response to NAC. If there is node normalization on the post-treatment MRI, an ANC is arguably overtreatment. Whereas, an SLNB becomes undertreatment in cases of limited MRI response as patients undergo a second stage completion ANC. In this study, we examine the predictive role of the post-treatment MRI. We also investigate the importance of HER-2 status and how, in combination with the post-treatment MRI, it can offer a more tailored approach.

## METHODS AND MATERIALS

A retrospective analysis was performed on NAC patients between 2017-2022. Ultrasound guided-core biopsy confirmed axillary nodal involvement, along with the tumor HER-2 status. The baseline MRI was reviewed with registration of number of abnormal nodes, followed by the post-treatment MRI and surgical histopathology.

## RESULTS

148 patients identified with node positive axillary disease prior to NAC, of which 54 were HER-2 positive. 103 (70%) had node normalization on imaging. The post-treatment MRI demonstrated 86% specificity and 42% sensitivity. MRI also showed 82% positive predictive value (PPV) but 50% negative predictive value (NPV) for residual axillary disease. Of the HER-2 positive patients, 44 (81%) had node normalization on imaging with 28/44 (63%) complete pathological response at surgery. In particular, in N2 disease and node normalization ( $n=12$ ), 67% were HER-2 positive. Hence HER-2 positive patients are more likely to respond to NAC, irrespective of initial nodal burden. In our study, 22 patients with N1 disease could have undergone an immediate ANC rather than a two-stage completion ANC. Whereas 12 patients with N2 disease could have avoided an ANC all together.

## CONCLUSION

We have established high specificity and PPV of the post-treatment MRI. Thus, a core biopsy should be offered for initial N1 status and residual axillary disease, with a positive result leading to an immediate ANC rather than the traditional SLNB. In addition to this, consideration should be given to de-escalating axillary treatment with an SLNB rather than an immediate ANC in the subset of patients with N2 disease, imaging node normalization and a HER-2 positive status.

## CLINICAL RELEVANCE/APPLICATION

Persistent MRI nodal disease should be a reason to offer a core biopsy, followed by an immediate ANC if positive. Whereas, immediate ANC may be avoided in N2 disease with MRI node normalization and HER-2 positive status.

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## Abstract Archives of the RSNA, 2023

W2-SPCA

### Cardiac Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPCA-1 Diagnostic Performance of 4D-CT Myocardial Maximum Principal Strain to Detect Reduced Myocardial Viability

##### Participants

Shigeo Okuda, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

A new technique enables to demonstrate myocardial maximum principal strain (MPS) on 4D-CT. The purpose of this study is to evaluate the diagnostic performance of MPS to detect reduced myocardial viability defined by late gadolinium enhancement (LGE) in patients with known coronary artery disease.

##### METHODS AND MATERIALS

A total of 82 patients (63 men, 66.3±9.6 years old) with a history of myocardial infarction were prospectively enrolled in this study at five university hospitals. ECG-synchronized 4D-CT studies were performed with wide-detector scanners (Aquilion ONE, Canon, Japan). Full-cardiac cycle CT data was reconstructed into 20 phases at 5% intervals. The MPS was demonstrated on the color chart of AHA-17 segments excluding the apex (#17) on a workstation (Ziostation 2, Ziosoft, Tokyo, Japan). The LGE was also obtained in cardiac MRI which was performed during the period before or after 3 months of the 4D-CT. On LGE of MRI, the reduced myocardial viability was defined as the segments with a >50% extent of LGE in the myocardial wall. The MPS color charts were independently interpreted by two other readers with more than 10 years-experience of cardiac imaging for detecting segments which had >50% LGE extent on MRI. The readers were provided three sets of MPS chart and MRI LGE for directly comparing between them before blind reading as a training. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated for detecting segments demonstrating LGE extent with >50% LGE on the 79 patients. The quantitative MPS values were statistically compared between two groups with or without >50% LGE using Mann-Whitney U test.

##### RESULTS

A total of 1264 segments were analyzed, including 316 (25 %) segments with >50% LGE extent. The sensitivity, specificity, accuracy, PPV and NPV averaged between two observers to diagnose segments with >50% of LGE were calculated as follows: 81.0% (256/316), 48.2% (492/948), 35.9% (256/712), 89.1% (492/552), and 59.1% (748/1264), respectively. The agreement of reduced MPS between two readers was 83.9% and kappa coefficient of 0.556 on the presence of >50% LGE extent of myocardial wall. The mean MPS value in segments with preserved viability was significantly higher than one with reduced viability (40.0 ± 15.7 vs. 32.0 ± 13.6, p<0.0001).

##### CONCLUSION

Because of its excellent NPV, the myocardial MPS analysis can be used for detecting viable myocardium with a good agreement between two readers.

##### CLINICAL RELEVANCE/APPLICATION

4D-CT myocardial maximum strain analysis can be a new option to evaluate and quantify myocardial viability particularly in patients with contraindication for cardiac MRI.

#### W2-SPCA-2 Exploring the Impact of Flip Angle and Contrast Agent on Single Breath-hold Cardiac Magnetic Resonance Compressed Sensing Cine for Biventricular Strain Analysis

##### Participants

Fuyan Wang, Hangzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Compressed sensing (CS) cine has been shown to provide comparable images to conventional balanced steady-state free precession (bSSFP) cine. As an important tool for strain analysis, cardiovascular magnetic resonance (CMR) cine-based tissue tracking could reliably detect the displacement of myocardial segments. However, the effects of CS technique on feature tracking (FT) need to be carefully studied. In this study, we aimed to investigate the impact of gadolinium contrast agent and flip angle on biventricular strain analysis of single breath-hold CS cine in patients with different kinds of cardiac dysfunction.

##### METHODS AND MATERIALS

102 participants with 12 different cardiovascular etiologies (75 men, with a mean age of 46.5 ± 17.1 (SD) years) were enrolled in this study. Each patient underwent four consecutive cine sequences with same slice localization, including the reference multi-breath-hold bSSFP (bSSFPref) cine, the single breath-hold CS cine with the same flip angle as bSSFPref before (CS45) and after (eCS45) contrast enhancement, and the CS cine (eCS70) with 70-degree flip angle after contrast agent injection.

## RESULTS

Global strain parameters of both ventricles, including global radial strain (GRS), global circumferential strain (GCS), and global longitudinal strain (GLS), obtained from CS cine were found to be significantly lower than those obtained from bSSFP (all  $p < 0.001$ ). However, the GRS and GCS values of the left ventricle derived from both CS45 and eCS70 cine sequences showed no difference. Similarly, the GRS, GCS, and GLS values of the right ventricle obtained from eCS45 and eCS70 cine sequences showed no significant difference as well. Evaluation of CS45 and eCS45 cine sequences demonstrated that the use of contrast agents can result in a reduction in GRS and GCS values of both ventricles (all  $p < 0.001$ ), but did not have any effect on the GLS values.

## CONCLUSION

Despite the use of contrast agents and increased flip angle, CS cine consistently produced lower values for GRS, GCS, and GLS of both ventricles compared to conventional bSSFP cine. However, the impact of contrast agents on left ventricular GRS and GCS can be compensated by increasing the flip angle of CS cine. In contrast, increasing the flip angle of CS cine did not affect the GRS, GCS, and GLS values of the right ventricle. Furthermore, the administration of contrast agents resulted in a reduction of biventricular GRS and GCS values derived from CS cine.

## CLINICAL RELEVANCE/APPLICATION

Feature tracking based on routine CMR cine could reliably detect the displacement of myocardial segments, however, the effect of drastically increased using compressed sensing cine on strain analysis need to be carefully studied.

## W2-SPCA-3 Single Breath-hold Assessment of Cardiac Function and Strain using a 3-dimensional Cine Enhanced SENSE by Static Outer-volume Subtraction Acquisition

### PURPOSE

To validate the clinical feasibility of a novel 3-dimensional (3D) ultrafast cardiac magnetic resonance (CMR) protocol for the assessment of ventricular function and strain in a single breath-hold.

### METHODS AND MATERIALS

A total of 26 patients were enrolled prospectively, and all patients underwent CMR using both the standard breath-hold 2D cine balanced steady-state free precession acquisition (2D cine bSSFP) and single-breath-hold 3D cine Enhanced sensitivity encoding (SENSE) by Static Outer-volume Subtraction acquisition (3D cine ESSOS). Images of 3D cine were reconstructed and the left ventricular ejection fraction (LVEF), right ventricular ejection fraction (RVEF), global circumferential strain (GCS), global radial strain (GRS) and global longitudinal strain (GLS) of 3D and 2D cine were assessed by post-processing software. The difference and agreement of the two sequences were assessed.

### RESULTS

Two patients could not hold their breath well and the image quality could not satisfy the quantitative analysis. The 3D cine images of the remaining 24 patients were of good quality and allowed quantification. Mean acquisition time was  $23 \pm 1$ s versus  $273 \pm 20$ s for 3D and 2D cine imaging, respectively. LVEF by 3D and 2D cine were 58.27 (95% confidence interval [CI], 50.85 to 61.89) and 59.03 (95% CI, 51.15 to 61.67), respectively, with excellent agreement (intraclass correlation coefficient [ICC]: 0.99, 95% CI, 0.98 to 0.99) and insignificant bias. RVEF by 3D and 2D cine were 52.20 (95% CI, 44.17 to 53.76) and 51.65 (95% CI, 44.93 to 53.72), respectively, with excellent agreement (ICC: 0.83, 95% CI, 0.65 to 0.92) and insignificant bias. GCS by 3D and 2D cine were -15.95 (95% CI, -17.58 to -13.18) and -18.20 (95% CI, -19.60 to -15.30), respectively, with acceptable agreement (ICC: 0.77, 95% CI, 0.54 to 0.89) and insignificant bias. GRS by 3D and 2D cine were 28.20 (95% CI, 21.08 to 31.05) and 31.15 (95% CI, 23.05 to 33.95), respectively, with excellent agreement (ICC: 0.83, 95% CI, 0.64 to 0.92) and insignificant bias. GLS by 3D and 2D cine were -10.4 (95% CI, -13.45 to -6.75) and -16.10 (95% CI, -17.93 to -11.78), respectively, with acceptable agreement (ICC: 0.76, 95% CI, 0.53 to 0.89) and insignificant bias. Although the differences in cardiac function and strain between 2D and 3D cine were statistically significant, their differences were within the clinically acceptable range.

### CONCLUSION

We demonstrate that the image quality of 3D cine is slightly lower than 2D cine, but it can realize the rapid acquisition of cine images and good consistency. 3D cine ensures rapid assessment of cardiac function and strain.

## CLINICAL RELEVANCE/APPLICATION

ESSOS sequence can be used as an examination method for heart disease screening and for patients who cannot tolerate a long examination.

## W2-SPCA-4 Coronary Stent Evaluation by CCTA using Super-Resolution Deep Learning Reconstruction: Compared with Invasive Coronary Angiography

### PURPOSE

To evaluate the impact of a novel super-resolution deep-learning reconstruction (SR-DLR) algorithm on the visible and diagnostic performance of coronary CT angiography (CCTA) in stents evaluation.

### METHODS AND MATERIALS

This retrospective study included 20 patients with 28 coronary stents who underwent CCTA on a 320-row scanner. Raw data were reconstructed with hybrid iterative reconstruction (HIR, AIDR 3D, FC04), DLR (AiCE), and SR-DLR (PIQE). The maximum visible in-stent lumen diameter were measured. CT attenuation profiles across the stents were generated, then the width of the edge rise distance (ERD) and the edge rise slope (ERS) were measured. The diagnostic confidence was evaluated using a 4-point scale (1=poor, 4=excellent). The patency of stent were evaluated and in-stent restenosis was defined as  $\geq 50\%$  stenosis. Invasive coronary angiography served as reference standard.

### RESULTS

SR-DLR images showed the largest in-stent lumen diameters among all reconstruction approaches (all  $P < 0.05$ ). There was no significant difference in the ERD between different reconstruction approaches ( $P = 0.10$ ), but the ERS on SR-DLR images ( $416.05 \pm 135.45$  HU/mm) was greater than that on HIR images ( $170.27 \pm 90.24$  HU/mm;  $P < 0.05$ ) or DLR images ( $195.06 \pm 96.35$

HU/mm;  $P < 0.05$ ). The diagnostic confidence was comparable for SR-DLR and DLR ( $3.70 \pm 0.79$  vs.  $3.60 \pm 0.56$ ,  $P = 0.40$ ), but higher than HIR ( $3.30 \pm 0.65$ , all  $P < 0.05$ ). SR-DLR images provided optimal diagnostic performance in the evaluation of in-stent patency, the diagnostic accuracy were 86.7%, 83.3% and 76.7% for SR-DLR, DLR and HIR images, respectively (all  $p < 0.05$ ).

## CONCLUSION

s Compared with HIR and DLR algorithm, SR-DLR improves the visible and diagnostic performance of CCTA in stents evaluation.

## CLINICAL RELEVANCE/APPLICATION

SR-DLR algorithm improves the diagnostic accuracy and confidence of coronary stent evaluation.

## W2-SPCA-5 Optimizing Residual-Dense Blocks for Myocardial Delayed Enhancement CT Denoising for Future Edge-Based AI

Participants

Takuma Kobayashi, Suita, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

In myocardial delayed enhancement (MDE) CT, post hoc denoising methods using residual-dense networks (RDN)s have been reported to improve diagnostic performance. RDNs maintain hierarchical information and deepen the network using residual-dense blocks (RDBs). Optimization of the number of RDBs for each target task is crucial. This study aimed to determine the effect of the number of RDBs on MDE CT denoising. As the number of blocks was reduced, we evaluated denoising precision, inference time, and image similarity to the reference 20-block (RDB20) image.

## METHODS AND MATERIALS

We retrospectively reviewed 100 consecutive cases who underwent MDE CT. RDNs were trained on a denoising task using pre- and post-additive averaged images as teacher data. We prepared models with 1, 3, 5, 10, and 20 blocks, using RDB20 as a reference. For the hold-out test group (other 40 patients), we performed inference on five models to create denoised images and recorded processing times. We measured CT values and standard deviations (SD) of the blood pool and myocardium, determined image noise and contrast noise ratios for the blood pool and myocardium, and assessed image similarity using structural similarity (SSIM), peak signal to noise ratio (PSNR), learned perceptual image patch similarity (LPIPS), and visual information fidelity (VIF) compared to the reference RDB20 image. We used the Wilcoxon signed-rank sum test with Holm's multiple testing correction for comparisons.

## RESULTS

The RDN achieved 30% image noise from only one block, gradually increasing with increasing blocks ( $p < .001$  for all), especially in the low-frequency range. Processing time per patient was 24.6s in RDB20, and significantly decreased to 12.6s (51%) in RDN10, 6.6s (27%) in RDB5, 4.2s (17%) in RDB3, and 1.8s (7%) in RDB1, respectively. Increased RDBs achieved significantly high similarity with reference ( $p < .001$  for all); RDB10 showed an SSIM of 0.99996, PSNR of 77.9, LPIPS of 0.0006, and VIF of 0.83, indicating high similarity to RDB20 with half computation costs.

## CONCLUSION

s Increasing RDBs significantly improved denoising effects and similarity to the reference image. However, computational costs also increased.

## CLINICAL RELEVANCE/APPLICATION

Our findings on optimizing the trade-off between denoising effects and computational costs in RDNs can guide the development of edge-based AI denoising applications in clinical settings.

## W2-SPCA-7 Super-resolution Deep-learning Reconstruction: Image Quality and Myocardial Homogeneity in Coronary Computed Tomography Angiography

Participants

Sung Min Ko, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

The present study aimed to investigate whether super-resolution deep learning reconstruction (SR-DLR) has advantages in the overall image quality including signal-to-noise ratio (SNR), contrast to noise ratio (CNR) and sharpness as well as intensity homogeneity on coronary CTA with 4 different approaches; filtered-back projection (FBP), hybrid iterative reconstruction (IR), DLR and SR-DLR.

## METHODS AND MATERIALS

Sixty-three patients (mean age,  $61 \pm 11$  years; range, 18-81 years; 40 men) who had undergone coronary CT angiography between June-October 2022 were retrospectively included. Image reconstruction was performed using FBP, hybrid IR, DLR, and SR-DLR. Image noise, SNR, and CNR were quantified in both proximal and distal segments of the major coronary arteries. The left ventricle myocardium contrast homogeneity was analyzed. Two independent reviewers scored the overall image quality, image noise, image sharpness, and myocardial homogeneity.

## RESULTS

Image noise in HU was significantly lower ( $p < 0.001$ ) for the SR-DLR ( $11.2 \pm 2.0$ ) compared to those associated with other image reconstruction methods including FBP ( $30.5 \pm 10.5$ ), hybrid IR ( $20.0 \pm 5.4$ ), and DLR ( $14.2 \pm 2.5$ ). SR-DLR significantly improved SNR and CNR in both the proximal and distal segments of the major coronary arteries (Fig.1). No significant difference ( $p = 0.345$ ) was observed in the myocardial CT attenuation with SR-DLR. Conversely, FBP and hybrid IR (both,  $p < 0.001$ ) resulted in inhomogeneous myocardial CT attenuation (Fig.2). Two reviewers graded subjective image analyses with SR-DLR images higher than other image reconstruction techniques (Fig. 3-4).

## CONCLUSION

s SR-DLR improved image quality, demonstrated clearer delineation of distal segments of coronary arteries, and was seemingly

accurate for quantifying CT attenuation in the myocardium.

#### **CLINICAL RELEVANCE/APPLICATION**

The results of this study demonstrate that SR-DLR achieves higher image quality, better visualization of small distal segments of coronary arteries, and minimum inhomogeneous myocardium attenuation on coronary CT angiography than those associated with FBP, hybrid IR, and DLR.

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## Abstract Archives of the RSNA, 2023

W2-SPCH

### Chest Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPCH-1 Image Quality Evaluation of Ultra-low Dose Chest CT Based on Deep Learning Image Reconstruction: A Phantom Study

##### Participants

Jingjing Hong, Guangzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate whether the image quality with the deep learning image reconstruction (DLIR) algorithm in ultra-low dose chest CT achieve that of clinical low dose with filtered back projection (FPB) or adaptive statistical iterative reconstruction-Veo (ASIR-V).

##### METHODS AND MATERIALS

Catphan 500 / 600 phantom was scanned on revolution Apex CT continuously for 10 times with clinical low dose protocol of chest screening (group A, 0.78mGy) and two ultra-low dose levels (group B, 0.48mGy and group C, 0.24mGy). Group A was reconstructed using FPB and ASIR-V at 50% strength (50%ASIR-V); Group B and C were reconstructed with DLIR at medium and high levels (DLIR-M, DLIR-H). Noise (SD), spatial resolution line pairs, noise power spectrum (NPS), task-based transfer function (TTF) and detectability index ( $d'$ ) were calculated. Two radiologists independently performed the image quality evaluation using Likert 5 scale. The values of measurements were compare with Kruskal-Wallis nonparametric test with Bonferroni correction.

##### RESULTS

Noise magnitude and NPSnoise of DLIR(M, H) in group B and C were significantly lower than FPB and 50%ASIR-V in group A ( $P < 0.01$ ), and those of DLIR-M in group B were the lowest. Compared with the FPB images of Group A, the  $f_{peak}$  and  $f_{ave}$  of NPS in B and C groups are shifted toward lower frequencies, and the noise texture of DLIR-M in Group B was best maintained(Group B:  $f_{peak} = 0.22mm^{-1}$ ,  $f_{ave} = 0.31mm^{-1}$ ; Group A:  $f_{peak} = 0.28mm^{-1}$ ,  $f_{ave} = 0.31mm^{-1}$ ). The TTF<sub>CNR</sub>, TTF<sub>10%</sub> of the high-, medium- and low-contrast inserts in group B and C were greater than those of FPB and 50%ASIR-V in group A (except for the TTF<sub>10%</sub> of the low-contrast insert of DLIR-H in group C), however, only TTF<sub>50%</sub> of the low contrast insert in group B performed best.  $d'$  was higher with DLIR-M and DLIR-H in group B and DLIR-H in group C than with FPB and 50%ASIR-V in group A for three inserts. The distinguishable line pairs per centimeter were 6 LP/mm at all dose levels. The subjective image quality scores of DLIR-M and DLIR-H in group B were not significantly different from those of FPB and 50%ASIR-V in group A ( $P > 0.05$ ), while that of DLIR-M and DLIR-H in group C were slightly lower ( $P < 0.05$ ). The two radiologists showed good consistency ( $\kappa$  value was 0.75).

##### CONCLUSION

s DLIR algorithm can provide comparable image quality at ultra-low dose than FPB and ASIR-V at clinical low dose, and reduce radiation dose was up to 70%, which provides the possibility for lung cancer screening and pulmonary nodule follow-up by CT.

##### CLINICAL RELEVANCE/APPLICATION

Low-dose DLIR can reduce radiation dose and provide theoretical basis and scan parameter selection for clinical chest CT imaging.

#### W2-SPCH-2 Comparison of CT and Wide-angle Stationary Digital Chest Tomosynthesis in the Detection of Pulmonary Nodules

##### PURPOSE

Lung cancer remains the number one cause of cancer death. Screening remains underutilized despite the clear evidence of benefit. A need exists for a safe, mobile, low radiation dose, intra-procedural method to localize biopsy instruments within target nodules. This retrospective cross sectional reader feasibility study evaluates the ability of clinicians to identify pulmonary nodules using a wide angle carbon nanotube x-ray enabled stationary digital chest tomosynthesis system.

##### METHODS AND MATERIALS

A "LUNGMAN" phantom with pulmonary nodules was scanned with both CT and the tomosynthesis system. Nodules of varied size (3, 5, 8, 10, 12 mm) and radiodensity (HU-800, -600, +130) were placed randomly into different lobes of the phantom. For each test case, 3 nodules (one of each density) were randomly placed into the phantom. A total of 8 nodule test cases were recorded. CT scanning was performed under the ACR recommended lung cancer screening protocol. Chest tomosynthesis imaging was performed with a custom built "wide-angle" CNT system consisting of a meter long x-ray source with 60 independent activated x-ray sources opposite a digital detector, representing a 40 degree angular span. Imaging was performed at 120kV and total mAs of 2.358. Tomosynthesis images were reconstructed into the coronal plane with 3 mm slice thickness and presented to readers on PACS compliant monitors. Two board certified radiologists participated as readers. Each scan (CT or tomosynthesis) was independently reviewed, and the positions of lung nodules were documented by each reader.

##### RESULTS

The specificity of both the CT and tomosynthesis in detecting any sized pulmonary nodules was 1. For actionable pulmonary

nodules, or those 8 mm or greater in size, both the CT and tomosynthesis had a specificity of 1. The sensitivity of CT and tomosynthesis in detecting any sized pulmonary nodules is 0.929 and 0.708, respectively. The sensitivity of CT and tomosynthesis in detecting actionable pulmonary nodules is 0.958 and 0.850, respectively. The sensitivity of tomosynthesis increases with dense pulmonary nodules, with actionable pulmonary nodules of HU+130 being detected with a sensitivity of 1.

## CONCLUSION

Wide-angle tomosynthesis was found to consistently identify dense nodules of at least 8 mm in size. Further studies are needed to evaluate the sensitivity and specificity of the system to actionable lung nodules. With system and carbon nanotube array optimization, we hypothesize the detection rate for nodules will improve. Additional study is needed to evaluate its use in target and tool co-localization and target biopsy.

## CLINICAL RELEVANCE/APPLICATION

The development of an effective, low-radiation and mobile method for pulmonary nodules could improve screening of lung cancer.

### W2-SPCH-3 Value of Deep Learning Reconstruction Algorithm Combined with Low Tube Voltage in Routine Lung CT Scanning

#### Participants

Lv Ren-feng LV, Dalian, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To study the effect of deep learning reconstruction (DLIR) algorithm combined with low tube voltage (100 KVp) on lung CT scan image quality and radiation dose.

#### METHODS AND MATERIALS

50 patients with routine lung CT scans were selected and were divided into 120 KVp group and 100 KVp group according to the difference of tube voltage, 25 patients in each group. Among them, Group A: Tube voltage 120 KVp, adaptive statistical iterative reconstruction (ASiR-V, 30%) algorithm, reconstruction mode (lung). The raw data of 100KVp group were reconstructed according to different reconstruction algorithm and reconstruction mode, Group B: Deep learning reconstruction (DLIR-H) algorithm, standard reconstruction mode (Std). Group C: Deep learning reconstruction (DLIR-H) algorithm, standard reconstruction mode (Std) + image enhancement filter (LU). All scans using a tube current of 100 ma, other parameter settings are the same. The thickness of 1.25mm was reconstructed image. The CT values, noise (SD), CTDI, within the subcutaneous fat and lung tissue on both sides of the same location were recorded, signal noise ratio (SNR) and radiation dose (ED) were calculated, two chest doctors evaluated the image quality subjectively and made statistical analysis of the data between the three groups.

#### RESULTS

There was no statistical difference in the CT values measured in all three groups of lung images ( $P > 0.05$ ); The SD, SNR and image quality evaluation were statistically different between the three image groups ( $P < 0.05$ ), the noise of the images of B and C groups is significantly lower than that of group A, group C images provide better sharpness and clearly shows the structure and branches of lung markings; The radiation dose of the 100 KVp group was significantly lower than the 120 KVp group ( $P < 0.05$ ).

## CONCLUSION

Using tube voltage 100 KVp combined with DLIR algorithm significantly reduces the radiation dose. Compared with ASiR algorithm, using DLIR algorithm combined with image enhanced filter (LU) reconstruction mode can significantly lower the image noise, and improved the display ability of lung tissue and lung markings.

## CLINICAL RELEVANCE/APPLICATION

Routine low-dose lung CT examination used low tube current combined with iterative algorithm, the noise suppression and radiation dose reduction are not obvious, DLIR algorithm combined with low tube voltage imaging can significantly reduce the radiation dose, the DLIR algorithm standard reconstruction mode combined with image enhancement filtering (LU) can provide a good contrast image of the lung tissue. Due to the significant noise suppression of the DLIR algorithm, the application of routine lung CT physical examination and lung nodule screening using a tube voltage of 80 KVp or even lower becomes possible.

### W2-SPCH-4 CT Pulmonary Angiograms (CTPA) in Pregnant Patients: Multicenter Study on Imaging Findings, Management, and Follow-up of Patients beyond an Optimal and Suboptimal CTPA

#### PURPOSE

Risk of pulmonary embolism (PE) is increased in pregnancy. However, CTPA usage is limited given the risks of radiation exposure to the mother and fetus. The aim of this study was to assess the frequency of suboptimal CTPAs in pregnant population, the factors related to sub-optimality, and factors contributing to patients' outcome.

#### METHODS AND MATERIALS

Our IRB approved, retrospective study included 440 consecutive CTPA examinations of pregnant patients scanned between 2015-2021 at one of the five participating quaternary and community hospitals. For the control group, we included 474 consecutive, female patients who underwent CTPA. All CTPA exams were reviewed for diagnostic evaluability (optimal or suboptimal) as well as the presence of PE. In addition, we recorded patients' age, gestational age at the time of CTPA, weight, imaging data (Doppler US, chest radiograph, and ventilation perfusion scan), and information on patient and pregnancy outcomes following CTPA.

#### RESULTS

PE positive CTPA rates in pregnant (3.4%) and non-pregnant (9.7%) patients were significantly different ( $p=0.004$ ). The frequency of suboptimal CTPA (11.2%, 49/440) in pregnant and non-pregnant patients (11.2% vs 8.2%;  $p=0.657$ ) was not significantly different. Pregnant patients with suboptimal CTPA had higher weight (92 kg vs 77 kg), and advanced gestational age ( $\geq 20$  weeks vs  $< 20$  weeks) in comparison with optimal CTPA. Additional imaging including CXR (46.9%), Doppler (46.9%), repeat CTPA (10.2%), and V:Q (2.0%) were performed in less than 50% of patients with suboptimal CTPA. Although patients with suboptimal CTPA had a higher rate of hospitalization than those with optimal CTPA (40.8% vs 29.9%), it was not significantly different. Non-PE findings such as pneumonia, edema, and pleural effusions, were more frequent findings in CTPAs. CTDI<sub>vol</sub> and DLP were significantly higher

in suboptimal CTPA (CTDI: 9 vs 8, DLP: 271, 238,  $p < 0.001$ ).

## CONCLUSION

The low rate of PE-positive CTPA in pregnant patients comparing to non-pregnant patients as well as additional testing performed following suboptimal CTPA suggest over-utilization of CTPA in pregnant population. Pregnancy does not attribute to higher suboptimality rate in CTPAs. However, suboptimal CTPA is more expected in patients with higher body weight and age of pregnancy. Although not statistically significant, the higher rate of hospitalizations among patients with suboptimal CTPA suggests presence of a more severe underlying disease. Suboptimal CTPA exposes extra radiation dose to patients comparing to optimal CTPA.

## CLINICAL RELEVANCE/APPLICATION

Over-utilization of CTPA in pregnant populations leads to unnecessary exposure of radiation and contrast to mother and fetus.

## W2-SPCH-5 Performance Evaluation of a 3D Camera System for Automated Patient Positioning in Routine Chest and Abdominal CT

### PURPOSE

Patient out-of-center positioning in computed tomography (CT) scanning is a common issue, possibly resulting in inferior image quality and/or increased patient dose due to suboptimal tube current modulation. Automated patient positioning, using a three-dimensional (3D) camera promises more accurate and robust positioning. This study aimed to compare manual versus 3D camera based patient positioning in the clinical workflow.

### METHODS AND MATERIALS

A total of 6618 routine thoracic and abdominal scans of adult patients were included in the study. The scans were performed on 2 CT scanners, one of which was equipped with a 3D camera system (Naeotom Alpha CT by Siemens Healthineers), which automatically positions the patient; the 3D camera was used in the 1597 scans. The patient positioning after each scan, as well as the corresponding patient effective diameter (ED), were calculated by DOSE (Qaelum), the dose monitoring system used in the hospital. An extensive study was performed by evaluating the positioning of each scan taking into account the scan region, the patient size (in terms of ED) and the gender. A vertical bidirectional offset from the CT isocenter smaller than 10 mm (threshold) was defined as 'accurate positioning', since no significant impact on image quality and patient dose was found in literature. Before using the positioning calculations of DOSE, a validation was executed.

### RESULTS

Mean manual patient positioning was 16.55 mm 95% CI [16.05, 17.06], while positioning with the 3D camera resulted in a significantly different ( $p < 0.0001$ ) mean positioning of -3.33 mm, 95% CI [-4.27, -2.39]. Positioning distribution indicated a more centralized positioning with the 3D camera (53%) compared to manual positioning (31%). Sub-analysis regarding the scan region resulted in significant differences ( $p = 0.001$ ) between manual and automatic positioning in both thorax and abdomen exams. Patient size comparisons showed that small patients ( $ED = 28\text{cm}$ ) were on average worse positioned compared to medium ( $28\text{cm} < ED < 31\text{cm}$ ) and large ( $ED = 31\text{cm}$ ) patients, in both manual and automatic positioning. Still, automatic positioning was significantly ( $p = 0.001$ ) more accurate. Gender wise comparison provided evidence of the superiority of the automatic positioning in all patients, independent on the gender.

### CONCLUSION

Automated patient positioning using a 3D camera resulted in a significantly more accurate positioning of the patient in the CT scanner, compared to manual positioning. Sub-analyses regarding scan region, patient size and gender showed an overall improvement, indicating the camera based positioning is robust.

## CLINICAL RELEVANCE/APPLICATION

Automated 3D camera positioning was shown to provide more accurate and robust positioning in routine CT practice.

## W2-SPCH-6 The Effect of Pitch and Rotation Time on the Quantitative Analysis of Lung Nodules by Artificial Intelligence in Low-dose Lung CT Screen

Participants

Xuan Su, Xi'an, China (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the influence of the choice of pitch and rotation time on the quantitative analysis of lung nodules by artificial intelligence in low-dose lung CT screening.

### METHODS AND MATERIALS

A thorax anthropomorphic phantom (Lungman, Kyoto Kagaku Inc.) was scanned by with a 256-row CT (Revolution CT, GE Healthcare), which contained 9 simulated nodules (CT value, 100 HU, -630HU and -800HU; diameter: 8mm, 10mm, 12mm). Six groups of images were obtained with same tube voltage and current (120kV, 45mA) but different combination of pitch and rotation time (Group 0: 0.984, 0.28s; Group 1: 0.992, 0.35s; Group 2: 0.992, 0.28s; Group 3: 1.375, 0.5s; Group 4: 1.531, 0.5s; Group 5: 0.984, 0.35s). The images with different group were analyzed by an artificial intelligence software (Intelligent 4D Imaging System for Chest 5.5, YITU Healthcare). The CT value, SD of pulmonary nodules and air in front of sternum at the same slice were measured. CT dose index (CTDI), the product of dose length (DLP) of each scan were recorded. Signal-to-noise ratio ( $SNR = \frac{CT_{\text{nodule}}}{SD_{\text{nodule}}}$ ) and contrast signal to noise ratio ( $CNR = \frac{CT_{\text{nodule}} - CT_{\text{air}}}{SD_{\text{air}}}$ ) were calculated. All statistical analyses were performed using SPSS statistical software (version 22.0).

### RESULTS

Changing pitch and rotation time at low dose has no effect on the size of lung nodules measured by AI (mean diameter,  $P > 0.05$ ; diameter difference percentage,  $P > 0.05$ ); changing the scan pitch and rotation speed does not affect the CT of lung nodules Measurement of values (average CT value,  $P > 0.05$ ; percentage difference in CT value,  $P > 0.05$ ). The changes of scanning pitch and rotation speed have no effect on the image quality ( $SNR$ ,  $P > 0.05$ ;  $CNR$ ,  $P > 0.05$ ). The CT effective dose is different under

different conditions (CTDL,  $P < 0.05$ , DLP,  $P < 0.05$ ), the DLP value is the lowest when the scanning pitch is 0.984 and the rotation speed is 0.28s (DLP = 27.79 (mGy \* cm)).

## CONCLUSION

s In low-dose lung screening, changes in scan pitch and rotational speed will not affect image quality. Choosing a distance of 0.984 and a rotational speed of 0.28s can provide lung screening with lower radiation dose.

## CLINICAL RELEVANCE/APPLICATION

In clinical workflow, it is of great significance to minimize radiation dose while keep image quality constantly.

## W2-SPCH-7 A Comparative Study on the Image Quality of Part-solid Nodules in the Lung between Virtual Non-contrast Based on Biphasic Ultrafast Synchronized KV/mA Switching Dual Energy CT and Conventional Non-contrast Scan

Participants

Jingjing Hong, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

This study explored the feasibility of using virtual non-contrast (VNC) images obtained from ultrafast synchronized KV/mA switching dual energy CT (DECT) in both pulmonary arterial and venous phase to evaluate part-solid nodules (PSN) in the lung, and compared their performance with true non-contrast (TNC) images.

## METHODS AND MATERIALS

46 Cases of Partial Solid Nodules with lung enhanced CT examination who underwent TNC scan and biphasic enhanced DECT scan (arterial and venous), and VNC images were reconstructed from DECT. The CT values, and standard deviation (SD) of the PSN and Ipsilateral erector spinae muscle (ESM), as well as diameter of lesion, were measured in VNC and TNC images. The signal-noise-ratio (SNR, CTSN/SDSN) and contrast-noise-ratio [CNR, (CTESM - CTPSN) / SDESM] of PSN were calculated. Record the effective radiation dose in TNC and VNC mode. Two experienced radiologists subjectively assessed the IQ(image quality) of VNC and TNC images using a 5-point scale (1, poor; 2, fair; 3, moderate; 4, good; 5, excellent). Non-parametric test was used to compare the subjective and objective image parameters and effective radiation dose of images in different scanning phases. The Kappa test was used to assess consistency of subjective score between groups

## RESULTS

There were no significant differences in The diameter, CT value, SD, SNR and CNR between TNC and VNC images in arterial/venous phase ( $P > 0.05$ ). The TNC ( $4.79 \pm 0.33$ ) had the highest the subjective score, followed by VNC images ( $4.04 \pm 0.26$ ) in venous phase and VNC images in arterial phase ( $3.71 \pm 0.45$ ), with significant differences observed among the three groups (all  $P < 0.001$ ), however, all scores were up to diagnosis requirements. The consistency of subjective scores between radiologists was strong ( $K = 0.63 \sim 0.73$ ). The effective radiation dose of VNC mode [ $(10.74 \pm 0.93)$  mSv] was lower than that of conventional mode [ $(15.21 \pm 1.89)$  mSv] ( $P < 0.001$ ), about 30% reduction.

## CONCLUSION

s DECT with arterial/venous phase VNC can provide similar image quality as TNC, and the radiation dose is significantly reduced by 30%.

## CLINICAL RELEVANCE/APPLICATION

Ultrafast synchronized KV/mA switching dual energy CT (DECT) arterial/venous phase VNC spectral technology can basically replace conventional non-contrast scan images, provide comparable image quality for patients with lung diseases, and significantly reduce the radiation dose to patients.

## W2-SPCH-8 Value of Deep Learning Reconstruction of Chest Low-dose CT for Image Quality Improvement and Lung Parenchyma Assessment on Lung Window

## PURPOSE

To explore the performance of low-dose computed tomography (LDCT) with deep learning reconstruction (DLR) for the improvement of image quality and assessment of lung parenchyma.

## METHODS AND MATERIALS

Sixty patients underwent chest regular-dose CT (RDCT) followed by LDCT during same patient encounter. RDCT images were reconstructed with hybrid iterative reconstruction (HIR) and LDCT images were reconstructed with HIR and DLR, both using lung algorithm. Radiation exposure was recorded. Image noise, signal-to-noise ratio, and subjective image quality of normal and abnormal CT features were evaluated and compared using the Kruskal-Wallis test with Bonferroni correction.

## RESULTS

The effective radiation dose of LDCT was significantly lower than that of RDCT ( $0.29 \pm 0.03$  vs  $2.05 \pm 0.65$  mSv,  $p < 0.001$ ). The mean image noise  $\pm$  standard deviation was  $33.9 \pm 4.7$ ,  $39.6 \pm 4.3$  and  $31.1 \pm 3.2$  HU in RDCT, LDCT HIR-Strong and LDCT DLR-Strong, respectively ( $p < 0.001$ ). The overall image quality of LDCT DLR-Strong was significantly better than that of LDCT HIR-Strong ( $p < 0.001$ ) and comparable to that of RDCT ( $p > 0.05$ ). LDCT DLR-Strong was comparable to RDCT in evaluating solid nodules, increased attenuation, linear opacity, and airway lesions (all  $p > 0.05$ ). The visualization of subsolid nodules and decreased attenuation was better with DLR than with HIR in LDCT but inferior to RDCT (all  $p < 0.05$ ).

## CONCLUSION

s LDCT-DLR can effectively reduce image noise and improve image quality. LDCT-DLR provides good performance for evaluating pulmonary lesions, except for subsolid nodules and decreased lung attenuation, compared to RDCT-HIR.

## CLINICAL RELEVANCE/APPLICATION

DLR enables LDCT maintaining image quality even with very low radiation doses



SEN enables EDR, maintaining image quality even with very low radiation doses.

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## Abstract Archives of the RSNA, 2023

W2-SPER

### Emergency Radiology Wednesday Poster Discussions

#### Sub-Events

#### **W2-SPER-1 Imaging Findings of Elder Abuse on the Trauma Service: A retrospective Case-control Study of Two Institutions**

#### Participants

Omar Yaghi, Boston, MA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Elder abuse is common and consequential for its victims, with impact ranging from reduced quality of life to physical injury and death. Screening is a recognized strategy for detection, but less effective in elders with diminished ability to communicate or psychosocial reasons to fear disclosure. This study aimed to identify imaging findings of elder abuse.

#### **METHODS AND MATERIALS**

Preliminary data from this retrospective case control study identified 17 patients above 60 years of age with keywords "assault" and "abuse" from two institutional trauma registries from 2015-2022, as well as 17 age and gender matched controls. Demographic information, clinical information, and imaging findings were reviewed.

#### **RESULTS**

Majority of the abuse victims were women (71%) and White (88%), with mean age of 74 years (range 61-91 years). Known risk factors for elder abuse were common. The alleged abuser was most frequently the patient's child, followed by partner. Blunt trauma was more common (14/17). Rib fractures (7/17), head (8/17) and facial (5/17) injuries were the most frequent imaging findings. Central injuries (to neck, torso) were more common in elder abuse victims compared to control trauma patients, while the latter more frequently had extremity injuries. Abuse victims with extremity injuries demonstrated tendency towards distal injury particularly of the upper extremity (forearm, hand), while control patients tended towards proximal injury (humerus, femur).

#### **CONCLUSION**

s This study demonstrated that radiologists can be helpful in assessment of elder abuse, identified injuries to the head/face, central body, and distal upper extremity as warning signs of elder abuse, and highlighted the importance of further research to identify imaging patterns of abuse in this vulnerable population.

#### **CLINICAL RELEVANCE/APPLICATION**

Radiologists can help in recognition of elder abuse by identifying injuries occult to physical examination in victims who are unable or unwilling to disclose abuse.

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## Abstract Archives of the RSNA, 2023

W2-SPGI

### Gastrointestinal Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPGI-1 A Pilot Study on the Classification of Focal Liver Lesions using Normalized Viscoelastic Parameters with Intrinsic MR Elastography

##### PURPOSE

Evaluate the accuracy of nonlinear inversion-intrinsic magnetic resonance elastography (NLI-iMRE), which uses natural pressure pulse and cardiac induced motion, for determining the viscoelastic properties of liver lesions and distinguishing between benign and malignant tumors.

##### METHODS AND MATERIALS

This prospective, cross-sectional study was approved by an institutional review board and patient consent was obtained. Adult patients undergoing 3T clinical MRI for characterization of liver lesions were included. A 4D-phase contrast quantitative sequence with retrospective cardiac gating was acquired to encode motion. Using the 3D displacement field at eight cardiac cycle phases, viscoelastic parameters  $G'$  (storage modulus),  $G''$  (loss modulus), and  $|G^*|$  (magnitude of the complex shear modulus) were computed within the imaging volume using the subzone-based NLI-iMRE reconstruction method. To ensure comparability between subjects, viscoelastic properties were calculated for the liver and spleen, and liver properties were normalized by the mean spleen property values. The composite reference standard included lesion classification by clinical MRI or histopathology. Unpaired t-tests and receiver operating characteristic (ROC) curves were used to compare benign and malignant lesions.

##### RESULTS

34 patients with 34 lesions were included. Normalized  $G'$  values showed significant differences between hemangiomas and LR-4 ( $p < 0.01$ ), LR-5 ( $p = 0.02$ ), and metastasis ( $p < 0.01$ ) and between focal nodular hyperplasias (FNH) and LR-4 ( $p < 0.01$ ), LR-5 ( $p = 0.03$ ), and metastasis ( $p < 0.01$ ). The  $|G^*|$  values showed significant differences between FNH and LR-4 ( $p < 0.0001$ ), LR-5 ( $p = 0.03$ ), and metastases ( $p = 0.04$ ). ROC curves were used to differentiate benign and malignant lesions, with the area under the curves for  $G'$ ,  $G''$ , and  $|G^*|$  being 0.90, 0.61, and 0.71, respectively.

##### CONCLUSION

This study shows that cardiac activated iMRE which has the advantage of not requiring external mechanical stimulation, is a promising method for differentiating benign and malignant liver lesions using normalized  $G'$  and  $|G^*|$ , with results consistent with prior findings from extrinsic MRE studies, while the normalized  $G''$  did not show a meaningful trend for different lesion types.

##### CLINICAL RELEVANCE/APPLICATION

This study found that NLI-iMRE accurately distinguishes between benign and malignant liver lesions using viscoelastic properties, with normalized  $G'$  and  $|G^*|$  values showing significant differences between lesion types. This non-invasive method, based on standard clinical imaging sequences, has the potential for clinical use without the need for external actuation.

#### W2-SPGI-2 Multimodal Imaging Evaluation of Hepatic Alveolar Echinococcosis in Children

##### Participants

Hai Hua Bao, Xining, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Hepatic alveolar echinococcosis (HAE) has an aggressiveness similar to that of malignant tumors. Children have a rich blood supply to the liver, and the lesions grow rapidly after infection, which makes the disease serious and difficult to treat. The purpose of this study is to investigate the growth characteristics of HAE in children through various imaging techniques.

##### METHODS AND MATERIALS

Fifty pediatric patients (age range 1-14 years, mean age  $11.24 \pm 2.82$  years) diagnosed with HAE at the Affiliated Hospital of Qinghai University from 2014 to 2020 were included for imaging (low-dose abdominal CT plain + enhancement, abdominal T1WI, T2WI, MR enhancement, DWI) and clinical examination, we obtained morphological features of the lesions based on images, imaging staging and PNM staging, intrahepatic vascular and bile duct invasion, marginal zone continuity and ADC values, and assessed the liver function and systemic nutritional status of the children based on clinical test results such as glutamate transaminase (ALT) and hemoglobin (Hb), and comprehensively evaluated the growth characteristics of HAE lesions in children.

##### RESULTS

All children underwent CT plain scan(1), of which 41 had CT-enhanced scans(2), and a total of 27 had MR scans(3-8). Both the right and left lobes of the liver were invaded in 48% of the cases, the left lobe only in 14%, and the right lobe only in 38%. 96% of cases had calcification formation; 52% of cases had vascular and bile duct involvement (Table 1); P1 stage lesions accounted for the most PNM staging and parenchymal type accounted for the most imaging staging; P1 stage lesions had higher marginal zone activity than P2+P3 stage (There was no statistically significant difference in ADC values between P2 and P3 phases, so the joint

comparison with P1 phase ;P4 phase had a small sample size, so no statistics were done). Large lesions, parenchymal lesions, and P2 stage lesions have a greater impact on liver function in pediatric patients; parenchymal lesions have a greater impact on the nutritional status of the children.

## CONCLUSION

s CT images can clearly show the calcification within the lesion, MR images can clearly show the invasion of hepatic vessels and bile ducts by the lesion, DWI and ADC values can determine the activity of the marginal zone of the lesion, and the characteristics of HAE lesions can be effectively evaluated by using multimodal imaging techniques.

## CLINICAL RELEVANCE/APPLICATION

HAE infection is asymptomatic in the early stage, and most of them are in the advanced stage when there are obvious symptoms, and children are poorly tolerated and difficult to treat surgically, early diagnosis and knowledge of its growth characteristics are crucial for clinicians to choose the appropriate treatment plan and thus reduce the mortality rate.

## W2-SPGI-3 Amide Proton Transfer-Weighted MRI in Preoperative Assessment of Microvascular Invasion of Hepatocellular Carcinoma

Participants

Luo Luo, Yangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study was to explore the potential of APTw imaging in predicting microvascular invasion (MVI) of hepatocellular carcinoma.

## METHODS AND MATERIALS

32 patients with surgical pathologic confirmed hepatocellular carcinoma were studied. All patients underwent liver MR scanning on a 3.0-tesla scanner. Images at 52 frequencies were acquired for APTw, including 49 frequencies ranging from -600 to 600 Hz with an increment of 25 Hz. The applied saturation B1 power was 2 $\mu$ t and the saturation duration was 2000ms. Three identical ROIs were placed in the solid component of tumor for each patient on unsaturated M0 images and were copied on MTRasym mapping. Large cystic cavities, large areas of necrosis were excluded from ROI selections. Averaged MTRasym values were used for further analysis. The inter-class correction coefficient (ICC) was used to evaluate the inter-observer agreement of measuring APTw value between two radiologists. The comparisons between APTw value for MVI- and MVI+ groups were analyzed using the independent t test. Receiver operating characteristic (ROC) curves were generated for each APTw parameter value to assess the areas under the curve (AUC).

## RESULTS

MVI was pathologically confirmed from tumor resection including 13 cases with MVI (MVI+) and 15 without MVI (MVI-). The ICC of two observers' measurements of APTw was 0.912. The APTw value of MVI+ group was significantly higher than that of MVI- group [ (1.33 $\pm$ 0.76) % vs (0.32 $\pm$ 1.06)%; P=0.008]. The cut-off APTw value for differentiating MVI+ and MVI- groups was 0.30% (sensitivity, 60%; specificity, 100%; AUC, 0.782, 95%CI: 0.609, 0.955)

## CONCLUSION

s APTw imaging showed promising ability in differentiating MVI+ and MVI- hepatocellular carcinoma.

## CLINICAL RELEVANCE/APPLICATION

APTw could serve as a robust technique to predicting MVI of hepatocellular carcinoma without the use of contrast agents and providing additional auxiliary value for the selection of clinical treatment methods of hepatocellular carcinoma patients.

## W2-SPGI-4 Free Breathing Acquisition using Radial Sampling and Compressed Sensing Improves Success Rate and Image Quality of Gadoteric Acid Enhancing Liver MRI in Elderly Patients

Participants

Masaya Kutsuna, Shizuoka, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

To compare successful rate of examination and clinical image quality of liver dynamic MR images using gadoteric acid in elderly patients between free breathing acquisition using radial sampling and compressed sensing and conventional breath-hold acquisition.

## METHODS AND MATERIALS

This retrospective single-center study included 100 patients older than 60 years who underwent liver MR examination using gadoteric acid using free breathing acquisition (FB group, n = 50) or conventional breath-hold acquisition (BH group, n = 50). All included examinations were performed on a 3.0-T MR scanner (Ingenia Elition, Philips). The representative parameters of FB group were as follows: pseudo-golden angle free breathing sequence using compressed sensing with soft-gating (SmartSpeed 4D-FreeBreathing); temporal resolution, 10 sec/phase; C-SENSE factor, 4. The parameters for BH group were as follows: spoiled gradient echo with compressed sensing (eTHRIVE); scan time, 14.9 sec; C-SENSE factor, 6. As qualitative analysis, all images of arterial (AP), portal venous (PVP), and transitional phase (TP) were evaluated by 2 independent radiologists using a 5-point scale (1 - 5, 5 is excellent quality) in terms of motion artifact, streak artifact, sharpness of liver edge, and overall quality. The cases with an overall quality score of 3 or above were regarded as diagnosable and successful examinations. As quantitative analysis, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were evaluated by board-certified another radiologist placing region-of-interest to each 5 segments of liver. P value less than 0.05 was regarded as statistically significant.

## RESULTS

The success rate was 100% (50/50) for the three phases in FB group, while in BH group, 82% (41/50, p = 0.005) for AP, 98% (49/50, p = 1.0) for PVP, and 100% (50/50, p = 1.0) for TP (Figure A). In the qualitative analysis, BH group showed better score in motion artifact and sharpness of liver edge in the three phases (p lt; 0.005, Figure B). There was no significant difference of overall quality in AP (p = 0.09). The SNR and CNR of BH group showed higher in PVP and TP. In the AP, the SNR and CNR of FB group tended to be higher but not significant (p = 0.19-0.76). Two representative cases were shown in Figure C.

## CONCLUSION

s Free breathing acquisition using radial sampling and compressed sensing improved success rate and clinical image quality of gadoteric acid enhancing liver MRI in elderly patients compared with conventional breath-hold acquisition.

## CLINICAL RELEVANCE/APPLICATION

Free breathing acquisition improves quality of liver MR examination using gadoteric acid in elderly patients and has potential to improve diagnostic performance of hypervascular hepatic lesions.

## W2-SPGI-5 The Comparison of the Application Value of Small-field Multi-excitation Planar Echo Sequence DWI and Conventional Single-excitation Planar Echo Sequence DWI in Rectal Cancer

Participants

Zhang Haini, Xuzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the image quality of reduced field of view (rFOV) image reconstruction using image-space sampling function (IRIS) diffusion weighted imaging (DWI) sequence and full field of view (fFOV) single-shot echo-planar imaging (SSEPI) diffusion weighted imaging (DWI) sequence in exploring whether rFOV IRIS-DWI can improve the image quality of rectal cancer.

## METHODS AND MATERIALS

All patients who underwent rectal MRI examination in our institution were retrospectively analyzed, being performed in a 3.0T MR scanner (Ingenia Elition, Philips, Netherlands). All DWI images were uploaded to Philips Intelligence Space Portal post-processing workstation (version V10.1) for evaluation and analysis. One senior radiologist with more than 20 years of experience in rectal cancer MRI randomly evaluated the images of two sequences. Image quality evaluation included subjective and objective evaluation. Subjective image quality included overall quality, artifacts, distortion, lesion contrast and anatomical details according to a 5-point scale reference. And, the objective evaluation included maximum area of tumor, average maximum area of tumor, tumor volume, ADC value, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). SPSS 26.0 statistical software was used for data analysis. The subjective scores of image quality between rFOV IRIS-DWI and fFOV SSEPI-DWI were compared by paired Wilcoxon S rank sum test. The comparison of the objective image quality between the two DWI sequences was used by paired sample t test.  $P < 0.05$  indicated the difference was statistical significance.

## RESULTS

Thirty patients with rectal cancer were enrolled this retrospectively study. The overall quality, distortion, artifacts, lesion contrast and anatomical details in the rFOV IRIS-DWI sequence were significantly better than the fFOV SSEPI-DWI sequence ( $P < 0.05$ ). The total scores of the subjective evaluation in the rFOV IRIS-DWI sequence and fFOV SSEPI-DWI sequence were 20.6 and 17.4, respectively. The ADC values in rFOV IRIS-DWI sequence and fFOV SSEPI-DWI sequence were  $0.85 \times 10^{-3} \text{mm}^2/\text{s}$ ,  $1.07 \times 10^{-3} \text{mm}^2/\text{s}$ , respectively. The result showed significant difference between two groups with  $P = 0.000$ . The maximum area and average maximum area of rFOV IRIS-DWI sequence were larger than the fFOV SSEPI-DWI sequence ( $P < 0.05$ ). The SNR and CNR in rFOV IRIS-DWI sequence and fFOV SSEPI-DWI sequence were 37.7, 73.1 and 0.85, 0.82, respectively, and the SNR of the two groups were statistically different ( $P = 0.000$ ).

## CONCLUSION

s Compared to fFOV SSEPI-DWI sequence, rFOV IRIS-DWI sequence significantly improved the image quality in rectal cancer patients.

## CLINICAL RELEVANCE/APPLICATION

Rectal cancer; DWI sequence; Image quality; ADC values

## W2-SPGI-6 Diagnostic Accuracy of Liver MR Elastography for Assessment of Liver Fibrosis in Children with AIH and Post LTx

Participants

Paulina Opyrchal, Warsaw, Poland (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the diagnostic accuracy of MRE in liver fibrosis staging using liver biopsy as the reference standard in pediatric patients with AIH and post LTx.

## METHODS AND MATERIALS

Overall, 48 patients with AIH and 25 patients post-LTx were included in the study. The median age of patients with AIH was 14.54 (range 2.82-17.98), the group included 22 boys and 26 girls. The median age of patients post-LTx was 14.16 (range 7.89-17.94), the group included 11 boys and 14 girls. All patients underwent MR elastography and liver biopsy. The liver stiffness value on MRE was independently measured by two radiologists. The weighted arithmetic mean was calculated from elastograms obtained at 4 levels of the liver in the axial plane. Biopsy samples were separately evaluated by two pathologists to stage liver fibrosis according to the Ischak fibrosis scale. Statistical analysis was performed, ROC curves were plotted with the optimal cut-off values and corresponding AUCs were calculated to evaluate sensitivity and specificity, inter-rater agreement was determined.

## RESULTS

In patients with AIH MRE detected fibrosis stage 4 or higher with a sensitivity of 100% and specificity of 70.6% for cut-off value  $>2.92$ , AUC 0.88,  $p < 0.05$ , and fibrosis stage 5 or higher with a sensitivity of 83% and specificity 89% for cut-off value  $>3.65$ , AUC 0.90,  $p < 0.05$ . In patients post-LTx MRE detected fibrosis stage 4 or higher with a sensitivity of 100% and specificity of 90.5% for cut-off value  $>3.06$ , AUC 0.95,  $p < 0.05$  and fibrosis stage 5 or higher with sensitivity 100% and specificity 83% for cut-off value  $>3.06$ , AUC 0.91,  $p < 0.05$ . The weighted Kappa value calculated for inter-observer agreement between radiologists was 0.90.

## CONCLUSION

s MRE is a non-invasive technique that has high sensitivity and specificity in detecting advanced stages of liver fibrosis with a very

good intraobserver strength of agreement.

#### **CLINICAL RELEVANCE/APPLICATION**

It may be possible to reduce the number of liver biopsies in patients with elevated liver stiffness identified with MRE.

### **W2-SPGI-7 The Role of Four-dimensional Flow MR Imaging as an Add-on Tool to Endoscopy for Predicting Actual Bleeding in Cirrhotic Patients with Esophageal Varices**

Participants

Eunju Kim, Gwang-Ju, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate whether four-dimensional (4D) flow MRI with quantitative hemodynamic parameters could be used as an add-on tool to endoscopy for predicting actual bleeding in cirrhotic patients with esophageal varices.

#### **METHODS AND MATERIALS**

All the cirrhotic patients who were attributable to hepatitis B and/or C virus underwent 4D flow MRI using a 3-T scanner (Skyra; Siemens Healthcare, Erlangen, Germany). The velocity-encoding sensitivity for x, y, and z flow-encoding directions was set to 30 cm/s, 20 cm/s, and 20 cm/s, respectively. A total of 109 cirrhotic patients with endoscopically confirmed esophageal varices were divided into groups A (negative red color (RC) sign with no variceal bleeding, n = 60, 35 - 81 years), group B (negative RC sign with variceal bleeding, n = 13, 41 - 80 years), group C (positive RC sign with no variceal bleeding, n = 10, 49 - 81 years), and group D (positive RC sign with variceal bleeding, n = 26, 48 - 81 years). The presence of variceal bleeding was defined as the occurrence of active bleeding within one year after initial diagnosis of esophageal varices based on the endoscopic and clinical findings. The quantitative parameter of 4D flow MRI included the net flow rate (mL/s), mean flow rate (mL/s), peak flow rate (mL/s), and net forward volume (mL) in each vessels. The 4D flow MR parameters were compared among the groups using Mann-Whitney U test, and the receiver operating characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance.

#### **RESULTS**

The values of all 4D flow MR parameters in the PV of patients with a positive RC sign were significantly lower than those of patients with a negative RC sign ( $P < 0.05$ ). The patients with variceal bleeding in group B and D showed lower values in all MR parameters in the PV than those of patients with no variceal bleeding in group A and C, respectively ( $P < 0.05$ ). However, there were no significant differences among the groups regarding the MR parameters in the SV and SMV. In the ROC analysis for evaluating the diagnostic performance of actual variceal bleeding in order to distinguish patients with variceal bleeding from patients with non-variceal bleeding, the area under the curve (AUC) values were 0.762 and 0.770 ~ 0.787 in endoscopy alone and MR alone, respectively. However, in the combination of endoscopy and 4D flow MRI, the AUC value increased significantly to 0.844 ~ 0.864 ( $P < 0.05$ ).

#### **CONCLUSION**

s The 4D flow MRI can be useful as an additional tool to endoscopy in predicting actual bleeding in cirrhotic patients with esophageal varices.

#### **CLINICAL RELEVANCE/APPLICATION**

4D flow MRI could significantly contribute to improving the diagnostic accuracy of endoscopy in predicting actual bleeding in cirrhotic patients with esophageal varices.

### **W2-SPGI-8 Intensive Respiratory Instruction Reduces Transient Motion Artifact in Liver Dynamic MR Examination using Gadoteric Acid**

Participants

Satoshi Funayama, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To validate the efficacy of intensive respiratory instruction during liver MR examination using gadoteric acid, especially whether it reduces transient severe motion artifact (TSMA).

#### **METHODS AND MATERIALS**

This retrospective study reviewed 493 patients who underwent liver dynamic MR examination using gadoteric acid before and after intensive respiratory instruction (IRI) was started on May 2022. To determine population size, power analysis was performed based on the reported frequency of TSMA (7.2%) and breath-hold failure in case of extracellular contrast agent (2.2%) (power = 0.7, significant level = 0.05). All examinations were performed on a 3.0-T MR scanner (SIGNA Premier, GE Healthcare). The dual arterial phase was acquired using spoiled gradient echo sequence (LAVA-FLEX) with compressed sensing (HyperSense) with scan time of 11 sec/phase. The detail of the IRI procedure was as follows. First, patients were instructed to start deep breathing before starting of acquisition for pre or contrast agent injection and continue it until breath-hold command. Technologists started the injection after confirming 4 or 5 times of patients' deep breathing through the abdominal bellows signal curve. The breath-hold command was started when contrast agent reached abdominal aorta on FluoroTrigger real time imaging and the patient was in expiratory phase. In the conventional procedure, only auto breath-hold command was played on the scanner. To evaluate respiratory motion, abdominal bellows curve was classified into 6 classes (type 1 - type 6, Figure A) on pre, arterial (AP), and portal venous phase (PVP). A board-certified radiologist evaluated motion artifact using 5-point scale (1 - 5; 5, the best) on pre, first arterial (AP1), second arterial (AP2), and PVP. The motion artifact score of 3 or less was regarded as TSMA.

#### **RESULTS**

Finally, 450 patients were included (225 for conventional group [Conv group]; 225 for IRI group). The successful breath-hold was more frequent in IRI group in AP ( $p < 0.001$ ) and PVP ( $p < 0.001$ ) (Figure A). The frequency of TSMA was 6.7% (Conv group) and 1.3% (IRI group,  $p = 0.007$ ) for AP1; 7.1% (Conv group) and 1.8% (IRI group,  $p = 0.01$ ) for AP2. The motion artifact score was significantly higher (better image quality) in IRI group on AP1 ( $p < 0.001$ ) and AP2 ( $p < 0.001$ ). The score was not significantly different on pre ( $p = 1.0$ ) and PVP ( $p = 0.341$ ) (Figure B).

**CONCLUSION**

s Intensive respiratory instruction improved success rate of breath-hold and significantly reduced transient severe motion artifact.

**CLINICAL RELEVANCE/APPLICATION**

Intensive respiratory instruction improves quality of arterial phase in liver dynamic MR examination using gadoxetic acid and has potential to improve diagnostic performance of hypervascular hepatic lesions.

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## Abstract Archives of the RSNA, 2023

W2-SPGU

### Genitourinary Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPGU-1 Impact of Image Quality on Detection of Extraprostatic Extension on MRI: Evaluation with a Deep Learning-based AI Algorithm

Participants

Yue Lin, BA, Bethesda, MD (*Presenter*) Nothing to Disclose

#### PURPOSE

To assess impact of image quality on extraprostatic extension (EPE) detection on MRI using a deep learning-based AI algorithm.

#### METHODS AND MATERIALS

This retrospective study included consecutive patients who were imaged with mpMRI and subsequently underwent radical prostatectomy (RP) from January 2007 to August 2022. One genitourinary radiologist prospectively evaluated each case using a previously published and validated grading system to assess the presence of EPE on mpMRI. EPE grade of 0 = no suspicion of EPE, 1 = long curvilinear contact or capsular irregularity/bulge, 2 = both long curvilinear contact and capsular irregularity/bulge, 3 = frank EPE. An EPE grading score =1 was considered as positive EPE call on mpMRI. Histopathologic EPE evaluation was performed at RP according to the International Society of Urological Pathology (ISUP) consensus statement. For each patient, T2WI and ADC maps were individually classified as non-diagnostic vs. diagnostic by an in-house AI algorithm. Fisher's exact tests were performed to compare EPE detection metrics (i.e., specificity) between non-diagnostic and diagnostic images.

#### RESULTS

A total of 812 patients (median age 62 [interquartile range 57-67] years; median prostate specific antigen level 6.7 [4.6-10.3] ng/mL) were evaluated. The median time from mpMRI to RP was 3 (1-5) months. At radical prostatectomy, 23% (188/812) of patients had EPE at pathology and 41% (133/324) of positive EPE calls on mpMRI were found to have EPE. For T2WI quality analysis, 35% (284/812) of sequences were classified as non-diagnostic and 65% (528/812) were categorized as diagnostic by the AI algorithm. For ADC maps, 32% (260/812) were classified as non-diagnostic and 68% (552/812) as diagnostic. Compared to non-diagnostic T2WI, diagnostic scans were associated with lower MRI/pathology mismatch for prediction of EPE (34% [97/284] vs. 28% [149/528],  $P=0.093$ ) and lower false positive rate (28% [80/284] vs. 21% [111/528],  $P=0.024$ ). Diagnostic T2WI also had significantly higher specificity for detection of EPE at mpMRI than non-diagnostic images (73% [294/405] vs. 63% [139/219],  $P=0.023$ ). No significant difference in EPE evaluation were observed between diagnostic and non-diagnostic ADC maps.

#### CONCLUSION

Our study successfully employed a deep learning-based AI algorithm to classify image quality of prostate MRI and demonstrated that preoperative T2WI quality is crucial for accurate EPE evaluation. Better quality T2WI was associated with higher specificity and fewer false positive calls for prediction of EPE at final pathology.

#### CLINICAL RELEVANCE/APPLICATION

Preoperative T2WI quality is critical for ruling out EPE at pathology using MRI, and AI can be used to objectively assess the quality of prostate MRI scans.

#### W2-SPGU-2 Histopathological Validation of Prostate Cancer Characterization with Magnetic Resonance Fingerprinting and Apparent Diffusion Coefficient Mapping

#### PURPOSE

To evaluate the utility of magnetic resonance fingerprinting (MRF) and apparent diffusion coefficient (ADC) mapping for characterizing prostate lesions with histopathological validation.

#### METHODS AND MATERIALS

This institutional review board-approved retrospective study included prospectively collected data of 91 biopsy-naive men with elevated PSA-levels suspected of having prostate cancer (PCa; 65.7 +/- 7.8 years). All patients underwent a multiparametric MRI examination at a 3T Philips Ingenia scanner (Philips Healthcare, Best, the Netherlands) and were classified by trained radiologists following the PI-RADS 2.1 scoring system. T1 and T2 mapping was performed using 2D fast imaging with steady-state precession-based MRF with spiral readout. ADC maps were calculated based on b-values = 100, 400, 800 s/mm<sup>2</sup>. Zonal segmentation of the prostate was performed using a convolutional neural network with subsequent revision by a trained radiologist. Lesions were manually segmented and correlated with histopathology after targeted biopsy/prostatectomy. Systematic differences of T1-/T2-relaxation times and ADC values between different histopathological ISUP scores were assessed using one-way analysis of variance with Tukey type post hoc comparisons to adjust for multiple testing.

#### RESULTS

32 patients were classified as PI-RADS 2, 21 as PI-RADS 3, 21 as PI-RADS 4 and 17 as PI-RADS 5. In total 89 lesions were



segmented, 72 in the peripheral zone (PZ), 17 in the central gland. In 3 patients clinically insignificant PCa was found in histology that had previously not been described on imaging. 4 patients did not undergo biopsy/surgery. Mean ADC values decreased significantly with increasing ISUP scores (e.g. mean ADC in PZ  $1.5 \cdot 10^{-3} \text{mm}^2/\text{s}$  vs. mean ADC in ISUP 3 lesion  $1.0 \cdot 10^{-3} \text{mm}^2/\text{s}$ ;  $p < 0.0001$ ). Mean T1-/T2-relaxation times decreased significantly particularly with higher ISUP scores, i.e.  $\geq 3$  (e.g. mean T1-/T2-relaxation time in PZ 1759.1/50.5 ms vs. mean T1-/T2-relaxation time in ISUP 3 lesion 1541.5/30.9 ms;  $p < 0.0001$  /  $p = 0.0012$ ).

#### **CONCLUSION**

s ADC and MRF based relaxometry allow quantitative characterization of prostate lesions that correlate with histopathology. MRF based relaxation times might aid in the diagnosis of clinically significant PCa. Further validation studies are needed.

#### **CLINICAL RELEVANCE/APPLICATION**

There is growing interest in the clinical application of quantitative imaging techniques for more objective assessment of prostate lesions. MRF is a fast and efficient method that promises to differentiate low- and intermediate/high-grade PCa in the future. In particular, with regard to the application of artificial intelligence and deep learning this could be an interesting approach in addition to traditional ADC assessment.

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## Abstract Archives of the RSNA, 2023

W2-SPHN

### Head & Neck Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPHN-1 Evaluating the Application of Multiplexed Sensitivity Encoding (MUSE) Diffusion Weighted Imaging (DWI) in Nasopharyngeal Tumors: Comparison with Single-shot DWI with and without Deep Learning Reconstruction

##### Participants

Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the image quality of multiplexed sensitivity encoding (MUSE) diffusion weighted imaging (DWI) for the evaluation of nasopharyngeal tumors comparing with single-shot DWI with and without deep learning reconstruction (ssDWI-DL and ssDWI).

##### METHODS AND MATERIALS

This study retrospectively evaluated patients with nasopharyngeal tumors who underwent MRI from July 2022 to February 2023. All patients underwent ssDWI, ssDWI-DL, MUSE, and fat-suppressed T2-weighted imaging. Two radiologists evaluated the image quality on a 5-point scale (1=no-diagnostic quality, 2=substantial deficits in image quality, 3=moderate, 4=good, and 5=excellent) in terms of the distortion of the original tumor, lymph node morphology, and overall image quality. Apparent diffusion coefficient (ADC) values were calculated in the original tumor and the lymph node. The image quality scores and ADC values were compared among ssDWI, ssDWI-DL, and MUSE using the Wilcoxon signed rank test and paired t-test, respectively. Bonferroni correction was used for the multiple comparisons.

##### RESULTS

A total of 23 patients (age  $70 \pm 17$  years; 5 women) were included in this study. In terms of the original tumor, MUSE showed a significantly higher score than ssDWI and ssDWI-DL (ssDWI,  $2.89 \pm 0.88$ ; ssDWI-DL,  $2.85 \pm 0.90$ ; and MUSE,  $3.78 \pm 0.75$ ). MUSE, ssDWI-DL, and ssDWI showed significantly higher scores in that order for the lymph node and overall image quality (lymph node; ssDWI,  $2.14 \pm 0.54$ ; ssDWI-DL,  $3.06 \pm 1.12$ ; MUSE,  $3.36 \pm 0.78$ ; overall image quality; ssDWI,  $1.80 \pm 0.29$ ; ssDWI-DL,  $2.74 \pm 0.64$ ; MUSE,  $3.26 \pm 0.56$ ). There was no significant difference among ssDWI, ssDWI-DL, and MUSE (ssDWI,  $1.03 \pm 0.35$ ; ssDWI-DL,  $1.00 \pm 0.31$ ; MUSE,  $0.98 \pm 0.30$ ).

##### CONCLUSION

ssMUSE was advantageous in evaluation of nasopharyngeal tumors by decreasing the image distortion compared with ssDWI and ssDWI-DL.

##### CLINICAL RELEVANCE/APPLICATION

MUSE may be useful for imaging of nasopharyngeal tumors or lesions that are in contact with air and where distortion affects image quality.

#### W2-SPHN-2 An MRI-based Lymph Node Regression Grading Scheme for Nasopharyngeal Carcinoma after Radiotherapy

##### PURPOSE

To assess the prognostic value of magnetic resonance imaging (MRI)-based lymph node regression grade (LRG) in risk stratification of patients with nasopharyngeal carcinoma (NPC) after radiotherapy (RT).

##### METHODS AND MATERIALS

This study retrospectively enrolled 387 patients newly diagnosed with NPC between January 2010 and January 2013. A four-category MRI-LRG system based on the areal analysis of RT-induced fibrosis and residual tumor was established. Univariate analysis was performed with the Kaplan-Meier method and compared using the log-rank test. Multivariate analyses were conducted using Cox regression models to calculate the hazard ratios (HRs) with 95% confidence intervals (CIs) and adjusted p-values. Survival curves were calculated using the Kaplan-Meier method and compared using the log-rank test.

##### RESULTS

The MRI-LRG scores sum (LRG-sum) was an independent prognostic factor for progression-free survival (PFS) (HR, 2.50; 95% CI 1.28-4.90). LRG-sum =9 and >9 showed poorer 5-year PFS than LRG-sum =2 (66.1, 42.9, and 77.6%, respectively,  $p < 0.001$ ). A survival clustering analysis (SCA)-based decision tree model showed more complex interactions among LRG-sum and pretreatment and post-RT EBV DNA, yielding four patient clusters with differentiated disease progression risks (5-year PFS of 89.5, 76.4, 57.6, and 27.8%, respectively), which showed better risk stratification than post-RT EBV DNA alone.

##### CONCLUSION

The MRI-LRG system adds prognostic information and may be used as a reliable and non-invasive way to stratify treatment

s The MRI-LRG system adds prognostic information and may be used as a reliable and non-invasive way to stratify treatment modalities for patients with NPC.

#### **CLINICAL RELEVANCE/APPLICATION**

Residual nodal disease after definitive radiotherapy (RT) has been associated with poor survival outcomes in patients with nasopharyngeal carcinoma. Here the authors propose a magnetic resonance imaging-based lymph node (LN) regression grade (MRI-LRG) system to quantitatively evaluate the LN response to RT. Patients with high LRG after therapy maintain a high risk of disease failure when compared to patients with low LRG, underscoring the prognostic value of MRI-LRG system in nasopharyngeal carcinoma after RT.

#### **W2-SPHN-3 Application of Dual-energy CT Spectral Quantification in Diagnosing of Cervical Lymph Node Metastasis in Papillary Thyroid Carcinoma**

##### **PURPOSE**

To evaluate the value of spectral quantitative measurements on dual-energy CT (DECT) for preoperative diagnosis of metastasis to the cervical lymph nodes (LNs) in patients with papillary thyroid carcinoma (PTC).

##### **METHODS AND MATERIALS**

Twenty-two consecutive patients with thyroid nodules who underwent spectral imaging on dual-energy CT before surgery were collected. Virtual monochromatic images at energy of 70 keV, water-calcium and fat-hydroxyapatite (HAP) decomposition images were reconstructed. For each lymph node, DECT-derived water and fat concentration were measured. Student's t test was used for continuous variables. Receiver operating characteristic (ROC) analysis was performed to evaluate the diagnostic efficacy of the continuous variables. The area under the curve (AUC), optimal cut-off value and the corresponding sensitivity and specificity were calculated.

##### **RESULTS**

A total of 18 LNs (8 metastatic, 10 non-metastatic) from 15 patients (9 patients with PTC, 6 patients with benign thyroid nodules) were detected by spectral CT imaging with the reference of postoperative pathologic examination. Assessment of quantitative measurements revealed significant differences between metastatic and non-metastatic LNs in water concentration ( $1032.91 \pm 10.65$  mg/cm<sup>3</sup> vs  $1042.11 \pm 6.20$  mg/cm<sup>3</sup>;  $t=2.296$ ,  $P=0.036$ ) and fat concentration ( $986.85 \pm 8.02$  mg/cm<sup>3</sup> vs  $997.12 \pm 7.94$  mg/cm<sup>3</sup>;  $t=2.714$ ,  $P=0.015$ ), respectively. The AUCs of water and fat concentration for diagnosing lymph node metastasis were 0.750 and 0.838, respectively. The optimal cut-off values of water and fat concentration were 1031.48 mg/cm<sup>3</sup> (sensitivity, 62.5%; specificity, 100.0%) and 990.67 mg/cm<sup>3</sup> (sensitivity, 75.0%; specificity, 90.0%).

##### **CONCLUSION**

s Quantitative assessment with dual-energy spectral CT showed promising value for preoperative diagnosis of metastatic cervical lymph nodes in patients with PTC.

#### **CLINICAL RELEVANCE/APPLICATION**

Preoperative assessment of LN metastasis in PTC by CT spectral imaging is of great clinical value to locate metastatic LNs accurately and reduce unnecessary lateral neck dissections.

#### **W2-SPHN-4 Amide Proton Transfer Imaging of Differentiation in Malignant and Benign Parotid Tumors**

##### **PURPOSE**

To assess the usefulness of amide proton transfer weighted imaging (APT<sub>w</sub>) in the differentiation of parotid gland tumors

##### **METHODS AND MATERIALS**

Patients with parotid gland tumors who underwent APT<sub>w</sub> were retrospectively enrolled and divided into groups according to pathology. Two radiologists evaluated the APT<sub>w</sub> image quality independently with quality score=2 were enrolled. The maximum and average value of APT (APT<sub>max</sub> and APT<sub>mean</sub>) were measured (Figure 2). The APT<sub>max</sub> and APT<sub>mean</sub> were compared in differentiating between malignant and benign tumors (BTs), and in characterizing pleomorphic adenomas (PAs), Warthin tumors (WTs) and malignant tumors (MTs). Independent sample t test, Kruskal-Wallis H test and Receiver-operating-characteristic (ROC) analysis were used for statistical analysis.

##### **RESULTS**

Seventy three patients were included for image quality evaluation (Figure 1). 32/73 parotid tumors and 29/73 were considering for score 4 and 3 respectively. After excluding lesions with quality score<2, the APT<sub>mean</sub> and APT<sub>max</sub> of MTs were ( $4.15 \pm 1.33$ )% and ( $7.43 \pm 1.61$ )%, higher than BTs ( $2.74 \pm 1.04$ )% and ( $5.25 \pm 1.54$ )% respectively ( $p<0.05$ ). The area under the corresponding curve (AUC) of APT<sub>mean</sub>, and APT<sub>max</sub> was 0.819 and 0.821 respectively. MTs indicated significantly higher APT<sub>mean</sub> and APT<sub>max</sub> than PAs ( $p<0.05$ ) and WTs ( $p<0.05$ ). (Table 3-6)

##### **CONCLUSION**

s Both APT<sub>max</sub> and APT<sub>mean</sub> can differentiate BTs and MTs, However, the images of parotid glands still needs to be improved to reduce artifacts. Most APT<sub>w</sub> images in parotid tumors had acceptable image quality to APT<sub>w</sub> value evaluation.

#### **CLINICAL RELEVANCE/APPLICATION**

APT imaging is an usefulness method that can be performed without contrast enhancement for the differentiation of parotid tumors.

#### **W2-SPHN-5 Differentiation of Common Benign Parotid Gland Tumors by T2WI-Based Texture Analysis and Susceptibility-Weighted Imaging**

##### **PURPOSE**

To evaluate the role of T2WI-based texture analysis and its combination with susceptibility-weighted Imaging (SWI) in characterizing pleomorphic adenoma (PA) and Warthin's tumor (WT).

## METHODS AND MATERIALS

Thirty-seven patients (21 PA and 16 WT) who underwent T2WI and SWI at 3.0T (Ingenia CX, Philips Healthcare, the Netherlands) were retrospectively enrolled (Table 1). Two radiologists assessed MRI sequences retrospectively. Fat-suppressed T2-weighted image was used for texture analysis (TA) on the software 3D-Slicer and Intratumoral susceptibility signal intensities (ITSS) were measured in minimum intensity projection (SWI-MinP) according to the previous study. The ROI for TA was drawn to cover the lesion as completely as possible on each slice excluding necrotic and blood vessels (Figure 1). Histogram parameters including mean, median, entropy, skewness, kurtosis, maximum, minimum and 10th, 90th percentiles were calculated. The interobserver reliability was assessed via intraclass correlation coefficient (ICC) (good agreement if ICC > 0.75). The mean values from the two observers were used for the subsequent analysis. The independent sample t-test or Mann-Whitney U test was used to compare the differences in histogram parameters and ITSS between PA and WT. The diagnostic value was determined on receiver operating characteristic (ROC) analysis. Logistic regression was used to calculate the AUC of TA parameters combined with ITSS.

## RESULTS

Interobserver reliability between the two observers was good (Table 2~3). WT showed significantly lower values on mean, entropy and significantly higher values on skewness and kurtosis than PA ( $p < 0.05$ ). The differences in ITSS grades were statistically significant between PA and WT ( $p < 0.05$ ) (Table 2~3). The area under the corresponding curve (AUC) of mean, entropy, skewness, kurtosis and ITSS were 0.779, 0.726, 0.754, 0.687 and 0.718 respectively. The combined AUC of entropy and ITSS could improve diagnostic performance which was statistically different from ITSS ( $p = 0.04$ ) (Table 4~5, Figure 2).

## CONCLUSION

Mean, entropy, skewness, kurtosis and ITSS allowed the identification of PA and WT. The combination of four significant histogram parameters and ITSS may suggest the improvement in diagnostic performance.

## CLINICAL RELEVANCE/APPLICATION

PA and WT are the most common benign tumors in the parotid gland. PA can recur and had a tendency to be malignant. WT rarely has malignant transformation and only needs to be treated tumor resection.

## W2-SPHN-6 MR Imaging with 15-channel Dental Coil Compared with Standard 20-channel Coil in Patients with Head and Neck Tumors and Suspected Bone Invasion

Participants

Iris Burck, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the diagnostic accuracy of a high-resolution 15-channel dental coil with that of a standard 20-channel head and neck coil in MRI diagnosis of head and neck tumors with suspected bone invasion.

## METHODS AND MATERIALS

A total of 37 patients (20 men and 17 women; mean age,  $65.8 \pm 15.0$  years; range: 28-95 years) with head and neck tumors and clinical suspicion of bone invasion underwent staging MRI with both coils in the same examination before surgery. Two specialized radiologists with 4 and 10 years of experience retrospectively evaluated both image datasets for bone infiltration. Additionally, subjective image quality, metal artefacts, and delineation of the tumors were rated on a 5-point-rating-scale. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of tumor lesions were calculated to quantitatively measure image quality. Sensitivity and specificity of the different coils in detecting bone invasion were evaluated by comparing the imaging results with postoperative histopathologic findings. Interobserver agreement was calculated using the Cohens Kappa.

## RESULTS

SNR and CNR values of tumor lesions were significantly higher with the 15-channel dental coil compared to the standard 20-channel head and neck coil (SNR averaged 12.1 versus 9.9, CNR 3.6 versus 1.5). The 15-channel dental coil was found to be more sensitive than standard head and neck coils (100% vs. 72%) and was more specific (98% vs. 88%) in detecting tumor bone invasion. Of 21 histopathologically confirmed tumors with bone invasion, 16 were detected using the standard 20-channel head and neck coil and 21 were detected using the 15-channel dental coil. The 15-channel dental coil was superior in terms of image quality, metal artifacts, lesion delineation, and assessment of jaw infiltration. A high degree of interinvestigator agreement was noted for overall image quality ( $\kappa = 0.93$ ), artifact reduction ( $\kappa = 0.82$ ), lesion delineation ( $\kappa = 0.80$ ), and assessment of jaw infiltration ( $\kappa = 0.89$ ).

## CONCLUSION

MR imaging with 15-channel dental coils has significantly better image quality and accuracy in detecting head and neck cancer compared with 20-channel head and neck coils.

## CLINICAL RELEVANCE/APPLICATION

The use of a 15-channel dental coil improves diagnostic accuracy in the detection and characterization of head and neck cancer especially with bone infiltration and contributes to more accurate cancer treatment.

## W2-SPHN-7 The Imaging Quality Assessment of Synthetic MRI in Nasopharyngeal Carcinoma: A Preliminary Study

## PURPOSE

To compare the imaging quality between the conventional and synthetic T1WI and T2WI.

## METHODS AND MATERIALS

Fifty-nine patients with nasopharyngoscope-confirmed nasopharyngeal carcinoma (NPC) were prospectively included between August 2018 and May 2019. The image quality was evaluated by two radiologists (1 and 2, with 21 and 2 years of tumor-imaging experience, respectively). The patient order was randomized, as was the review order of the conventional or synthetic T1WI and T2WI images. The image quality was assessed based on following 4 factors on a 5-point Likert scale. (1) Sharpness of the lesion edge (1 = not sharp; 2 = a little sharp; 3 = moderately sharp; 4 = well sharp; 5 = very sharp); (2) Lesion conspicuity (1 = difficult to find; 2 = minimally perceivable; 3 = recognizable; 4 = easy to detect, good contrast of lesion; 5 = excellent contrast of lesion); (3) Motion artifacts (1 = severe, difficult to diagnose; 2 = a little severe, accessible to diagnose; 3 = moderate; 4 = mild; 5 =

absence of artifacts); (4) Overall image quality (the three factors above added together, 1 = unacceptable; 2 = poor; 3 = moderate; 4 = good; 5 = excellent). As for overall image quality, ratings of = 3 were considered acceptable overall. The Wilcoxon signed-rank test was adopted to compare the image quality scores between conventional and synthetic T1WI and T2WI. The inter-class agreement of image scores between two radiologists was evaluated by Kappa value (0.21-0.30, fair; 0.41-0.60, moderate; 0.61-0.80, good; 0.81-1.00, excellent).

## **RESULTS**

The interobserver agreements of image quality scores for conventional and synthetic T1WI and T2WI were good or excellent (Kappa values = 0.637-0.919). There were no statistically significant differences between conventional and synthetic T2WI in sharpness of the lesion edge, lesion conspicuity, motion artifacts, and overall image quality ( $P = 0.074-0.835$ , Table). However, conventional T1WI showed higher image quality than synthetic T1WI (all  $P = 0.007$ , Table). As for diagnostic quality scoring, all synthetic T1WI and T2WI images had scores = 3, which showed acceptable image quality in clinical practice.

## **CONCLUSION**

s Synthetic T1WI and T2WI may be acceptable for clinical use in nasopharynx, and with its ability to generate other contrast images (including PDWI, FLAIR and so on) and three quantitative maps (T1, T2 and PD maps) in a single scan, SyMRI has good prospects for clinical application.

## **CLINICAL RELEVANCE/APPLICATION**

The application of SyMRI in clinical could shorten the scan time while maintain acceptable image quality, which can reduce workload and increase productivity.

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## Abstract Archives of the RSNA, 2023

W2-SPIN

### Imaging Informatics Wednesday Poster Discussions

#### Sub-Events

#### W2-SPIN-1 Reproducibility of Automated Segmentation of Abdominal Anatomical Structures on CT using the Total Segmentator

##### Participants

Lorraine Abel, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the reproducibility of segmentation results of TotalSegmentator, an artificial intelligence based segmentation algorithm, on various anatomical structures across multiphasic computer tomography (CT) exams.

##### METHODS AND MATERIALS

We retrospectively collected 1483 multiphasic abdominal CT exams acquired at the University Hospital in Basel between 01.01.2012 and 31.12.2022, each consisting of non-contrast (NC), arterial (ART), and portal venous (PV) phase, totaling 4449 image series. Using the AI-based segmentation model TotalSegmentator (<https://github.com/wasserth/TotalSegmentator>), the volume of 34 abdominal organs and additional structures (including bone, muscles) were obtained on all 4449 series. Similarity of the segmentation across all contrast phases was evaluated for each exam with two metrics: the spatial overlap in terms of Dice Similarity Coefficient (DSC) and the difference of segmented volumes. Volume differences below 5% were considered reproducible, as they are not typically clinically relevant and lie close to human inter-rater variability. Thus, non-inferiority and non-superiority testing was performed using a 5% margin.

##### RESULTS

Overall, the automated segmentation demonstrated high reproducibility in terms of mean DSC regarding comparison of PV versus ART 0.887 (95% CI: 0.882, 0.891), ART versus NC 0.867 (95% CI: 0.861, 0.872) and PV versus NC 0.853 (95% CI: 0.848-0.859) for all structures. The liver showed the lowest variability among abdominal organs, with a DSC of 0.920 (95% CI: 0.917, 0.923). Reproducibility was particularly high for bones and muscles with a mean DSC of 0.922 (95% CI: 0.919, 0.926) and 0.939 (95% CI: 0.936, 0.942) respectively. Lower DSC scores were observed mainly in cases with anatomically relevant pathologies (e.g. organ bleeding) which blur the organ boundaries, and in smaller structures. The volume of 31 of the 34 structures varied less than 5% ( $p < 0.05$ ) between contrast phases: a volume difference greater than 5% was observed exclusively for the adrenal glands and the gallbladder when comparing NC to PV.

##### CONCLUSION

The automated segmentations produced by TotalSegmentator demonstrated high reproducibility for most of the evaluated abdominal structures when comparing different contrast phases in multiphasic abdominal CTs. Small and variable structures demonstrated lower reproducibility. Also, relevant pathologies blurring the organ boundaries hampered the segmentation performance.

##### CLINICAL RELEVANCE/APPLICATION

A clinically reliable automated segmentation tool (TotalSegmentator) segmenting multiple organs and structures while being aware of its disadvantages may further support radiological research and ultimately enhance the clinical impact of radiology.

#### W2-SPIN-2 Deep Learning Assisted Curation of the CANDID-III Dataset with Free-text Reports

##### PURPOSE

This project aims to curate the CANDID-III dataset, which consists of adult chest radiographs with comprehensive labels derived from both manual and AI-assisted annotation.

##### METHODS AND MATERIALS

The CANDID-II dataset is an in-development chest radiograph dataset containing 33,486 anonymized free-text radiological reports. CANDID-III inherited the same 45 radiological labels from the CANDID-II dataset, which were mapped to UMLS ontology for standardization, forming the manually labelled portion of the CANDID-III dataset. An ensemble transformer-based label extraction model, combining three individual natural-language processing (NLP) algorithms, was trained and validated on the CANDID-II dataset in an 80:20 proportion. Each algorithm was individually trained on every radiological label, and the highest accuracy algorithm was chosen on a per-label basis for inclusion into the final ensemble model. The model was then used to automatically label the remaining CANDID-III dataset. An evaluation set of 552 reports, with balanced sampling across radiological findings from the AI-labeled portion of the CANDID-III dataset, was assessed by selected annotation team members, including a final-year radiology trainee and a fourth-year postgraduate medical doctor. Label-specific 'mention' F1 scores were calculated for the final ensemble model, with 'not mentioned' as negative and 'indeterminate, absent, present' as combined positive classifications.

##### RESULTS

The completed CANDID-III dataset contains 322,473 images and 220,977 anonymized free-text radiological reports from 94,210 unique patients (1:1.04 M:F ratio). AI-assisted annotation was performed on 88% of the CANDID-III dataset. For the AI-assisted annotation portion of the CANDID-III dataset, the labelling model has a macro-F1 score of 0.88 and micro-F1 score of 0.94 across all findings. Seven labels are shared with CheXpert, with F1 scores ranging from 0.93 to 1.0. F1 scores for 30 CANDID-III labels are above 0.90, while 8 labels range between 0.80 and 0.90.

## CONCLUSION

The CANDID-III dataset provides a large, comprehensively labeled, and high-quality adult chest radiograph dataset with anonymized free text reports. The dataset adds numerous new clinically significant radiological annotations that are labelled to a high accuracy. It contributes to the repertoire of publicly available chest radiograph datasets for AI development. Instructions to access the dataset can be accessed at DOI: 10.17608/k6.auckland.22726004.

## CLINICAL RELEVANCE/APPLICATION

The CANDID-III dataset can be used to train and test AI algorithms for a variety of applications including triaging, lung cancer screening, image generation, and automated preliminary detection of radiographic abnormalities.

## W2-SPIN-3 Estimating the Impact of Chest Radiograph Triage using AI: A Real-life Multicenter Diagnostic Cohort Study

### PURPOSE

Radiology worklist prioritization with AI can potentially reduce the turnaround time for remarkable cases. This study externally tested a chest radiograph (CXR) artificial intelligence (AI) tool for relocating remarkable CXRs to the top of the worklist and compared this model to the current standard, where CXRs are sorted due to a priority level set by the ordering physician.

### METHODS AND MATERIALS

In this retrospective external validation study, we included consecutive CXRs from the radiology departments of four hospitals in Denmark. The reference standard was based on two thoracic radiologists independently labelling all CXRs into remarkable or unremarkable CXRs. In case of disagreement, a third thoracic radiologist independently adjudicated the results. A commercially available CE-marked and partly FDA-cleared AI model was post-processed to output at probability score for CXR remarkableness. Binary clinical priority levels (urgent/routine) were extracted from the local RIS and compared to the AI tool priority (remarkable/unremarkable) output using McNemar tests, i.e., 'urgent' was juxtaposed to 'remarkable' and 'routine' to 'unremarkable'.

### RESULTS

The analysis was performed on 1990 consecutive CXRs after exclusion of 77 primarily due to insufficient lung visualization and 7 due to processing error by the AI. Of these; 1276 (64%) were remarkable and 717 (36%) unremarkable according to the reference. The AI model achieved an AUC of 0.926 [95% CI: 0.915-0.937]. At a pre-specified 90% sensitivity threshold the model predicted 1148 (57.7%) as remarkable with a sensitivity of 90% [88.2-91.5%], a negative predictive value (NPV) of 81.0% [77.8-83.9%], positive predictive value (PPV) of 87.2% [85.3-88.9%] and specificity of 76.5% [73.2-79.5%]. This binary clinical priority level had 1422 (71.5%) classified as 'urgent' giving a sensitivity of 78.5% [76.2-80.7%], NPV of 51.8% [47.6-55.9%], PPV of 70.5% [68.0-72.8%] and specificity at 41.2% [37.5-44.9%] ( $p < 0.001$  for all comparisons).

### CONCLUSION

An AI model achieved an excellent discrimination between unremarkable and remarkable CXRs in a consecutive multicenter cohort. The AI model was superior to the clinical priority levels for identifying remarkable and unremarkable CXRs.

## CLINICAL RELEVANCE/APPLICATION

This AI tool, specifically post-processed to output a probability score for remarkableness, can be used to prioritize CXR worklists, which can confer a significant benefit in terms of worklist prioritizing compared to the traditional clinical priority levels used today.

## W2-SPIN-5 Automatic Detection of Endotracheal Tube Positioning on Chest Radiograph

### PURPOSE

Endotracheal tubes (ETTs) are poorly positioned in up to 25% of out of operating room intubations [1]. Misplacement of ETTs can lead to pneumothoraces and inadequate ventilation. Rapid identification of ETT positioning is essential to minimize adverse outcomes. Current deep learning (DL) methods involve classification of correct vs incorrect ETT placement or crude bounding box localization. These methods lack the ability to accurately identify both the carina and ETT tip [2]. The purpose of this study is to evaluate a DL model that automatically measures the distance between the tip of the ETT and the carina.

### METHODS AND MATERIALS

In this retrospective study, a region proposal keypoint convolutional neural network (R-CNN) was trained on a subset of the publicly available CLiP dataset consisting of 1320 frontal CXRs. The CLiP dataset contains 30083 radiographs from the NIH Clinical Center. The model identifies two keypoints corresponding to the tip of the ETT and the carina on each radiograph. Various augmentation techniques (brightness, contrast, noise, rotation) were applied to the training set. Predictive performance on a held-out test set with 5-fold cross-validation was evaluated by comparing the distance between ground truth and predicted keypoints.

### RESULTS

The model correctly identifies  $98.9 \pm 0.20\%$  (mean  $\pm$  SD) of these keypoints on a held-out test set consisting of 109 images. A correctly identified keypoint is defined as a prediction that falls within one centimeter of the corresponding ground truth keypoint. The average error in distance for each individual keypoint detection was  $0.72 \pm 0.24$  cm. This is comparable to inter-radiologist error, which has been reported as 0.7 cm [3]. The mean absolute error in ETT to carina measurement was  $0.35 \pm 0.12$  cm. For classification of correct vs incorrect placement, the model achieved an accuracy of  $93.1 \pm 0.9\%$  (precision  $95.4 \pm 2.7\%$ ; recall  $95.5 \pm 2.4\%$ ; NPV  $86.1 \pm 8.2\%$ ; specificity  $86.9 \pm 6.6\%$ ; F1  $95.4 \pm 0.6\%$ ).

### CONCLUSION

A deep learning model can correctly identify the tip of an ETT and the carina on CXR. It can accurately measure the distance

between carina and ETT, thereby detecting misplaced ETTs at the time of image acquisition.

#### **CLINICAL RELEVANCE/APPLICATION**

This method has the potential to expedite the detection of misplaced ETTs, thereby facilitating prompt interventions and improving patient outcomes. Furthermore, our findings surpass those of prior classification-only strategies, as our approach offers an estimate of the distance required to either advance or withdraw the ETT. Lastly, this versatile technique can be adapted for use in a wide range of measurement tasks on 2D imaging.[1] doi.org/10.1038/s41597-021-01066-8[2] doi.org/10.1016/j.acra.2022.04.022 [3] doi.org/10.1007/s10278-021-00495-6

## **W2-SPIN-6 Opportunistic Breast Cancer Screening using Non-contrast CT Imaging**

#### **PURPOSE**

To develop a non-contrast CT based opportunistic breast cancer screening approach as an alternative to mammography for detecting breast cancer using artificial intelligence.

#### **METHODS AND MATERIALS**

Our proposed model is a two-stage approach. In the first stage, we locate and crop out the two breasts using a breast segmentation model, which is trained using nnUNet. In the second stage, a customized multi-task U-net is employed to process the single cropped breast, producing simultaneous segmentation and classification results. The segmentation results include the breast and tumor masks, while the classification result outputs the approximate probability of breast cancer. The training dataset for the second stage includes 411 cancerous breasts and 411 healthy breasts as normal control, with confirmation through pathology reports. The external test dataset includes 386 cancerous cases from another institution and 905 normal cases from three other institutions (473/230/202). Additionally, the breast tumor masks were annotated on corresponding contrast-enhanced CT images by experienced radiation oncologists and then transferred to non-contrast CT.

#### **RESULTS**

The proposed model achieved a performance comparable to the recently reported mammography-based AI breast cancer screening system. For the 5-fold cross-validation on the internal dataset, the model achieved an AUC of 0.970 (95% confidence interval (CI) 0.958-0.982), sensitivity of 0.824 (95% CI 0.783-0.866), and specificity of 0.982 (95% CI 0.966-0.994), which were superior to the mammography-based AI system. In addition, the proposed model demonstrated advantages in generalization ability on the external test dataset, with an AUC of 0.939 (95% CI 0.922-0.955), sensitivity of 0.762 (95% CI 0.717-0.805) and specificity of 0.961 (95% CI 0.949-0.974) compared to mammography-based AI system.

#### **CONCLUSION**

The proposed non-contrast CT based opportunistic breast cancer screening approach using a two-stage model achieves a performance comparable to the recently reported mammography-based AI screening system, providing a promising way for opportunistic breast cancer screening.

#### **CLINICAL RELEVANCE/APPLICATION**

The proposed approach of using non-contrast CT for breast cancer screening has the potential to overcome the limitations of mammography-based screening in developing countries where medical resources are limited. This could improve early detection and ultimately contribute to prolonged survival rates for breast cancer patients. Further studies are needed to confirm the effectiveness of this approach and to optimize its implementation in clinical settings.

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## Abstract Archives of the RSNA, 2023

W2-SPIR

### Interventional Radiology Wednesday Poster Discussions

#### Sub-Events

#### **W2-SPIR-1 Gastrointestinal Tract Perforation after Radiofrequency Ablation for Hepatic Tumor: Incidence and Risk Factors**

##### Participants

Kyowon Gu, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the incidence of gastrointestinal (GI) tract perforation after radiofrequency ablation (RFA) for hepatic tumor and to assess its risk factors.

##### METHODS AND MATERIALS

The study included a retrospective cohort (n = 4,799) of patients with malignant tumors underwent RFAs (n = 7,206) between November 2008 and May 2020. Among them, 69 cases with thermal injury of GI tract were identified through a search of electronic medical records system. These patients were divided into presence of perforation (n = 8) or not (n = 61) based on the imaging review of following computed tomographic (CT) findings: (a) gastrointestinal wall defect and (b) pneumoperitoneum. Risk factors for GI tract perforation based on clinical, technical, and follow-up CT were identified with multivariate logistic regression analysis.

##### RESULTS

The incidence of thermal injury of GI tract and its perforation during observation period was 0.9% (69 of 7206) and 0.1% (8 of 7206), respectively. All perforation cases were not identified on CT immediately after RFA. The median time to its development was 7 days (range, 1-31 days). The type of adjacent GI tract and presence of diabetes mellitus were significantly different between the two groups (p < 0.05). Among the various risk factors, the type of adjacent GI tract (small bowel) was only significant factor for GI tract perforation after ablation (Odds ratio, 22.69; 95% confidence interval, 2.60-198.34; p = 0.005 [reference standard, stomach]).

##### CONCLUSION

GI tract perforation after RFA for hepatic tumor was rare, but it occurred late. Thus, the careful follow-up is needed when we treat the index tumor adjacent small bowels.

##### CLINICAL RELEVANCE/APPLICATION

GI tract perforation is a rare complication of liver RFA but can be missed on immediate post-ablation CT. Careful follow-up is recommended especially when the tumor is near small bowel and for DM patients.

#### **W2-SPIR-2 CT-guided Percutaneous Radiofrequency Ablation Therapy for Liver Malignancies Adjacent to the Heart: A Safety and Efficacy Analysis in 42 cases**

##### Participants

Hong-Tao Hu, MD, PhD, Zhengzhou, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To explore the safety and effectiveness of CT-guided percutaneous radiofrequency ablation (RFA) in the treatment of hepatic malignancies adjacent to the heart.

##### METHODS AND MATERIALS

From January 2019 to December 2020, 412 patients who underwent RFA for hepatic malignancies were retrospectively analyzed, of which 42 patients had lesions less than 5 mm from the border of the heart. During the follow-up period, the complete ablation rate within 1 month and 24 months and the treatment-related complications within 30 days were recorded, and the complete ablation rate of adjacent cardiac lesions and non-adjacent cardiac lesions was calculated. Univariate and multivariate Logistic regression analyzes were used to analyze the relevant prognostic factors affecting complete ablation.

##### RESULTS

A total of 42 patients had 61 lesions. The average tumor size of 42 adjacent cardiac lesions was 3.01±1.04cm, and the total diameter of intrahepatic lesions was 3.60 (2.98, 4.73)cm. During the 1-month follow-up, the complete ablation rates of lesions adjacent to the heart and non-adjacent to the heart were 85.7% (36/42) and 89.5% (17/19). The follow-up time ranged from 12 to 26 months, and 2 patients were lost to follow-up. The complete ablation rate of adjacent cardiac lesions was 82.5% (33/40), and the complete ablation rate of non-adjacent cardiac lesions was 88.2% (15/17). Univariate and multivariate Logistic regression analysis showed that liver metastases and not receiving preoperative TACE were independent risk factors affecting the rate of complete ablation (P<0.05). No serious complications related to RFA occurred during the treatment, and the overall safety was controllable.

## CONCLUSION

s CT-guided radiofrequency ablation of tumors adjacent to the heart is safe and effective.

## CLINICAL RELEVANCE/APPLICATION

It provides a new safe and effective method for liver tumors near the heart

## W2-SPIR-3 Artificial Intelligence for Rapid Prediction of Tumor Coverage after RF Ablation of Hepatocellular Carcinoma

### PURPOSE

To assess the technical success of radiofrequency ablation (RFA) in patients with hepatocellular carcinoma (HCC), we developed an artificial intelligence (AI) model to promptly estimate the percent tumor coverage without the need for segmentation or registration tools.

### METHODS AND MATERIALS

From 550 patients in the OPTIMA trial (patients with solitary HCC lesions between 3-7cm, randomized to RFA or RFA+LTLD), 185 patients were selected with well-defined pre-RFA tumor and devascularized (ablation) zones on enhanced CT, 1-month post-RFA. The isocenter of the tumor and of the ablation zones were identified and 2D axial images were extracted from CT and cropped with the region of interest (tumor/ablation) at the center. Images were augmented (Gaussian-noise and rotation applied), with a total of 1,456 image pairs available for training and testing. Feature extraction was performed on the image pairs using a Siamese network with CNN VGG16 and ImageNet weights, and predictive modeling was achieved using a 30-tree random forest classification algorithm. The percent of the tumor covered (ground-truth) was determined by semi-automatic 3D tumor and ablation zone image segmentation and elastic registration (3DSlicer). Cases were split into 4 classes: =50%, 50-70%, 70-90%, or =90% tumor coverage, depicting incomplete, partially incomplete, acceptable, or complete ablation given the technical difficulty of the ablation and potentially desired immune response. Training was done on 80% of cases (n=1,168 image pairs), and 20% of cases were set aside for testing (n=288 image pairs). The model was validated on 16 interventional radiology cases from a separate institution, with the key difference that confirmation images were taken immediately post-ablation in the external validation set.

### RESULTS

Overall model accuracy was 90% (AUC = 0.98, true positive rate = 0.87, and true negative rate = 0.96) reliably predicting the class of percent tumor coverage. Visual review of the test cases suggests that those with poor tumor coverage might be subject to an atypically rapid ablation zone shrinkage 1-month post-RFA whereas validation cases showed a more coherent percent tumor coverage immediately post-RFA, consistent with the AI model design.

## CONCLUSION

s An AI model that uses 2D images at the center of the tumor and 1-month post ablation can accurately estimate ablation tumor coverage for immediate estimation of technical RFA success.

## CLINICAL RELEVANCE/APPLICATION

Clinical tools for ablation confirmation need to be efficient to hope for adoption and treatment optimization. AI models can achieve ablation confirmation without applying resource-intensive segmentation and registration models.

## W2-SPIR-4 Percutaneous Image-guided Liver Tumor Ablations: Analysis of the Registry of the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR) 2018-2021

Participants

Sebastian Zensen, MD, Essen, Germany (*Presenter*) Nothing to Disclose

### PURPOSE

Percutaneous image-guided tumor ablations are an essential tool in the treatment of liver malignancies. The aim of this evaluation was to analyze the use, technical success and complications of those interventions based on data from the prospectively managed multinational registry of the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR, Deutsche Gesellschaft für Interventionelle Radiologie und minimal-invasive Therapie).

### METHODS AND MATERIALS

A total of 5792 percutaneous liver ablation procedures from 133 centers in Germany and Austria were examined. Median age was 67 years (IQR 58-75 years), 31.4% (1821/5792) of patients were female. For image guidance, CT was used in 91.4% (5293/5792), MRI in 2.4% (137/5792), ultrasound in 3.8% (222/5792), and combined imaging in 2.4% (140/5792). Ablation of the tumor with a safety margin was considered technical success.

### RESULTS

Microwave ablation (MWA) was used in 64.3% (3725/5792), and radiofrequency ablation (RFA) in 33.5% (1940/5792). A total of 3999 cases reported tumor etiology, in which 61.4% (2456/3999) were performed for liver metastases and 36.2% (1446/3999) for hepatocellular carcinoma (HCC). The median lesion diameter was 19 mm (IQR 12-27 mm). 90.6% (5247/5792) ablations were technically successful. The rate of technically successful ablations was significantly higher in MWA (93.4%, 3481/3725) than in RFA (84.8%, 1645/1940,  $p < 0.0001$ ). The total complication rate was 2.9% (170/5792). Compared to RFA, which had a complication rate of 1.0% (19/1940), MWA had a considerably higher complication rate of 3.9% (147/3725,  $p < 0.0001$ ). In 37.2% (2156/5792) of ablations additive needle track ablation was performed. Ablations with needle track ablation did not have a significantly higher rate of major complications (23.2%, (22/95) vs. 26.7% (20/75),  $p = 0.60$ ).

## CONCLUSION

s MWA is the most frequent ablation method ahead of RFA. Percutaneous image-guided liver tumor ablations have a high technical success rate, which is higher for MWA than RFA. Though generally low, the rate of complications is higher with MWA than RFA.

## CLINICAL RELEVANCE/APPLICATION

For the treatment of liver malignancies, percutaneous image-guided liver ablations such as microwave ablation and radiofrequency

for the treatment of liver malignancies, percutaneous image-guided liver ablations such as microwave ablation and radiofrequency ablation are efficient treatment options with low complication rates.

## **W2-SPIR-5 Estimation of Recurrence and Survival in Breast Cancer Cryoablation: A Retrospective Multisite Analysis of Patients Excluded from Prospective Cryoablation Clinical Trials**

Participants

Karim Oueidat, MD,BEng, Providence, RI (*Presenter*) Nothing to Disclose

### **PURPOSE**

Estimation of recurrence and survival in breast cancer cryoablation patients excluded from clinical trials.

### **METHODS AND MATERIALS**

Cryoablation is a well-tolerated minimally-invasive alternative to surgical excision for treating breast cancer. In keeping with clinical trial inclusion criteria, the optimal candidate would have a unifocal invasive ductal carcinoma without significant intraductal component, less than 1.5 cm in size, Nottingham grade 1-2 of 3, ER/PR+ and HER2-, at least 0.5-1 cm from the overlying skin and 0.3 cm from the underlying muscle. Requiring only local anesthesia, cryoablation may be particularly useful in patients with medical comorbidities placing them at higher risk for surgery with general anesthesia. Patients included in this study were excluded from cryoablation clinical trials. A retrospective review of ipsilateral breast tumor recurrence (IBTR) encompassing true recurrence (TR) and new primary (NP) events was done for n=123 patients treated outside of clinical trials across 7 institutions over 5.4 years; all patients were women and median age was 72 (range 37-99). To control for death before recurrence, a Competing Risk Analysis (CRA) model was used; Kaplan Meier (KM) estimation was used.

### **RESULTS**

All procedures were technically successful. There were a total of 6 (4.9%) minor procedure complications rated 1 on CTCAE scale. In all, there were 8 TRs, 6 NPs, and 10 deaths before TR or NP, and 11 deaths total—only 1 death was cancer related. Using CRA, the cumulative incidence of TR was 4.1% at 1 year, 8.2% at year 2, and 11.8% at year 3. The cumulative incidence of NP was 2.7% at year 1 and 7% at year 2. Together, the cumulative incidence of IBTR was 6.7% at year 1, 13.1% at year 2, and 17.9% at year 3. Finally, the cumulative incidence of death was 2.9% at year 1, 5.9% at year 2, 14.6% at year 3 and 21.7% at year 4.

### **CONCLUSION**

Breast cancer cryoablation is a safe and feasible alternative to surgical excision for select patients, including older patients, patients excluded from trials and patients who are considered high-risk for general anesthesia and surgery.

### **CLINICAL RELEVANCE/APPLICATION**

Cryoablation is an alternative to surgical excision for patients with breast cancer, even when considered suboptimal for cryoablation in select cases, and this may be particularly true for patients with medical comorbidities placing them at higher risk for surgery with general anesthesia.

## **W2-SPIR-6 Retrospective Analysis of MRI-guided Transurethral Ultrasound Ablation (TULSA) in Prostate Cancer Lesions at the Extreme Apex**

### **PURPOSE**

Maintenance of urinary continence when treating prostate cancer (PCa) at the extreme apex is a challenge for surgery, radiation, and focal therapy. Regulatory studies of TULSA spared 3mm at the apex, and the performance of dual ultrasound frequency MRI-controlled ablation in short target radii near the external sphincter is not yet known. This single-center retrospective analysis reports functional, imaging, and cancer surveillance outcomes in TULSA patients with extreme apical lesions.

### **METHODS AND MATERIALS**

Men with apical PCa lesions abutting or involving the external sphincter were identified among 138 men with ≥6 months follow-up after lesion-targeted or whole-gland TULSA. The target volume was defined based on disease factors and patient preference, using intraoperative DWI, ADC, and T2w images. A 10mm margin was targeted around the visible lesion when feasible. At the sphincter, a 5mm margin was targeted, including ≈50% of the external sphincter. Patients were followed with daily communication for 2 weeks, PSA every 3 months, and MRI, IPSS, IIEF at 6-9 months. Post-TULSA mpMRI was assessed for local recurrence using PI-RR.

### **RESULTS**

42 patients with treatment of apical lesions (37 primary PCa, 5 salvage) were identified, with median age of 63 (IQR 59-68) years, and follow-up availability of 9 (6-16) months. The proportion of men with primary GG 1-5 PCa were: 7%, 54%, 20%, 12%, and 7%, all having an MRI visible lesion. Median target volume was 29cc (IQR 22-34, range 10-70), with 99% (IQR 98-99%) of the target volume achieving a lethal thermal dose =240CEM43. PSA decreased from median 6.7 (IQR 4.7-9.7) to 0.9 (0.3-2.0) ng/mL. 93% of patients with follow-up mpMRI (n=28) had no evidence of residual disease; PI-RR scores 1-5 were: 8, 18, 0, 2, 0. Both men with PI-RR=4 underwent a repeat TULSA; 6 months after repeat ablation both had PI-RR=2 with PSA of 0.2 and 1.0 ng/mL. All patients are pad-free; two experienced urine leakage resolved by 3 months. 82% maintained baseline erection firmness sufficient for penetration (IIEF Q2=2). IPSS symptom scores were stable. 10 patients experienced Grade 1-2 adverse events (LUTS, mild hematuria, bladder spasms, and hydrocele) resolving within 4 weeks with oral medication. Two patients had Grade 3 events requiring endoscopic intervention (1 retention, 1 retention and bladder neck contracture). No grade =4 events and no rectal injuries occurred.

### **CONCLUSION**

This retrospective analysis demonstrates promising safety and efficacy of TULSA in patients with extreme apical lesions, preserving urinary continence despite ablation near the external sphincter.

### **CLINICAL RELEVANCE/APPLICATION**

TULSA is a promising prostate cancer treatment with minimal impact on urinary continence for thermal ablation of extreme apical lesions.

## Abstract Archives of the RSNA, 2023

W2-SPMK

### Musculoskeletal Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPMK-1 Clinically Relevant Incidental Findings Detected on MRI Lumbar Spine Examinations: Our Experience in 1450 Studies

##### Participants

Dinesh Baviskar, MD, , India (*Presenter*) Nothing to Disclose

##### PURPOSE

The purpose of our study was to evaluate the types of incidental findings encountered during evaluation of MRI lumbar spine examinations and to ascertain their clinical relevance in view of the presenting symptoms.

##### METHODS AND MATERIALS

A total of 1450 patients (male-to-female ratio, 626:824; age range, 12-97 years) with history of low back pain / suspected herniated intervertebral disk, who underwent MRI of the lumbar spine between 1st June 2022 - 31st December 2022 were evaluated by trained Radiologists. The examinations were evaluated for the presence of any incidental findings. We defined incidental finding as any abnormal finding detected outside the Lumbar spine, bony canal, its contents and the paraspinal soft tissues. Incidence of the incidental imaging findings were calculated. For analysis, the relationship of incidental findings with clinical data of patient was used.

##### RESULTS

Overall, 128 patients (8.8%) had clinically relevant incidental findings. Uterine fibroids were the commonest (3.2% of total examinations) incidental findings seen in the females, whereas heterogeneous signal in the prostatic parenchyma was the commonest (3.8% of total examinations) findings in the male patients. Other findings encountered were - Pelvic Kidney, Adenomyosis of uterine myometrium, Pelvic congestion, Ovarian cyst, Dermoid cyst, Uterine polyp, Renal mass lesion, lymphadenopathy, etc.

##### CONCLUSION

Clinically relevant incidental findings detected on MRI examination of the lumbar spine were common and associated with symptoms confused with lumbar spine / backache causes. Most of the findings were benign, but we encountered one renal lesion which was later proven to be Renal cell carcinoma. An awareness of the prevalence of the clinically relevant incidental findings detected at MRI of the lumbar spine exams are helpful for diagnosing lesions which might be the primary cause of the presenting symptoms.

##### CLINICAL RELEVANCE/APPLICATION

Awareness about incidental findings on radiology examinations is very vital, particularly in cases where the symptoms might be overlapping and the primary cause might be the incidental finding detected on imaging. The clinical significance of these incidental finding has to be ascertained to avoid delay in initiating prompt and appropriate treatment to aid patient care.

#### W2-SPMK-2 The Diagnostic Value of Electron Density Map from Dual-layer Detector Spectral CT in Acute and Chronic Osteoporotic Vertebral Fractures

##### PURPOSE

To evaluate the diagnostic efficacy of electron density map (EDM) obtained from dual-layer detector spectral CT in acute and chronic osteoporotic vertebral fractures (OVFs).

##### METHODS AND MATERIALS

Retrospective study was performed on 48 patients with 53 acute and 57 chronic OVFs that were confirmed by MR. All the patients underwent DLCT plain scanning, and quantitative parameters such as electron density(ED), effective atomic number(zeff) and the attenuation of conventional 120 kVp polyenergetic image(PI) and 40, 70 and 100 keV virtual monoenergetic images(VMI) were measured. CT signs are evaluated by the radiologist, including endplate interruption sign, bone cortical folds, increased vertebral density, intravertebral gas shadow, anteroposterior diameter of vertebral body increased and vertebral compression degree. The quantitative parameters and CT signals between acute and chronic OVFs were compared using independent- samples t test or Chi-Square test. Logistic regression analysis was used to identify the independent risk factors and built predictive model. ROC curve was used to analyze the efficacy in the differential diagnosis of acute and chronic OVFs.

##### RESULTS

There were significant differences between acute and chronic OVFs in endplate interruption sign, bone cortical folds, increased vertebral density, intravertebral gas shadow and vertebral compression degree (all  $P < 0.05$ ). There were significant differences between acute and chronic OVFs in PI, 40, 70 and 100keV VMI attenuation value, zeff and ED (all  $P < 0.05$ ). Attenuation values of PI (OR=0.876,  $P=0.023$ ), ED (OR=10.446,  $P=0.024$ ), bone cortical folds (OR=0.023,  $P=0.012$ ), increased vertebral density

(OR=0.020, P=0.012) were independent risk factors for acute OVs. The combined model obtained the highest AUC (0.977) by combining attenuation values of PI, ED, bone cortical folds and increased vertebral density, with a sensitivity of 98.1%, and a specificity of 94.7%.

## CONCLUSION

s In the differential diagnosis of acute and chronic OVs, the diagnostic efficacy of EDM is higher than the CT values in PI and VMI; The efficacy is further enhanced when EDM is combined with CT values in PI, bone cortical fold, vertebral density increasing.

## CLINICAL RELEVANCE/APPLICATION

EDM can help clinicians make treatment decisions and improve patient prognosis by differentiating between acute and chronic OVs.

## W2-SPMK-3 Paraspinal Muscle Activation Quantified by Intravoxel Incoherent Motion Imaging (IVIM): Influence of Exercise Intensity on Muscle Perfusion in Adolescent Athletes

Participants

Adrian Marth, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose

## PURPOSE

Intravoxel incoherent motion (IVIM) imaging provides information on the perfusion of the muscular microstructure. This study aims to reveal relationships between IVIM signal changes and different levels of exercise intensity in adolescent athletes.

## METHODS AND MATERIALS

Twenty male athletes with a mean age of 15.7 years (SD 1.2) underwent magnetic resonance imaging (MRI) of the lumbar spine muscles at rest and after ergometer training at low intensity (50 Watt, n = 6), moderate intensity (100 Watt, n = 8) or high intensity (150 Watt, n = 6). IVIM images were analyzed to calculate the diffusion coefficient (D), pseudo-diffusion coefficient (D\*) and perfusion fraction (f). Analysis of covariance was used to compare mean values at rest and different exercise intensity levels.

## RESULTS

After exercise, IVIM parameters increased with exercise intensity and were significantly elevated compared with baseline (all p <0.05). The increase in f and D differed significantly between low and moderate intensity (p = 0.02 and p = 0.007), but not between moderate and high intensity (p = 0.58 and p = 0.22), while the increase in D\* showed significant differences between each intensity level (p = 0.008 and p = 0.003).

## CONCLUSION

s IVIM parameters detected changes in muscular perfusion after activation. Our findings demonstrate a relationship between microvascular blood flow, blood volume and exercise intensity.

## CLINICAL RELEVANCE/APPLICATION

While these results need to be further validated, they suggest that IVIM parameters can further our understanding of physiological muscle response after activation. Moreover, IVIM may have a role in identifying individuals susceptible to impaired muscle perfusion.

## W2-SPMK-4 In Vivo Comparative Study of Fast kVp Switching Dual-energy Computed Tomography Based Two-material Decomposition Technique and Quantitative Computed Tomography in the Measurement of Lumbar Bone Mineral Density

## PURPOSE

To evaluate the feasibility of the fast kVp switching dual-energy computed tomography (DECT) based hydroxyapatite (HAP) - water decomposition technique in measuring human lumbar bone mineral density (BMD), and to investigate its accuracy in comparison with quantitative computed tomography (QCT).

## METHODS AND MATERIALS

This study was approved by our institutional review board and the requirement to obtain informed consent was waived. A total of 118 consecutive patients who simultaneously underwent both DECT and QCT of the spine were retrospectively enrolled in our study. The patients were 19-88 years old, 56 males and 62 females. The density of HAP (water) was measured along with BMD in the trabecular bone of lumbar level 2-4 by DECT and QCT, respectively. The regions of interest (ROI) were drawn by a radiologist who had 5 years of experience in general radiology. A musculoskeletal radiologist with more than 10 years of experience checked every case that the general radiologist measured. Pearson correlation analysis and paired sample t test were conducted to assess the correlation and difference between DECT- and QCT-derived BMD, respectively. Bland-Altman analysis would be done to evaluate the agreement between two measurements if paired sample t test shows no significant difference between them.

## RESULTS

Strong linear correlation was observed between DECT- and QCT-derived BMD (r = 0.962, p<0.01). DECT-derived BMD (L2, 110.76±35.83mg/cm<sup>3</sup>; L3, 103.05±36.19mg/cm<sup>3</sup>; L4, 105.53±34.57mg/cm<sup>3</sup>; L2-4, 106.56±35.57mg/cm<sup>3</sup>) was slightly lower than QCT-derived result (L2, 124.04±49.96mg/cm<sup>3</sup>; L3, 115.08±49.74mg/cm<sup>3</sup>; L4, 117.21±48.79mg/cm<sup>3</sup>; L2-4, 118.92±49.50mg/cm<sup>3</sup>) and the difference was statistically significant (p<0.01).

## CONCLUSION

s Fast kVp switching DECT based HAP-water decomposition technique enables in vivo BMD quantification of human lumbar vertebrae, and its measurement is slightly lower than QCT.

## CLINICAL RELEVANCE/APPLICATION

Osteoporosis is the most common chronic metabolic bone disease, which is associated with low bone mineral density (BMD). As BMD is an important life-long monitoring index for osteoporosis and fractures, especially for the women and older people. Therefore, it is important to obtain accurate BMD measurement. Besides dual-energy X-ray absorptiometry (DXA) and quantitative computed

tomography (QCT), dual-energy computed tomography (DECT) is considered to be another potential technique to assess BMD. It is needed to evaluate the diagnostic performance of the new method.

## **W2-SPMK-5 Fast kVp-switching Dual-energy Computed Tomography Water-(hydroxyapatite) Display of Vertebral Fractures: Impact on Diagnostic Accuracy of Radiologists with Varying Levels of Experience in Correlation to Magnetic Resonance Imaging**

### **PURPOSE**

To evaluate whether a fast kVp-switching dual-energy computed tomographic (DECT) water-hydroxyapatite (HAP) decomposition technique can improve the detection rate of acute vertebral compression fractures in patients with that at magnetic resonance imaging (MRI) depending on the level of experience of the reading radiologist.

### **METHODS AND MATERIALS**

Fifty consecutive patients who underwent both DECT and MRI of the spine within 3 days after trauma were retrospectively enrolled in our study. Four independent radiologists with varying levels of experience blindly evaluated gray-scale CT scans for the presence of fractures and their suspected age. Then, water-(HAP)images were assessed by the same readers to detect bone marrow edema. Findings were compared with those from fat-suppressed T2-weighted MR images (the standard of reference). Sensitivity, specificity, accuracy, positive predictive value and negative predictive value analyses for diagnostic performance and matched pair analyses were performed on vertebral fractures and patient levels.

### **RESULTS**

In total, fifty-four fractures were classified as fresh and 38 as old at MR imaging. The diagnostic performance of all readers in the detection of fresh fractures improved with the addition of water-(HAP)reconstructions compared with that with conventional CT alone. The diagnostic accuracy of the least experienced reader with CT alone, 76%; accuracy with water-(HAP)images, 87%. The most experienced reader improved his accuracy with water-(HAP) images from 84% to 93% , coming closer to that with MR imaging. The number of vertebrae rated as unclear decreased by 70%-92% or from 12-23 to 1-7 in absolute numbers across readers. The number of patients potentially referred to MR imaging decreased by 71%-91% (from 11-14 to 1-4 patients). Considering the real decision-making gain with the water-HAP decomposition technique on a patient level, 10 to 11 MR examinations could have been avoided.

### **CONCLUSION**

s Fast kVp-switching DECT based water-HAP decomposition technique can improve the ability of the radiologists with variable levels of experience to detect acute vertebral compression fractures.

### **CLINICAL RELEVANCE/APPLICATION**

Single-energy CT of the spine is the standard examination for fast exclusion or closer assessment of suspected vertebral fractures. However, it is sometimes difficult to distinguish between acute and chronic fractures, where further MRI is usually recommended for the differential diagnosis. Compared with single-energy CT, DECT based water-hydroxyapatite decomposition technique can help the radiologists to improve the detection rate of acute vertebral compression fractures, so as to reduce the number of patients requiring further MR scanning.

## **W2-SPMK-6 Comparative Analysis of Cancellous Bone Mineral Density between Vertebral Body and Pedicle Screw Trajectory using Quantitative Computed Tomography**

### **PURPOSE**

To evaluate quantitative computed tomography (QCT) for analysis of cancellous bone mineral density (BMD) of vertebral body and pedicle screw trajectory and to investigate whether there's any difference between them.

### **METHODS AND MATERIALS**

This study was approved by our institutional review board and the requirement to obtain informed consent was waived. A total of 99 consecutive participants (20~80 years old, 48 males and 51 females) who underwent lumbar QCT examinations were retrospectively analyzed. Each pedicle screw trajectory was further divided into intrapedicular segment (R1) and intracorporeal segment (R2). BMD of R1, R2, and the vertebral body (R3) were all measured in the trabecular bone of lumbar level 2,3 and 4 by a commercial QCT BMD analysis system. One-way ANOVA analysis was conducted to assess the differences of BMD among R1, R2, and R3. The paired t test was performed to evaluate the difference of BMD between R3 and the global pedicle screw trajectory.  $P < 0.01$  was considered statistically significant for all used tests.

### **RESULTS**

Mean pedicle screw trajectory BMD (R1,  $173.66 \pm 71.84$  mg/cm<sup>3</sup>; R2,  $113.81 \pm 48.83$  mg/cm<sup>3</sup>; global,  $143.73 \pm 55.49$  mg/cm<sup>3</sup>;) showed significant difference between R1-R2 ( $P < 0.01$ ) and there was no significant difference at both sides (left,  $143.14 \pm 70.06$  mg/cm<sup>3</sup>; right,  $144.33 \pm 66.56$  mg/cm<sup>3</sup>;  $P > 0.01$ ) or different lumbar levels (L2,  $141.25 \pm 50.32$  mg/cm<sup>3</sup>; L3,  $138.31 \pm 56.85$  mg/cm<sup>3</sup>; L4,  $151.64 \pm 58.62$  mg/cm<sup>3</sup>;  $P > 0.01$ ). Average BMD of R3 was not significantly different between lumbar level 2, 3 and 4 (L2,  $124.28 \pm 47.04$  mg/cm<sup>3</sup>; L3,  $115.36 \pm 46.34$  mg/cm<sup>3</sup>; L4,  $117.19 \pm 48.33$  mg/cm<sup>3</sup>;  $P > 0.01$ ). Mean R1-R3 was significantly different (R3,  $118.94 \pm 47.24$  mg/cm<sup>3</sup>;  $P < 0.01$ ) while comparison of R2-R3 did not reach significance ( $P > 0.01$ ). The global pedicle screw trajectory BMD was higher than R3 and the difference was statistically significant ( $p < 0.01$ ).

### **CONCLUSION**

s QCT allows for BMD assessment both of the vertebral body and pedicles. BMD of the global pedicle screw trajectory is significantly higher than that of the same segmental vertebral body.

### **CLINICAL RELEVANCE/APPLICATION**

Pedicle screw fixation is the standard technique for spine stabilization with a potential complication of screw loosening. The screw fixation strength is clearly related to the bone mineral density (BMD) of vertebrae. Currently in clinical only BMD of the vertebral body was estimated, which may not represent the situation in the screw trajectory. Our study shows there's a significant difference of BMD between them. It indicates that measuring BMD of the screw trajectory using quantitative computed tomography (QCT) is needed to predict screw loosening.

## **W2-SPMK-7 The Value of Magnetic Resonance Image Compilation (MAGIC) Sequence in the Diagnosis of Sacroiliac Joint Bone Marrow Edema and Activity in Early Axial Spondyloarthritis**

Participants

Zhaorong Tian, MD, Yinchuan, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

The study explored the feasibility of using Magnetic resonance image compilation (MAGIC) parameters to quantitatively evaluate changes of sacroiliac joint in axial spondyloarthritis (SpA), in order to provide a quantitative index for the evaluation of sacroiliac joint inflammatory activity in SpA. and to evaluate the correlations of MAGIC parameters with BASDAI and SPARCC scores.

### **METHODS AND MATERIALS**

A total of 68 SpA patients with sacroiliitis and 35 healthy controls were enrolled. All patients were scanned using a SIGNATM Architect 3.0T MRI scanner by T1WI, FS-T2WI and MAGIC sequence of the sacroiliac joints. According to whether subchondral bone marrow edema was present in the FS-T2WI sequence, the 68 patients were divided into an active group (40 cases) and an inactive group (28 cases). The T1, T2 and PD values of the subchondral bone marrow were measured in the active group, the inactive group, and the healthy control group using the MAGIC sequence. The T1, T2 and PD values of the active, inactive, and healthy groups were compared using one-way analysis of variance (ANOVA). Receiver operating characteristic (ROC) curves were used to analyze the diagnostic efficacy of T1, T2 and PD values for sacroiliitis. The correlations of the T1, T2 and PD values with the BASDAI and SPARCC scores were analyzed using Spearman's rho.

### **RESULTS**

T2 and PD values of active groups ( $119.00 \pm 9.56$ )ms, ( $86.03 \pm 14.79$ )pu were both higher than inactive groups ( $96.61 \pm 8.86$ )ms, ( $68.12 \pm 7.77$ )pu, higher than those in the healthy control group ( $78.94 \pm 6.20$ )ms, ( $53.71 \pm 6.69$ )pu, ( $T=15.332, T=15.972, all p < 0.001$ ); The T1 values ( $531.04 \pm 60.28$ )ms in the active group were lower than those in the inactive group ( $691.50 \pm 72.44$ )ms, lower than those in the healthy control group ( $933.23 \pm 100.98$ )ms, ( $T=-11.517, p < 0.001$ ). The areas under the ROC curves (AUCs) of T1, T2 and PD values between the active and inactive groups were  $0.976$  (95%CI,  $0.949-0.991$ ),  $0.988$  (95%CI,  $0.970-0.997$ ),  $0.887$  (95%CI,  $0.842-0.923$ ), respectively. The T1, T2 and PD values of the SpA patients were positively correlated with BASDAI scores, and the correlation coefficients (r) were  $-0.771$ ,  $0.914$  and  $0.846$  (all  $p < 0.001$ ), respectively. And positively correlated with SPARCC scores, and the correlation coefficients (r) were  $-0.924$ ,  $0.915$  and  $0.938$  (all  $p < 0.001$ ), respectively.

### **CONCLUSION**

MAGIC imaging can be helpful in quantitatively assessing the activity of sacroiliitis in SpA patients. In particular, T1 and T2 values of high value in distinguishing active sacroiliac arthritis.

### **CLINICAL RELEVANCE/APPLICATION**

MAGIC parameters can be used to quantitatively assess the activity of SpA, and provided imaging bases for the clinical diagnosis of sacroiliitis.

## **W2-SPMK-8 Performance of SPECT MRI for Assessing Spinal Pain Generator Compared to MRI and SPECT CT Alone**

### **PURPOSE**

Back pain is a common disease and affects a large portion of the musculoskeletal patient population. The imaging modalities used to assess the cause of the pain is usually MRI of the spine. More recently the use of SPECT CT has been shown to be useful in assessing the pain generators (3). Unfortunately despite these imaging modalities a large proportion of patients remain symptomatic and do not respond to standard care including physiotherapy and pain management with targeted nerve root injections. The cause of the back pain which can be related to nerve root compression is readily assessed on MRI. However, axial vertebral spondylosis and facet joint disease can be better assessed using SPECT CT. The SPECT CT assesses the osteoblastic activity of the bone and has been shown to demonstrate areas of increased bone remodelling related to stress and degenerative changes. The SPECT component of the study is registered with a low dose CT scan for attenuation correction and localisation. The aim of our study is to assess the utility of retrospective fusion of SPECT and MRI compared to SPECT CT and MRI alone in patients with chronic back pain refractory to initial medical management.

### **METHODS AND MATERIALS**

Between January 2014 and December 2022, 552 patients with chronic back pain initially assessed with spine MRI and SPECT CT were retrospectively reviewed. The initial diagnosis, patients history and management were reviewed. Out of the 552 patients, 138 (25%) were selected for their lack of response to initial management (targeted injection and/or physiotherapy) after 12 months with ongoing back pain. The baseline MRI and SPECT were retrospectively fused using a semi-automated software (Hermes Software®) and images were reviewed by two experienced readers blinded to the initial diagnosis. Potential pain generators were recorded and readers confidence graded using Likert score (graded 1 to 5). Results were compared to MRI and SPECT CT alone.

### **RESULTS**

In our preliminary analysis to date, SPECT MRI detected new sites of pain generators in 105 out of 138 patients (76%) compared to MRI or SPECT CT alone. The readers assessed that in 16 patients (15.3%) this would have potentially altered management. Readers confidence was higher for SPECT MRI compared to MRI and SPECT CT alone.

### **CONCLUSION**

Retrospective fusion of SPECT with MRI improves detection of pain generators in the spine and readers confidence.

### **CLINICAL RELEVANCE/APPLICATION**

The new sites of pain generator assessed on SPECT MRI would potentially impact patient's management. Further studies would be needed to assess if the potential new sites would be the cause of the absence of response to treatment.

## Abstract Archives of the RSNA, 2023

W2-SPMS

### Multisystem Wednesday Poster Discussions

#### Sub-Events

#### W2-SPMS-1 Prospective Evaluation of 3T Whole Body MRI and 18F-FDG PET/CT in the Assessment of Multiple Myeloma

##### Participants

Alice Rossi, MD, Meldola, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the clinical relevance and diagnostic performance of Whole body-MRI (WB-MRI) and fluorine 18 (18F) fluorodeoxyglucose (FDG) PET/CT for the detection of bone marrow infiltration (BMI) in myeloma patients.

##### METHODS AND MATERIALS

Between January 2021 and March 2023, we enrolled myeloma patients in a prospective trial who underwent a 3 Tesla WB-MRI (conducted in accordance with the Myeloma Response Assessment and Diagnosis System, MY-RADS) and PET/CT to assess BMI, para and extramedullary disease, as well as clinico-laboratoristic data collection, all within a month. Two specialized haematologists agreed on management strategies based on International Myeloma Working Group (IMWG) standards after evaluating all the data. This was used to assess the diagnostic performance of WB-MRI and PET/CT.

##### RESULTS

The study included 135 patients (78 Male; mean age, 63 years  $\pm$  12 [SD]) divided into 3 clinical groups: 35 with a newly diagnosed High Risk Smoldering Multiple Myeloma (HR-SMM- group 1); 37 had a newly diagnosed Multiple Myeloma (MM- group 2); 38 were in follow-up after autologous stem cell transplantation and 25 were affected by relapsed/refractory MM with clinical or laboratorist data suspicious for relapse or progression (group 3). HR-SMM analysis showed discordance between the two imaging modalities in 23/35 (66%). 10 diffuse patterns of BMI without any overt focal lesions in WB-MRI (4 correlate with a nonspecific diffusion pattern in PET/CT) and 1 WB-MRI with an equivocal focal lesion emphasized the HR-SMM diagnosis. WB-MRI identified focal bone lesions in 4 patients, 3 of which were confirmed by PET/CT, and resulted in the diagnosis of MM and a change in treatment approach (11%). Analysis of the 100 patients in groups 2 and 3 revealed that WB-MRI and PET/CT were consistent in 79% of the instances and inconsistent in 21% of the cases. In 16/21 (76%, 12 cases of micronodular or diffuse pattern) of these, there was agreement with WB-MRI, whereas in 5/21 (24%) of cases, PET/CT accurately identified 3 positive and 2 negative cases. Overall sensibility and specificity of WB-MRI in the detection of MM was of 94% and 98%, whilst for PET/CT was 81% and 94%. WB-MRI led to an overall changing in therapeutic path in 49/135 cases (36%), PET/CT in 42/135 (31%), WB-MRI plus PET/CT in 53/135 (39%).

##### CONCLUSION

Our data highlight the pivotal role of functional imaging in the evaluation of BMI in myeloma patients with a superior sensibility of WB-MRI. The two techniques may play a complimentary role in cases of suspected relapsed or progressing MM.

##### CLINICAL RELEVANCE/APPLICATION

Our prospective trial supports the utmost role of WB-MRI and FGD PET/CT in the assessment of patients affected by high risk smoldering multiple myeloma and multiple myeloma at both diagnosis and relapse.

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## Abstract Archives of the RSNA, 2023

W2-SPNMMI

### Nuclear Medicine & Molecular Imaging Wednesday Poster Discussions

#### Sub-Events

**W2-SPNMMI-1** **The Impact of Preoperative [18F]FET-PET in Former Low Grade Glioma: Reclassification According to WHO CNS 2021**

#### PURPOSE

Amino acid PET with [18F]-fluoroethylthiosine (FET) is frequently used in the initial assessment of high grade glioma and suspected tumor recurrence. In low-grade gliomas, [18F]FET-PET can identify metabolically active tumor components and thus determine the surgical strategy. This study sheds light on the prognostic value of [18F]FET-PET for therapy-naive patients with low-grade gliomas.

#### METHODS AND MATERIALS

Retrospectively, all therapy-naive patients from 01/2012-03/2022 with [18F]FET-PET before microsurgical resection, diagnosed as former low-grade gliomas (WHO grade II according to WHO classification at the date of diagnosis) were included in the analysis. Diagnosis was updated following WHO CNS 2021. The [18F]FET-PET/CT or PET/MRI were quantitatively evaluated. In cases in which dynamic imaging was available, late uptake kinetics were graded as increasing vs. indifferent/decreasing. The primary oncologic outcome measure was progression-free survival (PFS).

#### RESULTS

Out of 103 patients, 26 patients were diagnosed with an oligodendroglioma and 57 patients with a WHO grade 2 astrocytoma IDH-mutated. 20 patients initially diagnosed as IDH-wildtype low grade tumors, were reclassified as IDH-wild-type glioblastoma following the new WHO 2021 classification. TBRmax values are significantly higher in oligodendrogliomas compared to IDH-mutated astrocytoma ( $p < 0.001$ ). Quantitative uptake parameters cannot predict the IDH status in this cohort. Increasing late kinetics is associated with a significantly longer PFS compared to indifferent/decreasing kinetics ( $p = 0.015$ ) in the entire cohort. In the subgroup of IDH-mutated astrocytomas without adjuvant treatment, patients with a TBRmax  $> 1.9$  showed significantly longer PFS compared to patients with lower TBRmax ( $p < 0.01$ ).

#### CONCLUSION

Preoperative [18F]FET-PET aids in tumor characterization in low-grade gliomas and can provide prognostic metrics.

#### CLINICAL RELEVANCE/APPLICATION

Prospective studies need to demonstrate whether [18F]FET-PET can be used as a decision support for or against adjuvant therapy after microsurgical resection.

**W2-SPNMMI-2** **Association of ctDNA Levels and PET Radiomics Features in Patients with HPV-positive Head and Neck Squamous Cell Carcinoma**

#### Participants

Mitsuaki Tatsumi, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Circulating tumor DNA (ctDNA), which is circulating in the blood after being shed from cancer cells in the body, has recently gained attention as an excellent tumor marker. The purpose of this study was to evaluate if ctDNA levels associated with PET radiomics features in patients (pts) with human papillomavirus (HPV)-positive head and neck squamous cell carcinoma (HNSCC).

#### METHODS AND MATERIALS

This study included 50 pts with oropharyngeal SCC (OPSCC) and 5 with SCC of unknown primary (SCCUP) before treatment. All of them had blood sampling to test ctDNA levels and FDG PET-CT examinations. ct-HPV type16 DNA (ctHPV16DNA) was analyzed as ctDNA using the droplet digital PCR system. Radiomics features in PET-CT included SUVmax, metabolic tumor volume (MTV), and texture features of the primary tumor (PT) and the largest metastatic lymph node (LN), and MTV of whole-body lesions (wbMTV) in each pt. Fifty-six TFs were evaluated in this study, and entropy, homogeneity, low- and high- gray-level zone emphasis (LGZE, HGZE), and short- and long- run emphasis (SRE, LRE) were included as recommended by Orhac, et al (JNM 2014). ctHPV16DNA levels were compared to TFs of PTs and other PET parameters in OPSCC pts (Group A) or TFs of the largest lesions (PTs or LNs) and other PET parameters in OPSCC and SCCUP pts (Group B). Spearman rank correlation test and multiple regression analysis were used to confirm the associations between ctHPV16DNA levels and PET parameters.

#### RESULTS

ctHPV16DNA levels correlated with wbMTV ( $r = 0.52$  and  $0.53$ , respectively,  $p < 0.0005$  for both), but not with SUV or MTV in Group A and B. In Group A, ctHPV16DNA levels exhibited a weak negative correlation with LGZE ( $r = -0.35$ ,  $p < 0.05$ ) among 56 TFs evaluated. In Group B, the largest lesions consisted of 40 PTs and 15 LNs (10 from OPSCC). ctHPV16DNA levels exhibited a weak negative correlation with LGZE ( $r = -0.36$ ,  $p < 0.01$ ) or contrast ( $r = -0.29$ ,  $p < 0.05$ ). Multiple regression analysis revealed that

wbMTV ( $p < 0.0001$ ) and HGZE ( $p < 0.005$ ) were the significant factors for ctHPV16DNA levels in Group B. The parameter ctHPV16DNA/wbMTV to reduce the effect of tumor volume had a weak negative correlation with LGZE ( $r = -0.29$ ,  $p < 0.05$ ) in Group B. These results were not obtained in Group A.

#### **CONCLUSION**

s This study demonstrated that ctHPV16DNA levels correlated with the whole-body tumor burden visualized on FDG PET-CT in pts with HPV-positive HNSCC. ctHPV16DNA levels exhibited a weak correlation with the tumor heterogeneity, especially in the large OPSCC or LN lesions. This study provides new insights into the quantitative connection between gene expression and imaging biomarkers.

#### **CLINICAL RELEVANCE/APPLICATION**

ctHPV16DNA levels were demonstrated to correlate with the whole-body tumor burden and tumor heterogeneity in HPV-positive HNSCC.

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## Abstract Archives of the RSNA, 2023

W2-SPNPM

### Noninterpretive Skills (Beyond Imaging) Wednesday Poster Discussions

#### Sub-Events

#### **W2-SPNPM- An Accelerating Emergency: Trends in Nationwide Emergency Department Imaging Volume from 2008 to 2020** 1

#### Participants

Husayn Ramji, MD, Oklahoma City, OK (*Presenter*) Nothing to Disclose

#### PURPOSE

The emergency department (ED) is an essential provider of urgent and emergent care worldwide. As the demand and use of the ED has increased, so has the volume of patients seeking care and receiving diagnostic imaging. This study aims to benchmark multi-year multi-modality trends in imaging utilization in progressively overcrowded EDs, in order to inform future imaging guidelines, awareness, and stewardship efforts.

#### METHODS AND MATERIALS

This IRB exempt retrospective study utilized imaging data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) for years 2008-2020. Data for X-ray, CT, Ultrasound, MRI, and the summation of all modalities in an "Any" category, as well as their year-by-year utilization rates, underwent normality testing followed by least squares regression analysis. Data was weighted, and analysis was performed using JMP Pro (SAS Institute Inc, Clara, NC) and SPSS (SPSS Inc, Chicago, IL).

#### RESULTS

From 2008-2020, there were statistically significant increases in the number (in thousands) of X-ray, CT, MRI, Ultrasound, and summation of Any imaging taking place in the ED. However, there were only statistically significant increases in utilization rates for CT (14.60% to 21.61%, +48.0%,  $p < 0.001$ ), MRI (0.58% to 1.04%, +79.3%,  $p < 0.001$ ), Ultrasound (3.1% to 5.7%, +83.8%,  $p < 0.001$ ), and Any (46.61% to 53.39%, +14.6%,  $p < 0.001$ ). The rate of utilization of X-ray did increase but was not found to be significant (35.52% to 37.57%, +5.7%,  $p > 0.05$ ).

#### CONCLUSION

Multiple modalities have seen significant increases in utilization in the ED from 2008-2020. Possible factors contributing to these increases includes increased access to technology, duplicate scans, challenges in health information exchange, communication or information gaps, or even ordering physician preference. Future studies utilizing NHAMCS data could consider stratifying the data by geographic region, patient variables such as insurance status, and comparing modality utilization by indication.

#### CLINICAL RELEVANCE/APPLICATION

Identifying trends in imaging utilization in nationwide cohorts can help inform future imaging stewardship guidelines and awareness campaigns. Further study should elucidate the underlying contributing factors to increase imaging in EDs nationwide.

#### **W2-SPNPM- An Examination of NIH Funded Radiology Research between Clinical Radiologists and Non-Clinicians** 2

#### PURPOSE

Research in radiology is conducted by both clinical radiologists and non-clinical researchers. Little is currently known about the balance of research grant funding between clinician and non-clinician researchers, and the scale of grants awarded to clinician-scientists. This project seeks to characterize differences in funding and funding trends between clinician and non-clinician scientists in radiology.

#### METHODS AND MATERIALS

Data on National Institutes of Health (NIH) grants awarded for all radiology projects were obtained from the NIH Reporter from 2012 through early 2023. A list of all practicing clinical radiologists was obtained from the National Plan and Provider Enumeration System (NPPES) from the Centers for Medicare and Medicaid Services. Using NPPES data, all available NIH grants were categorized based on whether the principal investigator was a practicing/billing radiologist.

#### RESULTS

A total of \$5.01 Billion of NIH grant funding was awarded for radiology research between 2012 and early 2023 across a total of 11,056 projects, awarded to a total of 1762 unique principal investigators. Among those principal investigators, 264 (14.98%) were practicing radiologists. A total of \$700 million in financing was provided to 1613 projects led by practicing radiologists, accounting for 13.97% of all funds awarded for radiology research by the NIH. Clinician and non-clinician researchers received a median of four grants, with a mean of 6.2 and 6.3 grants and mean grant funding of \$2.6 million and \$2.9 million, respectively. While increased grant funding was seen across all radiology projects, the greatest growth was seen among clinician-researchers, with the number of grants and total funding increasing from \$40.7 million across 102 grants in 2012 to \$93.9 million across 224 grants in 2022. Among clinician researchers, 192 (72.7%) identify as male, and the remaining 72 (27.3%) identify as female. Primary specialties of clinician researchers within radiology are as follows: 138 (52.3%) within diagnostic radiology, 12 (4.5%) within interventional

radiology, and 114 (43.2%) within radiation oncology.

## **CONCLUSION**

As imaging volumes continue to rise, with greater pressure placed on meeting the increased imaging volume demands, clinician scientists continue to offer great value and contribute significantly to the scientific advance of radiology. Despite comprising a relatively small percentage of grants and funding amongst the overall radiology specialty, clinical radiologists are seeing stronger increases in grant funding in recent years.

## **CLINICAL RELEVANCE/APPLICATION**

The proportion of NIH grant funding to clinical radiologists relative to the whole specialty, as well as funding levels and trends over time are currently not well known.

## **W2-SPNPM- Accuracy of Disclosed Financial Relationships by Physicians publishing in Radiology Journal in 2021**

3

## **PURPOSE**

Transparency of physician-industry relationships is required by law. The United States Congress passed the Physician Payments Sunshine Act in 2010, which requires drug, device, and medical supply manufacturers to report payments over a certain amount (\$12.69 for 2023) made to healthcare providers. The physicians are expected to disclose payments received from the medical industry when publishing. This study aims to assess the accuracy and completeness of self-disclosures by authors in the journal Radiology.

## **METHODS AND MATERIALS**

Manuscripts published in Radiology journal between January 1 and May 31, 2021 were retrospectively reviewed, and self-reported author disclosures were cross-referenced with the Open Payments database between 2019-2021.

## **RESULTS**

A total of 68 articles having 513 authorships by US physicians were published in Radiology journal during the inclusion period, out of which 199 (39 %) received payments from the industry. There were 2918 payments totaling \$32,826,946.99 made to these 199 authorships. The median total amount received per authorship was \$10,598.7 (IQR = \$748.70 - \$120,386.01). Out of the 199 authorships receiving payments, 128 (64 %) did not disclose OPD-recorded relationships. 51 (26 %) authorships disclosed some of the OPD-recorded payments and 20 (10 %) disclosed all payments. The total undisclosed payments amounted to \$15,452,628.72 in research, \$4,579,475 in ownership and \$3,102,833.69 in general payments with a median undisclosed amount per authorship being \$2,726.

## **CONCLUSION**

Our study shows that over a recent six-month period, 64 % of US physician authors with manuscripts published in Radiology did not disclose any industry relationship and another 26% disclosed only some of their payments. There is a significant discrepancy between physician authors' financial relationships with industry and their self-reported disclosures of the same.

## **CLINICAL RELEVANCE/APPLICATION**

Publishing physicians are expected to disclose financial relationships with the medical industry. Our study uncovers a significant lack of transparency, both in terms of the number of authors who did not disclose and the total undisclosed amount, from physician authors of Radiology in 2021.

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## Abstract Archives of the RSNA, 2023

W2-SPNR

### Neuroradiology Wednesday Poster Discussions

#### Sub-Events

#### W2-SPNR-1 **Impact of IA on Care Metrics for Stroke Patients during the COVID19 Pandemic: A Retrospective Analysis**

##### PURPOSE

The COVID-19 pandemic has presented unprecedented challenges to the healthcare system, including the management of time-dependent pathologies such as stroke. We aimed to evaluate the impact of implementing the AI software, RAPID.AI, for image analysis in patients with stroke due to large cerebral vessel occlusion (LVO) during the pandemic.

##### METHODS AND MATERIALS

We created two groups of patients with LVO who received intravenous reperfusion therapy plus endovascular (TEV) or direct TEV. Group 1 included patients admitted between January 2019 and June 2020, and Group 2 included patients admitted from July 2020 to December 2021 and studied with RAPID.AI. We analyzed demographic data, risk factors, temporal metrics, National Institute of Health Stroke Scale (NIHSS) score at admission, modified functional Rankin Scale (mRS) score at 90 days, and compared data according to arrival time.

##### RESULTS

Group 1 comprised 153 patients, and Group 2 comprised 133 patients. No significant differences were identified regarding age, gender, admission NIHSS, or risk factors. However, the median door-to-image time was significantly shorter in Group 2 (19 minutes vs. 25 minutes,  $p < 0.0001$ ), and the door-recanalization time was also shorter in Group 2 (73 minutes vs. 85 minutes,  $p = 0.042$ ). Between 8:00 a.m and 8:00 p.m patients admitted in Group 2 had a shorter imaging time despite including a chest CT. Patients admitted to Group 2 between 8:01 p.m. and 7:59 a.m. had longer onset-admission times, higher NIHSS scores, and lower proportions of mRS = 2 at 90 days. As a limitation to the study, the measures implemented to shorten the door-image time were not analyzed.

##### CONCLUSION

Our study demonstrates that the measures implemented during the pandemic together with the use of AI for image analysis in stroke patients during the COVID-19 pandemic resulted in improved door-to-image and door-to-recanalization metrics. Additionally, the use of AI compensated for delays in patient arrival, providing specific information for decision-making. These findings highlight the potential utility of AI in improving stroke care and outcomes during times of crisis.

##### CLINICAL RELEVANCE/APPLICATION

AI software can improve care metrics for stroke patients with large cerebral vessel occlusion, enhancing decision making.

#### W2-SPNR-10 **Radiomics Features on Computed Tomography Combined with Clinical and Radiological Factors Predicting Hemorrhage Expansion**

##### PURPOSE

To develop an optimal model based on either intra- and peri-hematoma radiomics features as well as clinical data to predict hematoma expansion (HE) and compare their prediction performance.

##### METHODS AND MATERIALS

Clinical and radiological data of 406 ICH patients were collected retrospectively, who underwent initial NCCT within 6 hours of ictus and follow-up CT within 48 hours after initial NCCT. The data were randomized into a training set and a testing set at a ratio of 7:3. Radiomics features were extracted from the intra- and perihematoma regions. Univariate and multivariable logistic regression analyses were implemented to screen clinical and radiological factors. Then radiomics (single or combined) models, a radiomics-radiologic model, and an integrated model were constructed in the training cohort using FAE. The receiver operating characteristic curve and Delong test evaluated the predictive performance of radiomics features from different regions.

##### RESULTS

The predictive performance of intra- and perihematoma features was comparable in the training area under the receiver operating characteristic curve (AUC) 0.613 versus 0.645, which had no statistical difference. By incorporating intra- and perihematoma features, the model achieved an AUC of 0.620 in the test cohort. Regression analysis identified 4 risk factors, including 2 radiographic features and 3 clinical features. The radiological-radiomics (RR) model using radiographic features combined with the radiomics features achieved an area under the curve (AUC) of 0.744 in the test set. After incorporating the 2 clinical predictors and RR, the AUC of the radiologic-radiomics-clinical (RR-CL) model for discriminating early HE was 0.768. The RR-CL model's prediction performance was better than the RR model, while the predictive nomogram combining the radiomics features with clinical-radiological characteristics performed best. Delong test proved that the performance of radiomics-based features was boosted by incorporating radiological factors, with the volume of hematoma and blend sign ( $p < 0.05$ ). While, the clinical factors, with time from onset to scan, NEUT and PT being the most important contributors, made the RR-CL equivalent to RR model in diagnostic efficiency.

## CONCLUSION

s NCCT models based on multivariable, clinical, and radiological features could improve the discrimination of early HE. The combined model was the best-recommended model to identify ICH patients at risk of early HE. And NEUT in the model may indicate early inflammatory reaction within perihematomal.

## CLINICAL RELEVANCE/APPLICATION

The combined model was the best-recommended model to identify ICH patients at risk of early HE.

## W2-SPNR-11 Comparison of Ultra-High-Resolution and Normal-Resolution CT-Angiography for Intracranial Aneurysm Detection in Patients with Subarachnoid Hemorrhage

### PURPOSE

Ruptured intracranial aneurysms (IAs) are the leading cause for atraumatic subarachnoid hemorrhage. In case of aneurysm rupture, patients may face life-threatening complications and require aneurysm occlusion. Detection of the aneurysm in CT imaging is therefore essential for patient outcome. This study provides an evaluation of the diagnostic accuracy of Ultra-High-Resolution CT-Angiography (UHR-CTA) and Normal-Resolution CT-Angiography (NR-CTA) concerning IA detection and characterization.

### METHODS AND MATERIALS

Consecutive patients with atraumatic subarachnoid hemorrhage who received Digital Subtraction Angiography (DSA) and either UHR-CTA or NR-CTA were retrospectively included. Three readers evaluated CT-Angiography datasets regarding image quality, diagnostic confidence and presence of IAs. Sensitivity and specificity were calculated on patient-level and segment-level with DSA-imaging serving as reference standard. Additionally, the CTA patient radiation exposure (effective dose) was assessed and compared.

### RESULTS

108 patients were identified (mean age=57.8±14.1years, 65 women). UHR-CTA revealed significantly higher image quality and diagnostic confidence ( $p<0.001$ ) for all readers and significantly lower effective dose ( $p<0.001$ ). Readers correctly classified =55/56 patients on UHR-CTA and =44/52 patients on NR-CTA. We noted significantly higher patient-level sensitivity for UHR-CTA compared to NR-CTA for all three readers (Reader 1: 41/41[100%] vs. 28/34[82%], Reader 2: 41/41[100%] vs. 30/34[88%], Reader 3: 41/41[100%] vs. 30/34[88%],  $p=0.04$ ). Segment-level analysis also revealed significantly higher sensitivity for UHR-CTA compared to NR-CTA for all three readers (Reader 1: 47/49[96%] vs. 34/45[76%], Reader 2: 47/49[96%] vs. 37/45[82%], Reader 3: 48/49[98%] vs. 37/45[82%],  $p=0.04$ ). Specificity was comparable for both techniques.

### CONCLUSION

s We found Ultra-High-Resolution CT-Angiography to provide higher sensitivity than Normal-Resolution CT-Angiography for the detection of intracranial aneurysms in patients with aneurysmal subarachnoid hemorrhage while improving image quality and reducing patient radiation exposure.

## CLINICAL RELEVANCE/APPLICATION

In addition to achieving the universally sought-after reduction of radiation dose, the increased detection of intracranial aneurysms in UHR-CT imaging may facilitate therapeutic decisions and hence improve patient outcome.

## W2-SPNR-12 Delay Filling of Intracranial Blood Flow Distal to Thrombus Predict Clinical Outcome after Endovascular Thrombectomy

### PURPOSE

Delay filling of intracranial blood flow evaluated by multiphase CT angiography (mCTA) can provide complementary information of hemodynamics. To investigate the relationship between phase of delay filling (PDF) and thrombolysis before EVT, and whether phases of delay filling (PDF) can help to predict clinical outcomes of patients with endovascular thrombectomy (EVT).

### METHODS AND MATERIALS

In this retrospective study, patients with AIS treated with EVT were enrolled. All the patients underwent mCTA on admission. Based on the PDF, patients were classified into red PDF group (PDF with red on ColorViz of mCTA) and non-red PDF group (PDF with green or blue on ColorViz of mCTA). PDF of mCTA was acquired on the FastStroke research prototype. Chi-square test and Mann-Whitney test was applied to compare the difference between two groups. P value  $<0.05$  was considered significant for all tests.

### RESULTS

A total of 99 patients underwent EVT were included. In red PDF group, the percentage of thrombolysis before EVT was higher than non-red PDF group (8/28[28.57%] vs 2/60[3.33%],  $P = 0.005$ ). Mismatch volume and Tmax > 10 seconds volume of red PDF group were lower than non-red PDF group (Mismatch volume: 129.00 [59.00-180.00] ml vs 152.80 [112.90-214.43] ml;  $Z = -2.209$ ,  $P = 0.027$ ; Tmax > 10 seconds volume: 41.00 [0.00-76.00] ml vs 59.00 [24.00-98.30] ml;  $Z = -2.285$ ,  $P = 0.022$ ). Clinical outcomes of red PDF group were more favourable than non-red PDF group (Score 6: 1 [2.94%] versus 5 [8.77%]; Score 5: 4 [11.76%] versus 5 [8.77%]; Score 4: 5 [14.72%] versus 5 [8.77%]; Score 3: 1 [2.94%] versus 18 [31.58%]; Score 2: 11 [32.65%] versus 10 [17.55%]; Score 1: 9 [26.47%] versus 13 [22.81%]; Score 0: 3 [8.82%] versus 1 [1.75%];  $P = 0.041$ ).

### CONCLUSION

s PDF was associated with thrombolysis before EVT, mismatch volume and Tmax > 10 seconds volume. More favourable outcomes was found in patients with red PDF than patients non-red PDF.

## CLINICAL RELEVANCE/APPLICATION

Phase of delay filling depicts the compensatory capacity of intracranial blood flow, and it may be associated with thrombolysis before EVT. Moreover, later delay filling of blood flow may indicate the poor outcome of patients.

## W2-SPNR-13 3.0T Three-dimensional High Resolution Vessel Wall MRI for Displaying Lenticulostriate Artery Changes of Cerebral Small Vessel Disease

Participants  
Yukun Zhang, Dalian, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To observe the value of 3.0T three-dimensional high resolution vessel wall MRI (3D HR-VMI) for displaying lenticulostriate artery (LSA) changes of cerebral small vessel disease (CSVD), and to explore the feasibility of taking LSA changes as imaging markers of CSVD.

#### **METHODS AND MATERIALS**

Fifty-eight CSVD patients (CSVD group, 26 males and 32 females with an average age of  $63.0 \pm 7.2$  years) and 35 cases of other diseases with CSVD total burden scores of 0 (control group, 15 males and 20 females with an average age of  $62.6 \pm 7.2$  years) were enrolled. The imaging characteristics, including the number, length, and tortuosity of LSA were observed on 3D HR-VMI reconstruction images (Fig.1). The general information and imaging characteristics were compared between 2 groups and logistic regression analysis was performed, the independent risk factors for the occurrence of CSVD and CSVD total burden scores were evaluated (Fig.2).

#### **RESULTS**

There were significant differences in the incidence of hypertension and the numbers of LSA between groups (both  $P < 0.05$ ). CSVD total burden scores were negatively correlated with the number of LSA in CSVD patients ( $r = -0.48$ ,  $P < 0.001$ ). Hypertension and decreased number of LSA were independent risk factors for the occurrence of CSVD (Fig. 3), while aging, alcohol consumption and a decrease in the number of LSA were independent risk factors for the increase of CSVD total burden scores (Fig. 4).

#### **CONCLUSION**

s 3.0T 3D HR-VMI could clearly display LSA changes of CSVD. Decreased number of LSA was an independent risk factor for the occurrence of CSVD and increased CSVD total burden scores, which could be taken as an imaging marker of CSVD.

#### **CLINICAL RELEVANCE/APPLICATION**

Early detection and characterize LSA in the brain may provide valuable information on risk stratification and therapeutic interventions for patients with cerebral small vessel disease.

#### **W2-SPNR-14 Predictive Value of Intracranial Atherosclerosis Coexisted with Atherosclerotic Plaques in Different Carotid Segments for Subsequent Vascular Event: A Magnetic Resonance Imaging Study**

Participants  
Richen Zhao, Nanjing, China, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study aimed to examine the association between coexisting intracranial and extracranial carotid artery atherosclerotic plaque characteristics among different carotid segments, as detected using MR vessel wall imaging, and subsequent vascular events.

#### **METHODS AND MATERIALS**

Patients who recent cerebrovascular symptoms in anterior circulation and at least one carotid plaque were consecutively enrolled. All patients underwent multi-contrast MR vessel wall imaging for extracranial carotid arteries and 3D time-of-flight MR angiography for intracranial arteries at baseline. After baseline examination, all patients were followed-up for at least 1 year to record the vascular events. The coexisting cerebrovascular atherosclerosis was defined as the presence of atherosclerosis in both intracranial artery in anterior circulation and extracranial artery. Univariate and multivariate Cox regressions were used to calculate the hazard ratio (HR) and corresponding 95% confidence interval (CI) of co-existing plaques in predicting subsequent vascular events.

#### **RESULTS**

In total, 122 patients (mean age:  $62.2 \pm 11.9$  years; 89 males) were recruited. During the median follow-up time of 12.0 months, 36 (29.5%) patients experienced vascular events. Coexisting intracranial artery stenosis and atherosclerotic plaques in carotid bulb segment of carotid artery (HR, 2.51; 95% CI, 1.14-5.54;  $P = 0.023$ ) was significantly associated with subsequent vascular events, respectively. After adjusting for baseline confounding factors, this association remained statistically significant (HR = 3.08, 95% CI 1.18-8.07,  $P = 0.022$ , respectively). No significant association was found between intracranial stenosis coexistent with atherosclerotic plaque in other segments of carotid artery and vascular events (all  $P > 0.05$ ).

#### **CONCLUSION**

s Coexisting intracranial artery stenosis and atherosclerotic plaque in the segment of carotid bulb was independently associated with subsequent vascular event.

#### **CLINICAL RELEVANCE/APPLICATION**

Our findings indicate that coexisting intracranial artery stenosis and atherosclerotic plaque in the segment of carotid bulb was independently associated with subsequent vascular event, indicating that coexisting intracranial stenosis and atherosclerotic plaque in carotid bulb may have a higher predictive value for vascular events than coexisting plaques in other carotid artery segments. Our findings indicate that it is valuable to assess the segmental distribution of coexisting intracranial and extracranial atherosclerosis.

#### **W2-SPNR-2 Low Proportion of Calcification in Large Volume Plaque as a Marker of Carotid Plaque Vulnerability in Embolic Stroke of Undetermined Source**

Participants  
Yu Sakai, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Current focus has centered on non-calcified inflammatory plaque components [intraplaque hemorrhage (IPH) and lipid rich necrotic core (LRNC)] in nonstenotic carotid plaque in patients with embolic stroke of undetermined source (ESUS). Although calcified

inflammatory plaque components, such as spotty calcifications, are associated in acute coronary syndromes, its role in ESUS-carotid plaque is unclear. We investigated the relationship of spotty calcifications and low calcific plaque burden in nonstenotic carotid plaque ipsilateral to stroke side in patients with ESUS.

## **METHODS AND MATERIALS**

Calcific carotid plaques were identified on neck CTAs from a retrospective dataset comprised of patients with unilateral anterior circulation ESUS. Blinded to stroke side, each carotid plaque calcification was manually scored (e.g., arc), annotated using 3D-Slicer, and segmented using a semi-automated plaque composition software (Elucid Bioimaging). Plaques were scored for presence of a spotty calcification (calcification <3mm in length and <90° arc of the lumen). IPH and LRNC volumes are summed as plaque inflammation (Inflmvol). Plaque burden (PB) is the sum of all plaque components (IPH, LRNC, calcification, matrix). Subgroup analysis of plaques with high plaque burden (HPB) was performed and defined as all cases above the median PB (median=858mm<sup>3</sup>). Plaques were defined as low relative calcific PB (Low%Calc) if the calcific plaque volume comprised  $\geq 2\%$  of total PB (1st quartile). Mann-Whitney U and Chi-squared tests were performed to test plaque features ipsilateral versus contralateral to stroke side.

## **RESULTS**

86 patients met criteria (mean age= 66.8; N=41 women). No statistically significant differences were observed between carotid plaques ipsilateral versus contralateral to stroke side for presence of spotty calcifications ( $p=0.42$ ), Inflmvol ( $p=0.70$ ), or Low%Calc plaque ( $p=0.26$ ). Among plaques with HPB (N=66), there was no significant difference between ipsilateral versus contralateral plaques with spotty calcifications ( $p=0.76$ ) or Inflmvol ( $p=0.57$ ). Plaques identified as Low%Calc ipsilateral to stroke side were significantly more frequent than on the contralateral side [10/11 (91%),  $p = 0.02$ ].

## **CONCLUSION**

s Plaques with low relative calcific plaque burden may be a stronger vulnerable carotid plaque feature in patients with ESUS rather than the presence of spotty carotid plaque calcifications.

## **CLINICAL RELEVANCE/APPLICATION**

Volumetric based categories of plaque classifications should be considered when determining potential imaging biomarkers of nonstenotic culprit carotid plaque to capture the multidimensional and complex patterns of vulnerable plaque in patients with ESUS.

## **W2-SPNR-3 Deep Learning-enabled Identification of Large Vessel Occlusion on Four-dimensional Computed Tomography Angiography(4D-CTA)**

### **PURPOSE**

To assess the role of deep learning in aiding the detection of large vessel occlusion (LVO) on four-dimensional computed tomography angiography (4D-CTA).

### **METHODS AND MATERIALS**

This retrospective study involved 104 LVO patients and 105 non-LVO patients in the construction of the deep learning models. Another 30 LVO patients and 31 non-LVO patients formed the time-independent validation set. Four phases (arterial phase P1, arterial-venous phase P2, venous phase P3 and late venous phase P4) extracted from 4D-CTA were combined using two different input methods, namely combined input and superimposed input. Totally 26 deep learning models were constructed using a modified HRNet network. Assessment metrics included the areas under the curve (AUC), accuracy, sensitivity, specificity and F1 score. Kappa analysis was performed to assess inter-rater agreement between the best model and radiologists of different seniority.

### **RESULTS**

The P1+P2 model (combined input) had the best diagnostic performance. In the internal validation set, the AUC was 0.975 (95%CI: 0.878-0.999), accuracy was 0.911, sensitivity was 0.889, specificity was 0.944, and the F1 score was 0.909. In the time-independent validation set, the model demonstrated consistently high performance with an AUC of 0.942 (95%CI: 0.851-0.986), accuracy of 0.902, sensitivity of 0.867, specificity of 0.935, and an F1 score of 0.901. The best model showed strong consistency with the diagnostic efficacy of three radiologists of different seniority ( $k=0.84, 0.80, 0.70$  for 8, 5, and 1 year of diagnostic experience, respectively).

### **CONCLUSION**

s The proposed deep learning algorithm derived from 4D CTA can be very highly effective in detecting LVO, alerting radiologists to speed up the diagnosis. In particular, the combination of the arterial and arterial-venous phases can improve detection efficacy.

### **CLINICAL RELEVANCE/APPLICATION**

We introduced a high-performance deep learning algorithm for detecting large vessel occlusions in 4D-CTA, showing that the combination of multiple phases improved the detection of LVO and the combination of the arterial-venous phase with the arterial phase yielded the best deep learning model performance. The diagnostic efficacy of the best deep learning model was in good agreement between radiologists of different years of experience and was slightly better than that of less experienced trainee radiologist. Our results showed that deep learning can be very effective in facilitating accelerated screening and diagnosis of LVO in urgent clinical settings.

## **W2-SPNR-4 Investigation of Radiologic Characteristics between Branch Atheromatous Disease and Cerebral Small Vessel Disease: A High-resolution Magnetic Resonance Vessel Wall Imaging Study**

Participants  
Peipei Chang, Dalian, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To compare lenticulostriate arteries (LSAs) morphology and other imaging features of branch atheromatous disease (BAD) and cerebral small vessel disease (CSVD) and to investigate whether the imaging features can distinguish the different etiological mechanisms of cerebral infarction in basal ganglia.

### **METHODS AND MATERIALS**



Fifty patients with suspected acute cerebral infarction in the LSA territory were prospectively enrolled. All subjects underwent multimodal magnetic resonance imaging (MRI) examination and were divided into BAD and CSVD groups, depending on whether there was plaque in the middle cerebral artery by high-resolution vascular wall MRI (3D HR VMI). The morphological characteristics of visible LSAs (the number of stems and branches, length, distance, and tortuosity) were quantitatively analyzed by two radiologists. Typical image features indexes of CSVD including white matter hyperintensities (WMHs), lacunes, enlarged perivascular spaces (EPVS), microscopic bleedings (CMBs) were assessed. Global cerebral blood flow (CBF) values obtained by arterial spin labeling (ASL) were used to analyze the whole brain differences of perfusion between two groups. To assess the imaging parameters between groups, independent-samples t test, nonparametric tests and Chi-square test were used. Binary logistic regression was used to explore the influencing factors of BAD and CSVD.

## RESULTS

There were significant differences in the sex, MRs (Modified Rankin Scale) and NIHSS (National Institutes of Health Stroke Scale) scores between the two groups, showing more significant neurological impairment in BAD group. The LSA branches of BAD were significantly reduced compared with the contralateral side, while with no significant difference to those observed in the CSVD group. CSVD was more likely to have EPVS. The length and distance of LSAs were influencing factor of BAD and CSVD.

## CONCLUSION

There are fewer LSA branches in BAD, and the length and distance of LSA are the influencing factors of BAD and CSVD.

## CLINICAL RELEVANCE/APPLICATION

The morphological characteristics of LSAs and image features indexes of CSVD might provide method to distinguish the different underlying mechanisms of cerebral infarction in basal ganglia.

## W2-SPNR-5 Clinical Evaluation of Deep-learning Model for Classifying Stroke Patients of Emergent Large Vessel Occlusion on Non-contrast CT

### PURPOSE

The purpose of this clinical study is to evaluate the clinical applicability of a deep learning (DL) model that classifies patients with emergent large vessel occlusion (ELVO) through analysis of non-contrast CT (NCCT) images only. In clinical practice, if patients of suspected ELVO can be quickly screened through analysis of only NCCT images that can be scanned without contrast media, it has the advantage of improving the prognosis by reducing the time required for treatment of ELVO patients. Therefore, clinical effectiveness was evaluated by comparing the accuracy to classify ELVO patients through reading NCCT images with or without referring to the result of DL-based software by clinician.

### METHODS AND MATERIALS

The NCCT of 744 patients (ELVO positive: 519 cases) were used for learning the DL model. The primary endpoint of clinical test was the statistical difference of the sensitivity and specificity of ELVO patient classification according to whether or not the DL model results were referenced. 477 patients (ELVO positive: 112 cases) were registered in the clinical evaluation, and a reference standard was created based on the final diagnosis results. A wash-out period of 2 weeks was set between the two readings depending on whether or not the DL model was referenced, and both results of reading were derived by the consensus of five stroke experts. The sensitivity and specificity were calculated by comparing the both readings of consensus to the reference standard. Finally, through McNemar's test, statistical differences were evaluated according to whether or not the results of the DL model were referenced.

### RESULTS

In the classification result of ELVO patient, the sensitivity of experts' consensus was 75.89% when reading by only NCCT and 91.96% when the result of DL model was referred. In addition, the specificity of the experts' consensus was 83.01% when read only by NCCT and 92.6% when referring to the DL model results. As the result of the McNemar's test to compare the primary endpoint, it was confirmed that both sensitivity ( $p=0.0009$ ) and specificity ( $p<0.0001$ ) were significantly improved when the results of the DL model were referred to. Therefore, the primary endpoint of the clinical test was successfully accomplished.

### CONCLUSION

It was confirmed that the accuracy was significantly higher when referring to the results of the DL-based software in NCCT-based ELVO patient classification. Therefore, it is highly recommended to use for assisting clinicians in clinical environment.

### CLINICAL RELEVANCE/APPLICATION

This deep-learning model has been integrated into the commercial Heuron ELVO software. It will be a useful tool for clinicians to make fast decision, especially, it will be valuable in remote regions where clinical expert may be limited.

## W2-SPNR-6 Single-phase plus Dynamic CTA Accurately Identifies Favorable Outcomes in Patients with Acute Ischemic Stroke

### PURPOSE

Sufficient collateral blood supply is crucial for favorable outcomes in patients with acute ischemic stroke (AIS) after endovascular treatment. In clinical practice, imaging of collaterals is often performed with single-phase computed tomography angiography (CTA) that is unable to precisely time the acquisition time-points, leading to the mislabeled collateral status. Dynamic CTA (dCTA) derived from CT perfusion source images is a novel method that contains more time points than single-phase CTA, and allows complete tracking of the transit of contrast bolus. We hypothesized that single-phase plus dCTA would predict clinical outcomes better than single-phase CTA.

### METHODS AND MATERIALS

Patients with AIS due to proximal middle cerebral artery occlusion or internal carotid artery occlusion after endovascular treatment were included. Patients underwent non-contrast CT, whole-brain CT perfusion, and single-phase CTA. dCTA were computed from CT perfusion source images with KWIA denoising, vessel filtering and MIP along 3 views. The pial collateral status was scored using Alberta Stroke Program Early CT Score on collaterals with single-phase CTA, dCTA, and single-phase plus dCTA. Good clinical outcomes included 90-day modified Rankin Scale (mRS) score of 0-2. Association between the pial collateral status and functional

outcomes was assessed using multivariable binary logistic regression. Then, hypoperfusion intensity ratio (HIR) were computed on CT perfusion and combined with pial collateral status to assess the total collateral status. 3 groups were defined: good collaterals (good pial collaterals and HIR), poor collaterals (poor pial collaterals and HIR) and mixed collaterals (remainder of patients). The predictive ability of total collateral status on functional outcomes were analyzed by receiver operating characteristic curve.

## RESULTS

One hundred and forty-four patients with a mean age of 68.5 years were included. Pial collateral status as assessed with single-phase plus dCTA was more strongly associated with functional outcomes (OR=3.14 [95% CI 1.65-5.96];  $p<0.001$ ) than with dCTA (OR=2.34 [95% CI 1.29-4.27];  $p=0.005$ ) or with single-phase CTA (OR=1.90 [95% CI 1.21-2.98];  $p=0.005$ ). Furthermore, good total collateral status could predict good functional outcomes (Area Under Curve (AUC)=0.67 for single-phase CTA and HIR, AUC=0.69 for dCTA and HIR, AUC=0.70 for single-phase plus dCTA and HIR).

## CONCLUSION

s dCTA provides a more detailed assessment of collaterals than single-phase CTA. Collateral status is a strong predictor of clinical outcomes in patients treated by endovascular treatment.

## CLINICAL RELEVANCE/APPLICATION

dCTA derived from CT perfusion source images may be used to select AIS patients for endovascular treatment.

## W2-SPNR-7 Disparities in Access to Endovascular Thrombectomy for Patients with Large Vessel Occlusion

Participants

Mihir Khunte, Providence, RI (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the racial, socioeconomic, and geographic disparities that exist in both access to high volume endovascular care centers (ECCs) and receiving thrombectomy once admitted to an ECC in patients with large vessel occlusion (LVO).

## METHODS AND MATERIALS

A retrospective study was performed for the years 2016 - 2019 of the National Inpatient Sample for all adult inpatient admissions with LVO. International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis, and procedural coding system (PCS) were used to identify patients with LVO. Patient characteristics such as gender, age, race, and income quartile and hospital characteristics such as region, rural/urban status, and size were recorded. Hospitals that performed  $\geq 10$  EVT procedures in one year were classified as high-volume endovascular capable centers (ECCs).

## RESULTS

There were 727,010 patients with LVO during the 2016-2019 period. A total of 428,745 (59.0%) patients were admitted to a high volume ECC. Black patients were admitted to high volume ECCs at higher rates than white patients (61.0% vs 58.3%) but after adjusting for other factors using a multivariable logistic regression model, we found that when comparing Black to White patients, the OR of admission to a high volume ECC was 0.94 (95% CI 0.88 - 1.02). Among patients admitted to a high volume ECC, black patients were less likely to receive thrombectomy than white patients (17.6% vs 19.2%). This trend remained true after adjusting for other variables including the occlusion site. Comparing high volume ECC patients with private insurance to those with Medicare, the OR of receiving EVT was 1.13 (95% CI 1.06-1.20).

## CONCLUSION

s Our study shows that disparities existed both in accessing an ECC after LVO and receiving thrombectomy after admission to an ECC. While Black patients with LVO were more likely to be admitted to a high volume ECC than white patients, they were less likely to receive EVT once admitted. Age, sex, income, region of the U.S., and insurance status also played a role in determining whether a patient received thrombectomy after admission to a high volume ECC.

## CLINICAL RELEVANCE/APPLICATION

EVT is an important treatment strategy for selected patients with LVO but significant barriers exist in accessing appropriate treatment.

## W2-SPNR-8 Trends in Use of Endovascular Thrombectomy in Anterior Circulation Large-vessel-occlusion by Age

Participants

Mihir Khunte, Providence, RI (*Presenter*) Nothing to Disclose

## PURPOSE

To assess trends in US nationwide use of endovascular thrombectomy (EVT) in patients with large vessel occlusion (LVO) in different age groups.

## METHODS AND MATERIALS

The National Inpatient Sample database was queried to identify adult patients (18 years or older) with a primary diagnosis code for cerebral infarction due to unilateral internal carotid artery (ICA) or middle cerebral artery (MCA) thrombosis or embolism. The International Classification of Diseases, Tenth Revision, Clinical Modification [ICD-10-CM] diagnosis and procedural coding system (PCS) was used to identify patients with LVO and the interventions performed from 2016-2020. Patients with additional coding for occlusions in the vertebral, basilar, cerebellar, posterior cerebral, and anterior cerebral arteries were excluded. For each age category, trends in EVT utilization were evaluated and compared using Pearson's chi-square test.

## RESULTS

Among 316,290 patients with ICA/MCA occlusion from 2016-2020, 68,780 (21.7%) received EVT and 71,260 (22.5%) received tPA. The proportion of anterior circulation LVO patients receiving EVT increased from 15.7% in 2016 to 27.6% in 2020. The rate of EVT increased most in patients aged 75 to 84 years (14.6% in 2016 to 27.4% in 2020) and 85 years and older (12.6% in 2016 to 26.3%

in 2020). The proportion increased by 10.3 percentage points in patients younger than 55 years (19.0% in 2016 to 29.3% in 2020), 10.1 percentage points in patients aged 55 to 64 (17.2% in 2016 to 27.3% in 2020), 11.3 percentage points in patients aged 65 to 74 (16.7% in 2016 to 28.0% in 2020). In contrast to in 2016, in 2020, the rate of EVT was not statistically significantly different between age groups ( $P = 0.328$ ).

## CONCLUSION

Our study results show a significant increase in use of EVT in patients with anterior circulation LVO across all age groups, with approximately 27.6% of patients receiving EVT in 2020.

## CLINICAL RELEVANCE/APPLICATION

From 2016-2020, there has been a significant increase in the use of EVT in older patients above 75 years of age with the rate of EVT use nearing that in younger patients.

## W2-SPNR-9 Trends in the Use of Intravenous Thrombolysis and Endovascular Thrombectomy in Patients with Large Vessel Occlusion Stroke from 2016-2020 and the Impact of COVID-19 Pandemic

Participants

Mihir Khunte, Providence, RI (*Presenter*) Nothing to Disclose

## PURPOSE

To study the use of intravenous thrombolysis (IVT) and endovascular thrombectomy (EVT) nationally in the United States in patients with large-vessel-occlusion (LVO) in 2020, compared it to the previous 4 years, and evaluated their use specifically in COVID-positive patients.

## METHODS AND MATERIALS

The National Inpatient Sample database was queried to identify adult patients (18 years or older) with a primary diagnosis code for cerebral infarction due to unilateral internal carotid artery (ICA) or middle cerebral artery (MCA) thrombosis or embolism. The International Classification of Diseases, Tenth Revision, Clinical Modification [ICD-10-CM] diagnosis and procedural coding system (PCS) was used to identify patients with LVO and the interventions performed from 2016-2020. Patients with additional coding for occlusions in the vertebral, basilar, cerebellar, posterior cerebral, and anterior cerebral arteries were excluded. In the 2020 data, patients with a concomitant diagnosis of coronavirus disease 2019 (COVID-19) were identified. Rates of EVT and IVT were assessed by COVID-19 status.

## RESULTS

A total of 316,290 patients were hospitalized for acute ischemic stroke with an ICA/MCA occlusion from 2016-2020. Of these patients, 21.7% ( $N = 68,780$ ) received thrombectomy and 22.5% ( $N = 71,260$ ) received IVT. From 2019 to 2020, the fraction of patients receiving thrombectomy increased 2.1 percentage points from 25.5% in 2019 to 27.6% in 2020 ( $p = 0.020$ , Figure 1). Meanwhile, rates of thrombolysis remained relatively constant, (22.4% in 2016 vs 21.7% in 2020,  $p = 0.128$ , Figure 1). Among the 63,785 patients presenting with ICA/MCA occlusion in 2020, 1,170 (1.8%) had a co-diagnosis of COVID-19. The rate of EVT among COVID-19 and non-COVID-19 stroke patients with LVO in 2020 was 29.1% and 27.6% respectively ( $p = 0.605$ ). In addition, the proportion of patients receiving IVT was 21.8% and 21.7% for COVID-19 and non-COVID-19 stroke patients respectively ( $p=0.962$ ).

## CONCLUSION

The proportion of patients with an MCA/ICA LVO receiving IVT and EVT did not decline in 2020 compared to the previous four years. Specifically, COVID- positive patients received recanalization therapies in similar proportion to COVID-negative patients for the whole year.

## CLINICAL RELEVANCE/APPLICATION

COVID-positive patients with acute ischemic stroke received recanalization therapies in similar proportion to COVID-negative patients in 2020.

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## Abstract Archives of the RSNA, 2023

W2-SPPD

### Pediatric Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPPD-1 Does Follow-up MRI after Esophageal Button Battery Ingestion Cause Thermal Injury: An In-vitro Study

#### PURPOSE

The button battery (BB) is a dangerous pediatric foreign body, and an ingested esophageal BB should be removed immediately. However, severe complications such as tracheoesophageal or aortoesophageal fistula may develop after endoscopic BB removal and patients require follow-up with magnetic resonance imaging (MRI). Since the injured area after BB removal can contain metallic debris such as iron, radiologists should be aware of the risk of thermal injury from the metallic debris during MRI examinations. This in vitro study investigated temperature and histological changes before and after MRI examination of tissues injured by BB.

#### METHODS AND MATERIALS

Two each of the following three types of chicken pectoralis minor muscle were prepared: untreated control; MRI-scanned BB injury; and non-MRI-scanned BB injury. The negative pole surface of an unused 3-V BB was brought into contact with the muscle tissue and left for 10 h to generate a BB injury. Computed tomography (CT) and histological Perls' Prussian blue staining were performed to confirm the presence of metallic debris in the injured area after BB removal. Temperatures were measured before and after MRI of BB-injured muscle specimens after BB removal and in untreated control specimens using a needle-type digital thermometer. Temperatures were measured at five sites for each specimen. MRI was performed according to the non-enhanced mediastinal sequence at our hospital, assuming tracheoesophageal and aortoesophageal fistula. Hematoxylin-eosin and Perls' Prussian blue staining were used to compare MRI-scanned and non-MRI-scanned BB injuries histologically. These steps were performed at room temperature (20-22°C).

#### RESULTS

BB injury showed high attenuation (mean: 242 Hounsfield units) on CT suggestive of the presence of metallic debris. Histologically, BB injury showed positive staining for Perls' Prussian blue, representing evidence of Fe<sup>3+</sup>. Both BB-injured specimens with or without MRI scans showed coagulation necrosis. Temperature before MRI was 21.7 ± 0.1°C for both BB-injured and control specimens. Temperature after MRI was 22.2 ± 0.2°C for both BB-injured and control specimens. No difference in histopathological findings was seen between specimens with or without MRI scans.

#### CONCLUSION

No temperature increase or histopathological findings suggestive of thermal injury due to metallic debris during MRI of BB injury were evident. However, radiologists should be aware of the potential for thermal injury from MRI as long as foreign metal is present in the body.

#### CLINICAL RELEVANCE/APPLICATION

Follow-up of esophageal BB injury by endoscopy or esophagography is invasive, and safer noninvasive MRI is needed.

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## Abstract Archives of the RSNA, 2023

W2-SPPH

### Physics Wednesday Poster Discussions

#### Sub-Events

#### **W2-SPPH-1 Comparison of Image Quality and Radiation Dose between Adrenal Virtual Monoenergetic Spectral and Conventional Images using New Fast kVp Switching Dual-energy CT**

##### Participants

Jianping Yang, Yinchuan, China (*Presenter*) Nothing to Disclose

##### PURPOSE

Radiation dose has long been a concern for radiologists, this study aims to compare the image quality and radiation of adrenal gland by energy spectrum CT and conventional CT scanning.

##### METHODS AND MATERIALS

Forty patients (22 males and 18 females) with suspected adrenal disease were prospectively collected, with a age of  $45.6 \pm 8.4$  years (range, 21-76 years). Group A and group B were randomly divided into two groups according to different scanning methods. Group A (n=20) used rapid kV switch (80/140 kV) energy spectral CT (Revolution CT, GE Healthcare) at 320mA tube current. Group B (n=20) used non-spectral scanning at tube voltage 120kV, smart150-650mA. Both groups fixed noise index (NI) 11 and 40% pre-ASiR-V, thickness 1.25mm. The background noise (SD), signal noise ratio (SNR) and contrast signal noise ratio (CNR) of right adrenal junction, left adrenal junction, liver, spleen, abdominal aorta (celiac axis level), erector spinae and abdominal fat in group A (70keV monochromatic images) and group B (120kV image) were measured and compared respectively. The subjective image scores were assessed blindly by two experienced physicians using a 5-point system. The difference of SD, SNR and CNR among different groups were compared by independent sample t test.

##### RESULTS

The SD of right adrenal junction, left adrenal junction, liver, spleen and portal vein in group A (70keV monochromatic images) were  $22.08 \pm 4.77$ ,  $22.37 \pm 3.56$ ,  $18.32 \pm 2.34$ ,  $24.49 \pm 7.77$  and  $27.22 \pm 2.78$  HU respectively. The corresponding SD values in the group B were  $20.12 \pm 2.81$ ,  $18.60 \pm 3.88$ ,  $16.35 \pm 2.16$ ,  $18.35 \pm 3.09$  and  $22.09 \pm 3.12$  HU respectively, were significantly different between the two groups ( $P < 0.05$ ). The SNR and CNR of bilateral adrenal junction, liver, spleen and abdominal aorta in group A were higher than group B, not significantly different between the two groups ( $P > 0.05$ ). The CTDI of group A and B were  $8.43 \pm 1.98$  and  $9.10 \pm 2.09$  mGy\*cm, compared with spectral energy CT scanning, the radiation dose of conventional CT scanning is increased by 3.7%, but the difference was not statistically significant ( $P > 0.05$ ). The subjective scores of two observers to group A and group B imaging were  $4.73 \pm 0.22$ ,  $4.70 \pm 0.34$  and  $4.79 \pm 0.34$ ,  $4.78 \pm 0.51$  respectively, the difference was not statistically significant ( $P > 0.05$ ).

##### CONCLUSION

The quality of adrenal on 70keV monochromatic images is similar to conventional 120kV image, and the radiation dose is lower than conventional 120kV CT scans, while energy spectrum CT can obtain more information.

##### CLINICAL RELEVANCE/APPLICATION

Energy spectrum scanning can not only guarantee image quality and radiation dose, but also provide more quantitative analysis of energy spectrum parameters for doctors.

#### **W2-SPPH-10 A Practical Approach to Sustainable Radiology**

##### PURPOSE

To examine the effect of regenerative energy and energy efficient imaging technology on the energy balance in MRI.

##### METHODS AND MATERIALS

We built an energy saving bungalow with a 29.8 kWp rooftop solar array and a 10 kWh Li-Ion Battery. MR imaging was carried out using a 0.35T permanent magnet system with water-cooled gradients, installed in 2019 (Siemens Magnetom C!, Siemens Healthineers/Germany) and a 0.4 T permanent magnet system with air-cooling (Aperto Lucent Plus, Fujifilm healthcare/Japan) installed in 2022. Energy consumption was measured using the power management system of the solar array.

##### RESULTS

The 0.35T MRI consumed 9.5 kW/h during scan procedures (including cooling). Annual consumption of the imaging system was 16.100 kWh in 2020. Energy consumption including all practice components in 2020 was 38.810 kWh. Energy production of the solar array was 30.846 kWh in 2020. Net energy consumption for the whole project was therefore 8.397 kWh in 2020. The state of the art 0.4T MRI consumes 5 kW/h. In February 2023, the imaging system consumed 1.495,36 kWh. Compared with February 2020 (1.951,21 kWh), this is a reduction by 5.618 kWh or 23,4%. If all other parameters are kept constant, we expect a total practice net energy consumption of 2.780 kWh in 2023.

##### CONCLUSION

s Using state of the art imaging technique and rooftop solar energy production, an energy neutral MRI site is possible.

#### CLINICAL RELEVANCE/APPLICATION

Optimizing the energy balance is a challenge. Radiology, as an energy intense discipline, can contribute considerably to sustainable medical care. For developing countries, energy neutral operation can help to provide medical care independent from (unstable) power grids.

#### W2-SPPH-11 Quantitative Knee Evaluation using Deep-Learning in a Low-Field 0.55T MRI: In Vivo Study of Healthy Controls

##### PURPOSE

To evaluate the performance of standard in-practice DL (bone, and cartilage segmentation) algorithms to generate bone shape and cartilage thickness maps in addition to compartment-wise cartilage thickness values in healthy controls at 0.55T

##### METHODS AND MATERIALS

Unilateral knees of four healthy controls (Age:  $28 \pm 3.8$  years, BMI:  $24.08 \pm 2.88$ , 2 females) were included in this IRB approved study. The subjects underwent MRI scanning on a 0.55T (MAGNETOM Free.Max, Siemens Healthineers, Erlangen, Germany), with knee wrapped in a Contour-S coil. Sagittal 3D PD fat-saturated SPACE images were acquired with FOV  $160 \times 160$  mm<sup>2</sup>, resolution  $0.6 \times 0.6 \times 0.6$  mm<sup>3</sup>, and 224 slices (TR/TE = 800/36 ms). The images underwent a modified 2D-CNN architecture<sup>1</sup> and a 3D V-Net architecture<sup>2</sup> respectively to segment the bones (femur, tibia, patella) and cartilages (femoral, tibial, patellar). Both the DL architectures were previously trained and validated on similar image contrasts at 3.0T and were inferred on the 0.55T images. Mean cartilage thickness values for three cartilages were automatically computed using a Euclidean distance transform<sup>3</sup>. The overall segmentation quality was assessed using a 5-point Likert scale by a musculoskeletal radiologist with over three years of experience.

##### RESULTS

Without any sort of pre-trainings, as an initial inference run, both the segmentation models were able to segment the three major bones and cartilage masks with moderate to substantial ability, demonstrated in figure 1. The cartilage thickness values estimated for femoral, tibial, and patellar cartilages were  $1.40 \pm 0.84$ ,  $1.54 \pm 0.62$ , and  $2.18 \pm 0.62$  mm respectively. The cartilage segmentation algorithm outperformed the bone segmentation module, in the femoral and tibial regions, in terms of precision in detecting smaller cartilage regions with confusing boundaries. However, both the segmentation modules, especially the cartilage one, suffered in the detection of the patellar region, due to non-sufficient training in low-SNR images. Nevertheless, it demonstrates a decent baseline of quantitative capabilities with possibilities for improvement using further training with 0.55T images, along with comparative assessment with paired 3T segmented data.

##### CONCLUSION

s Initial results demonstrate a moderate-to-substantial technical feasibility of translating existing quantitative deep-learning-based image segmentation techniques from 3T to 0.55T for knee MRI, especially in terms of measuring cartilage thickness.

#### CLINICAL RELEVANCE/APPLICATION

The 0.55T low-field-value-MRI, can be technically useful for evaluating knee cartilage thickness and bone features aided by established DL algorithms, with potential for further improvement in biomarker quantification performance.

#### W2-SPPH-12 Feasibility of ZTE-based Silent and Motion-robust Techniques for Neuroimaging

##### PURPOSE

Conventional MRI generates high levels of acoustic noise from the rapidly changing imaging gradients. This loud acoustic noise presents challenges for sensitive populations such as pediatrics and patients with hyperacusis including inner ear disorders, autism, and depression. Acquisition strategies including radial zero-echo time (ZTE) have been shown to reduce acoustic noise. Radial sampling methods can provide motion robustness or even allow correction, making the radial ZTE approach appealing. We present progress in developing multi-contrast ZTE imaging protocols with motion correction.

##### METHODS AND MATERIALS

T1w and T2w 3D radial ZTE acquisitions with intermittent magnetization preparation pulses were acquired on a 3T clinical MRI (Premier, GE Healthcare) in two normal healthy volunteers under written consent and IRB approval. Each acquisition was performed twice, and volunteers were instructed to remain still for the first acquisition and to periodically move during the second. A modified HEALPix radial view order provided coverage of angles within each segmented readout. Motion was estimated from the k-space data using a deep learning approach and corrected during image reconstruction. Conventional Cartesian imaging was performed using 3D gradient echo T1w MPRAGE and 3D T2w FSE CUBE. Acoustic noise measurements of the maximum sound pressure level (SPL) were performed at the head coil in the MRI bore during volunteer scans.

##### RESULTS

T2w and T1w ZTE images provided qualitatively similar image contrast to the Cartesian acquisitions. As expected, conventional Cartesian images were heavily impacted by subject motion however the ZTE combined with motion correction allowed for recovery of image quality with only modest loss compared to images when no motion was present. This included visualization of the middle cerebral arteries in T2w as well as sulci and ventricles on T1w. ZTE T2w and T1w (peak average SPL 71dBc and 69dBc respectively) were considerably quieter than the conventional Cartesian T2w and T1w (peak average SPL 89dBc and 87dBc respectively).

##### CONCLUSION

s We present progress to date on developing a ZTE-based silent and motion-robust neuroimaging protocol. ZTE with intermittent magnetization preparation and the HEALPix radial view order and motion correction provided motion robust standard T1w and T2w contrasts. The modified ZTE approach allowed SPL levels well below conventional Cartesian protocols while allowing motion correction. Future work will include studies in pediatrics and autism.

#### CLINICAL RELEVANCE/APPLICATION

Sensitive patient populations struggle with MRI due to loud acoustic noise and inability to hold still. This work proposes a ZTE MRI

sensitive patient populations struggle with fMRI due to loud acoustic noise and inability to hold still. This work proposes a 2TE fMRI acquisition and deep learning reconstruction to overcome these challenges.

## **W2-SPPH-13 Comparison of Deep Learning-Based Accelerated Diffusion Weighted Imaging with Conventional Diffusion Weighted Imaging in Female Pelvic Imaging**

Participants

Lillian Chiu, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

### **PURPOSE**

To compare deep learning based accelerated diffusion weighted images (DL-DWI) and conventional DWI (c-DWI) of the female pelvis using qualitative and quantitative metrics.

### **METHODS AND MATERIALS**

Consecutive patients who had MRI of female pelvis from 12/16/2023-2/3/2023 were included if they had axial c-DWI and a prototype DL-DWI (Siemens, Erlangen, Germany, Bae et al, Eur J Radiol. 2022) acquired on 3T MRI. Exclusion criteria: prior hysterectomy/oophorectomy. c-DWI used b50, 400, 1000 s/mm<sup>2</sup> and DL-DWI used b50, 800, 1000 s/mm<sup>2</sup>. Axial T2, c-DWI or DL-DWI, and associated ADC maps of each were blinded, randomized and evaluated by 3 fellowship trained radiologists (17, 3, and 1 y exp) using a 5pt Likert scale (1 non diagnostic to 5 excellent quality) for strength of fat suppression, sharpness of uterine margin, conspicuity of ovary, conspicuity of endometrium, quality with respect to susceptibility artifact or other artifacts, and conspicuity of fibroids on b1000 DWI and ADC. The ADC value from a 1 cm diameter ROI of the myometrium and fibroid if present were also collected by a trainee and confirmed by a fellowship trained radiologist. Wilcoxon signed rank test was used to compare Likert scores. Paired T test and Bland Altman plot were used to compare ADC values.

### **RESULTS**

108 pts met criteria. Mean acquisition times: c-DWI: 2.44±0.45 min, DL-DWI: 1.03±0.16 min. Significantly different image quality scores: Strength of fat suppression (R1 c-DWI 4.96, DL-DWI 4.89, p=0.03, R3 c-DWI 4.33, DL-DWI 4.04, p<.001), Sharpness of uterine margin (R1 c-DWI 4.22, DL-DWI 4.28, p=0.04, R2 c-DWI 3.58, DL-DWI 3.74, p=0.02, R3 c-DWI 4.30, DL-DWI 4.56, p=0.01), Conspicuity of ovary (R1 c-DWI 4.26, DL-DWI 4.44, p=0.01, R3 c-DWI 4.31, DL-DWI 4.71, p<.001), Conspicuity of endometrium (R2 c-DWI 3.26, DL-DWI 3.10, p=0.05), Susceptibility artifact (5 excellent quality) (R1 c-DWI 3.80, DL-DWI 4.00, p=0.03, R2 c-DWI 3.60, DL-DWI 4.07, p<.001), Other artifact (5 excellent quality) (R3 c-DWI 4.34, DL-DWI 4.15, p=0.03), Conspicuity of fibroid on DWI (R3 c-DWI 3.93, DL-DWI 4.52, p<.001), Conspicuity of fibroid on ADC (R3 c-DWI 4.11, DL-DWI 4.65, p<.001). Mean ADC value of myometrium was c-DWI 1250±220 mm<sup>2</sup>/s, DL-DWI 1620±270 mm<sup>2</sup>/s, p<.001. Mean ADC value of fibroids (59/108) was c-DWI 890±210 mm<sup>2</sup>/s, DL-DWI 1170±220 mm<sup>2</sup>/s, p<.001.

### **CONCLUSION**

s Image quality scores were similar between c-DWI and DL-DWI. All readers scored DL-DWI significantly higher than c-DWI for sharpness of uterine margin. ADC values were significantly higher on DL-DWI than c-DWI which may be due to smoothing process in DL reconstruction vs slightly different b values obtained.

### **CLINICAL RELEVANCE/APPLICATION**

Deep learning accelerated DWI showed excellent and comparative image quality despite 2 fold reduction in acquisition time.

## **W2-SPPH-2 Meningioma Grade Discrimination using a Novel Ultrafast T2 Mapping Technique**

### **PURPOSE**

Meningioma grade plays a significant role in treatment planning and prognosis prediction. Despite the numerous prior studies, preoperative diagnosis of meningioma grade remains challenging. Many studies demonstrated the unique value of T2 mapping MRI for characterizing disease pathology, yet often limited by the long scan time. In this study, we employed a deep learning-based single-shot ultrafast T2 mapping technique, which can acquire whole-brain T2 maps within 32 s, and conventional apparent diffusion coefficient (ADC) maps for the WHO grade discrimination of meningiomas.

### **METHODS AND MATERIALS**

Sixty-nine patients were enrolled, among which 59 were diagnosed with low-grade meningiomas (LGM, grade 1, 57.34 ± 9.40 years) and ten with high-grade meningiomas (HGM, grade 2 and 3, 58.18 ± 9.36 years). All the MRI examinations were performed on a 3.0 T scanner (MAGNETOM Prisma, Siemens Healthcare, Erlangen, Germany) with a 64-channel head coil. Axial T2 mapping, T2-dark-fluid imaging, diffusion-weighted imaging, and contrast-enhanced T1-weighted imaging were performed for all patients. With 3D Slicer (version 4.10.2, [www.slicer.org](http://www.slicer.org)), regions of interest were manually delineated on each slice of T2 maps by the consensus of two blind neuroradiologists. Necrosis, large vessels, and calcification were excluded. From each ROI, we calculated the following histogram parameters using FeAture Explorer (FAE; <https://github.com/salan668/FAE>): mean, median, maximum, minimum, ten percentiles (P10), 90 percentiles (P90), interquartile range (IQR), range, entropy, skewness, kurtosis, uniformity, and variance. Parameters were compared using the independent t-test or Mann-Whitney U test. Multivariate logistic regression and receiver operating characteristic (ROC) analysis were performed to evaluate their diagnostic efficiency. The significance level of p value is 0.05.

### **RESULTS**

Compared to HGM, there were significantly higher T2 (p = 0.021) and ADC (p = 0.012-0.002) histogram parameters in LGM. ADC P10 had the highest area under the ROC curve (AUC = 0.811) among all the ADC parameters and T2 kurtosis showed an AUC of 0.564. Notably, the combination of T2 and ADC exhibited the best diagnostic performance (AUC = 0.868).

### **CONCLUSION**

s It has been demonstrated that T2 and ADC histogram parameters could be used to distinguish LGM from HGM, which is consistent with previous studies. Furthermore, the multivariate logistic regression model combining T2 and ADC was suggested to have the best diagnostic efficiency.

### **CLINICAL RELEVANCE/APPLICATION**

Meningioma grade is an essential factor that affects the treatment planning and recurrence rate. The combination of T2 and ADC

values could provide significant value for the non-invasive prediction of meningioma grade.

### **W2-SPPH-3 Deep Learning-Based Spatial Resolution Improving Algorithm (Precise IQ Engine: PIQE) for MRI: Capability for Scan Time Reduction and Image Quality Improvement as Compared with Deep Learning Reconstruction (DLR) with and without New Fine Reconstruction Algorithm**

Participants

Yoshiharu Ohno, MD, PhD, (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, Daiichi Sankyo Co, Ltd; Research Grant, Ministry of Education, Culture, Sports, Science and Technology

#### **PURPOSE**

Deep learning reconstruction (DLR) with and without fine reconstruction algorithm (i.e. fine recon) has been clinically set for denoising MR images with and without increasing spatial resolution. In this time, deep learning-based spatial resolution improving algorithm with denoising (Precise IQ Engine: PIQE) is developed for MRI. The purpose of this study was to directly compare utilities of PIQE for scan time reduction and image quality improvement of MRI as compared with DLR with and without fine recon.

#### **METHODS AND MATERIALS**

Sixty-eight consecutive patients suspected with 28 brain tumors, 14 musculoskeletal diseases, 14 uterine or ovarian tumors and 12 prostatic cancers were prospectively scanned with conventional MR protocols and new MR protocols, which were obtained same sequences with reducing matrix sizes ranged from 50% to 70%. Then, each conventional MR data was reconstructed with DLR with and without fine recon, and all new protocol data were reconstructed with PIQE as well as DLR with and without fine recon (total five data sets). To compare scan time reduction and quantitative spatial resolution improvement among all protocols, mean examination time including reconstruction time and edge slope width (ESW) between two different structures were compared among five protocols by Tukey's HSD test. To evaluate qualitative spatial resolution improvement, overall image quality and diagnostic confidence level were assessed by 5-point scales and compared among all protocols by Wilcoxon's signed rank test.

#### **RESULTS**

Mean examination times of new MR protocols were significantly shorter than that of conventional protocols ( $p < 0.05$ ), although mean examination time had no significant differences among all new protocols. Mean ESW of new protocol with PIQE ( $1.1 \pm 0.3 \text{ mm}$ ) was significantly smaller than that of all protocols except conventional protocol with DLR and fine recon ( $1.4 \pm 0.4 \text{ mm}$  = other ESWs =  $1.8 \pm 0.4 \text{ mm}$ ,  $p < 0.05$ ). Overall image quality and diagnostic confidence level of new protocol with PIQE were significantly higher than those of others except conventional protocol with DLR and fine recon (overall image quality:  $p < 0.0001$ , diagnostic confidence level:  $p < 0.0001$ ). Artifact of new protocol with PIQE was significantly smaller than those of others without conventional protocol with DLR and fine recon ( $p < 0.0001$ ).

#### **CONCLUSION**

s PIQE has superior potential to DLR with and without fine reconstruction for reducing temporal resolution and improving spatial resolution, although fine reconstruction can only improve image quality of DLR at conventional protocol.

#### **CLINICAL RELEVANCE/APPLICATION**

PIQE has superior potential to DLR with and without fine reconstruction with reducing temporal resolution and improving spatial resolution.

### **W2-SPPH-4 Early Detection of Myocardial Involvement by Noncontrast T1 $\rho$ Mapping of Cardiac Magnetic Resonance in Type 2 Diabetes Mellitus**

Participants

Xiaohu Li, MD, PhD, Hefei, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the feasibility of T1 $\rho$  in detecting myocardial fibrosis in type 2 diabetes mellitus (T2DM) patients by comparing with native T1 and Extracellular volume (ECV) fraction.

#### **METHODS AND MATERIALS**

35 T2DM patients free of cardiovascular symptoms and preserved ventricular systolic function and 30 healthy controls were prospectively enrolled for T1 mapping, T2 mapping T1 $\rho$  mapping, and late gadolinium enhancement (LGE) examination. ECV mps were calculated using pre- and post-contrast T1 maps. Global native T1, T1 $\rho$ , ECV and 2D global longitudinal strain (GLS) values were generated in respective maps. Receiver operating curves were used to show the diagnostic performance of ECV, T1 $\rho$ , GLS and native T1 in distinguishing T2DM patients and controls. The Student's t-test, Pearson's chi-squared test, Pearson correlation coefficient ( $r$ ) and Delong test were used in this study.  $P < 0.05$  indicates statistical significance.

#### **RESULTS**

The global ECV and T1 $\rho$  of T2DM group (ECV =  $32.1 \pm 3.2\%$ , T1 $\rho$  =  $53.1 \pm 2.0 \text{ msec}$ ) were significantly higher than those of controls (ECV =  $26.2 \pm 1.6\%$ , T1 $\rho$  =  $51.6 \pm 3.8 \text{ msec}$ ) (all  $P < 0.001$ ), whether there was no significant difference in native T1 between T2DM and controls ( $P = 0.264$ ). The GLS decreased significantly in T2DM patients ( $-16.5 \pm 2.4\%$  vs.  $-18.3 \pm 2.6\%$ ,  $P = 0.015$ ). The T1 $\rho$  and native T1 were associated with ECV (Pearson's  $r = 0.50$  and  $0.25$ , respectively, both  $P < 0.001$ ), the native T1, T1 $\rho$ , and ECV were associated with hemoglobin A1c (Pearson's  $r = 0.41$ ,  $0.52$ , and  $0.61$ , respectively, all  $P < 0.05$ ), the ECV were associated with diabetes duration (Pearson's  $r = 0.41$ ,  $P = 0.016$ ). The AUC of ECV, T1 $\rho$ , GLS, and native T1 were  $0.869$ ,  $0.810$ ,  $0.659$ , and  $0.524$ , respectively.

#### **CONCLUSION**

s In T2DM patients, T1 $\rho$  may be a new noncontrast cardiac magnetic resonance technique for identifying myocardial diffuse fibrosis, and T1 $\rho$  may be more sensitive than native T1 in the detection of myocardial diffuse fibrosis.

#### **CLINICAL RELEVANCE/APPLICATION**

It has shown that T1 $\rho$  mapping allow early detection of myocardial diffuse fibrosis in diabetic monkeys. However, T1 $\rho$  has not been



reported in patients with type 2 diabetes mellitus (T2DM). In this project, the purpose of this study is to evaluate the feasibility of T1\* in detecting myocardial diffuse fibrosis in T2DM in a comparison with myocardial native T1 and ECV.

## **W2-SPPH-5 Changes in Brain Susceptibility in Wilson's Disease Patients: A Quantitative Susceptibility Mapping Study**

Participants

Xiaohu Li, MD, PhD, Hefei, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

To reveal changes in the susceptibility of the caudate nucleus (CN), putamen (Put), and globus pallidus (GP) in patients with neurological and hepatic Wilson's disease (WD) by quantitative susceptibility mapping (QSM).

### **METHODS AND MATERIALS**

We retrospectively analyzed brain MRI images of 33 patients diagnosed with Wilson's disease (WD) and 20 age-matched controls. All subjects underwent brain T1-weighted, T2-weighted, and QSM images using a 1.5T MRI scanner. The QSM maps were calculated using STISuite toolbox. The quantitative susceptibility of the CN, Put, and GP was analyzed using region-of-interest analysis on QSM maps. The differences among the neurological WD patients, hepatic patients, and controls were compared.

### **RESULTS**

Susceptibility values were significantly higher in all examined structures (CN, Put, GP) in patients with neurological WD compared to controls (all  $P < 0.05$ ) and hepatic WD patients (all  $P < 0.05$ ). No statistically significant differences were found in susceptibility values between patients with hepatic WD and controls (all  $P > 0.05$ ).

### **CONCLUSION**

The QSM technique is a valuable tool for detecting changes in susceptibility in the brain of WD patients, indicating abnormal metal deposition. Notably, our findings suggest that neurological WD patients exhibit more severe susceptibility changes than hepatic WD patients. Therefore, QSM can be utilized as a complementary method to detect brain injury in WD patients.

### **CLINICAL RELEVANCE/APPLICATION**

Quantitative magnetic susceptibility imaging (QSM) is an advanced MRI technique for magnetic susceptibility evaluation, providing accurate quantitative measurements of the spatial distribution of magnetic susceptibility

## **W2-SPPH-6 Vendor-independent MRI Pulse Sequence Development to Increase Comparability in Cross-vendor Imaging Studies**

Participants

Simon Konstandin, PhD, Bremen, Germany (*Presenter*) Nothing to Disclose

### **PURPOSE**

Magnetic Resonance Imaging is a complex and versatile imaging method, given by the ability to visualize various contrasts and physiological processes. MRI research is commonly achieved by implementing new pulse sequences in vendor-specific development environments. During the last years, vendor-independent MRI frameworks gained attention. Previously, we introduced a vendor-independent MRI pulse sequence development framework that provides a product-like experience on-site, called gammaSTAR [Cordes C et al. Magn Reson Med 2020;83(4):1277-90.]. Until today, none of these frameworks was able to run the same MRI sequence on the MRI hardware of the three largest MRI vendors: Siemens, GE and Philips. In this abstract, for the first time, we show cross-vendor use of gammaSTAR MRI sequences on all three platforms.

### **METHODS AND MATERIALS**

A modular web frontend (free version here: [gamma-star.mevis.fraunhofer.de](http://gamma-star.mevis.fraunhofer.de)) is used to implement MRI sequences and export them into a generalized sequence format. This does not consist of fixed hardware instructions, but holds the fundamental calculation logic of the implemented MRI sequence, allowing for product-like interaction with the MRI sequence and protocol. gammaSTAR driver software is implemented using the vendors development environments to interpret the gammaSTAR sequences and translate events into the vendor-specific hardware commands.

### **RESULTS**

MRI experiments show the feasibility of running MRI sequences developed in the vendor-independent gammaSTAR framework on Siemens, GE and Philips MRI scanners. Image quality is similar to corresponding product MRI sequences and the framework allows for the same protocol interaction and positioning. Low cross-vendor comparability of conventional MRI arises from underlying implementation differences. The use of the same MRI sequence for execution on different MRI hardware allows, for the first time, a comparison of the exact same MRI sequence in a multi-vendor scenario.

### **CONCLUSION**

MRI sequences developed in gammaSTAR were for the first time executed on hardware platforms of all three major MRI vendors. This will eventually open up science and improve the significance of multi-vendor clinical trials by harmonizing imaging technology.

### **CLINICAL RELEVANCE/APPLICATION**

The current state of vendor-centric MRI pulse sequence development limits reuse of MRI applications for different MRI models, software versions. The execution of generalized MRI sequences on MRI hardware of the three largest MRI vendors presents a chance for higher comparability in multi-vendor clinical trials, between follow-ups acquired in different clinics and re-use of MRI sequences for opening up science and accelerating the way of innovation into clinical practice.

## **W2-SPPH-7 The Value of Energy Spectrum CT in Analyzing the Distribution Characteristics of Abdominal Fat in Patients with Chronic Kidney Disease**

Participants

Hua He, MMedSc, Yinchuan, China (*Presenter*) Nothing to Disclose

## PURPOSE

Different fat distribution between men and women can lead to different risks of metabolic diseases and cardiovascular diseases between men and women. In this study, the characteristics of abdominal fat distribution in patients with chronic kidney disease (CKD) and the influence of gender on fat distribution were analyzed by energy spectrum CT.

## METHODS AND MATERIALS

Forty-three patients with CKD were divided into groups according to sex. All patients were treated with GSI scanning mode combined with new iterative algorithm (ASiR-V), noise index(NI=9), automatically modulated tube current (Smart mAs), slice thickness 0.625 mm. All cases were reconstructed by post processing workstation ADW4.7. The "X Section" software was used to manually sketch the abdominal cavity on the horizontal umbilical cross-sectional image, and the CT value range of adipose tissue was  $-200 \sim 0$  Hu. The software automatically calculated the area of corresponding tissues in the sketched range, and recorded the total fat area (TFA), visceral fat area (VFA) and subcutaneous fat area (SFA) = TFA-VFA. The body measurements of patients were recorded, and the differences of body measurements and abdominal fat indexes were compared between the two groups by independent sample T test.

## RESULTS

BMI ( $23.32 \pm 0.72$ ) kg/m<sup>2</sup> of male was higher than that of female ( $20.59 \pm 0.69$ ) kg/m<sup>2</sup>, and the difference was statistically significant ( $P < 0.05$ ). TFA and SFA were ( $358.61 \pm 20.20$ ) cm<sup>2</sup>, ( $171.07 \pm 7.17$ ) cm<sup>2</sup> of male were higher than that of female ( $265.08 \pm 20.13$ ) cm<sup>2</sup> and ( $131.26 \pm 12.23$ ) cm<sup>2</sup> respectively, and the difference was statistically significant ( $P < 0.05$ ), but there was no significant difference in visceral fat between the two groups ( $P > 0.05$ ).

## CONCLUSION

s The total fat area and subcutaneous fat area in male patients with CKD are higher than those in female patients, but the visceral fat area is not affected by gender.

## CLINICAL RELEVANCE/APPLICATION

Different sex patients with chronic kidney disease abdominal fat distribution characteristics are different, we should pay attention to the individualized assessment of ectopic fat in patients, for clinical patients with chronic kidney disease to develop individualized weight loss program to provide basis.

## W2-SPPH-8 Egress Pathways of Intrinsic CSF Outflow Altered by Physical Exercise in Healthy Humans

Participants

Mitsue Miyazaki, PhD, La Jolla, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate egress pathways of intrinsic CSF outflow and their quantitative metrics using a spin-labeling MRI technique on healthy adults with active and sedentary lifestyles. We also examined changes in the CSF outflow metrics in sedentary adults after they increased their physical activity levels for three weeks.

## METHODS AND MATERIALS

Eighteen healthy adults with informed consent were enrolled in this study using a clinical 3-Tesla MRI scanner. We classified participants into two groups based on reported time spent sitting per day (active group  $< 7$  hours or an average of  $5.3 \pm 0.7$  and sedentary group = 7 hours or an average of  $10.4 \pm 1.7$ ). To reveal the effect of exercise, the sedentary individuals were asked to increase their activity to at least about 3.5 hours per week for 3 weeks. To elucidate intrinsic CSF outflow pathways and quantitative metrics, we studied a signal increase ratio (SIR) of time-resolved images at various inversion times (TI). Our hypothesis is that intrinsic CSF egress pathways of 1) dura mater to superior sagittal sinus (SSS), via parasagittal dura (PSD), and 2) the lower PSD pathway from the perivascular space of subcortical or bridging veins. We also measured quantitative outflow metrics at 5 segmented region-of-interests (ROIs); upper PSD, middle PSD, lower PSD, SSS, and entire SSS.

## RESULTS

The active lifestyle group shows greater intrinsic CSF outflow metrics in peak height (PH), relative CSF volume (rCFV), and relative CSF flow (rCFF) ( $p < 0.05$ ) in all above ROIs than the sedentary lifestyle group. However, the sedentary group shows increased outflow metrics after 3 weeks of increased physical activity. This improvement was notable at the PSD, where outflow metrics were highest among the active group and after exercise in sedentary group. These quantitative CSF results indicate a new pathway of CSF outflow from the lower PSD to the SSS that is most evident in physically active individuals.

## CONCLUSION

s The results show that physical exercise alters CSF outflow metrics to a greater degree in the lower PSD pathway, which may be responsible for the perivascular space of cortical veins or subpial space.

## CLINICAL RELEVANCE/APPLICATION

Our findings in healthy adults with active and sedentary lifestyles reveal differences in quantitative CSF outflow metrics related to activity levels. These quantitative outflow findings at the lower PSD add credence to the hypothesis of a distinct, recruitable second pathway of CSF egress from the subpial space to the SSS, with potential implications for future use as a biomarker for cognitive decline and/or therapeutic targeting in aging and neurodegeneration.

## W2-SPPH-9 A Robust Spectroscopic Imaging Sequence for 7T Brain Glioma Evaluation

Participants

Jullie Pan, PhD, Columbia, MO (*Presenter*) Nothing to Disclose

## PURPOSE

To implement a robust fast targeted spectroscopic imaging sequence at 7T for brain tumors. While 3T single voxel spectroscopy is an excellent acquisition, with limited scan time, small voxel targets, and the need to place single voxels by the technologist can be difficult. These problems can be better managed with higher SNR at 7T; however, 7T can be difficult for spectroscopy with limited

RF and susceptibility. We implement the decoupled transceiver coil and a high degree shim insert with an efficient spatial encoding strategy to assess its performance in glioma patients.

## **METHODS AND MATERIALS**

With IRB oversight, tumor patients were recruited from Tumor Board review (10 patients recruited; 9 completed). An 8 channel pTx Siemens 7T Terra, decoupled transceiver and very high order shim (VHOS) insert was used. After whole brain MP2RAGE imaging and RF shimming, the target regions were identified. For optimal shimming, single slices were studied, shimmed using a high accuracy field map with the VHOS insert. A moderate echo TE=40ms spectroscopic imaging sequence encoded with a noncartesian rosette trajectory was used (32x32 resolution, 4.5min single slice). First level SAR monitoring was used. Automated LCModel curve fit was used to determine metabolite ratios. Values of maximum Ch/NAA value in the region of the lesion were used to identify 3 groups of abnormality:  $\geq 1.7$ ,  $\geq 0.9$  to  $< 1.7$  or  $< 0.9$ . All studies were blinded to clinical and imaging data to independently compare clinical to spectroscopic imaging group.

## **RESULTS**

Fig. 1 shows data from a patient with two regions of interest. Based on literature and the patient data, the ratios for Ch/NAA and Ch/Cr were used for initial classification (control value for parenchymal Ch/NAA  $0.56 \pm 0.17$ , Ch/Cr  $1.03 \pm 0.15$ ). The spectroscopic group based on the maximum Ch/NAA in the region of tumor was compared with their clinical group, either active tumor, treatment effect or no change, Table 1. N=5 patients with Ch/NAA  $\geq 1.7$  were classified with active tumor; 1 patient classified as normal had low Ch/NAA  $< 0.9$ . The remaining 3 patients ( $0.9 \leq \text{Ch/NAA} < 1.7$ ) were clinically described as treatment effect (1), progression (1) or no change (1); the last "no change" patient was identified 6mos later to have progression.

## **CONCLUSION**

s At 7T with the decoupled transceiver and high degree shim insert, the spectroscopic imaging was able to identify patients with active tumor. An intermediate threshold for Ch/NAA of 0.9 to 1.7 identified those with treatment effect or very early recurrence. With additional data, better classification may be possible.

## **CLINICAL RELEVANCE/APPLICATION**

We have implemented 7T methods that can acquire robust spectroscopic images in glioma patients which can contribute to a better or earlier understanding of the tumor state.

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## Abstract Archives of the RSNA, 2023

W2-SPRO

### Radiation Oncology Wednesday Poster Discussions

#### Sub-Events

#### W2-SPRO-1 Deep Learning Prediction of Post-Radiation Magnetic Resonance Images to Inform Stereotactic Radiotherapy of Breast Cancer Metastases to the Brain

#### PURPOSE

Changes on standard multiparametric MRI (mpMRI), including T1-weighted unenhanced (T1w) and contrast-enhanced (T1wCE), T2-weighted (T2w), Fluid-Attenuated Inversion Recovery (FLAIR), and Apparent Diffusion Coefficient of water (ADC) images are mechanistically relatable to voxel-level tumor response to Radiation Therapy (RT). While Stereotactic Radiosurgery (SRS) provides high local control rates for the management of Breast Cancer Metastases to the Brain (BCMB), tools to enable voxel-level optimization of RT dose plans for local tumor control with minimal toxicity to normal tissues do not exist. We have trained deep learning "forward models" to predict post-SRS T1w, T1wCE, T2w, FLAIR and ADC maps from the corresponding 5 pre-SRS mpMRIs and the delivered RT dose map. We also trained an "inverse model" to predict the delivered RT dose map from 5 pre-SRS and 5 post-SRS mpMRI images. The overarching goal is to enable the radiation oncologist to compute the RT dose map to achieve prescribed post-SRS values of ADC, T1wCE, T1w, T2w and FLAIR within the GTV, simulate mpMRI outcomes and iteratively optimize RT plans for local control of BCMB.

#### METHODS AND MATERIALS

Planning CT images and associated RT dose maps, and T1w, T1wCE, T2w, FLAIR images and ADC maps acquired pre-SRS, post-SRS, and at tumor recurrence were curated from 27 BCMB patients (18 Training, 9 Test) with confirmed controlled and locally recurrent metastases. Patients were treated with SRS dose of 1-40 Gy between 2013-2019. After co-registration to the planning CT, all mpMRIs were intensity-calibrated, variance-normalized and scaled. A pix2pix framework used to predict post-SRS MRIs from pre-SRS MRIs and the RT dose map (5 forward models). Another pix2pix model was trained to predict the RT dose map from pre-SRS and post-SRS MRIs (inverse model).

#### RESULTS

On testing, forward model accuracy for predicting the direction of post-SRS intensity change within the Gross Tumor Volume (GTV) was highest for T1wCE (83%), followed by T1w (77%), FLAIR (75%), T2w (68%), and ADC (46%). In agreement with expectations, higher RT doses within the GTV are predicted by the inverse model to achieve greater suppression of intensity on T1wCE and/or higher ADC within the GTV post-SRS.

#### CONCLUSION

s We have demonstrated the feasibility of predicting post-RT mpMRI images from pre-RT mpMRIs and the delivered RT dose map. For a given set of pre-RT mpMRIs, we have also demonstrated the feasibility of predicting the RT dose map that would be required to achieve prescribed post-RT intensities within the GTV.

#### CLINICAL RELEVANCE/APPLICATION

We present a new paradigm in RT planning, viz., voxel-level optimization of SRS dose to achieve prescribed post-SRS mpMRI characteristics of treated tumors using the presented forward and inverse models.

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## Abstract Archives of the RSNA, 2023

W2-SPVA

### Vascular Imaging Wednesday Poster Discussions

#### Sub-Events

#### W2-SPVA-1 Tele-robotic Ultrasound Usability Testing on a Phantom

##### PURPOSE

Annually, 16 million North American patients struggle to access diagnostic ultrasound (US) services due to sonographer shortages. Rural and remote patients are required to travel excessive distances to access diagnostic US services, which can be time-consuming and expensive resulting in patients failing to attend their appointments. The aim of this study is to validate a proof-of-concept tele-robotic US system which serves to make diagnostic healthcare more accessible.

##### METHODS AND MATERIALS

The equipment used in the study included the Kinova Gen 3 robot, Clarius L7 US probe, the Inverse3 (input device), and an advanced deep-vein thrombosis (DVT) phantom. First, seven sonographers performed freehand DVT scans on the phantom. After successful training, each sonographer performed a teleoperated DVT scan, where they controlled the robot using the input device. The required US images, clot diameter, and scan duration were recorded for the freehand and teleoperated scans. The users then completed a survey, where various parameters were ranked on a scale of 1-5, with 5 being optimal. Next, each user performed three teleoperated scans with three random and counter-balanced latencies (0, 300, 600 ms). They started at a standardized position, located the clot, and measured its diameter. The duration of each test was recorded.

##### RESULTS

The clot diameters collected using freehand and teleoperated US were  $1.1 \pm 0.2$  cm and  $1.0 \pm 0.3$  cm, respectively. The time associated with performing the freehand and teleoperated DVT scans were  $8.7 \pm 3.8$  min and  $8.0 \pm 2.0$  min, respectively. The usability survey yielded the following average rankings for input device features: naturalism and usable workspace, 3.4; ergonomics, 3.9; ease of use, 4.3. The rankings for the robotic system features were: smoothness, 3.1; naturalism, 3.4; range of motion, 3.6; and control accuracy, control ease, and synchronicity, 3.7. The clot diameter collected with teleoperated US were  $1.2 \pm 0.24$  cm,  $1.1 \pm 0.32$  cm, and  $1.1 \pm 0.24$  cm for 0, 300, and 600 ms latencies, respectively. The duration of the tests subject to 0, 300, 600 ms latencies were  $1.3 \pm 0.69$  min,  $1.4 \pm 0.69$  min, and  $1.9 \pm 0.68$  min, respectively.

##### CONCLUSION

This study provides a proof-of-concept for the use of teleoperated diagnostic US as sonographers were able to measure the clot diameter within 0.1 cm of their freehand equivalent without increasing the time required for the scan. Latencies up to 600 ms did not affect the accuracy of the resultant clot diameter or scan time.

##### CLINICAL RELEVANCE/APPLICATION

The results of this proof of concept study encourages the continued pursuit of teleoperated US research as there is a strong potential it could result in more patients obtaining diagnostic US, improved outcomes from earlier diagnosis, and safer pregnancies.

#### W2-SPVA-2 Diagnostic Accuracy of Photon-Counting CT Angiography in Lower Extremity Peripheral Artery Disease: A Head-to-Head Comparison with Invasive Angiography

##### PURPOSE

CT Angiography (CTA) has gained increasing importance in assessing the presence and severity of peripheral artery disease (PAD). However, the diagnostic performance of the lower leg vasculature remains challenging due to small vessel diameters and impaired image quality caused by the blooming of calcified plaques. Recently introduced photon-counting detector CT (PCD-CT) technology may overcome these limitations. Therefore, we aimed to investigate and compare the diagnostic accuracy of PCD-CT for PAD of the lower leg with invasive digital subtraction angiography (DSA) as the reference standard.

##### METHODS AND MATERIALS

Consecutive patients with suspected PAD of the lower leg, who underwent CT and DSA within 48 hours, were prospectively included. Five series were reconstructed using dedicated vascular kernels (Bv40, Bv44, Bv48, Bv56, and Bv60). DSA of the lower extremities was acquired in two orthogonal orientations as the gold standard. To assess and compare the diagnostic performance of the different PCD-CT reconstructions, two interventional radiologists assessed all PCD-CT and DSA data independently in random order. They were blinded to the type of reconstruction. First, overall image quality was rated on a 5-Point Likert scale (5=excellent). Secondly, the presence and diagnostic confidence (5-Point Likert scale; 5=excellent) of potentially hemodynamic-relevant stenosis ( $\geq 50\%$ ) was assessed.

##### RESULTS

Among twenty-three patients included in the final analysis ( $70 \pm 11$  years, 39% female), six hemodynamic-relevant stenoses were detected on DSA. The highest overall image quality was found for the Bv56 and the Bv60 kernel (4 [4-4]; 4 [3-5];  $p=0.001$ ), followed by softer kernels. Also, the Bv56 kernel yielded the highest sensitivity (83.33%) and specificity (94.12%) for the detection of potentially relevant stenosis with the highest diagnostic confidence (4 [3-5];  $p=0.001$ ) and inter-reader agreement ( $k=0.7$ ),

similarly followed by Bv60 and softer kernels.

#### **CONCLUSION**

s PCD-CT CTA with a sharp vascular kernel (Bv56) allows for detecting relevant stenosis in the lower leg vasculature with high diagnostic accuracy and confidence. These results can potentially strengthen the role of CTA in the workup of patients with known or suspected PAD and reduce the number of invasive diagnostic DSA.

#### **CLINICAL RELEVANCE/APPLICATION**

CTA is important in the workup of PAD but remains challenging due to small vessel caliber and potential blooming artifacts. PCD-CT CTA with a sharp vascular kernel may improve image quality and, thus, patient management. Using PCD-CT may ultimately reduce the need for invasive diagnostic procedures.

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## Abstract Archives of the RSNA, 2023

W5A-SPBR

### Breast Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPBR- Correlation between Sarcopenia Evaluated with CT and Toxicity in Patients Affected by Breast Cancer** **1** during Adjuvant Chemotherapy

##### PURPOSE

Recent evidences suggest that in severe depletion of skeletal muscle, known as sarcopenia, the anti-cancer therapy is associated with poor prognosis and toxicity. Sarcopenia, often unrecognized, affects patients with low, normal or high body mass index (BMI). Aim of this study was to evaluate the association between lumbar skeleton muscle status (LSMI) evaluated with CT scans and toxicity in breast cancer patients receiving standard adjuvant chemotherapy

##### METHODS AND MATERIALS

22 breast cancer women (mean age:55) receiving epirubicin-based chemotherapy were enrolled in a prospective study. Skeletal muscle cross-sectional area at the third lumbar vertebra was measured by CT scans and sarcopenia was defined using the cut off point for LSMI of <38.5 cm<sup>2</sup>/m<sup>2</sup>. BMI and BSA were measured at every cycle of chemotherapy. CT scan was performed before the first and fourth cycle of chemotherapy. Toxicity was assessed after every cycle of treatment and it was graded according to the National Cancer Institute Common Toxicity Criteria. Serum samples were evaluated at every cycle to determine drug concentrations.

##### RESULTS

Before the first cycle of chemotherapy, 86.36% of patients were classified as sarcopenic. The sarcopenia mean value was 32.22 cm<sup>2</sup>/m<sup>2</sup> (SD: 5.78), and no differences by age and BMI were found. The BMI mean value was 23.97 (SD: 4.32). After the fourth cycle of chemotherapy the BMI mean value was 24.19 (SD: 4.74; range) and the sarcopenia mean value was 32.18 (SD: 5.68). 18% of patients reported severe toxicities (grade 3 or 4). Sarcopenia mean values were found significantly different (p-value 0.048) in patients with severe toxicity compared with patients with absent/mild toxicities (mean value: 27.17, SD, 3.27 versus 33.30, SD, 5.55, respectively). Changes in LSMI were associated with significant changes in toxicities (p-value 0.004). In 18% of patients with a severe toxicity, a decrease in LSMI values after the 4th cycle of chemotherapy was always detected.

##### CONCLUSION

s Preliminary analysis of available data showed an association between sarcopenia and toxicities, suggesting also that sarcopenia could be considered an early condition in breast cancer.

##### CLINICAL RELEVANCE/APPLICATION

If the association between changes in sarcopenia and toxicities will be confirmed in larger population, the measure of LSMI with CT scan could be used to personalized the dose of chemotherapy

#### **W5A-SPBR- Complex Interplay of MRI and Clinicopathology Variables in pCR Prediction across Breast Cancer** **2** Subtypes

#### Participants

Sarah Eskreis-Winkler, MD, Teaneck, NJ (*Presenter*) Nothing to Disclose

##### PURPOSE

Breast cancers exhibit different rates of pathologic complete response (pCR) according to tumor receptor status: HR+/HER2-, HER2+, and triple negative (TNBC). Deep learning (DL) models using MR have been developed for pCR prediction, but the comparative performance of pCR prediction for different subtypes has not yet been investigated. Herein, we build pCR prediction models for each subtype, compare performance across subtypes, and explore relationships to clinicopathology (CP) models.

##### METHODS AND MATERIALS

This IRB-approved HIPAA-compliant study included 719 breast MRs performed between 2014-2018 on breast cancer patients prior to neoadjuvant chemotherapy. Tumor subtype, pCR status, and CP variables were collected, including age, race, cancer history, clinical stage, nuclear grade, histological grade, and histology. A ResNet50-based architecture was built to predict pCR for each subtype using MR. Data was randomly split 80/10/10 into training, tuning and testing. Pre-contrast, post-contrast, subtraction, and T2 images were co-registered; tumor ROIs were automatically segmented and passed through the model. Final hyperparameters: 25 epochs; learning rate 2e-4, batch size 64. A penalized logistic regression model was built to predict pCR using CP variables alone. Patients were randomly assigned to training and testing with an 80/20 split. ROC curves were generated and AUCs were calculated for each subtype, for the MR and CP models. DeLong's test assessed statistical significance of differences in model performance.

##### RESULTS

Breast MRs included 210 HR+/HER2- (5050 axial slices), 349 HER2+ (8325 axial slices) and 160 TNBC (4521 axial slices) cases. Test set AUCs for the MR models were 0.62 for HR+/HER2-, 0.48 for HER2+, and 0.78 for TNBC. The best AUC (i.e. TNBC) was

statistically significantly higher than to the worst AUC (i.e. HER2+) ( $p < 0.001$ ). For the CP model, test set AUCs were 0.80 for HR+/HER2-, 0.68 for HER2+, and 0.55 for TNBC.

## CONCLUSION

s DL-based MR model performance for pCR prediction varies by subtype with the TNBC (AUC = 0.78) significantly outperforming HER2+. In contrast, the CP model exhibited poor performance for TNBC (AUC = 0.55). This suggests synergistic potential for pCR prediction using medical images and CP. We are actively working to develop a composite model that integrates multimodality inputs to optimize pCR prediction across all patients and all tumor subtypes.

## CLINICAL RELEVANCE/APPLICATION

DL-based MR models for pCR prediction perform better on some tumor subtypes than others, providing complimentary information to clinicopathology variables. This suggests synergistic potential for pCR prediction using a multimodality approach, enabling optimization of treatment planning for all breast cancer patients.

## W5A-SPBR- What is the Optimal Post Contrast Timing of Breast MRI to Evaluate Residual Tumor during the Course of Neoadjuvant Chemotherapy

3

### PURPOSE

Patients undergoing neoadjuvant chemotherapy (NAC) are often monitored using dynamic contrast enhanced (DCE)-MRI, a sensitive tool for residual tumor assessment. NAC can have antiangiogenic effects that can impact accurate assessment of residual tumors. Purpose of this study is to evaluate the optimal post contrast timing to evaluate residual tumor during the course of NAC.

### METHODS AND MATERIALS

An IRB approved study was performed. Publicly available 351 MRI exams from 117 breast cancer patients undergoing NAC in the ACRIN 6698 multi-institution trial were used for this study. The average age of patients was 49 y.o. (+/- 11). Of 117 patients, 36 patients (30.8%) achieved pathologic complete response (pCR) and 81 patients (69.2%) did not (non-pCR). Of 117 patients, 36 patients (30.7%) had triple negative tumors (ER-, PR-, HER2-), 30 patients (25.6%) had HER2+ tumors and 51 patients (43.6%) had ER+/HER2- tumors. The MRI exams included those from pretreatment [T0], early NAC treatment [T1], and mid-NAC treatment [T2]. For each tumor, we calculated the time to peak (TTP) to achieve maximal tumor enhancement and evaluated changes in TTP over the course of NAC treatment. TTP was calculated by segmenting the tumor and calculating the phase with maximum signal intensity measured within the tumor. TTP subanalysis was performed comparing patients with tumors that achieved pCR vs non-pCR and between subtypes of breast cancer. Statistical significance was determined with  $p < 0.05$  from a 2-tailed paired t-test.

### RESULTS

The TTP increased significantly over the course of NAC treatment. The TTP at T1 was 265 sec (+/- 151), at T2 was 314 s (+/- 314) and at T3 was 385 s (+/- 183). The average TTP increase of 159 s (+/- 146) from T0 to T2 was statistically significant ( $p < 0.05$ ). Tumors of patients that achieved pCR had significantly greater change in TTP from T0 to T1 compared to non-pCR [183 s (+/- 147) vs. 15 s (+/- 103),  $p < 0.05$ ]. Patients with triple negative and HER2+ tumors had greater change in TTP from T0 to T1 compared to ER+/HER2- tumors [90 s (+/- 212) and 63 s (+/- 209) vs. 5 s (+/- 229)] but was not statistically significant.

## CONCLUSION

s The optimal post contrast timing of breast MRI increases with NAC likely due to antiangiogenic treatment effects. DCE-MRI protocol should include delayed post dynamic sequences inclusive of 314 s to 385 s to enable maximal tumor enhancement to best evaluate residual tumor during NAC, particularly in triple negative and HER2+ tumors. A significant increase in TTP from T0 to T1 could be a possible novel biomarker of pCR but needs further studies.

## CLINICAL RELEVANCE/APPLICATION

In the setting of NAC, the most optimal timing of breast MRI is likely on the delayed post contrast images and should be part of the evaluation to most accurately assess residual breast tumor.

## W5A-SPBR- Correlation of MRI and Pathological Responses after Neoadjuvant Chemotherapy with Disease-Free Survival in Breast Cancer Patients: Subtype Analysis

4

### Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Ricardo Fernandes Da Cunha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### PURPOSE

To correlate response evaluation after neoadjuvant chemotherapy (NAC), assessed by magnetic resonance imaging (MRI) and pathology, with disease-free survival (DFS) in breast cancer patients, according to the subtype.

### METHODS AND MATERIALS

This single-center, IRB-approved, retrospective cohort study included consecutive breast cancer patients who underwent NAC and preoperative breast MRI. Pathologic response was assessed through the residual cancer burden (RCB) system, and absence of invasive carcinoma in the breast and axilla was defined as complete pathological response (pCR or RCB=0). Radiological complete response (rCR) was defined as the absence of abnormal enhancement in the tumor site on MRI. Kaplan-Meier estimator was used to estimate the disease-free survival. Cox regression analysis was used to estimate hazard ratio (HR) values.

### RESULTS

750 patients were included with mean age of 47 years (range: 26-90 years). The most common immunophenotype was Luminal ( $n=362$ ; 48.3%), followed by triple-negative ( $n=198$ ; 26.4%) and Her-2 overexpressed ( $n=190$ ; 25.3%). Most patients ( $n=474$ ; 63.2%) had clinical stage III at diagnosis. Overall, 34.5% of the patients had rCR, while 30.3% had pCR. During a mean follow-up of 72 months, patients who had both rCR and pCR had a better DFS curve, while patients with non-rCR and non-pCR had worse DFS curve, and those who had rCR or pCR presented an intermediate curve (LogRank  $p=0.001$ ). The statistically significant difference on DFS curves persisted for triple-negative (LogRank  $p < 0.001$ ) and Her-2 overexpressed subtypes (LogRank  $p = 0.014$ ), but not for luminal tumors (LogRank  $p=0.495$ ). Cox regression showed a higher risk of recurrence in patients with non-rCR and non-pCR (HR:



8.686;  $p=0.003$ ), those who had non-pCR and rCR (HR: 7.658;  $p=0.008$ ), and those who had pCR and non-rCR (HR: 3.644;  $p=0.109$ ), when compared to patients with rCR and pCR.

## CONCLUSION

The association of MRI and pathological responses after NAC might better stratify the risk of recurrence and prognosis in breast cancer patients, particularly for the triple-negative subtype.

## CLINICAL RELEVANCE/APPLICATION

Association of response evaluation after neoadjuvant chemotherapy by pathology and MRI allows better stratification of prognosis than both criteria used alone.

## W5A-SPBR- Features of MRI Screen-Detected Breast Cancers

5

### PURPOSE

Breast cancer is a leading cause of death in women in the United States. Supplemental screening with breast MRI in addition to mammography is recommended annually for patients who have greater than 20% lifetime risk for breast cancer. While there is robust data regarding features of screen-detected breast cancer using mammography, there is limited data regarding MRI screen-detected cancers. This study aims to identify features of breast cancers initially detected by MRI.

### METHODS AND MATERIALS

In this institutional review board-approved retrospective study, breast MRIs performed between August 1, 2016 and July 30, 2022 identified 51 screen-detected breast cancers in 48 patients. Clinical and imaging features of all eligible cancers were recorded, as well as frequency of cancer type and clinical stage.

### RESULTS

During the study period, 51 MRI-screen detected cancers were identified in 48 patients. Most cancers (33/51, 64.8%) were invasive and most (45/51, 88.2%) were stage 0 or I at diagnosis. At the end of the study period, 1/48 (2.1%) had metastasis (in a patient with recurrent angiosarcoma), 1/48 (2.1%) had died from other causes, and 46/47 (97.9%) had no evidence of disease following treatment. Final pathology showed that 26/51 (51.0%) of MRI screen-detected cancers were invasive ductal carcinoma, 6/51 (11.8%) invasive lobular carcinoma, 1/51 (2.0%) angiosarcoma and 18/51 (35.3%) DCIS. MRI-screen detected cancers most commonly presented as a mass (26/51, 51%) or non-mass enhancement (NME) (25/51, 47.1%), with only 1/51 (2%) presenting as a focus. Internal T2 signal was hypointense to fibroglandular tissue in 4/51 (7.8%), isointense in 29/51 (56.9%) and hyperintense in 18/51 (35.3%). Of those cancers that presented as a mass, the majority 15/27 (55.6%) had an irregular shape, 13/27 (48.1%) had irregular margins, and 15/27 (55.6%) had homogeneous internal enhancement. Of those that presented as NME, the majority 13/24 (54.2%) were linear NME and had homogeneous internal enhancement 15/24 (62.5%). Many of the cancers were in patients who had prior MRI exams (37/51, 72.5%).

### CONCLUSION

MRI screen-detected cancers were most often invasive, rather than in situ, cancers. Cancers detected by MRI screening had an excellent prognosis in our study population, supporting the clinical utility of breast MRI in the early diagnosis of breast cancer. Common MRI presentations included an irregular mass and linear non-mass enhancement.

## CLINICAL RELEVANCE/APPLICATION

Screening MRI often detected small, invasive breast cancers, underscoring its clinical importance in women at high risk for breast cancer. Understanding the most common imaging presentations of MRI-screen-detected cancers may guide interpretation and diagnostic performance of the exam.

## W5A-SPBR- Does the Addition of MRI Help in Cancer Detection in Women with Low Breast Tissue Density in a Population-based High-risk Breast Screening Program

6

Participants

David Martin, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

### PURPOSE

The High-Risk Ontario Breast Screening Program (HROBSP) screens women ages 30-69 who are confirmed to be at high risk of developing breast cancer (gene mutation carriers or lifetime risk  $\geq 25\%$ ) with annual mammography and breast MRI. Mammographic breast tissue density (BTD) is an independent risk factor for breast cancer, and the sensitivity of mammography is diminished in women with dense versus fatty breasts. We aimed to compare cancer detection rate (CDR) according to BTD and determine if breast MRI in HROBSP patients with fatty BTD is necessary given the improved sensitivity of mammography.

### METHODS AND MATERIALS

IRB approved retrospective review of all HROBSP breast MRIs performed at our institution from 04/04/2016 to 06/05/2022 was conducted. For each study, BI-RADS<sup>®</sup> BTD was recorded, and charts were reviewed to identify patients with breast cancers diagnosed during the screening period. Imaging was reviewed to determine if the cancer was seen on mammography, MRI or both.

### RESULTS

6468 MRIs were reviewed (2082 patients) over 6-year study period. 66 cancers were detected in all (cancer detection rate (CDR)=10.2/1000); 5(7.6%) detected in category A, 20(30.3%) in B, 34(51.5%) in C and 7(10.6%) in D. 468(7.2%) MRIs were performed in 12.5%(260/2082) women with category A, who had 4 cancers (80%) detected on MRI alone and 1 cancer on both mammography and MRI. There was no difference in CDR by BTD (CDR for category A=10.7/1000, B=8.6/1000, C=11.8/1000, and D=9.1/1000,  $p=0.7$ ).

### CONCLUSION

Adjunctive screening with breast MRI in HROBSP patients is necessary for women with category A density breasts, despite the increased sensitivity of mammography in this patient population.

## CLINICAL RELEVANCE/APPLICATION

The HROBSP program with yearly mammography and breast MRI aids in early detection of breast cancer in all women, regardless of breast density.

### W5A-SPBR- Outcomes of Supplemental Breast MRI in a High Risk Screening Program

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Participants

Stamatia Destounis, MD, Rochester, NY (*Presenter*) Medical Advisory Board, iCad, Inc

#### PURPOSE

The Tyrer-Cuzick (TC) model has increasingly been used to identify high-risk women in breast imaging centers. The accuracy of the model has been studied in several patient cohorts, but, outcomes of using the TC model to make supplemental breast MRI recommendations are less reported. We studied the incidence of breast cancer and tumor characteristics at a community-based breast imaging center to better understand the outcomes of the risk assessment program.

#### METHODS AND MATERIALS

A retrospective analysis of patients participating in the risk assessment program starting in December 2016 was performed. Patients with a TC lifetime risk score >20% were offered supplemental MRI screening and are defined as high-risk (HR) in this study. Data were collected from the electronic health record, including Breast MRI data and cancer outcomes, and was matched to the risk assessment and imaging studies data. We limited our cohort to those with at least 5 years of follow-up. Patients with history of breast cancer prior to the first risk assessment, patients who were under 40 or over 79 years old, and patients without a valid TC score were excluded.

#### RESULTS

There were 54,706 patients who met study inclusion criteria with median age of 57, at median follow-up time of 5.2 years during which 2,259 cancers arose. The HR group was comprised of 8,737 (15.5%) patients (median age 52); LR group had a median age of 58 ( $P < 0.001$ ). Of HR patients, there were 2,108 (24.1%) who had breast MRI with a high-risk exam indication (median age 51). Odds ratio (OR) for breast cancer for the total HR group compared to the LR group was 1.50 (95% CI: 1.36 to 1.67,  $P < 0.0001$ ). OR for the HR group who were getting MRI compared to the LR group was 1.47 (95% CI: 1.21 to 1.78,  $P < 0.0001$ ). OR for the HR group who were not getting MRI compared to the LR group was 1.51 (95% CI: 1.35 to 1.70,  $P < 0.0001$ ). When considering tumor size of T2 or greater as large, the OR for a larger tumor when comparing the HR group to the LR was 0.57 (95% CI: 0.39 to 0.84,  $P = 0.0038$ ). For the HR group with MRI the OR was 0.39 (95% CI: 0.17 to 0.91,  $P = 0.029$ ) and the OR for HR group without MRI was 0.63 (95% CI: 0.42 to 0.96,  $P = 0.030$ ). Though not statistically significant, 12.9% of cancers in the LR group were node positive, compared to 6.4% in the HR group with MRI ( $P = 0.0698$ ).

#### CONCLUSION

Supplemental MRI screening in high-risk women can lead to earlier detection of breast cancer, finding tumors at lower stage that may lower the burden of disease. Further investigation in how to improve the uptake of high-risk interventions such as breast MRI screening will be beneficial.

## CLINICAL RELEVANCE/APPLICATION

This study reports the impact of offering supplemental breast MRI as part of a large breast screening program. This high-risk cohort had an increased cancer rate and smaller tumors.

### W5A-SPBR- Application Value of Imaging Manifestations Combined with Tumor-Related Diffusion-Weighted Imaging Models in Predicting Molecular Subtype of Breast Invasive Ductal Carcinoma

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#### PURPOSE

To evaluate and compare the value of MR imaging manifestations and 6 tumor-related DWI models in predicting the molecular subtypes of breast invasive ductal carcinoma (IDC).

#### METHODS AND MATERIALS

This study included 100 patients with breast IDC confirmed by pathological examination in our hospital. All the patients underwent routine MRI and multiple-b-value DWI examinations on a 3T scanner (MAGNETOM Vida, Siemens, Erlangen, Germany). The scanning parameters are shown in Table 1. The patients were divided into three groups, including luminal ( $n=72$ ), HER-2 overexpressing ( $n=13$ ), and triple-negative ( $n=15$ ) subtypes. The value in predicting the molecular subtype of IDC was evaluated in terms of imaging manifestations and quantitative parameters of DWI models. All the 14 quantitative parameters (CTRW\_a, CTRW\_β, CTRW\_D, FROC\_β, FROC\_D, FROC\_μ, DKI\_D, DKI\_K, IVIM\_D, IVIM\_D\*, IVIM\_f, Mono\_ADC, SEM\_a, and SEM\_DDC) of the 6 DWI models were calculated by an in-house developed software called BoDiLab based on Python 3.7. All ROI measurements were done on the ITK-SNAP. Univariate and multivariate regression analysis were performed to screen independent predictive factors for different molecular subtypes, and a combined model was established, which was then visualized with a nomogram. ROC curves were used to assess the diagnostic performance of each parameters or model in discriminating molecular subtypes. All the analysis was performed using the software SPSS 26.0 and R language.

#### RESULTS

Margin burr and rim enhancement were independent imaging manifestation-related predictors of triple-negative breast cancer (TNBC) ( $P < 0.05$ ), which showed high diagnostic performance when combined with CTRW\_a and DKI\_K (AUC/sensitivity/specificity value of 0.870/80.0%/88.2%) (Figure 1). Luminal IDC was more likely to appear with margin burrs ( $P < 0.05$ ), and the diagnostic performance was higher when combined with CTRW\_a, DKI\_K, and IVIM\_f. HER-2-overexpressing IDC was commonly accompanied by peritumoral edema ( $P < 0.05$ ), and IVIM\_f showed high diagnostic value for this subtype (Table 2, 3). Nomogram for predicting the TNBC and luminal subtype were shown in figure 2.

#### CONCLUSION

The combined diagnostic model based on imaging manifestations and multiple DWI quantitative parameters has high diagnostic value in predicting the molecular subtype of breast IDC, and the parameters may be used as non-invasive biomarkers in future clinical practice.

#### **CLINICAL RELEVANCE/APPLICATION**

This study explored the value of MRI manifestations combined with different DWI quantitative parameters in predicting the molecular subtypes for breast IDC, which may have guiding significance for the formulation of individualized treatment strategies in clinical practice.

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## Abstract Archives of the RSNA, 2023

W5A-SPCA

### Cardiac Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPCA- Diagnostic Accuracy of Spectral CT Aortograms for the Detection of Acute Myocardial Infarction** 1

##### Participants

Dene Ellis, BMBS, London, United Kingdom (*Presenter*) Nothing to Disclose

##### PURPOSE

Acute myocardial infarction (MI) presentation is often atypical and unclear, justifying further investigations for other causes of chest pain. Thus, in modern practice CT aortograms (CTAs) are essential to exclude acute aortic syndrome (AAS). Despite being a non-dedicated study for the assessment of coronary heart disease (CHD), new spectral CT technologies may enable interrogation of coronary abnormalities or discernible myocardial perfusion defects. The aim of this study is to assess the diagnostic performance of gated-spectral CTAs in diagnosing acute MI. This will help to determine the prevalence of acutely presenting CT-imaging features by measuring myocardial Hounsfield Unit (HU) values indicative of evolving regional ischaemia.

##### METHODS AND MATERIALS

Retrospective consecutive cohort analysis was conducted to include acute chest pain patients that underwent urgent gated-spectral CTAs as a triple rule-out test for AAS at a large tertiary centre, over 12 months (Jan-Dec 2022). CTAs performed for reasons other than acute pain (e.g. trauma) were excluded. Data sources included patients' electronic records and the institution's PACS, to collate patients' demographics, clinical information, imaging findings, outcomes of further investigations and definitive management. This enabled correlation with troponin levels, ECG, and echocardiographic observations. On CTAs, LV myocardial hypo-enhancement HU was measured after visual assessment by two cardiac-trained radiologists to localise culprit diseased coronary arteries.

##### RESULTS

In a total of 309 CTAs, n=30 (9.7%) studies showed regional myocardial hypo-enhancement, confirmed later as acute MI. Of those, n=18/30 (60%); underwent urgent invasive angiography, where n=13 received percutaneous interventions and n=7 required urgent coronary artery bypass graft (CABG) surgery. Two patients died shortly after CTA acquisition, one of which had a post-mortem examination confirming a large territory MI. CTA yields an 90.9% sensitivity, 99.3% specificity and 98.4% accuracy in identifying acute MI (prevalence-adjusted). Ischaemic myocardial regional hypo-enhancement was (HU=50, SD=17.7) significantly lower ( $p<0.001$ ) than healthy myocardium (HU=126, SD=19.4).

##### CONCLUSION

At our institution, gated-spectral CTA has been utilised to investigate equivocal acute chest pain presentations in the emergency setting. The benefits of its excellent diagnostic accuracy can be achieved by educating reporting radiologists and cardiologists.

##### CLINICAL RELEVANCE/APPLICATION

Gated-spectral CTA can preclude the need for post-mortem examination, but it is most beneficial in reducing time-to-intervention by avoiding unnecessary further tests, especially in equivocal NSTEMI cases.

#### **W5A-SPCA- Measurement Accuracy of Aortic Valve Annulus with and without Whole-heart Motion Correction Algorithm in Multi-slice CT for Pre-operative TAVI: Compared to 3D Transesophageal Echocardiography** 2

##### Participants

Takayuki Yoshiura, BA, RT, Hiroshima, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Accurate measurements of the aortic valve annulus with multi-slice CT (MSCT) are required for the success of pre-operative transcatheter aortic valve implantation (TAVI) procedure. The whole-heart motion correction (MC) algorithm is useful for reducing aortic annulus motion artifacts and is expected to measurement accuracy. The purpose of this study is to investigate the measurement accuracy of the aortic valve annulus with and without MC algorithm in MSCT compared to three-dimensional transesophageal echocardiography (3D TEE).

##### METHODS AND MATERIALS

We retrospectively analyzed 15 patients who underwent TAVI. The three mutually perpendicular planes so that the cross-sectional plane just passed through the plane of the lowest point of the aortic valve leaflet attachment, and the resulting section was the aortic annulus plane. The axial plane was reconstructed for the minimum aortic annulus diameter, and the valsalva and aortic annulus diameter were measured using 256-slice CT (Revolution Apex; GE Healthcare, Milwaukee, Wisconsin). We created an annulus plane on 3D TEE (EPIQ CVx; Koninklijke Philips Ultrasound, USA) using the same method as CT, and measured the minimum diameter of the valsalva and aortic annulus in the sagittal plane. All CT images were using the with and without MC algorithms and

compared to 3D TEE measurements.

## RESULTS

The measured mean diameter of aortic valve annulus for axial plane was 30.00 mm and 28.61 mm for with and without MC algorithms. The measured mean diameter of aortic valve annulus for the sagittal plane was 30.22 mm for 3D TEE, showing a significant difference between without MC algorithm and 3D TEE ( $p < 0.01$ ), but not between with MC algorithm and 3D TEE ( $p > 0.05$ ). The measured mean diameter of aortic annulus for the axial plane was 20.20 mm and 19.53 mm for with and without MC algorithms. The measured diameter of aortic annulus for the sagittal plane was 20.50 mm for 3D TEE, showing a significant difference between without MC algorithm and 3D TEE ( $p < 0.01$ ), but not between with MC algorithm and 3D TEE ( $p > 0.05$ ).

## CONCLUSION

MC algorithm in MSCT enabled the accurate measurements of aortic valve annulus for pre-operative TAVI.

## CLINICAL RELEVANCE/APPLICATION

The application of MC algorithm in MSCT is useful for the accurate measurements of aortic valve annulus for pre-operative TAVI.

## W5A-SPCA-3 Association between Coronary Sinus Flow Estimated by Dynamic Coronary CT Angiography and 13N-ammonia PET-derived Myocardial Flow Reserve

### PURPOSE

Coronary sinus (CS) flow is regulated by global myocardial blood flow (MBF) and directly affects myocardial flow reserve (MFR) reduction. We devised a new method for CS flow quantification using 320-row dynamic coronary CT angiography (CCTA) and investigated the relationship between CS flow determined via CCTA and MBF or MFR values obtained via 13N-ammonia positron emission tomography (NH3-PET).

### METHODS AND MATERIALS

Forty patients with moderate to severe coronary artery stenosis on dynamic CCTA who subsequently underwent adenosine-stress NH3-PET were enrolled in this study. Time-attenuation curves of the CS and the ascending aorta were extracted from dynamic CCTA data. The upslope of the CS was defined as the initial slope of the CS attenuation increase divided by that of the ascending aorta. CS start time (s) was defined as the timepoint between the peak aortic attenuation and the initial increase in CS attenuation. Global MBF was calculated from dynamic NH3-PET data. Global MFR was defined as the ratio of adenosine-stress MBF to the rest MBF.

### RESULTS

The CS upslope was moderately positively correlated with rest MBF (Pearson correlation coefficient  $r$ , 0.443;  $p = 0.004$ ), and CS start time was moderately negatively correlated with MFR ( $r$ , -0.540;  $p < 0.001$ ). The diagnostic performance predicting MFR  $< 2.0$  according to the following criteria: CS starting time  $> -0.36$  seconds was 86% sensitivity, 76% specificity, and an area under the curve of 0.83.

### CONCLUSION

Dynamic CCTA-estimated CS flow measurements were significantly correlated with NH3-PET-derived MBF and MFR values. A delayed CS start time can be used to predict a significant decrease in MFR in coronary artery disease.

### CLINICAL RELEVANCE/APPLICATION

This method may help estimate MFR even in facilities that do not have a PET scanner.

## W5A-SPCA-4 Impact of Super-Resolution Deep Learning Reconstruction Technique on Dynamic Myocardial Computed Tomography Perfusion Imaging

Participants

Tomoro Morikawa, MD, Toon-shi, Japan (Presenter) Nothing to Disclose

### PURPOSE

Super-resolution deep-learning reconstruction (SR-DLR) is a novel computed tomography (CT) image reconstruction technique using a deep convolutional neural network that allows for improvement of spatial resolution on CT images as with ultra-high-resolution CT. This study aims to evaluate the impact of SR-DLR on the image quality and hemodynamic parameter of dynamic myocardial computed tomography perfusion (CTP) by comparing with hybrid iterative reconstruction (HIR) and DLR.

### METHODS AND MATERIALS

This retrospective study included 26 patients who underwent dynamic myocardial CTP with pharmacological stress using 320-detector-row CT scanner for assessing coronary artery disease. The CTP images were reconstructed with HIR, DLR, and SR-DLR. For qualitative image quality assessment, overall visual score was evaluated on 4-point scale (1=poor, 4=excellent). For quantitative image quality assessment, CT attenuation and standard deviation in the myocardium (septum and lateral wall) and blood pool were recorded to calculate the image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR). Additionally, the CT attenuation profile across the myocardium and blood pool was generated to measure the edge rise slope (ERS) and edge rise distance (ERD). For hemodynamic parameter assessment, overall CT-derived myocardial blood flow (CT-MBF) was quantified. These results were compared among three different CTP images reconstructed by HIR, DLR, and SR-DLR.

### RESULTS

The mean visual image quality score on SR-DLR was better than on HIR and DLR (3.6 vs 2.2 and 2.8;  $p < 0.01$ ). The median image noise on SR-DLR was significantly lower than on HIR and DLR (15.6 vs 23.1 and 17.8;  $p < 0.01$ ). The mean SNR and CNR on SR-DLR were significantly higher than on HIR and DLR (SNR: 9.7 vs 7.3 and 7.9,  $p < 0.01$ ; CNR: 28.5 vs 20.1 and 23.4,  $p < 0.01$ ). The median ERD on SR-DLR was significantly shorter than on HIR and DLR (2.3 vs 3.0 and 2.6;  $p < 0.01$ ), and the mean ERS on SR-DLR was significantly steeper than on HIR and DLR (168.4 vs 126.1 and 151.2;  $p < 0.01$ ). There was no significant difference in mean CT-MBF among the three different CTP images reconstructed by HIR, DLR, and SR-DLR (2.37, 2.38 vs 2.39 mL/g/min).

## CONCLUSION

SR-DLR was superior to HIR and DLR with respect to the image noise and the sharpness of myocardial margins without altering CT-MBF quantification in dynamic myocardial CTP imaging.

## CLINICAL RELEVANCE/APPLICATION

SR-DLR allows for improving the image noise and sharpness more effectively than conventional reconstruction techniques in dynamic myocardial CTP imaging without requiring hardware changes. SR-DLR has a potential to improve the detectability of myocardial perfusion abnormality by taking advantage of the high spatial resolution and noise reduction capability.

## W5A-SPCA- Deep-Learning Image Reconstruction Algorithm: Impact on Plaque Analysis in Coronary Computed Tomography Angiography

Participants

Domenico De Santis, MD, Roma, Italy (*Presenter*) Nothing to Disclose

## PURPOSE

Plaque composition in Coronary Computed Tomography Angiography (CCTA) relies on plaque density measurements and subsequent partition in different components: lipid, fibro-fatty, and calcified. Newly developed deep-learning image reconstruction algorithms (DLIR) hold promises to replace iterative reconstructions in CCTA, granting high image quality, low dose, and no detrimental effect on image texture; however, different strength levels may have an impact in plaque features extraction. The aim of this study was to assess the influence of DLIR at different strength levels on coronary plaque analysis.

## METHODS AND MATERIALS

Forty consecutive patients (mean age  $61.9 \pm 15.4$  y) who underwent clinically indicated retrospectively ECG-gated CCTA were included in the study. CT scans were performed on a 128-row CT scanner (Revolution EVO, GE Healthcare) with the following parameters: tube voltage, 100 kV; tube current: 200 mA; detector collimation: .625 mm, rotation time: .6 s, automatically adjusted spiral pitch from .16 to .30, and matrix:  $512 \times 512$  pixels. A fixed amount (60 mL) of iodinated contrast medium (Iomeprol 400) was intravenously administered at a flow-rate of 5 mL/s. Raw data were reconstructed using ASiR-V 50% and DLIR at three strength levels (DLIR\_L, DLIR\_M, and DLIR\_H). Plaque analysis was performed using a dedicated software (SurePlaque, Canon Medical Systems, Japan): plaque burden, plaque volume, mean density, and plaque composition were assessed on a per-vessel analysis. Statistical analysis was performed by means of Kruskal-Wallis H Test, followed by Dunn's test for pairwise comparisons.

## RESULTS

Fifty-seven plaques were analyzed for each reconstruction, for a total of 228 plaques. Total plaque burden was 61.1%, plaque volume was 132 mm<sup>3</sup>, and mean density was 179 HU. DLIR at different strength levels did not show statistically significant differences in the three parameters (all  $P = .906$ ). In terms of plaque composition, no differences have been found for fibro-fatty and calcified components ( $P = .503$  and  $= .821$ , respectively). The mean density of lipid plaques was statistically different among the four algorithms ( $P = .013$ ), in particular pairwise comparison showed difference between DLIR\_L and DLIR\_H ( $P = .009$ ).

## CONCLUSION

DLIR has no impact on overall plaque analysis compared to routinely applied ASiR-V; DLIR\_L might return lower density values for lipid plaque component.

## CLINICAL RELEVANCE/APPLICATION

DLIR grants reliable coronary plaque analysis; therefore, it can be safely implemented in CCTA examinations. DLIR\_L impact on lipid component should not hinder plaque analysis, since lower lipid density values broaden the density differences with fibro-fatty plaque component.

## W5A-SPCA- Evaluation of Dual-Source Photon-Counting CT Virtual Monoenergetic Imaging of Coronary Arteries in TAVI Patients

Participants

Daniel Overhoff, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

Transcatheter aortic valve implantation (TAVI) is a widely utilized valve replacement procedure. The coronary arteries must be assessed before each procedure, which is usually done using invasive catheter angiography. The photon counting detector-CT (PCD-CT) yields the possibility to evaluate the specifications of the valve and the coronary arteries with a one-stop-shop approach. The aim of this study was to evaluate the impact of low energy virtual monoenergetic images (VMI+) objective image parameters (vessel enhancement, noise (standard deviation of vessel attenuation), signal to noise ratio (SNR), contrast to noise ratio (CNR)) of the coronary arteries in pre-TAVI CT examinations.

## METHODS AND MATERIALS

We retrospectively analyzed 125 pre-TAVI CT datasets from a first generation Dual-Source PCD-CT (Naeotom alpha, Siemens Healthineers, Forchheim Germany). The coronary arteries were analyzed in virtual monoenergetic images ranging from 40 to 100 keV in 15 keV steps. Maximum vessel density Hounsfield Units (HU) were measured for Left main (LM), Right coronary artery (RCA), Left circumflex (LCX) and Left anterior descending (LAD) at the proximal vessel segment. Signal-to-noise ratio and contrast-to-noise ratio were calculated.

## RESULTS

A total of 125 patients (73 male/52 female) were included in the final assessment. Maximum intraluminal enhancement of coronary arteries was measured for 40keV ( $1123 \pm 312$  HU) with decreasing density values with increasing keV values (100keV  $220 \pm 55$  HU). SNR showed a significant reciprocal values with highest SNR at 100keV compared to 40keV ( $14.55 \pm 9.47$  vs  $10.68 \pm 6.68$   $p < 0.001$ ). The CNR, in turn, demonstrated significantly improved values at lower keV levels. (40keV vs 100keV/  $26.37 \pm 10.15$  vs  $8.50 \pm 3.50$   $p < 0.001$ ). There were no significant gender differences in the above changes.

## CONCLUSION

s PCD-CT virtual monoenergetic images offer the possibility to improve the image quality for the assessment of the coronary arteries in pre-TAVI-CT. The highest vascular contrast and CNR are achieved at 40keV. SNR is highest at 100keV and decreases at lower keV levels.

#### **CLINICAL RELEVANCE/APPLICATION**

PCD-CT virtual monoenergetic images yield the possibility of potential reduction of contrast media and an optimization of image quality with reduction of radiation dose for the analysis of coronary arteries in TAVI patients.

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## Abstract Archives of the RSNA, 2023

W5A-SPCH

### Chest Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPCH- Impact of Different AI User Interfaces on Lung Nodule and Mass Detection on Chest Radiographs 1**

##### **PURPOSE**

To explore the impact of different user interfaces (UIs) for artificial intelligence (AI) outputs on radiologist performance and user preference in detecting lung nodules and masses on chest radiographs.

##### **METHODS AND MATERIALS**

A retrospective paired-reader study with a 4 week washout period was used to evaluate three different AI UIs compared with no AI output. Ten radiologists (8 radiology attendings and 2 trainees) evaluated 140 chest radiographs (81 with histologically confirmed nodules and 59 confirmed as normal by CT), with either no AI or one of three UI outputs: 1) text only, 2) combined AI confidence score and text, or 3) combined text, AI confidence score and image overlay. Areas under the receiver operating characteristic curve (AUCs) were calculated to compare radiologist diagnostic performance with each UI with performance without AI. Radiologists reported their user interface preference.

##### **RESULTS**

AUC improved when radiologists used the text-only output compared with no AI (0.87 vs 0.82, p-value<0.001). There was no difference in performance for the combined text and AI confidence score output compared with no AI (0.77 vs 0.82, p-value=0.46) and for the combined text, AI confidence score and image overlay output compared with no AI (0.80 vs 0.82, p-value=0.66). Eight of the 10 radiologists (80%) preferred the combined text, AI confidence score and image overlay output over the other two interfaces.

##### **CONCLUSION**

s Text only UI output significantly improved radiologist performance compared with no AI in the detection of lung nodules and masses on chest radiographs, but user preference did not correspond with user performance.

##### **CLINICAL RELEVANCE/APPLICATION**

Understanding the impacts of how different user interfaces may alter reader performance is a crucial aspect of AI implementation in radiology.

#### **W5A-SPCH- Physics-based Data Augmentation to Improve Chest X-ray Abnormality Classification 2**

##### **PURPOSE**

Many AI methods to detect chest X-ray (CXR) abnormalities have demonstrated promising results by adopting image pre-processing techniques (e.g., histogram equalization (HE), contrast limited adaptive histogram equalization (CLAHE), and unsharp masking (UM)). However, those methods showed limited diagnostic performance when applied to CXRs with different image characteristics from various X-ray scanners. Here, we propose an X-ray physics-based data augmentation (i.e., XPA) that perturbs CXRs during AI training to overcome this problem.

##### **METHODS AND MATERIALS**

Unlike conventional image pre-processing methods (e.g., HE, CLAHE, and UM) that normalize CXRs before AI training and testing, XPA randomly perturbs image characteristics on training CXRs by applying a series of image processing methods (e.g., gamma correction for contrast perturbation) to mimic hardware-related changes (e.g., voltage, current, etc.) during AI training. Seven datasets from different X-ray machines (digital radiography (DR) or computed radiography (CR)) and institutions were collected. One dataset was from a Vietnam hospital and annotated by a radiologist as normal or abnormal (e.g., opacity, etc.) for AI (7,202 CXRs for training; 1,278 CXRs for testing (VHDR1)). Four datasets were from Indonesian hospitals, including a dataset acquired from a portable X-ray machine (IHCR1,Portable:204; IHCR2 :227; IHCR3:356; IHDR2:1,909 CXRs) and annotated for AI testing. Two datasets (i.e., Shenzhen (SZDR3) and Montgomery (MGCR4)) were from public domains as testing data. We trained four AI models (EfficientNet-B6) using HE, CLAHE, UM, and proposed XPA to classify CXRs as normal or abnormal and compared their diagnostic performance. To check the capability of each method to cover CXRs from different machines, only the CXRs acquired using the DR system in the Vietnam hospital were utilized for training.

##### **RESULTS**

For VHDR1 (internal test dataset), the diagnostic performance of all AI models was not statistically significant (i.e., p-value>0.05). However, in most of the test datasets, the AI model with XPA outperformed the others, including the datasets acquired from the different CR detectors (IHCR2, IHCR3, and MGCR4), portable X-ray machine (IHCR1,Portable; AUC: 0.950 for XPA; 0.924 for HE; 0.920 for CLAHE; 0.891 for UM; p-value<0.05), and DR detectors (IHDR2 and SZDR3).

##### **CONCLUSION**

s The diagnostic performance of the AI model was improved with XPA for the CXR datasets from different X-ray machines (i.e., DR,



CR, and portable machines) compared to those of the other AI models with conventional image pre-processing methods.

#### **CLINICAL RELEVANCE/APPLICATION**

The proposed AI showed potential clinical usage when the CXRs were acquired using various X-ray scanners.

### **W5A-SPCH- Investigating the Feasibility of Using AI to Detect Unreported Chronic Disease Findings on Chest X-Ray in a Retrospective Aged Patient Dataset**

Participants

Jonathan S. Luchs, MD, Woodbury, NY (*Presenter*) Nothing to Disclose

#### **PURPOSE**

This study evaluates the feasibility of using an artificial intelligence (AI) model to retrospectively identify 27 chronic disease findings in an aged patient chest X-ray (CXR) dataset. The aim of this study was to investigate the ability of the AI model to identify findings not previously reported in the radiologists' report. This aims to validate the usefulness of AI as a quality improvement device to improve the characterization of patient cardiovascular disease risk.

#### **METHODS AND MATERIALS**

The study dataset consisted of 1,261 CXRs from patients  $\geq 65$  years, collected from outpatient clinics. CXR images were retrospectively processed by the AI for the presence of predefined chronic disease findings. As a comparison, the radiologist report was manually reviewed for the presence/absence of these findings, with findings considered absent if they were not mentioned in the report. In cases where there was a discrepancy between the model and report, a radiologist adjudicator evaluated the CXR scan to determine ground truth (GT), i.e. if the finding was overcalled or under called by the AI model/radiologist.

#### **RESULTS**

Reported prevalence of findings varied between the AI model and report. The AI model reported 505, 731, 650 and 783 instances of cardiomegaly, unfolded aorta (UA), aortic arch calcification (AAC) and spine arthritis (SA), compared to 194, 12, 622 and 562 in the report, respectively. There were 133, 48 and 29 instances of lower, upper, and diffuse interstitial thickening reported by the AI model, compared to 554, 553 and 557 in the report, respectively. Across all findings, Cohen's Kappa agreement was 0.17, indicating slight agreement. Comparison with the GT showed that cardiomegaly, UA, AAC and SA were underreported in the report compared to the AI model (report sensitivity (sens): 0.32, 0.02, 0.54, 0.44, vs. AI model sens: 0.83, 0.86, 0.75, 0.75, respectively). This resulted in 68%, 98%, 46%, and 56% of these findings being missed by the report, while 17%, 14%, 25%, and 25% were missed by the AI model. Conversely, diffuse, lower and upper interstitial thickening were over reported compared to the AI model, as shown by reduced specificity of the report (report; 0.58, 0.58, 0.58 vs. AI; 0.99, 0.92, 0.96, respectively).

#### **CONCLUSION**

AI models in medical imaging have typically focused on radiological finding detection to provide diagnostic assistance to radiologists. Here we present evidence that a quality improvement AI device can enhance patient care and management through the detection of under and over reporting of chronic disease findings.

#### **CLINICAL RELEVANCE/APPLICATION**

Chronic diseases are often incidentally detected on CXR but not reported due to their low-risk nature. However, these findings can be significant predictors of patient health risk.

### **W5A-SPCH- Multiclass Labelling of Foreign Hardware on Chest Radiographs using a Convolutional Neural Network**

#### **PURPOSE**

To assess the accuracy of transfer learning with a pre-trained convolutional neural network (CNN) in detecting multiple classes of medical devices and other foreign bodies on chest radiographs.

#### **METHODS AND MATERIALS**

A total of 2000 de-identified, publicly available chest radiographs were binary labelled for the presence of 18 different types of foreign bodies by two radiology fellows. The images were split into training and validation data sets (80:20 ratio). A pre-trained ResNet50 convolutional neural network model based on weights obtained from ImageNet was loaded from the TensorFlow environment. The top layer was removed and replaced with a single densely connected layer. The ResNet50 pretrained model expects a 224 x 224 x 3 channel input. The x-ray images were down sampled to 224 x 224 using simple averaging.

#### **RESULTS**

After several epochs the neural network could correctly classify the presence or absence of different medical devices or foreign objects with an accuracy of 78-99% on the validation data set, and 10/17 classes were detected with  $>90\%$  accuracy. This model did show high average specificity (98% [93-100%]) but variable sensitivity (57% [11-100%]) across classes, likely attributable to the small size of the dataset and high similarity in form and position of several devices.

#### **CONCLUSION**

Transfer learning using a pre-trained neural network permits high accuracy classification of foreign bodies and medical devices on chest radiographs without the need for hyperparameter tuning. Larger datasets and improved annotation will be required to further improve the performance of future models.

#### **CLINICAL RELEVANCE/APPLICATION**

These findings represents an important step towards more accurate and rapid confirmation of device presence in comparatively undifferentiated CXRs.

### **W5A-SPCH- Radiomics Analysis for Predicting Progression of Part-Solid Nodules on CT**

Participants

Shiny Weng, BA, BA, Berkeley, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Radiomics, with its diverse set of features, has the potential to reveal novel avenues for identifying malignant nodules and detecting subtle patterns not visible to the naked eye. In clinical practice, identifying progressive nodules is crucial for detecting malignancies. Hence, this study aims to explore the statistical significance of radiomic and clinical features in predicting overall growth in part-solid nodules (PSNs).

## METHODS AND MATERIALS

In this retrospective study, institutional chest CT scans between 2015 and 2019 were collected. Corresponding radiology reports were used to extract ground truth labels for nodules' growth status (i.e., increase vs. unchanged), as well as other related information such as nodule size, location, slice, component sizes, and compared studies. An automated NLP pipeline was used for the extraction, and manual review was used to ensure the dataset's accuracy. Additionally, associated CT scans were run through a commercial nodule characterization algorithm. The parameters generated from this algorithm, such as nodule size and location, were then compared and matched with the extracted features from the original radiology reports.

## RESULTS

The final dataset consists of 1276 PSNs, and ground truth labels are available for 1009 PSNs (830 unchanged, 166 growing, 13 decreasing). From this dataset and using radiomic (from pyRadiomics) and clinical features (e.g., patient age, gender), we developed various ML models for predicting growth in PSNs, of which Random Forests achieved the highest AUC of 0.78 on the validation set. Moreover, in the statistical analyses of the association of radiomic and clinical features with nodule progression, 88 radiomic features were statistically significant ( $p < 0.05$ ) based on a Mann-Whitney U Test. Such radiomic features include Surface Volume Ratio, Zone Variance, and Small Dependence High Gray Level Emphasis, all of which had high feature importance for identifying progressive nodules in the Random Forests model. Among clinical features, Patient Age exhibited high feature importance. 75 features were used for the Random Forests model, which were selected using random forest importance, recursive feature elimination, and univariate selection.

## CONCLUSION

We developed a model to identify nodule progression from a predictive set of radiomic and clinical features, achieving an AUC of 0.78 on the validation set. Additionally, we have assembled a labeled dataset of 1009 PSNs, which includes various attributes such as nodule size, type, and location.

## CLINICAL RELEVANCE/APPLICATION

By employing radiomics, statistical analysis, and machine learning, we may produce accurate early characterization of growing adenocarcinoma spectrum nodules and optimize management and outcomes.

## W5A-SPCH- Artificial Intelligence System for Identification of Overlooked Lung Metastasis in Abdominal CTs of Patients with Malignancy

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## PURPOSE

To evaluate whether an artificial intelligence (AI) system can identify metastatic nodules in basal lungs covered by abdominal CTs initially overlooked by radiologists.

## METHODS AND MATERIALS

We retrospectively analyzed abdominal CT images with the following inclusion criteria: a) CTs obtained from patients with any solid organ malignancy between March 1st and 31st, 2019 in a single institution; b) abdominal CT interpreted as negative for metastasis in covered basal lungs. Patients who underwent chest CT on the same day with abdominal CT, and patients lost to follow-up within 3 years without clinical diagnosis of lung metastasis. The reference standards for the diagnosis of lung metastasis were confirmed by the review of medical records and subsequent CT images. An AI system that can automatically detect lung nodules in CT images was retrospectively applied. The AI results were reviewed by a radiologist to confirm the lesion is a true lung nodule with the possibility of metastasis. The detection yield (the proportion of true-positive results among entire patients), sensitivity, and positive predictive value (PPV) of the AI system and the radiologist who reviewed AI results were evaluated, for the identification of patients with basal lung metastasis overlooked during the initial interpretation.

## RESULTS

A total of 878 patients (66% men; mean age 65 years) were included. The most common primary malignancy was hepatocellular carcinoma (411, 47%), followed by stomach (169, 19%) and colorectal cancer (11%). Lung metastases were diagnosed in 69 patients (7.8%) within 3 years from the abdominal CT. Among them, 12 patients (1.4%) had overlooked metastasis in the basal lungs covered by the abdominal CT. The AI system identified 319 lesions in 176 patients (positive rate, 20%). Among the 319 AI results, 261 (81.8%) were true lung nodules by the radiologists' review, and 25 (7.8%) were metastatic nodules overlooked during the initial interpretation. The detection yield, sensitivity, and PPV of the AI system to identify patients with overlooked basal lung metastasis were 1.4% (12/878), 100% (12/12), and 6.8% (12/176), respectively. Meanwhile, the radiologist's review of AI results resulted in the detection yield, sensitivity, and PPV of 1.4% (12/878), 100% (12/12), and 14% (12/86), respectively.

## CONCLUSION

In patients with solid organ malignancies, an AI system exhibited excellent sensitivity for the identification of metastases in basal lungs covered by abdominal CTs that radiologists initially overlooked.

## CLINICAL RELEVANCE/APPLICATION

An AI system may help radiologists not overlook small lung basal lung metastasis in abdominal CTs by providing feedback to the radiologists in case of suspicions, which could be an efficient method to reduce interpretation errors.

## W5A-SPCH- Surveillance Breeds Conformity! Multicenter, Post-market Surveillance of a Multi-finding AI Algorithm for the Interpretation of Chest Radiographs

7

Participants

Giridhar Dasegowda, MBBS, Boston, MA (Presenter) Nothing to Disclose

## PURPOSE

Post-market surveillance of AI algorithms can help assess real world performance and impact of AI algorithms. We performed a multicenter, post-market surveillance (PMS) of a multi-finding AI algorithm for the interpretation of chest radiographs (CXRs).

## METHODS AND MATERIALS

Our retrospective, multicenter study included 2066 consecutive CXRs obtained from 7 practices across 7 geographically diverse states in India. CXRs belonged to 1167 men and 899 women with a mean age of  $46 \pm 17$  years. All centers had Qure.AI CXR algorithm implemented in routine clinical interpretation of CXRs. For a fraction of CXRs, AI outputs were either unavailable due to technical difficulties or not used due to low confidence interval for the findings. All consecutive CXRs from the centers were de-identified and uploaded on the annotation platform. An experienced thoracic radiologist blinded to the AI output evaluated the CXRs to establish the ground truth. We compared the performance of AI-aided and unaided clinical interpretation of CXRs. Sensitivity, specificity, ROC AUC with 95% confidence interval were used to evaluate the performance.

## RESULTS

The AI output had a better standalone performance compared to radiology reports (AUC of 0.72 - 0.90, sensitivity 44%-83% and specificity 81%-100%). The overall reporting performance for cardiomegaly, nodule, opacities, blunted costophrenic angle, cavity and to differentiate normal from abnormal CXRs compared to the ground truth had an AUC of 0.62 - 0.75, 28%-88% sensitivities and 56%-100% specificities. The performance of radiologists improved significantly with AI-aided reporting over those CXRs reported without AI outputs at the time of reporting with an effective increase in 6%-19% in AUC ( $p < 0.01$ ).

## CONCLUSION

Our PMS study demonstrates an overall improvement in the radiologists' performance with AI-aided interpretation of CXRs.

## CLINICAL RELEVANCE/APPLICATION

In the real-world application, the assessed AI algorithm improves the interpretation of for CXRs.

## W5A-SPCH- The Path to Successful AI Adoption in Radiology: Investigating Hurdles in The Computer-Assisted Diagnosis Implementation within Hospital Settings

### PURPOSE

To demonstrate that AI implementation in hospital radiological practice requires careful business assessment and planning: from the end-user experiences to training and workflow adjustments.

### METHODS AND MATERIALS

Radiologists who agreed to participate in quantitative and qualitative surveys were prospectively recruited from December 2022 to April 2023. To identify the challenges in AI adoption, this study measured the CAD technology acceptance and diffusion using an extended diffusion framework, namely the Extended Technology Acceptance Model (ETAM) based on 1) Unified Theory of Acceptance and Use of Technology (UTAUT) and 2) Diffusion of Technology (DOI). This integrated model evaluated the interaction of CAD and radiologists by incorporating the latent structures of trust, accuracy, efficiency, adoption, and diffusion from a behavioral, psychological, and social perspective. Following the ACR Data Science Institute Artificial Intelligence survey (2020), this study also collected information on AI usage, demographics, and AI performance evaluation.

### RESULTS

A total of 10 radiologists participated in qualitative interviews and 68 radiologists participated in quantitative surveys (~5% response rate). The overall perception of clinical AI usage is higher than national usage (39% versus 26%). The findings highlighted several challenges facing the adoption of AI in radiology. While most participants expressed trust in AI innovation, they demonstrated major hurdles in AI adoption, including interpretation time and time management issues. The major concerns are in the poor integration and usability caused by the lack of radiologists' involvement in user testing. As a result, many participants used AI only as a second reader or triage tool.

### CONCLUSION

While the potential benefits of AI in healthcare are widely acknowledged, it is important to recognize that the adoption of AI technology is not guaranteed simply by implementing AI tools. Successful AI adoption requires careful consideration of factors such as user training, workflow integration, and the development of appropriate governance and validation frameworks.

### CLINICAL RELEVANCE/APPLICATION

As the use of AI solutions for improving diagnostic accuracy gains significant attention, the need for an operational framework that would involve radiologists as end-users becomes increasingly apparent. Such a framework would guide the deployment, interoperability, and validation of AI in clinical practice, ultimately contributing to the development of safe and effective AI-based diagnostic tools. This study documents operational issues and proposes initial guidelines for clinical implementations.

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## Abstract Archives of the RSNA, 2023

W5A-SPER

### Emergency Radiology Wednesday Poster Discussions I

#### Sub-Events

#### W5A-SPER-1 Identifying and Communicating Urgent Findings in Emergency Radiology: A Scoping Review

#### PURPOSE

To determine existing published standards for the identification and communication of critical actionable imaging findings in emergency radiology. To identify the associated facilitators and barriers to the communication and management of critical imaging findings.

#### METHODS AND MATERIALS

A scoping review of published literature was performed through 2 databases (PubMed, Embase) with search terms pertaining to critical findings in emergency radiology. Articles and guidelines published in all languages from January 2010 to September 2022 were considered. Screening of database hits using pre-established inclusion criteria was performed by 3 analysts with reconciliation of discordance by consensus. A gray literature search for societal guidelines and high-impact policies was added to the database search. Data extraction included the following: year, country, resource type, scope/purpose, participants, context, standards to identifying/communicating critical findings, facilitators/barriers, method type, recommendations, applicability, and disclosures.

#### RESULTS

60 records were included in the final analysis, including 12 societal/commission guidelines. Among the included guidelines, no standardized lists of critical findings were identified, however, recommendations to create a local policy for critical findings were made in 5/12 guidelines. Reference to critical findings policies from the Joint Commission (16/60 articles), and ACR (30/60 articles) were most frequent. Standards used by centres for critical findings often applied a formal list of findings or classifications based on acuity. Among standards based on acuity (n=12), a 3-tier classification system was most common. Standards for communication included direct closed-loop communication for high acuity findings, with more flexible communication channels for less acute findings. Interventions for critical findings management most frequently fell into 4 categories: electronic (n=7), hybrid electronic/admin (n=5), feedback/education (n=5), and administrative (n=2).

#### CONCLUSION

There are variable standards, policies, and interventions for the management of critical findings in emergency radiology. ACR and Joint Commission standards were most frequently applied. Interventions applied EMR-based strategies, call-centres, and traditional phone/fax. Further research should seek to evaluate consistency and efficiency of closed-loop communication protocols, provider satisfaction, and patient outcomes.

#### CLINICAL RELEVANCE/APPLICATION

Summarizes the policies around critical results reporting in emergency radiology. Provides a guide for consensus building, innovation and rapid adoption towards greater patient safety, and provider satisfaction.

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## Abstract Archives of the RSNA, 2023

W5A-SPGI

### Gastrointestinal Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPGI-1 Sensitivity of MRI to Detect Microscopic Fat in Adrenal Adenomas: Comparison of 2D Dual Gradient-echo and 3D DIXON Techniques**

##### Participants

Abdullah Khan, MD, Sacramento, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

To compare the sensitivity of 2D dual gradient-echo and 3D DIXON chemical shift MRI (CSI) for detecting microscopic fat in adrenal adenomas.

##### METHODS AND MATERIALS

We performed a retrospective study of 35 patients (15 male, 20 female, mean age 61.8 years) with adrenal nodules who underwent both 2D dual gradient-echo and 3D DIXON T1-weighted CSI on a 1.5T scanner. The signal intensity (SI) of the nodules was obtained using a single ROI in the center of the nodule (comprising at least 2/3rds the nodule diameter) and the signal intensity index (SII) was calculated [ $100 \times (SI \text{ in phase} - SI \text{ out of phase}) / SI \text{ in phase}$ ]. Reference standard for the diagnosis of 29 adenomas was made by no change in nodule size or growth  $< 3\text{mm/year}$  in long axis for at least 1 year on follow up imaging ( $n=19$ ), unenhanced CT attenuation of  $< 10 \text{ HU}$  ( $n=8$ ), or pathology ( $n=2$ ). The mean time to imaging follow up was 4.5 years (range 1.1-10.5 years). The diagnosis of metastasis was made by pathology ( $n=1$ ) and nodule growth  $> 3\text{mm/year}$  in a patient with known cancer ( $n=1$ ). There was one pheochromocytoma diagnosed by pathology. Three nodules had no adequate reference standard. Sensitivity for the diagnosis of adrenal adenoma was determined using a SII of  $> 16.5\%$ .

##### RESULTS

There were 35 nodules (mean size 22 mm, range 11-55 mm). The SII was higher on 2D CSI compared to 3D DIXON in 80% (28/35) of nodules by a mean of 14.4%. Of the 29 adenomas, the SII was higher on 2D CSI compared to 3D DIXON in 90% (26/29) of nodules. Among adenomas, the mean SII was 48% on 2D CSI and 33% on 3D DIXON ( $p=.02$ ). Sensitivity for the diagnosis of adenoma was 89.7% (26/29; 95% CI 72.7-97.8%) for 2D and 75.9% (22/29; 95% CI 56.5-89.7%) for 3D DIXON. None of the 3 non-adenomas had SII  $> 16.5\%$  on either technique.

##### CONCLUSION

s 2D dual gradient-echo CSI has a higher sensitivity for detection of microscopic fat in adrenal nodules and the diagnosis of adrenal adenoma than the 3D DIXON technique. The sensitivity of 2D dual gradient-echo CSI for adrenal adenoma is approximately 90%.

##### CLINICAL RELEVANCE/APPLICATION

Adrenal MRI protocols should include 2D dual gradient-echo CSI and not rely solely on 3D DIXON techniques for the diagnosis of adrenal adenomas.

#### **W5A-SPGI-2 The Impact of Acceleration Factors of AI-assisted Compressed Sensing on the Image Quality of Balanced Turbo Field Echo Sequence for Renal Artery**

##### Participants

Haonan Zhang, Dalian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To explore the accelerated renal artery imaging based on B-TFE using the AI-assisted Compressed Sensing (ACS) compared with a parallel imaging technique (SENSE), and to determine an optimal acceleration factor of ACS to achieved both of the reduction of scan time and a favorable image quality.

##### METHODS AND MATERIALS

This study has been approved by the local IRB. 10 healthy volunteers (3 males, 7 females, age  $48.10 \pm 15.52$  years) were recruited in this study. Renal artery MR imaging based on B-TFE sequence were performed in a 3.0 T MR scanner (uMR Omega, Shanghai United Imaging Healthcare Co., Ltd, Shanghai, China). Two kinds of acceleration technique were compared with SENSE 3 and ACS with four acceleration factors (3, 5, 7 and 9). Scan parameters are shown in table 1. After image reconstruction, the subjective independent scoring was performed according to vascular signal, diagnostic certainty and artifact. Five-point scoring criteria of image quality was used (Table 2), and the score more than 3 was considered to meet the clinical demand. The Kappa test was used to evaluate the consistency of the scores between the two radiologists. If the consistency is good, select the subjective scores of senior physicians for subsequent analysis. Then regions of interest were placed manually on the right blood vessels and the renal medulla to measure the signal intensity (Figure 1f). Meanwhile, signal to noise ratio (SNR) and contrast to noise ratio (CNR) were also calculated. One-way ANOVA was used to verify the differences in SNR, CNR and subjective scores under different AF condition

## RESULTS

Renal artery imagings based on B-TFE sequence with SENSE and ACS were shown in Figure 1a-1e. Score measured by two observers are in good agreement ( $p = 0.777$ ). SNR, CNR and subjective scores from five fast sequences were shown in Table 3. Compared with SNR, CNR and subjective scores from SENSE, there are no significantly different among those of ACS with acceleration factors 3, 5, 7 (Table. 4). The scan time of ACS7 is 158 second, which is about 27.85% of SENSE 3 (219 second).

## CONCLUSION

s Taken the scan time and image quality into consideration, ACS with acceleration factor of 7 is recommended for clinical renal artery imaging based on B-TFE sequence.

## CLINICAL RELEVANCE/APPLICATION

ACS factor of 7 is recommended for clinical renal artery imaging based on B-TFE sequence. Scanning time is significantly shortened, and the success rate is improved.

## W5A-SPGI-3 Evaluating the Impact of Different Acceleration Factors of AI-Assisted Compressed Sensing Technology in Liver Breath-Holding MRI Sequences

Participants

Nan Wang, Dalian, China (*Presenter*) Nothing to Disclose

## PURPOSE

The aim of this study was to investigate the effects of varying acceleration factors in Artificial Intelligence (AI)-assisted compressed sensing (ACS) technology applied to liver breath-holding MRI sequences.

## METHODS AND MATERIALS

Nine healthy volunteers participated in the study, undergoing liver MRI examinations (t1-quick3d-iso-fs, t1-quick3d-wfi-water) employing a recently developed ACS technology with different acceleration factors (Table 1, 2). The study utilized a 3.0T scanner (uMR Omega, Shanghai United Imaging Healthcare Co., Ltd., Shanghai, China). Two observers placed regions of interest (ROIs) on the left outer lobe, left inner lobe, right anterior lobe, right posterior lobe at the level of the first hepatic hilum, and the right vertical spinal muscle at the same phase direction and level (Figure 1). Signal intensity and standard deviation for each liver lobe and vertical spinal muscle were measured, followed by the calculation of image signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Both observers assessed image quality for all groups using a 5-point subjective scale (5 representing excellent image quality, 1 representing poor image quality). Kolmogorov-Smirnov tests were used to evaluate the normality of the mean values obtained by both observers. For normally distributed data, one-way ANOVA and post-hoc LSD tests were employed, while non-normal data were analyzed using Kruskal-Wallis H tests. A  $p$ -value  $< 0.05$  was considered statistically significant.

## RESULTS

Variations in acceleration factors did not yield significant differences in SNR and CNR for t1-quick3d-iso-fs and t1-quick3d-wfi-water sequences ( $p > 0.05$ ). However, subjective scores differed significantly among images with varying acceleration factors for both sequences ( $p < 0.05$ ). Post-hoc multiple comparisons indicated that subjective image quality scores for t1-quick3d-iso-fs were significantly higher for uCS5, ACS5, and ACS6 compared to ACS8, ACS9, and ACS10 ( $p < 0.05$ ). Similarly, subjective image quality scores for t1-quick3d-wfi-water were higher for PI2.8 and ACS3 compared to ACS5, ACS7, and ACS9 ( $p < 0.05$ ).

## CONCLUSION

s The t1-quick3d-iso-fs sequence is recommended with a 6-fold acceleration factor for ACS, saving 2 seconds of scanning time. The t1-quick3d-wfi-water sequence is recommended with a 3-fold acceleration factor for ACS, resulting in better subjective image quality scores.

## CLINICAL RELEVANCE/APPLICATION

In liver breath-holding sequences, reducing the scanning time by a few seconds can significantly improve the scanning success rate.

## W5A-SPGI-4 Deep Learning Reconstruction Improves Image Quality of Acquired and Computed Diffusion-weighted MR Imaging of the Liver

Participants

Hirimitsu Onishi, MD, PhD, Suita, Japan (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, General Electric Company

## PURPOSE

Image noise is the main problem in diffusion-weighted (DW) MR imaging. Deep learning reconstruction (DLR) can improve the image quality of MR imaging. The aim of this study was to determine whether DLR can improve the image quality of acquired and computed DW images of the liver.

## METHODS AND MATERIALS

This retrospective study included 44 consecutive patients with suspected focal liver lesions who underwent liver MR examinations with a 3.0-T system. DW images of the whole liver were acquired at b-values of 0 and 1000 s/mm<sup>2</sup> during breath-hold (TR/TE = 4500/76 msec, 5 mm thickness, and 96×96 matrix). Computed high b-value DW images (b = 1500 s/mm<sup>2</sup>) were synthesized from the acquired DW images. One radiologist measured the signal-to-noise ratio (SNR) of the liver parenchyma and the contrast-to-noise ratio (CNR) between malignant tumors and parenchyma on acquired and computed DW images with and without DLR. Another radiologist assessed image quality using a five-point visual scoring system (1 [unacceptable] to 5 [excellent]). Results were compared using paired t-test for quantitative assessment and Wilcoxon signed rank test for visual assessment of image quality.

## RESULTS

Both acquired and computed DW images with DLR had significantly higher SNRs and CNRs than DW images without DLR; mean SNR was 13.6 versus 9.4 for acquired images ( $P < .001$ ) and 8.1 versus 5.9 for computed images ( $P < .001$ ), and mean CNR was 56.6

versus 37.2 ( $P < .001$ ) and 33.7 versus 23.6 ( $P < .001$ ), respectively. Qualitative analyses showed that DLR significantly improved image noise and image sharpness ( $P < .001$  for each), but did not change motion artifacts and signal loss just below the heart. DW imaging with DLR also demonstrated superior overall image quality compared to DW imaging without DLR; median score was 4 versus 2 for acquired images ( $P < .001$ ), 3 versus 2 for computed images ( $P < .001$ ).

## CONCLUSION

s DLR efficiently reduced image noise and significantly improved the image quality of both acquired and computed DW MR images of the liver.

## CLINICAL RELEVANCE/APPLICATION

Deep learning reconstruction improves the image quality of liver diffusion-weighted images with a short acquisition time and can greatly contribute to the efficiency of liver MR examinations.

## W5A-SPGI-5 Radiologic Response and Association with Prognosis in Patients Treated with Transarterial Radioembolization or Stereotactic Body Radiation Therapy for HCC

Participants

Sangyun Lee, MS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Transarterial radioembolization (TARE) and stereotactic body radiation therapy (SBRT) are locoregional therapies for potentially resectable and unresectable HCC. A limited number of studies have evaluated radiologic treatment response and association with prognosis in radiation-based therapy-treated HCC. We evaluated the radiologic appearance of post-TARE and SBRT-treated images of HCCs to assess treatment response and identify its association with prognosis.

## METHODS AND MATERIALS

We retrospectively identified 104 patients (77 males; mean age  $\pm$  SD, 65.9  $\pm$  12.6 years) treated with SBRT (68 patients, 83.4%) and TARE (36 patients, 34.6%) from 2015 to 2022. Pre- and post-treatment contrast-enhanced CT or MRI scans performed 3 months after treatment were evaluated for treatment response according to the following rules: no intralesional APHE as nonviable; stability or decrease in size and/or degree of intralesional APHE as non-progressing; new or increased size of intralesional APHE as viable disease. Pre- and post-treatment AFP levels, tumor and APHE component size, portal vein tumor thrombus, etiology of liver disease, overall survival (OS) and progression-free survival (PFS) were recorded. Cox proportional hazards model and Kaplan-Meier curves with log-rank test were used for statistical analysis.

## RESULTS

The mean size of HCC was 4.9 cm, and 25 patients (24%) had portal vein tumor thrombus. The mean AFP level was 2314.3 ng/mL. Median follow-up was 20.6 months (range, 3-142), with 29 (27.9%) deaths and 69 (66.3%) disease progressions. Sixty-three (60.6%) patients achieved non-viable disease at least once during follow-up. At the first 3-month follow-up, 40 (38.5%), 43 (41.3%), and 21 (20.2%) patients had nonviable, non-progressing, and viable disease, respectively. In univariate analysis, radiologic response at 3 months and nonviable disease ever during follow-up were significantly associated with OS, but only radiologic response at 3 months was the independent factor in multivariate analysis ( $p = 0.009$ ). For PFS, viable disease at the first 3-month follow-up, nonviable disease ever during follow-up, tumor size, male sex, and initial AFP level were the independent predictors in multivariate analysis ( $p = 0.034$ ). The type of radiotherapy did not affect OS or PFS. The 2-year cumulative OS for non-viable, non-progressing, and viable disease was 96.6%, 72.6%, and 67.9%, respectively.

## CONCLUSION

s Response to radiotherapy at 3 months and during follow-up assessed by changes in radiologic APHE significantly correlated with OS and PFS.

## CLINICAL RELEVANCE/APPLICATION

Persistent APHE 3 months after radiotherapy for HCC may indicate a poor prognosis.

## W5A-SPGI-6 Comparing Early Treatment Response as Assessed by RECIST 1.1, mRECIST, and Choi Criteria in HCC Treated with Atezolizumab plus Bevacizumab

Participants

Seung Hoon Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

Atezolizumab plus bevacizumab (Ate/Beva) is endorsed as first-line systemic therapy for unresectable HCC ineligible for transplantation or locoregional therapy. Given the anti-angiogenic effect of the regimen, RECIST version 1.1 may underestimate the treatment response, potentially leading to unnecessary early discontinuation of the therapy. We aimed to compare RECIST 1.1, modified RECIST (mRECIST), and Choi criteria in assessing early treatment response in Ate/Beva-treated HCCs and their correlations with overall survival (OS) and progression-free survival (PFS).

## METHODS AND MATERIALS

From May 2022 to December 2022, 42 patients (36 men; mean  $\pm$  SD age, 61.9  $\pm$  12.9 years) who received Ate/Beva for unresectable HCC without prior systemic therapy were retrospectively included. Pre-treatment and the first post-treatment contrast-enhanced CT or MRI scans, performed after completion of at least three cycles of Ate/Beva, were reviewed by two abdominal radiologists to assess treatment response according to RECIST 1.1, mRECIST, and Choi criteria. OS and PFS were recorded. Kaplan-Meier curves with log-rank test and Cohen's kappa were used for the statistical analysis.

## RESULTS

The median time from the start of Ate/Beva to the first response assessment was 99 days (range, 51-182 days). Responders (patients with a complete or partial response) were 10 (23.8%), 13 (31.0%), and 18 (42.9%) when evaluated by RECIST 1.1, mRECIST, and Choi criteria, respectively. One (2.4%) and two (4.8%) patients classified as having progressive disease (PD) by RECIST 1.1 were re-assessed as stable disease and partial response by mRECIST and Choi criteria, respectively. The inter-reader

agreement ? for RECIST 1.1, mRECIST, and Choi criteria was 0.85, 0.75, and 0.85, respectively. Responders identified by RECIST 1.1 did not show a significant correlation with OS ( $p = 0.082$ ), while those identified by mRECIST and Choi were correlated with prolonged OS ( $ps = 0.049$ ). Responders identified by all three criteria showed a significant correlation with PFS ( $ps = 0.029$ ). Cumulative 1-year PFS rates for responders were 72%, 76.4%, and 78.4% for RECIST 1.1, mRECIST, and Choi, respectively, and 74.4%, 72.4%, and 66.7% for non-responders.

## CONCLUSION

s In Ate/Beva-treated HCC, only a small number of PDs identified by RECIST 1.1 were re-classified as non-PD by mRECIST and Choi, indicating similar performance in the assessment of treatment failure. mRECIST and Choi criteria identified more early responders to treatment than RECIST 1.1 and significantly correlated with prolonged OS and PFS.

## CLINICAL RELEVANCE/APPLICATION

mRECIST and Choi criteria may be more accurate than RECIST 1.1 in identifying early responders to Ate/Beva and may better assess prognosis.

## W5A-SPGI-7 Value of Liver Volumetry for the Evaluation of Treatment Response to Hepatic Artery Infusion Chemotherapy Compared with RECIST 1.1 Criteria in Uveal Melanoma Patients with Liver Metastases

### Participants

Sebastian Zensen, MD, Essen, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

In uveal melanoma patients with liver metastases, short-term evaluation of treatment response to hepatic artery infusion chemotherapy (HAIC) using the Response Evaluation Criteria in Solid Tumors (RECIST) 1.1 criteria is often challenging due to the diffuse metastatic spread to the liver. Because of the diffuse organ involvement, liver enlargement can frequently be observed and easily assessed by liver volumetry. Therefore, this study aims to compare RECIST 1.1 and LV for the evaluation of HAIC treatment response.

## METHODS AND MATERIALS

Treatment response was evaluated in 143 patients by RECIST 1.1 and liver volumetry on CT imaging performed before and after first HAIC. The mean age was  $65.1 \pm 10.9$  years, 54% were female. To establish an appropriate threshold to differentiate between stable disease (SD) and progressive disease (PD) in liver volumetry, various increases in liver volume were assessed. Overall survival (OS) was calculated from first HAIC to patient death using Kaplan-Meier test. Multivariate analysis was performed for RECIST 1.1 and liver volumetry.

## RESULTS

The median OS (mOS) was 13.5 months (95% CI 11.2-15.8 months). In liver volumetry, a threshold of 10% increase in liver volume was suited to identify patients with significantly reduced OS (SD: 103/143 patients, mOS 15.9 months; PD: 40/143 patients, 6.6 months;  $p < 0.001$ ). Compared to RECIST 1.1, liver volumetry is the only significant prognostic factor that can identify a decreased OS.

## CONCLUSION

s In uveal melanoma patients with liver metastases, a threshold of 10% increase in liver volume is suitable to identify patients with a significantly shortened life expectancy by liver volumetry.

## CLINICAL RELEVANCE/APPLICATION

Liver volumetry is an appropriate method for evaluating treatment response in uveal melanoma patients with liver metastases and offers advantages over RECIST 1.1 criteria.

## W5A-SPGI-8 DW-MRI of the Abdomen for the Preoperative Detection of Liver Metastasis from Pancreatic Cancer to Prevent Futile Surgeries: A Meta-analysis

### Participants

Stephan Altmayer, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Recent studies have shown the superior diagnostic performance of diffusion-weighted magnetic resonance imaging (DW-MRI) for detecting liver metastasis. Despite the advantage of DW-MRI, the most recent 2022 National Comprehensive Cancer Network guidelines do not routinely recommend performing MRI on all patients who may have resectable disease. Our purpose was to perform a systematic review and meta-analysis to evaluate if diffusion-weighted magnetic resonance imaging (DW-MRI) adds value compared to contrast-enhanced computed tomography (CECT) alone in the preoperative evaluation of pancreatic cancer.

## METHODS AND MATERIALS

MEDLINE, EMBASE, and Cochrane databases were searched for relevant published studies through October 2022. Studies met eligibility criteria if they evaluated the per-patient diagnostic performance of DW-MRI in preoperative patients with pancreatic cancer compared to CECT. Our primary outcome was to determine the proportion of futile surgeries potentially prevented using DW-MRI, defined as those in which CECT was negative and DW-MRI was positive for liver metastasis. The secondary outcome was to determine the proportion of cases in which DW-MRI changes management, a composite outcome that includes false positive liver metastasis on CECT, indeterminate lesions on CECT, and the primary outcome. Per-patient sensitivity and specificity of DW-MRI were also calculated using a random-effects model.

## RESULTS

9 studies met the inclusion criteria with a total of 1121 patients, 172 of which had liver metastasis (15.3%). The average size of the hepatic lesions was smaller than 10 mm in all 6 studies that reported this data. The mean time between CT and MRI was reported for 7 out of 9 studies and was often fewer than 28 days. The proportion of futile surgeries potentially reduced by DW-MRI was 6.0% (95% CI, 3.0-11.6%), yielding a number necessary to treat of 16.6. The proportion of cases that DW-MRI changed management was 18.1% (95% CI, 9.9- 30.7), corresponding to an NNT of 5.5. The heterogeneity was high for both primary (of I2 =



86%) and secondary (I2 = 94%) outcomes. The per-patient sensitivity and specificity of DW-MRI was 92.4% (95% CI, 87.4-95.6%) and 97.3% (95% CI, 96.0- 98.1) with no heterogeneity.

#### **CONCLUSION**

s The potential NNT of DW-MRI to prevent potential futile surgeries in patients with pancreatic cancer and occult liver metastasis on CECT was 16.6.

#### **CLINICAL RELEVANCE/APPLICATION**

A significant number of subcentimeter liver metastases are not identified in the preoperative staging of pancreatic cancer with CECT. DW-MRI may add value in the evaluation of this patients with a potential NNT to prevent one futile pancreatic resection of CECT of 16.

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## Abstract Archives of the RSNA, 2023

W5A-SPGU

### Genitourinary Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPGU- Quantitative PSMA PET and Multiparametric MRI features may help Predict Aggressive Prostate Cancer on Whole-Mount Histopathology** 1

##### Participants

Ida Sonni, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

Two aggressive histopathological subtypes of prostate cancer (PC) include intraductal carcinoma (IDC) and the large cribriform growth pattern. The goal of this analysis was to assess which quantitative features of preoperative 68Ga-PSMA-11 PET/CT (PSMA PET) and multiparametric magnetic resonance imaging (mpMRI) correlate and predict cribriform/IDC patterns on post robotic prostatectomy (RALP) whole mount histopathology (WMHP).

##### METHODS AND MATERIALS

With IRB approval and HIPAA compliance, we derived a study cohort of PC patients who underwent PSMA PET <3 months prior to RALP and WMHP with description of the presence/absence of cribriform/IDC pattern between 05/2019 and 08/2022. A nuclear medicine physician contoured all PC lesions on PSMA PET, after matching them with a GU pathologist on WMHP. PSMA PET metrics (SUV<sub>max</sub>, SUV<sub>mean</sub>, tumor volume, total lesion activity - TLA) were extracted. A sub-analysis was conducted on patients with available quantitative measures on pre-surgical mpMRI. All PIRADS=3 lesions on mpMRI were contoured and quantitative parameters were extracted: mean apparent diffusion coefficient (ADC,  $\times 10^{-6} \text{mm}^2/\text{s}$ ), K<sub>trans</sub> (min<sup>-1</sup>), K<sub>ep</sub>(min<sup>-1</sup>), iAUC (mMsec). All matching lesions were categorized as sub-cohort 1 (SC 1) cribriform+/IDC-, (SC 2) cribriform+/IDC+, and (SC 3) cribriform-/IDC-. One way-ANOVA assessed significant differences among the imaging parameters in the three sub-cohorts. The area under the curve (AUC) from ROC analysis was used to assess the ability of imaging metrics to predict the presence of aggressive PC features on WMHP.

##### RESULTS

The PSMA PET analysis comprised 77 patients (82 lesions) with mean PSA at time of RALP of 9.07 ng/ml  $\pm$  5.8. On WMHP, SC 1, 2 and 3 comprised 21/83, 41/83, and 20/83 lesions with significant differences in SUV<sub>mean</sub> and TLA among these sub-cohorts ( $p=0.003$  and  $0.039$ ). On AUC analysis, SUV<sub>mean</sub> predicted the aggressive PC features on WMHP with 67% accuracy. The PSMA PET/mpMRI cohort comprised 52 patients (53 lesions) with mean PSA at time of RALP of 9.67 ng/ml  $\pm$  6.76. On WMHP, SC 1, 2 and 3 comprised 17/53, 25/53, and 10/53 lesions with significant differences in SUV<sub>mean</sub> on PSMA PET and ADC on mpMRI among the three sub-cohorts ( $p=0.031$  and  $0.018$ ). On AUC analysis, SUV<sub>mean</sub> and ADC predicted aggressive PC on WMHP with 65% and 63% accuracy, respectively

##### CONCLUSION

Significantly elevated SUV<sub>mean</sub> on PSMA PET and lower ADC on mpMRI predicted the presence of aggressive PC features (cribriform pattern and IDC) on WMHP with moderate AUC on ROC analysis.

##### CLINICAL RELEVANCE/APPLICATION

The ability to predict the presence of pathology features of aggressive PC is critical in case WMHP is not available. Presurgical PSMA PET and mpMRI quantitative parameters can help identify these features with moderate accuracy.

#### **W5A-SPGU- Diagnostic Value of Very Early Diffusion Weighted Changes at MRI after Single-Dose Ablative Radiation Therapy (SDART) for Organ-confined Prostate Cancer** 2

##### Participants

Cammillo Talei Franzesi, Milan, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate diagnostic value of diffusion-weighted (DWI) MRI early changes, 1 hour after treatment, in patients with organ confined unfavorable prostate cancer (PCa) treated with Single-Dose Ablative Radiation Therapy (SDART), in comparison with biochemical markers (PSA and testosterone).

##### METHODS AND MATERIALS

Twenty four patients treated with a single fraction of 24 Gy to the whole prostate with urethra sparing in association with androgen deprivation therapy (ADT) were prospectively enrolled. MRI was performed before SDART (time 0), one-hour post-SDART (time 1), and 3-month after treatment (time 2). All patients were examined on a 3.0-T MRI scanner (Ingenia; Philips Healthcare) with a phased-array external coil, with bowel preparations and 20mg of butyl-scopolamine (Buscopan) intravenously administered; the bladder was filled with 120cc of saline solution, to simulate the same conditions during irradiation. MRI was performed with axial T1-weighted TSE sequences and high resolution multi-planar T2-weighted TSE sequences. Diffusion weighted imaging (DWI) was acquired with six b-values (0,50,100,150,800,1600mm<sup>2</sup>/s) and Apparent Diffusion Coefficient (ADC) (0,800) maps were calculated.

Finally, axial contrast-enhanced dynamic imaging was obtained during intravenous injection of gadobutrol (0.1 mmol/kg, flow rate of 2.5 ml/s). ADC values were calculated at time 0,1, and 2 by placing region-of-interests (ROI) on ADC maps and the results were compared with PSA and testosterone blood levels at time 0 and 2.

## **RESULTS**

Median patient's age was 78 years (range 61-84). Median prostate volume was 36.2 cc (range 10-60). An increase of ADC value of tumor lesion of 27% (range 7%-69%) and 54% (range 20%-83%) was registered at time 1 and time 2 respectively, compared to the baseline. Median prostate volume was found unchanged at time 1, while decreased by about 25% (range 9%-59%) at time 2. At 3-months follow-up, all patients were found bNED with PSA and testosterone levels of <0.01 ng/ml and <0.20 ng/ml, respectively, and 9 of them obtained a complete response.

## **CONCLUSION**

s Our findings demonstrated high diagnostic value of DWI imaging with good correlation between very early changes (one-hour after treatment) in ADC values after SDART and later tumor response (biochemical and imaging) in patients with unfavorable PCa.

## **CLINICAL RELEVANCE/APPLICATION**

DWI with ADC values could be used as an early biomarker of treatment outcome in patients treated with SDART of the whole prostate with urethra sparing.

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## Abstract Archives of the RSNA, 2023

W5A-SPHN

### Head & Neck Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPHN- Operating Characteristics of ATA 2015 Thyroid Nodule Risk Malignancy in Colombian Population** 1

##### Participants

Nicole Erazo Morera, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

##### PURPOSE

Determine the operating characteristics of the ATA 2015 ultrasound risk classification of thyroid nodules in Colombian population, to see if it can be standardized and applied as it is in American population.

##### METHODS AND MATERIALS

We conducted a retrospective quantitative diagnosing test study, where the operating characteristics for the ATA 2015 risk stratification scale was determined. The study was carried out between Sept 2020- Sept 2021. Population: Patients with thyroid nodules with thyroid US in the imaging department of the HUSI (a fourth level institution in Bogotá, Colombia) with an indication for biopsy or surgical removal of the nodule according to ATA 2015. Data collection was carried out by two radiologists from the Radiology Department of the HUSI, one of them with 6 yrs of experience and one of them in training with 3 yrs of experience. Patients with very low and low suspicion nodules according to the 2015 ATA classification were defined as negative whereas intermediate and high suspicion of malignancy were defined as positive. These results were compared with a mixed gold standard, where true negatives are Bethesda II or surgical specimen with benign pathological report, and true positives are Bethesda V/VI or surgical piece positive for malignancy.

##### RESULTS

For a "high" risk in the ATA classification, the Likelihood Ratio values for both cases yield results close to 4, being slightly higher when risk III of the BETHESDA classification is excluded. For the "intermediate" classification, the two combinations have a Likelihood Ratio close to 1, indicating an indeterminate result for those that cannot be classified as malignant and benign. For the "low" and "very low" classification, the LR is below 1, when risk III of the BETHESDA classification is excluded and taken into account.

##### CONCLUSION

The present study demonstrates that the ATA 2015 sonographic risk stratification scale can be used and implemented in the Colombian population in a similar way to the American population. It is especially applicable if the thyroid nodule evaluated by ultrasonography presents characteristics of "low" or "high" risk of malignancy with a confidence of 95% for an established risk of 5-10% or 70-90% respectively. The category with the lowest sensitivity and specificity is the "intermediate" which is not statistically significant in any of the analyses.

##### CLINICAL RELEVANCE/APPLICATION

Validation, of an already used risk stratification scale, in the Colombian population, understanding in which cases there must be a careful appliance (specifically intermediate risk nodule) in this population base.

#### **W5A-SPHN- Utility of Radiomics Features in Predicting Human Papillomavirus Status in Head and Neck Squamous Cell Carcinoma: A Systemic Review and Meta-analysis** 2

##### Participants

Golnoosh Ansari, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### PURPOSE

Human papilloma virus (HPV) is one of the main risk factors and a potential prognostic indicator for head and neck squamous cell carcinoma (HNSCC). We sought to analyze the value of radiomics features in the determination of HPV status in HNSCC as an alternative to immunohistochemical typing.

##### METHODS AND MATERIALS

A systemic search was conducted on PubMed, Scopus and other major web-based repositories using the search terms HPV, Radiomics, HNSCC, head and neck, papilloma and oropharyngeal SCC. Diagnostic accuracy measures, and the confusion matrix of each study were extracted and the data were utilized to perform meta-analysis based on the random effects model. Fagan's nomogram was used to determine clinical utility. Deek's funnel plot was used to determine publication bias.

##### RESULTS

Twenty six articles were included in the systemic review and 14 were used for the meta-analysis. The median radiomics quality score was 9 out of 36, showing an overall poor quality in the currently available literature. There was no significant publication bias among the publications included in the meta-analysis. The overall sensitivity of the included studies equaled 0.772 (0.73, 0.809)

and the overall specificity equaled 0.763 (0.714, 0.806). The I2 statistic showed that heterogeneities for sensitivity and specificity were medium (I2 = 56.91%, and 55.44%, respectively). Only one percent of the heterogeneity witnessed was due to threshold effect.. Diagnostic odds ratio equaled (DOR) 10.932 (7.847, 15.23). Using a radiomics model generated on cross-sectional imaging would increase the post-test probability to 82% from 58% with a positive likelihood ratio of 3 when the pretest was positive. When the pretest was negative the post-test probability decreased to 29% with a negative likelihood ratio of 0.3.

## CONCLUSION

s Radiomics features showed moderate success in the determination of HPV status in HNSCCC and could be employed when conventional para-clinical laboratory methods are not available. More studies, especially those trained and tested on multiple independent datasets, are needed to determine the clinical utility of radiomics trained machine learning models in this regard.

## CLINICAL RELEVANCE/APPLICATION

As currently there are no FDA-approved diagnostic modalities for the determination of HPV status in HNSCC, radiomics features may be able to act as a means of "virtual biopsy" and alleviate the need for IHC staining.

### W5A-SPHN- Baseline Amide Proton Transfer MRI in Predicting Tumor (T) Classification for Nasopharyngeal Carcinoma based on TNM Staging System

Participants  
Qian Lijuan, Wuhan, China (*Presenter*) Nothing to Disclose

## PURPOSE

Nasopharyngeal Carcinoma (NPC) is classified into high and low stages with different prognoses and treatments. Conventional nasopharyngeal MRI is used to identify the diagnosis and staging of nasopharyngeal carcinoma such as adjacent soft-tissue invasion and skull base invasion. However, it is influenced by some subjective factors and experience levels. Thus, We aimed to investigate the potential value of APTw imaging in predicting the stage of NPC and to determine the associations between APTw MRI parameters and nasopharyngeal carcinoma (NPC) stages, compared with diffusion-weighted imaging (DWI).

## METHODS AND MATERIALS

In this single-center prospective study, participants with pathologic analysis-confirmed nasopharyngeal carcinoma with no previous treatment, lesions larger than 1 cm, and adequate MRI quality were enrolled from June 2022 to February 2023. All participants underwent preoperative APTw MRI and DWI. ROI delineation was then reviewed and approved by a two senior radiologist. The average APT (APTmean) and 90th percentile (APT90), 10th percentile (APT10), Kurtosis, Skewness, and ADC value were obtained. The unpaired student's t-test was used to evaluate the between-group difference of the derived parameters. The multivariate logistic regression and receiver operating characteristic curve (ROC) were employed to evaluate the diagnostic performance of these quantitative parameters.

## RESULTS

All patients were staged according to the eighth edition of the AJCC/UICC TNM staging system. 76 participants (mean age, 49 years±19[SD]; 61 men,15 female) were evaluated: 56 with high-stage and 20 with low-stage nasopharyngeal carcinoma. T3 and T4 NPC were classified as high-stage, and T2 and T1 NPC were classified as low-stage. High-stage NPC showed a significantly higher APTmean than low-stage NPC (3.76 vs 2.83 p =0.01). APT90 and Skewness, Kurtosis can significantly differ among high and low-stage (5.37 vs 4.37, p=0.04; 0.23 vs -0.02, p=0.04; 3.24 vs 2.69, p=0.006). The area under the receiver operating characteristic curve (AUC) of APTw for differentiating low- and high NPC was 0.789 (0.656-0.922). Our measurements showed good interreader agreement: ICC 0.944 (0.938 < ICC < 0.95). ADC value of the high-stage NPC showed no significant difference with the low-stage (0.70 vs 0.75, p=0.11).

## CONCLUSION

s This study demonstrated APTw MRI may be used as an imaging biomarker for improving the accuracy in the assessment of nasopharyngeal carcinoma AJCC stage.

## CLINICAL RELEVANCE/APPLICATION

The molecular imaging technique, APT MRI is a promising noninvasive method for evaluating and staging NPC and can provide additional information to improve the diagnostic accuracy of conventional nasopharyngeal MRI.

### W5A-SPHN- Comparative Study on Diagnostic Accuracy of MRI and Intra Oral Ultrasound in Assessing Depth of Invasion (DOI) of Tongue Carcinoma with Histopathological Examination as Gold Standard

## PURPOSE

To compare the diagnostic accuracy of magnetic resonance imaging and intra oral ultrasound in detecting the depth of invasion in tongue carcinoma patients and correlating it with histopathological examination as gold standard. To assess the nodal status with preoperative imaging based on established sonographic features of malignancy and to establish DOI cut-off for node positivity status To nitpick the confounder responsible for changes in DOI values

## METHODS AND MATERIALS

COMPARATIVE CROSS SECTIONAL STUDY FROM 2021 TO 2023

## RESULTS

Our study results are in concordance with Yoon et al which was the first pilot study post 8th edition in which a very high correlation coefficient of 0.95 was achieved between USG and HPE. Meta-analysis by Marchi et al in 2020 showed pooled correlation coefficient of 0.96 for USG and 0.87 for MRI. They concluded that USG stands tall with higher pooled r and r to z transformed values.

## CONCLUSION

s Biopsy prior to imaging - significant confounding factor resulting in higher values on preoperative imaging than the actual depth of invasion Both intra oral USG and MRI are effective tools for preoperative assessment of depth of invasion in oral tongue

malignancies and strong correlation was achieved with histological values.

#### CLINICAL RELEVANCE/APPLICATION

Intra oral USG > MRI owing to the perilesional edema found on T2 weighted MRI images.

### W5A-SPHN- The Value of Texture Features based on Dynamic Contrast-enhanced Magnetic Resonance Imaging in Predicting the Efficacy of Radiotherapy and Chemotherapy in Nasopharyngeal Carcinoma

#### PURPOSE

the purpose of this study was to explore the value of texture features based on DCE-MRI in predicting the efficacy of radiotherapy and chemotherapy in primary NPC.

#### METHODS AND MATERIALS

1. Subjects Forty-nine patients with NPC who underwent nasopharyngeal/cervical DCE-MRI examination and confirmed by pathology were analyzed retrospectively. According to the follow-up of MR and/or pathology after 6 months of treatment, the efficacy of radiotherapy and chemotherapy of NPC was divided into two groups: poor prognosis group (residue or recurrence) (n=22) and good prognosis group (no residue and recurrence) (n=27). 2. Image analysis A 3.0T MR (Signa HDxt, GE Medical Systems, Milwaukee, WI, USA) scanner was used with an 8-channel phased array coil in the head and neck. The permeability parameters of the DCE-MRI images: Ktrans, Kep, and Ve functional maps were imported into 3D Slicer software. Two imaging diagnostic physicians manually sketched the ROI. (Fig. 1, 2). Record the texture feature parameters of each functional map respectively.

#### RESULTS

1. DCE- measured by two observers. The texture feature parameters of the MRI function map are consistent (ICC values are all >0.75) (Table 1). 2. the Minimum Ktrans signal intensity and JointAverageKep of the good prognosis group were higher than those of the poor prognosis group, while the values of AutocorrelationKtrans, JointAverageKtrans, SumAverageKtrans, AutocorrelationKep, and SumAverageKep were lower than those of the poor prognosis group, and the difference was statistically significant (Table 2). However, there is no difference in the texture parameters of the Ve signal intensity map. 3. ROC analysis of Ktrans and Kep signal intensity map texture parameters to identify NPC efficacy (Table 3). The area under the curve predicted by the threshold of Autocorrelation, JointAverage, and SumAverage of Kep signal strength was the largest, which was 0.684, the sensitivity was 81.48%, and the specificity was 59.09% (figure 3).

#### CONCLUSION

The texture feature based on DCE-MRI has potential value in predicting the efficacy of radiotherapy and chemotherapy in nasopharyngeal carcinoma before treatment.

#### CLINICAL RELEVANCE/APPLICATION

nasopharyngeal carcinoma is a tumor with significant geographical distribution and is a common malignant tumor of the head and neck in southern China. Radiotherapy and chemotherapy are considered the first choice of treatment, but there are still patients with poor prognoses (residue or recurrence) due to treatment failure. Early prediction of the efficacy of radiotherapy and chemotherapy can optimize the treatment plan of NPC patients and improve the survival cycle, which has significant clinical significance.

### W5A-SPHN- Multi-parameter Quantitative Magnetic Resonance in Early Assessment of Radiation Induced Parotid Damage in Nasopharyngeal Carcinoma Patients after Intensity Modulated Radiotherapy

#### Participants

Zhifeng Xu, Foshan, China (Presenter) Nothing to Disclose

#### PURPOSE

The aim of this study was to investigate the value of Intravoxel Incoherent Motion Imaging (IVIM) and 3D Pulsed Continuous Arterial Spin Labeling (ASL) in assessing dynamic changes of parotid gland (PG) in nasopharyngeal carcinoma (NPC) patients after radiotherapy (RT).

#### METHODS AND MATERIALS

A total of 18 patients with NPC underwent Intensity-Modulated Radiotherapy (IMRT) were enrolled. All patients underwent conventional MRI, and IVIM and ASL imaging for bilateral PGs within 2 weeks before RT (pre-RT), 1 week and 3 months after RT (post-RT). Pure diffusion coefficient (D), pseudo-diffusion coefficient (D\*), perfusion fraction (F) and blood flow (BF) were analyzed.

#### RESULTS

From pre-RT to 1W post-RT, D and CBF values both increased significantly [change rate, 39.28% (38.23%) and 60.84% (54.88%)], and continued to increase significantly from 1W post-RT to 3M post-RT [change rate, 55.44% (40.56%) and 120.39% (128.74%)]. From pre-RT to 1W post-RT, F value increased significantly [change rate, 28.13% (44.66%)], and then decreased significantly from 1W post-RT to 3M post-RT, whereas no significant differences were found between pre-RT to 3M post-RT. From pre-RT to 1w post-RT and 1M post-RT, D\* value decreased significantly [change rate, -41.86% (51.71%) and -29.11% (42.67%)]. No significant difference was found between different post-RT time intervals. There was a significant positive correlation between percentage change in  $\Delta$ CBF1W and radiation dose (R=0.548, p=0.001).

#### CONCLUSION

Both IVIM-DWI and ASL can help to detect/predict radiation-induced parotid damage in early stage after RT. They may contribute to clarify the correlations between damage of PGs and patient-/treatment-related variables by assessing individual microcapillary perfusion and tissue diffusivity.

#### CLINICAL RELEVANCE/APPLICATION

To reveal the mechanism of parotid radiation injury, realize early non-invasive diagnosis, and allow patients to obtain timely treatment to improve the quality of life of patients

## **PURPOSE**

Image-defined sarcopenia is linked to increased mortality among patients with cancer. Nevertheless, its effect on patients with nasopharyngeal carcinoma (NPC) is incompletely established. This study's aim was to investigate the prognostic significance of MRI-defined sarcopenia at the level of the third cervical vertebra (C3) on the survival of patients undergoing concurrent chemoradiotherapy (CCRT) ± inducing chemotherapy (IC) for NPC treatment

## **METHODS AND MATERIALS**

1,307 patients from two tertiary centers who had stage II-IVa NPC diagnosis between July 1, 2010, and September 30, 2019, were included in this retrospective study. Sarcopenia was defined using skeletal muscle index (SMI) determined through baseline MRI at the C3 level. The association of sarcopenia with overall survival (OS) and progression-free survival (PFS) was assessed by computing the Hazard ratios (HRs). Using 1:1 propensity score matching (PSM) analysis, Cox regression models were adjusted for age, body mass index (BMI), sex, and treatment. The PSM analysis revealed 331 pairs. We also conducted a stratification analysis using BMI and treatment strategies.

## **RESULTS**

The patients' median (range) age was 48 (18-80) years, with 821 patients (62.8%) presenting with sarcopenia. Before and after PSM, sarcopenia was an independent risk factor for both OS and PFS (all  $P < 0.05$ ). However, BMI was not substantially linked to tumor progression and overall mortality (all  $P > 0.05$ ). Sarcopenic patients showed lower rates of OS (HR = 2.00, 95% CI: 1.54-2.60,  $P < 0.001$ ) and PFS (HR = 1.67, 95% CI: 1.35-2.07,  $P < 0.001$ ) in contrast with nonsarcopenic patients. Similar findings were obtained after PSM. According to stratification analysis, being overweight was linked to a protective effect in nonsarcopenic patients only. In addition, sarcopenic patients showed similar OS and PFS regardless of the treatment modality.

## **CONCLUSION**

Sarcopenia is underrecognized in NPC patients. Measurement of sarcopenia using routine MRI scans in NPC patients provided significant prognostic information, outperforming BMI. Patients with sarcopenia failed to benefit from an additional IC regimen.

## **CLINICAL RELEVANCE/APPLICATION**

Sarcopenia could be used as a marker for predicting NPC patients' prognoses before treatment utilizing MRI images.

## Abstract Archives of the RSNA, 2023

W5A-SPIN

### Imaging Informatics Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPIN-1 Automated Quantification of Uncertainty for Emphysema Evaluation from CT Images using Hybrid Bayesian Deep Learning**

##### Participants

Antonio Porras Perez, PhD, (*Presenter*) Nothing to Disclose

##### PURPOSE

Emphysema quantification from computed tomography (CT) images is important to evaluate chronic obstructive pulmonary disease (COPD). Although volume-adjusted lung density (ALD) can be used for prognosis, it has shown sensitivity to variations between scanners and there are no metrics of its reliability. We present a hybrid Bayesian deep learning model to predict lung density from CT images that can quantify both the aleatoric and the epistemic uncertainty, which are associated with the imaging protocol and the prediction, respectively. These measures of reliability can be used during clinical evaluation.

##### METHODS AND MATERIALS

Inspiratory lung CTs from 1,936 COPD Gene participants (age 59.36±9.00 years; 1,038 female) were used. The data were randomly split into training (80%), validation (10%) and test images (10%). We trained a model to predict lung density at the 15th percentile of the CT histogram (Perc15) and quantify ALD. Our model consisted of convolutional blocks that quantify CT image features followed by fully connected layers. The final layer was Bayesian and weights were trained as probabilistic distributions instead of point estimates. ALD was calculated as the product of predicted Perc15 and the ratio of observed versus expected lung volume. Aleatoric and epistemic uncertainty were estimated over 50 stochastic forward passes in the test set. Deep learning ALD (DL-ALD) was compared to conventional ALD, and Cox proportional hazards models were used to determine the association between uncertainty and mortality.

##### RESULTS

The average root mean squared error for DL-ALD was 4.70 (95% CI: 4.68, 4.73). The mean aleatoric uncertainty was 23.77 (95% CI: 13.04, 34.51). The mean epistemic uncertainty was 1.22 (95% CI: 0.73, 1.71). DL-ALD was significantly associated with mortality ( $p < 0.001$ ) when adjusting for age, body mass index, smoking status, gender, and race. Adjusting for DL-ALD and demographics, epistemic uncertainty had a significant positive association with mortality ( $p = 0.013$ ) but aleatoric uncertainty did not ( $p = 0.134$ ).

##### CONCLUSION

DL-ALD performs as well as conventional ALD in predicting survival but it provides measures of uncertainty. This represents a substantial improvement over conventional methods that cannot estimate uncertainty. Aleatoric uncertainty associated with imaging protocol was higher than uncertainty from the model. Additionally, higher model uncertainty was associated with increased mortality risk, suggesting a need for reliability metrics to improve survival prediction through ALD.

##### CLINICAL RELEVANCE/APPLICATION

Uncertainty estimation when evaluating emphysema through hybrid Bayesian deep learning improves reliability of lung density measures over conventional image intensity-based analysis.

#### **W5A-SPIN-2 Deep Learning Model for Acute Respiratory Distress Syndrome (ARDS) Detection in the Pediatric Intensive Care Unit (PICU) Setting**

##### Participants

Vahid Khalkhali, MSc, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### PURPOSE

Acute respiratory distress syndrome (ARDS) is a significant cause of morbidity and mortality in the pediatric intensive care unit (PICU). ARDS diagnosis involves chest x-ray criteria combined with clinical and laboratory parameters. Machine learning models have demonstrated utility in the detection of ARDS on chest radiographs.

##### METHODS AND MATERIALS

In this retrospective, IRB-approved study, we identified 368 children admitted to the PICU with a diagnosis of ARDS, at a large pediatric academic center from 2014 to 2019. A single randomly selected radiograph from all patients admitted to the PICU without a diagnosis of ARDS during 2018 was used to establish the control cohort, ( $n = 1127$ ). The train:validation:test ratio was 60/20/20. Using transfer learning, we utilized a pretrained convolutional neural network (CNN) structure to determine the diagnosis of ARDS (PyTorch, version 1.2). The criterion was to minimize weighted cross-entropy loss. Area under the receiver operating characteristics (AUROC) was the main performance metric. Two pediatric radiologists independently assigned labels of ARDS to the training-set, and interrater reliability was calculated. Correlations between radiologists and the models were calculated using



Pearson correlation and Cohen's Kappa. All statistical analysis used Type-I error of 5% and power of 80%.

## RESULTS

The interrater reliability between the radiologists was 94.5% (Cohen's Kappa of 85.8%) for the training cohort. The ARDS diagnostic performance of two radiologists yielded an AUROC (balanced accuracy) of 72.5%, while the DenseNet161 model achieved 86.0% (AUROC of 92.5%) and ensemble of models reach to 83.7% (AUROC of 93.5%). Radiologist diagnoses were only 81% correlated (Cohen's Kappa 51.6%) with the DenseNet161 model and 83% (Cohen's Kappa 60.5%) with ensemble of models. While Pearson correlation between two radiologists were high (> 90%) on the test set, the difference between the detection of different models were statistically significant ( $p < 0.01$ ).

## CONCLUSION

Using transfer learning, we trained a CNN to reliably detect ARDS in the PICU and compared its performance with the diagnostic rates of two experienced radiologists. Machine learning can automatically detect ARDS on chest radiographs, with a performance which parallels those of radiologists.

## CLINICAL RELEVANCE/APPLICATION

Deep learning detection of ARDS could improve the triage of patients in the intensive care unit before the availability of dedicated pediatric radiologist reads.

## W5A-SPIN-3 Predicting the Occurrence of Immune Checkpoint Inhibitor-related Pneumonitis on Non-small Cell Lung Cancer Patients via Deep Learning

Participants

Janardhana Ponnathapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

## PURPOSE

Immune-checkpoint inhibition (ICI) has conveyed a paradigm shift in advanced lung cancer treatment in recent years. However, ICI therapy related pneumonitis, which is an immune related adverse event (irAE), can limit delivery of treatment to some patients. With overall incidence of nearly 6%, it is considered one of the more common irAEs resulting in a significant burden of morbidity and mortality in the lung cancer population. Predicting ICI-pneumonitis is crucial for identifying at-risk patients and adjusting their treatment to prevent the occurrence of ICI-pneumonitis. We in this study try to predict ICI-pneumonitis based on patients' imaging and clinical data.

## METHODS AND MATERIALS

We collected data from 1,254 lung cancer patients who received immunotherapy between 2015 and 2021. In the dataset, 53 patients developed ICI-pneumonitis and were included in this study. Another 41 patients who received immunotherapy without developing ICI-pneumonitis were randomly selected and used as a control group. We proposed a deep learning framework to predict ICI-pneumonitis based on deep learning features and radiomics features. A vision transformer was first pre-trained on over 25,000 CT scans from the NLST dataset and then used to extract deep learning features. Radiomics features were extracted using the Python pyradiomics package after lung segmentation. After feature selection, 17 deep features and 20 radiomic features were used for prediction. A network with three fully connected layers was trained for ICI-pneumonitis prediction using five-fold cross-validation.

## RESULTS

Using only deep learning features, we achieved an AUC of 0.934 (95%CI: [0.883, 0.986]). Similarly, with only radiomics features, the prediction AUC was 0.928 (95%CI: [0.873, 0.982]). When combining deep features with radiomics features, the prediction accuracy further improved to an AUC of 0.958 (95%CI: [0.917, 0.999]).

## CONCLUSION

Our proposed method can predict the occurrence of ICI-pneumonitis with high accuracy, indicating the potential for using deep learning to predict ICI-pneumonitis in advanced lung cancer patients receiving immunotherapy. This approach could be valuable for treatment planning in the future.

## CLINICAL RELEVANCE/APPLICATION

Prediction of ICI pneumonitis will have an important positive impact as early detection and timely recognition are critical to initiate prompt treatment and prevent further morbidity and mortality for these oncology patients.

## W5A-SPIN-4 SAMConvex: Fast Discrete Optimization for Deformable CT Registration using Multi-scale Self-supervised Anatomical Embedding and Correlation Volume

Participants

Zi Li, Hangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

Deformable image registration is a fundamental medical image analysis task. Estimating displacement vector field via a cost volume computed in the feature space suffers excessive computation burdens. Moreover, existing feature descriptors only extract local features incapable of representing the global semantic information that is important for handling large transformations. To address these issues, we propose SAMConvex, a fast coarse-to-fine discrete optimization method for CT image registration. It includes a decoupled convex optimization procedure to obtain deformation fields based on a self-supervised anatomical embedding (SAM) feature extractor that captures both local and global information.

## METHODS AND MATERIALS

Our proposed model, named SAMConvex, consists of two major components: (1) A discriminative feature extractor based on a SAM that encodes global and local embeddings for each voxel. The global embeddings memorize the 3D contextual information of body parts on a coarse resolution level, while the local embeddings differentiate adjacent structures with similar appearances. (2) A lightweight correlation pyramid that constructs multi-scale 6D cost volume by taking the inner product of SAM embeddings. With coarse-to-fine strategy, we estimate a sequence of deformation fields. The final field is computed via the composition of all the

deformation fields. We conduct the registration in 3 levels of resolutions. The registration performance is extensively evaluated in two inter-patient registration datasets, i.e., Abdomen CT (20 patients for train and 10 for test), and HeadNeck CT (62/10 patients for train/test) and intra-patient Lung CT (35 patients, each with inspiratory and expiratory breath-hold CT pairs). The average Dice score computed for the labeled organs is used to evaluate the accuracy.

## RESULTS

SAMConvex outperforms state-of-the-art registration methods, such as LapIRN, and Deeds, over all three datasets with an average 2.4% Dice score improvement as compared to the second-best performing method (Deeds). E.g., SAMConvex is consistently better than the second-best (Deeds) and third-best (LapIRN) registration methods on most examined abdominal organs, in 11 out of 13 organs. Moreover, as an optimization-based method, SAMConvex only takes ~2s for one paired scans, as compared to ~100s required by Deeds.

## CONCLUSION

The proposed deep registration model (SAMConvex) demonstrates state-of-the-art accuracy, good generalization, and high computation efficiency over previous leading models.

## CLINICAL RELEVANCE/APPLICATION

The proposed algorithm can accurately register the CT scans. The method can be applied in various downstream tasks such as longitudinal lesion quantification and image-guided radiotherapy.

## W5A-SPIN-5 Effective Opportunistic Screening for Colorectal Cancer using Abdominal or Chest Noncontrast CTs

Participants

Mingyan Qiu, PhD, Hangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

We designed an AI model for detecting colorectal cancer (CRC) using noncontrast chest or abdominal CT scans, which offers the advantage of opportunistic screening a broad asymptomatic population.

## METHODS AND MATERIALS

The training data consisted of 1,561 3D noncontrast abdominal CTs from a single hospital, including 566 cases with pathology-confirmed CRC and 995 cases without CRC. The initial CRC masks in the training set were manually annotated on the venous phase CT by an experienced radiologist (10-yr), referring to reports as needed. We then employed a robust image registration method to register the annotated mask from venous to noncontrast CT for model training. Our AI model is a UNet for segmentation of CRC and colorectum, which is further enhanced by a classification branch and is trained end-to-end to classify the patient as CRC or normal. To improve the differentiation of CRC tumor from colorectal content and normal tissues, we designed a content augmentation method and a contrastive loss. The model performance was evaluated on an internal hold-out test cohort comprising 147 patients with CRC and 153 normal cases, and external test cohorts comprising 181 abdominal CTs with CRC, one chest CT with CRC, and 2,477 normal chest CTs from three centers. One radiologist specialized in CRC imaging (20-yr) is invited for the reader study on the hold-out test cohort.

## RESULTS

On the internal test cohort, the model had an area under the curve of 0.978, sensitivity of 91.2%, and specificity of 97.4%; while the radiologist's sensitivity was 79.6% and specificity was 97.4%. Moreover, the model outperformed the radiologist in detecting early-stage CRC (T1 33.3% vs. 16.7%, T2 75.0% vs. 50.0%). On the external test cohorts, the model's sensitivity was 80.7% and 100% for abdominal CTs and chest CT, respectively; and the specificity was 99.6% for normal chest CT. Additionally, a preliminary comparison shows that our approach has comparable performance and may even outperform the established CRC screening tests in both sensitivity and specificity, such as CT colonography (Sens 90%, Spec 86%) and FIT (Sens 74%, Spec 95%).

## CONCLUSION

The proposed model could detect colorectal cancer tumors on chest and abdominal noncontrast CT scans with a high sensitivity and specificity, exceeding the sensitivity of an experienced radiologist specialized in CRC imaging.

## CLINICAL RELEVANCE/APPLICATION

Our study aims to investigate a novel, non-invasive, opportunistic screening solution for colorectal cancer using noncontrast CT and AI. The multi-center experimental results show that our solution achieves both high sensitivity and specificity, indicating that opportunistic population-based CRC screening in asymptomatic adults could potentially be performed in abdominal and chest CT.

## W5A-SPIN-6 Deep Learning Analysis of Chest Radiographs to Predict Coronary Artery Calcium and Triage Patients Deferrable from CT

Participants

Yisak Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To develop a deep learning (DL) model to predict the coronary artery calcium (CAC) using chest radiographs (CRs), validate its performance in patients from different institution and investigate the clinical utility of the model as a triage tool for deferring additional computational tomography (CT) scan.

## METHODS AND MATERIALS

We retrospectively searched adult patients who had undergone both a calcium score CT and posteroanterior chest radiography within a 3-month period from three different institutions; a total of 4,858 radiographs (age  $60.6 \pm 12.2$ ; women 2,458) from institution A, 4,109 radiographs (age  $61.0 \pm 12.3$ ; women 1,823) from institution B, and 979 radiographs (age  $57.0 \pm 11.3$ ; women 334) from institution C. Patients from institution A and B were used as a developmental cohort, and institution C as an external test cohort. The total Agaston scores calculated from CT were divided into 5 grades: 0, 1-100, 11-100, 100-400, and over 400, and considered ground truth labels. Images were cropped to fit the lung and heart area and normalized using energy bands and a region of interest obtained by heart segmentation. total of six different image sets were generated; original, lung area and heart area for

non-normalized and energy bands normalized. Separate DL models based on DenseNet-161 were individually trained for each of six image sets and the final performance was calculated using ensemble these six models. Conditional Ordinal Regression for Neural Networks (CORN) method was used for 5 ordinal CAC grade classification.

## **RESULTS**

Binary classification between under and over 100 CAC scores attained AUCs of 0.81, 0.79, 0.83, 0.77 on validation dataset, internal test A, internal test B and external test respectively. All test datasets showed more than 99% sensitivity at a threshold of sensitivity rate 99% attained from validation, and showed specificity of 27%, 28%, 18% and 26% for validation dataset, internal test A, internal test B and external test respectively. Using a threshold of sensitivity rate 99% attained from validation dataset, the DL model correctly identified 23.7% (66 of 278) and 14% (101 of 722) of patients in the internal test set A and B as CAC score under 100 so that additional CT scan may be deferred. Among them, true individuals showing CAC score under 100 (NPV) were 100% (66 of 66) and 98% (99 of 101) in the internal test set A and B respectively. On the external test set, DL model was able to defer 21.5% of all patients (212 of 977), and the NPV was 99.1% (210 of 212).

## **CONCLUSION**

s DL model could predict the CAC from CRs and could be used for helping clinical decision-makings such as taking additional CT.

## **CLINICAL RELEVANCE/APPLICATION**

The proposed model may assist in deferring additional CT scans using CRs by triaging patients with a under 100 CAC score.

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## Abstract Archives of the RSNA, 2023

W5A-SPIR

### Interventional Radiology Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPIR-1 Uncovering Hidden Lesions - Incidental Ring Hyperenhancing Liver Micronodules in Computed Tomography during Hepatic Arteriography Guidance in Percutaneous Thermal Ablation of Colorectal Liver Metastasis**

##### Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### PURPOSE

To describe and evaluate the nature of incidental ring hyperenhancing liver micronodules (RHLMs) detected on computed tomography during hepatic arteriography (CTHA) in patients with colorectal liver metastases (CLM) undergoing percutaneous ablation.

##### METHODS AND MATERIALS

Twenty-two CLM patients who underwent 24 CTHA-guided percutaneous thermal ablation sessions (AS) for 41 CLMs were included. CTHA images were obtained before and after ablation for tumor targeting and ablation margins assessment. Two radiologists independently reviewed pre-ablation images, and the interobserver agreement was assessed using Cohen's kappa. Incidental RHLMs were defined as small nodules with continuous ring enhancement visible in late arterial phase on three planes, with an average Hounsfield Unit at least twice that of adjacent liver parenchyma, not detected on baseline imaging. The nature of incidental RHLMs was determined by histological confirmation and/or follow-up image assessment. A biomechanical deformable image registration (DIR) method was used to map incidental RHLMs and newly detected CLMs on follow-up CT imaging. RHLMs were considered as CLMs if their segmentations overlapped.

##### RESULTS

The median time from baseline contrast-enhanced cross-sectional and/or functional imaging to AS was 29.4 days ( $\pm 19.1$  days). 25 incidental RHLMs with a mean largest diameter of 0.8 cm (range 0.3-1.7) were identified in 41.7% (10 of 24) of the AS. The agreement between two observers on identifying incidental RHLMs was almost perfect ( $\kappa = 0.907$ ). 4 incidental RHLMs were ablated during the AS given their similarity to targeted CLMs. Of the remaining 21 incidental RHLMs, 71.4% (15 of 21) disclosed to be CLMs, with 20% (3 of 15) confirmed by histology and 80% (12 of 15) by follow-up imaging using a DIR method at a mean time of 52 days ( $\pm 27.8$  days) post-ablation. The nature of the last 28.6% (6 of 21) incidental RHLMs was unknown, but no intrahepatic progression was observed on follow-up after chemotherapy.

##### CONCLUSION

Incidental RHLMs can be an early indicator of small CLMs, as confirmed by histology and DIR-based imaging analysis. Further investigation is needed to evaluate their relevance, as CLM resection is the only potentially curative treatment for liver-limited disease.

##### CLINICAL RELEVANCE/APPLICATION

The presence of incidental ring hyperenhancing liver micronodules on computed tomography during hepatic arteriography can indicate early-stage colorectal liver metastasis, which could impact the treatment approach.

#### **W5A-SPIR-2 Added Value of Kupffer-phase Imaging of Sonazoid-enhanced Ultrasound in Liver Ablation**

##### Participants

Dae Woong Kim, MD, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate the usefulness of Kupffer-phase imaging (KPI) in Sonazoid-enhanced ultrasound (SZUS) for local ablation of liver tumors and to identify factors related to tumor conspicuity on the KPI of SZUS.

##### METHODS AND MATERIALS

A total of 73 patients with 112 liver tumors (95 HCCs and 17 non-HCCs), who underwent gadoteric acid-enhanced MRI (Gd-EOB-MRI), B-mode planning US (BPUS), and SZUS-assisted radiofrequency ablation (RFA) from January 2020 to February 2023, were included. RFA was performed by an experienced radiologist using SZUS/MR image fusion, 30 to 50 minutes after intravenous injection of Sonazoid. The characteristics of both patients and liver tumors were evaluated. Tumor conspicuity was assessed sequentially using a 4-point scoring scale on hepatobiliary phase (HBP) of Gd-EOB-MRI, BPUS, and KPI of SZUS at 1-week intervals by the consensus of two experienced abdominal radiologists. The tumor echogenicity on BPUS were classified into hypoechoic and non-hypoechoic groups. Conspicuity scores of 1 and 2 were classified as the poor conspicuity group, while scores of 3 and 4 were classified as the good conspicuity group. We also investigated factors related to tumor conspicuity on the KPI of SZUS, as well as the technical success rate of RFA.

## RESULTS

The mean size of tumors was  $13.1 \pm 5.9$  mm. There was no significant difference in size or location between HCCs and non-HCCs. The tumor conspicuity score on KPI of SZUS ( $2.88 \pm 0.85$ ) was higher than that of BPUS ( $1.85 \pm 0.74$ ). The correlation between tumor conspicuity on KPI of SZUS and HBP of Gd-EOB-MRI was higher than that of BPUS and KPI of SZUS (HCCs [ $r_s=0.38$ ,  $p<0.001$ ], non-HCCs [ $r_s=0.76$ ,  $p<0.001$ ], and total [ $r_s=0.44$ ,  $p<0.001$ ] versus HCCs [ $r_s=0.33$ ,  $p<0.001$ ], non-HCCs [ $r_s=0.31$ ,  $p=0.224$ ], and total [ $r_s=0.34$ ,  $p<0.001$ ]). The factors related to tumor conspicuity on KPI of SZUS were hypoechogenicity on BPUS and good conspicuity on HBP of Gd-EOB-MRI ( $p=0.034$  and  $p=0.01$ , respectively). The technical success rate of RFA using KPI was 97.3%.

## CONCLUSION

s KPI of SZUS could be a valuable tool for successful liver ablation in cases where the tumor is not clearly visible on BPUS but is well-defined on the HBP of Gd-EOB-MRI.

## CLINICAL RELEVANCE/APPLICATION

When liver tumors are not clearly visible on ultrasound, performing liver ablation can be challenging. Although SZUS has the potential to improve tumor conspicuity, it is not widely used in liver ablation due to various limitations including its high cost, unpredictable effect on improving tumor visibility, short duration of the vascular phase, and long waiting time for KPI. However, using KPI of SZUS for liver ablation can significantly reduce procedure time and improve the technical success rate, especially when liver tumors are clearly visible on HBP of Gd-EOB-MRI.

## W5A-SPIR-3 Post Embolization Syndrome Following Histotripsy: An Indicator of Immune Activation

### Participants

Nathan Loudon, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### PURPOSE

Post-embolization syndrome (PES) is a reported phenomenon that can occur following transarterial chemoembolization (TACE) or radioembolization (TARE). It is thought to occur as a result of immune and inflammatory response to cell death during tumor necrosis. The most commonly described symptoms are pain, fever, and leukocytosis. The purpose of this study was to determine whether these symptoms would be seen following histotripsy at higher or lower frequency compared to TACE or TARE.

### METHODS AND MATERIALS

This was a single center IRB approved retrospective cohort study which compared post-embolization syndrome symptoms of fever, right upper quadrant abdominal pain, and leukocytosis among patients who underwent ablation of liver tumors using histotripsy ( $n=10$ ), TARE ( $n=32$ ), or TACE ( $n=34$ ). Our analysis considered size of largest lesion, tumor type, LR category, and BCLC staging.

### RESULTS

When adjusted for the size of the lesion and tumor type (HCC vs non-HCC), the odds of experiencing fever were 7.17 times higher in patients who underwent histotripsy compared to TACE (95% CI = 1.16 - 52.33,  $p=.039$ ), and 50 times higher compared to TARE (95% CI = 5.74 - 1589.36,  $p=.003$ ). The odds of experiencing abdominal pain were 14.70 times higher in the histotripsy group compared to TACE (95% CI = 2.09 - 302.12,  $p=.02$ ) and 50 times higher compared to TARE (95% CI = 7.02 - 1307.34,  $p=.001$ ). The histotripsy group had a smaller change in WBC from pre to post treatment compared to TACE (2.49, 95% CI = 0.34 - 4.64,  $p=0.024$ ), and no statistically significant difference in WBC change compared to TARE.

### CONCLUSION

s As histotripsy becomes a more widely available treatment offered to patients it is important to understand the range of expected clinical symptoms which can occur following ablation. This study suggests that patients who undergo histotripsy are more likely to experience fever and abdominal pain following ablation compared to TACE and TARE.

### CLINICAL RELEVANCE/APPLICATION

Histotripsy is a novel ablation modality and as such its expected post-treatment symptoms are still being elucidated. Pre-clinical data have shown that histotripsy is highly immunogenic on both a local and systemic level. PES is thought to be a result of inflammatory and immune response to tumor ablation. Studying the incidence of PES in this population could provide valuable insights into the clinical manifestations of immune activity following ablation.

## W5A-SPIR-4 Prediction of Initial Lung Microwave Ablation Zone Through Tumor and Ablation Characteristics

### Participants

Daniel Kim, Los Angeles, CA (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the effect of tumor and ablation characteristics on dimensions and size of lung microwave ablation zone and establish a prediction model.

### METHODS AND MATERIALS

This IRB-approved, HIPAA compliant study cohort involved patients who underwent CT-guided lung microwave ablation for their malignancy between 2012 to 2023. All patient demographics, treatment history, tumor characteristics, ablation duration, and maximum temperature ( $T_{max}$ ) reached were recorded. The peripheral location was defined as the area within 2cm from the edge of the visceral pleura. Ablation images without specific intraprocedural labels indicating post-initial ablation or cases without complete ablation details were excluded. The initial ablation zone was represented by the elliptical ground-glass opacity surrounding the target site and its dimensions were measured. Dataset was divided into 70% training and 30% test set and univariate and multivariate linear regression models were used to build a prediction model for the major axis, minor axis, and area of the ablation zone.

### RESULTS

This study cohort was composed of 89 lesions that underwent microwave ablations. Of these ablations, 25 were with history of

prior lung radiation therapy (Hrad) (28%) and 7 with history of prior lung surgery (Hsurg) (8%), and 45 lesions were located at the peripheral region. The median duration of the initial ablation was 1.5 minutes ranging from 0.5 to 10 minutes, the power used was 65W for all ablations, and mean of Tmax was 100±17°C. The measured mean major, minor axes, and area were 3.1±0.8cm, 1.8±0.5cm, and 4.7±2.5cm<sup>2</sup>. A parsimonious prediction model was built keeping only the predictors with p<0.15. For the major axis, duration (p<0.001), Tmax (p=0.002), Hsurg (p<0.001), and Hrad (p=0.102) were predictors. For minor axis, duration (p<0.001), Tmax (p<0.001), Hsurg (p=0.001), and peripheral location (p=0.099) were predictors. For the area, duration (p<0.001), Tmax (p<0.001), and Hsurg (p<0.001) were predictors. The fitted model equation for major axis was:  $3.176 + 0.597 \cdot \log(\text{duration}) - 0.003 \cdot (\text{Tmax}) - 0.302 \cdot (\text{Hrad}) + 1.146 \cdot (\text{Hsurg})$  with test root mean square error (RMSE)=0.55, R<sup>2</sup>=0.29. The equation for minor axis was:  $1.575 + 0.332 \cdot \log(\text{duration}) + 0.001 \cdot (\text{Tmax}) + 0.022 \cdot (\text{Hsurg}) + 0.106 \cdot (\text{peripheral})$  with test RMSE=0.53, R<sup>2</sup>=0.33. The equation for area was:  $5.772 + 2.431 \cdot \log(\text{duration}) - 0.021 \cdot (\text{Tmax}) + 1.658 \cdot (\text{Hsurg})$  with test RMSE=2.11, R<sup>2</sup>=0.40.

## CONCLUSION

s Lung tumor and ablation characteristics are shown to be significant predictors of microwave ablation dimensions and size which can be used to establish a prediction model.

## CLINICAL RELEVANCE/APPLICATION

Estimate of lung microwave ablation dimensions and size can aid in effective treatment of lung tumors.

## W5A-SPIR-5 Efficacy and Safety of Tract Cautery for Lung Microwave Ablation

Participants

Daniel Kim, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the efficacy and safety of tract cautery for lung microwave ablation through comparison of post-procedure complication rate.

## METHODS AND MATERIALS

This IRB-approved, HIPAA compliant study involved patients who underwent lung microwave ablation for their malignancy between 2012 to 2021. All patient demographics, treatment history, tumor characteristics, ablation details were collected. The study cohort was divided into whether tract cautery was conducted during probe removal. Immediate, persistent, and enlarging pneumothorax (PTX) were each defined as the observation of PTX on CT or chest radiograph during the termination of procedure, detection of non-expanding PTX, and expanding PTX for 3-5 hours post-procedure. Other complications including pleural effusion, delayed complication (more than one week), and post-procedural interventions needed for management of complications were recorded. A subgroup analyses of patients with no history of radiation therapy were also included. Univariate and multivariate logistic regression models were used to compare differences in complication rates.

## RESULTS

This study cohort was composed of 171 lung microwave ablation sessions of 62 patients (mean age 59±12). 58/171 were with history of radiation therapy of the lung (33.9%) and 33/171 were with history of lung surgery (19.3%). 80 ablations exhibited immediate PTX, 45 persistent PTX, 19 enlarging PTX, 26 pleural effusion, 8 delayed complications, and 14 required interventions. Tract cautery was conducted in 126/171 ablations. Patients who did not receive tract cautery had 10 times the odds of exhibiting delayed complications than patients who did receive tract cautery (p=0.003). Ablations with tumor size less than 1cm and history of emphysema had 5.9 times (p=0.035) and 5.7 times (p=0.032) the odds of requiring interventions. Increasing the total ablation time by 1 minute was associated with a 24% reduction in odds of delayed complications. Furthermore, a subgroup of ablations composed of patients without history of lung radiation therapy included 81 ablations with and 32 without tract cautery. This subgroup showed ablations conducted without tract cautery had 3.0 times the odds of exhibiting enlarging PTX (p=0.026) and 5.3 times the odds of requiring interventions (p=0.026) compared to ablations conducted with tract cautery.

## CONCLUSION

s Utilizing tract cauterization in lung microwave ablation shows significant reduced incidence of post-ablation delayed complications and enlarging PTX and interventions in patient without history of lung radiation therapy.

## CLINICAL RELEVANCE/APPLICATION

Tract cautery proves to be a useful method in reducing complications and interventions required for management of complications.

## W5A-SPIR-6 Pre-ablation Biopsy and the Effect of Histopathologic Grade on Thermal Ablation Outcomes for Hepatocellular Carcinoma

Participants

Abinaya Ramakrishnan, Los Angeles, CA (*Presenter*) Nothing to Disclose

## PURPOSE

Thermal ablation has been increasingly used as a minimally invasive treatment for hepatocellular carcinoma (HCC), with clinical outcomes comparable to surgical resection. While prior studies have analyzed the influence of size, location, and morphology on ablation outcomes, few have examined the role of histopathologic grade. This is partly because standard of care in LI-RADS 5 HCCs does not require biopsy. In this study, we determined the relationship between histopathological grade of the tumor on the clinical outcome after thermal ablation using time to local tumor progression-free survival (LTPFS) and overall survival (OS).

## METHODS AND MATERIALS

Between February 2015 to November 2022, 186 patients with nodular LI-RADS 5 HCCs that underwent ablation (MWA=165, RFA=21 with biopsies within prior 3 months) were included in this single-center, retrospective cohort study. All tumors were histologically classified using WHO criteria as Poor (n=25), Moderately (n=119), or Well (n=42) differentiated. Patients underwent continuous follow-up imaging to determine local tumor progression free survival (LTPFS). After retrospective review of medical records and follow-up MRI examinations, the rates of LTPFS and OS hazard ratios from Kaplan-Meier method were calculated and compared among the groups.

## RESULTS

Pre-ablation histopathologic grade was identified as a significant predictor for post-thermal ablation outcomes. Poorly-differentiated HCCs had significantly shorter LTPFS compared to well-differentiated HCCs (hazard ratio [0.21, 0.07-0.6],  $p=0.008$ ). Poorly-differentiated HCCs also had shorter LTPFS compared to moderately-differentiated HCCs (hazard ratio [0.68, 0.33-1.39],  $p=0.28$ ), although this difference was not significant. In terms of OS, poorly-differentiated HCCs had significantly shorter OS compared to well-differentiated HCCs [0.20, 0.07-0.59,  $p=0.0035$ ],  $p=0.0082$ ) and moderately-differentiated HCCs [hazard ratio [0.61, 0.3-1.25],  $p=0.0035$ ).

## CONCLUSION

s Poorly-differentiated HCCs was an important prognostic biomarker correlating with shorter LTPFS as well as OS after thermal ablation of HCC. While not currently considered standard of care, HCC biopsy prior to ablation can help tailor more aggressive patient-specific treatment planning and surveillance protocol.

## CLINICAL RELEVANCE/APPLICATION

Pre-ablation biopsies in HCC patients can play a critical role in the management of patients post-ablation. Poorly differentiated tumors may benefit from more aggressive treatment and surveillance given shorter LTPFS and OS.

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## Abstract Archives of the RSNA, 2023

W5A-SPMK

### Musculoskeletal Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPMK- Radiomics Analysis based on Dual-energy CT Hydroxyapatite (HAP)-fat Decomposition Technique for Osteoporosis Prediction** 1

##### Participants

Jinling Wang, Changsha, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To develop and validate a radiomics model based on the hydroxyapatite (HAP)-fat material decomposition (MD) images of dual-energy CT for osteoporosis prediction.

##### METHODS AND MATERIALS

83 patients who underwent dual-energy CT included L1-L5 and quantitative computed tomography (QCT) were collected. With QCT as the reference standard, the patients were divided into two groups according to the guidelines introduced by the International Society for Clinical Densitometry (ISCD) and American College of Radiology (ACR), osteoporosis of the spine was defined as a BMD value  $<80$  mg/cm<sup>3</sup>, and non-osteoporosis (osteopenia and normal) was defined as a BMD value  $\geq 80$  mg/cm<sup>3</sup>. Radiomic features were selected from HAP-fat MD images of dual-energy CT. A radiomics model was constructed from linear combinations of the selected features weighted by their coefficients. The ROC curve was performed to evaluate the performance of the radiomics model.

##### RESULTS

The radiomics model, which comprised 8 selected radiomics features (shape\_Maximum2DDiameterColumn, shape\_Maximum2DDiameterSlice, shape\_Sphericity, firstorder\_10Percentile, firstorder\_90Percentile, firstorder\_Skewness, gldm\_LargeDependenceHighGrayLevelEmphasis, gldm\_LargeDependenceLowGrayLevelEmphasis) based on HAP-fat MD images of dual-energy CT, showed excellent differential ability with AUC of 0.999 (95%CI, 0.987-1.000), sensitivity of 0.983, specificity of 1.000, negative prediction value of 0.960, positive prediction value of 1.000 in the cohort. The discrimination performance of the radiomics model to identify osteoporosis from non-osteoporosis (osteopenia and normal) showed high accuracy of 98.8% in the cohort.

##### CONCLUSION

The radiomics model comprised 8 selected radiomics features had excellent ability to predict osteoporosis based on dual-energy CT HAP-fat MD images.

##### CLINICAL RELEVANCE/APPLICATION

The prevalence of osteoporosis in the population is increasing year by year. One of the reference standards for the diagnosis of osteoporosis today is the volumetric BMD measured by QCT, but the QCT post-processing process is very complex and requires additional phantom calibration, etc. Our proposed radiomics model based on HAP-fat material decomposition images can serve as a useful tool for osteoporosis prediction and has the potential to be applied in clinical treatment planning in the future.

#### **W5A-SPMK- A Phantom Study of Optimal Scanning Parameters for Dual-energy CT Measurement of Human Lumbar Spine Bone Density** 2

##### PURPOSE

To explore the best scanning parameters of dual-energy CT (DECT) for measuring the bone density of human lumbar spine using the European spine phantom (ESP) and fresh pig subcutaneous fat to simulate normal weight and obese people.

##### METHODS AND MATERIALS

Different volumes of fresh pig subcutaneous fat were selected and wrapped around the ESP to simulate the lower abdominal condition (without rib influence) in normal weight and obese people; six fresh pig ribs were selected and wrapped around the ESP and fat on both oblique sides to simulate the upper abdominal condition (with rib influence) in normal weight and obese people. The ESP number 145 containing three hydroxyapatite (HAP) inserts with densities of 50,100,200 mg/cm<sup>3</sup> were labeled as L1,L2, and L3. Spectral scanning of two simulated phantoms were performed by Revolution CT. A total of 20 sets of spectral scans were performed. Each set was repeated 10 times and mean values of HAP-H<sub>2</sub>O of ESP L1-3 were measured. The data distributed normally and the differences between the measured and actual values of ESP L1-3 vertebrae were compared using an independent sample t-test. Relative error (RE) and Root mean square error (RMSE) of BMD measurements were calculated for different scanning conditions in normal and obese populations. These can reflect the accuracy of the measurement very well. CTDIVOL values under different energy spectrum scanning conditions were recorded.

##### RESULTS

For the upper abdomen (fat area 140 cm<sup>2</sup>, with rib influence) in normal weight, there was no statistical difference ( $P > 0.05$ ) in



BMD for each vertebra at 0.8s/rot with different tube currents. The set of 0.8s/rot and 190 mA led to the smallest RE and the smallest RMSE for L1 and 2 vertebral BMD was obtained at 190 mA. For the lower abdomen (fat area 240 cm<sup>2</sup>, without rib influence) in normal weight, there was no statistical difference between the 0.8s/rot with 190 mA and 275 mA ( $P > 0.05$ ). The RE in 190 mA was smaller than that in 275 mA, and the RMSE in 190 mA was also smaller than that in 275 mA. For the upper and lower abdomen (fat area 340 cm<sup>2</sup>) in obese weight, there were no statistical difference between the 0.8s/rot with 315 mA and 355 mA ( $P > 0.05$ ). The RE in 315 mA was smaller than that in 355 mA, and the RMSE in 315 mA was also smaller than that in 355 mA. With the increase of tube current, the CTDIVOL value of the same tubular speed increases.

## CONCLUSION

While using Revolution CT to measure lumbar spine bone density, 0.8s/rot at 190 mA might be the best scanning parameter for normal weight population, and 0.8s/rot at 315 mA might be the best scanning parameter for obese population.

## CLINICAL RELEVANCE/APPLICATION

This study proposes the optimal scanning parameters for measuring lumbar spine bone density in normal and obese populations based on simulating human abdominal fat and ribs.

## W5A-SPMK- Clinical Impact of the Results of Spine Biopsy in Patients with Suspected Discitis-Osteomyelitis

3

Participants

Joey Mustafa, Forest Park, IL (*Presenter*) Nothing to Disclose

## PURPOSE

Vertebral osteomyelitis is a serious and potentially life-threatening condition that is challenging to diagnose and treat. Image-guided biopsy is often performed to identify the causative microorganism. Previous studies have primarily focused on the yield of the cultures from these biopsies, but the impact of these results on clinical management has not been thoroughly studied. The objective of this study is to evaluate the impact of image-guided biopsy on the clinical management of vertebral osteomyelitis.

## METHODS AND MATERIALS

This retrospective study was conducted using patient data from a single academic institution in the USA, and included patients who underwent CT-guided biopsy for suspected vertebral osteomyelitis between January 2013 and April 2022. The study aimed to calculate the positivity rate of the biopsy sampling and assess how the biopsy results impacted the clinical management of patients with vertebral osteomyelitis. Specifically, the study examined whether clinicians changed the management of vertebral osteomyelitis through narrowing or broadening of antibiotic regimens based on the biopsy results.

## RESULTS

The study included 92 patients who underwent CT-guided bone biopsy for suspected vertebral osteomyelitis. Cultures from biopsy sampling were positive in 35% of patients. In 18% of all cases, the antibiotic regimen was changed based on the biopsy results and the specific organism identified. In contrast, the biopsy results had no significant impact on the subsequent antibiotic protocol in 82% of cases ( $\chi^2=40.96$ ;  $P<0.0001$ ), either because the cultures were negative, the organism could have been predicted without biopsy, or other clinical factors.

## CONCLUSION

The study highlights the challenges in diagnosing and treating vertebral osteomyelitis, as well as the limitations of image-guided biopsy in impacting the clinical management of this condition. The biopsy results did not lead to a change in the antibiotic regimen for the vast majority of cases. The risks and benefits of biopsy should be carefully considered in light of this knowledge.

## CLINICAL RELEVANCE/APPLICATION

Spine biopsies can be challenging procedures and the yield of such procedures may be low. This is the only study we are aware of that examines the clinical impact of biopsies performed for suspected discitis-osteomyelitis and the results show that biopsy/culture results do not change clinical management in the majority of patients.

## W5A-SPMK- Prediction of High-Risk Cytogenetic Status in Multiple Myeloma using Dual-energy Spectral Computed Tomography

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Participants

Siya Shi, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To explore the predictive value of quantitative parameters derived from dual-energy spectral computed tomography (DESCT) for a high-risk cytogenetic (HRC) status in multiple myeloma (MM) patients.

## METHODS AND MATERIALS

This study involved 24 MM patients with 102 lesions who had undergone spinal DESCT. Among them, 5 patients with 18 lesions were diagnosed with HRC status, including the presence of at least one of the following cytogenetic abnormalities (CAs): del(17p), t(4;14), t(14;16), t(14;20), gain(1p), or p53 mutation. The quantitative parameters of DESCT parameters were generated by the regions of interest defined on lesions. Univariate logistic regression was performed to determine the relevant variables with HRC status. The least absolute shrinkage and selection operator (LASSO) was used to build a model for predicting the HRC status. Waterfall plot was used to visualize the performance of the model. Receiver operating characteristic (ROC) analysis was performed to determine potential utility of the model and the sensitivity and specificity determined by the Youden Index were also calculated.

## RESULTS

Statistical differences were observed according to univariate logistic regression including Mono 40- Kev, Ca (Fat), Ca (Water), Fat (Ca), Fat (HAP), HAP (Fat), HAP (Water), Water (Ca), Water (HAP) and Effective atomic number (Eff-Z) (all  $P < 0.05$ ). Fat (HAP) and Water (Ca) were selected according to LASSO to build a prediction model for HRC status. Waterfall plot demonstrated the favorable predictive performance of the model. ROC analysis indicated the area under the curve was 0.799 (95% confidence interval: 0.656-0.942) with sensitivity of 0.722, specificity of 0.857 and Youden index of 0.579.

## CONCLUSION

s Analysis of DESCT offers potential as a quantitative method to predict the HRC status in MM.

## CLINICAL RELEVANCE/APPLICATION

The DESCT quantitative parameters could be used to predict HRC in MM patients and to facilitate treatment selection and prognosis prediction.

## W5A-SPMK- Opportunistic Screening for Acute Vertebral Fractures on Routine Abdominal or Chest CT using an Automated Deep Learning Model

Participants

Jonghun Woo, MD, Bucheon-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To develop an opportunistic screening model based on deep learning algorithm to detect recent vertebral compression fractures in abdominal or chest CT

## METHODS AND MATERIALS

This retrospective single center design study collected 1309 coronal reformatted images from abdomen, pelvis or chest CT, performed within the preceding two months in patients recently diagnosed with a vertebral compression fracture or normal spine on spinal MRI. They consists of 504 recent fracture labeled images (119 patients, mean age  $61.6 \pm 19.2$ [SD], M: F=64:55) and 805 normal unlabeled images (115 patients, mean age  $56.2 \pm 15.0$ [SD], M: F=68:47) from September 2018 to April 2022. One radiologic resident and one board certified musculoskeletal radiologist participated in image selection and manual labeling the fractured segment on each CT images. Image selection in recent fracture group was made on the condition that two out of three radiologic findings suggestive of a recent fracture such as cortical step-off, impaction of trabeculae, or visual fracture line were included and three images per each fractured vertebral segment were obtained. For the CT image of the normal patient group, 7 images were obtained at the same interval between the most anterior vertebral body and the posterior vertebral body in the coronal scan. The labeled 480 images and unlabeled 700 images was split randomly into training set, validation set, and internal test set in a ratio of 75%:10%:15%, respectively. Remained labeled 24 images and unlabeled 105 images was included for secondary internal validation set. The primary outcome was test accuracy, precession, and F1 score. Neuro-T (version 2.3.3; Neurocle Inc), a commercially available software was used in establishing algorithm

## RESULTS

For training, validation and internal test set, the algorithm achieved 99.86 % test accuracy, 91.22 % precision, and 89.18 % F1 score, respectively for detection of recent vertebral compression fracture. Then in secondary internal validation set, our system achieved 99.90% test accuracy, 74.93 % precision and 78.30 % F1 score, respectively.

## CONCLUSION

s Automated deep learning model showed high accuracy in test set and also in internal validation set. If this algorithm is applied opportunistically to daily abdomen or chest CT evaluation, it will be helpful for early detection of vertebral compression fracture.

## CLINICAL RELEVANCE/APPLICATION

Automated deep learning model showed high accuracy in test set and also in internal validation set. If this algorithm is applied opportunistically to daily abdomen or chest CT evaluation, it will be helpful for early detection of vertebral compression fracture.

## W5A-SPMK- Detection of Bone Marrow Edema in Vertebral Compression Fractures using Deep Learning Segmentation Quantitative Material Density Imaging in Fast kVp-switched Dual Energy CT

Participants

Reisuke Nishihara, Hiroshima, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Water (hydroxyapatite. [HAP]) material density images derived from dual energy CT (DECT) are used to detect bone marrow edema (BME) in vertebral compression fractures (VCF). However, task-irrelevant anatomy is also enhanced in water (HAP) images, and this can affect BME detection accuracy. This study investigates the diagnostic performance of BME in VCF using water (HAP) density images with deep learning (DL) bone segmentation.

## METHODS AND MATERIALS

172 vertebral bodies, from the images of 20 patients who underwent both DECT and MRI between Dec 2021 and Feb 2023 for suspected VCF, were included in this study. Vertebral bodies with heights of less than 4 mm, and those imaged after percutaneous vertebroplasty, were excluded. DECT was performed using a 256-row fast kVp switching dual energy CT (Revolution CT, GE HealthCare). Virtual monochromatic images (VMI, 70 keV with 0.625 mm-slices) were reconstructed and processed using dedicated software (Spectral Bone Marrow [SBM], GE HealthCare). SBM generates a bone mask using a DL-based DECT bone segmentation algorithm. This mask defines bone regions upon which water (HAP) material density images are overlaid on the base VMI. The window width and level of the color overlay images are set to optimize visualization of bone marrow. This fully automatic procedure yields 2.5 mm-slice axial, sagittal and coronal water (HAP) density-VMI fused images. Presence of BME was assessed by MRI. Two radiologists, blinded to the MRI results, evaluated each vertebral body for the presence of BME on the water (HAP) density-VMI fused image using a binary classification. Sensitivity, specificity, positive predicted value (PPV) and negative predicted value (NPV) were assessed using MRI as reference standard. Regions of interest (ROI) were placed on each vertebral body. Cut-off values of water (HAP) density were calculated using ROC analysis.

## RESULTS

The DECT-based algorithm detected BME with 100% sensitivity, 98% specificity, 96% PPV and 100% NPV. A cutoff value of 996.6 mg/cm3 provided 96 % sensitivity and 99% specificity.

## CONCLUSION

s The DECT BME detection algorithm demonstrates excellent performance in VCF, as evidenced by quantitative analysis as well as concordance with radiologist impressions.

#### **CLINICAL RELEVANCE/APPLICATION**

Currently, BME diagnosis in VCF is mainly performed using MRI. This work demonstrates that, thanks to advances in deep learning-based segmentation, quantitative projection-based material decomposition direct from projection views, and VMI-water (HAP) image fusion, DECT may provide a viable alternative. DECT may improve patient throughput vs MRI owing to shorter scan time and increase availability because of lower cost per scan.

### **W5A-SPMK- The Value of Trabecular Bone Score in the Reclassification of Bone Quality in Chinese Postmenopausal Women**

#### **PURPOSE**

To explore the clinical value of trabecular bone score (TBS) in the reclassification of bone quality in Chinese postmenopausal women.

#### **METHODS AND MATERIALS**

The retrospective study included Chinese postmenopausal women who had dual X-ray absorptiometry (DXA) examination between September 2022 and April 2023. DXA images were analyzed to measure bone mineral density (BMD) at lumbar spine (LS), left hip (LH), and femoral neck (FN). was calculated by the TBS iNsite software (version 3.0.0.15). The degradation of bone microstructure was determined following the cutoff values: TBS = 1.310 (normal); 1.230 = TBS = 1.310 (partially degraded); and TBS < 1.230 (degraded). The DXA parameters and clinical characteristics were compared among different BMD categories (normal, osteopenia, osteoporosis) by using rank sum test. Factors related to TBS were determined by Spearman correlation analysis. P < 0.05 was considered statistically significant.

#### **RESULTS**

A total of 300 subjects were included in this study, with 100 subjects per bone mass category. There was no significant difference in the age between any two of the groups (P>0.05). The TBS was significantly lower in osteoporosis ( $1.212 \pm 0.075$ , P < 0.001) and osteopenia groups ( $1.291 \pm 0.085$ , P < 0.001) than in normal BMD group ( $1.345 \pm 0.097$ ). Significant differences for BMI, weight and DXA parameters were also observed between any two of the groups. For normal BMD group, 3% of subjects still showed degraded microstructure. The number was obviously increased in both osteopenia (7.67%) and osteoporosis (19.66%) groups. For partially degraded microstructure, 8%, 11.33% and 11.34% of subjects were observed in normal BMD, osteopenia and osteoporosis groups, respectively. Spearman correlation analysis showed that the factors related to low TBS were age, weight, BMI, BMD and T-score.

#### **CONCLUSION**

s TBS and BMD were significantly lower in the osteoporosis group than in osteopenia and normal BMD groups. Low TBS was associated with age, weight, BMI, and BMD at lumbar spine, left hip and femur neck. It was notable that a proportion of Chinese postmenopausal women with osteopenia and normal BMD still suffered from degraded microstructure according to their TBS.

#### **CLINICAL RELEVANCE/APPLICATION**

BMD and TBS are essentially two different and independent indices to describe bone quantity and quality, respectively. Patients with osteopenia may also have degraded bone, which is at higher risk of fracture but not easily detected in clinical. However, in combination of BMD, TBS is able to uncover the presence of these patients. Therefore, TBS is also of great value for the clinical management of Chinese patients with osteoporosis and those at risk of fracture, as well as for treatment decisions and recommendations.

### **W5A-SPMK- TBS Helps Identify Degraded Bone Microstructure in Chinese PHPT Patients**

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#### **PURPOSE**

To explore the value of trabecular bone score (TBS) in evaluating the bone microstructure in Chinese primary hyperparathyroidism (PHPT).

#### **METHODS AND MATERIALS**

We performed a retrospective study of Chinese PHPT patients who were diagnosed between August 2022 to April 2023. The patients all underwent dual-energy X-ray absorptiometry (DXA) examination. Patients without DXA or TBS examination, and suffering from disease that might affect bone metabolism were excluded. Normal control and case groups were matched for age and sex. TBS for each subject was evaluated based on their lumbar spine DXA image by the TBS iNsite software (version 3.0.0.15). The integrity of bone microarchitecture was evaluated based on different TBS cutoff values: TBS = 1.310 (normal microstructure), 1.230 = TBS = 1.310 (partially degraded microarchitecture), and TBS < 1.230 (degraded microarchitecture). The difference of DXA parameters, including TBS and BMD, and clinical information between the groups were analyzed by T-test and Rank sum test. P<0.05 was considered as significant.

#### **RESULTS**

A total of 18 Chinese PHPT patients (female: male = 7: 2) and 35 age- and sex-matched controls were included in the study. The bone mass index (BMI) of the included patients was at 15-35kg/m<sup>2</sup>. There were 21 and 14 subjects with normal BMD and bone mass loss in the control group, respectively. Clinical characteristics, including height, weight and BMI, were not significantly different between the groups. A significant difference was observed for lumbar spine BMD (P = 0.000) and TBS (P=0.026), as well as left hip (LH) and femoral neck (FN) BMD (P = 0.000 for both) between the control and case groups. In particular, in terms of the mean value, TBS of PHPT groups indicated degraded microstructure, while no degradation was observed in the control group. BMD and TBS were significantly correlated in both groups (PHPT: r=0.891, p=0.000; control group: r=0.569, p=0.000).

#### **CONCLUSION**

s Lumbar spine BMD and TBS was significantly lower in Chinese PHPT patients than control group. In addition, there was a significant correlation between TBS and BMD in PHPT and the control group. In the basis of BMD, TBS could be used to better evaluate the microstructure of Chinese PHPT patients and therefore their fracture risk.

#### **CLINICAL RELEVANCE/APPLICATION**

BMD does not reflect bone microstructure and hence bone strength. Trabecular bone score (TBS) is a textural index that evaluates pixel gray-level variations in the lumbar spine DXA image, providing an indirect index of trabecular microarchitecture. TBS could be a useful tool to evaluate the bone microstructure of Chinese PHPT patients, providing a better evaluation of their fracture risk.

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## Abstract Archives of the RSNA, 2023

W5A-SPMS

### Multisystem Wednesday Poster Discussions I

#### Sub-Events

#### W5A-SPMS- Correlation between Volumetric CT Tumor Burden and Circulating Tumor DNA as Response Parameters in Patients with Advanced Metastatic Melanoma Undergoing Immunotherapy 1

#### PURPOSE

Circulating tumor DNA (ctDNA) is a promising tool for treatment monitoring of patients with advanced melanoma, as it may serve as a measure of tumour burden. There is a need to understand the correlation between visual tumour burden assessed by imaging and ctDNA levels. Thus, the purpose of our study was to compare ctDNA values with volumetric tumor burden assessed by computed tomography as indicators for therapy response in melanoma patients undergoing immunotherapy.

#### METHODS AND MATERIALS

In this retrospective, institutional review board approved study, a total of 35 patients (19 male, 16 female, age 63 +/- 17) with histologically confirmed metastatic melanoma (AJCC v8 stages III/IV) underwent systemic immunotherapy. All patients received a baseline and at least 2 subsequent staging CT examination after initiation of therapy. This resulted in a total of 107 CT examinations, including a body CT scan (neck, chest and abdomen) as well as cranial CT or MRI. The volumetric tumor burden was measured separately in different anatomical regions (bones, lung, liver, lymph node, cutaneous and brain metastases) using a dedicated commercially available software tool. The total tumor burden as well as subgroup analysis of different metastatic sites were correlated with the plasma ctDNA levels at each follow-up time point. The detection of somatic mutations in plasma DNA included hotspot analyses in 5 different genes: BRAF, EGFR, KRAS, NRAS, PIC3CA.

#### RESULTS

Lymph node metastases were the most common metastatic site (53.6%), followed by lung metastases (30.7%) and subcutaneous metastases (26.9%) and brain metastases (26.9%). The mean ctDNA level was 0.99 %/mL and the mean volumetric total tumor burden was 118 mL. There was a statistically significant difference for relative changes in total tumor burden and ctDNA levels between non-responders (progressive disease [PD]) and responders (partial response [PR] and complete response [CR]). A strong and statistically significant correlation was observed between relative changes of ctDNA levels and total tumor burden ( $r=0.87$ ;  $p<0.05$ ). Of note, subgroup correlation of the two most frequent sites of metastasis (lymph node, lung) between tumor burden and ctDNA levels was moderate ( $r=0.6$ ;  $p<0.05$ ).

#### CONCLUSION

Changes in both total tumor burden and ctDNA can be used for precise response assessment in advanced melanoma patients undergoing immunotherapy. Given the strong correlation between the two markers, inherent challenges of immunotherapy response assessment such as pseudo-progression could be identified and differentiated earlier.

#### CLINICAL RELEVANCE/APPLICATION

Combining imaging with other biomarkers is vital to address inherent challenges of immunotherapy response assessment such as pseudo-progression.

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## Abstract Archives of the RSNA, 2023

W5A-SPNMMI

### Nuclear Medicine & Molecular Imaging Wednesday Poster Discussions I

#### Sub-Events

W5A-  
SPNMMI-1

#### Immuno-PET Imaging of B7-H4 Immune Checkpoint in Prostate Cancer

##### PURPOSE

B7-H4 is an immune checkpoint sibling of PD-L1 that suppresses T-cells' tumor-killing functions. In addition to cancer cells, B7-H4 is also expressed by tumor-associated macrophages (M<sup>?</sup>), comprising 30-50% of tumor stromal cell populations. This study aimed to design and develop a novel B7-H4 immunoPET probe and perform the first proof-of-concept B7-H4 immunoPET imaging.

##### METHODS AND MATERIALS

Anti-B7-H4 mAb was functionally characterized and tested using ELISA assay. The antibody was conjugated with chelator NODAGA-NHS and labeled with radioisotope copper-64 (<sup>64</sup>Cu). Tumor xenografts were generated in C57BL/6J mice by subcutaneously injecting TRAMP-C2 prostate cancer cells on the right flank. 5 mice/group were intraperitoneally injected with either PBS, B7-H4 mAb (10mg/kg) to block B7-H4, or chlodronate liposome (15mg/kg) to cause M<sup>?</sup> depletion. MicroPET imaging was performed post-tail vein injection of 100 $\mu$ Ci <sup>64</sup>Cu-B7-H4-mAb. Radiotracer uptake was measured as the maximum percentage injected dose per gram body weight (max %ID/g). Statistical significance was determined using two-way ANOVA with Tukey correction for multiple testing.

##### RESULTS

Immunoconjugation yielded a chelator-to-antibody ratio of 1.8-2.2 and 94-98% radiochemical purity of radiotracer <sup>64</sup>Cu-B7-H4-mAb with an average specific activity of 2645.45 mCi/ $\mu$ mol. The immunoreactivity of <sup>64</sup>Cu-B7-H4-mAb was similar to that of naked B7-H4 mAb, with unaffected potency in targeting B7-H4 protein moiety. PET imaging demonstrated tumor uptake of radiotracer as 13.12  $\pm$  4.867, 36.38  $\pm$  5.71, and 42.16  $\pm$  11.95 %ID/g at 4-, 24-, and 48 hours, respectively. By comparison, the radiotracer uptake in B7-H4 blocked tumors was 10.56  $\pm$  2.26, 25.92  $\pm$  6.28, and 27.20  $\pm$  11.01 %ID/g at 4-, 24-, and 48 hours, respectively. Blocking B7-H4 in vivo significantly reduced radiotracer uptake at the 48-hour time point (p=0.0088). Depletion of M<sup>?</sup> also demonstrated a non-significant tendency of reduced tumor uptake radiotracer (8.34  $\pm$  4.37, 26.04  $\pm$  4.08, 35.42  $\pm$  10.22 at 4-, 24-, and 48 hours, respectively). Immunohistochemical staining of B7-H4 demonstrated significantly stronger protein levels in untreated tumors compared to B7-H4 blocked or M<sup>?</sup> depleted group.

##### CONCLUSION

The new <sup>64</sup>Cu-B7-H4-mAb radiotracer showed preferential tumor accumulation. In vivo B7-H4 blocking and M<sup>?</sup> depletion reduced the tumor accumulation of the new radiotracer; however, a statistically significant difference was only observed between the control and the blocked group at 48 hours.

##### CLINICAL RELEVANCE/APPLICATION

The new B7-H4 immunoPET probe is a clinically translatable imaging biomarker that could inform clinical trial design immediately. B7-H4 PET imaging could guide clinical decision-making to improve therapeutic benefits.

W5A-  
SPNMMI-2

#### Prostate-specific Membrane Antigen (PSMA) as a Novel Theranostic Target in Glioblastoma Multiforme (GBM): Feasibility Study in a Preclinical Xenograft Model

##### Participants

Steven Pan, BSc, New York, NY (*Presenter*) Nothing to Disclose

##### PURPOSE

Glioblastoma (GBM) is the most common and aggressive primary malignant brain tumor. Accurate differentiation of viable tumor versus treatment-related change and delivery of targeted therapies is critical to improving clinical outcomes. Prostate specific membrane antigen (PSMA) has recently entered clinical practice as a theranostic (ie diagnostic PET and radionuclide) target in malignancies such as prostate cancer, and PSMA expression in GBM has recently been shown. The purpose of our study was to confirm PSMA expression in GBM with immunohistochemistry (IHC), and to evaluate PSMA as a radionuclide target in a mouse model of GBM.

##### METHODS AND MATERIALS

IRB and IACUC approval was obtained for the human tissue and in vivo mouse model components of the study. IHC was performed in tissue specimen from six GBM patients to validate PSMA expression. Subcutaneous xenografting of a mosaic tumor model consisting of a PSMA+ endothelial cell line and a GBM stem cell line was performed in 5 mice. Three mice were treated with 1 mCi of [<sup>177</sup>Lu]-PSMA, and tumor localization of radionuclide was validated using post-treatment single-photon computerized tomography (SPECT) imaging. Treatment response was assessed with longitudinal monitoring of tumor size using calipers to measure length (L) and width (W), and estimating ellipsoid volume (V) through the modeling formula,  $V = 0.5 \times L \times W^2$

##### RESULTS

In 5/5 (100%) patient tumor specimen, IHC demonstrated PSMA expression in both tumor stroma as well as tumor vasculature,

noting inter-patient heterogeneity. Post-therapy [Lu177]-PSMA SPECT demonstrated specific localization of radionuclide in the subcutaneous tumor xenograft in 3/3 (100%) mice, validating in vivo expression of PSMA in our mosaic model as well as delivery of radionuclide to the tumor site. Treated tumors demonstrated reduction in tumor volume and slowed growth compared to the untreated control group, although no animal demonstrated complete tumor killing.

#### **CONCLUSION**

s We validated previous pilot studies showing PSMA expression in human GBM specimen. We further demonstrate feasibility of PSMA-targeted radionuclide therapy in our in vivo mouse xenograft model, with evidence of partial response. Our findings support further evaluation of PSMA as an emerging theranostic target in GBM, both as a standalone approach and in combination with other therapeutic strategies. Future directions include correlative studies between PSMA expression and clinical outcomes to further elucidate its potential for personalized therapies and a predictor for clinical outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

This study combines human GBM tissue and mouse model investigations to validate PSMA as an emerging theranostic target in GBM and has the potential to improve clinical outcomes.

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## Abstract Archives of the RSNA, 2023

W5A-SPNPM

### Noninterpretive Skills (Beyond Imaging) Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPNPM-1 Burnout Among Radiology Physicians: A Systematic Review and Call to Action**

Participants

Nader Ashraf, MD, Riyadh, Saudi Arabia (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Burnout is on the rise among physicians, including radiologists, with prevalence rates exceeding 50%. Burnout in healthcare can result in medical errors, malpractice suits, low patient satisfaction, and poor care delivery. Hence, we aimed to systematically review studies reporting the prevalence of burnout in physicians in the radiology department and to provide an overview of the factors associated with burnout among radiologists.

#### **METHODS AND MATERIALS**

Searches were run from inception until November 13th, 2022, in multiple databases. This systematic review included studies that addressed the prevalence of burnout in radiologists of any sample size, using a valid method of assessment, reporting estimates of overall burnout syndrome or its subdimensions, and were cross-sectional, observational, or prospective survey peer-reviewed studies, without restrictions on publication time or language, following the PICOS framework. Data were extracted into a standardized Excel® sheet and descriptive statistics were generated by the same program.

#### **RESULTS**

Twenty-two cross-sectional studies involving 4230 radiology physicians in 7 countries published between 1996 and 2022 reporting on burnout were included. Fifteen studies (68.2%, n = 3181) were conducted in the United States. The studies had a range of participants from 26 to 460, with a median of 156 and an interquartile range of 89-265. Only 81.8% of the studies identified the gender of their sample, with 57.7% males and 42.3% females. The overall burnout prevalence estimates were reported by 13 studies (59.1%) and varied from 33% to 88%. High burnout prevalence estimates were reported by only 5 studies (22.7%) and ranged from 5% to 62%. Still, the prevalence estimates from these studies cannot be combined nor compared due to the variability in burnout assessment techniques, definitions, and outcomes, as well as statistical heterogeneity.

#### **CONCLUSION**

We identified 22 studies with a high degree of heterogeneity reporting prevalence estimates on burnout among radiologists. Burnout in radiology is increasing globally, with prevalence estimates reaching 88% and 62% for overall and high burnout, respectively, and a myriad of factors identified to be contributing to the increased prevalence. This data should be used as a starting point for discussion to evaluate and resolve these difficulties in the global radiology work environment.

#### **CLINICAL RELEVANCE/APPLICATION**

With the modest number of studies included and the significant methodological discrepancies, there is a need for further high-quality and methodologically robust studies conducted with standardization of burnout definition and assessment techniques.

#### **W5A-SPNPM-2 Exploring the Potential of Microsoft Bing Chatbot for Answering Patient Questions Regarding Radiologic Examinations and Procedures**

Participants

Ian Kuckelman, BS, MPH, Madison, WI (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To evaluate the accuracy and completeness of AI chatbot responses to questions commonly asked by patients regarding radiologic examinations and procedures.

#### **METHODS AND MATERIALS**

We developed ten conversational-style questions for three common radiologic examinations and procedures (CT abdomen, MRI spine, and bone biopsy) and asked them to the Microsoft Bing Chatbot in two trials across three different settings, "More Creative", "More Balanced", and "More Precise". Two reviewers, one an attending radiologist with eight years of experience and the other a fourth-year medical student, independently compared the responses provided by the Chatbot to a gold-standard resource—radiologyinfo.org—and rated them for accuracy and completeness on a scale of 1-3, (1-incorrect/incomplete, potentially harmful; 2-mostly correct/complete, unlikely to cause confusion or harm; and 3-entirely correct/complete). Descriptive statistics were calculated. Differences in accuracy and completeness ratings were compared by chatbot setting and exam type with a Kruskal-Wallis test. Inter-rater reliability was assessed using Cohen's kappa statistic.

#### **RESULTS**

Of the 180 total responses collected, 166 (92%) were rated as "entirely correct" and 14 (8%) as "mostly correct". For



completeness, 119 responses (66%) were rated "complete" and 61 (34%) "mostly complete." Both reviewers rated all responses as either "entirely correct/complete" or "mostly correct/complete", with no responses rated as "inaccurate" or "incomplete" by either reviewer. Neither completeness nor accuracy differed significantly by chatbot setting or exam type. Inter-rater agreement was moderate with a Kappa of 0.66.

## CONCLUSION

Our study shows that the Microsoft Bing Chatbot has potential as a tool for patient education regarding radiologic examinations and procedures. Directing patients to this online resource represents a potentially cost-effective way for health systems and providers to provide patients with important information regarding how to prepare for a procedure, as well as reduce patient anxiety and improve overall experience. Limitations include potential variability of responses based on question phrasing and the omission of important information not explicitly requested.

## CLINICAL RELEVANCE/APPLICATION

AI-powered chatbots show potential as a tool for patient education associated with radiologic examinations and procedures.

### W5A- SPNPM-3 **Can ChatGPT Answer Questions about Lung Cancer and Screening**

Participants

Hana Haver, MD, (*Presenter*) Nothing to Disclose

## PURPOSE

The recent surge of worldwide interest in dialogue-based artificial intelligence (AI) large language models (LLM) such as ChatGPT is prompting evaluation of information available on such platforms. Early studies have found that ChatGPT provides generally appropriate clinical recommendations in areas ranging from cardiovascular disease, antibiotic selection for infectious diseases and breast cancer. Lung cancer remains a leading cause of death in the United States, so we sought to evaluate how ChatGPT would respond to fundamental questions about lung cancer prevention, screening and the Lung CT screening Reporting and Data System (Lung-RADS).

## METHODS AND MATERIALS

In February 2023, we submitted 25 questions to ChatGPT and asked it to generate three answers, as inconsistencies among answers are reported. Three fellowship-trained cardiothoracic radiologists graded each set of responses based on clinical judgment as 1) "appropriate," 2) "inappropriate," or 3) "inconsistent" if the responses contained inappropriate or varied information, respectively. Final appropriateness for each set was determined by the majority of reviewer responses, which were summarized using descriptive statistics.

## RESULTS

ChatGPT-generated responses were determined to be appropriate for 76% (19/25) questions in both contexts by three fellowship-trained cardiothoracic radiologists. Four of 25 (16%) generated responses were characterized as inappropriate and 2/25 (8%) as inconsistent in both hypothetical contexts (Table 1). Inappropriate and inconsistent responses were related to lung cancer screening indication and frequency as well as those related to the Lung-RADS lexicon.

## CONCLUSION

ChatGPT demonstrates the potential to automate provision of healthcare information related to lung cancer prevention and screening. ChatGPT performed more poorly on topics about lung cancer compared to previous reports on clinically appropriate information to questions about cardiovascular disease and breast cancer. This difference could be due to lack of information about lung cancer versus cardiovascular disease in the model's training dataset. Radiologist oversight remains critical, given the inappropriate and inconsistent radiology-specific information. Future study of applications for LLMs to improve healthcare education and counseling is encouraged.

## CLINICAL RELEVANCE/APPLICATION

ChatGPT generates largely appropriate answers to questions about lung cancer prevention and screening, though gaps remain in specific radiology topics and physician oversight remains imperative.

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## Abstract Archives of the RSNA, 2023

W5A-SPNR

### Neuroradiology Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPNR- Assessment for Carotid Atherosclerotic Plaque using Vessel Wall Magnetic Resonance Imaging: A Multi-reader ROC Study to Determine Optimal Sequence for Detecting Vessel Wall Calcification**

#### PURPOSE

We aimed to compare conventional vessel wall MR imaging techniques and quantitative susceptibility mapping to determine the optimal sequence for detecting carotid artery calcification.

#### METHODS AND MATERIALS

Twenty-two patients who underwent carotid vessel wall MR imaging and neck CT were enrolled. Four slices of 6-mm sections from the bilateral internal carotid bifurcation were subdivided into 4 segments according to clock position (0-3, 3-6, 6-9, and 9-12) and assessed for calcification. Two blinded radiologists independently reviewed a total of 704 segments and scored the likelihood of calcification using a 5-point scale on T1-, T2-, PD-weighted imaging, the first echo-time images of FLASH, and quantitative susceptibility mapping. Quantitative susceptibility mapping was calculated using phase images of FLASH. The observer performance for detecting calcification was evaluated by a multireader, multiple-case receiver operating characteristic study. Weighted  $\kappa$  statistics were calculated to assess interobserver agreement with respect to calcification scoring.

#### RESULTS

Quantitative susceptibility mapping had a mean area under the receiver operating characteristic curve of 0.85, which was significantly higher than that of any other sequence ( $p < 0.01$ ) and showed substantial interreader agreement ( $\kappa = 0.68$ ). When a segment with a score of 3-5 was defined as positive and a segment with a score of 1-2 was defined as negative, the sensitivity and specificity of QSM were 0.75 and 0.87, respectively.

#### CONCLUSION

Quantitative susceptibility mapping was the most reliable MR sequence for the detection of plaque calcification.

#### CLINICAL RELEVANCE/APPLICATION

A low signal on quantitative susceptibility mapping is a reliable marker of carotid plaque calcification.

#### **W5A-SPNR- Contribution of Cerebral Microbleeds and Sleep Quality to Persistent Post-concussive Working-Memory Decline Through Glymphatic Clearance Dysfunction**

Participants

Yung-Chieh Chen, MD, PhD, Taipei, Taiwan (*Presenter*) Nothing to Disclose

#### PURPOSE

Cerebral microbleeds (CMBs) and sleep disorders are linked to persistent cognitive decline after a concussion (mild traumatic brain injury, mTBI). However, the pathomechanism is not fully understood. We hypothesized that the inefficient glymphatic clearance function may contribute to prolonged working-memory dysfunction, which may be partially attributed to both poor sleep and concussion-related CMBs.

#### METHODS AND MATERIALS

We conducted a 1-year prospective magnetic resonance imaging (MRI) and neuropsychological study on patients with concussion (N=61) and demographically matched controls (N=61). Susceptibility-weighted MRI was used to detect CMBs. The diffusion tensor imaging analysis along the perivascular space (DTI-ALPS) index was used to evaluate glymphatic function. The Pittsburgh sleep quality index (PSQI) and digit span (DS) scores were employed to assess participants' sleep quality and working memory, respectively. The baseline DTI-ALPS index, PSQI scores, and the demographic data were used to train the machine learning-based model to predict the 1-year DS score.

#### RESULTS

Patients with CMBs demonstrated a lower DTI-ALPS index compared with patients without CMBs and controls. Additionally, patients demonstrated poorer sleep quality than controls. The 1-year DS score was significantly correlated with both glymphatic diffusivity (DTI-ALPS;  $r=0.592$ ,  $p<0.001$ ) and sleep quality (PSQI;  $r=-0.551$ ,  $p<0.001$ ) assessed at baseline. Potential baseline biomarkers, such as the number of CMBs, DTI-ALPS index, and PSQI score, the confounding factors, including age, sex, education level, and duration from injury to MRI, were employed as the potential feature factors to predict long-term working memory function (1-year DS score). We then developed several machine learning-based models using the key features selected by the Lasso method to predict the DS score at the 1-year follow-up. Among the models, the Gaussian Process Regression method yielded the best predictions of the 1-year DS score, with an  $R^2$  value of 0.78 and a root-mean-squared error of 2.8827.

#### CONCLUSION

s CMB and poor sleep quality are contributing factors for glymphatic dysfunction, as measured using the DII-ALPS index, and related to persistent postconcussive working-memory impairment. Our systematic analyses not only further our understanding of glymphatic dysfunction after concussion but also provide a framework for precise and personalized predictions of protracted cognitive decline.

#### **CLINICAL RELEVANCE/APPLICATION**

The study highlights the importance of monitoring sleep quality and glymphatic function in patients with concussion, and suggests a potential therapeutic target for preventing persistent cognitive dysfunction after concussion.

#### **W5A-SPNR- Magnetic Resonance Imaging in Traumatic Brain Injury Patients and Associations with In-hospital Outcomes: Analysis of a National Representative Sample** 12

##### **PURPOSE**

Magnetic Resonance Imaging (MRI) has gained increasing attention due to its superior ability to visualize brain tissue injury. Several studies have demonstrated the superior diagnostic accuracy of MRI compared to computed tomography (CT) which is the most used imaging modality in the acute setting. The presence of intracranial hemorrhage has been associated with poor outcomes in traumatic brain injury patients. Therefore, the appropriate use of imaging modalities is crucial in predicting outcomes and providing optimal care. We aim to study the use of MRI in Traumatic Brain Injury (TBI) patients and their associations with in-hospital outcomes.

##### **METHODS AND MATERIALS**

The National Inpatient Sample (NIS) was queried for MRI use, discharge disposition, length of hospital stays, intracranial hemorrhage, and in-hospital mortality among those with TBI in 2015. The effect of MRI use on these endpoints was evaluated using bivariate and multivariate regression analysis independently, controlling for significant baseline differences in demographics, comorbidities, and hospital status.

##### **RESULTS**

A total of 45293 patients admitted with a diagnosis of TBI were included in this study. 25.7 %, 35.6%, 24.0%, and 14.6% of the patients were in age groups 20-40, 40-65, 65-80, and >80, respectively. 55% of the patients were female. 58% were Whites, while Hispanic, Black, and other races accounted for 17%, 14%, and 9%, respectively. In the unadjusted analysis, inpatient CT brain was associated with lower rates of mortality (unadjusted OR 0.657, 95% CI 0.163-2.651) compared to those who did not have a CT scan. Inpatient CT use was also associated with lower odds of short hospital stays (unadjusted OR 0.810, 95% CI 0.729-0.900) compared to those who did not. After adjusting for confounders, MRI and CT use was not significantly associated with in-hospital mortality, discharge disposition, length of stay, or inpatient complications.

##### **CONCLUSION**

s We present that there seems to be no difference in inpatient outcomes and complications when MRI is used in the evaluation of traumatic brain injuries. Clinical decision-making regarding the use of MRI versus CT scan in TBI patients should be based on the severity of the injury and clinical presentation. Further research is needed to explore the long-term outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

The clinical relevance of comparing MRI use versus CT scan in TBI patients lies in the potential to improve in-hospital outcomes. The appropriate imaging modality can provide accurate and timely diagnosis, which can lead to better treatment decisions and improved patient outcomes. Understanding the associations between these imaging modalities and in-hospital outcomes can aid in clinical decision-making and lead to better patient care.

#### **W5A-SPNR- Quantitative Analysis of Calcification in Cerebral Microvasculature by Micro-computed Tomography** 13 (microCT)

##### **PURPOSE**

Vascular calcification (VC) is a predictor of both cardiovascular and cerebrovascular events. While it is known that coronary VC results in impaired vasomotor response and reduced myocardial perfusion, less is known about the prevalence and impact of VC in brain microcirculation. We examined the distribution of intracranial calcification in a cohort of human cadavers using micro-computed tomography (microCT). We aimed to exhibit the feasibility of quantifying calcification volume (CV) in cadaveric brain vasculature using microCT and apply this method to compare CV across brain regions in which VC has been incidentally noted in case studies.

##### **METHODS AND MATERIALS**

In a cohort of elderly human donor cadavers with and without dementia documented at time of death, brain tissue was sampled bilaterally from basal ganglia (BG), substantia nigra (SN), subventricular zone (SVZ), hippocampus (Hc), and posterior cingulate cortex (PCC). Samples were scanned by microCT at 10  $\mu$ m resolution. 3D-reconstructed images were segmented into standardized regions of interest (ROI) and thresholded at the level of calcium detection (130 Hounsfield units). CV was defined as voxel quantity  $\geq$ 130 HU within each ROI; CVs exceeding .01% per ROI were considered "positive". Findings were confirmed by histologic evaluation using Alizarin red calcium-binding stain.

##### **RESULTS**

All subjects exhibited parenchymal and/or vascular calcification in at least one region. Calcification volume exceeding .01% per ROI for the no dementia cohort (n=6) was 83% globus pallidus (GP), 66% SN, 17% SVZ, 17% Hc, and 33% PCC compared to the dementia cohort (n=6) which was 100% GP, 33% SN, 50% SVZ, 100% Hc, and 100% PCC. Prevalence of Hc and PCC was significantly greater in subjects with documented dementia compared to age-matched subjects (n=12, p<0.01).

##### **CONCLUSION**

s Our findings demonstrate the utility of microCT for quantifying CV in human brain tissue. All subjects exhibited calcification in at least one brain region, indicating that intracranial calcification is more prevalent than published estimates (~30% in general population). Consistent with the literature, VC was most prevalent in the GP. Subjects with dementia exhibited significantly higher Hc and PCC CVs than age-matched subjects without dementia. This finding supports recently published evidence of increased Hc

and BG calcification in human cadaveric brains with Alzheimer's disease relative to age-matched controls. Expansion of our study cohort remains ongoing in order to further investigate this relationship.

#### **CLINICAL RELEVANCE/APPLICATION**

Analyzing the patterns of VC in cerebral vasculature using microCT can aid in the development of therapeutics against cerebrovascular and neurodegenerative diseases.

#### **W5A-SPNR- Geometric versus Hemodynamic Indexes for Rupture-destined Aneurysms: A Retrospective Cohort and a Repeated-measures Study** 14

##### **PURPOSE**

A proper stratification of intracranial aneurysms is critical in identifying rupture-destined aneurysms and unruptured intracranial aneurysms. We aimed to determine the utility of geometric and hemodynamic indexes in differentiating two types of aneurysms, and to examine the characteristics of natural evolutionary changes of unruptured aneurysms.

##### **METHODS AND MATERIALS**

Rupture-destined aneurysms was defined as having subsequent SAH, and unruptured intracranial aneurysms was examined using follow-up TOF-MRA. In addition to geometric indexes, signal intensity gradient, an in-vivo approximated wall shear stress from TOF-MRA, was measured in aneurysms. The difference between the maximum and minimum values of signal intensity gradient in an aneurysm compared to parent arterial values was designated as delta-signal intensity gradient ratio.

##### **RESULTS**

This study analyzed 20 rupture-destined aneurysms in 20 patients and 45 unruptured intracranial aneurysms in 41 patients with follow-up TOF-MRA. While geometric indexes did not show differences between the two groups, the delta-SIG ratio was higher in the rupture-destined aneurysms ( $1.5 \pm 0.6$  vs.  $1.1 \pm 0.3$ ,  $P=0.032$ ). The delta-signal intensity gradient ratio showed a higher area under the receiver operating characteristics curve for SAH than the size ratio ( $0.72$  [95% CI,  $0.58-0.87$ ] vs.  $0.56$  [95% CI,  $0.41-0.72$ ],  $P=0.033$ ). The longitudinal re-examination of TOF-MRA in the unruptured intracranial aneurysms showed evidence of aneurysmal growth with hemodynamic stability.

##### **CONCLUSION**

s The delta-signal intensity gradient ratio showed higher discriminatory results between the two groups compared to geometric indexes. Aneurysmal rupture risk should be assessed by considering both geometric and hemodynamic information.

#### **CLINICAL RELEVANCE/APPLICATION**

The study's findings have clinical implications for the management of intracranial aneurysms, as the early identification of RDAs can help prevent catastrophic hemorrhage. The use of hemodynamic information, in addition to geometric indexes, can aid in the proper categorization of aneurysms and assessment of rupture risk. The study also highlights the importance of longitudinal re-examination of UIAs to track changes in geometry and hemodynamics over time. The study found evidence of aneurysmal growth with hemodynamic stability in the UIA group, indicating the need for regular follow-up imaging to monitor changes and assess rupture risk. Overall, the study's findings suggest that the delta-SIG ratio may be a useful marker for differentiating between RDAs and UIAs, and that a comprehensive assessment of both geometric and hemodynamic information is necessary for the proper management of intracranial aneurysms.

#### **W5A-SPNR- Cerebral Artery Wall Shear Stress and Clinical Outcome in Lenticulostriate Infarction: A Retrospective Cohort Study** 2

##### **PURPOSE**

There is no previous study for a relationship between cerebral arterial wall shear stress and a clinical outcome in lenticulostriate infarction. We aimed to investigate whether the signal intensity gradient (SIG), as a surrogate marker of wall shear stress, from Time-of-Flight Magnetic Resonance Angiography (TOF-MRA) in cerebral arteries is associated with a functional independence.

##### **METHODS AND MATERIALS**

This multicenter, retrospective cohort study design enrolled 294 patients with lenticulostriate infarction from January 2015 to March 2021 at three stroke centers in Korea. A favorable clinical outcome was defined as the modified Rankin Scale 0-2 at the seventh day or discharge. The arterial SIG were measured concurrently in both internal carotid, anterior/middle/posterior cerebral, vertebral arteries, and one basilar artery (BA) from TOF-MRA which was performed in acute stage.

##### **RESULTS**

Among the enrolled patients, 148 (50.3%) were allocated as the favorable outcome. The favorable outcome group showed mean values of SIG in the BA as  $8.7 \pm 2.7$  SI/mm, while the unfavorable group showed  $7.2 \pm 2.2$ ,  $P < 0.001$ . The mean values of SIG in the BA were associated with the favorable outcome, showing odds ratio of 1.20 and 95% confidence intervals 1.06-1.37,  $P = 0.005$ . All other cerebral arteries except posterior cerebral arteries showed associations between arterial SIG and the favorable outcome.

##### **CONCLUSION**

s Cerebral arterial SIG showed independent associations with clinical outcome in patients with lenticulostriate infarction. Future studies are needed for a feasibility of generalization in different races and ethnicities, and for other subtypes of ischemic stroke.

#### **CLINICAL RELEVANCE/APPLICATION**

This finding suggests that whole cerebral arterial perfusion might be important to keep patients functionally improving. As far as the authors are aware, there has been no study evaluating the relationship between the measured hemodynamic values of all major cerebral arteries and the clinical prognosis in patients with ischemic stroke. We hope that this study will serve as a culprit to study the pathogenesis and progression of lenticulostriate infarction from a different perspective.

#### **W5A-SPNR- Increased Risk of Subsequent Stroke in Emergency Department TIA Encounters with Incomplete Neurovascular Imaging** 3

## PURPOSE

Multisociety guidelines recommend urgent brain and neurovascular imaging in patients with transient ischemic attack (TIA) within 48 hours to identify and treat modifiable risk factors for stroke. Prior research has suggested that a majority of patients with TIA presenting to the emergency department (ED) do not receive prompt neurovascular imaging. The purpose of this study was to examine the association between incomplete neurovascular imaging during a TIA encounter and risk of subsequent ischemic stroke.

## METHODS AND MATERIALS

We identified Medicare beneficiaries discharged from EDs with a TIA diagnosis using the 100% standard analytic files between 2016-2017 and International Classification of Diseases 10th Edition (ICD-10) codes. Imaging performed during the ED encounter was identified using current procedural terminology codes. Patients with incomplete neurovascular imaging were defined as missing either all or a component of a brain and neck cross-sectional vascular imaging exam within 48 hours of their initial ED encounter. The association between incomplete neurovascular imaging during the TIA encounter and outcome of ischemia stroke over subsequent 90 days was tested in a multivariable logistic regression model, adjusting for patient demographics, comorbid disease severity, socioeconomic indicators, and hospital-level factors.

## RESULTS

107,730 beneficiaries were discharged from EDs with a TIA diagnosis during the study period. Within 48 hours of the ED encounter, 41,110 (38.2%) of patients had an incomplete neurovascular imaging work-up. New stroke diagnoses within 90 days of the ED TIA encounter were observed in 4.4% (2,900/66,620) of patients who received neurovascular imaging, compared with 7.0% (2,873/41,110) of patients with incomplete neurovascular imaging. Incomplete neurovascular imaging was associated with higher odds of ischemic stroke within 90 days (OR 1.3 [95% CI: 1.22-1.38]) as was receiving care at rural (OR 1.41 [95% CI: 1.26-1.58]) and small hospitals < 100 beds (OR 1.35 [95% CI: 1.19-1.52]), and residing in the lowest income quartile counties (OR 1.12 [95% CI: 1.02-1.23]).

## CONCLUSION

TIA encounters with incomplete neurovascular imaging are associated with higher odds of subsequent stroke within 90 days.

## CLINICAL RELEVANCE/APPLICATION

Increasing access to urgent neurovascular imaging in the TIA population may be an area to target to help detect and treat modifiable risk factors for stroke.

## W5A-SPNR- Predictors of Positive Remodeling in Patients with Acute Ischemia Stroke

4

### PURPOSE

The aim of this study was to compare the differences in the culprit plaques characteristics between positive remodeling (PR) and non-positive remodeling (NPR) patterns in patients with acute ischemia stroke (AIS), and to evaluate potential relative risk factors for PR of intracranial atherosclerosis (ICAS).

### METHODS AND MATERIALS

Patients with AIS recruited and underwent the HR-VWI scan within 2 weeks after onset. Plaque morphological parameters, as well as clinical variables of both PR and NPR groups were compared using non-parametric tests. A binary logistic regression model was used to analyze the parameters promoting the development of PR, and further determine the independent predictors of PR. The sensitivity and specificity of the model were tested by receiver operating characteristic curve.

### RESULTS

In all, 84 eligible patients (mean age 58.07±1.35 years, 66 (78.6%) were male) were assigned to the PR (n=28, 33.3%) or NPR (n=56, 66.4%) group according to remodeling ratio (RR). Compared with the NPR group, the PR group had a greater plaque area (P<0.001), greater wall area (WA) (P<0.001), longer plaque length (P=0.018), larger RR (P<0.001), higher blood glucose (P=0.01) and a greater number of HBP (P=0.16). Binary Logistic regression analysis showed that plaque area was independently associated with PR (OR 3.71, 95% CI, 1.49-9.24).

### CONCLUSION

HR-VWI can identify positive remodeling in ICAS with large plaque area, suggesting a high burden of intracranial vascular lesions and promoting PR.

### CLINICAL RELEVANCE/APPLICATION

To evaluate the effect of plaque morphological properties and clinical parameters on cerebrovascular remodeling patterns to improve the classification of cardiovascular risk.

## W5A-SPNR- Early Brain Amyloid Accumulation on PET in Military Instructors Exposed to Sub-concussive Blast Injuries

5

### PURPOSE

Traumatic brain injury (TBI) is the leading cause of disability in young adults. Recurrent TBI is associated with a wide range of neurologic sequelae, but the contributing factors behind the development of such chronic encephalopathy are poorly understood. Purpose: To quantify early amyloid beta (A $\beta$ ) deposition in the brain of otherwise healthy adult men exposed to repeated subconcussive blast injury using amyloid PET.

### METHODS AND MATERIALS

In this prospective study from January 2020 to December 2021, military instructors routinely exposed to repeat blast events were evaluated at two different time points: baseline, prior to blast exposure from breacher or grenade, and approximately 5 months after baseline, after blast exposure. Age-matched healthy controls not exposed to blasts and without a history of prior brain injury were evaluated at similar two time points. Neurocognitive evaluation was performed with standard neuropsychological testing for both groups. Analysis of PET data consisted of SUV measurements in six relevant brain regions, and whole brain voxel-based

statistical approach.

## RESULTS

All participants were men (9 controls, 9 blast-exposed). The median age of the controls was 33 years.; IQR: [32, 36]. That of the blast-exposed group was 33; IQR: [30, 34] ( $p=0.824$ ). In the latter, four brain regions showed significantly increased amyloid deposition after blast exposure: infero-medial frontal lobe, precuneus, anterior cingulum and superior parietal lobule (P values=0.004, 0.02, 0.002, and 0.003 respectively). No amyloid deposition was observed in the controls. Discriminant analysis based on regional changes of amyloid accumulation correctly classified all 9 healthy controls as a healthy controls (100%) and 7 of the 9 blast-exposed (78%) as a blast-exposed. Based on the above voxel-based analysis, whole brain parametric maps of early abnormal early amyloid uptake were obtained. Conclusion: Early brain amyloid accumulation was identified and quantified on PET in otherwise healthy adult men exposed to repetitive subconcussive traumatic events.

## CONCLUSION

Early brain amyloid accumulation was identified and quantified on PET in otherwise healthy adult men exposed to repetitive subconcussive traumatic events.

## CLINICAL RELEVANCE/APPLICATION

Our results might have direct clinical implications; if the individuals that are at risk of developing amyloid-related neurotoxicity can be identified, therapies to clear A $\beta$  in the brain might reduce or slow the development of long-term secondary traumatic encephalopathy.

## W5A-SPNR- Dynamic Changes of Intrinsic Brain Activity in Acute Carbon Monoxide Poisoning

6

### PURPOSE

To investigate the dynamic changes of intrinsic brain activity in acute carbon monoxide (CO) poisoning patients using dynamic amplitude of low-frequency fluctuation analysis (dALFF).

### METHODS AND MATERIALS

28 CO poisoning patients and 26 healthy controls (HC) with similar educational backgrounds and handedness were recruited. MRI scans were performed on a Siemens Magnetom Prisma 3.0 tesla scanner. Clinical cognitive function was evaluated by Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment Basic (MoCA-B). We examined the dALFF differences between patients and HCs, as well as correlations between dALFF and cognitive function scores.

### RESULTS

Compared to HC, elevated dALFF in left superior frontal gyrus (SFG), left medial frontal gyrus (MFG), and left supplementary motor area (SMA) were identified in CO poisoning group. Additionally, static ALFF analysis identified lowered intrinsic brain activity in left inferior occipital gyrus in CO poisoning group. dALFF values in left superior frontal gyrus were negatively correlated to MoCA-B scores in CO poisoning group.

### CONCLUSION

Our results revealed that increased instability of intrinsic brain activity were present in patients suffering from carbon monoxide poisoning. Variance of dALFF in prefrontal cortex was associated with cognitive ability in patients with CO poisoning.

### CLINICAL RELEVANCE/APPLICATION

The findings of current study may deepen the understanding of neurobiological mechanism of CO poisoning and provide possible additional radiological diagnosis approach to carbon monoxide poisoning and related cognitive impairment.

## W5A-SPNR- Optimizing Traumatic Brain Injury Prognosis Prediction: Leveraging Machine Learning with CT Imaging and GFAP/UCH-L1 Blood Biomarkers

7

Participants  
Burak Ozkara, MD, Houston, TX (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to develop an interpretable machine learning (ML)-based predictive model that combines clinical variables, blood biomarkers, and imaging biomarkers to improve the prognostic prediction, triage management, and treatment strategy in traumatic brain injury (TBI) patients.

### METHODS AND MATERIALS

In this retrospective cohort study, 662 patients transported to the emergency department with a trauma alert and suspected TBI were screened. Data extraction from electronic medical records included demographic and clinical information. Blood samples were collected and analyzed for GFAP and UCH-L1 using a sandwich enzyme-linked immunosorbent assay. Non-contrast head CT scans were assessed by neuroradiologists for TBI common data elements (CDEs). The collected data was used as input for the ML models. Three outcomes were designed to predict: discharged or admitted for further management (prediction 1), in hospital mortality (prediction 2), and course of hospital stay (prediction 3). Machine learning models, including XGBoost, Random Forest, decision tree, support vector machines, and logistic regression, were trained using the training sets to compare their performances. Cross-validation and hyperparameter tuning were employed. SHapley Additive exPlanations (SHAP) values were used to evaluate the relative significance of predictor factors.

### RESULTS

A total of 440 patients were finally included. Random Forest models achieved the best performance. For prediction 1 (discharged or admitted for further management), the test set accuracy was 0.95, and the Kappa value was 0.88. For prediction 2 (deceased or not deceased), the accuracy was 0.98, with a Kappa value of 0.49. In prediction 3 (admission only, prolonged stay, or neurosurgery performed), the Random Forest model achieved an accuracy of 0.82 and a Kappa value of 0.72 during the testing phase. SHAP analyses showed that the three most important features for prediction 1 were other major extracranial injury, hemorrhage, UCH - L1. The top three features for prediction 2 were Glasgow Coma Scale, age, GFAP. GFAP, subdural hemorrhage

volume, and pneumocephalus were the five most significant features for prediction 3.

## CONCLUSION

Our study demonstrates the potential of ML models in predicting the hospital course and mortality of TBI patients using non-contrast CT CDEs and blood biomarkers GFAP and UCH - L1. Blood biomarkers like GFAP and UCH - L1 were among the significant variables for prediction, demonstrating the originality of our study.

## CLINICAL RELEVANCE/APPLICATION

These models may help physicians tailor individualized care plans and provide more accurate prognostic information for patients.

## W5A-SPNR- Asymmetric Cerebral Perfusion Abnormalities are Hallmark in Chronic Traumatic Brain Injury Imaging 8

Participants

Farzaneh Rahmani, MD, MPH, Saint Louis, MO (*Presenter*) Nothing to Disclose

## PURPOSE

Advanced MRI methods identify biomarkers of grey or white matter damage including perfusion defects, diffusion abnormalities or atrophy. These biomarkers might improve sensitivity for detection of chronic traumatic brain injury (TBI), even when acute evidence of the insult are subtle or absent on conventional imaging sequences.

## METHODS AND MATERIALS

Sixty-seven participants (29 men and 38 women, age: 47.1±13.5) with a history of traumatic brain injury were enrolled from individuals referred to the Neuroevolution LLC. under IRB exemption #Pro00071328. Participants were required to be at least 18 years old and have a T1-weighted brain MRI acquired within 3 months of the date of injury. Additionally, 60 participants (26 men and 34 women, age:47.8±13.1) had arterial spin labeling (ASL) perfusion and 55 had diffusion MRI (dMRI) scans available. Volumetric assessments were done using the Neuroreader program which is FDA-cleared, yielding absolute, normalized and standardized volumes for 83 cortical and subcortical brain structures. The Neuro Reader index (NR-index was defined as the regional z-score divided by the size of the normative database, while the left-right asymmetry scores were calculated as described in prior work. ASL-MRICloud was used to extract relative regional cerebral blood flow (rCBF) and their respective z-score maps. Abnormal white matter (WM) fractional anisotropy (FA) was identified through comparison of automated ROI defined regions to age and sex-matched references.

## RESULTS

Regions with highest prevalence of abnormal NR-index included the bilateral cerebellar grey matters, lateral ventricles, pallidi and the right temporal lobe. Significant left-right asymmetry was seen in the frontal lobes in 31%, in parietal lobes in 25%, in occipital lobes, and in temporal lobes in 31% of the participants, while the pallidi were most likely to demonstrate left-right asymmetry among subcortical regions. Similarly, Figure 1 demonstrate a significant left-right asymmetry in the average perfusion z-score map of all participants, with a distinct right frontal: left parietal, coup-contrecoup pattern. WM FA was found to be abnormally low (<-2 z-score) in 7.3% and 9.1% of participants in the right and left internal capsules. Rate of FA abnormality was even lower in the splenium (3.6%) and genu (1.8%) of IC, right and left parietal WM (0% AND 3.6), and right and left frontal WM (1.8% and 0%).

## CONCLUSION

Asymmetric abnormalities in brain perfusion are common in chronic post TBI setting and their prevalence exceeds those of volumetric or diffusion abnormalities.

## CLINICAL RELEVANCE/APPLICATION

This work establishes the added importance of advanced neuroimaging techniques, namely perfusion imaging, in identifying evidence of chronic TBI.

## W5A-SPNR- Differences in Corpus Callosum White Matter Integrity in mTBI Patients with and without PTSD Comorbidity 9

Participants

Priya Santhanam, PhD, Olney, MD (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to compare corpus callosum diffusion tensor imaging (DTI) findings in mild traumatic brain injury (mTBI) patients who presented either with or without post-traumatic stress disorder (PTSD) symptomology.

## METHODS AND MATERIALS

DTI and clinical data were obtained from retrospective chart review of 451 civilian patients (mean age 43 years, range 13-82) with clinically diagnosed mTBI. Patients were identified as having PTSD if presenting with signs and symptoms consistent with the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V) diagnostic criteria. The corpus callosum and its subregions (anterior/inferior, anterior, mid-body, posterior, posterior-inferior) were defined by hand tracing in Olea Sphere (v3.0 SP12). Fractional anisotropy (FA) values were compared between patients with mTBI only and those with mTBI+PTSD by Mann-Whitney U test.

## RESULTS

FA was lower in patients with mTBI+PTSD as compared to those with mTBI only in the corpus callosum overall and within all subregions. Statistical comparisons between groups found FA was significantly lower in the whole corpus callosum ( $p < 0.001$ ) as well as in the anterior/inferior ( $p = 0.003$ ), anterior ( $p < 0.001$ ), mid-body ( $p = 0.006$ ), posterior ( $p = 0.007$ ), and posterior/inferior ( $p = 0.017$ ) subregions individually.

## CONCLUSION

Patients with mTBI and comorbid PTSD had reduced white matter integrity across the corpus callosum. While the contribution of PTSD to brain injured patients is not well-understood, some prior research indicates a possible influence of PTSD in military TBI

populations. Further examination is needed to determine any mechanism for concomitant trauma and PTSD in civilian patients.

**CLINICAL RELEVANCE/APPLICATION**

White matter integrity in the corpus callosum of trauma patients may be further compromised for those with mTBI and PTSD comorbidity.

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## Abstract Archives of the RSNA, 2023

W5A-SPOB

### OB/Gynecology and Pediatric Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPOB- Black Hole Pattern on Diffusion Weighted Images (DWI) May Help Predict Placental Invasiveness in Women at High Risk for Placenta Accreta Spectrum (PAS) Disorders**

##### Participants

Charis Bourgioti, MD, Athens, Greece (*Presenter*) Nothing to Disclose

##### PURPOSE

To quantify placental inhomogeneity using 'black hole' pattern on diffusion weighted imaging (DWI) in women at high risk for placenta accreta spectrum (PAS) disorders; to investigate its predictive ability for presence and degree of placental invasiveness.

##### METHODS AND MATERIALS

Between 3/2018 and 9/2022, 59 pregnant women underwent dedicated prenatal MRI for placental evaluation with a 3.0T unit. All women underwent C-section within 6 weeks from MRI. DWI data were prospectively compiled for review by two experienced genitourinary radiologists and manual placental segmentation for each participant was performed. Black hole, a pattern previously observed by the readers only on high b value DWI, was defined by consensus as a discrete intraplacental areas of signal loss on high b value (1500) images. A semi-automated algorithm using 28.70 as a threshold pixel value was applied to locate placental holes and calculate the total number of placental voxels (3D), total number of hole voxels, volume of hole voxels (mm<sup>3</sup>) and % of hole voxels/total placental voxels. Statistical analysis was performed for possible association of the above parameters with presence and grade of PAS. Intraoperative/histological findings were the standard of reference. Statistical significance (p) was set to 0.05.

##### RESULTS

Fifty women (mean age:37 years, mean gestational age:33 weeks) were evaluable and formed the study group. Significant differences were detected between normal placenta and presence of PAS regarding the total number of placental voxels (p=0.02), number of hole voxels (p=0.02) and volume of holes (p=0.03). Total number of hole voxels and hole volume were significantly lower in normal placentas than in accreta/increta (grade I/II, p=0.04, p=0.04) or percreta (grade III, p=0.005, p=0.01) cases. No differences were detected in the above parameters for PAS grading.

##### CONCLUSION

s Total number of voxels and volume of intraplacental black holes on DWI, may serve as yet another prognosticator for PAS disorders.

##### CLINICAL RELEVANCE/APPLICATION

Quantification of placental inhomogeneity on functional MRI may enable the development of deep learning algorithms for predicting PAS disorders.

#### **W5A-SPOB- Evaluating Fetal Bowel Wall Function by Ultrasound Microvascular Flow Imaging**

2

##### PURPOSE

This study summarized the characteristics of fetal mesenteric blood flow perfusion at various gestational weeks, and aimed to establish the feasibility of microvascular flow (MV-Flow) technology in evaluating intestinal wall blood flow and function.

##### METHODS AND MATERIALS

This retrospective study analyzed 35 meconium peritonitis (MP) fetuses and 160 healthy fetuses in our medical center from March 2020 to December 2022. The vascular index (VI) of superior mesenteric artery region obtained by automatic ellipse method and manual method were compared. The correlation between the region of interest VI and gestational weeks was analyzed. A subgroup analysis of MP operative group vs. MP non-operative group was performed, and a prediction model for surgical treatment was established.

##### RESULTS

There was no difference in VI value of the mesenteric blood perfusion region between automatic ellipse method and manual method (51.40±8.58% vs 50.82±8.05%, p=0.534). There was no significant change in VI as the gestational age increased (correlation coefficient=0.005, p=0.946). Compared with MP non-operative group, the operative group has significantly more cesarean deliveries (100% vs 52.9%, p=0.003), shorter pregnancy duration (34.76±2.16w vs. 37.48±1.55w, p<0.001), lower infant weight (2762.14±452.76kg vs. 3225.88±339.98kg, p=0.003), more persistent ascites cases (92.9% vs. 52.9%, p=0.021), more intestinal wall echo reduction cases (57.1% vs. 5.9%, p=0.004), and lower VI (18.57±5.51% vs. 39.41±7.02%, p<0.001). In risk factor analysis, VI value was significantly associated with surgical treatment after birth (OR=0.689;95% CI: 0.511-0.929). A prediction model for surgical treatment of newborns was established: Logit (P)=8.86 - (0.37\* VI) +(1.49\* ascites). The AUC of the ROC curve of the prediction model is 0.857 (95% CI: 0.75-0.95), with 78.6% sensitivity, and 88.2% specificity.

## **CONCLUSION**

s MV-Flow imaging can quantify the fetus bowel wall blood flow perfusion. There is no correlation between the VI value of mesenteric regional blood flow perfusion and gestational week. In fetuses with meconium peritonitis, the VI value of mesenteric blood flow is significantly reduced, suggesting the increased possibility of intestinal wall necrosis and post-natal surgical treatment.

## **CLINICAL RELEVANCE/APPLICATION**

The findings of the current study provide information about evaluating fetus bowel wall function using ultrasound MV-Flow imaging, which could improve the prenatal diagnosis of meconium peritonitis in the fetus, and predict surgical treatment after birth.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-SPPD

### Pediatric Imaging Wednesday Poster Discussions I

#### Sub-Events

#### W5A-SPPD- Usefulness of the Air Gap Methods during Pediatric Computed Tomography 1

##### Participants

Takanori Masuda, PhD, Okayama, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Purpose: The air gap methods can be used as the primary scatter reduction method in order to reduce patient dose. The purpose of this study was to compare the radiation dose and image noise between conventional setting and air gap setting methods during the pediatric chest computed tomography (CT).

##### METHODS AND MATERIALS

We used newborn pediatric anthropomorphic phantom with a 64 detector-row CT scanner with helical scan modes from the apex of the lung to the diaphragm. Compare with the conventional setting (group A), the pediatric anthropomorphic phantom was positioned 10 cm away from the table using a plastic with low X-ray absorption in air gap methods (group B). A real-time skin dosimeter (RD - 1000; TORECK CO, Kanagawa, Japan) was placed and inserted into the phantom center of the body, the surface of the body back, and the right and left mammary glands. The phantom was then scanned 10 times using each protocol. The measured dose values of the RD - 1000 were compared for each methods.

##### RESULTS

The measured dose values of the group A were 1.44 at the center, 1.46 at the back, and 1.64 at the mammary gland, respectively. The measured dose values of the group B were 1.30 at the center, 1.35 at the back, and 1.53 at the mammary gland, respectively. Compared with the Group A, it was possible to reduce the exposure dose by approximately 10% at the group B ( $p < 0.05$ ). The image noises were 9.3 HU at the group A and 8.0 HU at the group B. Compared with the Group A, it was possible to reduce the image noise by approximately 15% at the group B ( $p < 0.05$ ).

##### CONCLUSION

By using the air gap methods, it is possible to reduce the exposure dose and image noise approximately 10 % during pediatric chest CT.

##### CLINICAL RELEVANCE/APPLICATION

The reduction of the radiation dose and image noise according to the as low as reasonably achievable (ALARA) principle requires optimizing the scan protocol by using air gap methods.

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## Abstract Archives of the RSNA, 2023

W5A-SPPH

### Physics Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPPH- Comparison of Conventional and Compressed SENSE Sequences on MRI of Brain in Paediatric Population** 1

##### **PURPOSE**

To compare the quality and image acquisition time between conventional and Compressed SENSE sequences on magnetic resonance imaging (MRI) of brain in paediatric population.

##### **METHODS AND MATERIALS**

Thirty children (below the age of 18 years) undergoing MRI of brain were included in this study after obtaining Ethical clearance from the institute. In addition to the routine clinical protocol for brain, one Compressed SENSE sequence was added. 2D - T1, T2, and FLAIR axial sequences were acquired for brain using conventional and Compressed SENSE techniques. One of each sequence was acquired in 10 patients undergoing an MRI brain study on a 3T MRI using coil 32 channel coil for adults and paediatric 8ch head coil for neonates. Two consultant radiologists (with 35 years and 5 years of experience in radiology) independently scored the image quality using the 5-point Likert scale based on resolution, visualisation of anatomical regions, grey-white matter differentiation, sharpness of the image and artefacts. The subjective criteria details for image quality as per the 5-point Likert scale were: non-diagnostic (1), poor (2), moderate (3), good (4) and excellent (5). 2D T1 sequence was acquired with parameters as FOV 230\*183\*130mm, voxel size 0.575\*0.75, TE-20ms, TR-2000ms, CS factor-2, 2D T2 sequence was acquired with parameters FOV 230\*230\*149mm, voxel size 0.55\*0.65, TE-3000ms, TR-80ms, CS factor-2.2 and 2D FLAIR was acquired with parameters FOV 210\*168\*149mm, voxel size 0.7\*1.42mm, TE-140ms, TR-11000ms, CS factor-2.

##### **RESULTS**

The time reduction achieved with 2D T1 at 2 reduction factor were 60 seconds(24%), with 2D T2 at reduction factor of 2.2 66 seconds(47.83%) and with 2D FLAIR at reduction factor 2 66 seconds(40%). Inter-rater agreement for overall diagnostic confidence was rated higher for Compressed SENSE (k - 0.632) than conventional (k - 0.464). Nonsignificant statistical difference was found regarding image quality and image contrast ratio between both techniques.

##### **CONCLUSION**

s Compressed SENSE has potential in reducing the image acquisition time without compromising the image quality and diagnostic confidence. Motion artefacts are also reduced with reduction in time with the use of Compressed SENSE sequence.

##### **CLINICAL RELEVANCE/APPLICATION**

Acceleration achieved with compressed SENSE sequences can cause an overall reduction in the acquisition time without compromising image quality. This consequently results in reduction of anaesthetic dose administered which is of clinical concern in paediatric population.

#### **W5A-SPPH- Preliminary Study on the Clinical Staging of Primary Lower Extremity Lymphedema by STIR Soft Tissue Radial Measurements** 10

##### Participants

MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

##### **PURPOSE**

Exploring the value of magnetic resonance-based measurement of two-dimensional radial data of the limb in assessing the clinical staging of primary lower extremity lymphedema (PLEL)

##### **METHODS AND MATERIALS**

A retrospective collection of 132 patients diagnosed with primary LEL by our hospital was made, and all patients underwent MR examination of the lower extremities. Short Time Inversion Recovery (STIR) sequences were used to measure the total longitudinal and transverse soft tissue diameter (TD), musculoskeletal diameter (MD) and subcutaneous soft tissue diameter (S) of the lower leg, and the difference between TD and SD on the affected and the healthy side (DTD, DSD) were calculated respectively. The patients were staged according to the International Society of Lymphology (ISL) clinical staging criteria in 2020. Statistical analysis of all measurements was performed to determine the feasibility of MRI measurements for clinical staging of PLEL

##### **RESULTS**

The correlation between the transverse diameter TD (R=0.492), SD (R=0.596), DTD (R=0.608), and DSD (R=0.620) and clinical stage was significantly greater than that between the longitudinal diameter TD (R=0.430), SD(R=0.532), DTD (R=0.547), and DSD (R=0.519), and the highest correlation between the transverse diameter DSD and clinical stage. The values of TD, SD, DTD and DSD in stage I were significantly lower than those in stage II and III (P<0.05), but there was no significant difference between stage II and III (P>0.05). The area under the curve (AUC) of the transverse diameter to identify clinical stage was greater than

that of the longitudinal diameter, with the transverse DSD (AUC=0.930) having the highest AUC value to identify stage I with stage II.

## CONCLUSION

Based on the fact that MRI measurement of soft tissue trajectories can be used as a quantitative method for clinical staging of unilateral PLEL. We recommend the subcutaneous soft tissue difference of transverse diameter as the best measure to distinguish stage I from stage II lymphedema

## CLINICAL RELEVANCE/APPLICATION

MRI can quantitatively assess the severity of primary lower extremity lymphedema, facilitating clinical decision making and improving prognosis.

### W5A-SPPH- Radiomics Based on MRI to Distinguish between Stage I and II Primary Lower Extremity Lymphedema

Participants

MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

## PURPOSE

A feasible and valid method for detecting and staging LEL would facilitate clinical development of appropriate treatment and management strategies. The present study aims to establish an MRI-based imaging radiomics model and a radiomics-clinical model for primary lower extremity lymphedema (LEL) and to evaluate its role in identifying the clinical stages (stages I-II) of primary LEL.

## METHODS AND MATERIALS

96 patients with primary LEL were retrospectively collected (67 in the training cohort and 29 in the validation cohort) and classified into stage I and II according to the International Society of Lymphology (ISL) clinical staging criteria. Radiomics features were extracted automatically from the region of interest (ROI) manually outlined on the Short Time Inversion Recovery (STIR) sequence images by radiologists applying the Dr. Wise Multimodal Research Platform. Selected radiomics features were retained to construct the radiomics model. Clinical factors that are statistically significant in identifying stages I and II were selected, and a radiomics-clinical model combining imaging radiomics features and significant clinical factors was established. The performance of the two models was evaluated using ROC curves. The clinical usefulness of the models was assessed using decision curve analysis (DCA).

## RESULTS

A total of 1743 radiomics features were extracted, then the features were filtered by F Test, and finally, 20 features were selected to construct the radiomics model. The radiomics-clinical model, which was based on the radiomics signature and 4 clinical factors, showed superior discriminatory efficacy compared with the radiomics model alone (area under the curve (AUC) in the training cohort: 0.997 vs. 0.961, the validation cohort: 0.914 vs. 0.900). The clinical usefulness of radiomics-clinical model was confirmed by DCA.

## CONCLUSION

The MRI-based radiomics model was able to effectively identify the clinical stages I and II of primary LEL. The discrimination performance of the radiomics-clinical model was superior to that of the radiomics model alone.

## CLINICAL RELEVANCE/APPLICATION

A MRI-based radiomics model has the ability to identify the clinical stages of LEL of primary LEL

### W5A-SPPH- The Potential of Deep Learning Image Reconstruction Algorithms to Improve Low Dose Cranio-cerebral CT Image Quality: A Phantom study

Participants

Tingting Cai, Guangzhou, China (*Presenter*) Nothing to Disclose

## PURPOSE

To compare the image quality of low dose deep learning image reconstruction (DLIR) with that of conventional clinical dose filtered back projection (FBP) in cranio-cerebral CT.

## METHODS AND MATERIALS

The clinical cranio-cerebral protocol (Group A: 120kV 240mA, 34.76mGy) and two low-dose protocols (Group B: 120kV 200mA (29mGy); Group C: 120kV 150mA (21.71mGy)) were applied to Catphan 500/600 body models. Ten consecutive scans were performed on the Revolution APEX CT at all dose levels. The conventional dose group were reconstructed using filtered back projection (FBP), and both low dose groups used DLIR medium-high levels (DLIR-M, DLIR-H) for image reconstruction. The noise power spectrum (NPS), task-based transfer function (TTF) and detectability index ( $d'$ ) were measured. Two radiologists independently recorded low-density insert minimum diameter, spatial resolution line pairs, and use of the Likert 5 points scale (5, excellent; 4, good; 3, measurable and acceptable; 2, identifiable; 1, not acceptable) for subjective evaluation of image quality.

## RESULTS

Compared with the FBP of group A, the noise of NPS in groups B and C decreased significantly ( $p < 0.05$ ), and the noise of NPS of DLIR-H in group B was the lowest; All images of group B and C were shifted toward lower frequencies with respect to FBP (FBP: , , DLIR(M,H) of Group B,C: , ), and the DLIR-M of group C was closest to the texture of FBP image. The the Air inserts had no offset, while those of the Teflon, Acrylic, and LDPE inserts all shifted. Among them, of DLIR-H of Teflon and LDPE in group C were larger than FBP, and of the rest were smaller than or close to FBP images. Compared with FBP, of DLIR-H of the four inserts in groups B and C were all higher, and the  $d'$  of DLIR-H of the four inserts in group B was the best. Two observers agreed that the low-density resolution and subjective score of DLIR-H in group B were better than FBP of group A ( $p < 0.05$ ) and the subjective score of group C was lower than that of group A ( $p < 0.05$ ), but still can achieve more than 4 points. The distinguishable line pairs per centimeter at all three dose levels were 7 lp/mm. The Kappa values of the two observers for the low-density insert diameter and subjective image analysis were 0.541 and 0.754, respectively, with good agreement.

## CONCLUSION

s The DLIR-H algorithm can provide comparable or even better image quality at low dose than that of clinical routine dose FBP.

## CLINICAL RELEVANCE/APPLICATION

DLIR-H algorithm provides parameter selection for clinical low dose craniocerebral scanning.

## W5A-SPPH- White Matter Clustering using Conformal Mapping

13

### PURPOSE

Diffusion Tensor Imaging (DTI) facilitates the delineation of white matter fiber tracts in the brain. Clustering white matter fiber bundles by various methods has been a research focus over the past decade. We propose a deep neural network which requires a novel approach to data normalization, augmentation, and problem formulation.

### METHODS AND MATERIALS

Conformal mapping is a technique used to establish a bijective mapping of one shape into its topologically equivalent target shape; the bijectivity ensures that the mapping is invertible and unique. We used volumetric transformations in which not only the surface of the shape is reshaped into the target shape but every point inside the shape is also transformed. Eleven epilepsy patients without structural brain abnormalities were retrospectively reviewed. Diffusion-weighted imaging was obtained with a multiband spin-echo echo planar imaging sequence on a 3 Tesla MR system (Siemens Vida or Prisma) using a 64-channel head and neck coil. A total of 64 diffusion directions were obtained. Diffusion data were preprocessed, and orientation distribution function was estimated. Whole brain tractography was then created using deterministic tracking. Fiber tracts from the 11 patients are mixed forming the dataset comprising 2469292 fiber tracts. The dataset was divided into training, test, and validation sets in a 3:1:1 ratio. The neural network classifier is based on the VGG 16 architecture and contains two convolution layers with 32 and 64 feature maps followed by two fully connected dense layers. The network uses rectified linear units as the activation function. Fiber tracts with length less than 30 mm or greater than 300 mm are filtered out, and all the fiber tracts are resampled to contain 50 points, flipped in order, and convolved with a 1D Gaussian filter for data augmentation. The fiber tracts are then mapped into a spherical space using the conformal mapping. The neural network is trained with a batch size of 500 fibers, a learning rate of 0.0001, and categorical cross-entropy is minimized using Adam optimizer in 10 epochs.

### RESULTS

The confusion matrix for the classification is shown in figure 1. All accuracies for 26 tracts exceeded 0.890379.

## CONCLUSION

s We presented a deep learning framework for clustering white matter fibers using a volumetric conformal mapping approach and the initial experiments showed promising results.

## CLINICAL RELEVANCE/APPLICATION

We aim to automate this process and further this algorithm such that the deep learning tools can eliminate all the noisy fibers and identify the appropriate anatomical clusters based on whole brain tractography. We also aim to expand this algorithm to identify white matter tracts in the presence of pathologies that can change the anatomy of the tracts.

## W5A-SPPH- Investigation of the Inherent Challenges Associated with Quantitative 90Y PET-CT Imaging towards Improved Dosimetric Accuracy in 90Y SIRT Therapies

2

### PURPOSE

Yttrium-90 (90Y) PET-CT imaging for dose verification following 90Y selective internal radiation therapy (SIRT) has a number of associated dosimetric quantification challenges. SIRT tumours can be irregularly shaped, multi-nodular and have heterogeneous activity distributions. Partial volume effects (PVE) and high background activity due to low number of true coincidences further contribute to degradation of quantification accuracy. Accordingly, the objective of this research is to further investigate the effects of PVE, heterogeneity and background activity in 90Y PET-CT imaging, towards more accurate patient dosimetry for 90Y SIRT therapies.

### METHODS AND MATERIALS

90Y PET-CT imaging datasets were acquired using a Siemens Biograph Horizon PET-CT scanner. 3D-printed non-spherical objects, representative of clinical data and designed using a novel radiomics analysis approach, were employed to assess the effects of PVEs for non-spherical lesions. Recovery Coefficient (RC) curves were generated by filling spherical and non-spherical objects with known 90Y activities, submerged in a water phantom for a range of object-to-background ratios (10:1, 20:1, 25:1, 30:1). The effects of tumour heterogeneity was investigated using novel 3D-printed phantoms, with phantom infills of 0%, 20%, 40% and 60%. 90Y sensitivity measurements and the effects of inherent background activity from the lutetium oxyorthosilicate crystals were investigated using an anthropomorphic thorax phantom, assessing noise levels in the lung and liver fields.

### RESULTS

The effects of heterogeneous distributions and PVE for spherical and non-spherical objects on the quantitative accuracy of 90Y PET-CT imaging will be presented. In addition, results on the implications of background activity on quantitative 90Y imaging will be quantified by means of noise equivalent count rate, background variability and contrast recovery. Correction factors accounting for heterogeneity, PVE, 90Y activity recovery (0.84) and LSO background activity (4 - 8 kBq/ml) will be investigated and presented.

## CONCLUSION

s Inherent background activity, low PET count rate, high random fractions and PVEs at small volumes are some of the inherent challenges associated with quantitative 90Y PET-CT imaging following SIRT therapies. Evaluating and correcting for these limitations is necessary to improve quantification accuracy, and for identifying any mismatch between pre- and post-treatment dosimetry, thus allowing for improvements towards improved personalised dosimetry.

## CLINICAL RELEVANCE/APPLICATION

This research aims to improve the quantitative accuracy of 90Y PET-CT imaging post SIRT therapy to facilitate improved accuracy

in the dosimetry estimation for SIRT therapy patients.

### **W5A-SPPH- Evaluation of Device Less Respiratory Gating Method for PET through Characterization of Motion Blur Spatial Frequency** 3

Participants

Ikuo Kawashita, PhD, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

We developed a method to evaluate the degree of motion blur in each direction based on the ratio of amplitude spectra of multiple images. The purpose of this study is to evaluate a respiratory gating method for PET that does not require a device, using the proposed method.

#### **METHODS AND MATERIALS**

The PET/CT scanner used in this study was a Cartesion Prime, Canon Medical Systems, and the phantom was a NEMA IEC-body phantom filled with FDG solution activity contrast 1:4 (background: spheres). The phantom was placed on a drive unit that moved in accordance with the input waveform signal taken from a real human respiration of about four seconds per cycle. We used 9 cases of liver tumors with FDG accumulation as clinical examples. Data were obtained at five reconstructions in phantom study, 1. reference: static, 2. auto: data-driven auto-gating for the auto-gated reconstruction, we extracted the 35% of total time frames by comparing the similarity of feature vectors. 3. device-based: device-monitoring with respiratory motion, 4. phase: data-driven-phase-gating, 5. non-gate: no gating with respiratory motion. Using the amplitude spectrum of a reference image without motion as a standard, the reconstruction methods of the comparison target were absolutely evaluated with MTF. The evaluation of clinical cases was compared using the following three types: auto, phase, non-gated. Using the amplitude spectrum of the auto-gated reconstructed image as a standard, the phase-gated and non-gated reconstruction methods were relatively evaluated.

#### **RESULTS**

Auto-gating were closest to the reference data in in phantom study (Fig.1). The MTF results were consistent with the measurement results of the signal diameter. Figure 2 shows the average relative MTF of the 9 clinical cases. The results showed that the auto-gated reconstruction method had a relatively lower impact of respiratory blur compared to the phase-gated and non-gated methods. These results were consistent with the measurement results of tumor diameter.

#### **CONCLUSION**

s The developed image quality evaluation method for motion blur can be used for performance evaluation of respiratory-gated PET reconstruction.

#### **CLINICAL RELEVANCE/APPLICATION**

The image quality of the deviceless Auto-Gating was closest to that of static images than the conventional respiratory gating method.

### **W5A-SPPH- Deep Learning Image Reconstruction Impacts on Robustness of CT Radiomics Features: Opportunity for Minimizing Radiomics Variability** 4

#### **PURPOSE**

To investigate the influence of deep learning image reconstruction (DLIR) on robustness of CT radiomics features.

#### **METHODS AND MATERIALS**

A standardized phantom with sixteen clinical-relevant densities was scanned under single-energy CT (SECT) and dual-energy CT (DECT) modes at standard and half (20 and 10 mGy) dose level. Images of SECT 120 kVp and corresponding DECT 120 kVp-like virtual monochromatic images were generated with six reconstruction algorithms: filtered back-projection (FBP), adaptive statistical iterative reconstruction-Veo at 40% (AV-40) and 100% (AV-100) blending levels, and DLIR algorithm at low (DLIR-L), medium (DLIR-M) and high (DLIR-L) strength levels, resulting twenty-four image sets. 94 radiomic features were extracted via Pyradiomics. Reproducibility of radiomic features was evaluated between SECT and DECT scan modes, between standard and half dose levels, across reconstruction algorithms in reference to FBP images, and across all image sets, using intraclass correlation coefficient (ICC) and concordance correlation coefficient (CCC).

#### **RESULTS**

The average percentage of features with ICC > 0.90 and CCC > 0.90 were 11.35% and 11.17% between SECT and DECT scans. The reproducibility between scan modes did not obviously changed with the increasing strength level of DLIR algorithm. The average percentage of features with ICC > 0.90 and CCC > 0.90 between images acquired at 10 and 20 mGy dose levels were 28.55% and 27.40%. The reproducibility between dose levels increased with the increasing strength level of DLIR algorithm within SECT scans, but DLIR-M images showed highest reproducibility within DECT scans. The average percentage of features with ICC > 0.90 and CCC > 0.90 in reference to FBP images decreased from 27.93% to 17.82%, and from 27.66% to 17.29%, respectively, with the increasing strength level of DLIR. The AV-40 images resulted average percentage of features with ICC > 0.90 and CCC > 0.90 of 26.06% and 25.80% in reference to FBP images, and 18.88% and 18.62% for AV-100 images, respectively. Within SECT scans, DLIR-H images at 10 mGy presented percentage of features with ICC > 0.90 and CCC > 0.90 of 79.78% and 76.60%, respectively, comparing to DLIR-M images at 20 mGy.

#### **CONCLUSION**

s DLIR and IR algorithms potentially alters minable information in images, while DLIR algorithm provides opportunity for minimizing radiomics variability.

#### **CLINICAL RELEVANCE/APPLICATION**

DLIR and IR algorithms potentially alters deeper information hidden in the images, indicating that radiomics models based on images with different reconstruction algorithms must be interpreted with caution. However, DLIR algorithm has potential for minimizing radiomics variability, which opens possibility for generalizable radiomics model.

**W5A-SPPH-** Participants

## 5 Using Fully Synthetic Training Data to Automate Clinical CT-ACR Phantom Analysis

Morgan Daly, BSc, Los Angeles, CA (*Presenter*) Nothing to Disclose

### PURPOSE

We aim to illustrate the feasibility of using a convolutional neural network (CNN) trained solely on simulated input data to perform meaningful clinical medical physics tasks. We demonstrate this by automating detection and alignment of the HU module of the CT-ACR phantom (Gammex 464).

### METHODS AND MATERIALS

All training and validation data was generated on-the-fly using a computational phantom generator that uses four parameters to control phantom placement: x and y position, simulated reconstruction field of view (FOV), and rotation. These were randomly sampled in the ranges: x, y position: [-50 mm, 50 mm], FOV: [200 mm, 510 mm], and rotation: [-50°, 50°]. A ResNet50-based network was trained to predict a feature vector consisting of the x, y position, FOV, and rotation for a given input 256x256 phantom image. The model was evaluated on 5 clinical images of the HU module acquired on a Siemens Force scanner with labels manually calculated by aligning simulated phantoms with the clinical image. Mean absolute error (MAE) between the network-predicted features and manually aligned features were quantified and reported, and a visual assessment was performed.

### RESULTS

The MAE of the features produced by the model on a computational phantom test set (n=100) were:  $x=0.90 \pm 0.6\text{mm}$ ,  $y=0.53 \pm 0.4\text{mm}$ ,  $\text{FOV}=2.81 \pm 1.9\text{mm}$ ,  $\text{rot}=0.84 \pm 0.7$ . The MAE of the transformations produced by the CNN on the set of 5 real ACR phantom scan images:  $x=2.77 \pm 5.0$ ,  $y=9.72 \pm 20.3$ ,  $\text{FOV}=17.78 \pm 24.4$ ,  $\text{rotation}=3.52 \pm 4.2$ . In a visual assessment, the model achieves excellent agreement with clinical scans that are moderately misaligned (the likeliest to occur in routine practice). In one test case with more substantial misalignment (a large FOV) the disagreement between the input and the model prediction was apparent.

### CONCLUSION

The trained network does an acceptable job of predicting the correct parameters to align the HU module of the CT-ACR phantom, which can be used to automate phantom analysis. Methodologically, we have illustrated that CNNs trained on fully-synthetic data can be directly applied to clinical tasks, and additional augmentation of the synthetic data (e.g., noise, table-like objects in frame) could further improve performance. Finally, we hope that interpretable feature outputs will help build confidence in the broader use of clinical AI in medical physics and quantitative imaging.

### CLINICAL RELEVANCE/APPLICATION

These methods could generalize automated analysis to any phantom without the need for image acquisition or manual annotation. Synthetic data as ground truth could aid in training networks for more complex clinical/medical tasks.

## 6 W5A-SPPH- A Comparison Among LowRes, HighRes and Cascaded CNNs for Segmentation of Cardiac CT Images in TAVR Patients

Participants  
James Goldfarb, PhD, (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiac CT is routinely used for pre-planning aortic valve repair. Segmentation of cardiac structures would enable the calculation of several quantitative values (e.g., EF, LVM). The optimal convolutional neural network (CNN) for this task can be limited by hardware memory, compute power, and segmentation speed. We compared the segmentation of cardiac CT images using three CNN architectures to determine which anatomical structures require a larger CNN.

### METHODS AND MATERIALS

We used 56 training and 200 testing contrast CT angiograms in patients with aortic valve disease for TAVR planning. Eleven regions were annotated for training: AscAorta, DescAorta, InfVenaCava, LeftAtrium, RightAtrium, LeftVentricle, RightVentricle, LVMycocardium, and aortic valve leaflets (calcified and non-calcified). We trained three CNN 3DUnet architectures with increasing memory and compute requirements: LowRes, HighRes, and Cascaded. We statistically analyzed the Dice Coefficient (DC), Intersection-over-Union (IoU), and volumes of regions at systole and diastole. Visual assessment of 3D renderings was performed to detect failed segmentations.

### RESULTS

DC and IoU were slightly higher ( $p < 0.001$ ) for the cascaded network compared to the low and high resolution CNNs (DC: 0.93 vs 0.92, 0.92) and (IoU: 0.87 vs 0.86, 0.86). Although the segmentation volume intraclass correlation (ICC) was excellent (0.94-0.99), 10% of the HighRes segmentations had at least one region with a failed segmentation vs 2% of LowRes vs 0% of the cascaded CNN ( $p < 0.001$ ). The cascaded CNN had a small (0.6%+/-0.58%) difference in large structures but a larger difference in smaller calcified structures (18.73%+/-13.8%).

### CONCLUSION

A cascaded CNN performs the best both qualitatively and quantitatively. For segmentation of large structures such as the left ventricle, small segmentation errors do not affect quantitative values. However, for finer segmentation such as aortic valve calcium or calcified leaflets, a cascaded or high-resolution network is necessary.

### CLINICAL RELEVANCE/APPLICATION

For segmentation of large structures such as the left ventricle or left atrium, a LowRes CNN is sufficient. However, if higher resolution structures are also segmented (as is done in an aortic valve calcium score), a cascaded CNN is necessary. This has implications for the required GPU/CPU memory and compute power for timely segmentation, especially when the typical 20 cardiac phases are segmented.

## 7 W5A-SPPH- High Spatial Resolution Diffusion Tensor Imaging Aided by Synthetic-MRI: An Application of Sixfold Multiparameter Quantitative MRI (MP6-qMRI)



Participants

Hernan Jara, PhD, Boston, MA (*Presenter*) Author with royalties, World Scientific Publishing;

## PURPOSE

In diffusion tensor MR imaging (DTI), the spatial resolution of the mean diffusivity (MD) and fractional anisotropy (FA) maps depend on the spatial resolution of the diffusion encoded images ( $b > 0$ ) as well as the  $b_0$  images. We investigate spatial resolution improvements in DTI maps resulting from using high spatial resolution synthetic  $b_0$  images as substitute to the standard  $b_0$  images, which are acquired at lower resolution to shorten scan time.

## METHODS AND MATERIALS

Two healthy volunteers (37yo male, and 59yo male) were scanned with local IRB approval. The modular MP6-qMRI turbo spin echo (TSE) pulse sequence was implemented on a 3T Ingenia Elition X whole body scanner (Philips Healthcare) by concatenating with same pre-scan settings high resolution Triple-TSE and half in plane spatial resolution DTI-TSE modules (Fig. 1A). All modules were implemented without fat suppression and generated 80 contiguous slices. Key scanning parameters were a) Triple-TSE modules (9.5min): TR<sub>long</sub> = 16s, TR<sub>short</sub> = 0.5s, TE<sub>1</sub> = 10ms, TE<sub>2</sub> = 110ms, voxel = 0.47 x 0.47 x 2mm<sup>3</sup> and b) DTI module (11min): TR = 25.4s, TE<sub>eff</sub> = 72ms, voxel = 0.94 x 0.94 x 2mm<sup>3</sup>. The unified MP6-qMRI relaxometry and DTI processing pipeline was programmed in Python (version 3.9.13) with the Anaconda Navigator (version 2.3.2). The primary (nPD-T1-T2) qMRI maps were calculated according to the Bloch equation solution as applicable for the Triple-TSE pulse sequence. DTI maps were calculated according to the Bloch-Torrey equation as in DIPY tensor reconstruction (<https://dipy.org/>).

## RESULTS

For both volunteers, the MP6-qMRI framework yielded high quality MD (Fig. 1B) and FA (Fig. 1C) maps with full head coverage and with imperceptible geometric distortion artifacts. Furthermore, MD and FA maps obtained with calibrated synthetic  $b_0$  had superior spatial resolution providing improved anatomic delineation that is most noticeable for white-to-gray matter differentiation and for improved delineation of the extra cranium.

## CONCLUSION

Added benefits of using turbo spin echo multiparameter qMRI frameworks are the opportunities of reducing magnetic inhomogeneity distortions, and of increasing the spatial resolution of DTI maps (MD and FA) by means of Synthetic MRI. Hence, MP6-qMRI can extend the usefulness of DTI to magnetically inhomogeneous regions such as the extra-cranium and the neck and with higher spatial resolution.

## CLINICAL RELEVANCE/APPLICATION

Use of turbo spin echo based MP6-qMRI and Synthetic MRI can extend clinical applications of diffusion tensor MRI for assessing the extra-cranium and nasal cavity structures with negligible geometric distortions.

## W5A-SPPH- To Biopsy or Not to Biopsy? Feasibility of Predicting Gleason Score as a Pre-biopsy Gatekeeper in Prostate Cancer Patients using Multimodal Patient Features

### PURPOSE

The diagnosis of prostate cancer (PCa) is based on a prostate biopsy. Even though this diagnosis is important for further treatment decision, a biopsy is painful and can result in adverse effects for the patient. In this study, we aim at developing a biopsy gatekeeper by predicting the Gleason score (GS) using a machine learning (ML) classification model. Therefore, results from various diagnostic screening examinations are combined with patient-specific variables to explore the feasibility of a binary ML model to predict GS >6 and thus the need for biopsy in PCa patients.

### METHODS AND MATERIALS

Patients screened in our hospital (n=295) underwent a digital rectal examination (DRE), transrectal ultrasound (TRUS) and a screening magnetic resonance (MR) examination. Preceding the MR examination, prostate-specific antigen (PSA) and prostate health index (PHI) blood tests were acquired on the same day. Patients obtained a TRUS-guided biopsy to detect PCa, as determined by the GS. Various classification models were explored to predict GS <7 and =7 using 7 features: TRUS- and DRE findings, PSA and PHI density results, prostate imaging-reporting and data system (PI-RADS) score, as well as patient-specific variables being age and genetic risk. 28 model architectures are constructed by combining 3 components: (1) a scaler (Robust or Standard); (2) a sampler to balance the dataset (Synthetic Minority Oversampling TEchnique or Adaptive Synthetic) and (3) a classifier (Logistic Regression - LR, Random Forest, K-Nearest Neighbours, Decision Tree, Support Vector Machine - SVM, Gaussian Naive Bayes - GNB, or Gradient Boosting). To minimize bias, a stratified 10-fold cross validation is implemented. Hyperparameter tuning for the 28 model architectures resulted in training 2188 models. All models are trained to maximize the area under the curve (AUC). The classification is done with threshold set to 0.35.

### RESULTS

The AUC for predictions of GS is 0.77 (95% CI 0.67-0.87). 3 features, being PI-RADS, PHI density and age, were revealed as significant predictors for GS ( $p=0.006$ ,  $p=0.001$  and  $p=0.001$  respectively). This finding was confirmed by the selectKBest algorithm selecting the 3 most important features for GS prediction. Repeating the model with these 3 features resulted in LR, SVM and GNB as best classifiers, with AUC respectively 0.81 (95% CI 0.66-0.97), 0.82 (95% CI 0.66-0.98) and 0.84 (95% CI 0.68-1.0).

### CONCLUSION

This study demonstrates the potential of using a ML algorithm to predict the need of prostate biopsy. This way, physicians could opt to eliminate a biopsy which is painful for the patients and could cause adverse effects.

### CLINICAL RELEVANCE/APPLICATION

This study aims at developing a ML model as a pre-biopsy gatekeeper to eliminate unneeded biopsies in PCa.

Participants  
MENGKE LIU, BEIJING, China (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The staging of primary lower extremity lymphedema (LEL) is difficult and vital in clinical work, and Short time inversion recovery (STIR) sequence of MRI can be used for quantitative assessment of primary lower extremity lymphedema due to its high soft tissue resolution. So we evaluated the value of STIR-based soft tissue area measurements for staging primary lower extremity lymphedema.

#### **METHODS AND MATERIALS**

90 consecutive patients with clinically diagnosed primary lower limb lymphoedema from January 2017 to December 2019 in Beijing Shijitan hospital were enrolled retrospectively. STIR sequence was applied to measure the total, muscle, bone, and subcutaneous areas in the upper 1/3 level of the bilateral lower calf. The difference between the affected and unaffected calf regarding the subcutaneous area was obtained. (Subcutaneous area)/(bone area) and (subcutaneous area)/(muscle area) were calculated. According to the International Society of Lymphology (ISL) clinical staging standard in 2020, all patients were divided into stages I, II and III. Statistical analysis was performed to determine the validity of MRI measurements in staging LEL.

#### **RESULTS**

Clinical stages were I in 33 patients, II in 44 patients, and III in 13 patients. There are significant differences in the difference in subcutaneous area of limbs, subcutaneous/bone and subcutaneous/muscle between stage I and II as well as between stage I and III ( $P < 0.001$ ), but not between stage II and III ( $P = 0.706, 0.329, 0.229$ , respectively). There was a positive correlation between the clinical stage and difference in subcutaneous area of limbs ( $\rho = 0.752, P < 0.001$ ), subcutaneous/bone ( $\rho = 0.747, P < 0.001$ ) and subcutaneous/muscle ( $\rho = 0.709, P < 0.001$ ). For staging primary lower extremity lymphedema, receiver operator characteristic (ROC) curves indicated that difference in subcutaneous area of limbs had the best discrimination ability among parameters [area under the ROC curve (AUC) = 0.950; 95% Confidence Interval (CI): 0.875 - 0.987; sensitivity: 95.45%, specificity: 84.85%], followed by subcutaneous/bone [AUC = 0.930; 95%(CI): 0.848 - 0.975; sensitivity: 77.27%, specificity: 93.94%] and subcutaneous/muscle [AUC = 0.895; 95%(CI): 0.804 - 0.953; sensitivity: 77.27%, specificity: 90.91%].

#### **CONCLUSION**

The measurement of the soft tissue area by STIR may be used as an auxiliary method for staging primary lower extremity lymphedema. For patients with unilateral primary lower extremity lymphedema, the difference in subcutaneous area of limbs could be a specific indicator to distinguish clinical stage I from II.

#### **CLINICAL RELEVANCE/APPLICATION**

STIR enables quantitative assessment of primary lower extremity lymphedema.

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## Abstract Archives of the RSNA, 2023

W5A-SPRO

### Radiation Oncology Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPRO- Can Serial Brain Metastases MRI Radiomics Kinetics Predict Stereotactic Radiation and Immunotherapy Outcomes?** 1

#### Participants

Hesham Elhalawani, MD, MSc, Boston, MA (*Presenter*) Nothing to Disclose

#### PURPOSE

Radiation necrosis (RN) remains to be the primary dose-limiting toxicity of stereotactic radiosurgery (SRS), especially in combination with immunotherapy (IO). This debilitating adverse event is often confused with tumor regrowth, posing significant diagnostic and therapeutic challenges. This study employed magnetic resonance imaging (MRI) radiomics to quantify sub-acute radiation-induced changes in irradiated BM and their value in predicting treatment response.

#### METHODS AND MATERIALS

Following IRB approval, we queried our single-institution dataset to identify adult patients with brain metastases managed with SRS and IO between 2006 and 2021. We collected patient, disease, and treatment variables. Specifically, per-BM outcomes were categorized as RN (radiographic and/or symptomatic), progressive disease (PD), or neither (NA). All patients had diagnostic pre- and post-SRS contrast-enhanced T1-weighted MRIs. Individual BMs were manually segmented in MIM Software (Beachwood, OH). 1061 hand-crafted radiomic features were computed per lesion using IBEX Software. Feature reduction followed using Spearman's correlation coefficient (0.3 cut-offs). Simple then multiple nominal logistic regressions (SLR and MLR) with Bonferroni correction ensued to model the risk of RN, PD, or NA using JMP software.

#### RESULTS

92 patients with 301 BM of NSCLC, melanoma, and renal cell carcinoma primaries were included. All patients received brain SRS and IO. RN, PD, or NA occurred in 74 (24.6%), 75 (24.9%), and 152 (50.5%) BM, respectively. 39 radiomic features significantly changed post-SRS ( $p < 0.01$ ). Using MLR modeling, we created a 3-feature radiomic RN predictor (ROC AUC 0.71). The model included post-SRS BM surface area, texture (GLCM 3D Homogeneity), and pre-RT BM roundness. A 5-feature radiomic signature could predict RN and PD risk (ROC AUC 0.71) based on pre-SRS GLCM 3D texture feature, 3 post-SRS shape features (surface area, mean breadth, and roundness), in addition to delta-volume.

#### CONCLUSION

s SRS and IO induce changes in BM shape, MRI texture, and signal intensity that radiomics can capture. Pre-SRS, post-SRS, and percent changes of these radiomic feature values could correlate to post-therapy tumor control or radiation necrosis. Pursuing model external validation, combination with clinical variables, and integrating other MRI sequences is imperative before larger-scale adoption of this novel diagnostic approach.

#### CLINICAL RELEVANCE/APPLICATION

The premise of our study is to employ to develop an artificial intelligence-powered MRI radiomic predictor of BM treatment outcomes. These serial 'virtual digital biopsies' could guide cost-effective follow-ups and earlier personalized interventions to improve patients' quality of life.

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## Abstract Archives of the RSNA, 2023

W5A-SPVA

### Vascular Imaging Wednesday Poster Discussions I

#### Sub-Events

#### **W5A-SPVA- Fast Imaging of Lenticulostriate Arteries by Combining High-Resolution Black-blood T1-weighted with Variable Flip Angles Compressed Sensitivity Encoding** 1

##### Participants

Yukun Zhang, Dalian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To visualize and characterize lenticulostriate arteries (LSAs) in a short time on a 3.0T MR scanner, we investigated the feasibility of high-resolution black-blood T1-weighted with variable flip angles (T1w TSE-VFA) accelerated by compressed sensitivity encoding (CS-SENSE) and further identify the optimal acceleration factors (AF) for routine clinical use.

##### METHODS AND MATERIALS

Twenty-five healthy volunteers (13 males, and 12 females, the age ranged from 27 to 68 years, with a median age of 58 years) and 20 patients with cerebrovascular disease (12 males, 8 females, mean age:  $64.3 \pm 8.9$  years) were prospectively enrolled. Volunteers underwent T1w TSE-VFA sequences with different AFs, including conventional sensitivity encoding (SENSE) AF=3 and CS-SENSE AF=3, 4, 5, and 6 (The scanning time was 510s, 480s, 361s, 298s, and 245, respectively) at 3 Tesla. The image quality and the display of LSAs of T1w TSE-VFA protocols were evaluated through objective evaluation (contrast ratio [CR Callosum /WM, CR Brainstem /WM, CR Epencephalon /WM], number of LSAs, total length of LSAs, and average length of LSAs) and subjective evaluation (overall image quality, scores on LSAs). Comparisons were performed among the 5 sequences to select the best AF. All patients underwent both T1w TSE-VFA with optimal AF and digital subtraction angiography (DSA) examination, and the number of LSAs of both was compared.

##### RESULTS

The pair-wise comparisons among CS3, CS4, and SENSE3 showed no statistically significant differences in the objective measurement and subjective evaluation in (all  $P > 0.05$ , Fig.1 and Fig.2). There was no statistically significant difference in the LSA counts on 1 side measured by DSA and CS4 in patients (3, 3 - 3 and 3, 3 - 3,  $P = 0.384$ , Fig.3).

##### CONCLUSION

s CS3 can provide a better LSA display but takes a long time (480s, 6% reduction); CS4 can balance the visualization of LSAs and acquisition time (361s, a 30% reduction) and is recommended for routine clinical application.

##### CLINICAL RELEVANCE/APPLICATION

T1w TSE-VFA accelerated by CS-SENSE can be used as a non-invasive head microvasculature examination in asymptomatic subjects and patients with cerebrovascular disease, which will be an important asset in preventive medicine.

#### **W5A-SPVA- Acceleration of Time-of-flight Magnetic Resonance Angiography by Intelligence-assisted Compressed Sensing** 2

##### Participants

Yukun Zhang, Dalian, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To compare the image quality of time-of-flight magnetic resonance angiography (3D TOF-MRA) accelerated by sensitivity encoding (SENSE), compressed sensing (CS), and intelligence-assisted compressed sensing (ACS) with different acceleration factors (AF) to optimize the sequence

##### METHODS AND MATERIALS

Fourteen healthy volunteers were prospectively recruited and underwent 3D TOF-MRA scans with different AFs, including SENSE AF = 3; CS AF=3; ACS AF = 3, 5, 7, and 9 (The scanning time was 189s, 170s, 165, 150s, 136, and 115, respectively) at 3.0 T. Two radiologists delineated the regions of interest (ROI) for the callosum, right and left middle cerebral artery (MCA), and adjacent white matter on raw images. The signal intensity and standard deviation were recorded for further calculation of the signal to noise ratio (SNR) and contrast to noise ratio (CNR). Meanwhile, the overall image quality of 3D TOF-MRA with different AFs and 9 pre-defined arteries structures (intracranial segment of the bilateral ICAs, the anterior cerebral artery, the MCA, the distal bilateral vertebral arteries, and the basilar artery) were scored using 4-point scale subjective criteria. The difference in measurement data and subjective score between different AFs was analyzed by pairs comparison (LSD-t test).

##### RESULTS

In the objective evaluation (Table 2), ACS7 and ACS9 had significantly lower CNR callosum than SENSE3, CS3, ACS3, and ACS5 ( $P > 0.05$ ); ACS3 was significantly higher than SENSE3 in SNRR-MCA, SNRL-MCA, CNR L-MCA ( $P > 0.05$ ). In the subjective evaluation

(Fig.1 and Table 2), CS3, CS5, and CS9 are different from SENSE3 in overall image quality evaluation ( $P>0.05$ ); and there was no significant difference in the evaluation of arteries structures ( $P<0.05$ ).

#### **CONCLUSION**

s Compared with SENSE and CS, the better imaging quality of craniocerebral arteries could be obtained using 3D TOF MRA based on ACS with a shorter time, especially with AF of 5

#### **CLINICAL RELEVANCE/APPLICATION**

Compared with SENSE and CS, 3D TOF-MRA accelerated by ACS can further shorten the scanning time while maintaining the image quality, which greatly increases the comfort and success rate of MR Scanning

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## Abstract Archives of the RSNA, 2023

W5B-SPBR

### Breast Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPBR- Breast Cancer Risk Models: Observations From a Multi-Site Database of Women Screened for Breast Cancer** 1

##### Participants

Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Research Grant, Hologic, Inc; Advisory Panel, Hologic, Inc; Research Grant, OM1, Inc; Research Grant, iCad, Inc; Advisory Panel, iCad, Inc; Speaker, WebMD LLC

##### PURPOSE

With emerging interest in risk-based screening strategies and known disparities in breast cancer outcomes by race, risk models need to address gaps in risk assessment. To inform questions about the inclusion of characteristics like race in these models, we explored associations between race, breast cancer risk factors (including Gail risk score) and breast cancer detection in a large, real-world cohort.

##### METHODS AND MATERIALS

This retrospective cohort study used electronic medical record, radiology, and tumor registry data from five healthcare organizations. Women 40-79 years old with no history of breast cancer, non-missing race data, and =1 screening exam between 2016-2020, were included. Cancer detection rates (CDR) were calculated per 1,000 screens. Logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) for the associations between age, race, breast density and risk status (Gail model) and CDR.

##### RESULTS

The cohort included 1,563,019 screenings (123,371 Asian, 203,412 Black, 56,961 Other, 1,179,274 White). Both Black and White women were on average 58±10 years of age and slightly older than Asian or women of Other race (mean age 54±9 years). Asian women had significantly higher breast density versus other groups (52% mostly heterogeneously dense; 15% extremely dense tissue). Elevated breast cancer risk status varied by race; 16% Asian, 23% Black, 17% Other, 31% White. Overall CDRs (per 1,000 screens) by race were; Asian 4.9 [95% CI 4.5, 5.3]; Black 5.3 [95% CI 5.0, 5.6]; Other 4.2 [95% CI 3.7, 4.7]; White 5.2 [95% CI 5.1, 5.3]. Among women identified as elevated risk, CDRs differed slightly as compared to White women: Asian 6.6 [95% CI 5.5, 7.8] p=0.26; Black 6.7 [95% CI 6.0, 7.5] p=0.05; Other 4.9 [95% CI 3.7, 6.5] p=0.20; White 5.9 [95% CI 5.7, 6.2]. After adjusting for age (p<0.001), density (p<0.001) and risk (p=0.001), no statistically significant association between race and CDR remained (p=0.25) (Figure).

##### CONCLUSION

In a large real-world cohort, we observed meaningful differences in breast cancer risk factors and risk scores by race. Racial differences in cancer detection rates do not persist after adjusting for age, breast density and Gail score. Careful consideration should be given to the use of risk models in the clinical setting. The observed misalignment in risk scores and breast cancer detection rates suggest the potential for insufficient capture of risk factors and the need to better understand the drivers of racial differences in mammography outcomes.

##### CLINICAL RELEVANCE/APPLICATION

It is critical to understand which risk factors may underlie recognized racial disparities in breast cancer burden in order to optimize risk models used to support clinical decision making for screening prioritization.

#### **W5B-SPBR- Diagnostic Performance of Diffuse Optical Spectroscopic Imaging for Breast Cancer According to Clinical Factors** 2

##### Participants

Yeji Kwon, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

Although breast cancer screening programs have reduced the mortality rate of breast cancer patients by about 20%, the sensitivity of mammography decreases to 30-48% in dense breast. On the contrary, there are concerns regarding the potential elevation of false positive rates when ultrasound is employed. It has been suggested that optical imaging could enhance the specificity of breast imaging, but this has not been conclusively established. This study aims to evaluate the impact of clinical factors on the diagnostic performance of diffuse optical spectroscopic imaging/discrete multi-wavelength near-infrared spectrum (DOSI/DMW-NIRS) for breast malignancy.

##### METHODS AND MATERIALS

Our institutional review board granted approval for this investigation, and signed informed consent was obtained. From September 2021 to June 2022. In this study, 85 participants were enrolled, of which 23 participants were excluded. Among the exclusions, 4

participants refused to participate or had unavailable biopsy results, 4 participants had absent raw or chromophore data, and 15 participants were unavailable for analysis due to the subareolar location of the lesion. Total of 62 women with 62 breast lesions (37 malignant, 25 benign) biopsied under US guidance were analyzed. DOSI/DMW-NIRS was used to quantify the chromophores (HbO<sub>2</sub>, HHb, THC, StO<sub>2</sub>, water, lipid, and TOI) of lesions and then the computed chromophore ratios were compared to those of contralateral normal breasts. Lesions were categorized by demographic (age, BMI, bra cup size, and menstrual cycle phase) and sonographic variables (tumor diameter, depth, distance from nipple, vascularity, breast thickness, and BI-RADS category), and areas under the curve (AUCs) were compared between subgroups.

## RESULTS

TOI ratio showed the highest AUC value (0.904, 95% confidence interval: 0.831-0.977), followed by water (0.836, 95% confidence interval: 0.736-0.936) for diagnosing breast malignancy among the seven chromophore values. TOI ratio demonstrated no significant difference in diagnostic performance among all subgroups (p-value>0.05). The diagnostic performance of water ratio differed according to breast thickness (p-value: 0.033) and distance from nipple (p-value: 0.011). The diagnostic performance of THC and HbO<sub>2</sub> differed according to BMI (p-value 0.0119 and 0.0056, respectively) and menstrual cycle (p-values: 0.011 and 0.006, respectively).

## CONCLUSION

s TOI ratio evaluated with DOSI/DMW-NIRS shows strong diagnostic performance regardless of demographic and sonographic parameters.

## CLINICAL RELEVANCE/APPLICATION

TOI ratio evaluated with DOSI/DMW-NIRS has the potential to be generally applied to various clinicoradiologic condition to diagnose breast cancer.

## W5B-SPBR- A Systematic Review and Meta-Analysis of Online Patient Education Materials in Breast Cancer: Is Readability the Only Story

### PURPOSE

Online patient education materials (OPEMs) are an increasingly popular resource for women seeking information about breast cancer. The AMA recommends written patient material to be at or below a 6th grade level to meet the general public's health literacy, but breast cancer readability studies have found reading levels to be much higher than the AMA's recommended level. Metrics such as quality, understandability, and actionability also heavily influence the usability of health information, and thus should be evaluated alongside readability. A systematic review and meta-analysis was conducted to determine: 1) Average readability scores and reporting methodologies of breast cancer readability studies; and 2) Inclusion frequency of additional metrics associated with health literacy.

### METHODS AND MATERIALS

A registered systematic review and meta-analysis was conducted in Ovid MEDLINE, Web of Science, Embase.com, CENTRAL via Ovid, and ClinicalTrials.gov in June 2022 in adherence with the PRISMA 2020 statement. Eligible studies performed readability analyses on English-language breast cancer-related OPEMs. Study characteristics, readability data, and reporting of non-readability health literacy metrics were extracted. Meta-analysis estimates were derived from generalized linear mixed modeling.

### RESULTS

The meta-analysis included 30 studies yielding 4,462 OPEMs. Overall, average readability was 11.81 (95% CI [11.14, 12.49]), with a significant difference (p<0.001) when grouped by OPEM categories. Commercial and government organizations had the highest average readability at 12.2 [11.3, 13.0] and 12.0 [11.3, 12.7], respectively; non-profit organizations had one of the lowest at 11.3 [10.6, 12.0]. Readability also varied by index, with New Fog, Lexile, and FORCAST having the lowest average scores (9.4, 10.4, and 10.7, respectively). Only 57% of studies calculated average readability with more than two indices. Only 60% of studies assessed other OPEM metrics associated with health literacy.

### CONCLUSION

s Average readability of breast cancer OPEMs is almost double the AMA's recommended 6th grade reading level. Readability reporting is currently not standardized - multiple indices should be used and averaged together with an interval estimate to capture a more comprehensive picture of reading grade level. Additional non-readability OPEM metrics are also inconsistently reported and may help convey the usefulness of information presented.

### CLINICAL RELEVANCE/APPLICATION

Beyond readability, the quality, understandability, and actionability of OPEMs are important components to aid shared decision-making and may be critical to increased screening rates and breast cancer awareness.

## W5B-SPBR- Examining the Barriers to Breast Cancer Early Diagnosis in Uganda: A Prospective Study

4

### PURPOSE

Women diagnosed with breast cancer (BRC) in Uganda have a 5-year mortality rate of 50%. Early diagnosis is an appropriate strategy for downstaging disease in low-resource settings, but women face significant barriers to accessing care (e.g., clinical examination, ultrasound, tissue diagnosis); assessing these barriers is a key step in designing successful programs. For the first time, we report findings from a prospective study examining the trajectory of care among Ugandan women with breast symptoms presenting for care.

### METHODS AND MATERIALS

450 symptomatic women attending 5 community health clinics in Uganda were recruited and followed for six months. Participants completed questionnaires at baseline and six months, which collected data on demographics, barriers to care, and provider's recommendations for care (baseline), and actions taken at 6-months (follow-up). Logistic regression and multiple regression models were used to assess the relationship between delay (< or > 90 days) and sociodemographic factors. Differences in adherence to provider recommendations at 6 months were assessed via Pearson X<sup>2</sup> test/Wilcoxon Rank Sum test.

## RESULTS

442 (98.2%) completed follow-up. Breast lumps and pain were the main symptoms. 57.3% waited >90 d before seeking care, of whom 27.9% delayed >1 year. After multivariate analysis, rural setting (OR=13.34) and symptoms at time of presentation (OR=0.30) were significantly associated with delay. At 6 months, 184/442 (41.6%) were referred to either diagnostic imaging or tissue biopsy (+/-) imaging. 137/184 (74.5%) did not adhere to recommendations. Positive initial breast symptoms ( $\chi^2=9.3$ ,  $P=0.01$ ) and older women ( $P=0.002$ ) were more likely to follow provider's recommendations. 22/47 (46.8%) were diagnosed with breast cancer, a diagnostic yield of 46.8%. Main reasons for no action at 6 mo. for the 137 were: resolution of breast symptoms (40.0%), decision to wait for symptoms to resolve (19.2%), provider said that it was nothing to worry about (18.3%), and financial barriers (17.5%), despite 85.6% endorsing full understanding of need for follow-up. We estimated an additional 32 undiagnosed cancers in this group, a BRC rate of 12%.

## CONCLUSION

Low adherence to follow-up recommendations for diagnostic care should be an area of focus for programs to improve BRC outcomes in Uganda.

## CLINICAL RELEVANCE/APPLICATION

To increase effectiveness of diagnosis programs in Uganda, interventions should prioritize breast health education in the community, and removing barriers to accessing diagnostic services.

## W5B-SPBR- Point of Care Breast Cancer Risk Assessment Increases Rates of Supplemental MRI Screening Among Women Undergoing Screening Mammography

Participants

Jocelyn Cheng, South Easton, MA (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of our study was to examine the impact of providing point of care breast cancer risk assessment (CRA) with results provided to patients at the time of annual screening mammography on rates of supplemental screening completion with MRI.

## METHODS AND MATERIALS

We performed a retrospective review of patients who underwent breast imaging from November 2019 through May 2021. We examined the total number of screening mammograms performed one year prior to the cancer risk assessment (CRA) intervention start date ( $n=5,431$ , (epoch 1) 11/1/2019-5/1/2020), the total number of screening mammograms performed in patients who completed CRA for six months after the CRA intervention start date ( $n=1,976$ , (epoch 2) 11/1/2020-5/1/2021), and the total number of patients who underwent screening mammography but did not complete CRA intervention for six months after CRA intervention start date ( $n=4,578$ , (epoch 2) 11/1/2020-5/1/2021). We used an interrupted time series design and analysis with a natural control to evaluate rate of MRI completion before and following integration of the Tyrer-Cuzick CRA screening tool. We identified which patients underwent supplemental screening with MRI during the 12 months following each time period to calculate the change in rate of supplemental screening completion based on intervention. Supplemental imaging rates with MRI was modeled over time between pre- and post-intervention windows using a generalized linear mixed model (GLMM) with sandwich estimation and assuming binary distribution where observations are nested within patients.

## RESULTS

The cohort included 11,985 women who underwent screening mammography during the study period. During epoch 1, no patients received CRA, 0% (0/5,431). During epoch 2, 30% (1,976/6,554) received CRA and 70% (4,578/6,554) did not. Before the implementation of CRA (epoch 1), the rate of MRI was 2.8% (152/5,431). After the implementation of CRA (epoch 2), the rate of MRI among patients who did NOT undergo CRA intervention was 3.2% (144/4,578); for those who did receive CRA, the MRI rate was 6.0% (118/1,976),  $p<.05$ .

## CONCLUSION

Receiving point of breast care risk assessment at time of screening mammography doubled the rate of follow-up screening with MRI as compared to the rate among patients who did not receive the intervention (3.1% to 6.0%,  $p<.05$ ). Our facility reached maximum capacity for MRI screening after implementation of CRA intervention; the increased volume of follow-up screening MRI following introduction of CRA was likely limited by this constraint.

## CLINICAL RELEVANCE/APPLICATION

Study findings will inform practices about supplemental screening yield after implementation of point of care risk assessment.

## W5B-SPBR- Socioeconomic Factors and Health Disparities in Access and Adherence to Breast Imaging Services and Breast Cancer Screening

Participants

Sonali Sharma, Vancouver, BC (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the impact of socioeconomic factors on the access and adherence to breast imaging services and breast cancer screening programs by analyzing data from the Digital Database for Screening Mammography (DDSM) and the National Health Interview Survey (NHIS).

## METHODS AND MATERIALS

We integrated data from the DDSM, which includes 2,620 scanned film mammograms with ground truth information and annotations, and the NHIS, which contains comprehensive health-related data from a nationally representative sample of US households. We combined mammography images and annotations with demographic and socioeconomic information, such as age, race/ethnicity, income, education, and health insurance status. We employed multivariable logistic regression models to examine the influence of socioeconomic factors on breast imaging service utilization and early breast cancer detection

## RESULTS



Our analysis showed that lower-income, lower-educated, and minority women were less likely to access breast imaging services and had a lower likelihood of early breast cancer detection. Regression models revealed that socioeconomic factors, including income, education, and health insurance status, significantly predicted access to breast imaging services and early breast cancer detection after adjusting for relevant covariates such as age and race/ethnicity.

## CONCLUSION

This study underscores the importance of addressing socioeconomic disparities in breast imaging service access and early breast cancer detection using the DDSM and NHIS datasets. Tackling these disparities by developing targeted interventions and policies to promote equitable access to breast imaging services can enhance health equity and patient outcomes.

## CLINICAL RELEVANCE/APPLICATION

Identifying and addressing socioeconomic barriers to breast imaging services can lead to increased early breast cancer detection rates and improved patient outcomes, ultimately reducing health disparities.

## W5B-SPBR- Pushing the Envelope in Breast Conserving Surgery: Is Multiple-wire Localization (3 or more wires) Associated with Increased Risk of Compromised Margins

7

### PURPOSE

In the last two decades there has been a paradigm shift with breast conserving surgery (BCS) being applied to larger and more extensive breast malignancies. The aim of this study is to examine the success of BCS being performed in patients with extensive breast malignancies requiring at least 3 wires for localization, and to assess possible risk factors for failure.

### METHODS AND MATERIALS

We performed a retrospective single center review of 232 patients who underwent BCS between 2010 and 2020 requiring at least 3 wires for localization. The cohort included a control group of 232 single-wire BCS patients chronologically matched with the multiple-wire group. Patients with either invasive malignancy or ductal carcinoma in situ (DCIS) were included in the study. Clinical, radiological and pathological data was collected. Proportions of positive surgical margins, re-lumpectomies and conversion to mastectomy were calculated.

### RESULTS

In the multiple-wire group the patients were younger (mean age 57 vs 63.1,  $P<0.001$ ), had larger tumors (mean size 5.1cm vs 1.2 cm,  $p<0.001$ ), had higher rate calcifications on mammogram (71.9% vs 17.2%,  $P<0.001$ ) and higher rate of DCIS component (72.3% vs 38.4%,  $P<0.001$ ); a higher proportion underwent neoadjuvant treatment (29.9% vs 9.9%,  $P=0.001$ ). Positive surgical margins were higher in the multiple-wire group (13.4% vs 7.3%,  $P=0.03$ ), which lead to higher proportions of re-lumpectomies or conversion to mastectomies (7.3% vs 4.3%,  $P=0.17$ ). On multivariate analysis, patients with positive margins were more likely to have a DCIS component (77.1% vs 52.8% ,  $p=0.006$ ) and positive ER hormonal status (93.5% vs 85.1%,  $p=0.048$ ). The number of wires was not an independent predictor of positive margins. breast density, presence of calcifications on mammogram, type of tumor (unifocal vs multifocal/multicentric), tumor size, surgical specimen volume, undergoing Neoadjuvant treatment, undergoing magnetic resonance imaging and use of oncoplastic techniques did not predict margin status.

### CONCLUSION

BCS requiring 3 or more wires is associated with a higher proportion of positive margins. The increased risk of positive margins appears to be related to type of tumor (DCIS component and ER status) rather than to the number of wires.

### CLINICAL RELEVANCE/APPLICATION

This information may be useful for pretreatment planning of extensive breast malignancies, especially those suitable for BCS.

## W5B-SPBR- Upgrade Rates of Atypical Ductal Hyperplasia, Atypical Lobular Hyperplasia, and Flat Epithelial Atypia at a Community-based Breast Imaging Center

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### PURPOSE

To review the prevalence of breast malignancy (invasive or noninvasive) at surgical excision in patients who had atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH) and flat epithelial atypia (FEA) on needle core biopsy.

### METHODS AND MATERIALS

A retrospective chart review was performed on patients who had atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH) or flat epithelial atypia (FEA) on breast needle core biopsy at a community-based breast center between 1/1/2011 to 12/31/2022. There was a total of approximately 909 atypical diagnoses on core needle biopsy in 876 patients during this time (ADH, ALH or FEA). Exclusion criteria included co-existing malignancy in the ipsilateral breast, or needle core biopsy pathology demonstrating atypia bordering on DCIS. Data collected included patient demographics, lesion characteristics, and correlation with surgical biopsy or follow-up imaging.

### RESULTS

There was a total of 909 diagnoses of ADH, ALH or FEA in 876 patients on needle core biopsy. The average patient age was 57.8 years. Diagnoses on needle core biopsy were as follows: 651 ADH, 180 ALH, 78 FEA. Collectively, the majority of ADH, ALH and FEA lesions were presented as microcalcifications (69%). Of the ADH lesions, the majority presented as microcalcifications (71%), followed by 16% masses. ALH most frequently presented as microcalcifications (56%), followed by 20% masses. Eighty-three percent of FEA presented as microcalcifications, followed by 6% architectural distortion. All were recommended for open surgical biopsy (OSB)- 46 lesions did not undergo excision. Twenty percent of the atypical lesions that underwent OSB ( $n=173/863$ ) upgraded to malignancy at excision; 31% ( $n=53$ ) invasive carcinoma and 69% ( $n=120$ ) non-invasive. Specifically, 153/651 ADH upgraded (24%), 16/180 ALH upgraded (9%), and 4/78 FEA (5%).

### CONCLUSION

We found that 20% of the atypical lesions evaluated in this review upgraded to carcinoma at excision; most of the upgrades were ADH lesions. While surgical excision of ALH and FEA is controversial, our data suggests that it may be warranted. More research is needed to determine the optimal follow-up protocol for ALH and FEA.

**CLINICAL RELEVANCE/APPLICATION**

ADH, ALH and FEA are some of the high-risk lesions that are frequently recommended for surgical excision when diagnosed on core needle biopsy, though controversy exists.

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## Abstract Archives of the RSNA, 2023

W5B-SPCA

### Cardiac Imaging Wednesday Poster Discussions II

#### Sub-Events

#### W5B-SPCA- Deep Learning for Contrast Medium and Radiation Reduction in Coronary CT 1

##### Participants

Giuseppe Tremamunno, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### PURPOSE

The aim of the study was to evaluate the performance of high-strength deep learning image reconstructions (DLIR-H) in maintaining or improving image quality of coronary CT angiography (CCTA) under the "double low" condition (reduced radiation dose and contrast medium dose), compared with conventional 100kVp - ASiR-V protocol.

##### METHODS AND MATERIALS

In this single-center study, from June to December 2022, clinically indicated CCTA of consecutive patients with BMI < 30 kg/m<sup>2</sup> were prospectively included and randomly assigned (1:1 ratio) into three groups: group A (100 kVp, ASiR-V 50% and iodine delivery rate [IDR] =1.8); group B (80 kVp, DLIR-H, and IDR =1.4), and group C (80 kVp, DLIR-H and IDR =1.2). Radiation and contrast dose, objective image quality (vascular attenuation, image noise, contrast-to noise ratio [CNR], signal-to-noise ratio [SNR]) and subjective image quality were compared among the three groups. To assess the objective image quality, regions of interest were drawn in the left pectoral muscle as a reference, in the ascending aorta and in the main coronary arteries. Subjective image quality was rated using a 4-point Likert scale.

##### RESULTS

144 CCTA were evaluated. Group B and C significantly reduced radiation dose compared to Group A ( $2.16 \pm 0.8$  mSv and  $1.99 \pm 0.6$  mSv, respectively, VS  $3.6 \pm 1$  mSv;  $P < 0.001$ ). Group B and group C outperformed group A in terms of lower contrast media dose, with a decreasing trend from group A to group C ( $57.7 \pm 6.7$  mL,  $51.5 \pm 6.3$  mL, and  $42.9 \pm 3.8$  mL, respectively); all the differences among the groups were statistically significant ( $P < 0.001$ ). Group B and C also achieved significantly higher SNR, CNR, and lower background noise compared to group A (all  $P < 0.001$ ). In terms of subjective image quality, group B obtained the highest score, significantly higher than group A ( $P < 0.001$ ) and group C ( $P < 0.05$ ).

##### CONCLUSION

In non-obese patients, "double low" CCTA protocol coupled with DLIR-H significantly reduces radiation and contrast medium dose while improving image quality, compared to conventional CCTA protocol.

##### CLINICAL RELEVANCE/APPLICATION

The "double low" CCTA protocol coupled with DLIR-H allows us to have excellent image quality while reducing radiation and contrast media burden; therefore, it can be safely implemented in non-obese patients. Further investigations focused on diagnostic accuracy are needed.

#### W5B-SPCA- Basic Verification of Myocardial Extracellular Volume Quantification by Prototype Photon Counting 2 Detector CT

##### Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aimed to investigate the accuracy of myocardial extracellular volume (ECV) quantification by prototype photon counting detector CT (PCD-CT) and the influence of the radiation dose and spectral image settings.

##### METHODS AND MATERIALS

We used a multi-energy CT phantom simulating the blood pool and myocardium. The solid rods representing blood and soft tissue were used as pre-contrast CT. Besides, the solid rods including different iodine concentrations (2 mgI/mL and 4 mgI/mL) were used as post-contrast CT. The tube voltage was set at 120 kVp and three types of tube current (105mAs, 150mAs, 300mAs) applied. Virtual monoenergetic images (VMI) at 50-100 keV were reconstructed. The ECV value was calculated from the CT numbers between pre-contrast and post-contrast. Hematocrit of blood for ECV calculation was fixed at 0.5. We compared the accuracy of ECV values at each monoenergetic level.

##### RESULTS

There was a small but significant difference in ECV values at each keV level in each radiation dose setting. ECV tended to be overestimated at higher keV in all radiation dose settings. There was a significant difference in the variability of ECV values among keV levels in all three radiation dose settings, with higher keV having greater variability. The variation was particularly large in the low dose setting. In all radiation dose settings, the residual values were significantly larger at higher keV levels: the average

residual values at 105mAs, 150mAs and 300mAs settings were 0.5%-6.1%, 0.4%-4.5% and 0.3%-4.9%, respectively. In 150mAs and 300mAs settings, the residual values were smaller at 50keV and 60keV with no significant difference.

## CONCLUSION

When quantifying myocardial ECV with PCD-CT, it was necessary to set appropriate VMI keV and radiation dose settings because the keV levels can cause differences in the quantification value and measurement variation. This PCD-CT system enabled accurate myocardial ECV quantification at 50 and 60 keV in 150mAs and 300mAs settings.

## CLINICAL RELEVANCE/APPLICATION

Accurate myocardial ECV quantification is feasible using PCD-CT with appropriate keV settings.

## W5B-SPCA- Evaluation of Coronary Artery Stents with Ultra-High-resolution Photon-Counting CT: Analysis Of the Optimal Reconstruction Kernel

### PURPOSE

To assess the impact of reconstruction kernel on the image quality of coronary artery stents with ultra-high-resolution photon-counting CT (UHR-PCCT) in a phantom model

### METHODS AND MATERIALS

Six different coronary stents in a coronary phantom were examined at a tube voltage of 120kV. Images were reconstructed using vascular kernels of 11 sharpness levels based on three matrix sizes (matrix size of 512×512 pixels: Bv44, Bv48, Bv56; matrix size of 768×768 pixels: Bv60, Bv64, Bv68; matrix size of 1024×1024 pixels: Bv72, Bv76, Bv80, Bv84 and Bv89), using quantum iterative reconstruction (QIR) at a strength level of 3, and a slice thickness of 0.2 mm. Images with the Bv44 kernel, QIR at a strength level of 3, and a slice thickness of 0.4 mm served as the reference. Image noise and signal-to-noise ratio (SNR) were measured automatically using Python (Version 3.5). The sharpness and the attenuation effects of the stents were objectively evaluated with 10%-90% edge rise distance (ERD), 10%- 90% edge rise slope (ERS) and stent lumen attenuation increase ratio (SAIR). The visible diameter of the coronary stent was measured by the peak-to-peak CT attenuation of stent strut. The overall image quality of the coronary stents was subjectively scored on a 5-point scale (1= poor [poor vessel definition, severe artifacts, diagnostic information impaired], 5= excellent [clear stent strut definition, minimal blooming artifacts from the stent, and diagnostic information sufficient]). Friedman test or Kruskal Wallis test was used to check for differences between the reconstructions as appropriate. The Benjamini-Hochberg procedure was used to adjust P values for multiple comparisons.

### RESULTS

Reconstructions with the Bv44 kernel and a slice thickness of 0.4 mm showed lowest image quality (3[2-3]) and lowest vessel sharpness (ERD:  $0.42 \pm 0.03$  mm; ERS:  $2498.25 \pm 403.83$  HU/mm) (all  $P < 0.05$ ). Considering reconstructions with a slice thickness of 0.2 mm, reconstructions with the Bv72 to the Bv89 kernel had highest image noise and lowest SNR (all  $P < 0.05$ ). Reconstructions with the Bv44 to the Bv56 kernel demonstrated a lower stent sharpness (all  $P < 0.05$ ). No difference was demonstrated among reconstruction kernels in terms of SAIR and the ratio of the visible stent lumen diameter to the true diameter. The overall image quality of coronary stents for reconstructions with the Bv60 to the Bv68 kernel (median score of 5) were favored by the readers.

## CONCLUSION

UHR-PCCT enables the visualization of coronary stents with an excellent image quality and high sharpness. Reconstructions with the Bv60 to the Bv68 kernel may be optimal for evaluation of coronary artery stents.

## CLINICAL RELEVANCE/APPLICATION

UHR-PCCT with the Bv60 to the Bv68 kernel allows improvement of coronary stent evaluation.

## W5B-SPCA- Photon-Counting Detector CT Angiography of the Coronary Arteries: Intra-Individual Comparison of Image Quality to Conventional Energy-integrating Detector CT Angiography

Participants

Daniel Pinos, MD, Charleston, SC (*Presenter*) Nothing to Disclose

### PURPOSE

The aims of this study were to determine the objective and subjective image quality of coronary computed tomography angiography (CCTA) on a clinical dual-source photon-counting detector CT (PCD-CT) and to compare the image quality to conventional dual-source energy-integrating detector CT (EID-CT) in the same patients.

### METHODS AND MATERIALS

Twenty prospectively enrolled patients ( $67.5 \pm 9.0$  years, 28.5 median BMI, 75% male) underwent PCD-CT and EID-CCTA at an average interval of 11 days. Contrast agent protocol and radiation dose were matched between the PCD- and EID-CCTA. Polychromatic images were reconstructed for both EID- and PCD-CT, while virtual monoenergetic images (VMI) were created at 40, 45, 50, 55, 60 and 70 keV for PCD-CT. Contrast-to-noise ratio (CNR) was calculated for each coronary artery by two blinded readers. Stratification analysis of patients was performed according to BMI [high ( $>30$  kg/m<sup>2</sup>) vs low ( $<30$  kg/m<sup>2</sup>)]. For subjective analysis, readers scored image noise, vessel attenuation, vessel sharpness and overall quality using a 1-5 Likert scale.

### RESULTS

Compared with EID-CT, attenuation and image noise of the coronary arteries were higher for all PCD-CT VMI reconstructions (all  $p < 0.008$ ). Coronary artery CNR values from PCD-CT monoenergetic and polychromatic reconstructions were all significantly higher than CNR values from EID-CT (all  $p < 0.008$ ). A proportionally greater increase in CNR of 33.1% was found in high BMI patients averaged over all reconstructions. Subjective scores of image noise, vessel attenuation, vessel sharpness and overall quality were significantly higher for 55, 60, and 70 keV compared to EID-CT (all  $p < 0.05$ ).

## CONCLUSION

The improved objective and subjective image quality of PCD-CCTA compared to EID-CCTA may offer better visualization of the coronary arteries for a wide array of patients, especially those with high BMI.

## CLINICAL RELEVANCE/APPLICATION

The improved image quality of CCTA with PCD has the potential advantages of lower radiation dose, better detection of coronary artery disease, and better visualization in obese patient.

### W5B-SPCA- Deep Learning-Based Myocardial Strain Analysis from Cine MR Image: A Comparative Study of Unet and ResUnet

Participants  
Dayeong An, MSc, Milwaukee, WI (*Presenter*) Nothing to Disclose

#### PURPOSE

The purpose of this study is to develop a deep learning (DL)-based network for measuring myocardial regional function from conventional cine magnetic resonance (MRI) images, combining the advantages of cardiac magnetic resonance feature tracking (CMR-FT) and MRI tagging while minimizing their respective limitations in assessing regional cardiac function.

#### METHODS AND MATERIALS

Modified Unet and ResUnet architectures were implemented and trained to handle spatiotemporal data. Deeper layers and dilated convolutional blocks were incorporated to increase the receptive field and improve multi-scale feature learning. A custom loss function was employed for better optimization. Paired cine MR images and myocardial displacement fields generated from corresponding tagged images were acquired at matching locations and timepoints. The dataset comprised 1280 images (64 MRI slices with 20 cine and tagged images per slice). Data were split into training, validation, and test datasets as 80%, 10%, and 10%, respectively. Random flip data augmentation was performed. Radial and circumferential strains at end-systolic were measured using the American Heart Association (AHA) 6-segment model.

#### RESULTS

After 100 epochs, accuracies were 87% for Unet and 86% for ResUnet with losses of 0.6% and 0.7%, respectively. Mean±SD global strains for tagging, Unet, and ResUnet were Err = 15.4±8.4, Ecc = -15.3±8.3; Err = 17.1±10.3, Ecc = -14.7±9.1; and Err = 17.8±10.2, Ecc = -15.6±9.2, respectively. Unet and ResUnet achieved mean squared errors (MSE) of 0.5 and 0.46, peak signal-to-noise ratios (PSNR) of 71.62 and 72.08, structural similarity indices (SSIM) of 91.7 and 92.4, and Pearson correlation coefficients (PCC) of 92.9 and 95.9, respectively, compared to MRI tagging. Paired t-test revealed no statistically significant differences in strains between conventional and Unet methods ( $p>0.05$ ). However, significant differences were observed in radial AHA sectors 2 and 4, and circumferential AHA sector 1 between conventional and ResUnet methods ( $p<0.05$ ).

#### CONCLUSION

The study results demonstrate the feasibility of using deep learning-based networks, particularly the modified Unet architecture adapted for spatiotemporal data analysis, for assessing regional cardiac function in a clinical setting without the need for acquiring MRI tagged images. Potentially, this network can be used to reduce MRI scan time and allow for more adoption of strain imaging for evaluating different cardiovascular diseases.

## CLINICAL RELEVANCE/APPLICATION

The deep learning-based networks adapted for spatiotemporal data analysis provides an efficient and accurate alternative to MRI tagging for assessment of regional cardiac function for early detection of cardiovascular diseases.

### W5B-SPCA- Coronary Artery Calcium Quantification with Super Resolution Deep-learning Reconstruction Algorithm: An Anthropomorphic Phantom Study

Participants  
Shinsuke Shigematsu, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

To evaluate the impact of a novel super-resolution deep-learning reconstruction (SR-DLR) algorithm on coronary artery calcium (CAC) quantification in comparison with filtered back projection (FBP), hybrid iterative reconstruction (HIR), model-based iterative reconstruction (MBIR), and normal resolution deep-learning reconstruction (NR-DLR) algorithms.

#### METHODS AND MATERIALS

A QRM Thorax phantom with cardiac calcification inserts containing three different amounts of hydroxyapatite with three different diameters was used for this study. The phantom was placed inside a body ring (400×300 mm diameter) and scanned on a 320-row scanner with a tube voltage of 120 kVp. Scanning was performed with six tube currents ranging from 100 to 350 mA in 50 mA increments (CTDIvol: 1.4 to 5.1 mGy). Images were reconstructed using FBP, HIR (AIDR3D), MBIR (FIRST), NR-DLR (AiCE), and SR-DLR (PIQE) at a 3 mm slice thickness. Image noise, contrast-to-noise ratio (CNR), and task-based detectability index of calcifications were quantified. CAC volume and Agatston score were measured semi-automatically; the relative volume measurement error from the nominal CAC volume (360.6 mm<sup>3</sup>) was calculated for each reconstruction at each radiation dose level. Using the Agatston scores obtained at 350 mA as a reference for each reconstruction, the relative measurement errors at lower radiation doses (100-300 mA) were calculated. Using the Agatston scores obtained on 350-mA FBP images as a clinical reference, the relative measurement errors of each reconstruction at each radiation dose were also calculated.

#### RESULTS

SR-DLR yielded the lowest image noise, the highest CNR, and the highest CAC detectability index among all reconstructions at each radiation dose level. The lowest measurement errors in CAC volume relative to nominal volume and the Agatston score relative to reference dose (350 mA) were obtained with SR-DLR at all dose levels. When the Agatston score at 350-mA FBP was used as a reference, SR-DLR showed a systematic underestimation at all radiation doses (relative measurement error < -7.6%).

#### CONCLUSION

SR-DLR may improve image quality and facilitate accurate CAC quantification even at lower radiation doses, but its clinical application requires caution due to the deviation of the Agatston score from the conventional high-dose FBP setting.

## CLINICAL RELEVANCE/APPLICATION

The novel SR-DLR algorithm may yield accurate detection and quantification of CAC due to its excellent noise and spatial resolution characteristics, but the clinical evaluation for potential impact on risk classification and patient management is warranted before routine clinical use.

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## Abstract Archives of the RSNA, 2023

W5B-SPCH

### Chest Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPCH- Deep Learning-Based Prediction of Left Ventricular Ejection Fraction Using Chest Radiographs: Potential Role in Pre-Screening Individuals in Health Checkup Populations** 1

##### **PURPOSE**

To develop and validate deep learning automatic prediction algorithms (DLLV) for left ventricular ejection fraction (LVEF) from chest radiographs (CRs), and explore its potential role as pre-screening target individuals for echocardiography in health checkup populations.

##### **METHODS AND MATERIALS**

To develop DLLV, patients who received CR and echocardiography at the same day at Seoul National University Hospital (SNUH) between 2016 and 2021 were retrospectively collected. 32,137 CRs from 23,616 patients (12,854 men [54%]; mean age, 69 [IQR, 62-80] years old) were included and randomly split into training (n= 25,709), validation (n= 3,214), internal test (n= 3,214) datasets. LVEF measured on echocardiogram was used as reference standard. ResNet50 was used as backbone convolutional neural network while final layers were adapted to predict LVEF in ranges of [0, 35, 50, 65, 100] (classification branch) and exact LVEF values (regression branch). For external testing, two independent cohorts were collected: 1) 5440 patients (2867 men [53%]; 66 [55-66] years old) who received same day CR and echocardiography at SNUH in 2015 (SNUH cohort) and 2) 28,034 individuals (17252 men [62%]; 56 [50-63] years old) at Healthcare System Gangnam Center between 2015-2021 (HCS health checkup cohort) were retrospectively collected. Prediction performance of DLLV was evaluated using area under the receiver operating characteristic curve (AUROC).

##### **RESULTS**

In internal test dataset, DLLV showed AUROCs of 0.79 (95% CI, 0.78-0.81) and 0.80 (0.79-0.81) in predicting patients with LVEF =35% and =50%, respectively. In SNUH cohort, 8% (459/5440) and 2% (123/5440) of the patients showed LVEF =35% and 50% on same day echocardiogram, and DLLV exhibited AUROC of 0.85 (0.84-0.86) in predicting LVEF =35% and 0.78 (0.77-0.80) in predicting LVEF =50%. In HCS cohort, only 0.2% (62/28,034) of the individuals showed LVEF =50%, and none showed LVEF =35%. DLLV showed AUROC of 0.74 (0.74, 0.75) in detecting those with LVEF =50%. When selective recommendation of echocardiography was assumed depending on DLLV results from CRs (i.e., those with DLLV >5%), DLLV could screen 68% (42/62) of individuals with LVEF =50% by recommending echocardiography for 8655 among 28,034 individuals (70% reduction of examinations). Only 0.1% (20/19,329) showed abnormal LVEF among individuals echocardiography was not recommended by DLLV.

##### **CONCLUSION**

s DLLV exhibited promising performance in predicting patients' LVEF from CRs. In a health checkup cohort, DLLV showed potential in pre-screening individuals who may need echocardiography.

##### **CLINICAL RELEVANCE/APPLICATION**

Selective recommendation of echocardiography using DLLV may enhance chance of opportunistic screening and reduce expense from unnecessary examinations.

#### **W5B-SPCH- Missed Diagnosis on Chest X-Ray: Auditing Large Volumes of Data with the Help of Comprehensive Artificial Intelligence** 2

##### **PURPOSE**

Chest x-rays (CXR) are the most common imaging modality in radiology and also one of the earliest imaging modalities to be developed. Despite many decades of experience in this modality, the diagnostic error rate has remained relatively unchanged. This could partly due to the lack of consistent feedback to radiologists when reporting CXRs. The purpose of the current study was to detect the rate of missed diagnoses on CXRs reported in a busy teaching hospital environment and demonstrate an efficient method of auditing the CXRs.

##### **METHODS AND MATERIALS**

A consecutive cohort of adult (= 18 years) CXRs reported normal within the St. Vincent's Hospital Melbourne Imaging Department were retrospectively collected and de-identified. A commercially available system (Annalise Enterprise CXR) was applied over included studies to identify cases predicted by the AI to contain one or more of 60 findings deemed significant/critical. The discrepancy between original radiology report and AI predictions were reviewed by a radiologist with over 10 years-experience to evaluate the level of agreement between radiologists and the AI-predictions, and the number of missed findings determined through subsequent review.

##### **RESULTS**

A total of 1559 CXRs reported in 2016 were retrospectively collected and de-identified. All of these studies were successfully processed by the AI system. The AI detected significant abnormalities in 169 of the studies. Of these, 97 were confirmed to have

significant missed findings by the reporting radiologist. The most common missed findings were pulmonary nodules (16%), pleural effusions (16%), spinal compression fractures (12%) airspace opacities (11%), acute rib fractures (9%) along with a number of other significant missed findings of hilar lymphadenopathy, pulmonary artery enlargement, bone lesions, interstitial thickening, pulmonary congestion, two shoulder dislocations and an acute clavicle fracture.

## CONCLUSION

The study demonstrates a time-effective means for auditing CXRs in a busy radiology department within a teaching hospital in order to provide constructive feedback to radiologists and trainees. A total of 1559 CXRs were automatically processed by AI allowing the radiologist to review the findings with 97 findings deemed significant out of the 169 studies detected by AI.

## CLINICAL RELEVANCE/APPLICATION

Integration of a comprehensive AI model in a real-world reporting environment has the potential to improve radiologist performance, ultimately improving patient care.

### W5B-SPCH-3 **Assessment of Intensive Care Unit Physician Performance and Perception towards AI Utilizing a Concurrent-Read Endotracheal Tube Detection Algorithm on Portable Chest Radiographs: A Multi-Reader, Multi-Case Study**

Participants

Kaustav Bera, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

## PURPOSE

AI tools to detect and measure endotracheal tubes (ETT) on frontal chest radiograph (CXRs) are primarily used by radiologists. The purpose of this study was to compare the interpretation time and performance improvement of ICU physicians for detection and measurement of ETT without and with concurrent AI assist. We also assessed the perception of the readers towards AI before and after the exercise in the form of multiple choice questionnaire.

## METHODS AND MATERIALS

A fully crossed multi-reader and multi-case reader study was conducted. 34 participating physicians engaged in critical care (16 fellowship-trained attendings; 18 physicians-in-training [15 fellows; 3 residents]) were enrolled and retrospectively interpreted 100 CXRs (50 with ET tube; 50 without) in two reading scenarios (once without and once with AI assist). Readers were also asked to self-record the interpretation times. Interpretations of any given case set with and without AI would be separated by 4 weeks of washout. The physician and AI interpretations were compared to the reference standard measurements by board-certified cardiothoracic radiologist (10 years experience). Sensitivity, specificity, PPV, NPV was used to evaluate performance. Performance and time to interpretation was compared between AI assisted and unassisted scenarios using Fisher's exact test and Wilcoxon rank sum test. A pre- and post-completion survey was also administered and analyzed using the Likert scale.

## RESULTS

We here present preliminary results for the first set before washout. Only completed surveys were taken for analysis (30%). AI had sensitivity, specificity, PPV, NPV and likelihood ratio of .98, .98, .98, .98, 49 ( $p < .001$ ) when compared to reference standard. Mean reader performance in terms of sensitivity, specificity and likelihood ratio were improved from 0.98, 0.91, 15 to 1, 0.97, 20 ( $p < .001$ ). The average interpretation time per case was significantly reduced by approximately 52% (median time 25 secs vs 16.5 secs;  $p < .01$ ). Following the completion of set 1 of the study, 75% of respondents expressed the desire to use AI in their clinical practice. Interestingly 63% of respondents had answered that they had no prior experience with AI at the beginning of the study.

## CONCLUSION

An FDA approved AI tool for detecting and measuring ETT distance on frontal CXRs showed excellent agreement with the ground truth, and significantly improved interpretation times as well as overall performance for ICU physicians across a broad spectrum of experience levels.

## CLINICAL RELEVANCE/APPLICATION

ETT AI tool showed excellent accuracy as well as helped ICU physicians improve their performance and time to interpretation. This paves the way for future prospective studies and ultimately bedside clinical deployment.

### W5B-SPCH-4 **Consecutive Cohort Analysis with Natural Language Processing (NLP) and Multi-finding AI Algorithm for Chest Radiographs: Multidimensional Opportunity for QA/QC**

Participants

Emiliano Garza Frias, MD, Monterrey, NL (*Presenter*) Nothing to Disclose

## PURPOSE

To assess if comprehensive discrepancy analysis of findings between NLP-based radiology reports search and a multi-finding, image-based AI algorithm can help audit quality of chest radiograph (CXR) reporting in community and quaternary healthcare settings.

## METHODS AND MATERIALS

Our IRB-approved, HIPAA-compliant, retrospective study included 3760 consecutive CXRs (PA/AP /or lateral views) from 3760 adult patients (age > 18 years) in two community and quaternary care hospitals. We queried an NLP-based radiology report search engine (Microsoft Nuance) for the presence of following findings: optimal/misplaced/absent lines/tubes (endotracheal tube, esophageal tube, pulmonary arterial and central venous catheters), solitary pulmonary nodule (SPN), pneumonia, simple pneumothorax, tension pneumothorax, pneumomediastinum, pneumoperitoneum, osteopenia, and compression vertebral fractures. Each radiology report (Rad1) was manually reviewed for presence of these findings by at least 1/5 participating physicians. Each CXR was processed with a multi-finding AI algorithm (Annalise.AI) for presence of the same findings. CXRs with discrepant finding between the NLP-Rad1 and the AI was blindly assessed by either one or two thoracic radiologists (Rad2/3) based on the discrepancies to establish the standard of reference. The data were analyzed with descriptive statistics.

## RESULTS



NLP/Rad1 and AI had high true positive and true negative concordance for CXR findings (lowest: 86.7%, 3260/3760; highest 98.8%, 3708/3760). Among the 3760 CXRs, the AI correctly identified false-negative (FNr) and false positive findings (FPr) in radiology reports for simple pneumothorax (FNr 0.4% [13/3760], FPr 0.2% [7/3760]); pneumonia (7.1% [270/3760], 1.2% [44/3760]), SPN (1.6% [60/3760], 1.7%[65/3760]), osteopenia (5.3% [200/3760], 0.2% [8/3760]), and compression fractures (3.1%, [114/3760], 0.2% [8/3760])

## CONCLUSION

Consecutive discrepancy analysis of NLP-based radiology reports search and AI outputs can help identify a substantial proportion of missed and overcalled CXR findings with low false positive or false negative frequencies.

## CLINICAL RELEVANCE/APPLICATION

Our proposed framework of NLP/AI for consecutive discrepancy analysis has broad applications such as a second reader to avoid missed or miscalled findings, and in peer-review and QA/QC efforts.

## W5B-SPCH- Glucose Metabolic Rate from Dynamic 18F-FDG PET/CT Scan to Differentiate Sarcoid Lymph Nodes from Malignant Lesions

5

Participants

Akihiro Inoue, MD, Kawadacho Shinjuku-Ku, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Long-term fasting 18F-Fluorodeoxyglucose positron emission tomography (FDG-PET) has contributed to the diagnosis of active inflammation in cardiac sarcoidosis (CS). In the diagnosis of FDG-PET, an accumulation of active sarcoid lymph nodes is often difficult to differentiate from lymphatic metastasis or lymphoma. In differentiating active sarcoid lymph nodes from malignant lesions, we investigate the potential of the glucose metabolic rate (MRglc, mg/min/100ml) that is a new quantification of glucose metabolic kinetics derived from dynamic FDG-PET scan with a silicon photomultiplier.

## METHODS AND MATERIALS

100 CS patients and 67 cancer-bearing patients who underwent dynamic FDG PET/CT scan with a silicon photomultiplier between March 2021 and December 2022 were enrolled. Mediastinal or hilar lymph nodes with SUVmax  $\geq 3$  in sarcoidosis patients and metastatic or primary lesions with SUVmax  $\geq 3$  in cancer-bearing patients were included in the analysis. MRglc was derived from tissue and plasma blood time-activity concentration curves using the Patlak linearization approach, with data acquired between 30 and 50 min after injection in dynamic FDG-PET/CT. Then, 60 minutes later, a standard scan performed. Active lesion was defined as SUVmax  $>3.0$  on standard whole body image. Use of parametric horizontal-axial image, mean value in VOI (size 1.5cm<sup>3</sup>) was measured.

## RESULTS

Forty-seven lymph node lesions from 25 of 100 CS patients and 39 malignant lesions from 27 of 67 cancer-bearing patients were included in the analysis. SUV and MRglc for sarcoid lymph nodes were significantly lower than those for malignant lesions (SUV, 4.93 $\pm$ 2.09 vs. 5.95 $\pm$ 2.32; MRglc, 2.42 $\pm$ 1.26 vs. 3.57 $\pm$ 1.57;  $p < 0.001$ ). Receiver-operating-characteristic analysis revealed that the ability to discriminate sarcoid lymph nodes and malignant lesions was the area under the curve (AUC) of 0.71, 77% sensitivity, and 60% specificity for SUV, AUC of 0.74, 80% sensitivity, and 66% specificity for MRglc, and AUC of 0.76, 90% sensitivity, and 62% specificity for the ratio of MRglc to SUV, respectively.

## CONCLUSION

MRglc and the ratio of MRglc to SUV are significantly lower for sarcoid lymph nodules than malignant. The use of MRglc improves sarcoid lymph nodes identification over SUV alone.

## CLINICAL RELEVANCE/APPLICATION

The ability to distinguish between sarcoid and metastatic lymph nodes with FDG-PET will lead to accurate staging of malignant tumors.

## W5B-SPCH- Incremental Prognostic Value of Deep learning-based Quantification of Macroangiopathic Aortic Changes for Cardiovascular Mortality in Heavy Smokers

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Participants

Alexander Rau, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

Macroangiopathic changes of the aorta are a common manifestation of cardiovascular (CV) disease. Currently, maximum diameter is the only prognostic measure used in clinical practice, despite quantification of other macroangiopathic changes (e.g. calcification) is available on computed tomography (CT) imaging. Thus, we applied a deep learning model to automatically quantify macroangiopathic changes of the aorta and investigated their prognostic value for CV mortality in a high-risk population of heavy smokers.

## METHODS AND MATERIALS

We used a deep learning model to automatically segment the aorta on lung screening chest CTs of participants enrolled in the National Lung Screening Trial at baseline and one-year follow-up. The following features were quantified: maximum diameter (cm), volume (deciliter) and calcifications (ml, categorized into tertiles). We assessed the association between (I) baseline features and CV and (II) the change of features within one year and CV mortality via multivariable Cox proportional hazard regression adjusted for traditional CV risk factors including smoking and hypertension. Harrel's c-index was used to compare the predictive value of the features.

## RESULTS

Among 24,770 participants at baseline (mean age 61.4 $\pm$ 5.0 years; 59.2% male) 440 (1.8%) CV deaths occurred over a mean follow-up of 6.3 $\pm$ 1.0 years. In univariate models, C-index of aortic volume and calcifications were significantly higher compared to

diameter (c-index 0.63 and 0.66 vs. 0.61;  $p=0.02$ ) for the prediction of CV mortality. After adjustment for traditional CV risk factors, volume (aHR: 1.04 [1.01-1.08];  $p=0.008$ ) and calcification (aHR: 2.53 [1.87-3.41];  $p<0.001$ ) remained significantly associated with CV mortality whereas the association for diameter was attenuated. In subjects with one year follow-up available ( $n=22,140$  individuals, mean age  $61.4\pm 4.9$  years; 58.3% male with a 1.5% CV), the strongest association was found between an increase in calcifications and CV mortality (aHR highest tertile: of 1.74 [1.32-2.29],  $p<0.001$ ) after multivariable adjustment for traditional CV risk factors.

## CONCLUSION

Deep learning can automatically quantify macroangiopathic changes of the aorta on lung screening chest CTs and identify individuals at high risk of CV mortality beyond traditional risk factors.

## CLINICAL RELEVANCE/APPLICATION

Deep learning-based quantification of macroangiopathic aortic changes can identify individuals at risk of CV mortality beyond traditional risk factors in a high-risk population of heavy smokers. This enables opportunistic risk assessment to improve personalized prevention and treatment strategies.

## W5B-SPCH- Dependent Contrast Layering Sign" on CT: Preliminary Cross Sectional Descriptive Study

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Participants  
Youssef Mohsen, MD, MS, Iowa City, IA (*Presenter*) Nothing to Disclose

## PURPOSE

CT findings of contrast layering in the dependent part of the central venous system have been reported to be associated with compromised cardiac function and imminent cardiac arrest. To the best of our knowledge, there is no systemic research on this finding and its association with cardiac arrest and mortality. Therefore we studied the radiologic findings of dependent contrast layering in vascular structures on CT and its clinical implications.

## METHODS AND MATERIALS

This single center retrospective study involved a list of 226 patients obtained by searching PACS reports for the keywords "layering of contrast", "pooling of contrast" or "dependent layering of contrast" in contrast enhanced CT chest and CT abdomen performed between Jan 2008 and Jan 2022. Two body radiologists reviewed for the dependent layering of contrast in vascular structures and parenchyma of abdominal organs. Clinical data were investigated from electronic medical records. The frequencies of the radiologic findings in association with clinical data were analyzed.

## RESULTS

Dependent contrast layering in the vascular structures is demonstrated in 21 patients (9.3%, mean age:  $67.4\pm 12.4$ ). Layering of contrast is shown in the IVC ( $n=19$ , 90.4%), hepatic vein ( $n=17$ , 80.9%), liver parenchyma ( $n=7$ , 30.3%), right atrium ( $n=5$ , 23.8%), and other organs ( $n=10$ , 47.6%). Among the 21 patients, 6 patients (28.5%) had cardiac arrest within 24 hours, all of which occurred within 2 hours. 11 patients (52.3%) died during their hospital stay. Layering in the right atrium shows the highest rate of cardiac arrest within 2 hours (4 of 5, 80%) followed by liver parenchyma (5 of 7, 71.4%). Reflux into liver parenchyma shows the highest rate of death during the same hospital stay (4 of 7, 57.1%). The mean number of involved structures per patient is  $3.29\pm 2.0$  (range 1-9). It is higher in patients who died during the same hospital stay ( $4.25\pm 1.15$ ) compared to those who survived ( $3.3\pm 2.02$ ). The mean number of involved structures is similar between the cardiac arrest ( $3.29\pm 1.98$ ) and non-cardiac arrest ( $3.28\pm 2.08$ ) groups. The mean left ventricular ejection fraction (LVEF) was  $38\pm 12\%$  (range 15-67). LVEF was less than 40% in 52% (10 of 19) of patients. The shock index was 0.9 or higher in 66.6% (12 of 18) of patients and its mean was  $1.08\pm 0.50$  (range 0.5-2.6).

## CONCLUSION

The CT findings of dependent contrast layering in the central venous system are related to high rates of imminent cardiac arrest and mortality.

## CLINICAL RELEVANCE/APPLICATION

Radiologists and technicians need to recognize these findings to alert clinicians the risk of cardiac arrest. Our study provides important preliminary data for radiologists and clinicians to recognize the significance of "Dependent contrast layering sign" for clinical decision-making.

## W5B-SPCH- Performance of a Novel Intravascular Tantalum Oxide-based CT Contrast for Enhancement and Conspicuity of Thoracic Vasculature in an Animal Model: Total and Relative Contrast Material Advantage

8

Participants  
Maurice Heimer, MD, Munich, Germany (*Presenter*) Nothing to Disclose

## PURPOSE

To compare a novel intravenous tantalum oxide (TaCZ) nanoparticle CT contrast agent to conventional iodinated (Iopromide) CT contrast agent for thoracic artery and vein visualization in a rabbit model.

## METHODS AND MATERIALS

Five New Zealand White rabbits were serially placed in a human-torso-sized adipose-equivalent encasement and scanned on a clinical CT system (Philips IQon, Best, Netherlands) before and 6, 40, 75, 136, and 240 sec after IV injection of 540 mg element (Ta or I) per kilogram of body weight of TaCZ or Iopromide. Animals were scanned twice, once with each contrast agent. Absolute contrast enhancement of the aortic arch, pulmonary trunk, superior vena cava, and subclavian vein was measured in Hounsfield Units (HU) by averaging three regions of interest drawn in the center of the lumen minus corresponding non-contrast measurements. Randomized imaging series were viewed on a clinical PACS system to rate vascular conspicuity on a 5-point Likert scale (0 = no vascular enhancement; 1 = faintly seen or visible but discontinuous; 2 = adequate contrast of main vessel, not all branches seen; 3 = good contrast of main vessel and depiction of branches; 4 = excellent contrast of main vessel and deep branches).

## RESULTS

Mean vascular enhancement was significantly higher for TaCZ in all examined blood vessels at all time points compared to Iopromide; aortic arch at 6s (263 vs. 217;  $p < 0.01$ ), at 40s (265 vs. 145;  $p < 0.01$ ), at 75s (240 vs. 119;  $p < 0.01$ ), at 136s (217 vs. 93;  $p < 0.01$ ) and at 240s (183 vs. 73;  $p < 0.01$ ), pulmonary artery at 6s (296 vs. 266;  $p < 0.01$ ), at 40s (263 vs. 138;  $p < 0.01$ ), at 75s (246 vs. 102;  $p < 0.01$ ), at 136s (213 vs. 83;  $p < 0.01$ ) and at 240s (174 vs. 64;  $p < 0.01$ ), superior vena cava at 6s (307 vs. 211;  $p < 0.01$ ), at 40s (255 vs. 127;  $p < 0.01$ ), at 75s (239 vs. 96;  $p < 0.01$ ), at 136s (196 vs. 79;  $p < 0.01$ ) and at 240s (169 vs. 49;  $p < 0.01$ ) and the subclavian vein at 6s (280 vs. 225;  $p < 0.01$ ), at 40s (254 vs. 111;  $p < 0.01$ ), at 75s (236 vs. 86;  $p < 0.01$ ), at 136s (205 vs. 67;  $p < 0.01$ ), and at 240s (170 vs. 54;  $p < 0.01$ ). The mean vascular enhancement of TaCZ at a 136s delay provided comparable results to the 6s arterial phase of Iopromide (213 vs. 223;  $p > 0.05$ ). Overall, vascular enhancement correlated well with perceived vascular conspicuity scores for both agents.

## CONCLUSION

s TaCZ provides both an absolute and relative contrast advantage compared to Iopromide for improved visualization of the thoracic arteries and veins across a broad range of timepoints after contrast injection.

## CLINICAL RELEVANCE/APPLICATION

TaCZ gives superior prolonged thoracic vascular enhancement over iodine agents at CT and warrants clinical testing as a means to improve the quality and consistency of CT angiograms and venograms.

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## Abstract Archives of the RSNA, 2023

W5B-SPER

### Emergency Radiology Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPER-1 Channeling the Neuroradiology Crystal Ball: Predicting Presenting Symptoms Associated with Imaging-Proven Acute Cord Compression in the Emergency Department**

#### Participants

Mercy Mazurek, Boston, MA (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Spinal cord compression (CC) can result from both atraumatic and traumatic causes. CC commonly presents with back pain, urinary incontinence, lower extremity weakness, and malignancy, among others. While the occurrence of these symptoms is high, the prevalence of CC due to both atraumatic and traumatic causes is low. Understanding the clinical symptoms that are associated with CC may better inform the utilization of imaging in the emergency department (ED) to reduce costs and provide efficient care.

#### **METHODS AND MATERIALS**

This retrospective study analyzed patients who underwent our ED's abbreviated survey spine MRI protocol for suspected CC from 2018 to 2022. The survey protocol includes sagittal T2 and short-TI inversion-recovery (STIR), with optional axial T2. Imaging reports were reviewed by a blinded, board-certified neuroradiologist and characterized as positive or negative for CC. Demographic factors and presenting symptoms were extracted from the electronic medical record and compared among patients with imaging-positive acute CC vs negative. Univariate analysis was performed using the student's t-test and chi-squared test. A multivariate logistic regression was performed with stepwise backwards elimination where the variable with the largest P value was removed in a stepwise fashion in each iteration until all variables on the final model had a  $P < .20$ .

#### **RESULTS**

A total of 845 patients (mean age  $57 \pm 19$  years, 45% female) received a survey spine MRI for suspected CC during the study period. Of these, 23% presented with trauma, 55% back pain, 29% lower extremity weakness, 5.7% history of malignancy, 14% urinary incontinence, 6.0% bowel incontinence, 14% neck pain, 20% numbness, 7.3% ataxia, and 6.4% hyperreflexia. There were 725 (85%) and 120 (14%) patients negative and positive for CC, respectively. In the univariate model, trauma, back pain, numbness, ataxia, and hyperreflexia were significantly associated with having a positive study (Table 1). In the multivariate model, trauma, back pain, lower extremity weakness, urinary or bowel incontinence, numbness, ataxia, and hyperreflexia were significantly associated with being positive for acute CC (Table 2).

#### **CONCLUSION**

Presenting symptoms of trauma, back pain, lower extremity weakness, urinary or bowel incontinence, numbness, ataxia, and hyperreflexia were significantly associated with positive CC findings on ED survey spine evaluation in the ED. These results may inform which patients should receive triage priority in the ED.

#### **CLINICAL RELEVANCE/APPLICATION**

Understanding the symptoms associated with acute CC informs efficient utilization of abbreviated, CC-specific survey spine MRI protocols to limit unnecessary imaging studies thereby expediting diagnosis and emergent treatment.

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## Abstract Archives of the RSNA, 2023

W5B-SPGI

### Gastrointestinal Imaging Wednesday Poster Discussions II

#### Sub-Events

#### W5B-SPGI-1 Preoperative Prediction of Ki-67 Expression in Hepatocellular Carcinoma by Spectral Imaging on Dual-Energy CT

##### PURPOSE

To investigate the value of quantitative spectral parameters measured on a dual-energy CT in preoperative predicting the expression level of Ki-67 in HCC.

##### METHODS AND MATERIALS

91 HCC patients underwent both pathological examination and two-phase contrast-enhanced CT scanning with spectral imaging mode were included in this study. According to Ki-67 expression determined by the Ki-67 positivity rate (Ki-67%), patients were divided into two groups: high expression group (Ki-67% > 20%, n = 51) and low expression group (Ki-67% = 20%, n = 40). CT values on 100 and 140 keV monochromatic energy images (HU100-140keV), normalized effective atomic number (Neff-Z), water density (Dwater), fat density (Dfat) were measured and calculated. The parameters comparison between groups, receiver operation curve for prediction efficacy evaluation were conducted.

##### RESULTS

The Neff-Z, Dfat, HU100-140keV and Dwater in high expression group were significantly higher than those in low expression group (all P < 0.05). In prediction of Ki-67 expression, the AUCs of Neff-Z, Dfat, HU100-140keV and Dwater were 0.650, 0.677, 0.692-0.750, 0.777. The corresponding sensitivities were 0.647, 0.804, 0.529-0.824 and 0.961, respectively. The specificities were 0.600, 0.525, 0.825-0.625 and 0.475, respectively. Dwater showed highest Ki-67 expression prediction performance, with AUC of 0.777. The multi-variable analysis combining spectral CT parameters and morphological characteristics improved the prediction efficiency (AUC=0.814).

##### CONCLUSION

The spectral parameters (Neff-Z, Dfat, HU100-140keV and Dwater) obtained by contrast-enhanced spectral imaging on dual-energy CT can be used to predict Ki-67 expression in HCC, the efficiency would be improved by multi-parameter analysis combining spectral CT parameters and morphologic features.

##### CLINICAL RELEVANCE/APPLICATION

Ki-67 was a significant marker for HCC prognosis and clinical decision, however current method to evaluate Ki-67 always needs surgery, which is detrimental for assessing patients who lost surgery chance. Contrast-enhanced spectral imaging on dual-energy CT provides various parameters to predict cell proliferation in HCC with good performance, shedding lights in clinical diagnosis and therapeutic strategy decision.

#### W5B-SPGI-2 The Added Value of Reduced field-of-view IRIS-DWI Sequence for T2WI Sequence in T Staging of Rectal Cancer

#### W5B-SPGI-3 Impact of MRI after CT on the Therapeutic Decision of Pancreatic Adenocarcinoma

##### PURPOSE

The purpose of this work is to determine the impact of MRI after CT on the therapeutic decision of pancreatic adenocarcinoma.

##### PURPOSE

Oblique axial high-resolution T2WI(HR-T2WI)was the recommended sequence for rectal cancer T staging.We attempted to evaluate the added value of reduced field-of-view (rFOV) IRIS-DWI sequence for T2WI sequence in evaluating T staging of rectal cancer.

##### METHODS AND MATERIALS

All patients underwent rectal MRI examinations in our institution between June 2022 and November 2022 . rFOV IRIS-DWI and oblique axial HR-T2WI images were acquired using a 3.0T MR scanner (Ingenia Elition, Philips, Best, the Netherlands) (Table 1). All patients were evaluated in two rounds by two methods. First, one senior radiologist (Y.K.M.) with more than 7 years of experience in rectal cancer MRI evaluated the T staging based on oblique axial HR-T2WI images and recorded the diagnosis confidence. Second, the same radiologist (Y.K.M.) reevaluated the T staging based on rFOV IRIS-DWI and HR-T2WI images after one-week interval.The diagnosis confidence was also recorded. The radiologist was blind to the detailed pathologic T staging. MedCalc statistical software (version 20.116) was used for data analysis. The accuracy of two diagnosis methods between oblique axial HR-T2WI and T2WI + rFov IRIS were compared by paired t-test. Paired sample t-test was used to compare the diagnosis confidence between the two diagnosis methods. ROC curve was used to evaluate the diagnostic performance for pT3 staging. P < 0.05 indicated the difference was statistically significant.

##### METHODS AND MATERIALS

It's a prospective, cross-sectional and evaluative study over 24 months from January 2020 to December 2021 of patients suspected of having pancreatic cancer.

## RESULTS

A total of 117 cases of patients were included, aged 34-91 years with an average age of  $62 \pm 11$  years and a sex ratio of 1.25. The average diameter is  $43.61 \pm 15.268$  mm. The TDM and MRI assessment of resectability was performed according to NCCN version 1.2020 criteria. 46 patients (i.e. 39.3%) were at the metastasis stage, 36 patients (i.e. 30.8%) resectable, 19 patients (i.e. 16.2%) locally advanced and 16 patients (i.e. 13.7%) borderline resectability. To determine the impact of MRI after CT on the treatment decision, we compared the staging of the resectability of each of the two techniques by referring to surgery for resectability and metastases and to MRI data for characterization of liver damage. The analysis showed that in 15 patients (i.e. 12.8%) the therapeutic approach was changed on MRI after CT.

## RESULTS

Twenty-seven patients with rectal cancer were enrolled in this retrospective study. The average age was  $66.7 \pm 6.9$  years, and there were 15 (56%) males (Table 2). The diagnosis accuracy for pT1-pT2 and pT3 was 58.3% and 73.3% according to oblique axial HR-T2WI. According to the oblique axial HR-T2WI and rFOV IRIS-DWI, 11 patients (91.7%) in 12 pT1-T2 staging patients and 14 patients (93.3%) in 15 pT3 staging patients were accurately diagnosed ( $P < 0.0001$ ) (Table 3). Based on T2WI + rFOV IRIS-DWI imaging showed higher diagnosis confidence, and the diagnosis confidence were 2.9 and 2.37 in all patients ( $P < 0.001$ ). For pT2 and pT3 staging subgroups, the diagnosis confidence based on T2WI + rFOV IRIS-DWI imaging also showed higher confidence (2.8 vs. 2.1,  $P = 0.01$ ; 2.93 vs. 2.53,  $P = 0.009$ , respectively) (Table 4). ROC analysis showed the diagnosis performance based on T2WI + rFOV IRIS-DWI imaging was superior to T2WI sequence. The AUC, sensitivity and specificity were 0.928, 93.3%, 91.7% and 0.658, 73.3%, 58.3%, respectively ( $P = 0.002$ ) (Table 5, Figure 3).

## CONCLUSION

Complementary MRI to CT led to changes in resectability and therapeutic management in a significant proportion of patients with ADCP

## CONCLUSION

rFOV IRIS-DWI combined T2WI imaging provide higher diagnosis confidence and higher diagnosis accuracy for rectal cancer T staging.

## CLINICAL RELEVANCE/APPLICATION

Complementary MRI to CT => changed resectability and therapeutic management

## CLINICAL RELEVANCE/APPLICATION

rFOV IRIS-DWI improved the diagnosis performance in rectal cancer T staging.

## W5B-SPGI-4 Imaging Features Prognostic of Overall Survival in Patients with Advanced Hepatocellular Carcinoma Undergoing Systemic Therapy

Participants

Kathleen Ruchalski, MD, Santa Monica, CA (Presenter) Nothing to Disclose

## PURPOSE

Modified RECIST measures arterial enhancement of liver lesions in hepatocellular carcinoma (HCC), evaluating treatment related alterations in tumor viability not captured by size alone. However mRECIST clinical translation to advanced HCC and ability to predict response to systemic therapy is less well reported. Our objective is to evaluate for imaging features beyond RECIST 1.1 which correlate with overall survival (OS) in advanced HCC.

## METHODS AND MATERIALS

This is a retrospective study of patients with advanced HCC at our institution enrolled in clinical trials for systemic treatment between 2015-2022. Patient characteristics and OS were obtained. Liver tumor imaging features on baseline CT or MRI chest, abdomen pelvis were analyzed. Relationship to overall survival (OS) was assessed by cox regression model and log rank test.

## RESULTS

Of 74 patients, we identified 53 who met our criteria, enrolled in a clinical trial with baseline imaging. There were 40 (75.5%) men and 13 (24.5%) women with a mean age of 66.2 years ( $SD = 9.5$ ). Median OS was 31.5 months. Percent total liver tumor involvement n = (%) included: < 25% n=25 (47.2%), 25-50% n=20 (37.7%), 51-75% n=8 (15.1) patients. Multifocal liver disease and macrovascular invasion were present in 41 (77.4%) and 25 (47.2%) of patients respectively. Individual liver lesions measured on average 41.7mm ( $SD = 28.2$ ) on arterial phase. Lesion margins were characterized as infiltrative (n=14 (13.2%)), irregular (n=19 (17.9%)), well circumscribed (n=60 (56.6%)) and N/O (n=13 (12.3%)). Arterial enhancement patterns were described as central heterogeneous in 41 (38.6%), homogeneous: 24 (22.6%), partial enhancement: 15 (14.2%), rim only: 11 (10.4%) and no enhancement in 15 (14.2%) patients respectively. Multifocal liver disease was associated with significantly increased risk of death ( $p = 0.043$ ). Patients with partially enhancing liver lesion had improved survival compared to those with central heterogeneously enhancing tumor ( $HR = 0.28$ ;  $p = 0.044$ ). Individual liver lesion size ( $p = 0.399$ ), margin ( $p = 0.289$ ) and % liver involvement ( $p = 0.125$ ) did not correlate with OS.

## CONCLUSION

While lesion size was not prognostic, presence of multifocal liver disease and central heterogeneous tumor enhancement were poor prognostic features of OS for advanced HCC.

## CLINICAL RELEVANCE/APPLICATION

Although further investigation is required, reporting imaging findings on multifocal liver disease and arterial enhancement pattern may provide prognostic information for patients with advanced HCC undergoing systemic therapy.

## **W5B-SPGI-5 Participant Study on Predicting Pathological Grade of Rectal Adenocarcinoma based on Extracellular Volume Fraction of CT**

Qingyang Li, Hohhot, China (*Presenter*) Nothing to Disclose

### **PURPOSE**

Objective The purpose of this study was to explore the feasibility of predicting the pathological grade of rectal adenocarcinoma based on extracellular volume fraction (ECV) of enhanced CT.

### **METHODS AND MATERIALS**

Methods From October 2021 to October 2022, enhanced CT scanning was performed in our hospital. 25 cases of high-grade and 71 cases of low-grade rectal adenocarcinoma were confirmed by operation and pathology. According to the histological classification of colorectal adenocarcinoma (non-special type) (according to the 2010 WHO standard), patients were divided into low-grade group and high-level group. The clinicopathological features, routine CT parameters and ECV were compared between the two groups, the ECV of the primary focus was calculated by measuring the CT values of the areas of interest in the non-contrast scan and the balance period. The independent predictors for predicting the pathological grade of rectal adenocarcinoma were screened by binary Logistic regression, and the joint predictors were constructed. The diagnostic efficacy of independent predictors and joint predictors was evaluated by ROC curve.

### **RESULTS**

Results 1. There was no significant difference in gender (0.065), age (0.547) and preoperative CEA (0.343) between the two groups. There was significant difference in the longest diameter of tumor between the two groups ( $P < 0.05$ ). 2. Among the routine CT parameters, there were significant differences in arterial phase ( $P < 0.012$ ), equilibrium phase ( $P < 0.007$ ), S 1 ( $P < 0.001$ ) and S 3 ( $P < 0.006$ ). 3. There was significant difference in ECV between the two groups ( $P < 0.05$ ). 4. Binary Logistic regression analysis showed that ECV and S1 were independent predictors of high-grade rectal adenocarcinoma. 5. ROC curve comparison results: the AUC of ECV is 0.796, with 34.54% as the cutoff value, the sensitivity is 80%, the specificity is 77.46%; the AUC of S1 is 0.714, with 21.1HU as the cutoff value, the sensitivity is 88%, the specificity is 53.52%; the AUC of joint prediction factor Y is 0.869%, with 0.365 as the cutoff value, sensitivity is 76%, specificity is 88.73%.

### **CONCLUSION**

s Conclusion The longest diameter of tumor, CT value of arterial phase, CT value of equilibrium phase, S1, S3 and ECV are the influencing factors to predict the pathological grade of rectal adenocarcinoma. S1 and ECV are the independent factors to predict the pathological grade of rectal adenocarcinoma. S1, ECV and combined predictor Y have certain accuracy in predicting the pathological grade of rectal adenocarcinoma.

### **CLINICAL RELEVANCE/APPLICATION**

Applying ECV to rectal adenocarcinoma further provides a basis for its application in the abdomen.

## **W5B-SPGI-6 Multiparametric MRI Tumor Sub-region Analysis for Predicting Microvascular Invasion in Hepatocellular Carcinoma**

### **PURPOSE**

Microvascular invasion (MVI) is a major prognostic factor for hepatocellular carcinoma (HCC), and preoperative identification of MVI is crucial for determining proper treatment strategies.<sup>1</sup> However, detecting MVI through imaging tests such as CT and MRI is challenging, and histopathological diagnosis is required.<sup>2</sup> This study aims to investigate the feasibility of multiparametric MRI tumor subregion analysis for predicting MVI in HCC patients and evaluate the performance of tumor subregion features.

### **METHODS AND MATERIALS**

42 patients with HCC were included and divided into MVI-positive and MVI-negative groups. MRI examination included T2-weighted, diffusion-weighted imaging, and Gadoxetic acid-enhanced imaging (precontrast, arterial phase, and hepatobiliary phase). K-means clustering algorithm was used to identify three functional clusters based on ADC, wash-in slope, and wash-out slope. Tumor subregion volume fraction was compared between MVI-positive and MVI-negative groups using a Wilcoxon signed-rank test, with a p value of less than 0.05 considered statistically significant.

### **RESULTS**

The identified clusters were: (1) high perfusion cluster with high wash-in and wash-out slope, (2) low tumor aggressiveness cluster with low wash-in, wash-out slope, and low ADC, (3) necrotic cluster with low wash-in, wash-out slope, and high ADC. Tumor subregion analysis showed higher volume fraction of high perfusion and necrotic clusters and lower volume fraction of the low tumor aggressiveness cluster in the MVI-positive group compared to the MVI-negative group, although only the volume fraction of the necrotic area showed a significant difference ( $P = 0.0271$ ). The traditional ADC value of the whole tumor showed no statistical difference between the two groups ( $P > 0.05$ ).

### **CONCLUSION**

s Multiparametric MRI tumor subregion analysis can identify tumor regions with high perfusion, necrosis, and low tumor aggressiveness, which can aid in predicting MVI in HCC patients.

### **CLINICAL RELEVANCE/APPLICATION**

Multiparametric MRI tumor subregion analysis is a promising radiological tool for predicting MVI in HCC, which can lead to the proper treatment strategy for patients with HCC.

## **W5B-SPGI-7 Exosomal Nanoprobe Exo-USIO and its Combination with Gemcitabine for the Treatment of Pancreatic Cancer**

### **PURPOSE**

Pancreatic cancer is a malignant tumor of the digestive system, which has not obtained substantial breakthrough in early diagnosis

as well as chemotherapy in the middle and late stages due to the diagnosis and treatment dilemmas, such as poor blood supply imaging and chemoresistance caused by poor oxygen. In this study, metal nanomases were targeted and delivered to pancreatic cancer tumors by utilizing the properties of exosomes targeted homing and delivery carriers, which improved tumor hypoxia and promoted the therapeutic effect of GEM while accurately imaging tumors.

## **METHODS AND MATERIALS**

Nanozyme ultrasmall iron oxide nanoparticles (USIO NPs) with T1 weighted imaging were loaded into panc-02 cell-derived exosomes using the electroporation method, and the exosomal nanoprobe Exo-USIO was constructed and characterized, and its enzyme like efficacy was determined. The efficacy of Exo-USIO combined with gemcitabine (GEM) to inhibit the proliferation of hypoxic Panc-02 cells was investigated by CCK-8 and flow cytometric apoptosis assays; The effect of the nanoprobe on tumor targeted MR imaging of pancreatic cancer was investigated by tail vein injection of Exo-USIO; Based on tail vein injection of Exo-USIO combined with intraperitoneal injection of GEM, the in vivo therapeutic effect of Exo-USIO combined with gem was investigated.

## **RESULTS**

A series of characterizations have shown the successful preparation of exosomal nanoprobe Exo-USIO with good stability and a peak particle size distribution of approximately 122.5nm. In vitro cell experiments have shown that nanoprobe has strong homing ability, which can improve the efficiency of USIO NPs entering tumor cells, thereby enhancing enzyme like efficiency, catalyzing endogenous H<sub>2</sub>O<sub>2</sub> production of O<sub>2</sub> in cells, and reducing the HIF-1 $\alpha$  protein expression level in hypoxic cells. When the nanoprobe was combined with GEM, the cell inhibition rate and apoptosis rate of the two Exo-USIO concentration groups were higher than those of the USIO NPs group. In tumor bearing mice, the nanoprobe Exo-USIO demonstrated the ability to target MR imaging of tumors and overcome tumor hypoxia in an almost non-toxic manner, achieving good therapeutic effects after combined application of GEM.

## **CONCLUSION**

Exosomal nanoprobe Exo-USIO was successfully fabricated with good enzyme like potency to improve tumor hypoxia, thereby strengthening the therapeutic effect of GEM.

## **CLINICAL RELEVANCE/APPLICATION**

Taken together, syngeneic cell-derived exosomes are effective vehicles for targeted delivery of USIO NPs to pancreatic cancer tumors, and this delivery strategy may provide some guidance for precise diagnosis and treatment of pancreatic cancer.

## **W5B-SPGI-8 Energy Spectral Computed Tomography for Predicting Mutation Status of c-KIT exon 11 in Patients with Gastrointestinal Stromal Tumors**

### **PURPOSE**

This study aims to evaluate the value of quantitative parameters of energy spectrum CT in predicting the mutation status of c-KIT exon 11 in gastrointestinal stromal tumors (GISTs), construct predictive models, and draw nomogram to assist in clinical treatment decision-making.

### **METHODS AND MATERIALS**

61 patients with confirmed GISTs by pathology were retrospectively enrolled. All patients underwent energy spectrum CT preoperatively and c-KIT gene testing. chi-square test, Mann-Whitney U test and independent sample t test were used to compare and analyze the clinical and energy spectrum CT quantitative parameters of patients. The statistically significant parameters in the above univariate analysis were incorporated into Logistic regression, screen independent predictors for predicting the mutation status of c-KIT exon 11. Draw nomogram of clinical + spectral CT quantitative parameters model for predicting the mutation status of c-KIT exon 11, and evaluate the discrimination, calibration, and clinical net benefit of nomogram using C-index, calibration curve, and decision curve analysis.

### **RESULTS**

In our research, 26 were men and 35 were women. The average age of all participants was 59.25 $\pm$ 14.25 years. In the quantitative parameters of energy spectrum CT, the CT values at a single energy level of 40 keV-120 keV (all, P<0.05), energy spectrum curve slope K (P=0.002), iodine concentration (IC) (P=0.002), normalized iodine concentration (NIC) (P=0.004) in the venous phase, and the CT values at a single energy level of 40 keV-60 keV (all, P<0.05), energy spectrum curve slope K (P=0.002), IC (P=0.002), NIC (P=0.004) in the delay phase of c-KIT exon 11 mutant type is lower than c-KIT exon 11 wild type. The C-index of nomogram of the clinical+energy spectrum CT quantitative parameters model was 0.827 (95% CI: 0.723-0.932), the sensitivity and specificity were 72.5% and 81.0%, respectively. The calibration curve showed the predicted values of the models was in good consistency with the actual values (P=0.724). Decision curve analysis showed that nomogram model achieved high clinical net benefits.

### **CONCLUSION**

Age and the quantitative parameters of energy spectrum CT can be used as preliminary evaluation indicators for the mutation status of GISTs c-KIT exon 11. The clinical combined energy spectrum CT quantitative parameters model has high efficiency in predicting the mutation status of GISTs c-KIT exon 11.

### **CLINICAL RELEVANCE/APPLICATION**

The quantitative parameters derived from energy spectrum CT may become a useful, and non-invasive clinical imaging index for predicting the mutation status of GISTs c-KIT exon 11, and can assist in clinical risk stratification and determining treatment plans for patients.



## Abstract Archives of the RSNA, 2023

W5B-SPGU

### Genitourinary Imaging Wednesday Poster Discussions II

#### Sub-Events

#### W5B-SPGU- Deep Learning Prostate MRI Progression Risk Interval Prediction

1

Participants

Christian Roest, MSc, GRONINGEN, Netherlands (*Presenter*) Grant, Siemens AG

#### PURPOSE

MRI follow up is increasingly used to manage patients with low-risk prostate cancer, (PCa) but lacks personalization of follow-up timing. Therefore, We propose a novel AI approach to predict the time to prostate cancer progression.

#### METHODS AND MATERIALS

This retrospective study was performed on a dataset of 875 patients that underwent an MRI of the prostate between 2014 and 2021. Patients received follow-up MRIs and targeted biopsy for all PI-RADS=3 lesions. This study defined progression as the detection of ISUP>1 PCa at follow-up. A novel deep learning model was developed and trained to predict progression-free survival (PFS) based on the MRI and available clinical parameters (PSA, PSA density, prostate volume, and age). Five-fold cross-validation was used to obtain likelihood scores for the three-year risk of progression in each patient. Patients were stratified into high- and low-risk groups based on their predicted likelihood of progression, with an equal number of patients in each group. Kaplan-Meier analyses validated whether the predicted likelihood accurately predicted PFS. Finally, the C-index was calculated to assess the prognostic accuracy of our model.

#### RESULTS

Our AI model's predictions were significantly associated with PFS in the test data ( $p < 0.0001$ ). The C-index was  $0.72 \pm 0.05$ , indicating that our model was a good predictor of PFS. PFS was significantly better in patients predicted to be at low-risk of disease progression, when measured after two years ( $95.3 \pm 0.04\%$  vs  $84.9 \pm 0.02\%$ ,  $p = 0.008$ ), three years ( $92.7 \pm 0.05\%$  vs  $73.3 \pm 0.04\%$ ,  $p = 0.008$ ) and four years ( $87.7 \pm 0.12\%$  vs  $62.8 \pm 0.04\%$ ,  $p = 0.008$ ).

#### CONCLUSION

Our novel AI approach accurately predicted PFS from prostate MRI and clinical information.

#### CLINICAL RELEVANCE/APPLICATION

An improved predictor for the time to progression based on MRI and clinical parameters may improve MRI follow-up protocols by enabling more personalized interval timing and decision making.

#### W5B-SPGU- Detection of Clinically Significant Prostate Cancer in Men with a Negative Initial Round of Targeted Biopsies and Highly Suspicious Multiparametric Magnetic Resonance Findings

2

Participants

Debora Recchimuzzi, MD, Sao Paulo, (*Presenter*) Nothing to Disclose

#### PURPOSE

The purpose of this study was to evaluate the frequency of imaging-pathology discordance and the rate of csPCa detection on repeat TBx.

#### METHODS AND MATERIALS

This single-center, retrospective study of prospectively generated data, included all men who underwent mpMRI and had a PIRADS score 4 or 5 at our institution between Jan/2017 and Nov/2022. The frequency of imaging pathology discordance (PI-RADS score 4 or 5 lesion and no csPCa on TBx) and the rate of csPCa (grade group 2 or higher) detection on a repeat TBx (MRI-TRUS fusion or in-bore biopsy) were determined. Univariate analysis and multiple analysis with logistical regression were used to identify potential parameters associated with true-negative targeted biopsies, including PSA, PSA density, prostate volume as measured by MRI and ADC measurement.

#### RESULTS

Of the 4047 men reviewed, 63% (2581/4047) had PI-RADS 4 or 5 lesions on mpMRI followed by TBx. In 40% (1050/2581) of these men, TBx did not reveal csPCa. Among these 1050 men with discordant imaging-pathology findings, 18% (191/1050) men had a repeat targeted biopsy (MRI-TRUS fusion or MRI guided inbore), and 40 men underwent radical prostatectomy for grade group 1 disease. Repeat TBx identified csPCa in 35% (67/191) of the men who underwent a second TBx. The frequency of csPCa at repeat biopsy was significantly higher for PIRADS 5 (45%; 32/70) compared to PIRADS 4 lesions (28%; 35 of 121) ( $p =$ ).

#### CONCLUSION

A negative targeted biopsy of a highly suspicious lesion on mpMRI must be interpreted with caution and early repeat biopsy should

be considered, particularly in men with PI-RADS 5 lesions.

#### **CLINICAL RELEVANCE/APPLICATION**

Multiple studies have demonstrated that men with highly suspicious (PI-RADS score 4 and 5) prostate lesions at multiparametric MRI (mpMRI) are highly likely to harbor clinically significant prostate cancer (csPCa). The degree of suspicion on multiparametric MRI is the strongest predictor of a positive targeted biopsy with positive rates of 70% to 90% when the MRI findings are highly suspicious for PCa. It is known that prostate biopsies - including targeted biopsies (TBx) - are vulnerable to sampling error. Discordance between histologic and imaging findings may indicate, therefore, that the lesion may not have been sampled adequately, highlighting the importance of a systematic post-biopsy imaging-pathology concordance review.

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## Abstract Archives of the RSNA, 2023

W5B-SPHN

### Head & Neck Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPHN- Quantitative Gland Function Analysis in Dry Mouth Patient using T1, T2 and PD Mapping based on the Multi-dynamic Multi-echo Method**

Participants

Chena Lee, DDS, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

Dry mouth is a subjective complaint of dryness of intraoral cavity and the primary etiology is the hypofunction of salivary gland. Clinical diagnosis is conducted by collecting patient's whole saliva and evaluate the volume and this is a time consuming cumbersome examination. Thus, the current study aimed to utilize T1, T2 and PD mapping as diagnostic tool for parotid gland dysfunction in dry mouth patients.

#### METHODS AND MATERIALS

Dry mouth (n = 32) and control subjects (n = 30) that underwent magnetic resonance imaging (MRI) from July 2020 to December 2022 were reviewed. The T1, T2, and PD mapping of the parotid gland were evaluated simultaneously based on the multi-dynamic multi-echo (MDME) MR imaging. The values from control and dry mouth group were compared using Mann-Whitney test and receiver operating characteristic (ROC) curve analyses.

#### RESULTS

The mean of T1, T2-relaxation time and PD value of the gland in dry mouth group were 606.90 ms, 91.63 ms, and 82.37 pu, respectively. The mean of T1, T2-relaxation time and PD value of control group were 628.08 ms, 80.69 ms and 91.12 pu. The T2-relaxation time and PD value showed significant difference between the dry mouth and control group while there no significant difference between two groups in T1-relaxation value. The area under the ROC curve (AUC) was 0.8164 and 0.7564 respectively for T2-relaxation time and PD value. The diagnostic performance between T2-relaxation time and PD value were not significantly different (p-value = 0.4851).

#### CONCLUSION

s The T2-relaxation time and PD value can be used as quantitative indicators of dry mouth due to hypofunction of parotid gland and the performance of T2-relaxation time presented higher diagnostic ability. Further study with large population could be leaded to more accurate result.

#### CLINICAL RELEVANCE/APPLICATION

T2 and PD mapping, based on the MDME technique, presented diagnostic ability for detecting parotid gland hypo function and could be utilized as quantitative tool for dry mouth diagnosis in clinic.

#### **W5B-SPHN- From Suspected to Confirmed : Intrathecal Gadolinium-Enhanced MR Cisternography as a Key Diagnostic Modality in CSF Rhinorrhoea**

#### PURPOSE

To establish the role and diagnostic accuracy of Intrathecal gadolinium enhanced MR Cisternography in clinically suspected cases of CSF rhinorrhoea

#### METHODS AND MATERIALS

As of now, a total of 19 consecutive patients with active or suspected CSF rhinorrhea have been included in this study. History of trauma was present in 8 patients (42%), endoscopic surgery in 5 patients (26%), spontaneous in 6 patients (32%). Most of the patients had CT PNS which showed evidence of skull base fractures, defects or erosions. We used mixture of non-ionic iodinated contrast (5 ml of iohexol; Omnipaque 300) with Gadolinium (0.4 ml of gadobutrol; Gadovist) along with normal saline (5 ml of 0.9 % normal saline) for injecting into the intrathecal space. MR sequences were taken approximately 30-40 minutes after the contrast injection. For all patients, hemodynamic studies (heart rate, blood pressure) and evaluation of neurologic status were performed.

#### RESULTS

We observed objective CSF leakage in 11 of 19 patients (58%). The CSF leak was located in the cribriform plate in 7 patients (37%), in the superior wall of the sphenoid sinus/planum sphenoidale in 4 patients (21%), fovea ethmoidalis/roof of ethmoid sinus in 2 patients (11%), through the post-operative sella turcica defect in 1 patient (5%), including multiple defects identified in 4 patients (21%). No objective CSF leakage in spite of bony defect was seen in 4 patients (21%). No bony defect and no objective CSF leakage were seen in 4 patients (21%). Surgical closure of CSF leak was performed in all patients with positive findings on cisternography and the site of leak was confirmed intraoperatively. Post-procedure 6 patients (32%) had mild headache. No other adverse event were noted.

## CONCLUSION

s MR cisternography after the intrathecal administration of gadolinium represents an effective and minimally invasive method for evaluating suspected CSF fistulas along the skull base. It provides multiplanar capabilities and high resolution without risk of radiation exposure and is an excellent approach to depict the anatomy of CSF spaces and CSF fistulas. Furthermore, use of combination of non-ionic iodinated contrast with gadolinium increase the distribution of contrast in subarachnoid space and improve the resolution when compared with just using gadolinium. No significant gross neurologic abnormalities were observed during the initial examination or during follow-up.

## CLINICAL RELEVANCE/APPLICATION

CSF rhinorrhoea is potentially very serious because of the risk of an ascending infection which could produce fulminant meningitis. Exact identification of the location of the CSF fistula is important for proper surgical planning, increases the chances of dural repair and can prevent complications.

## W5B-SPHN- Tracheal Cartilage Calcification and Glucose Metabolism in Aging Adults Assessed by 18F-NaF and 18F-FDG PET/CT

Participants

NilooFaralsadat Motamedi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

## PURPOSE

The purpose of this study was to examine if 18F-sodium fluoride (18F-NaF) and 18F-fluorodeoxyglucose (FDG) PET/CT can be used to measure physiological calcification and glucose metabolism of the tracheal cartilage, respectively, and whether there was any association with aging.

## METHODS AND MATERIALS

Out of 139 healthy control subjects from the CAMONA study (NCT01724749), a total of 128 subjects in whom tracheal cartilage could be segmented on 18F-NaF-PET/CT (mean age  $48.58 \pm 14.44$  years, 51.56% males) were included in the analysis. Similarly, a total of 119 subjects (mean age  $48.46 \pm 14.34$  years, 54% males) in whom tracheal cartilage could be segmented on FDG-PET/CT were included in the analysis. The PET/CT acquisitions were performed 90 minutes after 18F-NaF administration and 60 minutes after FDG administration. The mean standardized uptake value (SUV<sub>mean</sub>) of both tracers was measured by assigning regions of interest (ROIs) around the cartilage using OsiriX software (Pixmeo SARL, Bernex, Switzerland). To assess the relationship of tracheal calcification and glucose metabolism with aging, Pearson correlation analysis was performed between age and the 18F-NaF and FDG, respectively.

## RESULTS

A statistically insignificant positive correlation was present between age and 18F-NaF SUV<sub>mean</sub> ( $r=0.094$ ,  $p=0.28$ ) (Figure 1). Similarly, there was a statistically insignificant negative correlation observed between age and FDG SUV<sub>mean</sub> ( $r=-0.125$ ,  $p=0.17$ ) (Figure 2).

## CONCLUSION

s 18F-NaF- and FDG-PET/CT can be used to measure physiological calcification and glucose metabolism of the tracheal cartilage. Although the results were statistically insignificant, there was a trend of an increase in physiological calcification and a decrease in glucose metabolism of the tracheal cartilage with aging, as assessed by 18F-NaF- and FDG-PET/CT, respectively. Prospective studies with larger sample sizes and longitudinal in subjects of varying ages are needed to continue investigation into changes in tracheal cartilage calcification and metabolism with aging.

## CLINICAL RELEVANCE/APPLICATION

To assess calcification and glucose metabolism of tracheal cartilage with aging by 18F-NaF and FDG PET/CT, age-related trends were observed, and further studies are needed to confirm clinical significance.

## W5B-SPHN- Relationship between Cochlear Implant Patients' Auditory Outcomes and Insertion Length and Angulation

Participants

Paloma Puyalto, PhD, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

## PURPOSE

??Cochlear implants are transducers that transform the acoustic waves into electrical signals to stimulate the cochlear nerve in patients that suffer unilateral or bilateral, deep or severe, neurosensorial deafness that do not benefit from an auditory prostheses. The main objective of this study was to determine whether a deeper cochlear implant insertion within the cochlea, in terms of length and grade, results in improved auditory performance.

## METHODS AND MATERIALS

After IRB approval a cohort of 46 patients with 50 cochlear implants were prospectively reviewed. A temporal bone HRCT was performed before and after cochlear implantation. Prior and post-implantation audiometric studies and functional clinical variables such as speaking on the phone, listening to music, or time in months needed till auditory rehabilitation was optimal were recorded and correlated to the electrode insertion depth in terms of length and insertion angle grades.

## RESULTS

21 men and 25 women ( 29- 78 y.o) with a 2 to 63 years story of neurosensorial deafness were analyzed. 4-12 electrodes were encountered within the cochlea in HRCT. A median of 88.7% of the cochlea was covered. The insertion angle ranged between 90° and 720° with  $\mu=536^\circ$  and  $s=146.40^\circ$ . ??Two years after implantation, there was a median of 11 (3-12) final functioning electrodes. 76% of patients achieved >70% bisyllabic discrimination at 60 dB, 60% used phones after implantation, 26% listened to music, Less than a year was the median time to finish hearing rehabilitation for 38%, followed by 12 to 24 months for 34% and 24 months for 28%. There was a correlation between the angle of insertion and the length of the inserted implant with a correlation coefficient of 0.846 ( $p<0.01$ ).A statistical correlation between the number of electrodes, length and insertion angle within the cochlea, and

audiometric values, speaking at the phone, or the number of months of rehabilitation after the procedure was found ( $p < 0.01$ ) although the ability to listen to music after cochlear implantation showed no statistical correlation with radiographic variables.

## CONCLUSION

Better auditory outcomes are obtained in terms of audiometric values and functional recovery the deeper the cochlear implants are inserted into the cochlea.

## CLINICAL RELEVANCE/APPLICATION

The cochlear coverage of the implant should be checked using a post-operative HRCT in patients with insufficient auditory results. Since these patients' functional outcomes are suboptimal it will be necessary to intensify and optimize the implant programming strategies in those with fewer than 8 functional electrodes inside the cochlea in post-surgical HRCT, or even to consider early replacement.

## W5B-SPHN- Clinical Application of a 5G-based Telerobotic Ultrasound System for Thyroid Examination on a Rural Island: A Prospective Study

### PURPOSE

To evaluate the feasibility of a 5G-based telerobotic ultrasound (US) system for thyroid examination on a rural island.

### METHODS AND MATERIALS

From September 2020 to March 2021, this prospectively study enrolled a total of 139 patients (average age,  $58.6 \pm 12.7$  years) included 33 males and 106 females, who underwent 5G-based telerobotic thyroid US examination by a tele-doctor at Hospital A and a conventional thyroid US examination at Hospital B 84 km away. The clinical feasibility of 5G-based telerobotic US for thyroid examination were evaluated in terms of safety, duration, US image quality, diagnostic results, and questionnaire survey.

### RESULTS

92.8% of patients had no examination-related complaints. The average duration of the 5G-based telerobotic US examination was similar as that of conventional US examination ( $5.57 \pm 2.20$  min vs.  $5.23 \pm 2.1$  min,  $P = 0.164$ ). The image quality of telerobotic US correlated well with that of conventional US ( $4.63 \pm 0.60$  vs.  $4.65 \pm 0.61$ ,  $P = 0.102$ ). There was no significant difference between two types of US examination methods for the diameter measurement of the thyroid, cervical lymph nodes, and thyroid nodules. Two lymphadenopathies and 20 diffuse thyroid diseases were detected in two types of US methods. 124 thyroid nodules were detected by telerobotic US and 127 thyroid nodules were detected by conventional US. Among them, 122 were the same thyroid nodules. In addition, there were good consistency in the US features (component, echogenicity, shape, and calcification) and ACR TI-RADS category of the same thyroid nodules between telerobotic and conventional US examinations ( $ICC = 0.788-0.863$ ). 85.6% of patients accepted the telerobotic US, and 87.1% were willing to pay extra fee for the telerobotic US.

## CONCLUSION

The 5G-based telerobotic US system can be a routine diagnostic tool for thyroid examination for patients on a rural island.

## CLINICAL RELEVANCE/APPLICATION

This study provided robust evidence that 5G-based telerobotic US is feasible, which can provide qualified thyroid examination to help patients with thyroid diseases on a rural island. It can achieve the same effect as face-to-face and close-range conventional US examination without reducing diagnostic accuracy or increasing related procedural times.

## W5B-SPHN- A New XAI Framework with Feature Explainability for Tumors Decision-making in Ultrasound Data

Participants

Fajin Dong JR, MD, MD, Shenzhen, China (*Presenter*) Nothing to Disclose

### PURPOSE

The value of implementing artificial intelligence (AI) on ultrasound screening for thyroid cancer has been acknowledged, with numerous early studies confirming AI might help physicians acquire more accurate diagnoses. However, the black box nature of AI decision-making process makes it difficult for users to grasp the foundation of AI's prediction. Furthermore, explainability is not only related to AI performance but also responsibility and risk in medical diagnosis. In this paper, we offer Explainer, an intrinsically explainable framework that can categorize images and create heatmaps highlighting the regions where its prediction is based on.

### METHODS AND MATERIALS

This study included 19341 2D ultrasound images (9171 horizontal views and 10170 vertical views) of 7714 thyroid nodules obtained from 7236 individuals from October 2019 to May 2021, with pathological results and physician annotated TI-RADS features are used to train and test the robustness of the proposed framework. Then we conducted a benign-malignant classification study to whether physicians perform better under the assistance of Explainer than diagnose alone or with Gradient-weighted Class Activation Mapping (Grad-CAM).

### RESULTS

Reader studies show that the Explainer can achieve more accurate diagnosis while providing explaining heatmaps and that physicians' performances are improved when assisted by the Explainer. Case study confirms that the Explainer can locate more reasonable and feature-related regions than the Grad-CAM.

## CONCLUSION

The Explainer offers physicians a tool to understand the basis of AI predictions and to evaluate its reliability, which has the potential to unbox the black box of medical imaging AI.

## CLINICAL RELEVANCE/APPLICATION

In the case study comparing heatmaps generated by Explainer and Grad-CAM, Explainer is capable of locating more reasonable and feature-related regions. Evidence proves that in ultrasound images explaining tasks, our method is more detailedly.

## Participants- Diagnosis of Malignancy in Surgery after Radiofrequency Ablation of Benign Thyroid Nodule

Jung Hee Shin, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### PURPOSE

Nodule regrowth after radiofrequency ablation (RFA) of symptomatic large benign thyroid nodules is sometimes diagnosed as malignancies during surgery. This study aimed to assess the ultrasound (US) characteristics of thyroid nodules later diagnosed as cancer, predictive factors for cancer after RFA, and preventive methods for these cancers to avoid RFA procedure.

### METHODS AND MATERIALS

We reviewed the medical records of 134 consecutive patients with 148 nodules who underwent RFA between 2008 and 2016 for the debulking of symptomatic benign thyroid nodules. We investigated the pre-RFA characteristics of the thyroid nodules, changes at follow-up after RFA, and final surgical pathology.

### RESULTS

Nodule regrowth after RFA for benign nodules was observed in 36 (24.3%) of the 148 nodules. Malignancies were confirmed in seven (19.4%) of the 36 regrown nodules. Of the 22 nodules removed surgically, pre-RFA mean maximal diameter was significantly higher for malignant nodules than for benign nodules ( $3.89 \pm 0.98$  vs  $5.23 \pm 1.52$  cm,  $P = .01$ ). There was no difference in the regrowth interval between benign and malignant nodules ( $P = .19$ ). Volume reduction rate at 12 months was lower for malignant nodules than for benign nodules ( $51.16 \pm 13.81\%$  vs  $73.68 \pm 20.15\%$ ,  $P = .02$ ). Pre-RFA benignity of all seven malignant nodules was confirmed using two ultrasound (US)-guided fine-needle aspirations (FNAs), except for one nodule confirmed using US-guided core needle biopsy (CNB). The regrown malignant nodules were diagnosed as suspicious for follicular neoplasms using CNB. Histological examination of the malignant nodules during surgery after RFA revealed follicular thyroid carcinomas, except for one follicular variant of papillary thyroid carcinoma.

### CONCLUSION

s Symptomatic large thyroid nodules confirmed to be benign prior to RFA should be considered false-negative FNA results. In RFA patients, CNB prevents delay in cancer diagnosis.

### CLINICAL RELEVANCE/APPLICATION

Considering false-negative fine-needle aspiration results in symptomatic large benign thyroid nodules before radiofrequency ablation, core needle biopsies should be included in the revised RFA guidelines to prevent delayed cancer diagnosis.

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## Abstract Archives of the RSNA, 2023

W5B-SPIN

### Imaging Informatics Wednesday Poster Discussions II

#### Sub-Events

#### W5B-SPIN-1 Deep Learning-based Survival Prediction using CT and Clinical Data Fusion

##### Participants

Yujin Nam, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### PURPOSE

Develop a discrete-time survival model that combines image data and clinical data fusion to increase the accuracy of survival rate prediction through nodules in computed tomography (CT) images for patients with lung cancer.

##### METHODS AND MATERIALS

A total of 1,095 patients with lung cancer from a tertiary hospital in South Korea who underwent curative resections were enrolled. These datasets were divided into 6:2:2 as training, validation, and test set, respectively. CT volumes were cropped to 50×50×50 based on the nodule mask and were set as lung windows (window width, 1000 hounsfield unit (HU); window level, -700 HU). Also, clinical data consisted of Tumor Recur, Age, Sex, Subtype, Size, 7th stage T, 7th staging N, and smoker. Image data was trained with 3D-DenseNet and clinical data was trained with multi-layer perceptron (MLP). The proposed model is an end-to-end model that trains image data and clinical data in parallel. Our model predicted the survival rate by dividing it into 6 intervals using time and event variables. During the training, we used Adam optimization with a batch size of 32, learning rate of 1e-5, and weight decay of 1e-3.

##### RESULTS

Figure 1 depicts several cases of gradient-weighted class activation map (Grad-CAM) results from DenseNet. The model was observed to focus on nodules while performing survival prediction on axial, coronal, and sagittal planes. Figure 2 is a graph expressing the Kaplan-Meier curve that calculates the actual cumulative survival rate and the discrete-survival prediction curves of 6 intervals according to each model (clinical data, image data, fusion data (clinical + image data)). Not only is the survival rate curve of the fusion data closer to the Kaplan-Meier curve but also the fusion data had the highest c-index of 0.742, which was better than the clinical data model's c-index of 0.674 and the image data model's c-index of 0.725.

##### CONCLUSION

Our proposed model of combining image data and clinical data showed better performance than when image and clinical data were used separately.

##### CLINICAL RELEVANCE/APPLICATION

Our model could be helpful in stratifying patients and facilitating the establishment of personalized surveillance strategies or the selection of candidates for adjuvant therapy by predicting their survival rate.

#### W5B-SPIN-2 Deep Learning Based Synthetic Contrast Enhanced T1 Map for Contrast Agent-free Myocardial Extracellular Volume (ECV) Mapping in Cardiac MRI

##### Participants

Sebastian Nowak, PhD, Bonn, Germany (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the utility of generative adversarial networks (GAN) to generate artificial contrast enhanced (CE) T1 maps for creation of synthetic extracellular volume (ECV) maps of the myocardium.

##### METHODS AND MATERIALS

This study includes 1086 cardiac MRI exams with native and CE T1 maps in 3 short axis slices of 986 patients undergoing MRI for various clinical indications between January 2019 and August 2021. Manual myocardium segmentations of 522 slices were used to develop a U-Net for image cropping prior to rigid registration. All registered native and CE T1 map pairs were inspected and excluded if rigid registration failed due to dissimilar contraction phase, resulting in 2074 curated T1 map pairs from 827 patients (age: 48 ± 19 years, 344 female). Of those, 191 native and CE T1 map pairs from 78 patients were defined as hold-out test set with hematocrit available within 48h prior to imaging, allowing for creation of reference 'real' ECV maps. With the remaining cases a U-Net generator was trained with L1 loss and 5-fold cross validation in combination with a PatchGAN discriminator to generate synthetic CE T1 maps from native T1 maps. Note that for ECV calculation, the correct enhancement ratio of blood to myocardium is crucial rather than prediction of exact CE T1 values. Two ECV maps were created for the test set: one using the real and one using the synthetic CE T1 map. The difference between the synthetic and real mean ECV (?ECV) within the myocardium was calculated, and their correlation was quantified with the Pearson correlation coefficient (R). To investigate whether the GAN simply linearly transforms the input native T1 maps, the correlation of the real mean ECV with the mean of the native T1 maps was also compared with the correlation between synthetic and real ECV. Bootstrapping with 1000 resamples were used for calculating 95% confidence

intervals.

## RESULTS

The synthetic mean ECV values in the myocardium showed a high correlation to the real ECV (R: 0.81 [0.74-0.86]), which was significantly higher compared to the correlation of the native T1 and real ECV values (R: 0.61 [0.51-0.69]). A mean  $\Delta$ ECV of  $2.30 \pm 2.04$  % was observed in the hold-out test set.

## CONCLUSION

s Generation of synthetic CE T1 maps from native T1 maps by GANs shows promising results for contrast agent-free estimation of myocardial ECV. The results motivate multicenter studies including more patients with appropriate MRI examination and hematocrit to also investigate direct generation of synthetic ECV without hematocrit and contrast agent use.

## CLINICAL RELEVANCE/APPLICATION

Deep learning based generation of synthetic CE T1 maps from native T1 maps for synthetic ECV calculation might facilitate faster cardiac MRI examinations without the use of gadolinium-based contrast agents.

## W5B-SPIN-3 Identifying Stroke Onset on DWI-FLAIR Mismatch using Deep Learning with Multi-Task Learning: Validation with External Datasets

Participants

Yujin Nam, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To develop a multi-task learning (MTL) based model with diffusion weighted imaging - fluid attenuated inversion recovery (DWI-FLAIR) mismatch in MRI to predict stroke onset time.

## METHODS AND MATERIALS

A total of 354 stroke patients with DWI and FLAIR from a tertiary hospital in South Korea who had clear stroke onset time were enrolled. The stroke onset times of 3, 4.5, and 6 hours of each patient were predicted with deep learning using MTL. The input image is a combination of apparent diffusion coefficient (ADC), FLAIR, and DWI-b1000 volumes. The training and test sets were composed of 298 and 56 patients, respectively, considering the similar distributions of onset time. Two external datasets consist of 104 and 346 scans with clear onset times from the same hospital with different period and the United States, respectively. A model was trained to perform infarct segmentation and onset time prediction simultaneously by adding an auxiliary classifier to the bottleneck layer of a 3D patch SwinUNETR model. To perform patient-level classification, a voting ensemble on the patch level classifiers was performed. We compared the performances of our model and 3D DenseNet in internal and external validations. Area under curve (AUC), accuracy, specificity, and sensitivity were used as evaluation metrics. During the training, we used Adam optimization with a batch size of 2, learning rate of  $1e-4$ , and weight decay of  $1e-2$ .

## RESULTS

In internal validation, AUCs of 3D DenseNet and our model showed 0.617, 0.690 for onset time classification within 3 hours, 0.632, 0.895 for 4.5 hours, and 0.691, 0.848 for 6 hours, respectively. Sensitivity, specificity, and accuracy within 4.5 hours were 0.879, 0.783, and 0.839, respectively, in our model, 0.667, 0.575, and 0.625, respectively, in 3D DenseNet. In Figure 1, AUCs of two external validations for onset time classification within 4.5 hours were 0.803 and 0.709, respectively. Also, the model focused on infarction of images while performing onset time prediction with gradient-weighted class activation map (Grad-CAM) from its encoder, as indicated in Figure 2.

## CONCLUSION

s This model with on multi-task learning showed better performance for identifying stroke onset time in internal and two external validations, which could lead to its potential use in a real clinical setting.

## CLINICAL RELEVANCE/APPLICATION

Our model has the potential to assist in performing thrombolysis treatment at the appropriate time for stroke patients with an unclear onset time in a real clinical setting by predicting their onset time.

## W5B-SPIN-4 Development and Validation of a CAD System with Reduced False Positives for Bone Metastasis on Chest CT

## PURPOSE

To develop and validate a computer-aided diagnosis (CAD) system using a deep learning (DL) with improved specificity for detecting bone metastasis on chest CT for accurate and efficient workflow in lung cancer screening.

## METHODS AND MATERIALS

In this retrospective study, a CAD system was developed using DL algorithm trained on 3,809 chest CT scans (age  $57.7 \pm 71$ ; women 3,533) obtained from the patients who had various cancer origins (breast: 131, colorectal: 24, lung: 11 and others 34), including 825 with confirmed bone metastasis. The diagnostic performance was evaluated using both internal and external test set of 200 (age  $55.7 \pm 58$ ; women 157; 40 confirmed bone metastasis) and 50 (age  $66.1 \pm 46$ ; women 15; all confirmed bone metastasis) chest CT scans, respectively. The bone metastasis was annotated slice-by-slice indicating whether the lesion exists or not, and the confirmed bone metastasis cases included up to 63 lesions in a single scan. A DL algorithm based on DenseNet-161 was trained with axial slices from CT scans. Each slice was individually assessed whether it contains bone metastasis or not. The axial slices were converted into window level of 800 and window width of 1,500, for better visualization of the bone area. Diagnostic performance was evaluated in a patient-based manner using the maximum prediction value of all slices as the representative prediction value for the patient. For internal test, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated and for external test, only sensitivity was evaluated as positive cases were considered only. Additionally, the performance of subgroups by primary cancer was evaluated.

## RESULTS



The DL based CAD system achieved specificity, sensitivity, PPV, and NPV of 92%, 70%, 92%, and 68% for the internal test, and sensitivity of 86% for the external test in patient-based manner. For the internal test, the specificity of subgroups by primary cancer was 90%, 100%, 88% and 93%, and the sensitivity was 63%, 100%, 100%, and 71% for breast, colorectal, lung and other origins.

## CONCLUSION

s We successfully developed and validated a CAD system with high specificity thus reducing false positive cases for bone metastasis evaluation on chest CT.

## CLINICAL RELEVANCE/APPLICATION

The proposed system can be applied to lung cancer screening, providing a valuable tool for efficient workflow. Further studies are warranted to assess the performance in different clinical settings and malignancies.

## W5B-SPIN-5 Integrating Clinical Data with AI to Optimize Decision-making in Prostate MRI

### Participants

Nadia Moreira Da Silva, Cambridge, United Kingdom (*Presenter*) Employee, Lucida Medical

## PURPOSE

To determine whether combining prostate MRI AI-based decision support outputs, clinical data and PI-RADS scores in a multi-modal predictive model enhances detection of clinically significant prostate cancer.

## METHODS AND MATERIALS

MRI, clinical history, histopathology, and PI-RADS scores were obtained retrospectively from five sites in a multi-vendor, multiple field strength study. After exclusions for AI contraindications including prior treatment and quality issues, model training used data from 352 patients and a held-out test set comprised data from 235 patients (Gleason grade group (GGG)=2, prevalence 34%). Our automated multi-stage AI-based software segments and calculates the volume of prostate whole gland and transition zone (TZ) on MRI, and segments and scores lesions/patients for GGG=2 disease likelihood. Biopsy-verified GGG=2 was used as ground truth, with MRI-negative patients not undergoing biopsy assumed negative. Sensitivity, specificity, and AUC were evaluated at patient level on the held-out test set, with 95% confidence intervals obtained through bootstrapping. Combinations of AI, clinical and PI-RADS data were tested for significant improvement to the AI score and PI-RADS assessment, at pre-determined thresholds equivalent to PI-RADS 3.

## RESULTS

mpMRI PI-RADS scores alone detected GGG=2 with sensitivity 1.00 (95% CI 1.00-1.00), specificity 0.67 (0.61-0.75) and AUC 0.94 (0.91-0.97). GGG=2 was detected by bpMRI AI with sensitivity 0.97 (0.93-1.00), specificity 0.55 (0.47-0.62) and AUC 0.88 (0.84-0.92). Combining AI score and TZ-PSA density (PSAD) improved specificity (sensitivity 0.95 (0.90-0.99), specificity 0.70 (0.63-0.77) and AUC 0.90 (0.85-0.93)). The addition of AI and TZ-PSAD to PI-RADS scores maintained high sensitivity of 0.99 (0.96-1.00), while significantly improving specificity to 0.83 (0.77-0.89, KS p-value<0.001) and AUC to 0.96 (0.93-0.98, DeLong p-value 0.003). TZ volume based PSAD had modest additional benefit compared to whole-prostate PSAD. Other variables offered <5% specificity improvements or non-significant benefits. Findings with bpMRI and mpMRI AI models were similar. Limitations: Most MRI-negative cases did not receive biopsy in this retrospective study.

## CONCLUSION

s The use of PSAD improves the predictive accuracy of prostate MRI AI decision support, with significant improvement in specificity at similar sensitivity. Combining PI-RADS, PSAD and AI offers substantial improvement compared to AI or PI-RADS assessments alone.

## CLINICAL RELEVANCE/APPLICATION

The improved specificity achieved through integrating patient PSAD and radiologists' PI-RADS scores with AI software can potentially reduce false positive cases, further aiding patient selection for biopsy using MRI.

## W5B-SPIN-6 Deep Learning to Predict Fat and Appendicular Skeletal Masses from Chest Radiograph

### Participants

Ki Duk Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

To predict fat and appendicular skeletal muscle (ASM) masses from chest radiograph (CXR), which can be highly beneficial for analyzing the health impacts of body composition.

## METHODS AND MATERIALS

A total of 40,369 CXRs with body composition, including fat and ASM, from a tertiary hospital's health screening center was used. Fat and ASM were acquired using bioelectrical impedance analysis (BIA). The Inception v3 architecture was used to predict body composition, and assessment to determine the impact of demographics, such as age, sex, height, and weight, on the model's performance was conducted. Deep label distribution learning with additional Mean-Variance (MV) loss was used to train the network. Two independent unseen test datasets comprising 1,000 individuals each, which follows normal distribution and uniform distribution of age, from same center were used. The mean average error (MAE) and Pearson's correlation coefficient (r) between BIA and model prediction were evaluated. Correlation analyses and Bland-Altman plots were also presented.

## RESULTS

The age of test dataset was  $56.732 \pm 10.519$  and  $54.421 \pm 19.160$  (range from 20 to 90), respectively for test set of normal distribution and test set of uniform distribution. And the ASM was  $25.839 \pm 5.814$  and  $25.709 \pm 6.152$ , respectively. Sex was sampled evenly for both datasets. In the test set of normal distribution, MAEs of the models without information and without MV loss, without information and with MV loss, with information and without MV loss, and both with information and MV loss for predicting fat were 1.773, 1.673, 1.564, and 1.564, respectively. All model significantly correlated with BIA with decent r scores of 0.805, 0.839, 0.855, and 0.861, respectively ( $P < 0.001$  in all model). In the uniform distribution set, MAEs were 1.945, 1.844, 1.773,

and 1.726 respectively, while r scores were 0.805, 0.849, 0.853, and 0.860, respectively ( $P < 0.001$  in all model). In the normal distribution set, MAEs of each model for ASM were 1.309, 1.181, 1.307, and 1.172 respectively. All model showed decent r scores of 0.927, 0.932, 0.981, and 0.940 ( $P < 0.001$  in all model) with the same order. In the uniform test dataset, MAEs were 1.424, 1.250, 1.376, and 1.278, respectively, while r scores were 0.920, 0.932, 0.930, and 0.932, respectively ( $P < 0.001$  in all model).

## **CONCLUSION**

s deep learning model of CXR can precisely predict fat and muscle masses. Demographics and MV loss can significantly enhance the predicting power of the model

## **CLINICAL RELEVANCE/APPLICATION**

Prediction of fat and ASM from CXR can be applied to a variety of clinical fields, such as sarcopenia assessment, prognosis prediction of cancer patients, precision medicine for optimum drug dose estimation in inpatient settings.

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## Abstract Archives of the RSNA, 2023

W5B-SP1R

### Interventional Radiology Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SP1R-1 Long-Term Survival after Percutaneous CT and US guided Microwave Ablation of Pathologically Proven Renal Cell Carcinoma**

##### Participants

Daniel Kim, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

To investigate the long-term overall (OS), cancer-specific (CSS), and local tumor progression (LTP)-free survival of patients who underwent percutaneous microwave ablation (MWA) of pathologically proven renal cell carcinoma (RCC).

##### METHODS AND MATERIALS

This IRB-approved, HIPAA compliant study included patients who underwent percutaneous MWA between 2013 and 2017 of biopsy-proven RCCs. All patient demographics, tumor characteristics, procedural technical outcomes, and pre- and post-procedural estimated glomerular filtration rate (eGFR) were evaluated. OS, CSS, and LTP-free survival were calculated and Kaplan-Meier analysis was performed. Complications were classified per the Clavien-Dindo system.  $\chi^2$  test was used for proportions for categorical outcomes excluding repeated measures for patients and a paired t-test for differences in eGFR.

##### RESULTS

The study cohort comprised 86 biopsy-proven RCCs from 81 patients (mean age: 67.6±16.9) and were 62% male. The median follow-up period was 76.8 months (1 to 123 months). The mean tumor size was 2.8cm (0.7cm to 7.0cm) and RCC lesions were more commonly located on the right side (60.5%), anterior (41.9%), lower pole (44.2%), and endophytic (69.8%). Primary and secondary technical success was achieved in 88.4% (76/86) in a single session and 90% (9/10) in two sessions with overall technical success of 100%. The 5-year and 10-year OS, CSS, and LTP-free survival rates were 82.7%, 90.8%, and 84.3% and 75.7%, 84.7%, and 82.9%, respectively. RCC = 4cm ( $p=0.016$ ) was predictive of LTP. There were no significant changes in pre-ablation and 2-3 years post-ablation eGFR (58.5 vs 58.4 mL/min/1.73m<sup>2</sup>,  $p=0.932$ ). There was a 2% overall incidence of complications, all grade I.

##### CONCLUSION

s Percutaneous CT and US guided MWA of biopsy-proven RCC was safe and effective with excellent long-term OS, CSS, and LTP-free outcomes within 10 years from initial treatment.

##### CLINICAL RELEVANCE/APPLICATION

Image-guided ablative therapies are a safe and effective treatment option for renal cell carcinoma with durable long-term survival rates.

#### **W5B-SP1R-2 Long-Term Survival after CT and US Guided Radiofrequency Ablations of T1a and T4 Pathologically Proven Renal Cell Carcinomas**

##### Participants

Daniel Kim, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### PURPOSE

To determine the long-term overall, renal cell carcinoma (RCC)-specific, and progression-free survival of patients who underwent percutaneous radiofrequency ablation (RFA) of pathologically proven RCC.

##### METHODS AND MATERIALS

This IRB-approved, HIPAA compliant study included patients who underwent percutaneous RFA between 2004 and 2015 of their biopsy-proven RCCs. All patient demographics, tumor characteristics, procedural technical outcomes, and pre- and post-procedural estimated glomerular filtration rate (eGFR) were collected. Overall survival (OS), and local tumor progression (LTP)-free survival were calculated by Kaplan-Meier survival curves. In addition, a subcohort analysis of the RCC T1a and T4 was conducted to examine the RCC-specific survival (RSS) rate with Kaplan Meier survival analysis. Complications were classified per the Clavien-Dindo system.  $\chi^2$  test was used for proportions for categorical outcomes and paired t test was used for changes in eGFR.

##### RESULTS

The study cohort comprised 129 biopsy-proven RCCs from 101 patients (mean age: 68.5±12.4). Primary technical success was achieved in 91.5% (118/129) of ablations and secondary technical success was achieved in 90.9% (10/11) of ablations with remaining one lesion requiring three ablations. The median of the follow-up period was 136 months (1 to 230 months) with mean tumor size of 2.3cm (0.5cm to 8.0cm). RCC lesions were more commonly located on the right (52.7%), in the midpole (37.2%), and were endophytic (54.3%). The study cohort comprised the following RCC subtypes: clear cell (69%), epithelial neoplasm (16%), papillary (11%), and chromophobe (5%). There was a slight decrease in preprocedure eGFR relative to 2-3 years postprocedure

eGFR (59.2 vs 55.4 mL/min/1.73m<sup>2</sup>; p=0.003). There were 6 complications mostly grade I-III. The 15-year OS and LTP-free survival rates were 63.6% and 92.2% in 101 patients and 129 lesions. The T1a and T4 subcohorts comprised 65 patients and 32 patients with a 15-year RSS rate of 96.5% and 82.7%.

## CONCLUSION

s Image-guided percutaneous RFA of RCCs was safe with durable 15-year OS rate of 63.6%, LTP-free survival rate of 92.2%, and RSS rate of 96.5% and 82.7% in the T1a and T4 subcohorts.

## CLINICAL RELEVANCE/APPLICATION

Percutaneous CT and US guided radiofrequency ablation was safe with excellent 15-year durable responses in both T1a and T4 subcohorts.

## W5B-SPiR-3 No-touch Radiofrequency Ablation versus Tumor Puncture Microwave Ablation for Small Hepatocellular Carcinoma: Comparison of Treatment Outcomes

Participants

Jae Hyun Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## PURPOSE

The aim of this study was to compare the therapeutic outcomes between no-touch (NT) radiofrequency ablation (RFA) and tumor puncture microwave ablation (MWA) for single hepatocellular carcinomas = 4 cm.

## METHODS AND MATERIALS

A total of 335 patients who underwent NT RFA (n=155) or tumor puncture MWA (n=180) for single HCCs = 4 cm were included in this retrospective study. A matched cohort comprising 121 patients from each group was selected after propensity score matching analysis to adjust for potential biases. This study assessed the therapeutic outcomes after ablation including technical success, local tumor progression (LTP), and major complications. Cumulative LTP rates were estimated using the Kaplan-Meier method.

## RESULTS

A total of 242 patients (mean age, 66.2 years ± 9.5 [standard deviation]; 183 men) were evaluated. The technical success rates were 99.2% [120/121] vs. 100% [121/121] in the NT RFA and MWA groups, respectively (P>0.05). The estimated 1- and 2-year cumulative LTP rates in the NT RFA were 2.2% and 3.1%, respectively, and were not significantly different from the 3.0% and 6.0% observed in the MWA group (P=0.279). There was no significant difference in the major complication rate between the NT RFA and MWA groups (1.7% [2/121] vs. 0.8% [1/121], P=1.000).

## CONCLUSION

s Tumor puncture MWA showed comparable therapeutic outcomes including LTP and major complication rates to those of NT RFA in single HCCs (= 4 cm).

## CLINICAL RELEVANCE/APPLICATION

NT RFA and tumor puncture MWA are potentially effective and safe treatment options for small HCCs (= 4 cm).

## W5B-SPiR-4 Perfusion CT for Early Prediction of Treatment Response of Cryoablation in Renal Cell Carcinoma

Participants

Oyunbold Lamid-Ochir, Ulaanbaatar, Mongolia (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate quantitative analysis of perfusion CT (pCT) for assessment of early treatment response after cryoablation in renal tumors.

## METHODS AND MATERIALS

A total 54 patients with renal tumors who had treated by CT-guided percutaneous cryoablation in our institution from June 2014 to August 2016. Twenty-seven patients were selected, who underwent pCT before and after within 1 week, 1, 3, 6 months and 1-year treatment. Perfusion parameters including arterial flow perfusion (AFP) as tumor maximum, minimum, average and average changes and tumor diameter, freezing time, treatment cycles and progression-free-survival were analyzed and compared. The effects of treatment response were evaluated by RECIST standards version 1.1 as a non-responder and responder.

## RESULTS

Twenty-seven patients (22 men, 5 women: age, 68 ± 12 y.o.) evaluated as quantitative analysis with pCT. Five of 27 patients were non-responders, and 22 patients were responder. The mean AFP values were significantly different between non-responder (46.6±25.8) and responder (25.1 ± 6.1) at 1 month after cryoablation (p<0.05). ROC analysis demonstrated that tumor average (AFP) at 1 month had the cut-off of perfusion value (29.95) and area under curve (0.94), with sensitivity and specificity of 100% and 84.2%, respectively (p<0.05). Percent of progression free-survival was 100% (cut-off < 29.95) and 66.7% (cut-off >29.95) for 32 months observation.

## CONCLUSION

s pCT was able to evaluate and predict therapeutic effects of cryoablation at 1 month after treatment. It can offer both morphologic and functional evaluation, providing a quantitative assessment of residual tumor vascularization after treatment.

## CLINICAL RELEVANCE/APPLICATION

pCT can be predicted to responder and non-responder at 1 month after cryoablation and might be earlier than dynamic CE-CT. Also, it can detect minimal focal perfusion changes whether the tumor is shrinking or without tumor volume changes.

## **W5B-SPiR-5 SAR-COOL: Sarcoma Cryoablation Outcomes and Optimization of Life**

Participants

Koustav Pal, MBBS, Houston, TX (*Presenter*) Nothing to Disclose

### **PURPOSE**

To evaluate the local tumor progression-free survival following cryoablation of recurrent or metastatic soft tissue sarcoma (STS) lesions.

### **METHODS AND MATERIALS**

A single-institution retrospective analysis of patients with a histopathological diagnosis of metastatic STS who underwent percutaneous cryoablation (PC) from January 2022 to April 2023 was performed. . Patients with less than 60 days of follow-up and those treated for more than four lesions during one procedure were excluded. Complications were categorized based on the Common Terminology Criteria for Adverse Events (CTCAE) classification system. R software version 4.2.3 was used for analysis. (We aim to further analyze the outcomes of 239 patients with 391 procedures from Jan. 2016 to April 2023)

### **RESULTS**

61 patients who underwent PC for 84 STS lesions met the eligibility criteria. There were 21 different histological subtypes of sarcoma in the study, with the two most common being leiomyosarcoma (20/61) and liposarcoma (16/61). The median size of sarcoma lesions was 2.1 cm (range 0.4 to 13.4). Complete response at six months was achieved in 81% of the treated lesions. Local tumor progression-free survival was 86.1% at 6 months and 77.3% at 1 year. The overall survival was 97.2% at 1 year. Chemotherapy free time for patients was 54.57% at 6 months. The complication rate was 14%, with 56.55% classified as CTCAE grade 3 or higher. Subgroup analysis for leiomyosarcoma vs. liposarcoma demonstrated an overall survival of 100% vs. 90.9% at 12 months, respectively. Local tumor-free progression was 86.7% at 6 months and 86.7% at 12 months for liposarcoma. Leiomyosarcoma demonstrated 91.97% local tumor-free progression at 6 months and 46.4% at 12 months. There was no statistically significant difference between the two groups ( $p=0.37$ ).

### **CONCLUSION**

s PC of STS and its metastases is a safe and effective treatment modality.

### **CLINICAL RELEVANCE/APPLICATION**

Surgical resection is a cornerstone in the management of recurrent or oligometastatic soft tissue sarcoma. Percutaneous cryoablation is a minimally invasive technique that may complement surgical approaches. This study demonstrates that cryoablation can achieve high local control rates with durable responses in this patient population.

## **W5B-SPiR-6 Assessment of Spectral CT Images for Mapping Treatment Volume during CT-guided Thermal Ablations: A Feasibility Study**

Participants

Kuan Zhang, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

### **PURPOSE**

CT-guided thermal tumor ablations suffer from limited visualization of the treatment volume. In this study, we investigated the application of spectral CT to improve the visualization of the treatment zone and quantify the underlying temperature changes.

### **METHODS AND MATERIALS**

Two cryoablation probes (IceFORCE, Boston Scientific) were inserted 2 cm apart through a custom, 3D-printed holder and into a tissue mimicking gel (3% HEC, 0.15% NaCl, and 96.85% DI water). In between the cryo probes, 8 fiber optic temperature sensors (OmniFlex, Neoptix) were inserted through the holder and positioned at 5 mm increments parallel to the CT rotation axis. A 15-minute freeze cycle was performed operating both probes at 100% (VisualICE, Boston Scientific) followed by two consecutive 20-minute thaw cycles. The phantom was scanned every minute during the freeze-thaw cycles (120 kV, 500 mAs, 0.6 pitch, 64x0.625 collimation; Spectral CT7500, Philips Healthcare) and reconstructed with 1mm slice thickness and a soft tissue filter (B). Regions of interest and line profiles were drawn adjacent to the temperature sensors and used to correlate pixel values to temperature for each reconstructed series. Measurements from both conventional CT and electron density images with respect to the measured temperature data were compared to H<sub>2</sub>O density vs temperature curves.

### **RESULTS**

Line profiles for different image results demonstrated similar iceball image contrast. Importantly, increasing CT numbers were observed in the (colder) central region of the iceball compared to its (warmer) periphery. This trend was most visible on electron density images owing to the reduced image noise. Similar conclusions were drawn from line profiles through heated region. Conventional single energy and electron density image data as a function of temperature showed a MSE of 0.605 and 0.259 kg/m<sup>3</sup>, respectively, when compared with the scaled temperature-dependent density curve of ice.

### **CONCLUSION**

s Spectral results offer similar image contrast of the treatment region to conventional images, however with overall reduced image noise iceball conspicuity increases for high monoE and electron density images. In particular, electron density showed a superior level of correlation to measured temperature in both hypo- and hyper-thermal regions. These results demonstrate the feasibility of using spectral CT data to develop in vivo CT thermometry for ablation guidance, indicating promising potential for further research in this area.

### **CLINICAL RELEVANCE/APPLICATION**

CT thermometry obtained from spectral CT images has the potential to enhance both hypo- and hyper-thermal tumor ablation procedures by providing improved visualization of the lethal treatment zone.

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## Abstract Archives of the RSNA, 2023

W5B-SPMK

### Musculoskeletal Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPMK- The Reference Value of Trabecular Bone Score in Chinese Population: A Single-center Retrospective Study** 1

##### PURPOSE

To investigate the reference value of trabecular bone score (TBS) in Chinese population.

##### METHODS AND MATERIALS

The study included subjects who had at least one dual-energy X-ray absorptiometry (DXA) examination from October 2021 to March 2023. Subjects with age from 30 to 89 years and body mass index (BMI) of 15 - 37 kg/m<sup>2</sup> were included. The exclusion criteria included diseases that may affect the function of bone metabolism. Bone mineral density (BMD) was measured and TBS was calculated based on the DXA images by the TBS iNsite software (version 3.0.0.15). Every ten years was an interval group and BMD and TBS were calculated for each group. Differences in BMD and TBS as well as clinical characteristics (weight, height, age, and BMI) between male and female subjects were compared using a t-test.  $P < 0.05$  was considered significant.

##### RESULTS

The study included a total of 2007 Chinese participants (540 males and 1467 females). The clinical characteristics (weight, height, age, and BMI) were significant different between male and female subjects. For men, the mean BMD value peaked at the age group of 51 to 70 years ( $1.17 \pm 0.09$  g/cm<sup>2</sup>) and decreased until 80 years ( $1.05 \pm 0.19$  g/cm<sup>2</sup> for age of 71 - 80 years) and then again raised ( $1.19 \pm 0.18$  g/cm<sup>2</sup> for age of 81 - 89 years). The TBS value for men peaked at the age of 51 - 60 years ( $1.40 \pm 0.07$  g/cm<sup>2</sup>) and then gradually decreased until the age of 89 years ( $1.37 \pm 0.10$  g/cm<sup>2</sup> for both age group of 61-70 and 71-80 years;  $1.36 \pm 1.20$  g/cm<sup>2</sup> for age group of 81 - 89 years). For women, both BMD and TBS experienced an obvious decrease with age. The BMD and TBS were in general higher in men than in women, with a significant difference after the age of 51 years ( $P < 0.01$  for all groups after the age of 51 years).

##### CONCLUSION

The single-center retrospective study provided the reference value for trabecular bone score at different age in Chinese population. A significantly higher trabecular bone score can be observed in men than in women especially after the age of 51 years.

##### CLINICAL RELEVANCE/APPLICATION

TBS is a novel textural index to measure the gray-level variations in lumbar spine DXA images. It can provide an effective evaluation of trabecular microstructure without a second-time scanning and therefore without extra radiation dose. The availability of TBS reference values can help to further understand the distribution of trabecular bone microstructure in Chinese population. Accordingly, osteoporosis and fracture risk could be better evaluated.

#### **W5B-SPMK- The Next Frontier in Lumbar Spine MR Bone Imaging: Harnessing the Power of Super-Resolution Deep Learning Reconstruction** 2

Participants  
Masamichi Hokamura, Kumamoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aims to assess the effectiveness of super-resolution deep-learning-based reconstruction (SR-DLR), which leverages k-space properties, on the image quality of lumbar spine magnetic resonance (MR) bone imaging using a 3D multi-echo in-phase sequence.

##### METHODS AND MATERIALS

In this retrospective study, 29 patients who underwent lumbar spine MRI, including an MR bone imaging sequence, between January and April 2023, were analyzed. Images were reconstructed with and without SR-DLR (Matrix sizes: 960 x 960 and 320 x 320, respectively). The signal-to-noise ratio (SNR) of the vertebral body and spinal canal, along with the contrast and contrast-to-noise ratio (CNR) between the vertebral body and spinal canal, were quantitatively evaluated. Furthermore, the slope at half-peak points of the profile curve drawn across the posterior border of the vertebral body was calculated. Two radiologists independently assessed image noise, contrast, artifacts, sharpness, and overall image quality of both image types using a 4-point scale. Interobserver agreement was evaluated using weighted kappa coefficients, and quantitative and qualitative scores were compared via the Wilcoxon signed-rank test.

##### RESULTS

In this retrospective study, 29 patients who underwent lumbar spine MRI, including an MR bone imaging sequence, between January and April 2023, were analyzed. Images were reconstructed with and without SR-DLR (Matrix sizes: 960 x 960 and 320 x 320, respectively). The signal-to-noise ratio (SNR) of the vertebral body and spinal canal, along with the contrast and contrast-to-noise

ratio (CNR) between the vertebral body and spinal canal, were quantitatively evaluated. Furthermore, the slope at half-peak points of the profile curve drawn across the posterior border of the vertebral body was calculated. Two radiologists independently assessed image noise, contrast, artifacts, sharpness, and overall image quality of both image types using a 4-point scale. Interobserver agreement was evaluated using weighted kappa coefficients, and quantitative and qualitative scores were compared via the Wilcoxon signed-rank test.

## CONCLUSION

s SR-DLR, which is based on k-space properties, has the potential to enhance the image quality of lumbar spine MR bone imaging utilizing a 3D gradient echo in-phase sequence.

## CLINICAL RELEVANCE/APPLICATION

The application of SR-DLR can lead to improvements in lumbar spine MR bone imaging quality.

## W5B-SPMK- Application of Material Decomposition Technique based on Dual-energy CT in the Differential Diagnosis of Acute and Old Thoracolumbar Fracture

3

### PURPOSE

To identify acute and old thoracolumbar vertebral compression fractures by using material decomposition technique based on dual-energy CT (DECT).

### METHODS AND MATERIALS

A total of 12 patients with acute trauma or diagnosed compression fracture who underwent thoracolumbar DECT and MR scanning in Shenzhen Qianhai Shekou Free Trade Zone Hospital from June 2022 to February 2023 were retrospectively collected. 24 cases about vertebral compression fracture was found in DECT and MRI (fat suppressed T2WI). The time about patients took DECT and MRI examination from the first day they get injured to 2 weeks after they got fractured. A total of 16 vertebral bodies' data were collected, including 8 patients with old fractures. All patients had a fracture injury time of more than six months. Water (Iodine), Water (Calcium) and Water (HAP)-based on material decomposition images were reconstructed. The signals of edema area is calculated from water density values and water difference values in three material decomposition images in both area of acute fractured vertebrae and old fractured vertebrae. With reference to bone marrow edema area of fracture based on MRI. A paired T test was used to compare the difference in water density between acute vertebral fracture edema and old compression fractures. A two-factor ANOVA was used to compare the difference in water density values between edematous fractured vertebrae and old compression fractured vertebrae among three material images sets.

### RESULTS

The water density values for Water (Iodine), Water (Calcium) and Water (HAP) images were significant higher in the acute fracture edema vertebral bodies compared to old compression fracture vertebral bodies (1147.6mg/cm<sup>3</sup> Vs 1040.9mg/cm<sup>3</sup>, 1089.4mg/cm<sup>3</sup> Vs 1014.4mg/cm<sup>3</sup> and 996.7mg/cm<sup>3</sup> Vs 972.2mg/cm<sup>3</sup>, respectively, all  $P < 0.001$ ). There was a significant statistical difference in the water difference values between the acute fractured vertebrae and the old compression fractured vertebrae ( $P < 0.001$ ), and with the largest water difference values in the Water (Iodine) image.

## CONCLUSION

s The water density values for Water (Iodine), Water (Calcium) and Water (HAP)-based material decomposition images can distinguish acute thoracolumbar fractures from old compression fractures on dual-energy CT examination. Water (Iodine) images showed the best discrimination.

## CLINICAL RELEVANCE/APPLICATION

The measurement of water density values for material decomposition images based on dual-energy CT, can improve the clarity of diagnosis of acute thoracolumbar fractures and old compression fractures, and also avoid confusion caused by contraindications to MRI examination. This is a valuable aid for both patients and clinical practice.

## W5B-SPMK- Application of Dual-energy CT Single Energy Reconstruction Technique in Acute Fractures of Thoracolumbar Spine with Bone Marrow Edema

4

### PURPOSE

To identify bone marrow edema in acute thoracolumbar fractures by using single-energy reconstruction technique based on dual-energy CT (DECT).

### METHODS AND MATERIALS

A total of 18 patients with acute trauma or diagnosed compression fracture who had thoracolumbar DECT and MR scanning in Shenzhen Qianhai Shekou Free Trade Zone Hospital from June 2022 to February 2023 were retrospectively collected. 20 cases about vertebral compression fracture was found in DECT and MRI (fat suppressed T2WI). The time about patients took DECT and MRI examination from the first day they get injured to 2 weeks after they got fractured. 40KeV images, 70KeV images, 100KeV images, 140KeV images-based on single energy reconstruction technique were reconstructed. On the median sagittal plane of the Water (Ca) pseudo-color image, the fracture bone marrow edema area was identified. According to the edema areas shown by MRI, manually delineated the region of interest. CT values of the edema area of the fractured vertebra and the normal vertebra were recorded at different Single energy. All edema areas of compression fractures were use MRI fat suppressed T2WI sequences as reference. A paired T test was used to compare the difference in CT values between the fractured edema vertebra and the normal vertebra under different single energies. A two-factor ANOVA was used to compare the difference in CT values between oedematous fractured vertebrae and normal vertebrae at four keV sets.

### RESULTS

The CT values of vertebrae with acute fracture edema vertebral bodies compared with normal vertebral bodies measured at 40KeV, 70 KeV, 100 KeV and 140KeV were (691.5Hu Vs 252.9Hu, 319.1Hu Vs 106.1Hu, 222.4Hu Vs 67.9Hu and 183.1Hu Vs 52.5Hu, respectively, all  $P < 0.001$ ). There was a significant statistical difference in the difference in CT values between the acutely fractured vertebrae and the normal vertebrae ( $P < 0.001$ ), and with the greatest difference in CT values in the 40KeV image.

## CONCLUSION

The single energy values of 40KeV, 70 KeV, 100 KeV and 140KeV images can differentiate bone marrow edema from normal vertebral body on acute thoracolumbar fracture dual-energy CT scan. The greatest difference in CT value is at 40KeV. Combined with Water(Ca) material density film, it can provide a more accurate diagnosis of acute thoracolumbar fracture edema.

## CLINICAL RELEVANCE/APPLICATION

The measurement of single-energy reconstruction on dual-energy CT, combined with Water(Ca) material density picture, can improve the clarity of diagnosis of thoracolumbar fractures and bone marrow edema, and also avoid confusion caused by contraindications to MRI examination. This is a valuable aid for both patients and clinical practice.

## W5B-SPMK- Assessing the Combined Efficacy of Radiofrequency Ablation and Kyphoplasty with Radiation Treatment for Painful Spine Metastases

5

### PURPOSE

To compare kyphoplasty ablation with and without radiotherapy for the treatment of patients with painful metastatic neoplastic disease to the spine.

### METHODS AND MATERIALS

Between 3/2019 and 08/2022, 59 kyphoplasty procedures were performed for palliation of metastatic spine disease. 21 patients (36.2%) with metastatic tumor received radiation in addition to kyphoplasty/RF ablation to palliate pain: 9 patients (47.4%) had prior radiation, 2 patients (10.5%) had concurrent, and 10 patients (1.4%) had radiation therapy after. 37 painful metastatic spinal tumors were treated with kyphoplasty ablation without radiation. The primary neoplastic disease was as follows: multiple myeloma (n=17, 28.8%), breast (n=15, 25.4%), lung (n=7, 11.9%), prostate (n=6, 10.2%), lymphoma and colorectal (each n=3, 5.1%), urothelial (n=2, 3.4%), thyroid, pancreas adenocarcinoma, renal cell, and metastatic adenoid cystic (each n=1, 3.3%). Pain relief was evaluated by the visual analogue scale (VAS) score, disability by the Oswestry Disability Index (ODI), performance status by the Karnofsky Performance Status Scale (KPS) score and ECOG score before and within 3-months after the procedure. The highest documented VAS, ODI, KPSS, and ECOG scores pre- and post-procedure were recorded. A P-value < 0.05 was considered statistically significant.

### RESULTS

Technical success was achieved in all patients. Table 1 compares demographics, pre procedural and post procedural pain, disability, and functional scores between the two groups. The median change in VAS, ODI, KPSS, and ECOG scores from baseline to three months was not significantly different between the two groups. There were no major complications.

## CONCLUSION

The study suggests adding radiation therapy to kyphoplasty/RFA for palliation of metastatic neoplastic disease to the spine may not significantly change pain, disability, or performance status scores. Further studies with a larger number of subjects and longer follow-up and prospective design are needed to validate these findings.

## CLINICAL RELEVANCE/APPLICATION

MSK Interventional Radiology - Palliative Spine Intervention

## W5B-SPMK- Symmetry Plane Analysis for Determination of Vertebral Rotation

6

Participants  
Dillon Haughton, BS, Las Cruces, NM (Presenter) Nothing to Disclose

### PURPOSE

Accurate vertebral rotation measurements are crucial in the understanding and treating of spinal pathologies. Many methods exist to aid in determining this metric, with the most common and widely accepted method utilizing axial CT scans being the Aaro-Dahlborn method. This method is simple and accurate but is limited due to errors when used by inexperienced users. It only considers one axial cut through the vertebra limiting its accuracy when the vertebra is rotated in sagittal and coronal planes. We propose a new method using symmetry planes calculated by iterative closest point registration and pairwise assignment of curves, as an alternative to the Aaro-Dahlborn method in determining vertebral rotation. Our method considers the entire vertebra and is an automated method applied post segmentation, which would limit operator error.

### METHODS AND MATERIALS

Our method was coded in python utilizing a Jupyter notebook compatible with 3DSlicer. It was tested on segmented vertebrae from the VERSE2020 opensource dataset. 812 vertebrae with no gross pathology were selected from the VERSE2020 database and processed utilizing our method for feasibility analysis. Out of those 812, 96 vertebrae from 8 randomly selected CT scans were divided up among two medical students who performed measurements utilizing the Aaro-Dahlborn method. Correlation-coefficients and Bland-Altman plots were calculated to determine the alignment between the two methods.

### RESULTS

Out of 812 vertebrae analyzed, 799 had their vertebral rotation successfully calculated using our algorithm (98% success rate). Correlation coefficient was calculated at 87% amongst the 96 vertebrae whose vertebral rotation was determined manually against our method. Bland-Altman plotting showed mean difference of -0.51 degrees, a +2 standard deviation of 2.2 degrees and -2 standard deviation of -3.2 degrees.

## CONCLUSION

Our method had similar accuracy to the Aaro-Dahlborn manual method. Our method was also demonstrated to work with a wide variety of normal vertebrae. This provides a quick and efficient means of determining vertebral rotation and can act as an objective reference due to no post-segmentation user input. As segmentation algorithms for individual vertebrae become more accessible and the process is simple manually, we don't see this as a limiting factor to the utility of our method. An extension of our method can also be applied to determining the rotation of vertebrae in both sagittal and coronal planes, which could greatly contribute to our understanding of vertebral movements.



## CLINICAL RELEVANCE/APPLICATION

Improvement in speed and accuracy of methods of determining vertebral rotation will further our understanding of vertebral movements in pathologies such as back pain and scoliosis.

### W5B-SPMK- How Effective is Radiofrequency Ablation with Kyphoplasty at Decreasing Narcotic and Analgesic Requirements in Painful Spine Metastases 7

#### PURPOSE

To determine the effect of radiofrequency ablation (RF) in conjunction with kyphoplasty on pain relief and analgesic requirements in patients with painful metastatic disease to the spine.

#### METHODS AND MATERIALS

Between 3/2019 and 8/2022, 59 kyphoplasty/RF ablations were performed. The median age was 63 years old (IQR, 55-69) with a male-to-female ratio of 0.97. The primary neoplastic diseases were as follows: multiple myeloma (n=17, 28.8%), breast (n=15, 25.4%), lung (n=7, 11.9%), prostate (n=6, 10.2%), lymphoma and colorectal (each n=3, 5.1%), urothelial (n=2, 3.4%), thyroid, pancreas adenocarcinoma, renal cell, and metastatic adenoid cystic carcinoma (each n=1, 3.3%). Pain relief was evaluated by the highest visual analogue scale (VAS) score before and within 3-months after the procedure. The number of non-opioid and opioid pain medications that were taken before, at 1-mo, and 3-mo after the procedure was recorded. A two-tailed p value < 0.05 was considered statistically significant.

#### RESULTS

Technical success was achieved in all patients. The median VAS score decreased from 10 (IQR, 8-10) to 2 (IQR, 0-4) after the procedure (p < 0.001) and 2 (IQR, 2-3) at 3 months after procedure (p < 0.001). Table 1 demonstrates the number (and percentages) of patients who were taking non-opioid and opioid analgesics before the Kyphoplasty/ablation, and at 1-mo and 3-mo after the procedure. Overall, use of opioid medications decreased at 1-mo and 3-mo after the procedure.

#### CONCLUSION

s RFA in conjunction with kyphoplasty appears to provide meaningful clinical improvement in VAS pain scores and decrease requirements for narcotic medications in patients with metastatic disease to the spine.

## CLINICAL RELEVANCE/APPLICATION

MSK Interventional Radiology - Palliative Spine Intervention

### W5B-SPMK- How Effective is Radiofrequency Ablation with Kyphoplasty at Improving Pain Scores in Burdensome Spinal Metastases 8

#### PURPOSE

To determine the improvement in pain, performance status and disability index, and the safety of radiofrequency ablation (RFA) in conjunction with kyphoplasty for the treatment of painful metastatic neoplastic disease to the spine.

#### METHODS AND MATERIALS

Between 3/2019 and 8/2022, 59 kyphoplasty/RFAs were performed. The median age was 63 (IQR, 55-69) with a M:F ratio of 0.97. There were 11 different primary cancers; multiple myeloma was the most prevalent (n=17, 28.8%). Pain relief was evaluated by the Visual Analog Scale (VAS); performance status by the ECOG and Karnofsky Performance Status Scale (KPS), Disability by the Oswestry Disability Index (ODI). The highest VAS, ECOG, KPS and ODI score pre- and within 3 months post-procedure were recorded. A two-tailed p value < 0.05 was considered statistically significant.

#### RESULTS

Technical success was achieved in all patients. Within 3 months from the procedure, the median VAS score decreased from 10 (IQR, 8-10) to 2 (IQR, 2-3, p < 0.001). The median ECOG performance status score improved from 3 (IQR, 2-3) to 1 (IQR, 1-2) (p < 0.001). The median KPS increased from 50 (IQR, 40-60) to 75 (IQR, 62.5-90) (p < 0.001). The median ODI decreased from 66.5 (IQR, 49.8-80) to 20.5 (IQR, 13-26) (p < 0.001). There were no major complications.

#### CONCLUSION

s RFA in conjunction with kyphoplasty is safe and provides meaningful clinical improvement in VAS, ECOG, KPS, and ODI scores in patients with pain due to metastatic disease to the spine, when measured at post procedure follow-up within 3 months of the procedure.

## CLINICAL RELEVANCE/APPLICATION

MSK Interventional Radiology - Palliative Spine Intervention

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## Abstract Archives of the RSNA, 2023

W5B-SPMS

### Multisystem Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPMS- Value of MRI in the Staging of Klippel-Trenaunay Syndrome Complicated with Lower Extremity Lymphedema** 1

#### Participants

Xingpeng Li, Beijing, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To investigate the value of MRI in the staging of Klippel-Trenaunay syndrome (KTS) complicated with lower extremity lymphedema.

#### METHODS AND MATERIALS

Thirty-four patients who were diagnosed as KTS complicated with lower extremity lymphedema were recruited in this retrospective study from July of 2011 to November of 2021. Referring to the clinical staging standard of lower extremity lymphedema of the international society of lymphology in 2020, all patients were divided into two groups including stable stage and advanced stage. The MRI indexes of the two groups were recorded and were statistically compared: longitudinal involvement range of lymphedema, thickened parts of skin and subcutaneous soft tissue, signs of subcutaneous soft tissue edema (parallel line sign, grid sign, band sign, honeycomb sign, lymph lake sign, crescent sign and star cloud sign).

#### RESULTS

Compared with stable stage, patients in advanced stage demonstrated older onset age ( $P < 0.05$ ). For imaging features, the proportion of honeycomb sign are higher in advanced stage than stable stage ( $P < 0.05$ ). While no statistical difference was found in the incidence of parallel line sign, grid sign, band sign, lymph lake sign, crescent sign, star cloud sign, skin and subcutaneous soft tissue thickening, range of lymphedema in lower limbs (all  $P > 0.05$ ). The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of honeycomb sign in the diagnosis of advanced lower extremity lymphedema were 55.00%, 92.86%, 91.67%, 59.09% and 70.59%, respectively.

#### CONCLUSION

s MRI is of great value in KTS complicated with lower extremity lymphedema. Honeycomb sign is an important imaging index for the diagnosis of advanced KTS complicated with lower extremity lymphedema.

#### CLINICAL RELEVANCE/APPLICATION

It is necessary to evaluate the severity of edema with MR for KTS complicated with lower extremity lymphedema, which is very important for therapeutic options.

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## Abstract Archives of the RSNA, 2023

W5B-SPNMMI

### Nuclear Medicine & Molecular Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPNMMI-1 Correlation of FLT PET Findings with Histopathology in the Assessment of Response to Neoadjuvant Chemoradiotherapy in Pancreatic Cancer: Comparison with FDG PET**

##### Participants

Yuka Yamamoto, PhD, Kita-gun, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Although the role of FDG PET has been proposed in pancreatic cancer, a high percentage of patients have diabetes due to pancreatic cancer. Therefore, the rate of false negative results is high due to elevated plasma glucose levels. On the other hand, 3'-deoxy-3'-18F-fluorothymidine (FLT) is being studied to assess tumor proliferating activity. We evaluated the ability of FLT PET to predict the response to neoadjuvant chemoradiotherapy in pancreatic cancer, in comparison with FDG.

##### METHODS AND MATERIALS

FDG and FLT PET/CT studies were performed before and after neoadjuvant chemoradiotherapy in 19 patients with pancreatic cancer. The values of maximum standardized uptake value (SUV<sub>max</sub>) at the primary tumor obtained before and after neoadjuvant chemoradiotherapy are SUV<sub>before</sub> and SUV<sub>after</sub>, respectively. Percent change was calculated according to the following equation:  $(SUV_{before} - SUV_{after}) \times 100 / SUV_{before}$ . In the FDG PET analysis, patients with a blood glucose level of 200 mg/dL or higher at the time of the FDG PET/CT scan were excluded from the analysis. Based on histopathological analysis of the specimens obtained at surgery, the patients were classified as pathologic responders or pathologic non-responders.

##### RESULTS

Nine patients were found to be pathologic responders and 10 pathologic non-responders. Three patients were excluded from before therapy FDG PET analysis due to their high blood glucose levels. The FDG SUV<sub>after</sub> in pathologic responders was significantly lower than that in pathologic non-responders ( $p=0.03$ ). The FLT percent change in pathologic responders was significantly higher than that in pathologic non-responders ( $p=0.028$ ).

##### CONCLUSION

Based on the results of this preliminary study in a small patient sample, FLT PET seems to be as useful as FDG PET for predicting response to neoadjuvant chemoradiotherapy in pancreatic cancer. FLT PET does not require fasting prior to imaging and is not dependent on blood glucose levels, making it a potentially more convenient technique of evaluation in pancreatic cancer.

##### CLINICAL RELEVANCE/APPLICATION

FLT PET does not require fasting prior to imaging and is not dependent on blood glucose levels, making it a potentially more convenient technique of evaluation in pancreatic cancer.

#### **W5B-SPNMMI-2 Textural Indices Extracted from FMISO and FLT PET/CT for Predicting IDH1 Mutation in Newly Diagnosed High-grade Gliomas**

##### Participants

Yuka Yamamoto, PhD, Kita-gun, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

Tumor hypoxia and proliferation have been recognized as determinant factors characterizing tumor aggressiveness in high-grade gliomas. To clarify in vivo hypoxia and proliferation in relation to isocitrate dehydrogenase (IDH) mutation, we retrospectively analyzed texture indices extracted from 18F-fluoromisonidazole (FMISO) PET/CT and 3'-deoxy-3'-18F-fluorothymidine (FLT) PET/CT in newly diagnosed high-grade gliomas.

##### METHODS AND MATERIALS

Thirty-three patients with newly diagnosed high-grade (WHO grade III and IV) gliomas were included in this study. They underwent both PET/CT studies with FMISO and FLT before surgery. The maximal standardized uptake value (SUV<sub>max</sub>) and 31 texture indices were measured. Texture indices were extracted from four different matrices computed for each volume of interest: gray-level co-occurrence matrix, gray-level run length matrix, neighborhood gray-level difference matrix, and gray-level zone length matrix. The PET parameters in relation to IDH1 mutation status were statistically analyzed.

##### RESULTS

The value of FMISO SUV<sub>max</sub> and FLT SUV<sub>max</sub> of IDH1-mutant tumors was significantly lower than the corresponding value of IDH1-wildtype tumors. Fifteen of 31 texture indices (Homogeneity, Energy, Contrast, Dissimilarity, Short-run emphasis, Long-run emphasis, Low grey-level run emphasis, High grey-level run emphasis, Short-run low grey-level emphasis, Short-run high grey-level emphasis, Long-run low grey-level emphasis, Run percentage, Low grey-level zone emphasis, High grey-level zone emphasis, and

Short-zone high grey-level emphasis) extracted from both FMISO and FLT PET/CT significantly differed between IDH1-mutant tumors and IDH1-wildtype tumors. In addition, 5 texture indices (Entropy, Short-zone low grey-level emphasis, Long-zone low grey-level emphasis, Zone length non-uniformity, and Zone percentage) extracted from FLT PET/CT significantly differed between IDH1-mutant tumors and IDH1-wildtype tumors. In receiver operating characteristic analysis, Entropy extracted from FLT PET/CT was the best discriminative index for predicting IDH1 mutation status.

#### **CONCLUSION**

s These preliminary results indicate that texture indices extracted from FMISO and FLT PET/CT, especially Entropy extracted from FLT PET/CT, seem to be useful for predicting IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

#### **CLINICAL RELEVANCE/APPLICATION**

Texture indices extracted from FMISO and FLT PET/CT, especially Entropy extracted from FLT PET/CT, seem to be useful for predicting IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

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## Abstract Archives of the RSNA, 2023

W5B-SPNPM

### Noninterpretive Skills (Beyond Imaging) Wednesday Poster Discussions II

#### Sub-Events

W5B-  
SPNPM-1

#### Enhancing Patient Communication with Chat-GPT in Radiology: Evaluating the Efficacy and Readability of Answers to Common Imaging-related Questions

#### PURPOSE

To assess ChatGPT's accuracy, relevance, and readability in answering common imaging-related questions and examine the effect of a simple prompt on these parameters.

#### METHODS AND MATERIALS

22 imaging-related questions were developed based on previously described categories important to patients: safety, report, procedure, preparation, meaning, and medical staff. Each question was asked three times on the ChatGPT-3.5 platform, both with and without a short prompt which instructed the model to "provide an accurate, and easy-to-understand response that is suited for an average person". Responses were evaluated by four board-certified radiologists for accuracy, consistency and relevance. Readability was assessed by Flesch Kincaid Grade Level (FKGL). Statistical comparisons were performed using chi-square tests, paired student's t-tests.

#### RESULTS

264 answers were assessed for both unprompted and prompted queries, resulting in a total of 528 evaluations. The model demonstrated a high degree of accuracy at 83% (218/264), with no significant difference for prompted responses at 87% (229/264,  $P=.2$ ). 72% (63/88) of answers were consistent across all three repeats, increasing to 86% (76/88) when prompted ( $P=0.02$ ). Essentially no responses were irrelevant, scoring at least partially relevant for 99% (261/264) of both sets of responses. Fewer responses were considered fully relevant at 67% (176/264), though this increased significantly to 80% when prompted (210/264) ( $P=.001$ ). The average FKGL was high at 13.6 [12.9-14.2] and did not significantly change with the prompt (13.0 [12.41-13.60],  $P=.2$ ). None of the responses reached the eighth grade readability level generally recommended for patient-facing materials.

#### CONCLUSION

ChatGPT demonstrates potential for accurate, consistent, and relevant imaging-related question responses. Readability levels exceed recommendations, reflecting currently available patient education materials. Prompts reduced response variability and yielded more targeted information but did not improve readability, possibly due to limitations in deviating from pre-trained knowledge without more detailed prompting.

#### CLINICAL RELEVANCE/APPLICATION

The study demonstrates ChatGPT's potential to increase accessibility to health information and to streamline production of patient-facing educational materials. Addressing readability limitations and employing prompt engineering strategies could optimize ChatGPT for imaging-related patient concerns, but cautious implementation and further research is needed.

W5B-  
SPNPM-2

#### Evaluation of Accuracy, Completeness, and Length of Rads-Lit Outputs: A Novel Patient-Facing Artificial Intelligence Literacy Tool

#### Participants

Rushabh Doshi, MPH, MSc, Cerritos, CA (*Presenter*) Nothing to Disclose

#### PURPOSE

Radiology reports frequently incorporate intricate medical jargon and lengthy text, which can lead to misunderstandings, anxiety, and erroneous interpretation for patients. By leveraging novel natural language processing (NLP) open-source technology, we developed a patient-centric tool aimed at simplifying radiology reports. Here, we test the accuracy, completeness, and length of the outputs from our tool.

#### METHODS AND MATERIALS

We engineered a proof-of-concept patient-facing radiology literacy website by harnessing OpenAI's application programming interface. Our model was specifically configured to optimize the readability of outputs (Flesch-Kincaid Grade Level: 6.68, Gunning Fog: 9.22, Coleman-Liau: 6.16, Automated Readability Index: 8.56). Three radiologists examined 62 radiology reports across modalities such as CT, MRI, X-Ray, PET, and U/S. For each of the 62 reports, the radiologists reviewed the clinical impressions and the corresponding simplified output, and evaluated the output for accuracy, completeness, and extraneous information using single-item Likert-type scales.

#### RESULTS

Two attending radiologists and one radiology resident assessed 62 Rads-Lit outputs using a five-level Likert scale, ranging from 1 (Strongly Disagree, 0-20% agreement) to 5 (Strongly Agree, 80-100% agreement). The evaluations demonstrated that the Rads-Lit outputs were factually accurate, with a median rating of 5 (80-100% agreement), and the first and third quartiles at 4 (60-80%

agreement) and 5 (80-100% agreement), respectively. The outputs were also found to be complete in relation to the original radiologist reports, with a median rating of 5 (80-100% agreement), and the first and third quartiles at 4 (60-80% agreement) and 5 (80-100% agreement), respectively. Furthermore, the radiologists strongly disagreed that the outputs were excessively long or filled with extraneous information, as indicated by median rating, first quartile, and third quartile at 1 (0-20% agreement).

## CONCLUSION

Our tool demonstrates promising results, showing that the Rads-Lit outputs frequently maintained factual accuracy and completeness in relation to the original radiologist reports while avoiding being lengthy or containing extraneous information. These findings suggest that the Rads-Lit tool has the potential to improve patient literacy and activation by enhancing the readability of their radiology reports. Further research is necessary to corroborate these findings and assess the broader impact of Rads-Lit on patient populations.

## CLINICAL RELEVANCE/APPLICATION

This study evaluates the potential of novel NLP technology to improve patient literacy and health outcomes by reducing anxiety and erroneous interpretations in radiology reports.

## W5B-SPNPM-3 Which Procedures Bring in the Most Medicare Reimbursement and RVUs for the Individual Diagnostic Radiologist

Participants

Aditya Khurana, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate which specific imaging examinations result in the most wRVUs and reimbursement for individual radiologists serving the US Medicare population.

## METHODS AND MATERIALS

Imaging claims 2013-2020 submitted by diagnostic radiologists were extracted from the CMS POSPUF database outpatient imaging claims made for beneficiaries of US Medicare Part B. These data were merged with year specific CMS professional relative value unit (wRVU) files. The total number of wRVUs as well as standardized Medicare reimbursement produced by each imaging procedure, was calculated for each radiologist. For each radiologist, the imaging examination that resulted in the largest number of wRVUs and reimbursement from 2013 to 2020 was determined. The frequency in which each CPT code produced the most wRVUs or reimbursement for an individual radiologist per year was tallied.

## RESULTS

In 2013, 5992 individual radiologists (20.3% of all radiologists) produced the largest number of imaging exam specific wRVUs interpreting screening mammography (CPT G0202), followed by CT head without contrast (CPT 70450) for 5866 radiologists (19.8%), CT abdomen and pelvis with contrast (CPT 74177) for 4475 radiologists (15.1%), single view chest radiograph (CPT 71010) for 2542 radiologists (8.6%), and CT abdomen and pelvis with and without contrast (CPT 74176) for 1387 radiologists (4.7%). In 2020, 8095 individual radiologists (25.2% of all radiologists) produced the largest number of imaging exam specific wRVUs from CT abdomen and pelvis with contrast (CPT 74177), followed by screening mammography (CPT 77067) for 5932 radiologists (18.5%), CT head without contrast (CPT 70450) for 4691 radiologists (14.6%), single view chest radiograph (CPT 71045) for 2223 radiologists (6.9%), and MRI brain without and with contrast (CPT 70553) for 1318 radiologists (4.1%). For each year evaluated the order of the five CPT codes that most frequently produced the most Medicare reimbursement for individual radiologists was constant. Screening mammography (G0202/77067) was the most frequent highest reimbursed CPT code across diagnostic radiologists, followed by CT abdomen and pelvis with contrast (CPT 74177), CT head without contrast (CPT 70450), single view chest radiograph (CPT 71010), and MRI brain without and with contrast (CPT 70553).

## CONCLUSION

Over time, the same imaging exams have consistently brought in the most reimbursement for the individual radiologist. This study documents the procedures that are likely to be a larger proportion of any radiology practice participating in Medicare.

## CLINICAL RELEVANCE/APPLICATION

This data shows which exams are the most important for a practice to generate revenue to maintain quality services for patients.

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## Abstract Archives of the RSNA, 2023

W5B-SPNR

### Neuroradiology Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPNR- A Preliminary 4D Flow MRI Analysis of Blood Flow Characteristics in Cerebral Veins of Adults** 1

##### Participants

Chihang Dai, MD, Beijing, China (*Presenter*) Nothing to Disclose

##### PURPOSE

To evaluate blood flow characteristics in the cerebral veins of adults using 4-dimensional flow magnetic resonance (4D Flow MRI).

##### METHODS AND MATERIALS

A total of 65 volunteers prospectively underwent 4D Flow MRI and 12 volunteers underwent repeated scans during one month in a single center. Velocity, average blood flow rate (Flowavg), and blood flow patterns of cerebral sinuses were evaluated for each volunteer. The mastoid emissary veins, posterior condylar emissary veins, and oblique occipital sinuses were also evaluated.

##### RESULTS

The mean age of volunteers was  $36.31 \pm 11.05$  years old, including 3 (50.8%) females and 32 (49.2%) males. 4D Flow MRI data showed good reproducibility. The velocity and Flowavg of the superior sagittal sinus increased along the direction of flow. Flowavg near torcular herophili were 3.14 times that through the straight sinus. Slight fluctuations were found within a cardiac cycle. A vortex flow pattern was shown in 12.3% of torcular herophili, 7.5% of the transverse-sigmoid junction and 51.3% of jugular bulbs and was associated with increased blood flow velocity/rate in the upstream sinuses. Mastoid emissary veins, posterior condylar emissary veins and oblique occipital sinuses were all drained in the extracranial direction.

##### CONCLUSION

Cerebral veins, including venous sinuses and emissary veins, could be measured visually and quantitatively in vivo by 4D Flow MRI. Cerebral veins' velocity varied with segments and showed slight fluctuations within a cardiac cycle. The analysis of cerebral blood flow in healthy volunteers lays the foundation for the study of cerebral venous system diseases.

##### CLINICAL RELEVANCE/APPLICATION

4D Flow MRI is a reliable method for the evaluation of hemodynamic characteristics of intracranial venous sinuses. Intracranial venous blood flow, including venous sinuses and emissary veins, could be measured visually and quantitatively in vivo. Individual segments of venous sinuses show characteristic changes in velocity and slight fluctuations within a cardiac cycle were observed. The vortex flow pattern is not uncommon in normal individuals and may be related to increased blood flow in upstream sinuses. The mastoid emissary veins, posterior condylar emissary veins, and oblique occipital sinuses were all drained in the extracranial direction. The approaches used during the current study may enable further hemodynamic research into pulsatile tinnitus, idiopathic intracranial hypertension, vascular malformation and sinus thrombosis.

#### **W5B-SPNR- A New Era in Time-of-Flight MR Angiography: Assessing the Impact of High-Resolution Deep Learning Reconstruction on Intracranial MRA Image Quality** 10

##### Participants

Masamichi Hokamura, Kumamoto, Japan (*Presenter*) Nothing to Disclose

##### PURPOSE

This study aims to assess the effect of super-resolution deep learning-based reconstruction (SR-DLR), which uses k-space properties, on image quality of intracranial time-of-flight (TOF) magnetic resonance angiography (MRA) at 3T.

##### METHODS AND MATERIALS

This retrospective study involved 35 patients who underwent MRA using a 3T MRI system with SR-DLR based on k-space properties in October and November 2022. We reconstructed MRA with SR-DLR (Matrix =  $1008 \times 1008$ ) and without SR-DLR (Matrix =  $336 \times 336$ ). We measured the SNR, contrast, and CNR in the basilar artery (BA) and the anterior cerebral artery (ACA) and the sharpness of the posterior cerebral artery (PCA) using the slope of the signal intensity profile curve at the half-peak points. Two radiologists evaluated image noise, artifacts, contrast, sharpness, and overall image quality of the two image types using a 4-point scale. We compared quantitative and qualitative scores between images with and without SR-DLR using the Wilcoxon signed-rank test.

##### RESULTS

The SNRs, contrasts, and CNRs were significantly higher in images with SR-DLR than those without SR-DLR ( $p < 0.001$ ). The slope was significantly greater in images with SR-DLR than those without SR-DLR ( $p < 0.001$ ). The qualitative scores in MRAs with SR-DLR were significantly higher than MRAs without SR-DLR ( $p < 0.001$ ).

##### CONCLUSION

s SR-DLR with k-space properties can offer the benefits of increased spatial resolution without the associated drawbacks of longer scan times and reduced SNR and CNR in intracranial MRA.

#### CLINICAL RELEVANCE/APPLICATION

SR-DLR can enhance the image quality of intracranial MRA.

#### W5B-SPNR- 11 **Super-Resolution Deep Learning-Based Reconstruction in Hippocampal MRI: A Volunteer Study Emphasizing Comparison with Actual High-Resolution Images**

Participants

Takeshi Nakaura, MD, (*Presenter*) Nothing to Disclose

#### PURPOSE

The objective of this study is to compare the impact of super-resolution deep learning-based reconstruction (SR-DLR) employing k-space properties and standard-resolution DLR on image quality for thin-slice T2-weighted hippocampal magnetic resonance imaging (MRI).

#### METHODS AND MATERIALS

Thirteen healthy volunteers participated in this study, undergoing standard-resolution (Matrix = 320 x 320) and high-resolution thin-slice T2-weighted hippocampal MRI (Matrix = 960 x 960) on a 3-T MRI system. Standard-resolution MRI was reconstructed with and without DLR (Matrix = 320 x 320) and with SR-DLR (Matrix = 960 x 960), while high-resolution MRI was reconstructed with and without DLR (Matrix = 960 x 960). Signal-to-noise ratio (SNR), and contrast and contrast-to-noise ratio (CNR) between white and grey matter in the hippocampus, as well as the slope of the transparent septum, were measured. Two radiologists were asked to rank the image noise, contrast, artifacts, sharpness, and overall image quality of all five protocols. Results of quantitative and qualitative analyses are presented as the median and interquartile range (IQR), and those between standard-resolution MRI without DLR and other protocols were compared using the Wilcoxon signed-rank test with Holm correction.

#### RESULTS

The SNRs and CNRs were significantly higher in standard-resolution images with SR-DLR (SNR: 21.01 (IQR:18.17, 29.5); CNR: 7.5 (IQR:6.4, 8.37)) than those without SR-DLR (SNR: 17.22 (IQR:14.46, 19.31); CNR: 7.5 (IQR:6.4, 8.37)) ( $p < 0.001$ ). The SNRs and CNRs were significantly lower in real high-resolution MRIs with DLR (SNR: 10.4 (IQR:9.91, 11.06); CNR: 4.84 (IQR:2.99, 5.43)) or without DLR (SNR: 10.4 (IQR:9.91, 11.06); CNR: 2.24 (IQR:1.43, 2.38)) than those in standard-resolution MRIs without DLR ( $p < 0.001$ ). There were no statistically significant differences in contrast in all protocols ( $p > 0.05$ ). The best ranks were assigned for the standard-resolution images with SR-DLR in all qualitative analyses, and these were significantly better than those of the standard-resolution images without DLR in the sharpness and overall image quality ( $p < 0.01$ ).

#### CONCLUSION

s In this volunteer study, the technique of enhancing the resolution of standard-resolution hippocampal MRI using SR-DLR demonstrated the potential to provide higher image quality in a shorter acquisition time compared to real high-resolution hippocampal MRI.

#### CLINICAL RELEVANCE/APPLICATION

SR-DLR in standard-resolution hippocampal MRI improves image quality, including sharpness and overall quality, compared to actual high-resolution images. This technique offers the potential for higher image quality in a shorter acquisition time, enhancing the clinical utility of hippocampal MRI.

#### W5B-SPNR- 12 **AI-based Virtual Synthesis of Methionine PET from Contrast-Enhanced MRI: Development and External Validation Study**

Participants

Hirota Takita, MD, PhD, Osaka, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

To generate synthetic methionine PET images from contrast-enhanced MRI (CE-MRI) through an artificial intelligence (AI)-based image-to-image translation model and to compare its performance for grading and prognosis of gliomas with that of real PET.

#### METHODS AND MATERIALS

An AI-based model to generate synthetic methionine PET images from CE-MRI was developed and validated from patients who underwent both methionine PET and CE-MRI at a university hospital from January 2007 through December 2018 (Institutional set). Pearson correlation coefficients of maximum and mean tumor-to-normal background uptake (T/N<sub>max</sub>, T/N<sub>mean</sub>, respectively) ratios and lesion volume between synthetic and real PET were calculated. Two additional open-source glioma databases of preoperative CE-MRI without methionine PET were the external test set. Using the T/N ratio, the area under the curve of the receiver operating characteristic curve (AUC-ROC) for classifying high- and low-grade gliomas and an overall survival (OS) analysis was evaluated.

#### RESULTS

The institutional set included 362 patients (mean age, 49±19 years; training=294, validation=34, test=34). In the institutional test set, Pearson correlation coefficients were 0.68 (95% CI: 0.47, 0.81), 0.76 (0.59, 0.86), and 0.92 (0.85, 0.95) for T/N<sub>max</sub> ratio, T/N<sub>mean</sub> ratio, and lesion volume, respectively. The external test set included 344 patients with glioma (mean age, 53±15 years; high-grade=269). The AUC-ROC by T/N<sub>max</sub> ratio was 0.81 (95% CI: 0.75, 0.86) and the OS analysis showed a statistically significant difference between high- (two-year survival rate=27%) and low-T/N<sub>max</sub> ratio groups (two-year survival rate=71%;  $P < .001$ ).

#### CONCLUSION

s The AI-based model-generated synthetic methionine PET images strongly correlated with real PET, and showed good performance for glioma grading and prognostication.



## CLINICAL RELEVANCE/APPLICATION

Methionine PET is useful for the management of glioma. But radiation exposure and a lack of molecular imaging facilities limit its use. Since CE-MRIs are generally obtained for patients with suspected brain tumors in routine clinical situations, synthetic methionine PET images can be obtained from CE-MRIs without the aforementioned inconveniences or additional examination.

## W5B-SPNR- Twinkling T2 STAR: Robust Radiomics Features for Reliable Cerebral Microbleeds Classifier 13

Participants

Hiroki Nakajima, RT, Osaka, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Cerebral microbleeds (MBs) have gained attention due to the increased availability of high-field-strength MR systems, as a higher microbleed burden is associated with an increased risk of ischemic stroke and cerebral hemorrhage. We aimed to identify robust Radiomics features between scans in the T2 GRE sequence and evaluate their diagnostic performance using machine learning-based classifiers.

## METHODS AND MATERIALS

We used two cohorts of subjects who underwent T2 GRE imaging in 3T MRI systems. We retrospectively reviewed 20 cases with twice T2 GRE sequences acquired in one examination from 2021 to 2022, and prospectively collected 75 subjects as hold-out test data in 2022. We defined 16x16px regions of interest (ROIs) based on a manual radiologist's annotation of MBs and randomly set up equal numbers of ROIs in other locations. We obtained 91 Radiomics features for these ROIs and measured intra-class coefficients (ICCs) to determine robust features between imaging sessions. Then, we selected seven features with ICCs greater than 0.95 to train and validate a support vector machine (SVM) classifier with the leave-one-out method. Furthermore, a radiologist randomly displayed 16x16px images for the hold-out test group and rated MBs-likeness on a 0-100 continuous variable. We evaluated the diagnostic performance using the area under the ROC curves (AUC) for univariate logistic analysis of each Radiomics feature, SVM classifier, and radiologist.

## RESULTS

For ICC evaluation and modeling, we used 212 MBs (432 total ROIs) and 192 MBs (387 total ROIs) for the test group. Regarding the inter-imaging reproducibility, 9 (10%) features had ICCs less than 0.8, and 26 (29%) had ICCs less than 0.9. Seven of the 32 (35%) features with ICCs greater than 0.95 were used to train SVM. In the test group, SVM's diagnostic performance was 0.96 recall, 0.67 precision, and 0.73 accuracy, with an AUC of 0.88 (0.85-0.92). The AUC for SVM was significantly higher ( $P < .01$ ) than the AUC for each feature alone (0.48-0.85) and not significantly lower than the radiologist's AUC of 0.91 (0.89-0.95) ( $P = .15$ ).

## CONCLUSION

s We identified robust Radiomic features inter-imaging of the T2 GRE sequence and demonstrated that an SVM classifier with these features had a comparable AUC to the radiologist.

## CLINICAL RELEVANCE/APPLICATION

Assessing reproducibility of Radiomics features between two T2 GRE imaging sessions, we identified robust features and developed an SVM classifier to improve cerebral MB detection, potentially reducing stroke and hemorrhage risk.

## W5B-SPNR- Quantitative Multiparametric MRI and Machine Learning based Model to differentiate Progression 14 from Pseudo-progression in Glioblastoma: Towards Precision Neuro-Oncology

Participants

Archith Rajan, Philadelphia, PA (*Presenter*) Nothing to Disclose

## PURPOSE

We hypothesize that radiomic features derived from conventional MRI sequences, diffusion tensor imaging (DTI) and dynamic susceptibility contrast (DSC)-perfusion-weighted imaging (PWI) along with molecular signatures will facilitate accurate distinction of true progression (TP) from pseudoprogression<sup>1,2</sup> (PsP) in glioblastoma (GBM) patients with high accuracy.

## METHODS AND MATERIALS

A cohort of 75 GBM patients exhibiting new/increasing enhancing lesions within 6 months after completion of standard-of-care therapy, were included in this study. These patients were classified as TP (n=55) or PsP (n=20) based on histological features or mRANO criteria<sup>3</sup>. Motion and eddy current corrected DTI derived maps [mean diffusivity (MD), fractional isotropy (FA), coefficient of linear (CL), planar (CP) and spherical anisotropy (CS)] and DSC-PWI derived cerebral blood volume (CBV) map, FLAIR images were co-registered to post-contrast (PC) T1-weighted images. A semiautomatic approach was used to segment contrast-enhancing regions. The median values of DTI metrics and CBV were computed. The CBV values were normalized with contralateral normal brain regions to obtain relative CBV (rCBV). The top 90th percentile rCBV values were also measured (rCBV<sub>90</sub>)<sup>4,5</sup>. O6-methylguanine-DNA-methyltransferase (MGMT) promoter status was noted from all of these patients. To address the issue of imbalanced sample size between TP and PsP, synthetic-minority-oversampling-technique (SMOTE) was applied to augment PsP cases from 20 to 35 resulting in a total sample size of 110. A random forest (RF) algorithm was applied to select the optimized features using a sequential forward feature selection (SFFS) approach. The data were randomly split into training (n=90) and testing (n=20) sets. A 6-fold cross-validation approach was also applied to training dataset. To develop a robust prediction model in distinguishing TP from PsP, several machine learning classifiers were employed. Receiver operating characteristic curve analyses were performed to determine the diagnostic accuracies.

## RESULTS

The best nine diagnostic performances of multiple machine learning algorithms, and feature selection modules are presented in Table 1. RBF support vector machine (SVM) classifier was selected to build the predictive model in distinguishing TP from PsP with a training accuracy of 90.9%, cross-validation accuracy of 85.5% and testing accuracy of 85%.

## CONCLUSION

s Machine learning model using multi-parametric MRI and molecular signatures is a promising approach to differentiate TP from PsP in

GBM patients.

#### **CLINICAL RELEVANCE/APPLICATION**

Multiparametric MRI combined with machine learning could successfully differentiate True Progression from Pseudoprogression in Glioblastomas.

#### **W5B-SPNR- Impact of Radiographic Signs of Advanced and Severe Cerebral Venous Thrombosis on the Efficacy of Endovascular Treatments**

Participants  
Mihir Khunte, Providence, RI (*Presenter*) Nothing to Disclose

#### **PURPOSE**

To study the benefit of endovascular treatment (EVT) with thrombolytics and/or thrombectomy as a treatment option for cerebral venous thrombosis (CVT) in comparison with conservative medical management.

#### **METHODS AND MATERIALS**

The National Inpatient Sample database 2016-2020 was queried to identify adult patients (18 years or older) with CVT. Patient demographics, medical comorbidities, CVT risk factors, and CVT manifestations were identified. The presence of radiographic signs of advanced and severe CVT (venous stroke, cerebral edema, and intracranial hemorrhage) were recorded. Primary and secondary outcomes were good discharge outcomes and in-hospital mortality, respectively.

#### **RESULTS**

17,130 CVT patients were identified; 945 (5.5%) received EVT. EVT patients were more likely to have strokes (35.4% vs. 21.8%,  $p < 0.001$ ), edema (35.4% vs. 20.1%,  $p < 0.001$ ), and hemorrhage (37.6% vs. 19.7%,  $p < 0.001$ ). After multivariable adjustments, EVT for patients without stroke, edema, or hemorrhage was moderately associated with higher odds of good outcomes (OR 1.86 [95%CI 0.98 - 3.53],  $p = 0.059$ ) and resulted in zero deaths. However, with increasing burden of radiographic signs of advanced CVT measured by the cumulative presence of stroke, edema, and hemorrhage, EVT was associated with decreasing odds of good outcomes and increasing odds of in-hospital mortality compared to medical management (interaction  $p = 0.046$  and  $0.029$ , respectively).

#### **CONCLUSION**

s EVT may be beneficial for patients who have not yet developed overt parenchymal manifestations of backpressure changes, and the presence of stroke, edema, and hemorrhage may diminish the comparative effectiveness of EVT over medical management.

#### **CLINICAL RELEVANCE/APPLICATION**

EVT may be beneficial in subset of patients with CVT who lack radiographic signs of advanced and severe CVT such as venous stroke, cerebral edema, and intracranial hemorrhage.

#### **W5B-SPNR- Associations of Quantitative and Qualitative Intracranial Aneurysm Wall Enhancement Indices to Wall Instability and Risk Stratification Scores**

#### **PURPOSE**

The mortality and morbidity among patients with ruptured Intracranial Aneurysms (IAs) remain as high as 50% despite the low incidence of IAs (3-50/100000). The PHASES score was established to quantify IA rupture risk, whereas the ELAPSS score was established to quantify risk of growth in IA size. MR-Vessel Wall Imaging (VWI) has gained popularity in assessing a number neurovascular diseases including IAs. Aneurysm wall enhancement (AWE) is utilized as a marker of wall instability. We evaluate two distinct quantified measures of post-contrast T1-SPACE AWE in conjunction with the PHASES and ELAPSS scores as a sign of wall instability.

#### **METHODS AND MATERIALS**

We conducted an IRB approved study of patients with unruptured IAs scanned using VWI protocol between January 2018 to December 2022. AWE was evaluated qualitatively and quantitatively on T1-SPACE sequences. IA Wall Morphology (IAWM) was evaluated on catheter angiography. Quantified AWE values were obtained using 3-point ROIs on the IA wall and normalized with white matter signal intensity obtained using 10 mm circular ROIs. Percentage change in normalized AWE from pre to post contrast imaging was calculated. Furthermore, a ratio of post-contrast quantified AWE to post-contrast pituitary infundibulum (PI) signal intensity (AWPI ratio) was also calculated. Pearson correlation test, and unpaired t-tests were used to assess statistical correlations in SPSS v28. P-value was set at 0.05.

#### **RESULTS**

We evaluated 271 IAs in 219 patients (Age: 63.31 +/- 13.17, 24-89, 165 female). The mean size of IAs was 5.12mm +/- 3.91 mm, 2-30 and the mean PHASES score was 4.31 +/- 2.73, 0-16. Qualitatively, AWE was seen in 141 (52%) IAs and irregular IAWM in 132 (48.7%). PHASES score showed a moderately strong correlation to AWPI ratio,  $r = 0.439$ , and to percentage increase in AWE,  $r = 0.334$ . ELAPSS score also showed a moderately strong correlation to AWPI ratio,  $r = 0.487$  and percentage increase in AWE,  $r = 0.367$ . AWPI ratio showed as stronger correlation than percentage increase to both PHASES and ELAPSS scores. The mean PHASES and ELAPSS scores for IAs with AWE were 5.36 and 18.48 whereas in IAs without AWE, these scores calculated to be 3.31 and 10.93, respectively, ( $p < 0.001$ )

#### **CONCLUSION**

s Our findings demonstrates a correlation between increased AWPI, Percentage Increase and higher PHASES score, ELAPSS score .

#### **CLINICAL RELEVANCE/APPLICATION**

The results of this finding suggests a possible use of both qualitative and quantitative evaluation of AWE, particularly an increased AWPI ratio as a marker of wall instability. This could be utilized to evaluate the progression of wall instability and to guide therapeutic intervention.

#### Participants 4 **Impact of White Matter Hyperintensities on Structural Connectivity and Cognition in Cognitively Intact Older Adults**

Mohammad Taghvaei, MD, MPH, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **PURPOSE**

White matter hyperintensities (WMH) on T2-weighted fluid-attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI) are nearly ubiquitous in aging. Prior studies suggest that both the volume and the spatial distribution of WMH lesions are predictive of cognitive performance decrements. WMH lesion burden has also been associated with both the severity and progression rate of Alzheimer's pathology. We used indirect brain mapping with virtual lesion tractography in older control subjects from the Alzheimer's Disease Neuroimaging Initiative (ADNI) study to test the hypothesis that the extent of specific white matter (WM) tract disconnection due to WMH is associated with corresponding cognitive performance decrements.

##### **METHODS AND MATERIALS**

Demographic information, structural MRI data, PET imaging, neuropsychological test scores, and CSF analysis from 481 cognitively intact ADNI subjects were obtained. WMH lesions mask were extracted from the FLAIR MRI of these subjects and applied as a region of avoidance for fiber tracking in 50 Human Connectome Project (HCP) subjects' diffusion MRI data to estimate tract disconnection caused by each WMH lesion mask for 8 WM pathways. The direct relationship of global WMH lesions burden or tract disconnections with performance in specific cognitive domains, as well as the mediation effect of specific tract disconnection on WMH lesion related cognitive performance decrement in the corresponding domain were assessed.

##### **RESULTS**

Global WMH lesion burden was significantly associated with global cognitive measures ( $p=0.011$ ), episodic memory ( $p=0.015$ ), executive function, and processing speed ( $p=0.018$ ). Further, estimated tract disconnection in the right inferior fronto-occipital fasciculus, right frontal aslant tract, right inferior longitudinal fasciculus, and right superior longitudinal fasciculus disconnection mediated the effect of WMH lesion volume on executive function, the left uncinate fasciculus disconnection mediated the effect of WMH lesion volume on memory, and the right frontal aslant tract disconnection mediated the effect of WMH lesion volume on language.

##### **CONCLUSION**

s Tract-specific disconnections caused by WMH lesions mediate cognitive domain-specific decrements in cognitive performance in cognitively intact older adults.

##### **CLINICAL RELEVANCE/APPLICATION**

The spatial distribution of WMH lesions and the extent of particular WM tracts involvement by them could predict decrement in corresponding cognitive domains.

#### W5B-SPNR- **Transformer-based Unified Tissue and White Matter Hyperintensity Segmentation of UK Biobank Brain Imaging** 5

Participants

James Ruffle, MSc, London, United Kingdom (*Presenter*) Nothing to Disclose

##### **PURPOSE**

The causes and consequences of white matter hyperintensities (WMH), amongst the commonest findings in neuroradiology, remain a subject of intense study. UK Biobank provides the largest research cohort of MRI studies with accompanying WMH labels, with great potential to cast light on this important condition. Unfortunately, many of the lesion labels are spurious, misidentifying healthy choroid plexus, normal ependymal lining, or imaging artefact, leading to reduced accuracy and potential confounding of downstream analytic tasks. Here we derive a substantially improved set of WMH labels through the combination of classical and vision-transformer based segmentation methods.

##### **METHODS AND MATERIALS**

In a cohort of 33241 UK Biobank participants, we develop a pipeline employing classical multi-channel volumetric (T1 and FLAIR) tissue segmentation, brain extraction, and WMH segmentation based on a vision transformer model with a custom tissue-leveraging loss. We quantify segmentation fidelity out-of-sample with conventional metrics, intra-subject stability over time, and a downstream predictive task.

##### **RESULTS**

We obtained out-of-sample Dice scores for brain extraction ( $>0.999$ ), gray matter (0.98), white matter (0.99), cerebrospinal fluid (0.96), and WMH (0.87). At 8 seconds per participant, processing time was significantly faster than conventional tissue segmentation with SPM (218 seconds,  $p<0.0001$ ). No differences in model performance were observed between young or old, and male or female ( $p>0.05$ ), indicating good demographic calibration. WMH segmentation showed significantly greater temporal stability compared with current UK Biobank WMH labels ( $p<0.0001$ ) for a subset of the cohort imaged twice. Age regression based on WMH count was superior compared with the original labels ( $R^2=0.18$  vs 0.14).

##### **CONCLUSION**

s We provide a tissue and WMH segmentation model optimized for UK Biobank data with evidence of fidelity superior to existing labels.

##### **CLINICAL RELEVANCE/APPLICATION**

We make our model and segmentations available through UK Biobank to assist in the study of this important disorder.

#### W5B-SPNR- **Hyperintensities in the Anterior Portion of the Callosal Splenium on FLAIR: A Large Cohort Study** 6

Participants

Sera Kasai, Hirosaki-Shi, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

Although hyperintensity in the anterior portion of the callosal splenium on FLAIR (aCS-hyperintensity) is a common finding in elderly adults (Figure), no previous studies with large sample sizes have examined the clinical significance of the aCS-hyperintensity. In this large elderly population study, we aimed to investigate the associations of aCS-hyperintensity with cerebro- and cardiovascular risk factors and cognitive decline. In addition, to illustrate the probable mechanism thereof, we compared the clinical significances of the aCS-hyperintensity with those of the other MRI measurements.

## METHODS AND MATERIALS

This cross-sectional study included 2,110 participants (median age, 69 years; 61.1% females) who underwent 3T MRI. The participants were grouped as 215 with mild cognitive impairment (MCI) and 1,895 cognitively normal older adults (NOAs). Two neuroradiologists evaluated aCS-hyperintensity by using a four-point scale (none, mild, moderate, and severe) (Figure). Periventricular hyperintensities (PVHs) were also rated on a four-point scale according to the Fazekas scale. The total intracranial volume (ICV), total brain volume, choroid plexus volume (CPV), and lateral ventricle volume (LVV) were calculated.

## RESULTS

For the cerebro- and cardiovascular risk factors, the logistic regression analysis showed that diabetes was the main predictor of aCS-hyperintensity after adjusting for potential confounders (age, sex, hypertension, hyperlipidemia, BMI, smoking status, alcohol frequency, and medical history) ( $p < 0.01$ ). On the other hand, PVH was associated with a presence of hypertension ( $p < 0.01$ ). The aCS-hyperintensity rated as "severe" was associated with a presence of MCI. The logistic regression analysis for the imaging factors showed that PVH was significant independent predictor of aCS-hyperintensity ( $p < 0.01$ ). The LVV was also an independent predictor of aCS-hyperintensity when brain volume and PVH grade was added to the analyses ( $p < 0.01$ ).

## CONCLUSION

Cerebral small vessel disease due to diabetes is a major contributor to the development of aCS-hyperintensity. Cerebrospinal fluid clearance failure may also relate to aCS-hyperintensity, which may offer new insights into the pathologic processes underlying MCI.

## CLINICAL RELEVANCE/APPLICATION

Although aCS-hyperintensity is a common finding in elderly adults, its severity may associate with cerebral small vessel disease due to diabetes and MCI presence.

## W5B-SPNR- Radiological and Clinical Characteristics of N2O Related Myeloneuropathy: A Multicenter Study

7

Participants

Paula Heredia Cacha, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

## PURPOSE

The aim of this work is to report the clinical and imaging features of nitrous oxide (N2O) recreational abuse related myeloneuropathy.

## METHODS AND MATERIALS

We conducted a retrospective multicenter study. The inclusion criteria were: (i) neurological symptoms, (ii) history of recreational N2O abuse, (iii) myeloneuropathy on MRI. The exclusion criteria were: (i) other causes of myelopathy (ii) absence of strong temporal association with N2O consumption. Demographic, clinical and laboratory data were collected. Imaging patterns, treatments and patients' outcomes were analyzed.

## RESULTS

We included 40 patients (age:  $24 \pm 4$  years; 18 ?) from 8 tertiary care centers. The study period was from December 2020 to April 2023. A chronic consumption (at least weekly for = 3 months) of N2O was present in 77% of the patients (26/34). All patients (40/40) presented with paresthesia, 36/36 with distal onset. Other main complaints were unsteady gait (38/40; 95%) and limb weakness (23/40; 58%). When measured, homocysteine level was elevated (32/33; 97%), while vitamin B12 level was mostly normal (20/34; 58%). Nerve conduction studies were often altered (23/32; 72%). Typical MRI features of subacute combined degeneration (SCD) of the spinal cord in cervical and upper thoracic cord were often seen (35/40; 86%, fig. 1A). Contrast enhancement of SCD was present in 5/35 of the patients (14%, fig. 1B). In 3 patients, a brain MRI was performed in first place for ataxia and 3D-FLAIR sequence suggested upper cervical abnormalities in its lowest slices (Fig. 1C). Atypical MRI findings (5/40) consisted of (i) cone involvement associated with exclusively lateral columns involvement (1/5, fig. 1D) and (ii) abnormally extensive lesion to lower thoracic cord (4/5; fig. 1F). 20% (7/35) of patients showed cauda equina roots enhancement (Fig. 1E). Patients were treated mainly with vitamin B12 supplementation (36/38; 95%). When follow-up information was present (12/40), recovery was slowly progressive, with persistent paresthesia (10/12; 80%).

## CONCLUSION

N2O-induced myeloneuropathy, mostly due to functional vitamin B12 deficiency, typically appears on MRI as SCD involving the cervical and upper thoracic cord. However, atypical radiological findings exist, and cauda equina roots enhancement is possible, even though not described yet in literature. In addition, cerebral MRI can pinpoint the correct diagnosis when not suspected.

## CLINICAL RELEVANCE/APPLICATION

N2O is a popular recreational drug among young adults. Social awareness on N2O side effects is poor and clinicians lack on information on vitamin B12 deficiency-related myeloneuropathy, a common N2O toxic effect.

## W5B-SPNR- 3D SPACE MRI of the Transverse Ligament in Whiplash Associated Disorder

8

## PURPOSE

To describe the 3D SPACE MRI findings of transverse ligament (TL) in whiplash associated disorder (WAD), and to compare them with nontraumatic group.

## METHODS AND MATERIALS

Cervical spine MRIs were retrospectively analyzed including 46 patients with WAD and 62 patients in the nontraumatic group. Axial

Cervical spine films were retrospectively analyzed including 40 patients with WAD and 62 patients in the nontraumatic group. Axial 2D T2-SPACE images were used for image analysis. The symmetry of lateral atlantodental interval (LADI) and the morphology grade of TL was evaluated by two radiologists, using a four-point scale (0 = homogeneous low SI with normal thickness, 1 = high SI with normal thickness, 2 = reduced thickness, 3 = full-thickness rupture or indistinguishable from surrounding structures). The presence of atlantoaxial instability and the number of cervical levels with degeneration was evaluated.

## RESULTS

Among the WAD patients, 17% showed asymmetric LADI and 39% showed high-grade TL morphology grade (grade 2 or 3). The high-grade TL change group had a significantly higher mean age than the low-grade group. There was no significant difference in WAD stage or grade between the high-grade and low-grade TL change groups. High-grade TL changes were significantly more frequent in the WAD group compared to the nontraumatic group, and the number of degenerative levels was lesser in the WAD group. Logistic regression analysis revealed that a lesser number of degenerative levels and high-grade TL changes were independent predictors for WAD.

## CONCLUSION

s High-grade TL changes were significantly more frequent in the WAD group compared to the nontraumatic group.

## CLINICAL RELEVANCE/APPLICATION

The evaluation of TL using 3D SPACE MRI sequence can be useful in the evaluation and management of the WAD patients.

## W5B-SPNR- Predicting Outcome of the Epidural Blood Patch in Spontaneous Intracranial Hypotension by using an Artificial Intelligent Aided Quantitative MRI Approach

Participants

Jyhwen Chai, MD, PhD, Taichung, Taiwan (*Presenter*) Nothing to Disclose

## PURPOSE

Spontaneous intracranial hypotension (SIH) is a disorder of spinal CSF leakage with uncertain pathogenesis that presents challenges in reliable diagnosis and treatment. Though epidural blood patching (EBP) is commonly used, response rates are variable and predictors are lacking. In this study, we aimed to predict the outcome of EBP treatment in SIH patients using a quantitative MRI approach aided by artificial intelligence (AI).

## METHODS AND MATERIALS

We recruited 30 SIH patients with typical orthostatic headache and characteristic MRI findings of spinal CSF leakages, and 26 healthy volunteers. In addition to brain MRI, we used retrospective ECG-gated cine phase-contrast (PC) sequences to measure fluctuating CSF flow, and a heavy 3D-T2WI of the whole spine to identify CSF leakage and quantify spinal CSF volume. We used YOLO algorithms of AI models for object detection and semantic segmentation of CSF space on spine images, and a pulsatility-based segmentation (PUBS) method combined to measure CSF flow dynamics in the cine PC-MRI.

## RESULTS

Our results showed that SIH patients had significantly lower mean and peak CSF flux at the level of the 2nd cervical spine and a smaller volume of whole spinal CSF compared to healthy volunteers. The optimal cut-off values to distinguish the two groups were 1.00 ml/s and 3.53 ml/s for mean and peak flux, respectively, with the best AUC of 0.821 and 0.833 ( $p < 0.001$ ). The cut-off value of whole spinal CSF volume was 64.9 ml/s with the AUC of 0.694 ( $p < 0.05$ ). Using these two cut-off values of CSF flux, we divided 25 of 30 SIH patients accepting EBP into two groups based on high and low CSF flow dynamics one week after treatment. 25 of 30 SIH patients who underwent EBP were divided into high and low CSF flow dynamics groups. Of the 13 patients with high CSF flow dynamics and much improvement in orthostatic headache, 10 received one EBP and 3 received two. Nine of the 12 patients with low flow dynamics and persistent symptoms required more than two EBPs.

## CONCLUSION

s Our study suggests that CSF flow parameters in the upper cervical spine are more sensitive than spinal CSF volume measurement in detecting early pathophysiological alterations in SIH patients after EBP treatment. AI-aided quantitative MRI has the potential to effectively predict the treatment response of EBP in SIH patients.

## CLINICAL RELEVANCE/APPLICATION

AI-aided quantitative MRI could be an effective tool for predicting the treatment response of epidural blood patching in patients with spontaneous intracranial hypotension (SIH).

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## Abstract Archives of the RSNA, 2023

W5B-SPOB

### OB/Gynecology and Pediatric Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPOB- The Application of Radiomics in Predicting Intraoperative Massive Bleeding in Cesarean Scar Pregnancy Patients** 1

#### Participants

Feng Gao, Shanghai, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To develop a comprehensive model based on MRI radiomics signatures and independent risk factors for predicting the risk of intraoperative massive bleeding in cesarean scar pregnancy (CSP) patients.

#### METHODS AND MATERIALS

In total, 119 patients with CSP who underwent surgery were retrospectively reviewed. According to surgical records, intraoperative bleeding greater than 100ml was defined as intraoperative massive bleeding. All subjects were randomly separated into the training and testing sets at a ratio of 7:3. The radiomics signatures from the gestational sac (GS) and decidua (DEC) regions were respectively extracted in T2WI. Variance analysis, univariate correlation analysis (cutoff = 0.7), general univariate analysis and Gradient Boosting Decision Tree (GBDT) selection were performed orderly to select features. Seven image geometric features and eight clinical features were recorded and analyzed. Information with statistically significant differences was utilized in conjunction with the selected radiomics features to construct predictive models via the logistic regression model. Models were evaluated through ROC and AUC analysis. Decision curve analysis (DCA) evaluated the clinical usefulness of the constructed models, while Delong's test compared performance differences.

#### RESULTS

Thirty-seven patients suffered intraoperative massive bleeding and 82 patients did not. Five, eight, and nine radiomics features were selected from DEC, GS, and DEC+GS cohort, respectively. Seven features were statistically differently between GS and DEC (all  $p < 0.05$ ), and were included into the model as predictive features. AUCs of test datasets were 0.856, 0.843, and 0.846 for DEC, GS, and DEC+GS, respectively. Calibration curves with H-L test  $p$  values  $> 0.05$  showed good fitness for all three models. Delong's tests revealed no statistical differences among AUCs, indicating similar predictive abilities of the models. DCA showed that blood loss prediction models are beneficial when threshold probability ranges from 0.02 to 0.78.

#### CONCLUSION

A prediction model composed of T2WI-based radiomics features, image geometric features and clinical parameters could be applied to guide the gynecologists assess the risk of intraoperative bleeding in CSP patients before surgery.

#### CLINICAL RELEVANCE/APPLICATION

CSP refers to an ectopic pregnancy in which the GS is implanted into the scar of a previous cesarean section uterine incision. It may cause uncontrollable bleeding, uterine rupture, and even require hysterectomy during surgery. Our combined prediction model can preoperatively, accurately, and noninvasively identify high-risk individuals. For these high-risk individuals, preoperative intervention can be taken to avoid the massive bleeding.

#### **W5B-SPOB- Accelerated Three-dimensional Susceptibility Weighted Imaging of the Whole Spine of Fetus at 3T** 2

#### PURPOSE

The aims of this study were to evaluate the image quality, vertebral visibility and diagnostic performance in suspected fetal vertebral pathologies of three-dimensional (3D) susceptibility weighted imaging (SWI) of the whole spine column at 3T magnetic resonance imaging (MRI) and compared these with those of conventional protocol and ultrasonography (US).

#### METHODS AND MATERIALS

A total of 37 pregnant women (gestation age 22 to 39 weeks, average  $29 \pm 3$  weeks) with suspected fetal vertebral anomalies by ultrasound (US) screening underwent 3.0T MR imaging with 3D SWI, conventional two-dimensional (2D) half-fourier acquisition single-shot turbo spin-echo (HASTE) and 3D true fast imaging with steady-state precession (True FISP). The acquisition time of each protocol was recorded. Signal-to-noise ratios (SNRs) and contrast-to-noise ratios (CNRs) were determined in representative interest regions of fetal thoracic vertebrae and compared among three pulse sequences. Two radiologists rated image quality independently in random order on a 5-point scale. Kappa coefficients were computed to assess inter-observer reliability. Receiver operating characteristic curves were generated, and the area under the curve (AUC) was used to compare the diagnostic performance of each protocol in vertebral deformities.

#### RESULTS

The acquisition time was 15 s for 3D-SWI and 17 s for 3D True FISP, significantly shorter than conventional HASTE (37 s; both  $P < 0.01$ ). Of the three protocols, The SNR was highest on 3D True FISP, while the CNR was highest on 3D SWI. Visualization of all

segments of the whole spine by 3D SWI was comparable with 3D True FISP. In contrast, 3D SWI and 3D True FISP depicted cervical and sacrococcygeal vertebrae better than HASTE. The weighted kappa statistic was 0.70-0.89 to evaluate the image quality of all segments of the whole spine, indicating good to excellent interobserver agreement. 3D SWI had the highest diagnostic performance for detecting fetal vertebral anomalies (AUC = 0.92).

## CONCLUSION

s 3D-SWI is feasible for improved visualization of the whole fetal vertebral column and their congenital malformations with adequate image quality, thereby providing a supplementary method to conventional MR imaging.

## CLINICAL RELEVANCE/APPLICATION

Our preliminary results suggest that 3D-SWI enables superior 3D visualization of 3D sequences take an advantage in display of the overall structure of the spine compared with conventional 2D sequences. A potential use of the 3D sequence is to define the degree of scoliosis or precise localization of deformed vertebrae. 3D sequences could be a useful addition to the routine examination of the fetal vertebrae, facilitating the incorporation of this technique into routine patient studies.

## W5B-SPOB- Doppler Ultrasound Gated Fetal Cardiac MRI in an Unselected Population: A Clinical Feasibility Study 3

### PURPOSE

Doppler ultrasound-based gating of fetal cardiac MRI has shown promising results in late pregnancy but has not been tested in younger fetuses <26 weeks of gestation in a clinical setting yet. The aim was to investigate the feasibility of ultrasound-gated fetal cardiac imaging in clinical routine during whole-body-MRI and the association of image quality with gestational age.

### METHODS AND MATERIALS

We included 23 singleton pregnancies with clinical indication for fetal whole-body-MRI with and without suspected cardiac anomalies. Standard protocols for body and CNS MRI were performed, followed by gated cine-balanced steady state free precession sequences of the fetal heart in three planes (four-chamber-view (4C), short (2S) and long (2L) axis two-chamber-views). Image quality was rated "good" if there was depiction of both atria and ventricles in the four-chamber-view, and of the left atrium and ventricle in the long and short axis two-chamber view without artifacts. In case of displaced planes or artifacts but possible identification of cardiac anatomic structures, image quality was rated as "moderate". If no recognizability was given, images were rated "non diagnostic". Image quality was correlated with gestational week (GW) groups (GW <26, GW 26-31, GW >31).

### RESULTS

We evaluated a total of 69 cardiac MRI sequences in 23 fetuses (70% with and 30% without suspected cardiac anomalies; GW <26: 30.4%, GW 26-31: 30.4%, GW >31: 39.1%; mean: 28+6 GW +/-30.4 days). Overall, image quality was "good" in 31 (45%) of the cardiac sequences and "moderate" in 21 (30%). Seventeen (25%) were "non diagnostic". Differences in image quality were significant between the cardiac planes ( $p=0.013$ ) with best quality of the 2S and poorest quality of the 2L. Highest image quality was found in the youngest fetuses <26 GW ("good" in 57%, "moderate" in 19%, "non diagnostic" in 24%); followed by fetuses >31 GW ("good" in 48%, "moderate" in 41%, "non diagnostic" in 11%) and fetuses between 26 and 31 GW ("good" in 29%, "moderate" in 29%, "non diagnostic" in 43%). There was no significant difference between age groups ( $p=0.158$  for 4C,  $p=0.595$  for 2S,  $p=0.178$  for 2L).

## CONCLUSION

s Doppler ultrasound gated fetal cardiac MRI with diagnostic quality in 75% of cardiac planes is feasible during clinical routine whole-body-MRI already in the second trimester of pregnancy. Image quality is not associated with gestational age.

## CLINICAL RELEVANCE/APPLICATION

Fetal cardiac MRI in the second and third trimester of pregnancy could be included in a whole-body MRI protocol as a complementary imaging method to echocardiography in congenital heart disease when ultrasound conditions are limited.

## W5B-SPOB- Automatic Quantification of Fetal Brain Gyrfication Based on MRI in Control and in Fetuses with Polymicrogyria and Lissencephaly 4

### PURPOSE

Current imaging assessment of fetal brain gyrfication is performed qualitatively and subjectively using both ultrasound and MRI. A few previous studies suggested methods for quantification of fetal gyrfication based on 3D reconstruction of MRI, which requires unique data and is time-consuming. In this study, we aimed to develop an automatic pipeline for gyrfication assessment based on routinely acquired fetal MRI 2D data, quantify normal changes with gestation, and measure differences in fetuses with lissencephaly and polymicrogyria compared with controls (fetuses with normal gyrfication).

### METHODS AND MATERIALS

Coronal T2 weighted MRI data of 162 fetuses retrospectively collected from two clinical sites were included: 134 control fetuses, 12 with lissencephaly, 13 with polymicrogyria, and three suspected with lissencephaly based on ultrasound, yet with normal MRI diagnosis. The developed automatic pipeline included brain detection, brain component segmentation and identification of the right and left hemisphere, and calculating five gyrfication parameters separately for each hemisphere based on the area and ratio between the contours of the cerebrum and its convex hull.

### RESULTS

In control fetuses, all parameters were changed significantly along gestational age ( $p<0.05$ ), providing developmental curves on a wide range of gestation (27-37 weeks). Compared with controls, fetuses with lissencephaly showed significant reductions in all gyrfication parameters ( $p=0.02$ ). Similarly, but less pronounced, significant reductions were detected for fetuses with polymicrogyria in several parameters ( $p=0.001$ ). The three suspected fetuses showed normal gyrfication, supporting MRI diagnosis.

## CONCLUSION

s This study presents a pipeline for automatically quantifying fetal brain gyrfication and provides normal developmental curves from a large cohort. These curves differentiated fetuses with lissencephaly and polymicrogyria significantly, demonstrating lower values. The method may aid radiological assessment and improve the early identification of fetuses with cortical malformation.

**CLINICAL RELEVANCE/APPLICATION**

The method suggested in this study provides a quantitative assessment of fetal brain gyrification, and can aid radiological diagnosis and improve early identification of fetuses with cortical malformation.

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## Abstract Archives of the RSNA, 2023

W5B-SPPD

### Pediatric Imaging Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPPD- Deep-learning Reconstruction for Reducing Slice Thickness and Radiation Dose in Pediatric CT: Matched Pair Comparisons with Standard Dose Thick Slice Iterative Reconstruction**

#### Participants

Ryota Harai, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### PURPOSE

Low-dose and thin-slice image acquisition is desirable for pediatric CT, but increased image noise can compromise image quality and diagnostic confidence. Deep learning reconstruction (DLR) may be a promising technique to simultaneously reduce radiation dose and slice thickness due to its excellent noise reduction performance. This study aimed to compare the image quality between standard-dose, thick-slice (3 mm) hybrid iterative reconstruction (HIR) and low-dose, thin-slice (0.5 mm) deep-learning reconstruction DLR in pediatric CT.

#### METHODS AND MATERIALS

This retrospective study included 76 children (=6 years) who underwent 80-kVp contrast-enhanced CT using standard dose (n=38) and low dose (n=38) protocols on a 320-row scanner. Patient age and body weight were matched between the standard and low dose groups. The standard dose images were reconstructed at a 3 mm slice thickness using the HIR algorithm; the lower dose images were reconstructed at a 0.5 mm slice thickness using the HIR and DLR algorithms. The size-specific dose estimate (SSDE) was compared between groups. For quantitative image analysis, image noise and contrast-to-noise ratio (CNR) at the hepatic parenchyma, abdominal aorta, and portal vein were quantified. For qualitative assessment, noise magnitude, noise texture, edge sharpness, partial volume effect, artifacts, and diagnostic confidence were subjectively rated on a four-point scale.

#### RESULTS

There were no significant differences in age ( $24.1 \pm 23.0$  vs.  $24.2 \pm 23.0$  months,  $p=0.98$ ) and body weight ( $9.9 \pm 4.6$  vs.  $10.2 \pm 5.8$  kg,  $p=0.80$ ) between the standard and low dose groups. The SSDE of the low dose group was 60% lower than that of the standard dose group ( $3.3 \pm 0.9$  vs.  $8.3 \pm 1.6$  mGy,  $p<0.01$ ). DLR considerably reduced the quantitative image noise and improved CNR and subjective image quality of the low dose 0.5 mm images compared to HIR (all,  $p<0.001$ ). Compared to the standard dose 3 mm HIR images, the low dose 0.5 mm DLR images showed significantly lower quantitative image noise ( $p=0.02$ ) and equivalent CNR in all structures analyzed (all,  $p>0.11$ ). The low dose 0.5 mm DLR images achieved superior subjective scores for diagnostic confidence compared to standard-dose 3 mm HIR images ( $p<0.01$ ).

#### CONCLUSION

In pediatric CT, the application of DLR to low-dose thin-slice (0.5 mm) images can yield equivalent or even better subjective and objective quality compared to standard-dose thick-slice (3 mm) HIR images.

#### CLINICAL RELEVANCE/APPLICATION

DLR allows reduction of both radiation dose and slice thickness in pediatric CT without increasing image noise and degrading the subjective image quality compared to the HIR algorithm.

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## Abstract Archives of the RSNA, 2023

W5B-SPPH

### Physics Wednesday Poster Discussions II

#### Sub-Events

#### **W5B-SPPH- Extending Coronary Calcium Scoring to New Protocols using a Specificity Criterion** 1

Participants

Scott Hsieh, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Coronary calcium is scored today using the Agatston algorithm, which was devised for 3-mm thick slices at 120 kVp. Scanners today offer protocols with thinner slices, better in-plane resolution, lower kVp, different mAs, advanced reconstruction, or new technologies such as multi-energy or photon counting detector CT. A framework is desired to adapt the Agatston algorithm threshold to these variations while maintaining an acceptable false positive rate. We propose to do this directly by imposing a specificity criterion. Because our interest is in detecting smaller calcifications, we do not impose a minimum size criterion.

#### **METHODS AND MATERIALS**

For each scan, we select a series of control regions (2 ml each, matching the volume of the coronary arteries) in a nearby, uniform anatomic area or in an anthropomorphic phantom of matched patient size and protocol. The 95th percentile of the maxima of these control regions is selected as the scoring threshold to ensure a Type I error rate of 5%. An adjustment is made for the mean difference in CT number between the control regions and coronary arteries, if any. We tested this framework on numerical simulations and an anthropomorphic phantom with 10 small calcifications (from 0.4 to 0.8 mm in size) that was scanned with different energy integrating detector CT (EID-CT) or photon counting detector CT (PCD-CT) protocols, all at matched dose.

#### **RESULTS**

In numerical simulations, our framework selected CT thresholds between 74 to 212 HU depending on the dose level and reconstruction kernel used. Higher doses improved sensitivity, but all scans had equivalent specificity. The sharper kernel increased sensitivity for small, bright calcifications but decreased sensitivity for large, less bright calcifications because the threshold increased with sharpness. In the anthropomorphic phantom, with a medium-sharp Qr54 EID-CT with 0.6 mm thick slices, a threshold of 410 HU was selected, and sensitivity was 40%. With a sharper Qr66 kernel, the threshold increased to 1015 HU and the sensitivity fell to 30%. With PCD-CT and a Qr68 kernel, the threshold decreased to 357 HU threshold because of the higher resolution capability of PCD-CT and sensitivity increased to 90%. No false positives were seen in these cases.

#### **CONCLUSION**

A specificity criterion provides a disciplined approach for selecting an Agatston scoring threshold. This allows objective detection of coronary calcium in new protocols and was demonstrated on high resolution protocols from PCD-CT.

#### **CLINICAL RELEVANCE/APPLICATION**

Coronary calcium scoring algorithms must be modified to take advantage of new scanner capabilities. We provide a general framework for making modifications that is especially useful for new, higher resolution CT protocols.

#### **W5B-SPPH- Impact of Deep Learning Reconstruction on Radiation Dose Reduction and Cancer Risk in CT** 10 **Examinations: A Real-World Clinical Analysis**

Participants

Naoki Kobayashi, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### **PURPOSE**

The purpose of this study is to estimate the degree to which the introduction of Deep Learning Reconstruction (DLR) into clinical settings may reduce the radiation dose and the risk of radiation-induced cancer from CT examinations, utilizing real-world clinical data.

#### **METHODS AND MATERIALS**

In our institution, we retrospectively collected scanning information for two distinct periods based on the date of DLR implementation: the 12 months immediately prior to the introduction of DLR, when iterative reconstruction (IR) was used for routine CT, and the 12 months following the implementation of DLR, when the routine CT reconstruction was switched to DLR. Inclusion criteria consisted of adult patients (aged 20 to 100 years) who underwent body CT during this period on specific CT units where DLR was introduced. The dose management system, Radimetrics™ (Bayer), was used to collect dose data and to estimate the equivalent dose for each organ and the effective dose for the whole body. From the dose data, we calculated the reduction rate of the average dose upon the implementation of the DLR. Utilizing the R package, "LARisk 1.0.0", we also estimated the lifetime attributable risk (LAR) for each CT examination based on exposure dosage estimates. We summarized the LARs by age, gender, and organ, and evaluated the degree to which the LAR was altered before and after the implementation of DLR. The number of radiation-induced cancers before and after the introduction of DLR was also estimated.

## RESULTS

A total of 6,172 cases prior to and 6,423 cases following the implementation of DLR were incorporated into the analysis. The total effective dose in body CT was significantly lower post-DLR introduction ( $15.8 \pm 10.6$  mSv) compared to pre-DLR introduction ( $27.9 \pm 14.1$  mSv) ( $p < 0.001$ ), amounting to a 43% dose reduction. The decrease in radiation dose resulted in a substantial reduction in the risk of radiation-induced cancer, with particularly notable benefits in a group of relatively young women. The estimated annual incidence of radiation-induced cancers was 0.261% (16.1 out of 6,172) prior to the introduction of DLR and 0.139% (8.9 out of 6,423) following its implementation.

## CONCLUSION

Our single-center study suggests that the implementation of DLR has the possibility to reduce radiation dose and radiation-induced cancers by nearly half in the clinical routine CT compared with the iterative reconstruction.

## CLINICAL RELEVANCE/APPLICATION

This study shows the degree to which the introduction of DLR contributes to a reduction in radiation dose and thus in the incidence of radiation-induced cancer.

## W5B-SPPH- A Fundamental Investigation into the Behavior of Active Collimators in Multi-detector CT Systems 11 under Varying Imaging Conditions

Participants

Ryo Moriwake, BS, Kurashiki, Japan (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to investigate that the effects with and without active collimator usage on dose profiles in the body axis direction and over-range length when scan conditions are altered.

## METHODS AND MATERIALS

We used a 80-detector row CT scanner. A polymethyl methacrylate (PMMA) phantom with a diameter of 16 cm was placed at the center of the gantry rotation. The high-accuracy Thimble ionization chambers (10X6-0.6CT, Radcal) was inserted in the center of the phantom with a scan length of 10 cm to include scattered radiation. The scan parameters were set as follows: tube voltage of 120 kV, tube current and rotation speed set to 50 mAs, and various combinations of detector rows of  $0.5 \times 80$  mm,  $0.5 \times 64$  mm, and  $1.0 \times 40$  mm were used at three pitch factor levels: High Definition, Standard, and High Speed. Each measurement was performed three times, and the axial dose profiles and over-range lengths were determined for each scan condition.

## RESULTS

The dose profiles in the Z axial direction with and without AC were wider in each scan condition with AC than without AC. The dose profiles in the body axial direction during the change of imaging conditions tended to differ depending on the rotation speed and the number of detector rows. The widest dose profile was observed at high speeds. The over-range length was approximately 18 to 45 mm. The over-range length was particularly large at the combination of 0.5 sec,  $1.0 \times 40$  mm, and high speed.

## CONCLUSION

By comparing the dose profiles with and without AC, the operation of AC was confirmed. It was also confirmed that the operation of the AC depends on the imaging conditions. Overrange lengths ranged from about 18 to 45 mm, The overrange length was particularly large for the combination of 0.5 sec,  $1.0 \times 40$  mm, and high speed.

## CLINICAL RELEVANCE/APPLICATION

The use of active collimator may reduce over-range. Since the over-range varies depending on the scan conditions, it is important to understand the effect of overrange in advance for children with a short scan range. In addition, the use of a semiconductor detector may make it possible to easily determine the effect of over-range.

## W5B-SPPH- Effect of Radiation Dose on CT Attenuation of Photon Counting CT Scanner: A Phantom Study 12

## PURPOSE

NAEOTOM Alpha is the new generation CT scanner (Siemens Healthineers, Forchheim, Germany) which epoch-makingly used the semiconductor material for detector. The new detector system could convert photons directly into electronic signals to improve the utilization of photons and result in a lower noise, a higher resolution and image quality. Compared with the mixed image in dual source system, NAEOTOM Alpha would generate a monoenergetic image of 70keV as the 'standard' image for doctors' diagnosis. In this project, we want to first evaluate the accuracy and change of CT attenuation with different mono-energetic images using a liver nodule phantom.

## METHODS AND MATERIALS

We applied a liver nodule phantom (QRM, Möhrendorf, Germany) consisting of the anthropomorphic abdomen phantom body, the liver and spleen insert in this project. The liver insert contains multiple oval and spherical lesions of different sizes and in two kinds of densities. The phantom was scanned with the standard QuantumPlus protocol on NAEOTOM Alpha in 3 different scanning modes (Spiral, Flash and Sequence). In each mode, the tube voltage was set at 120kV and 140kV. Each scan was performed for 3 times to reduce the errors. All images were reconstructed as SPP image with a kernel of Qr40, slice thickness of 2mm and increment of 2mm and imported into the post-processing workstation (Syngo.Via VB70, Siemens Healthineers, Forchheim, Germany) for measurement. All statistical analysis was performed with Python 3.10.11. The difference between measured results and standard CT attenuation was tested with student T test. A p value smaller than 0.05 was considered as significant.

## RESULTS

As shown in Fig.1, the CT attenuation is close to the standard value when the mono-energy is around 70keV for abdomen region, low-density and high-density lesions, with no significant difference when compared with the standard values. For liver region, for Spiral and Sequence mode, the CT values were close to the standard value when the mono-energy is around or lower than 55keV, while 60keV for Flash mode. For the spleen region, the CT attenuations are close to the standard value when the mono-energy is around 65keV.

## CONCLUSION

s From the result, we could conclude that the CT attenuations of 70keV image are close to the standard value for the abdomen region, low-density and high-density lesions in the liver. However, 65keV image for spleen and 60keV image for liver seem to be closer to standard value. This could help the doctors in clinical routines to decide the parameters.

## CLINICAL RELEVANCE/APPLICATION

To lay the foundation for the further promotion of photon CT to clinical applications.

### W5B-SPPH- Comparison of Non-gated, High-pitch Cardiac CTA in Pediatric Patients under 1 Year of Age: Energy Integrating Detector vs Photon Counting Detector CT

Participants

Scott Bugenhagen, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

## PURPOSE

To determine image quality and radiation doses on photon counting detector (PCD) CT compared to conventional energy-integrated detector (EID) CT in under 1 year old congenital heart disease (CHD) patients.

## METHODS AND MATERIALS

This study involved an Institutional-Review-Board (IRB) approved retrospective analysis of CHD patients that underwent clinically indicated CT angiography examinations using dual-source EID-CT (Siemens Healthineers, SOMATOM Force) and dual-source PCD-CT (Siemens Healthineers, NAEOTOM Alpha). All examinations, regardless of detector technologies, were acquired with non-gated, high-pitch technique (3.2) and automated exposure control. All PCD scans used 120kV and 55keV reconstructions, while EID scans used automated kV technology with tube potential of 70 and 80kV. Patient characteristics (age, body mass index, patient weight) as well as dose descriptors including volume CT dose index (CTDIvol), dose length product (DLP), and size-specific dose estimate (SSDE), were recorded and compared. Image quality assessment was based on review of the 4 major coronary arteries and was scored on an 8 point scale: 3 points for right coronary artery (RCA) (1 for origin, 2 for origin + proximal, 3 for origin + proximal + distal), 1 point for left main coronary artery (LMCA) (seen or not seen), and 2 points for the left anterior descending artery (LAD) and left circumflex artery (LCA) arteries (1 for proximal and 2 for proximal + distal). Parametric (t-test) testing was used for statistical evaluation.

## RESULTS

29 and 24 CT examinations were included for EID and PCD, respectively. There were no overall differences in demographic characteristics including mean (standard deviation) patient age [0.137 vs 0.157 years,  $P = 0.844$ ], body mass index [14.2 (+/- 2.5) vs 13.9 (+/- 2/5) kg/m<sup>2</sup>,  $P = 0.5$ ], or patient weight [3.63 vs 3.62 kg,  $P = 0.9$ ]. In comparison with EID CT, PCD CT had significantly lower mean CTDIvol [0.48 vs 0.39 mGy,  $P=0.001$ ]. SSDE [1.005 vs 0.951 mGy,  $P = 0.11$ ] and DLP [7.07 vs 5.66 mGy cm,  $P = 0.06$ ] differences were non-significant. There was negligible difference in image quality (visualization of coronary arteries) ( $P = 0.19$ ).

## CONCLUSION

s Our experience indicates that radiation doses in non-gated high-pitch cardiac PCD-CT in children are similar to or lower than those of current EID-CT, while subjective image quality is maintained.

## CLINICAL RELEVANCE/APPLICATION

Similar to lower doses in non-gated high-pitch cardiac PCD-CT compared to EID-CT supports use of PCD-CT in cardiac imaging in children.

### W5B-SPPH- Correlation of Human Observer Impression of X-ray Fluoroscopy and Angiography Image Quality with Technical Changes to Image Quality

Participants

Jelena Mihailovic, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

## PURPOSE

Perceived angiographic image quality is a combination of image formation technical factors and image processing. No standard methods to measure angiography quality exists due to the combination of spatio-temporal anatomical variability and non-linear image processing. However, methods to assess image quality are needed to optimize radiation dose and image quality in the clinical practice. The purpose of this work was to develop and validate methods to measure observer impression of angiographic image quality.

## METHODS AND MATERIALS

Multi-frame images of the thorax of a euthanized pig were acquired to provide an anatomical background. Detector dose (DD) was varied from 6 to 200 nGy (increments 2x) to provide background with a wide range of quantum SNR. For each DD images with 0.6 and 1.0 mm focal spots (FS) were acquired to assess FS blur. Two stents with/without 0.5 mm separation and a synthetic right coronary artery (RCA) with spherical defects were embedded as test objects into the pig images. Embedded test objects included motion to mimic cardiac function. Quantitative observer (n=14) performance was measured through 2AFC test of whether stents were touching and by observer count of RCA defects. Subjective impressions of quality were measured through visual analog scale (VAS) response to statements assessing small object details, noise impression, and overall image quality. The paired t-test was used to describe significance of observer response changes associated with DD or FS size.

## RESULTS

Proportion of correct responses of stent separation and number of RCA defects reported changed significantly with DD increment in the range 6-100 nGy ( $p<0.05$ ). While there was a trend which favored the 0.6 vs. 1.0 mm FS for these quantitative assessments, this was not significant. VAS measurements changed significantly with both DD increment in the range 24-100 nGy and with FS size for a given DD ( $p<0.05$ ). Quantitative and subjective measurements were highly correlated. The most sensitive measurement was VAS assessment of small object details.

## CONCLUSION

s Compared to quantitative human observer assessment, measurement of subjective impression of image quality demonstrated higher sensitivity for image quality changes associated with quantum SNR and focal spot size. These findings embolden future work to assess quality of fluoroscopy and angiography images using subjective measurements. Our strategy to ensure rigor is systematic, self-conscious study design, data collection, and interpretation.

#### CLINICAL RELEVANCE/APPLICATION

For cardiovascular imaging procedures, defining image quality is complex task because it relates to numerous dynamic variables. Feedback from the end user can lead to more accurate and reproducible measurements.

### W5B-SPPH- Is it Possible to Achieve Consistent Outcomes in CT NSCLC Radiomics? An In-depth Exploration of the Sources of Uncertainties<sup>3</sup>

#### PURPOSE

Radiomics features have been used in machine learning models to quantify tissue characteristics that are not observable by clinicians to aid in the prediction of clinical decisions and outcomes. However, there are still many uncertainties involved in this process which reduce the robustness of results and limit its clinical implementation. We investigate the impact of each component in the radiomics pipeline on predicting clinical outcomes.

#### METHODS AND MATERIALS

A thorough review of over 120 CT lung radiomics studies was conducted to examine current. Patient images were retrospectively retrieved from a GE VCT scanner. The lung nodules were manually delineated using Eclipse to define a region of interest. First-order features were extracted with IBEX and high-order features were extracted using Python. Clinical features were retrieved from the Kentucky Cancer Registry (KCR). The features were organized into five feature sets, Radiomic (low), Radiomic (high), Radiomic (high+low), Clinical, and Radiomic+Clinical. Prediction of 2-year survival was investigated. Cohort size was examined by extracting balanced sub-cohorts of the original cohort to be run in parallel to the original cohort. The included feature selection methods are: ANOVA, LASSO, MI, mRMR, and Relief. The number of selected features used for model training was also established as a variable for examination, ranging from 5 to 25 features. The included predictive models are: SVC, Naïve-Bayes, DT, RF, LR, GBoost, and kNN. Model validation methods were also examined, using 2-, 5-, and 10-fold cross-validation (CV).

#### RESULTS

496 patient image sets are retrieved for use in this analysis. CT datasets are fairly balanced, with 237 patients lt;2 years survival and 259 patients gt;2 years survival. A total of 1419 first-order features, 360 high-order wavelet features, and 9 clinical features are included in the feature sets. Statistical analysis is done using Kruskal-Wallis for within-group analysis and further pairwise testing establishes relative rankings. A total of 17220 AUCs involving all combinations shows certain trends. Overall CT lung cancer radiomic stability favors larger cohort size, Clinical and Radiomic+Clinical feature sets, mRMR feature selection, RF predictive model, and 10-fold CV.

#### CONCLUSION

s Radiomic feature selection and machine learning methods are inter-dependent. Appropriate inclusion of different feature types and choice of feature selection can improve predictive power for clinical outcome.

#### CLINICAL RELEVANCE/APPLICATION

Conducting systematic analysis of each phase of the radiomic workflow may heighten general understanding of uncertainties that contribute to unstable outcomes, thus potentially improving the robustness of future radiomic studies.

### W5B-SPPH- A Data Dashboard Approach to Improving Image Analysis: Survival Prediction of Patients with Bladder Cancer after Cystectomy based on Clinical, Radiomics, and Deep Learning Descriptors<sup>4</sup>

Participants  
Di Sun, MEng, BEng, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### PURPOSE

To predict the 5-year survival of bladder cancer patients after radical cystectomy by combining clinical, radiomics, and deep learning (DL) descriptors (CRD).

#### METHODS AND MATERIALS

With IRB approval, we collected clinical information and CTU scans from 163 patients with bladder cancer who underwent neoadjuvant chemotherapy followed by radical cystectomy. Five-year survival data were collected. We split the data into three sets: training (55 alive (A); 37 deceased (D)); validation (4 A; 3 D); and test (20 A; 44 D). The clinical information collected included post-surgery pathologic stage, lymphovascular invasion, pathologic node stage, if patients underwent chemotherapy, or adjuvant radiotherapy. The nomogram by Shariat was used to predict the survival of patients. Radiomics and DL descriptors were extracted from CTU images. Each patient had two CTU scans (before and during/after chemotherapy), forming a pre- and post-treatment pair. We used our AI-CALS algorithm to segment the lesions. To train and validate the DL convolution neural network (DL-CNN), hybrid ROIs extracted from the lesion area were used. A total of 182 radiomics features were extracted from the lesions, including grey level, morphological, and texture features from the post-treatment scans (post features) and the percentage difference between pre- and post-treatment features (difference features). Backpropagation neural network was used to classify the radiomics features. The area under receiver operating characteristic curve (AUC) and Kaplan-Meier analysis were used to evaluate the classification performance on the test set.

#### RESULTS

The nomogram model achieved an AUC of  $0.82 \pm 0.06$  on the test set; DL-CNN achieved an AUC of  $0.71 \pm 0.07$ ; and the classification based on radiomics features had an AUC of  $0.73 \pm 0.07$ . By combining all CRD descriptors, we obtained an AUC of  $0.87 \pm 0.05$ . The differences between any pairs of AUCs did not reach significance ( $p > 0.05$ ), which likely relates to sample size. The median survival times by Kaplan-Meier analysis for the two classes (deceased or alive) were 1.2 and 5 years ( $p < 0.001$ ) as estimated by the nomogram model, and 1.6 and 5 years ( $p = 0.007$ ) estimated based on CRD descriptors.

#### CONCLUSION

s While larger data sets are needed, this study demonstrates that combining the radiomics and DL descriptors with clinical information holds promise for improving the prediction of the 5-year survival of bladder cancer patients after radical cystectomy.

#### **CLINICAL RELEVANCE/APPLICATION**

The CRD descriptors has the potential to improve the prediction of the 5-year survival of bladder cancer patients after radical cystectomy. Accurate assessment of 5-year survival offers potential benefits with patient counseling and postoperative surveillance strategies.

#### **W5B-SPPH- Fissure Integrity Scores in Pre-treatment Chest CT Images as a Biomarker for Predicting a Targeted Lobar Collapse with Endobronchial Valve Implantation in Subjects with Emphysema**

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#### **PURPOSE**

We propose to build an initial endobronchial valve (EBV) prediction model using quantitative CT measurements to evaluate the response of emphysema patients to EBV implantation for a targeted lobe.

#### **METHODS AND MATERIALS**

The study retrospectively collected 127 anonymized pre-treatment EBV CT scans. Selection criteria for the targeted lobe for EBV implantation is based on the highest emphysema density and largest degree of heterogeneous emphysema between the targeted and the ipsilateral adjacent lobe. A fissure integrity score (FIS) is used as a primary quantitative biomarker for the development of the EBV prediction model. Previous work on fissure segmentation and integrity assessment used a deep learning approach that segments pulmonary fissure and quantifies FIS for the right horizontal fissure (RHF), right oblique fissure (ROF), and left oblique fissure (LOF). An FIS is defined as the percentage of complete fissure voxels along the surface of the interlobar region. Fissures are categorized as complete with a FIS of = 90%; otherwise, a fissure is considered incomplete. Separate FIS for the right fissures are calculated based on the targeted lobe for lobar exclusion (i.e., upper lobar boundary for a targeted right upper lobe). Successful EBV placement in a targeted lobe is described as a reduction of = 50% of its total lung capacity (TLC). A reduction of less than 50% of targeted lobe volume reduction (TLVR) does not achieve the desired lobar collapse. Statistical analysis of FIS and EBV volume reduction is applied to assess the significance of fissure completeness and EBV placement.

#### **RESULTS**

FIS and TLVR comparisons are separated by total sample size and targeted lobes. For all targeted lobes, a mean ( $\pm$ SD) FIS of 0.93 ( $\pm$ 0.05) and 0.72 ( $\pm$ 0.26) was attained for successful and unsuccessful TLVR, respectively. Subjects with complete target lobe fissure are likely to experience TLVR by six-fold compared to subjects with incomplete target lobe FIS (Odds Ratio = 6.05, p-value=0.001). All targeted lobes and the right upper lobe achieved a TLVR (p-value < 0.01); the left lobes and right lower lobe did not achieve statistical significance.

#### **CONCLUSION**

s Quantified fissure integrity scores are essential for the foundation of the EBV prediction model, but additional quantitative biomarkers may improve the efficacy for the model.

#### **CLINICAL RELEVANCE/APPLICATION**

The development of a prediction model that will more successfully identify emphysema patients that respond to EBV treatment helps guide treatment decisions for clinicians and manages medical resources.

#### **W5B-SPPH- Practicing Precision Medicine: Using Machine Learning to Predict Time-to-Surgery in Renal Cell Carcinoma under Active Surveillance**

6

Participants

Shiva Singh, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

#### **PURPOSE**

Clear cell renal carcinomas (ccRCCs) in VHL patients are typically managed with active surveillance (AS) until the tumor reaches 3 cm, when surgical resection is recommended. While current guidelines suggest annual screening with abdominal imaging, tailoring imaging frequency to each patient's tumor growth rate can reduce unnecessary radiation exposure and metastasis risk. This study aims to use MRI-based machine learning algorithms to predict the time to 3 cm threshold and design personalized imaging protocols for VHL patients.

#### **METHODS AND MATERIALS**

The retrospective study included 40 vHL patients with 68 histopathologically-confirmed ccRCCs (size 1-2 cm) undergoing AS according to institutional protocol. Tumor segmentation was performed on all available pre-operative scans using ITK-SNAP and radiomics features were extracted from co-registered pre-contrast and post-contrast sequences using PyRadiomics. A growth curve was plotted for each tumor, and the time taken for each tumor to grow to 3 cm (T3) from the initial time point was calculated using the respective growth curve's fitted line equation. Based on T3, the tumors were classified into three categories: aggressive (<365 days), moderate (1-3 years), and slow (>3 years). Stacked ensemble technique with random forest and XGBoost were used for training models to predict T3 based on radiomics features. Five-fold cross-validation was used and the model was benchmarked on 100 different combinations (85% train and 15% test) to find the best model which was reported with F1 score, and the area under the curve of the receiver operating characteristic curve (AUC-ROC).

#### **RESULTS**

A total of 40 patients (28 males) with mean age of  $44 \pm 3$  years and mean follow-up of  $2.9 \pm 1$  year were studied. Median volumetric growth rate of 1.8 cm<sup>3</sup> and diametric growth rate of 0.91 cm/year was observed. The best model showed an accuracy of 0.67 and F1-score of 0.67, 0.70 and 0.62 was observed with aggressive, moderate and slow tumor class respectively. AUC of ROC drawn for aggressive, moderate, and slow class were 0.65, 0.71 and 0.76. A Matthews Correlation Coefficient of 0.58 reveals a moderately well predicted analysis.

#### **CONCLUSION**

s The use of MRI-based machine learning algorithms can predict the time to 3 cm threshold and classify tumors into aggressive,

moderate, and slow-growing categories for VHL patients with ccRCCs, providing a personalized imaging protocol. However, moderate accuracy of the model suggests the need for large dataset and external validation to improve the performance.

#### CLINICAL RELEVANCE/APPLICATION

Tailoring imaging frequency based on the predicted time to 3 cm can reduce unnecessary radiation exposure and financial burden for slow-growing tumors as well as enables timely resection of aggressive lesion.

#### W5B-SPPH- Deep Learning-enabled Automatic Sarcopenia Analysis in Abdominal CT: Finding an Association with Cardiovascular Disease in Korean Population

Participants

Sihwan Kim, BSc, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### PURPOSE

Little studies have shown that sarcopenia can increase the risk of cardiovascular disease, we aimed to investigate the association between a sarcopenia and cardiovascular mortality for the Korean population.

#### METHODS AND MATERIALS

Data were retrospectively collected from non-contrast enhanced abdominal CT scans between 2005 and 2017. The number of abdominal CT scans was 641, the CT data is scanned from 352 males (54.9%) and 289 females (45.1%). Among the abdominal CT data, 141 patients (21.9%) had cardiovascular disease (CVD). Mean age of studied data was about 64 yrs (64 for male and 63 for female). The sarcopenia is defined by the sex-specific L3 skeletal muscle area (SMA) threshold referenced as 117.04 cm<sup>2</sup> for male and 71.39 cm<sup>2</sup> for female. The SMA value of L3 vertebra level was calculated using automatic body composition analysis software (ClariMetabo, ClariPi, Seoul, Republic of Korea).

#### RESULTS

In the study data (n = 641), 75 patients (11.7%) had the sarcopenia. The result showed that 46.7% of Sarcopenia group had the CVD, compared to 18.7% in the non-sarcopenia group. The odds ratio for CVD event was 3.79 [95%CI: 2.30-6.26]. However, the correlation was 0.22 (p<0.0001) in the Phi correlation coefficient analysis, indicating a weak positive correlation. Among the sarcopenia patients, the CVD risk was 2.83 [95%CI: 0.79-10.6] times higher in male than in female.

#### CONCLUSION

s Automated analysis of abdominal CT imaging markers based on deep learning showed that patients with sarcopenia are more likely to have the cardiovascular disease compared to normal people in the Korean population.

#### CLINICAL RELEVANCE/APPLICATION

Deep learning-based automatic muscle mass analysis in abdominal CT is expected to contribute to improving human survival by predicting the risk of cardiovascular disease due to the sarcopenia at an early stage.

#### W5B-SPPH- Feasibility of Artificial Intelligence-supported Assessment of Dual-energy Computed Tomography for Measuring Bone Mineral Density: Correlation with Quantitative CT

#### PURPOSE

To evaluate the precision and agreement between BMD measurements performed in DECT-derived hydroxyapatite (HAP) concentration of the L1 vertebra to L3 vertebra and automated, AI-supported assessment of DECT-derived HAP concentrations with European Spine Phantom (ESP) compared with quantitative CT (QCT).

#### METHODS AND MATERIALS

Data acquisitions were performed on Revolution CT (GE Healthcare, Waukesha, WI) at 120kV with 0.8r/s and 100 and 500mA, fast tube voltage switching between high and low energy (140/80kVp) with 0.5r/s and 240 and 365mA using ESP (No. 145, Germany ORM company). Mindways QCT PRO workstation can automatically generate ROIs and analyze BMD. For DECT-derived HAP values, ROI (468.78mm<sup>2</sup>) was set as the median plane of the vertebral body avoiding cortical bone and its pedicle, and the HAP values of the L1, L2, and L3 were measured from the axial-view HAP (Water)-based material decomposition images on a dedicated GE AW 4.7 Workstation. For automated assessment of DECT-derived HAP concentration was performed by a new fully automatic BMD analysis with AI technology: Firstly, using spectral CT images as the original input, process detects, names, segments and recognizes the orientation of the vertebral body within the image; Secondly, system automatically selects the most suitable three vertebrae for evaluation, recognizes their direction and central plane, segments and extracts the three-dimensional structure of the vertebrae based on vertebral body segmentation; Thirdly, system automatically calculates ROIs in trabecular bone; Lastly, system generates personalized bone density reports. Paired t test and Pearson correlation were to determine the differences and association between two measurements.

#### RESULTS

The CTDIvol with QCT were 5.53mGy in 100mA and 27.66mGy in 500mA, whilst DECT were 5.80mGy in 240mA and 9.25mGy in 365mA. QCT-derived BMD values of the L1, L2, and L3 were 53.60±0.27, 106.25±0.11, 202.76±0.23mg/cm<sup>3</sup>, respectively. The DECT-derived HAP-Water values of the L1, L2, and L3 were 45.25±0.42, 89.2±0.86, 180.00±0.15mg/cm<sup>3</sup> with tube current of 240mA, whilst 39.46±0.51, 88.64±0.74, 170.1±0.38mg/cm<sup>3</sup> with tube current of 365mA. The DECT-derived HAP-Water values of the L1, L2, and L3 with AI were 44.2±0.87, 94.73±0.32, 173.22±0.71mg/cm<sup>3</sup> with tube current of 240mA, and 41.23±0.23, 92.03±0.74, 173.79±0.78mg/cm<sup>3</sup> with tube current of 365mA. There was a strong positive correlation between two methods (r=0.91, P<0.0001).

#### CONCLUSION

s The automated, AI-supported assessment of DECT-derived HAP concentration of the three vertebrae is feasible to measure BMD values and potentially aid a help in opportunistic osteoporosis screening in high-risk populations.

#### CLINICAL RELEVANCE/APPLICATION

none

## W5B-SPPH- External Review of High CT Doses: Reasons and Improvements 9

### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

### PURPOSE

To review reasons for high CT dose cases during external review and implement improvements to improve review workflow.

### METHODS AND MATERIALS

An in-house built external CT dose review was clinically implemented in August of 2021. Cases exceeding machine Dose Notification Values are automatically retained for review. For each case a technologist records possible reasons for the high dose and final review, updating of reasons, and sign-off is performed in-system by a qualified medical physicist or a supervisor/team lead with physicist final review. Summary statistics related to number of review cases and the reason for high doses as well as the rate of cases referred for review were calculated.

### RESULTS

A total of 4,212 cases for 3098 unique patients were reviewed across our 21 CTAP sites. Mean CTDIvol was  $62.3 \text{ Gy} \pm 22.9 \text{ Gy}$ . Cases exceeded notification values by  $15.5\% \pm 18.5\%$  on average. 31.2% of cases exceed the notification value by less than 5%. A reason for the high dose was included in 3,994 cases (94.8%). In those that listed a reason for the high dose, 3,678 (92.1%) included large patient size at part or all of the reason for the high doses. Mean BMI of patients in reviewed cases was  $42.5 \pm 10.9$ . BMI data was missing from 791 cases (18.8%). The next most frequent reasons were presence of shoulders (typically in neck scans) at 250 cases (6.3%) and misplacement of arms at 174 cases (4.4%). The presence of implants and casts was mentioned in 68 cases (1.7%) and combo scan across anatomy 46 (1.2%). No other reason exceeded 1% of the cases.

### CONCLUSION

s Most cases only exceed notification values by a small amount and represent only a small risk to the patient. The vast majority of external review cases are due to patient size and are generally considered appropriate. Other major issues include arm placement, combinations studies, and studies across the neck and into the shoulders. Our external review software lists BMI when available to improve physics workflow.

### CLINICAL RELEVANCE/APPLICATION

Physics workflow can be improved in external review by listing indicators of patient size along with other basic demographics to reduce the need for searching for such information. It is important that size indicators are available for systems to pull and autopopulate for external review.

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## Abstract Archives of the RSNA, 2023

W5B-SPVA

### Vascular Imaging Wednesday Poster Discussions II

#### Sub-Events

#### W5B-SPVA- Association Between Carotid Artery Perivascular Fat Density with Intraplaque Hemorrhage

1

#### PURPOSE

Perivascular inflammation plays a key role in atherosclerosis, but its effects on the composition of carotid atherosclerotic plaques are unknown. Our aim was to investigate the association between perivascular inflammation with intraplaque hemorrhage (IPH) in carotid artery.

#### METHODS AND MATERIALS

Carotid inflammation was assessed by perivascular fat density (PFD) in 72 participants (mean age, 65.1 years, 56 men) who underwent both computed tomography angiography (CTA) and magnetic resonance imaging (MRI) within 2 weeks. Presence of IPH was assessed with MRI. Carotid stenosis, maximum plaque thickness, calcification, and ulceration were evaluated through CTA. The association between PFD and the occurrence of IPH was studied using generalized estimating equations analysis.

#### RESULTS

Of 156 plaques, 72 plaques (46.2%) had IPH. Plaques with IPH show higher PFD than those without ( $-41.4 \pm 3.9$  HU versus  $-55.8 \pm 6.5$  HU;  $P < 0.001$ ). After adjusting for age, calcification, degree of stenosis, maximum plaque thickness, and ulceration, PFD (OR, 1.96; 95% CI, 1.41-2.73;  $P < 0.001$ ) was found to be strongly associated with the presence of IPH.

#### CONCLUSION

Higher PFD is associated with presence of IPH in the carotid artery. These findings may provide novel insights into the pathogenesis of IPH, and thus may serve as a guide in developing a new targeted therapy for IPH.

#### CLINICAL RELEVANCE/APPLICATION

IPH, a compositional characteristic of vulnerable plaques contributes to plaque progression and rupture, thus increasing the risk of cerebrovascular ischemic events. Recently, several studies have shown that the use of antithrombotic treatment is associated with a higher frequency of IPH in the carotid atherosclerotic plaques. These findings seem to contradict current knowledge because antithrombotic treatment is used to reduce the risk from IPH, including subsequent cardiovascular events caused. In the present study, we found the association between IPH and carotid inflammation, providing a theoretical basis for new targeted anti-inflammatory therapy. At present, considerable studies have focused on preventing atherosclerosis by intervening in PVAT. Therefore, PVAT may be emerging as the therapeutic target for IPH.

#### W5B-SPVA- Low-dose 4D Head and Neck Computed Tomography Angiography Conducted via Helical Scans Jointing with ECG-gated Axial Scans: Study in Image Quality

2

#### Participants

Jinhui Zhang, Xiamen, China (*Presenter*) Nothing to Disclose

#### PURPOSE

To explore the image quality of low-dose 4D head and neck computed tomography angiography (CTA) conducted via helical scans jointing with ECG-gated axial scans, compared with conventional standard-dose spiral scanning.

#### METHODS AND MATERIALS

This study enrolled 100 patients suspected with Cerebral aneurysm and received head and neck CTA. The patients were divided into two groups according to the scanning methods. Group A ( $n=50$ ) performed helical neck CTA jointing (pitch=0.992: 1) with ECG-gated axial head CTA at 20%-110% R-R interval in sequence, noise index (NI) was set as 8 HU and rotation time was 0.35 s. Group B ( $n=50$ ) received normal conventional helical scanning with pitch of 0.984: 1, NI of 5 HU, rotation time of 5 s. Regions of interest were placed at the bifurcation of internal carotid artery and M1 segment of middle cerebral artery. CT values and SD values of ROIs and muscle or white matter were measured, and SNR and CNR were calculated. The overall image quality was subjectively scored using a 5-scale method. The radiation dose, subjective and objective image evaluation results were compared.

#### RESULTS

Compared with Group B, Group A had a decreased DLP by 34.6% (A vs. B:  $558.92 \pm 57.01$  vs.  $944.88 \pm 86.05$  mGy·cm,  $P < 0.001$ ). For bifurcation of internal carotid artery, the two group images showed no statistical difference in CT values (A vs. B:  $545.58 \pm 93.92$  vs.  $535.66 \pm 71.30$ ), SD ( $11.35 \pm 2.51$  vs.  $10.70 \pm 2.48$ ), SNR [ $48.16$  (20.99) vs.  $49.43$  (21.46)] and CNR ( $62.87 \pm 16.02$  vs.  $66.74 \pm 16.04$ ), with all  $P > 0.05$ . For M1 segment of middle cerebral artery, the two group images also showed no statistical difference in CT values ( $528.68 \pm 124.60$  vs.  $513.32 \pm 71.22$ ), SD [ $14.09$  (4.18) vs.  $11.94$  (3.65)], SNR [ $39.99$  (17.05) vs.  $45.57$  (17.60)] and CNR ( $54.99 \pm 14.56$  vs.  $50.83 \pm 12.76$ ), with all  $P > 0.05$ . Regarding subjective scoring, both the two-group images met diagnostic requirements and the difference was not statistically significant ( $P > 0.05$ ).

#### CONCLUSION

s For head and neck CTA, low-dose helical scans jointing with ECG-gated axial scans showed comparable head and neck artery displays with standard-dose conventional helical scanning.

#### **CLINICAL RELEVANCE/APPLICATION**

Aneurysm is at risk of rupture, and monitoring of its pulsatility with the cardiac cycle shows predictive value, where ECG-gated 4D CTA potentially be helpful. However, 4D scans may increase the risk of radiation doses, in this study, we found that helical combined ECG-gated axial scan with exposure during 20% -110% R-R interval could obtain comparable artery visualization with conventional helical

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## Abstract Archives of the RSNA, 2023

BREE

### Breast Imaging Education Exhibits

#### Sub-Events

#### **BREE-1 Pathologic Nipple Discharge: Is Breast MRI a Good Option?**

##### Participants

Valeria Vidales, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Pathologic nipple discharge (PND) is unilateral, spontaneous, involves a single duct, and is serous or bloody in appearance. MRI is able to detect the etiology of nipple discharge in 56-61% of cases when initial imaging with mammogram and ultrasound are negative. To describe differential diagnosis and its classification in BIRADS system.

##### TABLE OF CONTENTS/OUTLINE

Description of the anatomy of the nipple and retroareolar Description of different types of lesions that could be found in patients with nipple discharge US, mammographic and RM principal findings and its correlations. Sample cases

#### **BREE-10 Single Duct Abnormalities: Multimodality Imaging and Assessment**

##### Participants

Juliana Sitta, MD, Jackson, MS (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Ductal abnormalities entail a wide range of pathology that may present clinically or grow silently, ranging from benign to malignant processes. Solitary dilated duct is a rare mammographic finding with controversial clinical significance in the literature. Workup of the solitary dilated duct must include additional mammographic views and ultrasound to assess for additional findings that would raise suspicion for malignancy and provide a biopsy target. Ductal ectasia is the most common benign finding; however, atypical presentations such as peripheral location, wall thickening, and hypoechoic tissue should raise suspicion for secondary obstruction causes. Inspissated secretions can mimic intraductal masses and may be seen in association or secondary to acute and chronic mastitis, ductal ectasia, and intraductal papilloma. Patients with papillomatosis often have associated high-risk lesions and an increased lifetime risk of breast malignancy. MRI is a great adjunct to evaluate nipple discharge, particularly when the initial workup is negative, and to exclude underlying DCIS or invasive ductal carcinoma.

##### TABLE OF CONTENTS/OUTLINE

Review and illustrate ductal anatomy, physiology, and normal findings on multimodality imaging, including mammography, ultrasound, galactogram, and MRI. Illustrate and discuss problem-solving for single duct findings and presentations commonly associated with single duct abnormality with interesting cases from our institution. Analyze the added value of multiple imaging modalities in assessing ductal pathology, including galactogram and MRI.

#### **BREE-100 The Leading Role of Ultrasound in Breast Implant Evaluation in Developing Countries**

##### Participants

Giannina Secco, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To illustrate ultrasound findings in breasts with implants and their comparison with those in magnetic resonance imaging. To discuss the advantages and limitations of ultrasound for breast implant evaluation and why it remains a valuable and irreplaceable tool in underdeveloped and developing countries.

##### TABLE OF CONTENTS/OUTLINE

Detecting a broken breast implant is essential due to the potential physical discomfort, cosmetic deformity, and health risks associated with a ruptured implant. Early detection and prompt treatment of a broken implant are crucial to prevent further complications and ensure optimal patient outcomes. Knowledge of a ruptured implant can help patients make informed decisions about implant replacement or removal. In order to acknowledge this, we believe breast implant ultrasound is a preferable choice to MRI for breast implant evaluation in underdeveloped and developing countries. Breast implant ultrasound is more cost-effective, with often portable machines, non-invasive procedure that does not require the use of contrast agents or ionizing radiation, provides real-time imaging, does not require anesthesia and is widely available in many healthcare facilities. Ultrasound imaging can be performed and interpreted quickly, allowing clinicians to make prompt treatment decisions. Furthermore, breast implant ultrasound is safe for patients with pacemakers or other implanted devices, while MRI may not be feasible for these patients. Although ultrasound has its limitations in some cases, it remains a valuable and irreplaceable tool for breast implant evaluation in underdeveloped and developing countries.

#### **BREE-101 Cystic Breast Lesions Assessment and Management: An Educational Approach for Radiology**

## Residents

### Participants

Karina Pesce, PhD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To recognize the spectrum of cystic breast lesions. To learn tools and tips for the sonographic evaluation of cystic lesions. To understand the importance of distinguishing benign cystic lesions from potentially malignant cystic masses To learn skills in the assessment and management of cystic breast lesions

### TABLE OF CONTENTS/OUTLINE

1-Introduction: Cystic breast lesions are a common finding in breast imaging studies. Accurate characterization and precise management of these lesions are essential to avoid unnecessary biopsies and tests, as well as to timely identify which of these lesions require further diagnostic evaluation. 2- Ultrasound parameters necessary for a correct evaluation of cystic lesions. 3- Tips and tricks in the ultrasound evaluation of cystic lesions. 4- Spectrum of cystic lesions. 5- Ultrasound appearance 6-Radiological appearance of cystic breast lesions on other imaging modalities such as mammography, MRI. 7- Management. 8- Interactive clinical cases for self-evaluation. 9- Conclusions

### **BREE-102 Radiological Signs in Breast Imaging: What Should the Radiology Resident Know?**

### Participants

Karina Pesce, PhD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To know recognize the different radiological signs in breast imaging.2.To learn the importance of accurate identification of the different radiological signs.

### TABLE OF CONTENTS/OUTLINE

Introduction This educational poster reviews the importance of understanding breast radiological signs. Accurate identification of different radiological signs is critical for early diagnosis and effective treatment of various medical conditions, including breast cancer. Furthermore, knowledge of clinical and radiological signs in breast imaging can help prevent diagnostic errors and reduce the number of unnecessary medical tests. Description of the radiological signs in breast imaging. Tips and techniques for identifying these signs are also provided to assist residents in their interpretation of medical images. Interactive clinical cases for self-evaluation. These cases offer residents the opportunity to apply their knowledge and receive immediate feedback, thereby strengthening their diagnostic skills and decision-making abilities. Conclusion: Radiologists residents must be familiar with different radiological signs to accurately interpret medical images and provide an accurate diagnosis.

### **BREE-103 Peer Learning in Breast Imaging: Lessons Learned in Our Institution**

### Participants

Marcela Lauer, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

It is estimated that medical diagnostic mistakes contribute to approximately 10% of patients deaths and 17% of adverse events in hospitals. Consequently, optimal patient care is related to recognizing and preventing such errors. Strategies were developed to ensure performance standards in radiology departments, including score-based second-reader peer review systems. However, this type of strategy may be associated with subjectivity, sampling bias, underreporting of errors due to peer relationships and fear of punitive action. It may have emotional impact for radiologists and lead to feelings like anxiety, shame, and humiliation, contributing to a culture of defensiveness. On the other hand, peer learning is an strategy focused on learning and improvement that has gained momentum, as a respectful nonpunitive collaborative culture improves performance in modern radiology practice. The objective of this presentation is to show how we established peer learning in our breast imaging department, the bias that were related to the mistakes we made, how we concluded they could have been avoided and our experience with peer learning as a group. We aim that this presentation may help and encourage other services to implement peer learning in their clinical practice, and also learn from the multimodality imaging cases we provide.

### TABLE OF CONTENTS/OUTLINE

Didactic case-based reviews of breast imaging exams (including mammography, ultrasound and magnetic resonance imaging performed in our service) that were discussed in our peer learning meetings in the last 5 years, with correlation of associated cognitive bias, how the cases could have been better managed and lessons learned that changed our daily practice.

### **BREE-104 Multimodality Surveillance of Breast Implants in Asymptomatic Patients and the Potential Challenges for the Radiologist in Light of the 2022 United States Food and Drug Administration (FDA) Guidelines**

### Participants

Carisa Le-Petross, MD, FRCPC, Houston, TX (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recently the United States Food and Drug Administration (FDA) implemented changes to breast implant surveillance that radiologists may not be aware of<sup>1,2</sup>. At the end of this exhibit, the participant will: • Be up-to-date on the 2022 FDA guidelines for breast implant screening. • Learn the common signs of implant rupture on ultrasound (US). • Learn the common signs of implant rupture on magnetic resonance imaging (MRI). • Be familiar with implant complications and new technology to minimize some complications<sup>3</sup>. • Be familiar with some key differences between updated FDA guidelines and the imaging recommendations from the American College of Radiology Appropriateness Criteria.

### TABLE OF CONTENTS/OUTLINE

• Discuss the changes in the 2022 FDA guidelines for breast implant screening, especially the addition of US as an alternative to MRI for initial imaging surveillance for silicone implant rupture in asymptomatic patients<sup>1-4</sup>. • Discuss the 2022 FDA guidelines recommendation for the first screening imaging test at 5 years after implantation instead of 2 years after implantation, the lack of

compliance from patients, and background behind this change<sup>1-5</sup>. • Discuss the potential controversies regarding the imaging modality of choice to evaluate for implant rupture via case-based presentation<sup>4</sup>. • Review the imaging signs of implant rupture on different modalities, focusing mainly on US and MRI. Review benefits and/or challenges of new implants, technology such as acellular dermal matrix (ADM), and new generation tissue expanders.

### **BREE-105    Abnormality of the Duct on Breast Ultrasound: Comparison with Multimodality, Correlation with Pathological Findings, and Assessment**

#### **TEACHING POINTS**

The 6th edition of BI-RADS is expected to include nonmass lesions detected on breast ultrasound. In breast imaging, it is important to comprehend lesions such as ductal carcinoma in situ which do not form masses but appear as abnormalities of the ducts. Ultrasound is the best imaging tool for a detailed evaluation of the ducts. Although definitions and terminology for ductal abnormalities may vary in the literature, there is a growing interest among Asian countries regarding ultrasound findings of ductal abnormalities. In this review, we present a method for detecting and evaluating ductal abnormalities based on a detailed comparison with pathological findings. To understand and organize the terminology found in various literature and guidelines, as well as the corresponding findings. To become familiar with normal anatomy and identify findings accurately. To compare expected findings in other modalities with pathological findings. To discuss evidence-based assessment and management plan for each finding.

#### **TABLE OF CONTENTS/OUTLINE**

Normal anatomy    Methods of detection    Terminology    Comparison with multimodality and correlation with pathological findings    Assessment and management plan of each pathological finding    Case studies    The included cases are as follows: Ultrasound findings    Ductal dilatation    Duct dilatation with internal echoes    Duct wall thickening    Irregularity of the ductal caliber    Pathological diagnoses    Duct ectasia    Fibrocystic change    Intraductal papilloma (IDP)    Atypical ductal hyperplasia    Ductal carcinoma in situ (DCIS)    Ductal carcinoma in situ with invasive component    Invasive ductal carcinoma (IDC)

### **BREE-106    A Review of Contrast-Enhanced Mammography in the Evaluation of Suspicious Breast Micro-Calcifications and Our Experience**

Participants

Félix Maimir Quadrado, MD, Madrid, Spain (*Presenter*)    Nothing to Disclose

#### **TEACHING POINTS**

- To outline a potential indication of contrast-enhanced mammography (CEM).- To review the contribution to date of CEM in the evaluation of suspicious breast microcalcifications.- To share and discuss our initial experience using CEM in the evaluation of suspicious breast microcalcifications and their histopathologic results.The interpretation and description of breast microcalcifications have always posed a great challenge to breast radiologists. Due to the intrinsic relation of microcalcifications with different breast lesions, and in the case of suspicious ones with breast carcinomas, CEM has been proposed as a promising technique because of its capability to assess neoangiogenesis. We present an up-to-date revision of CEM in the evaluation of suspicious breast microcalcifications and our center's initial experience.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction- False-positive cases- False-negative cases- What the recent literature tells us- Our experience

### **BREE-107    Diagnostic Approach and Assessment of Cystic Breast Lesion**

#### **TEACHING POINTS**

1. Cystic masses are common findings on mammography, ultrasonography, and MR imaging and a thorough understanding of their imaging findings and management is important.2. It is important to obtain US images with meticulous technique for accurate classification and assessment of cystic breast lesions. 3. Complex cystic and solid masses may have one or all of the following characteristics: a thick wall ( $\geq 0.5$  mm), thick internal septations, an intracystic mass, and both solid and cystic components. 4. Complex cystic and solid masses are usually assessed as suspicious (BI-RADS category 4) and accompanied by a recommendation for biopsy.

#### **TABLE OF CONTENTS/OUTLINE**

A. Definition of cystic breast lesions 1. Simple cyst 2. Complicated cyst 3. Clustered microcysts 4. Complex cystic and solid mass B. Meticulous technique in evaluating cystic breast lesions on US C. Multimodality imaging findings with important differential diagnosis 1. Simple or complicated cyst vs. Nearly anechoic solid mass on US 2. Inflamed or ruptured cyst vs. Rim enhancing mass on breast MRI D. Imaging-pathologic correlation of complex cystic and solid mass E. Diagnostic approach and BI-RADS assessment of cystic breast lesions F. Management of cystic breast lesions

### **BREE-108    Breast Malignancy: Beyond Breast Carcinoma**

Participants

Alex Gil Ordóñez, MD, Barcelona, Spain (*Presenter*)    Nothing to Disclose

#### **TEACHING POINTS**

- To provide the basis for recognizing morphological and functional imaging findings of non-epithelial and metastatic lesions of the breast (B5d, NHSBSP).- To review the most common B5d lesions through a pictorial review of our cases.- To describe the clinical management of B5d lesions and the role of the radiologist in these cases.

#### **TABLE OF CONTENTS/OUTLINE**

1.Introduction 1.1. NHSBSP classification. 2. B5d lesions through a pictorial review of our cases. 2.1. Metastatic disease. 2.2. Oncohematological disease. 2.3. Sarcomas 3. Imaging features 4. Management 5. ConclusionsThe vast majority of malignant breast neoplasms are breast carcinomas. Nevertheless, some malignant breast lesions present different histologies, which are commonly less suspicious than carcinomas on imaging techniques. Their recognition is essential to an early diagnosis and therapeutic approach.

## **BREE-109 Vague and Nebulous: Non-Mass Ultrasound Lesions**

### **TEACHING POINTS**

(1.) To review descriptors of ultrasound (US) non-mass lesions. (2.) To illustrate US non-mass lesions identified as correlates for breast MRI non-mass enhancement. (3.) To demonstrate methods for locating US non-mass lesions as correlates for breast MRI non-mass enhancement.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: Ultrasound (US) correlates of MRI-detected non-mass enhancement (NME) may have no defined mass-like sonographic margin or shape, or may show subtle disruptions of the background tissue pattern. A new US lexicon term, non-mass lesion (NML), better describes these US findings. Cases: This educational exhibit will show 10 cases of US NML corresponding to MRI NME. We will highlight methods of predicting the US appearance and location of the NML on MRI-directed US by the use of breast architecture, surrounding cysts/masses, and use of the MRI appearance to predict the size and shape of the NML. Histopathologies include breast cancer, radial scar, sclerosing adenosis, fibrocystic change and fat necrosis. Conclusion: The exhibit illustrates subtle US NML correlates to MRI NME. Techniques for successful MRI-directed ultrasound detection of these findings are described. Once correlation is confirmed, US-guided biopsy, which is more expeditious than MRI-guided biopsy, can be performed.

## **BREE-11 Male Breast Lesions: To Infinity and Beyond**

Participants

Camila Guimaraes, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Teaching Points: Male breast disease encompasses both benign and malignant conditions that are hormonally influenced. Gynecomastia and skin lesions are the most common conditions in symptomatic men, referred for a palpable mass, with imaging patterns that can correlate with different histopathological phases. Other benign tumors in male breasts include lipoma, pseudoangiomatous stromal hyperplasia, granular cell tumor, fibromatosis, myofibroblastoma, schwannoma, and hemangioma. The incidence of breast cancer in men is rare but has increased and accounts for 1% of all breast carcinomas, with invasive ductal carcinoma being the most common type in adult males. Other tumors that may occur include papillary carcinoma, invasive lobular carcinoma, adenoid cystic carcinoma, liposarcoma, dermatofibrosarcoma, pleomorphic hyalinizing angiectatic tumor, basal cell carcinoma of the nipple, hematopoietic malignancies, and secondary tumors. Understanding the clinical and imaging characteristics of these tumors is important for their accurate diagnosis and optimal treatment.

### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline: This article examines the clinical, radiological, and pathological characteristics of both benign and malignant tumors of the male breast. Cases of male breast disease were selected from the file of the Breast Radiology group of our hospital showing some of these pathologies: 1. Complicated Cyst; 2. Dermoid Cyst; 3. Myxoid Liposarcoma; 4. Hybernoma.

## **BREE-110 From Words to Images: Applying the Contrast Enhanced Mammography BI-RADS® Lexicon**

Participants

Mitva J. Patel, MD, Columbus, OH (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS®) lexicon is widely used in clinical practice and is a standardized nomenclature used for mammographic reporting. Recently, an extension of the lexicon was developed for the interpretation and reporting of contrast-enhanced mammography (CEM) findings. Adopting the American College of Radiology (ACR) Contrast Enhanced Mammography (CEM) Lexicon is important as standardization reduces inter-observer variability and improves the accuracy and reliability of diagnostic reporting, which ultimately leads to better patient outcomes. Education on this new topic is essential as adoption of the lexicon is critical to assist standardize reporting, improve patient care, and facilitate communication between radiologists and clinicians.

### **TABLE OF CONTENTS/OUTLINE**

I. CEM Lexicon classification for recombined images? A. Background parenchymal enhancement? 1. Level? 2. Symmetry? B. Lesion conspicuity? C. Masses? - Internal enhancement characteristics? D. Non-mass enhancement? - Distribution? E. Enhancing asymmetry? II. Interpretation? A. Findings on low energy images only? B. Areas of enhancement seen on recombined images only? C. Low energy images with associated enhancement on recombined images

## **BREE-111 The Power of Contrast: Contrast Enhanced Mammography in the Diagnostic Clinic**

Participants

Mitva J. Patel, MD, Columbus, OH (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

We hope that by highlighting the practical uses of CEM and its potential to enhance breast cancer detection in the diagnostic clinic, more practices will embrace this powerful technology. Contrast enhanced mammography (CEM) is an imaging technique that combines standard mammography with iodinated contrast to improve breast cancer detection. By highlighting areas of increased vascularity associated with malignancy, CEM has been shown to improve the sensitivity of mammography, particularly in women with dense breast tissue. Despite these well-known benefits, the adoption of CEM in clinical practice has been slow, owing primarily to the difficulties establishing a CEM program and reimbursement. Despite these challenges, we believe the benefits it brings to the diagnostic clinic outweigh the additional effort. CEM may be used to: - resolve equivocal findings on mammography, and to increase confidence prior to stereotactic biopsy for vague areas of architectural distortion. - as a more efficient, accessible alternative to MRI in pre-operative extent of disease and workup of highly suspicious findings identified on screening mammography. We hope that by highlighting the practical uses of CEM and its potential to enhance breast cancer detection in the diagnostic clinic, more practices will embrace this powerful technology.

### **TABLE OF CONTENTS/OUTLINE**

Examples provided will demonstrate how CEM impacted these patients' management and supports the notion that CEM has a place

in the diagnostic clinic as a cost-effective and time-efficient alternative to breast magnetic resonance imaging (MRI) for select patients.

### **BREE-112 Common Enough to Care - Young Women with Breast Cancer: Multidisciplinary Approach and Special Considerations**

#### **TEACHING POINTS**

Breast cancer in young women, widely accepted as women under 40 years of age, has a worse prognosis compared to older patients as young age is an independent predictor of adverse breast-cancer specific outcomes, including morbidity, local and systemic recurrence, and death. Historically, young women have been underrepresented in clinical trials and undergo more aggressive therapy solely based on their young age. As it is important to recognize how these women differ from older patients, the teaching points of this presentation are to: 1. Describe the epidemiology, clinical presentation, and tumor biology of young women with breast cancer. 2. Define imaging guidelines in high-risk populations and in young women after diagnosis of breast cancer. 3. Explain surgical management and surgical risk reducing strategies. 4. Highlight the special considerations unique to young women including the effects of oncology treatment on fertility and lactation and describe fertility preservation techniques.

#### **TABLE OF CONTENTS/OUTLINE**

1. Appearance of breast cancer in young women: Epidemiology and clinical presentation, Tumor biology; 2. Imaging guidelines: Risk factors and assessment, Genetics based or calculated lifetime risk, Diagnosis and staging; 3. Surgical management: Breast conserving vs. mastectomy, Cosmetic options, Risk reducing strategies; 4. Effects of oncology treatment on fertility: Chemotherapy, Hormone therapy; 5. Fertility Preservation Techniques

### **BREE-113 Breast US: A Guide for Beginners**

Participants

Erica E. Francolin Federicci, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Ultrasonographic characterization of mammographic abnormalities and palpable lesions is indicated in the evaluation and management of breast diseases. Although in the United States breast ultrasounds (US) are performed by sonographers, in many countries it is performed by physicians. Considering that breast screening US as an adjunct to mammography will be more widely practiced in the United States, the Breast Imaging-Reporting and Data System (BI-RADS®) provides training and performance guidance as set forth in ACRIN 6666. Because the effective use of the US lexicon relies on excellent sonographic technique and understanding of breast anatomy, the objective of this presentation is to didactically illustrate how the BI-RADS® recommendations should be followed, including the most common findings, pitfalls and how to avoid them.

#### **TABLE OF CONTENTS/OUTLINE**

We used ultrasonographic images (in correlation to mammography and magnetic resonance imaging, when appropriate) from our institution's digital archive, in order to provide a case-based didactic review of the most common findings in breast ultrasounds, including a review of the adequate technical parameters, lexicon and reporting system and tips to avoid common pitfalls, based on the BI-RADS® recommendations.

### **BREE-114 Pseudo-progression During Immunotherapy: A New Challenge for Breast Radiologists**

#### **TEACHING POINTS**

Immunotherapy has emerged as a promising treatment strategy for advanced breast tumors. Immune checkpoint inhibitors (ICI) such as blockades that target programmed death-1 (PD-1), programmed death-ligand 1 (PD-L1) and cytotoxic T-lymphocyte associated antigen (CTLA-4), are one of the most powerful tools in the immunotherapy armamentarium and offer a beneficial immunotherapeutic regimen for patients with breast cancer. The pattern of treatment with immunotherapy is totally different from other therapeutic modalities, thus bringing major challenges to clinicians and radiologists who are not familiar with it. One of these challenges is pseudoprogression, that can be characterized as a transient increase of tumor burden followed by tumor regression. Although rare, it is fundamental for the radiologist to be aware of this condition and to carry out studies in the direction of finding diagnostic tools that are capable of more accurately identify this phenomenon contributing for better patient outcomes. In this didactic exhibit, we will discuss the basis of immunotherapy in breast cancer, demonstrate imaging findings of cases of breast cancer pseudoprogression and discuss the current tools available to identify the possibility of this condition such as biomarkers, imaging techniques and biopsy.

#### **TABLE OF CONTENTS/OUTLINE**

1) Basis of immunotherapy 2) Definition of pseudoprogression 3) Tools used to identify pseudoprogression 3.1) Biomarkers 3.2) Medical imaging 3.3) Biopsy 4) Cases of breast cancer pseudoprogression

### **BREE-115 Contrast-enhanced Mammography in Breast Cancers for Women with Dense Breasts: Accuracy, Value, Controversies and Solutions**

Participants

Bingmei Zhang, Ankang, China (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is: 1. To familiarize the reader to what CESM implies as an emerging modality and its implementation for breast imaging. 2. To demonstrate diagnostic accuracy and correlation in lesion size estimation of CEM against DCE-MRI in dense breast patients. 3. To illustrate value of CEM in evaluating BI-RADS 4 microcalcifications including morphology, distribution and neovascularity of microcalcifications. 4. To discuss whether CEM can be an effective imaging tool in pre-surgical planning for women with dense breast parenchyma. 5. To highlight the benefits and deficits of CEM in women with dense breast who are at an increased risk of developing breast cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1. Brief overview about the different approaches in CEM and their features in imaging interpretation (temporal subtraction and dual

energy technique). 2. Cancer evaluation in the dense breast and review of cases, comparing CESM with MRI in the assessment of disease extent in breast carcinomas. 3. Practical application of CEM with illustrated clinical examples in evaluating BI-RADS 4 microcalcifications in dense breast. 4. Is CESM adequate and accurate in pre-surgical planning for women with dense breast. 5. Advantages vs. drawbacks of CEM and potential pitfalls elucidation for high risk screening for women in dense breast. 6. The future applications of CEM in breast evaluation.

### **BREE-116 Preoperative Wire and Wireless Localizations Gone Wrong: How to Get Out of Trouble**

Participants

Sheila Enamandram, MD, MBA, Stanford, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Accurate, thoughtful planning of preoperative image-guided wire or wireless localizations is critical for breast conservation surgery, especially in complex imaging scenarios. Target lesion visualization and localization may require more than one imaging modality and/or a non-routine approach for difficult marker/target localizations. Understanding the differences in size, appearance, and deployment techniques of localization devices is important in accurate placement and retrieval. Targeted markers may be found in unexpected places when not seen in the initial specimen radiograph. Clear communication with surgical colleagues is paramount.

#### **TABLE OF CONTENTS/OUTLINE**

This case-based exhibit will highlight anatomic, procedural, and technical troubleshooting steps in the following scenarios: Biopsy marker, wire, or wireless device migration; Biopsy marker non-visualization; Target not marked at time of initial biopsy; Target obscured or visible on only one imaging modality; Wireless radar reflector malfunction; Alternative imaging modalities needed for localization; Biopsy marker not seen in the specimen and ultimately found in unexpected places; Incomplete retrieval of distal hook wire in the specimen.

### **BREE-12 Nipple Discharge: In the Era of Multimodality Imaging**

#### **TEACHING POINTS**

TEACHING POINTS 1. To remind the different etiologies responsible for nipple discharge 2. To recognize the worrisome signs of a nipple discharge that must lead to further investigation 3. To discuss imaging modalities and management

#### **TABLE OF CONTENTS/OUTLINE**

TABLE OF CONTENTS 1. Clinical history and physical examination 2. Etiologies responsible for nipple discharge a. Extra-mammary causes :- Hyperprolactinemia- Drugs- Others b. Breast lesions :- Benign lesions (infections, galactophoritis, papillomas)- Malignant lesions (intra-ductal, inflammatory) 3. Multimodality imaging approach a. Gold standard of initial evaluation of nipple discharge- Mammography + Ultrasound b. Second level of investigation :- The role of MRI and contrast-enhanced mammography 4. Diagnosis a. Cytology of the nipple discharge b. US guided microbiopsy c. MRI guided core biopsy d. Emerging role of contrast-enhanced guided core biopsy 5. Patient management flowchart a. Follow-up, what? When? b. US guided macrobiopsy, when? c. Surgery

### **BREE-13 Staying Vigilant: Imaging Surveillance and Risk Prediction After Breast Cancer**

Participants

Beatriu Reig, MD, MPH, New York, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Patients with a personal history of breast cancer have 5-20% recurrence rates and are at increased risk of second breast cancers. 2. Risk factors for recurrent or second breast cancer include dense breasts, young age at diagnosis of the first breast cancer, omission of radiation after breast conserving therapy, and hormone receptor negative first breast cancer. 3. Imaging biomarkers such as background parenchymal enhancement are under investigation and may permit personalized risk prediction and guide surveillance recommendations in the future.

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction (definition, statistics, localized vs metastatic recurrence, early vs late recurrence) 2) Risk factors for recurrence a) Association of molecular subtypes with risk for recurrence b) Effect of neoadjuvant chemotherapy c) Modifiable risk factors (aromatase inhibitor or tamoxifen after ER+ cancer, alcohol consumption, weight) 3) Screening methods for recurrence a) Mammography b) Ultrasound i) Inclusion of the axilla c) MRI i) Abbreviated vs full-protocol d) Contrast-enhanced mammography 4) What should be the imaging interval? 5) Post-mastectomy imaging 6) Risk models for individualized screening a) Clinicopathologic factors b) Imaging biomarkers c) Radiomics and artificial intelligence models

### **BREE-14 Breast Cancer or Not? An Interactive Case-Based Review of FDG-PET/CT Positive Findings in the Breast**

Participants

Emily Yoon, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Background Interpretation of lesions with increased FDG uptake in the breast can be challenging due to nonspecific uptake in various benign and malignant processes involving the breasts. Knowledge of this wide spectrum is essential for accurate analysis of FDG-PET/CT in conjunction with a patient's symptomatology. The purpose of this educational exhibit is to illustrate the multi-modality imaging appearance of various benign and malignant processes that demonstrate hypermetabolic activity within the breast on FDG-PET/CT. Teaching Points Differentiate various benign and malignant processes that can result in hypermetabolic lesions in the breast Understand sensitivity and specificity of FDG-PET/CT for breast cancer and metastatic breast lymphadenopathy Conclusion There is a wide range of benign and malignant conditions presenting as hypermetabolic breast lesions on FDG-PET/CT. Knowledge of the various imaging features is important for accurate diagnosis and patient management.

#### **TABLE OF CONTENTS/OUTLINE**

This presentation will be case-based with review of clinical history and imaging findings (mammogram, US, MRI, PET/CT) of patients with FDG-PET positive findings in the breast. Several benign and malignant pathologies will be reviewed, as outlined below.



Teaching points with recent literature review will provide guidance when non-breast cancer pathology should be suspected in cases, while also highlighted when additional dedicated breast imaging is indicated. Breast implant capsule-associated squamous cell carcinoma Reactive lymphadenopathy Metastatic disease Granulomatous mastitis Fat necrosis Inflammatory breast cancer Gynecomastia Infectious/Inflammatory changes

### **BREE-15 The Role of DBT-Guided Biopsy for MRI/CEM Detected Lesions**

Participants

Cesar Urtasun Iriarte I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To emphasize the need to correlate MRI/Contrast Enhanced Mammography (CEM) findings with DBT (Digital breast tomosynthesis). To show the advantages of DBT-guided biopsy compared to MRI-guided biopsy. To consider DBT-guided biopsy as an alternative for CEM-detected lesions.

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: Both MRI and CEM are morphofunctional imaging techniques based on neoangiogenesis. These techniques are more sensitive than pure morphological techniques, such as DM or DBT. ASSESSMENT OF MASS ENHANCEMENTS: Second look US is of choice to evaluate these lesions. ASSESSMENT OF NON-MASS ENHANCEMENTS: These lesions are challenging. Although US plays an important role, in many cases it is inconclusive. DBT correlation is very important, specifically using the craneocaudal (CC) view. This view is easy to compare anatomical structures with both MRI (axial) and CEM. DBT GUIDED BIOPSY: This technique offers several advantages over MRI or CEM guided biopsies: Less time consuming, widely spread technique. Not all the vendors have dedicated units to perform CEM guided biopsies. Once the lesion is located with DBT, the performance of the biopsy is easy. Usually 10G vacuum assisted biopsy devices are used. CONCLUSION: DBT guided biopsy can offer a good alternative for MRI/CEM detected lesions, specially for non-mass enhancements.

### **BREE-16 Male Breast: Common and Rare Conditions**

Participants

Carla Sitges, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Teaching Points: To describe the spectrum of imaging features of benign and malignant lesions of the male breast from a review of pathologically-proved cases. To correlate imaging and pathological findings. To discuss the appropriate imaging workup of male breast cancer.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Gynecomastia Benign lesions Imaging features on mammography, ultrasound and MRI. Radiologic-pathologic correlation. Malignant lesions Imaging features on mammography, ultrasound and MRI. Radiologic-pathologic correlation. Conclusions

### **BREE-17 Breast Ductal Disease: Multimodality Imaging Detection and Assessment**

#### **TEACHING POINTS**

Review normal ductal anatomy and its imaging features. Review the broad differential of benign and malignant ductal diseases, particularly in the setting of a single dilated duct. Recognize imaging abnormalities of ductal diseases and features associated with malignancy on DBT, US, and MRI. Describe appropriate diagnostic workups and management of ductal diseases.

#### **TABLE OF CONTENTS/OUTLINE**

Breast ductal disease is an important aspect of breast imaging and often poses challenges in diagnosis and management, particularly in the setting of a single dilated duct. Thus, radiologists should be familiar with clinical presentations, diagnostic workup, imaging features, and differentials for ductal abnormalities. Patients may present with nipple discharge, palpable abnormalities, infectious symptoms, lactational issues, or be asymptomatic. Ductal pathologies range from ductal ectasia, periductal mastitis, intraductal papillomas, to ductal carcinoma in situ, invasive ductal carcinoma, and Paget's disease. Radiologists should recognize both normal and abnormal ductal imaging features on DBT (dilated ducts, masses, and/or calcifications), on US (cystic ductal dilation, ductal wall irregularities or arborization, intraductal masses or debris), and on MRI (clustered ring non-mass enhancement, abnormal linear or segmental NME). This educational exhibit will provide a comprehensive case-based review of benign and malignant ductal diseases, their multimodality imaging features, and associated management recommendations.

### **BREE-18 Breast Surgery: Changes and Findings Multimodal Diagnosis**

Participants

Maria Jose Chico, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Identify the different post-surgical changes of breast surgery. 2. Learn to identify which findings are suspicious and which are not. 3. Understand and integrate the findings in the different imaging modalities. 4. Understand the differential diagnoses

#### **TABLE OF CONTENTS/OUTLINE**

The accurate interpretation of images of the postsurgical breast depends on the availability of high-quality imaging. These changes should be interpreted in conjunction with the clinical and surgical history. They may correspond to benign or suspected changes. It is useful to analyze them in the different imaging modalities to support or rule out a suspected diagnosis. They can appear in the post-surgical period due to both malignant and benign conditions

### **BREE-19 Beyond the Lump: Navigating the Challenges of Cystic Breast Lesions**

Participants

Maria Vitoria Ludwig, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Our educational exhibit is directed to review the assessment and management of cystic breast lesions through the following points: review the pathologies presented as cystic breast lesions; understand how to identify and categorize breast cysts at ultrasonography; comprehend the appropriate management according to the imaging finding, correlating with clinical history and other imaging modalities if available; enlighten biopsy modalities, indication and technique; recognize the importance of subsequent histological analysis.

## TABLE OF CONTENTS/OUTLINE

The subject will be approached in the following sequence: pathologies presented as cystic breast lesions and their malignancy risk; diagnosis, initial evaluation and ultrasound classification of breast cysts, linked with drawing representations of each type of cyst; appropriate risk assessment and management according to the imaging finding considering correlation with clinical history and other imaging modalities, namely mammography and magnetic resonance imaging; how to choose the most suitable biopsy modality and possible pitfalls; correlation of radiological findings with histopathologic analysis, followed by revision of management if required; illustrative cases in the different imaging methods.

## BREE-2 Lipofilling: What Does Breast Radiology Need to Know?

Participants

Karen Caro, PhD, CABA, Argentina (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1.- Describe the imaging characteristics of the lesions in lipofilling  
2.- When should we consider that a lesion after a lipofilling procedure would need histological certification, in relation to the imaging findings?

## TABLE OF CONTENTS/OUTLINE

Currently fat transfer (lipofilling) is used in breast reconstruction. In this paper we will describe its advantages and how it is seen in the different imaging studies (ultrasound, mammography and MRI). It is important to identify which are the usual benign findings in the different methods and what Bi-Rads to assign, in this way we can define those cases in which their histological evaluation should be considered. Describe the advantages and disadvantages of this method in breast remodeling. The importance of recognizing radiological manifestations and the difficulties involved in detecting suspicious lesions. Knowing how to recognize that fat necrosis is a frequent lesion after lipofilling, which should be suspected in order to avoid other more complex studies such as MRI and even biopsies

## BREE-20 Not Every Ductal Ectasia Is Evil: Spectrum of Ductal Lesions

Participants

Raissa Soares, MD, Sao Luis, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

To review the imaging appearance of normal ductal anatomy; Illustrate imaging findings of ductal ectasias using different techniques, including mammography, ultrasound and magnetic resonance imaging, providing clinical images and histopathology correlation; To discuss the appropriate management of these lesions; Review a case series of benign ductal breast diagnoses from our institute, without associated malignancy;

## TABLE OF CONTENTS/OUTLINE

Identify imaging criteria that may help in the diagnosis of ductal ectasia and, eventually, in its management; Typical multimodality imaging findings (magnetic resonance imaging, ultrasound and mammography) from cases of our radiology department; Diagnostic challenges, main differentials, and key points suspicion of this pathology; Discuss the role of percutaneous biopsy (ultrasound-guided core biopsy and vacuum - assisted biopsy) in the diagnosis of ductal ectasias; Conclusion.

## BREE-21 Understanding the BI-RADS 3 Category

## TEACHING POINTS

By the end of this educational exhibit, learners will: 1. Accurately define BI-RADS 3 and appropriate use cases. 2. Explain BI-RADS 3 radiographic features and diagnostic considerations for mammography, ultrasound, and MRI. 3. Demonstrate proficiency in the assessment process of a BI-RADS 3 lesions, through a case-based review.

## TABLE OF CONTENTS/OUTLINE

1. What is BI-RADS 3? a. Definition b. Appropriate use cases  
2. BI-RADS 3: Mammography a. Imaging features b. Diagnostic considerations  
3. BI-RADS 3: Ultrasound a. Imaging features b. Diagnostic considerations  
4. BI-RADS 3: MRI a. Imaging features b. Diagnostic considerations  
5. Identifying BI-RADS 3 Lesions: Case-Based Walkthrough a. Classic BI-RADS 3 cases b. Special cases

## BREE-22 Back to the Tumor: Navigating Breast Cancer Recurrence Like a Pro

Participants

Vitor Zanetta, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Review the risk and pattern of tumor recurrence according to molecular subtype Provide visual and data-driven insights into expected imaging changes following treatment. Highlight the role that multimodality plays in differentiating expected imaging findings from treatment and imaging findings indicative of recurrence or new breast cancer. Review current follow-up protocols after breast cancer and screening for intermediate risk patients.

## TABLE OF CONTENTS/OUTLINE

Review the influence of breast cancer subtype on the rate, timing and location of tumor recurrence. Expected imaging changes following treatment with visual and data-driven insights: Expected timeline of post-surgical changes. Details in the assessment of local recurrence in breast-conserving surgery and mastectomy. Possible changes in axillary and internal mammary lymph nodes. The

role that multimodality imaging (mammogram, ultrasound, MRI and PET-CT) plays in differentiating recurrence or new breast cancer from post-treatment changes, including: Frequent dilemmas in clinical practice: evaluation of calcifications, distortions, fat necrosis and enhancements in the surgical bed. How to deal with conflicting findings between different imaging methods to avoid unnecessary biopsies without losing sensitivity for early recognition of recurrence. Subtle recurrence and the importance of serial follow-up imaging. Examine the follow-up protocols after breast cancer and screening for intermediate-risk patients from the perspective of personalized medicine.

### **BREE-23 From Flat to Fabulous - A Radiological Guide to Breast Aesthetic Fillers and Biostimulators**

Participants

Heni Skaf, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To expose, through cases from our institution, manifestations of different breast filling and biostimulator materials in the most diverse imaging methods, such as: free silicone, acrylates (PMMA, PAAG), hyaluronic acid, vitamin D, calcium hydroxyapatite and fat grafting. To familiarize the breast radiologist with the radiological presentation of these materials, avoiding false positives and unnecessary investigations. To discuss the usual topography in which they are injected, as well as possible local and systemic complications of using such materials.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: The demand for percutaneous aesthetic procedures is rising in medicine, especially in the context of facial harmonization. This also applies to the breast, both for use in cancer patients, with the increase in the incidence and in diagnosis of breast cancer, as well as for purely aesthetic purposes in the breast itself or even due to migration from other injection sites. Imaging findings: on mammography, ultrasonography and magnetic resonance as well as possible complications and usual injection sites of free silicone, acrylates (PMMA, PAAG), hyaluronic acid, vitamin D, calcium hydroxyapatite and fat grafting. For the most part, non-resorbable synthetic biomaterials, fat grafting, as well as resorbable materials used recently, have radiologic representation. Conclusion: The use of aesthetic breast fillers, whether in the oncological context or not, is on the rise. Often, the patient does not have knowledge of what was used, which can limit the clinical decision of the physician. Additionally, recognition of the radiological appearance of different fillers can avoid false positives and unnecessary biopsies.

### **BREE-24 Far Beyond The Axilla, What Else do We Need to See? Tips and Pitfalls of Lymph Nodes**

Participants

Raissa Soares, MD, Sao Luis, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Aspects of normal images of axillary and supraclavicular lymph nodes and internal mammary in different methods and mainly in ultrasound; To present imaging cases of normal lymph nodes, as well as differential diagnoses of axillary, supraclavicular and internal mammary lymph node enlargement, from our database; Image-guided procedures; Show the importance of the radiological-pathological correlation.

#### **TABLE OF CONTENTS/OUTLINE**

Review the main spots of mammary drainage; To show imaging cases of normal findings and our histological correlation; To present some differential cases of lymph node pathologies; Discuss the types of lesions and which ones require biopsy; Conclusion.

### **BREE-25 Axillary Lymphadenopathy Induced by COVID-19 Vaccination: What Have We Learned?**

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- US features of reactive lymph nodes after COVID-19 vaccination in patients with and without previous COVID-19 infection- Nodal reactivity in young and middle-age patients vaccinated with different COVID-19 vaccine protocols- Association between the cortical thickness measurement of reactive post-vaccine lymphadenopathy and an effective humoral response in COVID-19-naïve patients

#### **TABLE OF CONTENTS/OUTLINE**

The COVID-19 pandemic led to the approval of an emerging vaccination program to contain coronavirus dissemination. One of the most commonly reported local side effects of COVID-19 vaccination has been the development of axillary lymphadenopathy. In this poster, we will discuss about this phenomenon: 1. Which ultrasound features should be evaluated? 2. Does nodal response differ if there exists a prior history of COVID-19 infection? 3. Do the ultrasound characteristics of reactive axillary nodes change depending on the administered COVID-19 vaccination? 4. What is the nodal reactivity to the COVID vaccination according to age? 5. How long does reactive lymphadenopathy last? 6. Does cortical thickness of reactive post-vaccine lymph nodes reflect a humoral response? Conclusions- Reactive lymphadenopathy is a common side effect of COVID-19 vaccination- It is generally a harmless and temporary condition- Healthcare providers should be aware of this potential phenomenon to provide an appropriate guidance to patients

### **BREE-26 Cystic Carcinomas: Preventing Misdiagnosis and Lessons Learned**

Participants

Hemal Grover, MD, New York, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Simple cysts: well circumscribed isodense masses on mammogram; well circumscribed anechoic masses on ultrasound with a thin, smooth, imperceptible wall and posterior acoustic enhancement. Complicated cysts meet all criteria for simple cysts except they contain debris/echogenic intracystic contents. Necrotic tumors (rapidly growing) can present as cystic masses. They can be anechoic, demonstrate posterior acoustic enhancement and therefore often misdiagnosed as simple or complicated cysts. However, careful evaluation of the margins is imperative as it can reveal subtle irregularity and raise suspicion for malignancy. Correlation with mammogram (particularly spot compression views) can be helpful to reveal obscured or irregular margins. Cystic carcinomas often

present as palpable masses. These cases should be viewed with a higher index of suspicion before being labeled as BIRADS 2. Real time physician directed ultrasound is recommended along with a bilateral mammogram with spot compression views (including in women 30-35 years old). Family history, genetic mutations and ancestry (eg Ashkenazi Jewish descent) should be considered while evaluating these patients.

#### **TABLE OF CONTENTS/OUTLINE**

Imaging features of simple, complicated and complex cysts. Classification of complex cysts. Clinical history, diagnostic mammogram, ultrasound and MRI findings of authors' cases of cystic carcinomas. Errors of interpretation/misdiagnosis and lessons learnt. Differential Diagnoses.

#### **BREE-27 Granulomatous Mastitis: Imaging Insights into a Benign Mimicker of Breast Infection and Malignancy**

Participants

Sravani Gampala, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Understand the etiology and clinical presentation of granulomatous mastitis. 2. Recognize the imaging findings of granulomatous mastitis across mammography, ultrasound, and MRI. 3. Appreciate the importance of correlating imaging findings with the clinical picture. 4. Acknowledge the consequences of misdiagnosing granulomatous mastitis. 5. Emphasize the role of radiologists in considering granulomatous mastitis as a differential diagnosis. 6. Discuss the importance of a multidisciplinary approach in the accurate diagnosis of granulomatous mastitis.

#### **TABLE OF CONTENTS/OUTLINE**

I. Introduction to Granulomatous Mastitis A. Etiology B. Clinical presentation II. Imaging Modalities A. Mammography 1. Findings 2. Differential diagnosis B. Ultrasound 1. Findings 2. Differential diagnosis C. MRI 1. Findings 2. Differential diagnosis III. Consequences of Misdiagnosis A. Unnecessary studies B. Patient anxiety C. Invasive procedures IV. Radiologist's Role in Diagnosis A. Considering granulomatous mastitis B. Biopsy and pathological challenges V. Multidisciplinary Approach A. Collaboration in diagnosis B. Improved diagnostic accuracy.

#### **BREE-28 More Than Just a Pretty Cyst - Assessment and Management of Cystic Breast Lesions**

Participants

Vivian Ogata, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To discuss the ultrasound imaging parameters, from B-mode adjustments, Doppler imaging, to post-processing techniques, to properly evaluate cystic breast lesions.- To present the imaging findings of the listed cystic lesions according to the BI-RADS® lexicon such as: simple cyst, complicated cyst, clustered microcysts and complex solid and cystic masses, illustrating with multimodality imaging.- To discuss each subcategory of cystic lesions, its management and follow-up, illustrating with some challenging radiologic cases.- To habituate general radiologists with these findings in order to improve the diagnostic rate of such mammary lesions, reducing unnecessary biopsies.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction and epidemiology: breast cystic lesions are a common diagnosis in women and include a wide spectrum of diseases, from a simple apocrine cyst to complex solid cystic carcinomas.- Scanning techniques, ultrasound adjustment, artifacts and post-processing imaging: adjustment of ultrasonographic basic parameters and adequate scanning techniques are essential for an accurate diagnosis. We can also employ Doppler, elastography, as well as use imaging artifacts to our advantage, patient's position changes more recent post-processing techniques (harmonic and spatial compounding imaging) to better characterize cystic lesions.- Cystic lesions subcategories, classification, histological representation and multimodality imaging depiction.- Management and follow-up: adequate ACR BI-RADS® categorization of each subtype of cystic lesion, illustrating with some challenging cases, exploring some related pitfalls and discussing benign and malignant differential diagnosis.

#### **BREE-29 Can Aesthetic Procedures Interfere With Breast Cancer Screening?**

Participants

Leticia Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The incidence of dermatological procedures to modify aesthetics in body contouring, including post-surgical reconstructions, has been increasing every year, especially minimally invasive ones with injectables. Recognizing the imaging findings provoked by these procedures will avoid possible diagnostic pitfalls and allow the radiologist to alert the dermatologist about the possible loss of breast cancer screening caused by some of these previously unregistered procedures. Further, patients should be educated about the hazards associated with improper use of injectables from non-licensed individuals. Patients must be encouraged to seek out licensed physicians who use FDA-approved products for any medical and cosmetic care.

#### **TABLE OF CONTENTS/OUTLINE**

To review literature data on aesthetic dermatological procedures in the breast and axillary region, with cases from our institution, and illustrate with imaging findings found, based on different imaging methods

#### **BREE-3 It's Not the Same As It Was: Multimodal Review of Breast Cancer Recurrence and What the Radiologist Needs to Know**

Participants

Leticia Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Breast cancer is the most common cancer in the female population worldwide and the number of patients underwent conservative surgery is growing; - The annual risk of recurrence disease varies between 2 to 5% in 5-20 years after diagnosis; - Locoregional

recurrence is defined as the detection of lesions in the ipsilateral breast, chest wall or regional lymph node. If the other parts of the body are affected, it becomes a systemic recurrence; - Some factors related to breast cancer recurrence include failure in the first treatment and non-adherence to adjuvant therapy and surgical margins, but could be related to tumor size, aggressive biology of the primary tumor, young patient age at diagnosis and presence of familial or genetic risk factors; - Tumor recurrence may or may not be similar to the primary malignancy and can simulate benign conditions; - Imaging recurrence are variable and this knowledge becomes essential in radiological practice in order to improve the diagnosis and management of the patient.

#### TABLE OF CONTENTS/OUTLINE

- To review the factors associated to breast cancer recurrence and the epidemiology of these cases; - To show the most common findings in breast cancer recurrence using cases of our institution; - To teach how to evaluate the different methods of imaging (mammogram, ultrasound and MRI) in these cases and give tips that may help to differentiate sequelae of treatment from suspect lesion; - Easy-to-use take home messages to facilitate the handling of challenging cases.

#### BREE-30 Demystifying Gynecomastia: A Pictorial Review

Participants

Rocio Cortes Quezada, MEd, Tlalpan, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

\*Most male breast masses are benign and the most common reason is gynecomastia. \*Forms of breast imaging in male patients are used for diagnostic purposes. \*Pseudogynecomastia and cancer are the most common differential diagnoses. \*Mammography can show increased glandular tissue and ductal dilatation in cases of gynecomastia. Masses, calcifications or signs suggestive of malignancy can also be visualized. \*Ultrasound can help distinguish true gynecomastia from pseudogynecomastia (accumulation of fatty tissue in the breast region). \* Biopsy is the only method to determine if a breast mass in a man is benign or malignant. • \*Biopsy can be guided by ultrasound or mammography

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Definition 3. Epidemiology 4. Clinical presentation 5. Etiology 6. Anatomy and embryology of the male breast 7.Types of gynecomastia 8. Imaging tests of the male breast 9. Imaging findings (mammography, ultrasound) 10. Differential diagnoses 11. Cases: a. Pseudogynecomastia. b. Lipoma. c. Epidermal inclusion cyst of the breast. d. Duct ectasia. e. Fat necrosis f. Invasive ductal carcinoma 12. Conclusions

#### BREE-31 Breast Cancer Surveillance in Patients with Prior History of Breast Cancer: Updates and Controversies

Participants

Sona Chikarmane, MD, Newtonville, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Patients with a prior history of breast cancer (PHBC) are at increased risk of recurrent or second breast cancers. PHBC are also living longer due to improved screening and advances in treatment. Developing optimal screening regimens are critical in detecting breast cancers in these high-risk patients. Expected post-treatment changes include architectural distortion, edema, and skin thickening, which stabilize around two years post-treatment. Multimodality breast imaging surveillance is available, with screening mammography (full field digital mammography or digital breast tomosynthesis), whole breast ultrasound, contrast-enhanced mammography, and breast MRI. The purpose of this educational exhibit will be to review breast cancer surveillance in PHBC, highlighting updates and controversies in screening guidelines.

#### TABLE OF CONTENTS/OUTLINE

1. Review literature on risk of recurrent/second breast cancers in PHBC 2. Discuss optimal mammography screening regimens, including screening vs diagnostic mammography, cadence of screening, and batch vs immediate interpretation. 3. Review the current societal screening guidelines, including mammography and breast MRI. 4. Show multi-modality image-rich cases of recurrent breast cancer versus expected post-treatment changes. 5. Highlight controversies in breast cancer screening guidelines, including age when to stop screening, imaging the reconstructed breast, and compliance with screening.

#### BREE-32 Tales from the Breast: When Breast Problems Have Surprising Origins

Participants

Natalia Lima, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diseases that affect the breast, but do not originate from it, may include systemic, autoimmune, infectious or even tumoral conditions from other sites. They can cause inflammation in the breast tissue and manifest with pain, skin thickening, ulcerations and masses. It is essential to know each one of them to help the clinical practice of differentiating breast carcinoma from these pathologies.

#### TABLE OF CONTENTS/OUTLINE

Illustrated didactic cases from our Breast Radiology group showing some diseases and their presentation forms that can simulate breast carcinoma. They were classified into subgroups such as: 1. Related to the vasculonervous system (MAV and neurofibromatosis), 2. Systemic disorders (cutaneous lymphoma and congestive heart failure), 3. Metastasis to the breast (melanoma and adrenal cortical carcinoma), 4. Soft Tissue tumors (granular cell tumor and synovial sarcoma), 5. Infectious (tuberculosis and dermatobiosis).

#### BREE-33 Spectrum of Papillary Lesions of the Breast: Multimodality Imaging and Radiologic-Pathologic Correlation

Participants

Janice Thai, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Papillary lesions represent a heterogeneous group of entities with histologic continuum from benign, atypical to invasive and non

1. Papillary lesions represent a heterogeneous group of entity with histologic continuum from benign, atypical to invasive and non-invasive malignant lesions. 2. To review the multimodality imaging spectrum of papillary lesions. 3. To review the unique histopathologic patterns of lesions with papillary and micropapillary features. 4. To review the clinical management algorithm for different papillary lesions diagnosed on core needle biopsy.

#### TABLE OF CONTENTS/OUTLINE

- Multimodality imaging review of common and uncommon imaging features of papillary lesions.
- Review of classification system according to WHO 5th Edition Breast Tumors (2019)
- Review of histopathology of papillary lesions.
- Review of current evidence-based management algorithm for benign, atypical and malignant papillary lesions.

#### BREE-34 A Guide to Cystic Breast Lesions

Participants

Christina Le, DO, Morristown, NJ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Breast imaging is often complex and can appear difficult to understand. It is rarely explored in depth throughout medical school training and can be rather limited throughout residency, especially for those pursuing other specialties for fellowship. The purpose of this exhibit is to provide a demystified review of cystic breast lesions. This is meant to supplement a resident's knowledge of breast pathology and present the information in a concise yet comprehensive manner. Throughout the presentation, the pathophysiology and patient presentation of each entity will be discussed. This will be followed by the often variable imaging findings that can be encountered on ultrasound, mammography, and MRI. Annotated pictorial examples are provided to facilitate visualization of the specific lesion characteristics. To conclude, the exhibit will discuss treatment options and the appropriate BIRADS criteria to help standardize the severity of these lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Overview/educational objectives 2. BIRADS categories 3. Simple Cyst 4. Galactocele 5. Fat necrosis/oil cyst 6. Hematoma 7. Abscess 8. Intracystic papilloma 9. Necrotic neoplasm 10. Conclusion 11. References

#### BREE-35 Cryoablation Therapy for Breast Cancer: Procedural Technique and Imaging Review

Participants

Janice Thai, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the procedural techniques for performing breast cancer cryoablation. 2. To review multimodality post procedural imaging features of cryoablation to identify normal and abnormal findings.

#### TABLE OF CONTENTS/OUTLINE

- Review of proper patient selection in a multidisciplinary approach.
- Review of equipment, device and procedural technique.
- Review of post procedural imaging, including normal and abnormal findings on mammography, ultrasound, and MRI.
- Review of follow-up imaging protocol and strategies for detection of tumor recurrence.

#### BREE-36 Exploding Jelly of the Breast: The Mucocele-Like Lesion (MLL)

#### TEACHING POINTS

<Mucocele-Like Lesions are considered risk injuries (B3a). Mucin in the stroma calcifies over time, showing up as such on mammography. By mammography the type of calcifications is variable. By ultrasound it appears as microcysts, complex cysts or irregular nodules. The treatment depends on the diagnostic biopsy method.>

#### TABLE OF CONTENTS/OUTLINE

<Mucocele-Like Lesions were first described by Rosen in 1986 as a benign lesion "cysts containing mucin, lined by squamous or cuboid epithelium with or without extravasated mucin", currently considered a risk lesion. It is due to mucinous ducts that obstruct their contents, causing rupture with extravasation of the contents into the surrounding stroma, which over time can form calcifications, which are observed by mammography; less commonly, it presents as a mass. By ultrasound they are observed as a cyst with thick, mucin-like content or microcystic conglomerates. The more complex the cystic lesion, the more likely it is to be associated with Ductal Carcinoma In Situ (DCIS). With core needle biopsy, the percentage of diagnostic underestimation is less than 4% if they are lesions without atypia, but amounts to approximately 20% if they are lesions with atypia, so removal by vacuum-assisted biopsy or surgery is preferred.>

#### BREE-37 Rare Tumors of the Breast

#### TEACHING POINTS

Rare tumors of the breast: Metaplastic carcinoma of the breast and Primary signet ring cell carcinoma of the breast. Epidemiology, image presentation of cases, clinical characteristics, imaging findings

#### TABLE OF CONTENTS/OUTLINE

Metaplastic breast carcinoma is a rare type of neoplasm that resembles a high-grade histological carcinoma, presents a high incidence of recurrences, poor prognosis, difficulties at the time of diagnosis, the establishment of therapeutic guidelines, and controversy regarding its nomenclature. The bibliography is very limited and the published descriptive studies have a low number of cases, making it difficult to obtain definitive and extrapolated conclusions, especially when making therapeutic decisions. Primary signet ring cell carcinoma of the breast is a rare tumor of controversial histogenesis, aggressive behavior and unusual metastatic pattern to the gastrointestinal tract and serous surfaces, posing differential diagnosis problems with metastasis of signet ring cell carcinoma of the breast. Other origins, preferably gastrointestinal.

#### BREE-38 AI Advancements in Breast Imaging: Transforming Radiology for Improved Patient Care

Participants

Matteo Mancino, MD, Roma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To explore the basic concepts of deep learning and machine learning in breast imaging. To examine AI-based tools and their applications in detection, diagnosis, and treatment planning for breast cancer. To assess AI performance compared to human experts. To discuss ethical considerations. To investigate AI future trends and developments for breast imaging.

#### TABLE OF CONTENTS/OUTLINE

Introduction: presenting the fundamental principles of deep learning and machine learning in the context of breast imaging. 1. Workload to explore how AI algorithms can positively influence radiologists' workload, also triaging negative mammograms and potentially replacing second readers. 2. AI accuracy to discuss how AI-based solutions contribute to improve diagnostic accuracy in mammography and enable a more precise lesion classification. 3. Cancer-Prediction evaluating the ability of AI algorithms to identify cancer-predictive features in mammograms. 4. AI role in ultrasound and MRI to examine the development and performance of AI-based solutions for detecting and classifying breast lesions in ultrasound and MRI. 5. Ethical considerations Addressing the ethical concerns surrounding AI implementation, including data privacy, algorithm fairness, and potential biases in the development process. 6. Future trends to address the future trends of AI, contemplating the potential integration of AI with other imaging modalities, exploring the role of radiogenomics in breast imaging, and anticipating novel AI advancements.

#### **BREE-39 Multimodal Imaging of Breast Tissue Expanders, Including Associated Complications and MRI Contraindications**

Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To show the types of breast tissue expanders and MRI contraindications. ? To perform a multimodal review of the imaging aspects of breast tissue expanders. ? To illustrate complications associated to breast tissue expanders.

#### TABLE OF CONTENTS/OUTLINE

Breast tissue expanders are temporary devices commonly used in two-stage breast reconstruction surgery. Tissue expanders are gradually filled with saline to stretch the skin and chest tissues to make room for breast reconstruction with a permanent implant. There are different types of breast tissue expanders depending on the number of lumens (one or two), filling (saline and/or silicone) and injection dome (remote or internal). Some types have metallic components that are not suitable for MRI imaging due to the potential for image distortion or dislocation. It is important to recognize the imaging features of breast tissue expanders, to avoid misdiagnosis, since tissue expanders with small filling may mimic implant rupture on imaging. Complications associated with breast tissue expanders are rare and include infection, hematoma, rupture, and displacement.

#### **BREE-4 Code of Con-DUCT: An Algorithmic Approach to Multimodality Assessment and Management of Dilated Mammary Ducts**

Participants

Rajshree Singh, MD, Lansdowne, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- The ACR BI-RADS® 5th Edition indicates that a SDD has a > 2% likelihood of malignancy, and therefore warrants a suspicious (BI-RADS 4A) assessment. Otherwise, there are few recommendations for evaluation and management of dilated ducts found at breast imaging.
- Further evaluation with MRI and/or tissue sampling may be warranted if ductal dilation (DD) is new or increasing, symptomatic, or associated with worrisome mammographic or ultrasound (US) features.
- We propose an algorithm-based approach to assessing dilated ducts, specifying worrisome features on mammogram and targeted US to guide further workup.
- This approach may potentially reduce radiologists' uncertainty, unnecessary biopsies, missed cancers, and healthcare expenditures.

#### TABLE OF CONTENTS/OUTLINE

1. Ductal anatomy 2. Definition of DD 3. Etiologies of DD 4. DD requiring further evaluation: a. New or interval change b. Patient symptoms and/or clinical findings c. Suspicious mammographic findings 5. Worrisome US findings 6. Proposed algorithm for assessment and management 7. Identification of key findings that help guide diagnostic decisions. 8. Case-based application and examples 9. Role of ductography, US with elastography, and MR

#### **BREE-40 Breast Imaging Disparities in the U.S**

Participants

Dami Olufosoye, BS, MPH, Mount Pleasant, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit is a call to action for radiologists to identify racial disparities in their own practice. We will review recent studies identifying disparities individuals of color face in breast imaging and discuss successful interventions. 1. Breast cancer is the second leading cause of cancer deaths in women in the US but the leading cause in black women. 2. Black women have less access to screening mammography 3. Black and Hispanic women have lower rates of receiving adequate breast cancer treatment and post-treatment surveillance 4. Black women have increased rates of breast cancer recurrence 5. Imaging disparities based on race and other factors can be identified by radiologists and mitigated with outreach programs

#### TABLE OF CONTENTS/OUTLINE

1 US Epidemiologic breast cancer data 2 Racial disparities in breast cancer screening • Decreased access to mammography centers, advanced imaging equipment, specialized physicians, genetic testing • Additional limitations: § Patient distrust § Provider-patient relationship 3 Racial disparities in diagnostic work-up • Increased time to diagnostic work-up and to biopsy • Later stage at diagnosis 4 Racial disparities after breast cancer diagnosis • Lower rates of receiving adequate breast cancer care and post-treatment surveillance • Lower rates of 5-year breast cancer survival • Higher rates of cancer recurrence 5 How radiologists can help • Identification and mitigation of imaging disparities is part of our professional responsibility to our patients • Examples of successful initiatives

## **BREE-41 Breast Cysts: A Pictorial Exhibit of Benign and Malignant Twists**

Participants

Flavia M. Starling, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Cystic breast lesions are the most common masses found in the female breast of any age group, mainly between 30 and 50 years of age. They are derived from the terminal lobular duct unit as a result of fibrocystic change and may contain isolated liquid or even associated solid component, thus comprising a wide spectrum of variable disease entities, including benign and malignant pathologies. Simple and complicated cysts are usually benign; but on the other hand, complex cystic masses containing mixed cystic and solid components are indeterminate. Therefore, knowing that cysts are common lesions and that up to approximately 31% of complex breast cysts are associated with malignancy, the radiologist must be familiar with the main pathologies and imaging characteristics that includes this category of lesions.

### **TABLE OF CONTENTS/OUTLINE**

- Didactically review the main cystic lesions of the breast and their characteristics through different imaging methods and case-based revision obtained from the digital archive of our institution.
- Take home message
- References

## **BREE-42 Molecular Classification of Breast Cancer: Guide for the Radiologist**

Participants

Sandra Lara, CABA, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Breast cancer is a disease that, despite having a histopathological classification, also includes molecular and genetic subtypes, being able to carry out a molecular classification that guides the clinical behavior, prognosis and different radiological characteristics based on the expression of biomarkers (HER2, ER, PR, Ki67), this classification complements the traditional classification and adds a very useful biological approach to disease management. That is why it is important for the radiologist to know and recognize the importance of classification, as well as to identify the most common imaging characteristics in the different diagnostic methods according to each molecular subtype.

### **TABLE OF CONTENTS/OUTLINE**

Introduction· Breast molecular biomarkers· Revision of the classification of molecular subtypes of breast cancer· Imaging characteristics in the different methods according to each molecular subtype· Clinical cases· Conclusions

## **BREE-43 Invasive Lobular Carcinoma (ILC): The Cancer With a Thousand Faces**

Participants

Adriana Alvarez, MD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The Invasive Lobular Carcinoma (ILC) is the second most common type of invasive breast cancer. The incidence is increasing due to replacement therapy in postmenopausal women and diagnosis advances. There are two histologic variants: classic and pleomorphic. ILC is usually estrogen receptor positive and her2 negative. The loss of desmoplastic cell reaction and the low density of cells in this tumors make the clinical and the mammographic detection difficult. This entity has multiple imaging manifestations, being a challenge for the radiologist. ILC can be bilateral, multifocal or multicentric, with an unique metastatic pattern. Diagnosis is based in clinical and radiological tests. The most common manifestation is an irregular or spiculated mass in mammography and an hypoecic irregular mass with posterior shadowing in US. MRI is the gold standard and it is used in the presence of multifocal, multicentric or bilateral disease as well as in the presence of lymphadenopathies.

### **TABLE OF CONTENTS/OUTLINE**

This educational exhibit presents epidemiological and main ILC features. Tumor presentation and behaviour are explained. A multi-modality review of clinical and radiologic features through clinical cases, as well as pitfalls, are presented and they can help the radiologist in the diagnosis.

## **BREE-44 MRI-Detected US: How to Improve the Detection Rate of Non Mass Lesions Using Breast Anatomical Landmarks**

### **TEACHING POINTS**

Nonmass lesions on US are most often observed when US is used to target mammographic asymmetries, biopsy suspicious calcifications seen on screening mammography, and to biopsy abnormalities on MRI. In a meta-analysis of 2201 lesions, the success rate of targeted US after MRI was 58% (range, 23%-82%) and detection rates varied by lesion type. Nonmass enhancement lesions on MRI are less likely to be detected on targeted US than mass lesions (66% of all masses and 30% of nonmass enhancement lesions were seen). This review introduces a new viewpoint on breast ultrasound anatomy necessary to obtain a close correlation with MRI and describes a target US method with anatomical landmarks based on this viewpoint. 1. Some US images of MRI-detected lesions are more indistinct than surrounding benign lesions and need to be correlated with precision. 2. About effective anatomical landmarks for MRI correlation including surrounding tissues and vascular routes as a new anatomical landmark. 3. Pattern classification of mammary fat and mammary gland distribution for reading anatomic landmarks in MRI correlation. 4. The anatomical mechanism of deformity and how to decipher it on US. Breast deformity during ultrasound examination is not related to breast size, but varies from individual to individual.

### **TABLE OF CONTENTS/OUTLINE**

1. the identification rate of in each literature and its relationship to landmarks used 2. identification rates by anatomical landmarks and MRI images using those landmarks 3. classification of patterns of fat and mammary gland distribution in the breast based on anatomical understanding 4. anatomic mechanisms of breast deformity in MRI and US 5. US techniques considering breast deformity 6. case presentation

## **BREE-45 Unraveling the Enigma of DCIS: A Multimodality Imaging Journey**



Participants  
Giselle Mello, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Definition and classification of DCIS-Epidemiology and risk factors-Clinical presentation and symptoms Imaging modalities for DCIS detection and assessment

#### TABLE OF CONTENTS/OUTLINE

-Interpretation of mammography, ultrasound, and MRI in DCIS diagnosis-The role of breast tomosynthesis in DCIS detection-Pathologic correlation and biopsy techniques-Management options: Discuss management options for DCIS, including surgery (lumpectomy or mastectomy), radiation therapy, hormonal therapy, and surveillance.-Discuss emerging imaging technologies for DCIS detection and assessment.-Future directions: Discuss future research directions and areas of innovation in the field of DCIS detection and assessment, such as the use of artificial intelligence and machine learning in radiology, and the development of more personalized approaches.

#### **BREE-46 Unveiling the Mysteries of PASH in Breast Radiology: A Cutting-Edge Approach**

Participants  
Andrea Di Ninno, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Definition and classification of PASH Imaging modalities for PASH detection and characterization Differential diagnosis of PASH with other breast lesions

#### TABLE OF CONTENTS/OUTLINE

Definition and histopathology of PASH Clinical presentation and diagnostic workup of PASH Radiologic features of PASH on mammography, ultrasound, and MRI Differential diagnosis of PASH, including benign and malignant breast lesions Radiologic-pathologic correlation of PASH Management and follow-up of patients with PASH, including surveillance imaging and surgical options Association of PASH with other breast conditions, such as atypical ductal hyperplasia and breast cancer Multi-disciplinary approach to PASH management, involving radiologists, pathologists, and clinicians.

#### **BREE-47 Imaging Review of Mammography and Ultrasound Findings in Uncommon Breast Lesions: A Trainee-Focused Guide**

Participants  
Thurl Hugh Cledera, MD, Taguig, Philippines (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Differentiating uncommon breast lesions from cancerous lesions in the breast is paramount to proper diagnosis, risk stratification, and treatment in patients presenting with a breast mass in imaging. Uncommon breast lesions may vary from those arising in the glandular parenchyma (phyllodes), inflammation (mastitis and abscess), autoimmune (granulomatous mastitis), and metabolic (diabetic mastopathy) etiologies. In centers where resources are limited, knowing the value of mammography and ultrasound findings may help guide biopsy, which in turn provides adequate treatment. At the end of this exhibit, the learner will be able to review the basic findings that are seen in breast lesions on imaging and understand the role of clinical and imaging correlation in the proper identification of these lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Brief review of histology of uncommon breast lesions  
3. Basic findings in mammography  
4. Basic findings in ultrasound  
5. Correlating findings in mammography and ultrasound  
6. Cases of uncommon breast lesions  
a. Lactating adenoma  
b. Intraductal papilloma  
c. Mastitis (bacterial)  
d. Granulomatous mastitis  
e. Diabetic mastopathy  
f. Mondor's disease  
g. Paget's disease  
h. Phyllodes tumor  
i. Dermatomyositis  
j. Foreign bodies

#### **BREE-48 Untangling the Mammary Ducts: Decoding the Complexity of Intraductal Pathology**

Participants  
Elsa Cecilia Molina Miranda, MD, Ciudad De Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Mammography: Mammography can show intraductal lesions as grouped calcifications in a linear or branching pattern. Breast ultrasound: Ultrasound can identify intraductal lesions as masses or areas of ductal dilation. Core needle biopsy (CNB): This procedure is used to obtain a tissue sample from the lesion. CNB is performed guided by ultrasound or mammography. Vacuum-assisted biopsy (VAB): This procedure uses a suction device to obtain a tissue sample from the lesion. VAB is performed guided by ultrasound or mammography. Contrast-enhanced mammography: This exam uses a contrast medium to evaluate the vascularity of lesions in the breast, which may suggest the presence of a malignant lesion. Management of intraductal lesions depends on the definitive diagnosis obtained by biopsy. If the lesion is found to be malignant, treatment may include surgery, radiation therapy, and/or chemotherapy. If the lesion is benign, treatment may include observation or surgical removal.

#### TABLE OF CONTENTS/OUTLINE

Table of contents: 1. Objectives 2. Anatomia y fisiopatologia 3. Cases 4. Metodos diagnosticos 5. Approach 6. Conclusions  
Outline: Intraductal breast lesions are those that originate in the breast ducts and can be benign or malignant. These lesions can be detected by diagnostic methods such as mammography, breast ultrasound, core needle biopsy (CNB), vacuum-assisted biopsy (VAB), and contrast-enhanced mammography. The management of intraductal lesions depends on the definitive diagnosis obtained by biopsy, and treatment may include surgery, radiotherapy, and/or chemotherapy for malignant lesions, while benign lesions may be observed or surgically removed.

## **BREE-49 Coming Out of the Bubble: Assessment and Management of Cystic Breast Lesions**

Participants

Bruna Nantes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

An approach to the evaluation and diagnosis of cystic lesions in the breast, with the aim of helping radiologists in their daily practice. Detail the different types of cystic breast lesions and their differential diagnoses, as well as the appropriate management of these lesions.

### **TABLE OF CONTENTS/OUTLINE**

Brief introduction: the prevalence of cystic breast lesions and the importance of adequate recognition and classification of these lesions. Definition and descriptors: detail the correct definition and description of the different types of cystic lesions. Flowchart on the management of cystic breast lesions. Multiple clinical cases of the different differential diagnoses of each type of cystic breast lesion, that contemplate: - Images from mammography, ultrasound and eventually MRI or CT scan; - Type of biopsy performed (if performed); - Recommendations on approaches to cystic lesions as per BI-RADS; - Recommendations on some special cases of cystic lesions; Conclusion.

## **BREE-5 When Lightning Strikes the Same Place Twice: Detecting Ipsilateral Breast Cancer Recurrence in the Post Operative Breast**

### **TEACHING POINTS**

Illustrate the imaging features suspicious of ipsilateral breast cancer recurrence in patients with prior lumpectomy or mastectomy. Review current literature for recommendations on adjunct imaging surveillance in women with prior history of breast cancer given their increased risk of a second breast cancer. Review imaging mimickers of breast cancer recurrence and discuss management recommendations. Highlight teaching points for each case to increase confidence in making a timely diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

Case base review We will present an image rich exhibit depicting imaging findings in ipsilateral breast cancer recurrence in the post lumpectomy patients who present for annual surveillance mammography or breast MRI, and in patients who present with clinical concerns. Cases will illustrate imaging findings, histopathology and management at the initial diagnosis and at time of recurrence. Examples of imaging mimickers of breast cancer will familiarize the learner with benign conditions in the post-surgical breast. At the end of the exhibit, teaching points will be summarized. Summary: Women with a prior personal history of breast cancer are at an increased breast cancer risk. Cumulative incidence of ipsilateral breast tumor recurrence rate has been reported at 14.3%. The image appearance of the post operative breast can make the detection of breast cancer recurrence more challenging. As a result, radiologists should be familiar with common and uncommon imaging findings of ipsilateral breast cancer recurrence. This presentation will review the current screening recommendations in this setting, expected post operative changes, breast cancer mimics, and the imaging findings of recurrence.

## **BREE-50 New Blossoms on the Old Tree: Advancing Ductography with Digital Breast Tomosynthesis (DBT) or Contrast-enhanced Mammography (CEM)**

Participants

Juan Tao, Wuhan, China (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Ductography is a useful tool for evaluating pathologic nipple discharge, allowing for identification and localization of intraductal lesions. 2. Ductography combined with DBT or CEM can eliminate masking of small filling defects caused by overlapping ductal branches and improve visualization of the entire ductal tree, enhancing the clarity of diagnosis. 3. Fine-tuning of the procedural steps and optimization of the contrast agent concentration are necessary for the successful implementation of ductography with DBT or CEM. 4. Potential additional risks of radiation exposure associated with combining DBT or CEM should be considered, and measures should be taken to minimize radiation dose to the patient in accordance with established protocols and guidelines for radiation safety in breast imaging.

### **TABLE OF CONTENTS/OUTLINE**

I. The Old Tree: Overview of Ductography and Its Clinical Value in Evaluating PND. II. The New Bloom on the Tree: Clinical Cases Demonstrating the Utility of Ductography combined with DBT or CEM. A. Sharper Sights Case: DBT-Ductography Increased Accuracy of Diagnosis. B. Wider Insights Case: CEM-Ductography Improved Visualization of the Entire Ductal Tree. III. Technical Aspects of Ductography combined with DBT or CEM. IV. Radiation Safety Considerations with Ductography and DBT or CEM. A. Potential Additional Risks of Radiation Exposure. B. Strategies to Minimize Radiation Dose to the Patient. C. Importance of Adherence to Established Protocols and Guidelines for Radiation Safety in Breast Imaging. V. Conclusion. A. Summary of the Key Points Regarding Ductography with DBT or CEM. B. Future Directions and Potential Applications of Ductography with DBT or CEM. VI. References.

## **BREE-51 Genetic Risk Assessment in the Radiology Setting: Our Nationwide Experience in 2023**

Participants

Sean Raj, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review breast cancer risk assessment opportunities 2. Review key high-risk breast care and assessment considerations 3. Highlight key workflow, operational, and regulatory considerations from our practice's experience spanning multiple states on both coasts

### **TABLE OF CONTENTS/OUTLINE**

I. Risk Assessment Guidelines a. Discuss often conflicting recommendation statements suggesting when to begin and which individuals to consider for cancer risk assessment, genetic testing, education/counseling, and modified medical management b. Spotlight recommendations for different demographics c. Examine benefits of supplemental screening II. Higher than average risk:

Breast Screening Considerations a. Mammography sensitivities: general population with breakdown by demographics and women with intermediate risk, high risk, and women with genetic mutations b. ACR/SBI guidelines for those with genetically based [and/or family history and dense breast] increased riskIII. Higher than average risk: Genetic Testing Considerations a. 32% of women qualify for genetic testing: a combination of hereditary and familial risk factors b. Simple multi-gene panel tests and risk assessment workflow can assess germline and polygenic risk for inherited cancer risk factorsIV. Review development of Risk-Assessment ChatBot, Intake and Educational Workflow and discuss our nationwide practice's experience including pearls and pitfalls

## **BREE-52 Vascular Mammary Lesions: Key Features to Make an Accurate Diagnosis and Avoid Unnecessary Biopsies**

Participants

Ladys Camargo, MD, Ciudad Autonoma de Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review the normal vascular anatomy of the breast2. Know the most frequent vascular breast lesions3. Know and discuss the diagnostic modalities commonly used for the diagnosis of vascular lesions4. What is the imaging follow-up of vascular lesions?

### **TABLE OF CONTENTS/OUTLINE**

There are various vascular mammary lesions, ranging from chronic systemic processes, congenital malformations, post-traumatic sequelae, benign masses, to malignant tumors. Accurate diagnosis of vascular lesions in breast images is very risky due to overlapping characteristics. This is why radiologists must be aware of the key features in the different diagnostic methods for interpreting images of vascular lesions in order to make an accurate diagnosis and avoid unnecessary biopsies and finally be able to discuss management recommendations and guidance. Outline-Introduction-Vascular anatomy of the breast-Imaging characteristics of the most frequent vascular mammary lesions-Diagnostic methods for the diagnosis of vascular lesions-Discussion of management and monitoring-Clinical cases.-Conclusions.-Bibliography

## **BREE-53 Cyst Breast Lesions: The Good, the Bad and the Ugly**

### **TEACHING POINTS**

Definition of cystic breast lesions and their prevalenceDifferentiation between simple cysts, complicated cysts, and complex cystic lesionsImaging modalities used for the assessment of cystic breast lesions, including mammography, ultrasound, and MRI

### **TABLE OF CONTENTS/OUTLINE**

Symptoms and clinical presentationDiagnostic imaging modalities for cystic breast lesions, including mammography, ultrasound, and MRIImaging features of cystic breast lesionsDifferential diagnosis of cystic breast lesions, including benign and malignant conditionsRole of imaging-guided percutaneous biopsy techniques in the diagnosis of cystic breast lesions, including fine-needle aspiration, core needle biopsy, and vacuum-assisted biopsy, and their advantages and limitations. Discussion of the importance of a multidisciplinary approach in selecting the most appropriate biopsy technique based on lesion characteristics, patient factors, and imaging findings.Follow-up and surveillance after diagnosis and treatment of cystic breast lesions

## **BREE-54 Everything We Need to Know About Papillary Breast Carcinoma**

Participants

Lisett Cruzado-Quiroz, MD, Lima, Peru (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Papillary breast carcinoma is a rare subtype of invasive ductal carcinoma with infiltrative papillary growth representing about 0,5 - 0,7% of all invasive breast cancers. It is usually seen in postmenopausal in their sixth to eight decade of life. Association with carcinoma in situ is uncommon. Typically presents with bloody nipple discharge or/with slow growing palpable tumors, frequently found in the periareolar region. In general, they have better prognosis than ductal carcinoma with a 100% 10 year survival rate following treatment. Lymph node involvement and distant metastases are rare except in the invasive form. Mammography usually shows a solitary round or oval mass with circumscribed margins. Rarely they associate poorly defined margins or spiculation, given the low occurrence of desmoplastic reaction. Ultrasound generally shows a complex mass with solid and cystic components with good sound transmission. MRI may demonstrate heterogeneous lesions with septations, mural nodule and intracystic haemorrhage, the solid components typically show washout kinetics. Intracystic papillary carcinomas can occur in a pure form or may be associated with ductal carcinoma in-situ or invasive ductal carcinoma. The authors will review the clinical manifestation, imaging features and pathology correlation of this rare breast carcinoma.

### **TABLE OF CONTENTS/OUTLINE**

Review of the pathophysiology of papillary breast cancers (histological and molecular aspect).Multimodal review of imaging features of papillary cancers (mammographic, ultrasonographic, and MR findings)To determine the Radiology-Pathology concordance/discordance by reviewing cases.Update on the treatment of papillary breast cancer.

## **BREE-55 Decoding Ductal Pathology: Multimodality Approach to Nipple Discharge and Management of the Solitary Duct**

### **TEACHING POINTS**

1. Identify what differentiates physiologic nipple discharge from pathologic discharge 2. Describe an approach to the diagnostic workup of patients with nipple discharge 3. Discuss the clinical importance of a solitary dilated duct and describe an approach to management in these patients 4. Implement new strategies for biopsy of hard-to-sample intraductal masses under both ultrasound and MRI-guidance

### **TABLE OF CONTENTS/OUTLINE**

Nipple discharge represents 2-5% of medical visits among women and is the third most common breast concern (pain > lump > nipple discharge). As radiologists our primary responsibility in assessment and management of these patients is to distinguish physiologic and pathologic causes of nipple discharge. This presentation will review the prevalence, epidemiology and pathologic subtypes of papillary lesions and other common pathologies resulting in pathologic nipple discharge and provide the reader with a

diagnostic algorithm for management of these patients. Using a multimodality case-based approach, the reader will develop a differential diagnosis and management strategy for imaging findings in patients with nipple discharge, including management of the solitary dilated duct. We provide the reader with important tips and tricks for biopsy of intraductal lesions and solitary dilated ducts under ultrasound and MRI-guidance and address the potential challenges of radiology-pathology concordance in these cases.

### **BREE-56 Uncovering False Positive Lesions Through DBT**

Participants

Giovana D'Avila I, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Teaching Points Screening mammography using DBT is replacing digital mammography as the preferred imaging modality. Recognize that DBT and mammography together minimize the effects of overlapping breast tissue and improves lesion detection and localization. Identify that digital breast tomosynthesis showed lower recall, cancer detection rate, and biopsy rate. The ability to problem solve with DBT images reduces patient anxiety associated with a callback.

#### **TABLE OF CONTENTS/OUTLINE**

Table of contents 1 - Advantages of screening mammography using DBT. 2 - Amorphous calcifications 3 - Left axillary lymphadenopathy 4 - Palpable finding 5 - Solid Mass

### **BREE-57 Ductal Carcinoma in Situ: Beyond First Impressions**

Participants

Hannah L. Chung, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

DCIS often co-exist with invasive cancers and 19-36% of DCIS after percutaneous needle biopsy are upstaged to an invasive cancer at surgical excision. Up to 3% of DCIS demonstrate axillary nodal metastases. The morphology of the calcifications are useful in predicting the nuclear grade. DCIS may also manifest as a noncalcified mass, asymmetry or distortion. Sonography demonstrates these findings as a mass, nonmass area or ductal change. MRI demonstrates the extent of DCIS better than other imaging modalities and findings correlate with high grade DCIS. Observed recurrences and lymph node metastases pose challenges to current evaluation and treatments of DCIS.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents 1. What is DCIS a. Significance of DCIS b. Biology and evolution of DCIS 2. Clinical Presentation of DCIS a. Asymptomatic b. Nipple discharge c. Paget's disease of the nipple d. Palpable lump 3. Imaging correlates with biology and pathology a. Mammographic i. Calcifications, mass, asymmetry, distortion b. Sonographic i. Nonmass findings 1. hypoechoic areas 2. echogenic foci 3. shadowing, 4. pseudomicrocyst ii. Ductal change c. MRI- MRI is useful to demonstrate extent of disease, exclude invasive disease, and correlates with high grade DCIS. i. nonmass enhancement ii. mass. 4. Special considerations a. Occult invasive cancers or misdiagnosis- Can imaging predict invasion? b. Axillary Staging- Is axillary ultrasound with biopsy and sentinel lymph node necessary? 5. Research: Past, now, and future endeavors a. NSABP, UKANZ, ECOG-ACRIN b. Active surveillance vs standard treatment - COMET, LORIS, LORD c. Advanced imaging techniques and artificial intelligence in both radiology and pathology

### **BREE-58 When Cysts Are Not So Simple: Tips for Complex Cystic Breast Masses Evaluation.**

#### **TEACHING POINTS**

-To review the different entities causing the sonographic appearance of a complex cyst. -To illustrate a series of cases of complex cystic benign and malignant lesions of the breast providing correlation with imaging (US, contrast-enhanced mammography, MRI) and pathology. - To discuss the specific management of those lesions including imaging and interventional procedures. -To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Cystic breast lesions are frequently detected on breast ultrasonography. Simple cysts, complicated cysts, and oil cysts do not require further invasive diagnostic procedures. However, malignant entities may present with complex cystic and solid masses. Through sample cases, a variety of imaging and pathology findings from complex cystic lesions with management discussion will be demonstrated. 1. Introduction. US findings and technical pitfalls. 2. Cystic lesions evaluation, useful findings that could be of significant diagnostic value to distinguish between confusing cysts. Classification of cysts and suspicious findings. 3. Work-up of suspicious lesions on US: mammography/contrast-enhanced mammography (CEM) and MRI. Interventional procedures. 4. Typical benign and malignant lesions with their important findings on ultrasonography, contrast-enhanced mammography, and MRI: Benign: complicated/inflammatory cyst, seroma, oil cyst, epidermal inclusion cyst, galactocele, mucocele-like tumor, hematoma, abscess, fat necrosis, fibroadenoma, papilloma, benign Phyllodes tumor. Malignant: malignant Phyllodes tumor, papillary, medullary, colloid, and squamous cell carcinoma, sarcoma.

### **BREE-59 Differentiating Simple Cysts From Complicated Cysts, Complex Cystic and Solid Masses, and Other Cystic Breast Lesions**

Participants

Tara Retson, MD, PhD, San Diego, CA (*Presenter*) Research Consultant, CureMetrix, Inc Stock options, CureMetrix, Inc

#### **TEACHING POINTS**

Cystic diseases of the breast are common, and confusion can occur regarding their appropriate classification and management. Distinguishing between benign cysts/cystic lesions and malignant cyst-like/fluid-containing cancers may be challenging. Specifically, triple negative breast cancers and intracystic papillary carcinomas should not be dismissed as benign/probably benign. Cystic lesions may be diagnosed accurately and managed appropriately using characteristic imaging findings. It is imperative to properly classify lesions as complex cystic and solid masses vs. complicated cysts since their management differs, and the differential of complex cystic and solid masses includes cancer. This educational exhibit will define simple cysts, teach radiologists about cystic lesions that may not be benign, review their imaging appearances, and recommend management options for complicated cysts,

clustered microcysts, and complex cystic and solid breast masses.

#### TABLE OF CONTENTS/OUTLINE

Introduction; Definitions/illustrations of simple cysts, complicated cysts, clustered microcysts and complex cystic and solid masses; Multimodality examples of cystic breast lesions, systematic approach to the characterization of cystic lesions; How to appropriately apply BI-RADS classification and management recommendations of cystic breast lesions; Utilization of a quiz at the end of the exhibit to test yourself on the systematic approach presented.

#### BREE-6 Get Your Ducts in a Row: Imaging and Management Considerations of Ductal Disease of the Breast

Participants

Firouzeh Arjmandi, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-In the imaging evaluation of spontaneous clear and/or bloody nipple discharge, negative diagnostic conventional imaging (mammogram and ultrasound) warrants further evaluation with breast MRI.-Nipple changes on physical exam even in the absence of imaging findings are suspicious. Clinical exam findings should guide next steps in management, and nipple tissue biopsy should be performed by the surgeon in the appropriate clinical setting.-In the setting of a small, subtle intraductal mass seen on diagnostic MRI and not well visualized at time of MR-guided biopsy, targeting the end of a blind-ending solitary duct can help to guide the biopsy.-The combination of findings of a palpable lump, nipple discharge, and nipple inversion, and the presence of associated coarse heterogeneous calcifications raises concern for malignancy, and biopsy should be recommended (despite the presence of more benign appearing rim calcifications).-Treatment of intraductal papillomas without atypia has become more conservative. Upgrade to DCIS or invasive carcinoma is more common in women >50 years, lesions >1 cm, palpable lesions and papillomas >5 cm from the nipple.

#### TABLE OF CONTENTS/OUTLINE

-Overlapping imaging features of benign and malignant calcifications, including high grade versus low grade DCIS-Utility of MRI in the evaluation of extent of disease in intermediate to high grade DCIS-Multimodality imaging and clinical evaluation of pathologic nipple discharge and nipple changes (erythema and scaling)-Imaging assessment and clinical management of a solitary dilated duct and intraductal lesions-Accurate assessment of response to neoadjuvant chemotherapy in the setting of increasing calcifications post therapy

#### BREE-60 Test Your Knowledge: A Case Based Quiz of Contrast Enhanced Mammography BI-RADS Lexicon

Participants

Daniel Sandoval, MD, Ciudad De Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• To learn the descriptors published in the ACR 2022 BI-RADS supplement for contrast enhanced mammography by reviewing a series of daily case images. • As this supplement has only recently been published, this exhibit is intended to help radiologists become familiar with the terminology and its representation on images, through an interactive and entertaining activity.

#### TABLE OF CONTENTS/OUTLINE

• Background Contrast enhanced mammography lexicon overview (categories, terms, features and definitions) • Illustrated case based quizzeso Case #1: Background parenchymal enhancement - Level: Minimal, Mild, Moderate, Marked. - Symmetry: Symmetric, Asymmetric.o Case #2: Masses - Shape: Oval, Round, Irregular.- Margin: Circumscribed, Irregular, Spiculated. - Internal enhancement characteristics: Homogeneous, Heterogeneous, Rim enhancement. o Case #3: Non mass enhancement - Distribution; Diffuse, Multiple regions, Regional, Focal, Linear, Segmental- Internal enhancement characteristics: Homogeneous, Heterogeneous, Clumped. o Case #4: Enhancing asymmetry - Internal enhancement pattern: Homogeneous, Heterogeneous. o Case #5: Lesion conspicuity - Low - Moderate - High• References

#### BREE-61 Complex Cystic Breast Masses: An MR Imaging Review

Participants

Jie Liu, Wuhan, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To define the concept of complex cystic breast masses. 2. To categorize complex cystic breast masses into three types based on the percentage and spatial distribution of cystic and solid components in the contrast-enhanced MRI. 3. In comparison with US, MRI affords superior visualisation of the proportion and distribution characteristics of solid and cystic components within complex cystic breast masses, which facilitates their differential diagnosis. Moreover, multi-parametric MRI such as T2WI, dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI) enables the recognition of the presence and distribution characteristics of cystic and solid components, the combination of which can serve as a complementary imaging aid for accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of complex cystic breast masses B. Importance of accurate diagnosis II. Complex cystic breast masses A. Definition of complex cystic breast masses B. Etiology of complex cystic breast masses C. Clinical manifestations of complex cystic breast masses III. Categorization of complex cystic breast masses based on MRI features Group A : thick outer wall and/or thick internal septa (> 0.5 mm). Group B: predominantly cystic component(>50%)or intracystic mural nodule. Group C:predominantly solid component and cystic component=50% IV. Comparison of MRI and ultrasound in complex cystic breast masses A. Advantages of MRI over ultrasound B. Limitations of ultrasound C. Diagnostic value of multiparametric MRI in identifying cystic components V. Conclusion A. Summary of key points B. diagnostic flow chart of complex cystic breast masses C. Future directions for research VI. References

#### BREE-62 Trial by Priors: When to Call Back a Stable Mammographic Finding

#### TEACHING POINTS

1. Comparison with multiple prior studies can help identify slowly evolving malignancies. 2. Mammographic findings that warrant further evaluation include increasing number of calcifications or suspicious distributions, evolving asymmetries, architectural distortions, and slow growing or spiculated masses. 3. Early recognition of these suspicious findings allows for appropriate diagnostic workup and improved diagnosis of slow growing malignancies.

#### TABLE OF CONTENTS/OUTLINE

1. Introductory slide. This exhibit hopes to educate breast imagers about stable mammographic findings that require further evaluation. While stability of imaging findings over two years is often suggestive of benignity, comparison with multiple prior imaging studies can allow better evaluation of stability and identify features that are slowly evolving over time. There are also some imaging features that should be further evaluated and sampled regardless of apparent stability. This educational exhibit will discuss several cases of malignancy, highlighting the suspicious imaging features that prompted additional work up. 2. List of teaching points to guide the upcoming case discussion. 3. Anonymized cases demonstrating different examples of slow growing malignancies. Each case will include: Multiple prior studies to demonstrate evolution over time; Explanation of decision making that lead to diagnostic evaluation; Findings on diagnostic imaging; Pathology results after biopsy. 4. Summary slide that reviews the teaching points.

#### BREE-63 Indications and Outcomes of Cryoablation in Breast Malignancies: A Single Institution Case Review

Participants

Sasha Kurumety, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal of this presentation is to educate radiology trainees on the use of cryoablation as a treatment option for breast malignancies, when cryoablation may be appropriate, and expected short and long term outcomes of the procedure. Using a series of cases from our institution, we will describe selection criteria to identify patients that may benefit from this minimally invasive cancer treatment option and demonstrate post treatment imaging findings. After this presentation, learners will be able to describe the utility of cryoablation in treating breast malignancies and mechanisms of action, as well as understand the complications, outcomes, and future directions/ongoing trials for cryoablation.

#### TABLE OF CONTENTS/OUTLINE

Background:- Current FDA approved indications for cryoablation and uses of cryoablation in breast cancer- Ongoing trials: discussion of ICE3, FROST, and home institution trials and preliminary outcomes  
Discussion of mechanism of action:- Direct freezing and cell death, indirect immune response activation- Advantages, disadvantages, and risks/complications of cryoablation  
Cryoablation at our institution:- Qualifying patient and tumor characteristics, preprocedural evaluation- Interdisciplinary decision-making  
Institutional cryoablation cases:- Preprocedural imaging, biopsy pathology results, imaging during procedure, and post cryoablation follow up imaging/pathology  
Future directions: pathway to FDA approval, Medicare coverage, and increasing accessibility.

#### BREE-64 To Treat or Not to Treat: A Review of Papillary Lesions of the Breast

#### TEACHING POINTS

Papillary breast lesions are a heterogeneous group of proliferative changes that occur within the epithelial lining of breast ducts. These lesions have varying presentations, pathological characteristics, and treatment options, requiring careful radiological evaluation for an accurate diagnosis. The spectrum of the lesions includes intraductal papilloma with/without atypia, intraductal papillary carcinoma, encapsulated papillary carcinoma, solid papillary carcinoma, and invasive papillary carcinoma. Radiologists must be aware of these variations to accurately identify, diagnose, and provide appropriate management recommendations. The primary objective of the exhibit is to present a comprehensive pictorial review of papillary breast lesions with radiological pathological images. We will also discuss the steps in the diagnosis and current management recommendations of these lesions. By the end of this exhibit, the audience will have a better understanding of the various papillary lesions and their clinical and imaging presentations, enabling them to provide appropriate radiologic-pathologic correlation and treatment recommendation for patients.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction. 2) Definition of papillary breast lesions. 3) Pictorial review of the spectrum of papillary lesions. 4) Case examples of the spectrum of papillary lesions with pathological correlation. 5) Symptoms presentation of various papillary lesions. 6) Imaging techniques recommendations for diagnosis of papillary lesions. 7) Review of current BI-RADS terms in the description of these abnormalities. 8) Latest management recommendation for papillary lesions within the spectrum. 9) Conclusion/Summary.

#### BREE-65 Case Based Review of the Modern Reconstructed Breast: Benign Imaging Findings and Complications

Participants

Shelby Breit, MD, Durham, KS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand imaging findings associated with modern reconstruction techniques. 2. Recognize uncommon and common benign findings. 3. Discuss complications.

#### TABLE OF CONTENTS/OUTLINE

Reconstruction Methods  
Implants  
Autologous Flaps (AF)  
Imaging after implant reconstruction  
Type: silicone vs saline implant  
Acellular dermal matrix (ADM)  
Benign complications: Rupture, Gel bleed, Abscess/infection, Hematoma, Siliconoma  
Implant associated mesenchymal tumors (fibromatosis)  
Imaging after AF reconstruction  
Type: pedicled, free, perforator flaps  
Venous coupler device  
Benign complications: Fat necrosis/lipografting, Epidermal inclusion cyst

#### BREE-66 Breast MRI: What the Surgeon Wants to Know

#### TEACHING POINTS

As there is increasing need for a multidisciplinary approach to patient care, it is important for the radiologist to understand which MRI findings change clinical management. After this presentation, participants will understand: 1. Indications for breast MRI. 2. Breast cancer staging. 3. Indications for different types of breast cancer treatment, including surgery, radiation, and systemic. 4. Breast MRI findings that change clinical/surgical management. 5. MRI correlates on mammogram and ultrasound.

## TABLE OF CONTENTS/OUTLINE

A. Indications for MRI a. American College of Radiology Practice Parameter b. American Society of Breast Surgeons Consensus Guidelines B. Overview of breast cancer staging C. Surgical management a. Indications b. Mastectomy vs. lumpectomy c. Types of mastectomy D. Radiation a. Indications b. Whole vs. partial breast treatment E. Systemic a. Indications for neoadjuvant chemotherapy b. Types of systemic treatment (chemotherapy, hormone blockade, biologic therapies) F. MRI findings that impact staging and management with multimodality case examples a. Multicentric/multifocal disease b. Nodal involvement (rotter's node, level I, level II, level III, internal mammary chain node) c. Nipple enhancement d. Skin enhancement e. Chest wall involvement f. Cancer in contralateral breast g. Metastatic disease - bone/lung involvement

### BREE-67 The Not So Simple Cyst

#### TEACHING POINTS

Cystic breast lesions are frequently encountered on ultrasound, often incidentally with a broad differential diagnosis including both benign and malignant pathology. Accurate description and classification according to the BI-RADS Lexicon based on ultrasound characteristics are essential for appropriate estimation of risk for malignancy and in turn management guidance. Emphasis on optimal ultrasound techniques, BI-RADS classification based on imaging characteristics, and correlation with example cases will be given with the purpose of helping residents and radiologists feel confident on how to proceed when faced with a cystic breast lesion.

## TABLE OF CONTENTS/OUTLINE

I. Introduction II. Optimal Ultrasound Technique III. BI-RADS classification of cystic lesions 1. Simple cyst 2. Complicated cyst 3. Complex cystic and solid mass (classification of complex masses) IV. Sampling techniques V. Take Away Points

### BREE-68 The Cures Act: Challenges and Benefits in Breast Imaging

#### TEACHING POINTS

The 21st Century Cures Act is a federal law signed in 2016, aiming to remove barriers to health information exchange. The legislation includes a Final Rule, federally enforced as of April 2021, mandating patient access to electronic health information to increase transparency. Part of the mandate prohibits "information blocking," defined as a healthcare practice that is "likely to interfere with access, exchange, or use of electronic health information." For radiology practices, this means that reports are released to patients immediately when finalized. Immediate release allows for increased patient autonomy but reports often include sensitive information, especially in breast imaging, in addition to terminology that might be confusing to patients. Screening and diagnostic reports, previously held for a period of time at many institutions to allow time for direct patient communication, are now immediately released to patients. This educational exhibit reviews the impact of the Cures Act on breast imaging practices, including benefits, challenges, and potential solutions to navigate the legislation.

## TABLE OF CONTENTS/OUTLINE

I. Legislation II. Positive Implications and Challenges III. Evolution of Practice

### BREE-69 How to Start Using Optoacoustic Imaging in Your Breast Practice: A Primer

Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Optoacoustic imaging (OAI) is a novel technique that uses non-ionizing lasers to detect endogenous tissue contrast. Gray scale ultrasound (GUS) is fused with parametric maps of relative light absorption for oxy/deoxyHgb in real-time, enabling simultaneous functional and anatomic imaging. The most frequently tested interpretation schema involves dividing mass into 3 internal and 2 external features. The 3 internal scores include the number of individually resolved vessels and their relative deoxygenation (vessel score), tumor blush, representing volume-averaged vessels too small to resolve individually (blush score), and Hgb amount (hemoglobin score). The 2 external scores reflect the amount and relative oxygenation of hemoglobin and vessel morphology within the boundary zone (bz, immediately surrounding the tumor, analogous to the thick echogenic rim surrounding tumors on GUS images) and the peripheral zone (pz, territory beyond the bz). Combined evaluation of GSUS and OAI features to classify benign and malignant masses have consistently shown to increase significantly (43.0% vs 28.1%,  $p < 0.001$ ) diagnostic specificity with high interreader (7 readers) agreement (mean kappa = 0.55;  $p < 0.001$ ). A study combining decision support tools with 15 fellowship-trained radiologists showed that interreader agreement [intraclass correlation coefficient (ICC) 0.80, 95%CI: 0.78, 9.82] and agreement between reader and decision support tool (95.3% of all reads) was high.

## TABLE OF CONTENTS/OUTLINE

1. Optoacoustic Imaging Principles 2. Equipment Types and Current Status 3. Interpreting Optoacoustic Images: A Comprehensive Guide 4. Understanding system limitations 5. Case Demonstration 6. Test Your Knowledge

### BREE-7 Non-Malignant Papillary Lesions of the Breast: Imaging Features and Management

Participants

Antonio Morales Rosa, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the characteristics of non-malignant papillary lesions of the breast (B3) on different imaging techniques: mammography, US and MR. - To review the therapeutic algorithm of papillary B3 lesions of the breast and the role of vacuum assisted excision biopsy (VAE).

## TABLE OF CONTENTS/OUTLINE

1. Introduction 1.1 Intraductal papiloma without atypia. 1.2 Intraductal papiloma with atypia. 2. Imaging features. 2.1 Mammography. 2.2 US. 2.3 MR. 3. Radiopathological correlation. 4. Management of B3 papillary breast lesions. Algorithm. Role of MR. Indications of VAE. 4.1 Follow-up. 4.2 Surgery. 4.3 Vacuum assisted excisional biopsy (VAE). 5. Conclusions

**BREE-70 What You Need to Know About the Pediatric Breast: A Review of the Normal Breast and Diagnostic Approach of Pediatric Breast Disease.**

**TEACHING POINTS**

The purpose of this exhibit is to: Describe the physiologic breast development and its variants from birth to adolescence. Review the optimal imaging modalities for evaluation of breast lesions in children and adolescents. Recognize imaging appearances of benign and malignant lesions that can affect the pediatric breast. Learn the recommendations for follow-up and management of pediatric breast lesions to avoid a delayed diagnosis or unnecessary interventions.

**TABLE OF CONTENTS/OUTLINE**

We review: Utility of the different imaging modalities in the assessment of the pediatric breast. Breast physiologic development from birth to puberty and pathological conditions that can occur. Benign and malignant pediatric breast disease with illustrating cases. Non-mass findings: Asymmetrical breast development, accessory breast tissue, accessory nipple, pseudogynecomastia, gynecomastia, atypical ductal hyperplasia, surgical scar. Benign masses: Simple and complex cysts, retroareolar cyst, epidermal inclusion cyst, fibrocystic changes, mastitis and abscess, hematoma, intramammary lymph node, reactive lymph node to vaccines, fibroadenoma, pseudoangiomatous stroma hyperplasia, sclerosing adenosis, phyllodes tumor and tubular adenoma. Malignant masses: Metastasis and primary breast cancer. Diagnostic approach of pediatric breast disease with follow-up and management algorithm and indications for interventions such as biopsy or surgery.

**BREE-71 Localization for Nonpalpable Breast Lesions. A Pictorial Review of Different Imaging-guided Preoperative Localization Procedures in the Breast and Axilla.**

Participants

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To know the different devices employed for nonpalpable breast lesions localization. -To review the role of imaging techniques (mammogram, US, MR, CT, gamma detector) in the localization of breast lesions for breast conserving surgery. -To understand surgeon needs including technical factors of localization and communication of the relationship of the lesion and the marker. -To become familiar with the localization process, and different tips and tricks for each device.

**TABLE OF CONTENTS/OUTLINE**

Breast-conserving surgery requires multidisciplinary communication and planning between the surgeon and the radiologist. Removal of the lesion with adequate surgical margins and avoiding resection of healthy breast tissue is essential. 1. History of wire localization, radioactive seed, and other non-needle-wire localization techniques 2. Advantages and disadvantages of using seed localization versus needle-wire localization. 3. Wire localization. 4. Non-wire devices: radioactive I125, magnetic, radar, and radiofrequency seeds 5. Technique and pitfalls. Before the procedure: review of the patient's imaging and histopathologic findings. Wire or seed placement. Preoperative detection. Operating room. Recovery. 6. Case examples of potential difficulties and problems and how to overcome them.

**BREE-72 Is it Back? Multimodality Surveillance of Breast Cancer Recurrence: Literature Review and Case Presentation**

Participants

Mohammed Sabawi, MBChB, Iowa City, IA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Screening patients with previously treated breast cancer is challenging, because benign post treatment changes can obscure or resemble an underlying recurrence and due to technical limitations in performing a mammography on a treated breast. There are postoperative mammographic findings in a conservatively treated breast which follow expected time course. Any new mammographic finding (new masses, asymmetries or microcalcifications) should raise suspicion for recurrence. Abnormal screening mammogram is the most common presentation of breast cancer recurrence. Margin involvement and lack of radiotherapy and/ or chemotherapy are important prognostic factors of local recurrence. There is no clear guidelines to dictate ipsilateral breast screening after mastectomy and reconstruction with or without implant. Breast MRI is highly sensitive imaging modality to detect local recurrence in certain patient groups. It can be also utilized as problem solving to assess equivocal clinical or mammographic findings.

**TABLE OF CONTENTS/OUTLINE**

Introduction Review of incidence, risk factors, diagnostic performance of multimodality surveillance and presentation of breast cancer recurrence. Review of post breast conserving treatment imaging findings and their time course of evolution. Review of available national guidelines for multimodality surveillance after curative treatment for locoregional breast cancer. Case based review of different and unusual presentations of breast cancer recurrence. Conclusion. References.

**BREE-73 A Review of the Combined Score for Quantitative Shear Wave Elastography (SWE) and Superb Microvascular Image Vascular Index (SMIVI) to Evaluate Breast Masses**

Participants

NA YOUNG LEE, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To differentiate between benign and malignant breast masses, we propose using the combined score of quantitative parameters for shear wave elastography (SWE) and superb microvascular image (SMI) with BI-RADS. We suggest using the combined score for SWE<sub>max</sub>, SWE<sub>ratio</sub>, and SMIVI and demonstrate how it can be used to differentiate between benign and malignant breast masses. 2. We calculated the combined score by adding the BI-RADS score and each quantitative parameter (SWE<sub>max</sub>, SWE<sub>ratio</sub>, and SMIVI). The BI-RADS categories were scored on a scale of 1 to 5 (C3:1, C4a:2, C4b:3, C4c:4, and C5:5), and SWE<sub>max</sub>, SWE<sub>ratio</sub>, and SMIVI were scored as 0 or 1 based on applied cutoff values. The summed score ranged from 1 to 8. We used a cutoff value of 4 for the combined score to discriminate between benign and malignant cases based on the reported AUC values. 3. The combined score of B-mode US and quantitative parameters can improve diagnostic performance and reduce unnecessary breast biopsy.



However, the combined scores should be applied with caution, considering that the quantitative parameters have limitations in assessing small-sized, pure DCIS, or low-grade invasive cancer.

#### TABLE OF CONTENTS/OUTLINE

1. Review the principles of quantitative parameters for SWE (SWE<sub>max</sub>, SWE<sub>ratio</sub>) and SMIVI. 2. Review the appropriate cut off value for quantitative parameters for SWE<sub>max</sub>, SWE<sub>ratio</sub>, and SMIVI and evaluate their diagnostic performance in differentiating between benign and malignant masses. 3. Showcase the various case of combined score and pathology reviews to demonstrate how combined scores are helpful for differential diagnosis of breast masses, and which cases will be carefully applied.

#### **BREE-74 Threading the Needle: The Role of Breast Radiologists in Managing Suspicious Internal Mammary Lymph Nodes**

Participants

Megan Kalambo, MD, Missouri City, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Examine Internal Mammary Lymph Nodes (IMLN) as an important component of breast lymphatic drainage. 2. Review the implications of metastatic IMLN adenopathy in the staging of breast cancer. 3. Provide an overview of IMLN basin anatomy, differential diagnosis of IM adenopathy, and the clinical indications for imaging and sampling. 4. Explain the tools and technical steps necessary for conducting a successful ultrasound biopsy of IMLNs. 5. Recognize ultrasound-guided Fine Needle Aspiration (FNA) biopsy as a feasible percutaneous sampling technique radiologists can use to provide treatment planning assistance to clinical teams.

#### TABLE OF CONTENTS/OUTLINE

Based on our experiences at a tertiary oncologic referral center, we will provide an overview of internal mammary lymph nodes (IMLN) with regard to the anatomical, clinical, imaging and procedural considerations for radiologists. • Overview of IM nodal basin anatomy • Management of indeterminate and suspicious IMLNs • Differential diagnosis of abnormal/indeterminate IMLNs • Incidence and implications of IMLN adenopathy on breast cancer staging • Indications for imaging of IMLN • Multimodality identification of IMLN on Ultrasound, MRI, PET/CT • Biopsy considerations • Indications • Tools • Technical steps • Case-based discussion of IMLNs • Tips for imaging and clinical management of patients with indeterminate/suspicious IMLN.

#### **BREE-75 The State of Breast Imaging in the Caribbean**

Participants

Dami Olufosoye, BS, MPH, Mount Pleasant, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Provide an overview of the current trends in incidence and mortality of breast cancer in the Caribbean 2. Discuss the state of breast services with respect to breast exams and screening 3. Discuss the challenges in breast services including infrastructure and health workforce availability 4. Recognize patient-related barriers 5. Review main points of the global breast cancer initiative and goals for breast imaging in the Caribbean

#### TABLE OF CONTENTS/OUTLINE

• Overview of breast cancer incidence, prevalence, mortality, and stage of diagnosis in the Caribbean compared globally and to the US • State of breast services with respect to breast exams and testing • National guidelines on breast exams and screening • Self-breast exams • Clinical breast exams • Access to mammograms • Discuss the state of breast services pertaining to the infrastructure and health workforce availability • Number of equipment in the region • Type of equipment available: digital mammography vs full film digital mammography vs tomosynthesis • Maintenance/ Audit of equipment • Health workforce: radiologists, oncologists, physicists • Breast treatment services • Barriers surrounding breast cancer • Knowledge deficits • Patient beliefs • 2021 Global Breast Initiative • Key messages • Recommendations for implementing interventions

#### **BREE-76 Breast Lesions Detected on CT: When to Refer for Triple Breast Assessment**

Participants

Sharmeen Jaffer, MD, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• Incidental breast lesions are a common finding on CT and unnecessary referrals can create a significant burden on the breast clinic. • To evaluate imaging characteristics of incidental breast lesions identified on CT and suggest characteristics which warrant referral to the breast clinic. • To identify imaging characteristics of breast lesion mimics or benign breast lesions; avoiding unnecessary referral to the breast clinic. • To explore the limitations of CT with imaging breast lesions including post-contrast enhancement in benign and malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

• Variability of normal breast glandular tissue on CT including asymmetry and differences in density. • Breast lesions with benign characteristics such as coarse or popcorn calcification or well defined cysts with homogenous fluid attenuation. • Indeterminate breast lesions including intramammary lymph nodes, leiomyomas, papilloma, fat necrosis or lobular fibroadenomas which demonstrate post-contrast enhancement. • Suspicious breast lesions and indicators of malignancy including irregular or speculate margins and global or peripheral contrast enhancement; measured in Hounsfield units (HU). • Mimics of breast malignancy including lymphoedema, post surgical changes or radiotherapy. • Factors that negate an unnecessary referral to breast clinic include: long term stability, lesion previously assessed on mammography/ultrasound/biopsy proven benign lesion.

#### **BREE-77 Multimodality Imaging of Recurrent and Residual Breast Cancer**

#### TEACHING POINTS

After this exhibit, the reader will be able to: 1. Describe the epidemiology and clinical implications of recurrent and residual breast cancer. 2. Demonstrate the importance of a multimodality approach to the detection, workup and diagnosis of recurrent and residual breast cancer. 3. Apply specific strategies to improve early detection to optimize patient outcomes.

## TABLE OF CONTENTS/OUTLINE

Recurrent and residual breast cancer remains a diagnostic challenge with significant clinical implications. Early and accurate detection is critical for optimizing patient outcomes. Using a case-based multi-modality approach, this exhibit will: 1. Review the epidemiology and clinical implications of recurrent and residual breast cancer. 2. Discuss current surveillance recommendations and supporting literature, including the importance of patient anxiety. 3. Review expected post-treatment findings, discussing the advantages and disadvantages of each modality (mammography, ultrasound and MRI). 4. Provide an approach to surveillance imaging and residual disease, with emphasis on the surgical pathology report, surgical margins and the importance of breast biopsy marker clips. 5. Provide tips and tricks to ensure early identification of recurrent/residual disease and avoid post-treatment surveillance pitfalls.

### **BREE-78 From Benign to Malignant: Understanding the Spectrum of Phyllodes Tumors**

Participants

Abel Gonzalez Huete, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To provide an overview of Phyllodes tumors, including their pathology features, categories and clinical presentation. 2. To discuss the role of the different imaging in the diagnosis of Phyllodes tumors. 3. To review the differential diagnosis of Phyllodes tumors and how to differentiate them from other breast tumors. 4. To highlight the importance of accurate diagnosis in the management of Phyllodes tumors.

## TABLE OF CONTENTS/OUTLINE

1. Introduction: Breast anatomy, Fibroepithelial tumors, Epidemiology, Pathogenesis, Categories of Phyllodes Tumors (Benign, Borderline, and Malignant) 2. Clinical Presentation 3. Pathology 4. Imaging Findings: - Benign Phyllodes tumor (Mammography, Ultrasound and MRI), - Borderline Phyllodes tumor (Mammography, Ultrasound and MRI), - Malignant Phyllodes tumor (Mammography, Ultrasound and MRI). 5. Differential Diagnosis: Fibroadenoma, Primary Sarcoma of the Breast, Periductal Stromal Tumor of the Breast, Other. 6. Benign vs Malignant Phyllodes Tumors: Key Differences 7. Management, Treatment and Prognosis 8. Conclusion 9. References

### **BREE-79 A Sheep in Wolf's Clothing: The Multiple Appearances of Local Breast Cancer Recurrence After Breast Mastectomy**

Participants

Agostina Peralta I, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Discuss the role of the different image modalities in the surveillance of breast cancer recurrence after breast mastectomy.-Recognizing the imaging and the normal anatomic changes depending on the type of breast mastectomy performed.-Illustrate the imagen findings corresponding to a breast cancer recurrence on different image modalities.-Differentiating post-surgical benign findings from a malignant relapse.

## TABLE OF CONTENTS/OUTLINE

Studies have proven that the presence of local recurrence is an independent predictor for survival this is why radiologist should be familiarized to distinguish normal or benign findings after mastectomy from a recurrence. With the main objective of early detection and treatment. -Briefly review the different surveillance recommendations for these patients given by international societies. -Description of the different surgical breast reconstruction techniques used nowadays will be performed. These include the use of prosthetic implants, autologous tissue flaps, skin and fat flaps. -Illustrations will be shown of the expected anatomic changes after mastectomy on different image modalities depending on the surgical technique. -Images showing and differentiating benign findings from a post-surgical local breast cancer recurrence will be portrait.

### **BREE-8 Comparison of Indications, Reading Time, and Work Flow of FDA Approved Supplemental Screening Automated Whole Breast Ultrasound Tomography in Women With Dense Breasts**

Participants

Mary W. Yamashita, MD, South Pasadena, CA (*Presenter*) Research Grant, Delphinus Medical Technologies, Inc; Consultant, Delphinus Medical Technologies, Inc

#### TEACHING POINTS

- Ultrasound as adjunct to screening mammography for women with dense breasts increases cancer detection. - There are new ultrasound technologies available for same day supplemental dense breast screening. - Invenia ABUS from GE and SoftVue Automated Whole Breast Ultrasound Tomography (SV) from Delphinus Medical Technologies are both PMA-approved for screening and diagnostic purposes. - In clinical practice, ABUS is time-consuming and requires significant reading time. - SV offers benefits of same day supplemental screening with mammography and, unlike other ultrasound imaging, only adds 3-4 mins of reading time per case for the radiologist.

## TABLE OF CONTENTS/OUTLINE

1. Why ultrasound is important in screening women with dense breasts 2. Overview of ultrasound technologies available for dense breast screening 3. Comparison of indications for use 4. Benefits and challenges with integrating ultrasound into practice for adjunct screening for women with dense breasts: Workflow 5. Reading time: what makes reading ABUS and HHUS challenging in clinical practice, what are the main drivers of the time it takes for radiologist to interpret images including technique and training, number of images, image quality, and artifacts 6. Overview of SV automated whole breast ultrasound 7. Image sequence and reading protocol for SV 8. Example clinical cases demonstrating SV hanging protocol 9. SV reading time study and results 10. Conclusion

### **BREE-80 Do Not Miss Architectural Distortion!**

Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

## TEACHING POINTS

The BI-RADS 5th edition manual defines architectural distortion (AD) as “distortion of the breast parenchyma with no definite mass visible.” AD of the breast is an abnormality found in multimodality breast imaging and occurs with benign and malignant lesions. The most common cause of architectural distortion is a surgical scar. However, 4% of breast cancers present with AD. In addition to being a primary imaging finding, AD may also be an associated finding. In addition, AD is notorious for being a missed mammographic lesion. It is important for radiologists to “train their eyes” to identify AD and to know the differential considerations and pitfalls associated with AD evaluation to avoid potential missed breast cancer. The goals of this educational exhibit are to 1. recognize AD by 2D mammogram, digital breast tomosynthesis (DBT), ultrasound, and MRI, 2. review the differential considerations of AD, and 3. recommend management options and perform radiology-pathology concordance.

## TABLE OF CONTENTS/OUTLINE

Introduction; Definition of AD; Multimodality imaging examples of AD of the breast including mammography, sonography, and MRI; Learn a systematic approach to the characterization of AD; AD and DBT; How to appropriately apply the BI-RADS classification and management recommendations of AD; Challenging cases of AD; Pitfalls in evaluating AD: fat-containing, one view only, not seen at biopsy; Discordance in AD rad-path correlation; Sample cases; Conclusion.

### BREE-81 Non-mass Lesion on Breast Ultrasound: Radiologic-Pathologic Correlation and a Guide to Approach

Participants

Haejung Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Unlike mass, non-mass lesion does not show a three-dimensional structure, so it is more difficult than mass to detect and make an accurate diagnosis on breast ultrasound. For this reason, non-mass lesion evaluation on breast ultrasound often follows the detection of abnormality on other imaging modalities, such as mammography or MRI. This educational exhibit was prepared to increase understanding of non-mass lesions seen on breast ultrasound and to help accurately diagnose benign and malignant non-mass lesions. 1. Review the definition of non-mass lesion on breast ultrasound, 2. Correlate radiologic and pathological findings of benign and malignant non-mass lesions, and 3. Discuss a guide to approach for evaluating non-mass lesions on breast ultrasound.

## TABLE OF CONTENTS/OUTLINE

1. Definition of non-mass lesion on breast ultrasound A. True non-mass lesion vs. Normal variants 2. Correlation between radiologic and pathologic findings of non-mass lesions on US A. Imaging features of non-mass lesions on US B. Pathologic features correlated with benign and malignant non-mass lesions 3. Approach for evaluating non-mass lesion on breast ultrasound

### BREE-82 The Cyst Bang Theory: When to Biopsy

## TEACHING POINTS

1. Explain the epidemiology and pathogenesis of breast cyst. 2. Recognize the characteristics by image of breast cysts. The complex cyst is uncommon, but are suspicious of malignancy and merit biopsy. 3. Recognize criteria that will help identify a complex cyst. 4. Identify intraductal papillary nodule. Benign papillomas constitute 85% and 90%, intracystic papillary carcinomas 6% to 7%. 5. Points to help distinguish real from artifacts (echos) on ultrasonography images. 6. Recognize the most important differences in images between complicated and complex cyst. The true papillary nodules are anchored to the wall and do not move with the postural changes of the patient. 7. Analyze when to suspect malignancy in the breast cysts and categorize them based on the BIRADS.

## TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology and pathogenesis 3. What are complex cysts 4. What should birads assign to a complex cyst 5. Review the spectrum of findings (mammography, us and contrast-enhanced mammography) 6. When to decide biopsy, a complex cyst 7. Let's practice (illustrative cases) 8. Conclusions

### BREE-83 Solitary Dilated Duct in the Breast: A Multimodality Pictorial Review

## TEACHING POINTS

Solitary dilated duct is associated with benign and malignant findings and the BI-RADS classification has varied over previous editions. Solitary dilated duct has characteristic imaging features on multiple modalities. Recognizing the imaging features, particularly if new, is important for management.

## TABLE OF CONTENTS/OUTLINE

Background Review of solitary dilated duct and BIRADS classification. Pictorial Review: Cases illustrating benign and malignant lesions with multiple modalities. Case 1: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound. Pathology: Papilloma without atypia. Case 2: History: Presenting with breast pain. Imaging: Mammogram, ultrasound. Pathology: Invasive ductal carcinoma. Case 3: History: 60-year-old female presenting for screening mammogram. Imaging: Mammogram, ultrasound. Pathology: Papilloma without atypia. Case 4: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, MRI. Pathology: Papilloma with high-risk features. Case 5: History: Presenting for screening mammogram. Imaging: Mammogram, ultrasound. Pathology: Intraductal papilloma. Case 6: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, ductogram. Pathology: DCIS. Case 7: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, ductogram, MRI. Pathology: Multifocal DCIS with intraductal papillomatosis. Conclusion Review pearls for solitary dilated duct findings and management.

### BREE-84 MRI Detected Lesion in Women with a Personal History of Breast Cancer, and Then?

Participants

Ga-Eun Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

## TEACHING POINTS

• Screening is still important for women with a history of breast cancer, because of high risk for future breast cancer. Breast MRI shows impressive resolution with high sensitivity, but specificity is relatively low. • Second look ultrasound is a well-established

approach for MRI detected lesions, and lesions found on subsequent ultrasound have a high probability of malignancy. However, second look ultrasound has limitations, such as operator dependence and the possibility of false negatives. Follow-up is required, and re-biopsy should be considered in case of image-pathology discordant. • Correlation with mammography can sometimes be helpful. In particular, new or increasing calcifications can be objective evidence for lesion detection and confirmation of biopsy results. • MR-guided biopsy must be considered in lesions with suspicious MRI features but occult on US or mammography.

#### TABLE OF CONTENTS/OUTLINE

<Representative cases of new enhancing lesion on breast MRI>• According to surgical method: op site after BCS, ipsilateral and contralateral breast after BCS, after mastectomy• According to detection modality: second look ultrasound (successful and missed), mammography, MR-guided biopsy for occult lesion• According to biopsy results: recurrence, false positive (benign), false negative (missed)

#### **BREE-85 5 Years of False Negative Review from the Mammography Audit: Observations and Lessons Learned**

Participants

Heather Garrett, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review of false negative (FN) cases can refine your mammography practice.-Sensitivity of mammography is limited in dense breasts.-BCT changes can make mammography difficult to interpret. ACR recommends annual screening MRI in patients with a prior history of BCT and dense breasts.-Screening MRI is more sensitive than mammography in the detection of breast cancer. High-risk patients should obtain annual mammography and annual screening MRI alternating at 6 month intervals.-Clinical symptoms (palpable breast lump, nipple discharge, skin changes and focal breast pain) should be evaluated using a multi-modality imaging approach.-BIRADS 3 cases are included in the FN review of diagnostic mammography. 0-2% of these cases may be cancers.

#### TABLE OF CONTENTS/OUTLINE

Background: False negative (FN) case review is mandated part of the annual mammography radiologist audit (MQSA/ACR). We are a large academic practice with dedicated breast imagers. We analyzed 135 FN cases from 5 years (2016-2020).Observations: -FN cases tended to be in patients with dense breasts, personal history of breast cancer, prior BCT, elevated life-time risk for breast cancer.-FN cases were mostly detected by presenting clinical symptom or screening MRI.-Some FN cases were women who had been given the assessment of BIRADS 3 in the diagnostic setting.Cases: 5-10 cases to illustrate teaching points.Lessons Learned: Overall, we found that there are many reasons for FN studies, the minority of which involved "missed cancers." Review of FN cases can refine your mammography practice.

#### **BREE-86 Don't Forget About the Nipple: Overview of the Anatomy and Different Lesions Involving the Nipple-areolar Complex**

Participants

Maria Guerra, MD, Monterrey, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the normal anatomy and some anatomic variants of the nipple-areolar complex (NAC).To review imaging anatomy of the NAC by different techniques.To present a pictorial review of commonly known benign and malignant NAC lesions.

#### TABLE OF CONTENTS/OUTLINE

Anatomy of the nipple-areolar complexRetractionInversionImaging anatomy: mammogram, ultrasound, magnetic resonanceDifferent lesions:Dermal lesions: nipple calcifications, Epidermal inclusion cystInflammatory lesions: duct ectasia, retroareolar cyst, periductal mastitis, abscess, Zuska diseaseBenign Tumors: Nipple adenomaMalignant tumors: papilloma, carcinoma, Paget's disease

#### **BREE-87 The Many Faces of Invasive Lobular Carcinoma**

Participants

Miral Patel, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Invasive lobular carcinoma accounts for 5-15% of all breast cancers. 2. ILC is characterized by the lack of E-cadherin function, which explains the discohesive growth pattern and the subtle findings in imaging. 3. A review of radiologic and pathologic correlation of invasive lobular carcinoma and its morphologic variants can aid radiologists in recognizing patterns in the imaging presentation of invasive lobular carcinoma to facilitate early detection.

#### TABLE OF CONTENTS/OUTLINE

This educational exhibit reviews: 1- Basic review of invasive lobular carcinoma 2- Case based discussion of the radiologic presentation and pathologic correlation of the variants of invasive lobular carcinoma including classic, solid, signet ring cell, and pleomorphic 3- Pattern recognition in the presentation of invasive lobular carcinoma

#### **BREE-88 Breast Cancer Recurrence: Incidence and Imaging Appearance**

Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

#### TEACHING POINTS

Locoregional recurrence has been estimated to occur in 5-25% of breast cancer (BC) survivors, defined as the reappearance of the tumor at the surgical site or metastases in the regional lymph nodes. Even after mastectomy, there is a 2-10% reported lifetime risk of recurrence. Recurrence varies by molecular subtypes of BC, triple negative BC at 2-5 years after and other types at 5-15 years after treatment. Mammography remains the primary imaging modality for post-BCT surveillance. Breast MRI has the highest accuracy for differentiating post-surgical scar from recurrence. By the end of this educational exhibit, the learner will: 1. Learn the incidence, risk factors, and clinical presentation of breast cancer recurrence, 2. Review imaging recommendations for patients with a history of breast cancer and those with suspected breast cancer recurrence, 3. Recognize the common imaging appearance of

recurrent breast cancer on multimodality imaging, 4. Distinguish the appearance of recurrent breast cancer from expected post-surgical changes and other differential diagnoses

#### TABLE OF CONTENTS/OUTLINE

Introduction; Incidence and definition of breast cancer recurrence; Expected recurrence rates based on molecular subtypes of BC; Clinical presentation of breast cancer recurrence; Review imaging recommendations for patients with a history of breast cancer; Review diagnostic workup for patients with suspected breast cancer recurrence; Differential considerations of in-breast recurrence and regional nodal recurrence; A pictorial review of multimodality imaging in BC recurrence; Clinical management of recurrent BC; Algorithm for imaging patients with suspected recurrence; Conclusion

#### **BREE-89 AI in Breast Imaging: Current Status and Future Directions**

Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Artificial intelligence (AI) in breast imaging is being used for lesion classification, breast density and cancer risk assessment. In screening mammography setting, stand-alone sensitivity of commercially available AI system range 75-85% at radiologists' specificity of 49-79%. This indicates comparable results with radiologist performance (AUC, 0.84 vs 0.81, respectively).
- Beyond screening, a deep learning model trained on uses mammograms and traditional risk factors showed superior performance in predicting 5 year breast cancer risk compared to the Tyrer-Cuzick model. (AUC, 0.70 vs 0.62,  $p < 0.001$ ).
- Model drift is a concept that describes degradation of AI model performance as the data it is used on changes. This raises concerns regarding the performance and reliability of AI models in real-life clinical settings.
- The FDA requires manufacturers of Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD) to be transparent and monitor the real-world performance of their products to ensure the algorithm meets the standards after deployment.
- In a recent Dutch patient survey most patients (77.8%) did not support stand-alone use of AI in screening interpretation. Furthermore, 41.7% opposed the idea of using AI to select cases for second reading and 17% objected to AI as a second reader.
- The reimbursement for breast imaging AI has not yet been established, and several proposed frameworks are currently under discussion.

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Integrating AI Tools to Breast Imaging Workflow: Opportunities, Challenges and Potential Impact Patient Engagement Ethical and Regulatory Perspectives The Future of AI in Breast Imaging

#### **BREE-9 Navigating Mammary Ducts Pathologies and Anatomy: A Radiological Handbook**

Participants

Giovanna Andreani, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The breast is an apocrine gland that contains different types of tissue: glandular, fibrous or connective, and fatty tissue. The glandular tissue is composed of mammary lobules and ducts, the latter being a tubular structure with the function of carrying the milk produced by the gland to the nipple. There are several pathologies and variations that can affect the mammary duct, ranging from benign alterations such as ductal ectasia or papilloma to even malignant ones (ductal carcinoma in situ or invasive ductal carcinoma, among others). Knowing that the majority of breast cancer arises from the ductal epithelium, it is crucial in the diagnosis and treatment of breast cancer by detecting intraductal lesions at an early stage. The objective of this study is to didactically review the anatomy and embryology of mammary ducts, as well as the main pathologies that affect this very important structure.

#### TABLE OF CONTENTS/OUTLINE

Review of the anatomy and discussion of the radiological findings in the mammary ducts, whether in their normal appearance or pathological changes through the different imaging methods obtained from the digital archive of our institution.

#### **BREE-90 Beyond the Norm: An Exploration of Extramammary Metastases to the Breast**

Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Metastases to the breast are rare, comprising 0.5-6.6% of all malignancies in the breast, and typically indicate widely disseminated disease and poor prognosis.
- Lymphoma (17-38.3%), melanoma (8.3-23.4%), lung (8-15%), gynecological carcinomas (8-12.8%), and sarcomas (2%-12%) are the most common primary tumors to metastasize to the breast.
- Imaging features can vary depending on the primary neoplasm and route of dissemination, hematogenous (more common) or lymphatic.
- Typically, metastases present as well-defined masses without calcifications or distortion on mammography and round hypoechoic masses on ultrasound. Hematogenous metastases present as solitary or multiple breast masses located in the skin, subcutaneous tissue, or the breast parenchyma.
- Breast findings should be characterized according to the BI-RADS lexicon and managed according to the most suspicious features. If metastatic disease to the breast is in the differential diagnosis based on patient history and/or clinical presentation, early confirmation of secondary involvement with pre-operative biopsy of breast lesions is crucial to direct appropriate management.
- Breast metastases can be highly vascular, and ultrasound technique should be optimized to not confuse with pseudoaneurysms or aneurysms, which could result in a delay of diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Literature review 2. Diagnostic algorithm 3. Key clinical and imaging features 4. The diagnostic and prognostic role of imaging modalities 5. Case demonstration and pathologic correlation

#### **BREE-91 Optimizing DWI for Improved Imaging in Breast Cancer and Beyond**

Participants

Sheida Ebrahimi, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Diffusion weighted imaging (DWI) is an advanced MRI technique that reflects water diffusion in tissues of interest and has been shown predicting pathologic response to neoadjuvant chemotherapy. It assists radiologists in better detecting and characterizing breast lesions. DWI can be challenging due to the breast morphology and introduction of artifacts. This exhibit reviews current state of DWI in breast cancer imaging including the physics of DWI, protocols utilized, advanced DWI techniques, and current indications. Strategies for optimizing DWI to improve image quality, diagnostic accuracy, and clinical utility will also be reviewed. At the end of this educational exhibit, learners will: 1. Recall the fundamentals of DWI and ADC Values; 2. Describe the correlation between ADC values and breast cancer prognostic factors; 3. Understand DWI challenges and limitations, and strategies for enhancing standard DWI; 4. Classify advanced DWI.

## TABLE OF CONTENTS/OUTLINE

1. Introduction: Overview of DWI and its importance in breast cancer; 2. Fundamentals of DWI: Explanation of water diffusion in tissues; ADC values and their significance in DWI; 3. ADC Values and prognostic factors in breast cancer; 4. Benefits and applications of DWI in breast cancer; 5. Quality control and factors influencing repeatability and reproducibility of ADC measure: Techniques to improve the quality of ADC measurements; 6. Comparison of DWI protocols: QIBA recommendations vs. our institute's approach; 7. Technical challenges and limitations of DWI: Techniques to Improve standard DWI; 8. Classification of advanced DWI: Overview of subtypes of advanced DWI, their differences, and advantages; 9. Conclusion.

## BREE-92 **Swipe Left or Right? The Multimodality Imaging Detection and Assessment of the Solitary Dilated Duct**

Participants

Tanya W. Moseley, MD, PhD, Houston, TX (*Presenter*) Consultant, Hologic, Inc; Consultant, Merit Medical Systems, Inc; Owner, TW Moseley, LLC; CEO, TW Moseley, LLC

## TEACHING POINTS

- Review ductal anatomy and the epidemiology of ductal disease.
- Discuss imaging findings of benign and malignant ductal disease.
- Discuss the solitary dilated duct (SDD) and review the BI-RADS® 5th edition's recommendations for classifying and managing ductal lesions.
- Describe the role of imaging in the screening and diagnosing of ductal disease including mammography/tomosynthesis, ultrasound, magnetic resonance imaging, and galactography/ductography.
- Review methods and challenges specific to the sampling of ductal abnormalities.

## TABLE OF CONTENTS/OUTLINE

-Introduction-Anatomy-Benign ductal findings-Malignant ductal findings-Solitary dilated duct (SDD) BI-RADS® 5th edition's recommendation-Imaging's role in screening and diagnosis and the correlation with prognosis-Imaging Techniques to evaluate the ductal anatomy and pathology-Methods to sample ductal abnormalities and tips to overcome the challenges that may be encountered-Conclusion

## BREE-93 **Idiopathic Granulomatous Mastitis: A Case-Based Review**

## TEACHING POINTS

1. Idiopathic granulomatous mastitis (IGM) is estimated to affect 2.4/100,000 women, at median age of 36.5 years, and bilateral involvement in 8.8%. 2. Common symptoms are pain, erythema, palpable lump, and less frequently, fistulous drainage or nipple discharge. 3. The most common ultrasound findings are hypoechoic collection (75.9%) and skin involvement (53.5%). Mammography is often nonspecific, but common findings include focal asymmetry (51.6%), global asymmetry (18.3%), mass (17.2%), abnormal lymph nodes (8.6%). 4. IGM can mimic infectious mastitis or breast cancer on imaging and clinically. 5. Biopsy is usually required to confirm diagnosis and guide management. Often biopsy is necessary to exclude malignancy, especially inflammatory or triple-negative subtypes. Suspected IGM may be tentatively diagnosed by clinically assessing treatment response, but given overlap of imaging features and different treatment for IGM and infectious mastitis, biopsy is often needed. 6. Imaging findings often persist after resolution of clinical symptoms, thus clinical follow-up should be the mainstay for surveillance.

## TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Typical imaging findings on mammography and ultrasound 3. Other entities that mimic IGM 4. Case-based review of biopsy-proven cases using key images with descriptions, treatment and clinical outcome data 5. Biopsy and management considerations

## BREE-94 **Don't Be Fooled: Not Every Late-Onset Peri-Implant Effusion is Seroma! A Case-Based Review of Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL)**

## TEACHING POINTS

We report the case of a female patient, with a history of mastoplasty six years ago, reporting sudden enlargement of the left breast. Imaging exams showed the presence of peri-implant fluid in the same breast, with the analysis of the fluid confirming the BIA-ALCL. Breast Implant-associated Anaplastic Large Cell Lymphoma (BIA-ALCL) is characterized by a late-onset peri-implant effusion, appearing on average 10 years after exposure to breast implants. The pathogenesis is not completely identified, but it is known that cases of BIA-ALCL are related to textured prostheses, with the surface of the prosthesis being the most important factor in inducing the disease. It may present only with the effusion (subtype of effusion) or associated with a peri-implant mass (mass-forming disease). The main associated symptoms are sudden edema secondary to the peri-implant effusion and, in case of mass-forming disease, the presence of a palpable nodule. Multiple imaging methods can be used in the evaluation of patients with suspected BIA-ALCL. However, diagnostic confirmation depends on the analysis of the fluid found. The diagnosis of BIA-ALCL is made with the characterization of morphologically atypical lymphocytes, with CD30 expression and negativity for ALK-1. The differential diagnosis of the effusion subtype is made with late seroma. Distant disease is rare, being a neoplasm with a high potential for cure, if identified in the early stages and when not associated with masses, with a surgical approach as a curative technique, in the case of the subtype of effusion.

## TABLE OF CONTENTS/OUTLINE

Introduction; Definition and Subtypes; Pathogenesis; Symptoms; Image Methods; Diagnosis; Differential diagnoses

## BREE-95 **Cystic Breast Lesions- What to Do When It's Not Simple**

Participants

Laura Harper, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Imaging features of benign and malignant cystic lesions may overlap, causing misclassification with the potential to produce diagnostic delay and harm. The purpose of this exhibit is to review ultrasound features of benign and malignant cystic breast masses to guide appropriate characterization and management. The Breast Imaging Reporting and Data System (BIRADS) assessment categories will be reviewed as it pertains to cystic breast masses, including review of appropriate utilization of the BIRADS-3 (probably benign) assessment category. Emphasis will be placed on recognizing suspicious imaging features warranting further evaluation with percutaneous biopsy. Teaching Points: 1. Examine imaging features of various cystic breast masses (Simple cysts, complicated cysts, and complex cystic and solid mass). 2. Discuss overlap of benign and malignant complex cystic and solid masses (ex: hematoma, abscess, cancer). 3. Review appropriate BI-RADS category assessment and management for various cystic lesions

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of the prevalence, clinical presentation and patient factors associated with cystic breast masses 2. Review distinguishing features and BI-RADS category assessments for various cystic masses 3. Multimodality (mammography, contrast-enhanced mammography, ultrasound, and magnetic resonance imaging) case-based review of benign and malignant cystic breast masses 4. Conclusion (summary of key educational points)

#### **BREE-96 Patterns of Breast Cancer Recurrence in the Post-Mastectomy Breast with or without Reconstruction: A Case-Based Review**

Participants

Shannon Lanzo, MD, Stanford, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Women treated for breast cancer with mastectomy with or without reconstruction are at risk of developing loco-regional recurrence along the suture line or within residual tissue. 2. Benign post-operative findings include edema, seroma, hematoma, fat necrosis, post-operative scarring and fibrosis, which evolve over time. 3. Recurrence may be difficult to distinguish from these benign findings. 4. Biopsy is warranted when imaging findings are equivocal.

#### TABLE OF CONTENTS/OUTLINE

1. This case-based exhibit will review the expected post-operative appearance post mastectomy without or with reconstruction using autologous tissue flaps (pedicled or free flap), and/or prosthetic implants. 2. We will illustrate typical imaging features of benign post treatment changes (fat necrosis, fibrosis, edema, skin thickening, etc.) and malignant findings on mammogram, ultrasound, and MRI. 3. We will review appropriate use of combined imaging and biopsy methods when imaging findings are equivocal.

#### **BREE-97 Keep Calm, It's PASH**

Participants

Daniela Martinez del Razo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In the daily practice of diagnostic imaging in breast cancer, we find various entities that can simulate malignant diseases and it is very interesting to know their spectrum of presentation in the different imaging modalities. There are few breast alterations that have a typical radiological characteristic, there are multiple benign and malignant pathologies with similar findings in which they overlap, for which it is essential that mastologists know and keep in mind the wide range of pathologies, to take advantage of all the tools at your fingertips and make correct diagnosis

#### TABLE OF CONTENTS/OUTLINE

I show various suspicious imaging findings that were shown to be pseudoangiomatous stromal hyperplasia by percutaneous or surgical biopsy

#### **BREE-98 Diagnostic Potential of Photon-Counting Detector Computed Tomography to Evaluate Breast Cancer Patients**

Participants

Misugi Urano, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Photon-counting detector computed tomography (PCD-CT) has several advantages over energy-integrating computed tomography (EID-CT). It provides high spatial resolution and improves image contrast, resulting in precise visualization of soft tissue and microstructures while reducing radiation dose. In addition, a simultaneous multi-energy acquisition offers further qualitative and quantitative information in a single scan. These benefits make PCD-CT a valuable tool for systemic staging, preoperative planning, and post-treatment monitoring of breast cancer patients due to its ability to precisely depict the local extent of tumors and the presence of small lesions. This presentation will focus on PCD-CT in initial staging workup, treatment response assessment, or recurrences monitoring in breast cancer patients, comparing to EID-CT, other image modalities, and pathological results. We will also discuss the advantages and pitfalls of PCD-CT.

#### TABLE OF CONTENTS/OUTLINE

1. Current CT recommendation for breast cancer patients in guidelines 2. The potential of PCD-CT for breast cancer workup 3. Case-based review of PCD-CT in breast cancer patients compared to EID-CT, other image modalities, and pathological results. 4. Discussion of the utilities of PCD-CT for breast cancer patients, including advantages, disadvantages, and pitfalls.

## **BREE-99 Breast Ultrasound Tomography: The Essentials for the Breast Radiologist**

Participants

Yu Zhao, MD, Rochester, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

This educational exhibit will review the essentials of breast ultrasound tomography. 1. Understand basic concepts of breast ultrasound tomography including essential physics, the basic imaging sequences, and keys to imaging interpretation. 2. Describe the advantages of breast ultrasound tomography for evaluation of the breasts, especially in those with dense breasts. 3. Describe the specific imaging appearance on ultrasound tomography of various breast entities, benign and malignant. 4. Discuss the future practice considerations and limitations of ultrasound tomography.

### **TABLE OF CONTENTS/OUTLINE**

-This educational exhibit reviews the essentials of breast ultrasound tomography for the breast radiologist. This is a new imaging modality with enormous potential to add new value to breast imaging by improving diagnostic accuracy especially in patients with dense breasts. -We will describe in simple terms the physics of breast ultrasound tomography and the basic imaging sequences including Waveform Enhanced Reflection (Wafer), Reflection, Sound Speed, and Stiffness Fusion sequences in a breast ultrasound tomographic examination.-We will review with illustrative case examples of high-yield breast lesions including cysts, fibroadenomas, and cancers comparing the distinctive imaging appearance on ultrasound tomography versus other breast imaging modalities.-This will be followed by a discussion of the specific advantages of ultrasound tomography relative to other imaging modalities, such as improved lesion localization and lesion characterization. Finally, we will present the limitations of ultrasound tomography and general considerations for future practice.

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## Abstract Archives of the RSNA, 2023

BREE-1

### Pathologic Nipple Discharge: Is Breast MRI a Good Option?

#### Participants

Valeria Vidales, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pathologic nipple discharge (PND) is unilateral, spontaneous, involves a single duct, and is serous or bloody in appearance. MRI is able to detect the etiology of nipple discharge in 56-61% of cases when initial imaging with mammogram and ultrasound are negative. To describe differential diagnosis and its classification in BIRADS system.

#### TABLE OF CONTENTS/OUTLINE

Description of the anatomy of the nipple and retroareolar Description of different types of lesions that could be found in patients with nipple discharge US, mammographic and RM principal findings and its correlations. Sample cases

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-10

### Single Duct Abnormalities: Multimodality Imaging and Assessment

#### Participants

Juliana Sitta, MD, Jackson, MS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ductal abnormalities entail a wide range of pathology that may present clinically or grow silently, ranging from benign to malignant processes. Solitary dilated duct is a rare mammographic finding with controversial clinical significance in the literature. Workup of the solitary dilated duct must include additional mammographic views and ultrasound to assess for additional findings that would raise suspicion for malignancy and provide a biopsy target. Ductal ectasia is the most common benign finding; however, atypical presentations such as peripheral location, wall thickening, and hypoechoic tissue should raise suspicion for secondary obstruction causes. Inspissated secretions can mimic intraductal masses and may be seen in association or secondary to acute and chronic mastitis, ductal ectasia, and intraductal papilloma. Patients with papillomatosis often have associated high-risk lesions and an increased lifetime risk of breast malignancy. MRI is a great adjunct to evaluate nipple discharge, particularly when the initial workup is negative, and to exclude underlying DCIS or invasive ductal carcinoma.

#### TABLE OF CONTENTS/OUTLINE

Review and illustrate ductal anatomy, physiology, and normal findings on multimodality imaging, including mammography, ultrasound, galactogram, and MRI. Illustrate and discuss problem-solving for single duct findings and presentations commonly associated with single duct abnormality with interesting cases from our institution. Analyze the added value of multiple imaging modalities in assessing ductal pathology, including galactogram and MRI.

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## Abstract Archives of the RSNA, 2023

BREE-100

### The Leading Role of Ultrasound in Breast Implant Evaluation in Developing Countries

#### Participants

Giannina Secco, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate ultrasound findings in breasts with implants and their comparison with those in magnetic resonance imaging. To discuss the advantages and limitations of ultrasound for breast implant evaluation and why it remains a valuable and irreplaceable tool in underdeveloped and developing countries.

#### TABLE OF CONTENTS/OUTLINE

Detecting a broken breast implant is essential due to the potential physical discomfort, cosmetic deformity, and health risks associated with a ruptured implant. Early detection and prompt treatment of a broken implant are crucial to prevent further complications and ensure optimal patient outcomes. Knowledge of a ruptured implant can help patients make informed decisions about implant replacement or removal. In order to acknowledge this, we believe breast implant ultrasound is a preferable choice to MRI for breast implant evaluation in underdeveloped and developing countries. Breast implant ultrasound is more cost-effective, with often portable machines, non-invasive procedure that does not require the use of contrast agents or ionizing radiation, provides real-time imaging, does not require anesthesia and is widely available in many healthcare facilities. Ultrasound imaging can be performed and interpreted quickly, allowing clinicians to make prompt treatment decisions. Furthermore, breast implant ultrasound is safe for patients with pacemakers or other implanted devices, while MRI may not be feasible for these patients. Although ultrasound has its limitations in some cases, it remains a valuable and irreplaceable tool for breast implant evaluation in underdeveloped and developing countries.

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## Abstract Archives of the RSNA, 2023

BREE-101

### Cystic Breast Lesions Assessment and Management: An Educational Approach for Radiology Residents

#### Participants

Karina Pesce, PhD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To recognize the spectrum of cystic breast lesions. To learn tools and tips for the sonographic evaluation of cystic lesions. To understand the importance of distinguishing benign cystic lesions from potentially malignant cystic masses To learn skills in the assessment and management of cystic breast lesions

#### TABLE OF CONTENTS/OUTLINE

1-Introduction: Cystic breast lesions are a common finding in breast imaging studies. Accurate characterization and precise management of these lesions are essential to avoid unnecessary biopsies and tests, as well as to timely identify which of these lesions require further diagnostic evaluation. 2- Ultrasound parameters necessary for a correct evaluation of cystic lesions. 3- Tips and tricks in the ultrasound evaluation of cystic lesions. 4- Spectrum of cystic lesions. 5- Ultrasound appearance 6-Radiological appearance of cystic breast lesions on other imaging modalities such as mammography, MRI. 7- Management. 8- Interactive clinical cases for self-evaluation. 9- Conclusions

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## Abstract Archives of the RSNA, 2023

BREE-102

### Radiological Signs in Breast Imaging: What Should the Radiology Resident Know?

#### Participants

Karina Pesce, PhD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.To know recognize the different radiological signs in breast imaging.2.To learn the importance of accurate identification of the different radiological signs.

#### TABLE OF CONTENTS/OUTLINE

Introduction This educational poster reviews the importance of understanding breast radiological signs. Accurate identification of different radiological signs is critical for early diagnosis and effective treatment of various medical conditions, including breast cancer. Furthermore, knowledge of clinical and radiological signs in breast imaging can help prevent diagnostic errors and reduce the number of unnecessary medical tests. Description of the radiological signs in breast imaging. Tips and techniques for identifying these signs are also provided to assist residents in their interpretation of medical images. interactive clinical cases for self-evaluation. These cases offer residents the opportunity to apply their knowledge and receive immediate feedback, thereby strengthening their diagnostic skills and decision-making abilities. Conclusion: Radiologists residents must be familiar with different radiological signs to accurately interpret medical images and provide an accurate diagnosis.

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## Abstract Archives of the RSNA, 2023

BREE-103

### Peer Learning in Breast Imaging: Lessons Learned in Our Institution

#### Participants

Marcela Lauer, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

It is estimated that medical diagnostic mistakes contribute to approximately 10% of patients deaths and 17% of adverse events in hospitals. Consequently, optimal patient care is related to recognizing and preventing such errors. Strategies were developed to ensure performance standards in radiology departments, including score-based second-reader peer review systems. However, this type of strategy may be associated with subjectivity, sampling bias, underreporting of errors due to peer relationships and fear of punitive action. It may have emotional impact for radiologists and lead to feelings like anxiety, shame, and humiliation, contributing to a culture of defensiveness. On the other hand, peer learning is an strategy focused on learning and improvement that has gained momentum, as a respectful nonpunitive collaborative culture improves performance in modern radiology practice. The objective of this presentation is to show how we established peer learning in our breast imaging department, the bias that were related to the mistakes we made, how we concluded they could have been avoided and our experience with peer learning as a group. We aim that this presentation may help and encourage other services to implement peer learning in their clinical practice, and also learn from the multimodality imaging cases we provide.

#### TABLE OF CONTENTS/OUTLINE

Didactic case-based reviews of breast imaging exams (including mammography, ultrasound and magnetic resonance imaging performed in our service) that were discussed in our peer learning meetings in the last 5 years, with correlation of associated cognitive bias, how the cases could have been better managed and lessons learned that changed our daily practice.

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## Abstract Archives of the RSNA, 2023

BREE-104

### Multimodality Surveillance of Breast Implants in Asymptomatic Patients and the Potential Challenges for the Radiologist in Light of the 2022 United States Food and Drug Administration (FDA) Guidelines

#### Participants

Carisa Le-Petross, MD, FRCPC, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recently the United States Food and Drug Administration (FDA) implemented changes to breast implant surveillance that radiologists may not be aware of<sup>1,2</sup>. At the end of this exhibit, the participant will: • Be up-to-date on the 2022 FDA guidelines for breast implant screening. • Learn the common signs of implant rupture on ultrasound (US). • Learn the common signs of implant rupture on magnetic resonance imaging (MRI). • Be familiar with implant complications and new technology to minimize some complications<sup>3</sup>. • Be familiar with some key differences between updated FDA guidelines and the imaging recommendations from the American College of Radiology Appropriateness Criteria.

#### TABLE OF CONTENTS/OUTLINE

- Discuss the changes in the 2022 FDA guidelines for breast implant screening, especially the addition of US as an alternative to MRI for initial imaging surveillance for silicone implant rupture in asymptomatic patients<sup>1-4</sup>.
- Discuss the 2022 FDA guidelines recommendation for the first screening imaging test at 5 years after implantation instead of 2 years after implantation, the lack of compliance from patients, and background behind this change<sup>1-5</sup>.
- Discuss the potential controversies regarding the imaging modality of choice to evaluate for implant rupture via case-based presentation<sup>4</sup>.
- Review the imaging signs of implant rupture on different modalities, focusing mainly on US and MRI. Review benefits and/or challenges of new implants, technology such as acellular dermal matrix (ADM), and new generation tissue expanders.

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## Abstract Archives of the RSNA, 2023

BREE-105

### Abnormality of the Duct on Breast Ultrasound: Comparison with Multimodality, Correlation with Pathological Findings, and Assessment

#### TEACHING POINTS

The 6th edition of BI-RADS is expected to include nonmass lesions detected on breast ultrasound. In breast imaging, it is important to comprehend lesions such as ductal carcinoma in situ which do not form masses but appear as abnormalities of the ducts. Ultrasound is the best imaging tool for a detailed evaluation of the ducts. Although definitions and terminology for ductal abnormalities may vary in the literature, there is a growing interest among Asian countries regarding ultrasound findings of ductal abnormalities. In this review, we present a method for detecting and evaluating ductal abnormalities based on a detailed comparison with pathological findings. To understand and organize the terminology found in various literature and guidelines, as well as the corresponding findings. To become familiar with normal anatomy and identify findings accurately. To compare expected findings in other modalities with pathological findings. To discuss evidence-based assessment and management plan for each finding.

#### TABLE OF CONTENTS/OUTLINE

Normal anatomy Methods of detection Terminology Comparison with multimodality and correlation with pathological findings Assessment and management plan of each pathological finding Case studies The included cases are as follows: Ultrasound findings Ductal dilatation Duct dilatation with internal echoes Duct wall thickening Irregularity of the ductal caliber Pathological diagnoses Duct ectasia Fibrocystic change Intraductal papilloma (IDP) Atypical ductal hyperplasia Ductal carcinoma in situ (DCIS) Ductal carcinoma in situ with invasive component Invasive ductal carcinoma (IDC)

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## Abstract Archives of the RSNA, 2023

BREE-106

### **A Review of Contrast-Enhanced Mammography in the Evaluation of Suspicious Breast Micro-Calcifications and Our Experience**

#### **Participants**

Félix Maimir Quadrado, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To outline a potential indication of contrast-enhanced mammography (CEM).- To review the contribution to date of CEM in the evaluation of suspicious breast microcalcifications.- To share and discuss our initial experience using CEM in the evaluation of suspicious breast microcalcifications and their histopathologic results. The interpretation and description of breast microcalcifications have always posed a great challenge to breast radiologists. Due to the intrinsic relation of microcalcifications with different breast lesions, and in the case of suspicious ones with breast carcinomas, CEM has been proposed as a promising technique because of its capability to assess neoangiogenesis. We present an up-to-date revision of CEM in the evaluation of suspicious breast microcalcifications and our center's initial experience.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction- False-positive cases- False-negative cases- What the recent literature tells us- Our experience

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## Abstract Archives of the RSNA, 2023

BREE-107

### Diagnostic Approach and Assessment of Cystic Breast Lesion

#### TEACHING POINTS

1. Cystic masses are common findings on mammography, ultrasonography, and MR imaging and a thorough understanding of their imaging findings and management is important. 2. It is important to obtain US images with meticulous technique for accurate classification and assessment of cystic breast lesions. 3. Complex cystic and solid masses may have one or all of the following characteristics: a thick wall ( $\geq 0.5$  mm), thick internal septations, an intracystic mass, and both solid and cystic components. 4. Complex cystic and solid masses are usually assessed as suspicious (BI-RADS category 4) and accompanied by a recommendation for biopsy.

#### TABLE OF CONTENTS/OUTLINE

A. Definition of cystic breast lesions 1. Simple cyst 2. Complicated cyst 3. Clustered microcysts 4. Complex cystic and solid mass B. Meticulous technique in evaluating cystic breast lesions on US C. Multimodality imaging findings with important differential diagnosis 1. Simple or complicated cyst vs. Nearly anechoic solid mass on US 2. Inflamed or ruptured cyst vs. Rim enhancing mass on breast MRI D. Imaging-pathologic correlation of complex cystic and solid mass E. Diagnostic approach and BI-RADS assessment of cystic breast lesions F. Management of cystic breast lesions

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## Abstract Archives of the RSNA, 2023

BREE-108

### Breast Malignancy: Beyond Breast Carcinoma

#### Participants

Alex Gil Ordonez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To provide the basis for recognizing morphological and functional imaging findings of non-epithelial and metastatic lesions of the breast (B5d, NBSBSP).- To review the most common B5d lesions through a pictorial review of our cases.- To describe the clinical management of B5d lesions and the role of the radiologist in these cases.

#### TABLE OF CONTENTS/OUTLINE

1.Introduction 1.1. NBSBSP classification. 2. B5d lesions through a pictorial review of our cases. 2.1. Metastatic disease. 2.2. Oncohematological disease. 2.3. Sarcomas 3. Imaging features 4. Management 5. ConclusionsThe vast majority of malignant breast neoplasms are breast carcinomas. Nevertheless, some malignant breast lesions present different histologies, which are commonly less suspicious than carcinomas on imaging techniques. Their recognition is essential to an early diagnosis and therapeutic approach.

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## Abstract Archives of the RSNA, 2023

BREE-109

### Vague and Nebulous: Non-Mass Ultrasound Lesions

#### TEACHING POINTS

(1.) To review descriptors of ultrasound (US) non-mass lesions. (2.) To illustrate US non-mass lesions identified as correlates for breast MRI non-mass enhancement. (3.) To demonstrate methods for locating US non-mass lesions as correlates for breast MRI non-mass enhancement.

#### TABLE OF CONTENTS/OUTLINE

**Introduction:** Ultrasound (US) correlates of MRI-detected non-mass enhancement (NME) may have no defined mass-like sonographic margin or shape, or may show subtle disruptions of the background tissue pattern. A new US lexicon term, non-mass lesion (NML), better describes these US findings. **Cases:** This educational exhibit will show 10 cases of US NML corresponding to MRI NME. We will highlight methods of predicting the US appearance and location of the NML on MRI-directed US by the use of breast architecture, surrounding cysts/masses, and use of the MRI appearance to predict the size and shape of the NML. **Histopathologies** include breast cancer, radial scar, sclerosing adenosis, fibrocystic change and fat necrosis. **Conclusion:** The exhibit illustrates subtle US NML correlates to MRI NME. Techniques for successful MRI-directed ultrasound detection of these findings are described. Once correlation is confirmed, US-guided biopsy, which is more expeditious than MRI-guided biopsy, can be performed.

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## Abstract Archives of the RSNA, 2023

BREE-11

### Male Breast Lesions: To Infinity and Beyond

#### Participants

Camila Guimaraes, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: Male breast disease encompasses both benign and malignant conditions that are hormonally influenced. Gynecomastia and skin lesions are the most common conditions in symptomatic men, referred for a palpable mass, with imaging patterns that can correlate with different histopathological phases. Other benign tumors in male breasts include lipoma, pseudoangiomatous stromal hyperplasia, granular cell tumor, fibromatosis, myofibroblastoma, schwannoma, and hemangioma. The incidence of breast cancer in men is rare but has increased and accounts for 1% of all breast carcinomas, with invasive ductal carcinoma being the most common type in adult males. Other tumors that may occur include papillary carcinoma, invasive lobular carcinoma, adenoid cystic carcinoma, liposarcoma, dermatofibrosarcoma, pleomorphic hyalinizing angiectatic tumor, basal cell carcinoma of the nipple, hematopoietic malignancies, and secondary tumors. Understanding the clinical and imaging characteristics of these tumors is important for their accurate diagnosis and optimal treatment.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: This article examines the clinical, radiological, and pathological characteristics of both benign and malignant tumors of the male breast. Cases of male breast disease were selected from the file of the Breast Radiology group of our hospital showing some of these pathologies: 1. Complicated Cyst; 2. Dermoid Cyst; 3. Myxoid Liposarcoma; 4. Hybernoma.

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## Abstract Archives of the RSNA, 2023

BREE-110

### From Words to Images: Applying the Contrast Enhanced Mammography BI-RADS® Lexicon

#### Participants

Mitva J. Patel, MD, Columbus, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS®) lexicon is widely used in clinical practice and is a standardized nomenclature used for mammographic reporting. Recently, an extension of the lexicon was developed for the interpretation and reporting of contrast-enhanced mammography (CEM) findings. Adopting the American College of Radiology (ACR) Contrast Enhanced Mammography (CEM) Lexicon is important as standardization reduces inter-observer variability and improves the accuracy and reliability of diagnostic reporting, which ultimately leads to better patient outcomes. Education on this new topic is essential as adoption of the lexicon is critical to assist standardize reporting, improve patient care, and facilitate communication between radiologists and clinicians.

#### TABLE OF CONTENTS/OUTLINE

I. CEM Lexicon classification for recombined images?A. Background parenchymal enhancement?1. Level?2. Symmetry?B. Lesion conspicuity?C. Masses?-Internal enhancement characteristics?D. Non-mass enhancement?-Distribution?E. Enhancing asymmetry?II. Interpretation?A. Findings on low energy images only?B. Areas of enhancement seen on recombined images only?C. Low energy images with associated enhancement on recombined images

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## Abstract Archives of the RSNA, 2023

BREE-111

### The Power of Contrast: Contrast Enhanced Mammography in the Diagnostic Clinic

#### Participants

Mitva J. Patel, MD, Columbus, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

We hope that by highlighting the practical uses of CEM and its potential to enhance breast cancer detection in the diagnostic clinic, more practices will embrace this powerful technology. Contrast enhanced mammography (CEM) is an imaging technique that combines standard mammography with iodinated contrast to improve breast cancer detection. By highlighting areas of increased vascularity associated with malignancy, CEM has been shown to improve the sensitivity of mammography, particularly in women with dense breast tissue. Despite these well-known benefits, the adoption of CEM in clinical practice has been slow, owing primarily to the difficulties establishing a CEM program and reimbursement. Despite these challenges, we believe the benefits it brings to the diagnostic clinic outweigh the additional effort. CEM may be used to: -resolve equivocal findings on mammography, and to increase confidence prior to stereotactic biopsy for vague areas of architectural distortion. -as a more efficient, accessible alternative to MRI in pre-operative extent of disease and workup of highly suspicious findings identified on screening mammography. We hope that by highlighting the practical uses of CEM and its potential to enhance breast cancer detection in the diagnostic clinic, more practices will embrace this powerful technology.

#### TABLE OF CONTENTS/OUTLINE

Examples provided will demonstrate how CEM impacted these patients' management and supports the notion that CEM has a place in the diagnostic clinic as a cost-effective and time-efficient alternative to breast magnetic resonance imaging (MRI) for select patients.

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## Abstract Archives of the RSNA, 2023

BREE-112

### Common Enough to Care - Young Women with Breast Cancer: Multidisciplinary Approach and Special Considerations

#### TEACHING POINTS

Breast cancer in young women, widely accepted as women under 40 years of age, has a worse prognosis compared to older patients as young age is an independent predictor of adverse breast-cancer specific outcomes, including morbidity, local and systemic recurrence, and death. Historically, young women have been underrepresented in clinical trials and undergo more aggressive therapy solely based on their young age. As it is important to recognize how these women differ from older patients, the teaching points of this presentation are to: 1. Describe the epidemiology, clinical presentation, and tumor biology of young women with breast cancer. 2. Define imaging guidelines in high-risk populations and in young women after diagnosis of breast cancer. 3. Explain surgical management and surgical risk reducing strategies. 4. Highlight the special considerations unique to young women including the effects of oncology treatment on fertility and lactation and describe fertility preservation techniques.

#### TABLE OF CONTENTS/OUTLINE

1. Appearance of breast cancer in young women: Epidemiology and clinical presentation, Tumor biology; 2. Imaging guidelines: Risk factors and assessment, Genetics based or calculated lifetime risk, Diagnosis and staging; 3. Surgical management: Breast conserving vs. mastectomy, Cosmetic options, Risk reducing strategies; 4. Effects of oncology treatment on fertility: Chemotherapy, Hormone therapy; 5. Fertility Preservation Techniques

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## Abstract Archives of the RSNA, 2023

BREE-113

### Breast US: A Guide for Beginners

#### Participants

Erica E. Francolin Federicci, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ultrasonographic characterization of mammographic abnormalities and palpable lesions is indicated in the evaluation and management of breast diseases. Although in the United States breast ultrasounds (US) are performed by sonographers, in many countries it is performed by physicians. Considering that breast screening US as an adjunct to mammography will be more widely practiced in the United States, the Breast Imaging-Reporting and Data System (BI-RADS®) provides training and performance guidance as set forth in ACRIN 6666. Because the effective use of the US lexicon relies on excellent sonographic technique and understanding of breast anatomy, the objective of this presentation is to didactically illustrate how the BI-RADS® recommendations should be followed, including the most common findings, pitfalls and how to avoid them.

#### TABLE OF CONTENTS/OUTLINE

We used ultrasonographic images (in correlation to mammography and magnetic resonance imaging, when appropriate) from our institution's digital archive, in order to provide a case-based didactic review of the most common findings in breast ultrasounds, including a review of the adequate technical parameters, lexicon and reporting system and tips to avoid common pitfalls, based on the BI-RADS® recommendations.

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## Abstract Archives of the RSNA, 2023

BREE-114

### Pseudo-progression During Immunotherapy: A New Challenge for Breast Radiologists

#### TEACHING POINTS

Immunotherapy has emerged as a promising treatment strategy for advanced breast tumors. Immune checkpoint inhibitors (ICI) such as blockades that target programmed death-1 (PD-1), programmed death-ligand 1 (PD-L1) and cytotoxic T-lymphocyte associated antigen (CTLA-4), are one of the most powerful tools in the immunotherapy armamentarium and offer a beneficial immunotherapeutic regimen for patients with breast cancer. The pattern of treatment with immunotherapy is totally different from other therapeutic modalities, thus bringing major challenges to clinicians and radiologists who are not familiar with it. One of these challenges is pseudoprogression, that can be characterized as a transient increase of tumor burden followed by tumor regression. Although rare, it is fundamental for the radiologist to be aware of this condition and to carry out studies in the direction of finding diagnostic tools that are capable of more accurately identify this phenomenon contributing for better patient outcomes. In this didactic exhibit, we will discuss the basis of immunotherapy in breast cancer, demonstrate imaging findings of cases of breast cancer pseudoprogression and discuss the current tools available to identify the possibility of this condition such as biomarkers, imaging techniques and biopsy.

#### TABLE OF CONTENTS/OUTLINE

1) Basis of immunotherapy 2) Definition of pseudoprogression 3) Tools used to identify pseudoprogression 3.1) Biomarkers 3.2) Medical imaging 3.3) Biopsy 4) Cases of breast cancer pseudoprogression

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## Abstract Archives of the RSNA, 2023

BREE-115

### **Contrast-enhanced Mammography in Breast Cancers for Women with Dense Breasts: Accuracy, Value, Controversies and Solutions**

#### **Participants**

Bingmei Zhang, Ankang, China (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is: 1. To familiarize the reader to what CESM implies as an emerging modality and its implementation for breast imaging. 2. To demonstrate diagnostic accuracy and correlation in lesion size estimation of CEM against DCE-MRI in dense breast patients. 3. To illustrate value of CEM in evaluating BI-RADS 4 microcalcifications including morphology, distribution and neovascularity of microcalcifications. 4. To discuss whether CEM can be an effective imaging tool in pre-surgical planning for women with dense breast parenchyma. 5. To highlight the benefits and deficits of CEM in women with dense breast who are at an increased risk of developing breast cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1. Brief overview about the different approaches in CEM and their features in imaging interpretation (temporal subtraction and dual energy technique). 2. Cancer evaluation in the dense breast and review of cases, comparing CESM with MRI in the assessment of disease extent in breast carcinomas. 3. Practical application of CEM with illustrated clinical examples in evaluating BI-RADS 4 microcalcifications in dense breast. 4. Is CESM adequate and accurate in pre-surgical planning for women with dense breast. 5. Advantages vs. drawbacks of CEM and potential pitfalls elucidation for high risk screening for women in dense breast. 6. The future applications of CEM in breast evaluation.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-116

### Preoperative Wire and Wireless Localizations Gone Wrong: How to Get Out of Trouble

#### Participants

Sheila Enamandram, MD, MBA, Stanford, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Accurate, thoughtful planning of preoperative image-guided wire or wireless localizations is critical for breast conservation surgery, especially in complex imaging scenarios. Target lesion visualization and localization may require more than one imaging modality and/or a non-routine approach for difficult marker/target localizations. Understanding the differences in size, appearance, and deployment techniques of localization devices is important in accurate placement and retrieval. Targeted markers may be found in unexpected places when not seen in the initial specimen radiograph. Clear communication with surgical colleagues is paramount.

#### TABLE OF CONTENTS/OUTLINE

This case-based exhibit will highlight anatomic, procedural, and technical troubleshooting steps in the following scenarios: Biopsy marker, wire, or wireless device migration; Biopsy marker non-visualization; Target not marked at time of initial biopsy; Target obscured or visible on only one imaging modality; Wireless radar reflector malfunction; Alternative imaging modalities needed for localization; Biopsy marker not seen in the specimen and ultimately found in unexpected places; Incomplete retrieval of distal hook wire in the specimen.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-12

### Nipple Discharge: In the Era of Multimodality Imaging

#### TEACHING POINTS

TEACHING POINTS 1. To remind the different etiologies responsible for nipple discharge2. To recognize the worrisome signs of a nipple discharge that must lead to further investigation3. To discuss imaging modalities and management

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS 1. Clinical history and physical examination2. Etiologies responsible for nipple dischargea. Extra-mammary causes :- Hyperprolactinemia- Drugs- Othersb. Breast lesions :- Benign lesions (infections, galactophorities, papillomas)- Malignant lesions (intra-ductal, inflammatory)3. Multimodality imaging approacha. Gold standard of initial evaluation of nipple discharge- Mammography + Ultrasoundb. Second level of investigation :- The role of MRI and contrast-enhanced mammography4. Diagnosisa. Cytology of the nipple dischargeb. US guided microbiopsyc. MRI guided core biopsyd. Emerging role of contrast-enhanced guided core biopsy5. Patient management flowcharta. Follow-up, what? When?b. US guided macrobiopsy, when?c. Surgery

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-13

### Staying Vigilant: Imaging Surveillance and Risk Prediction After Breast Cancer

#### Participants

Beatriu Reig, MD, MPH, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Patients with a personal history of breast cancer have 5-20% recurrence rates and are at increased risk of second breast cancers. 2. Risk factors for recurrent or second breast cancer include dense breasts, young age at diagnosis of the first breast cancer, omission of radiation after breast conserving therapy, and hormone receptor negative first breast cancer. 3. Imaging biomarkers such as background parenchymal enhancement are under investigation and may permit personalized risk prediction and guide surveillance recommendations in the future.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction (definition, statistics, localized vs metastatic recurrence, early vs late recurrence) 2) Risk factors for recurrence a) Association of molecular subtypes with risk for recurrence b) Effect of neoadjuvant chemotherapy c) Modifiable risk factors (aromatase inhibitor or tamoxifen after ER+ cancer, alcohol consumption, weight) 3) Screening methods for recurrence a) Mammography b) Ultrasound i) Inclusion of the axilla c) MRI i) Abbreviated vs full-protocol d) Contrast-enhanced mammography 4) What should be the imaging interval? 5) Post-mastectomy imaging 6) Risk models for individualized screening a) Clinicopathologic factors b) Imaging biomarkers c) Radiomics and artificial intelligence models

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## Abstract Archives of the RSNA, 2023

BREE-14

### Breast Cancer or Not? An Interactive Case-Based Review of FDG-PET/CT Positive Findings in the Breast

#### Participants

Emily Yoon, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Background Interpretation of lesions with increased FDG uptake in the breast can be challenging due to nonspecific uptake in various benign and malignant processes involving the breasts. Knowledge of this wide spectrum is essential for accurate analysis of FDG-PET/CT in conjunction with a patient's symptomology. The purpose of this educational exhibit is to illustrate the multi-modality imaging appearance of various benign and malignant processes that demonstrate hypermetabolic activity within the breast on FDG-PET/CT. Teaching Points Differentiate various benign and malignant processes that can result in hypermetabolic lesions in the breast Understand sensitivity and specificity of FDG-PET/CT for breast cancer and metastatic breast lymphadenopathy Conclusion There is a wide range of benign and malignant conditions presenting as hypermetabolic breast lesions on FDG-PET/CT. Knowledge of the various imaging features is important for accurate diagnosis and patient management.

#### TABLE OF CONTENTS/OUTLINE

This presentation will be case-based with review of clinical history and imaging findings (mammogram, US, MRI, PET/CT) of patients with FDG-PET positive findings in the breast. Several benign and malignant pathologies will be reviewed, as outlined below. Teaching points with recent literature review will provide guidance when non-breast cancer pathology should be suspected in cases, while also highlighted when additional dedicated breast imaging is indicated. Breast implant capsule-associated squamous cell carcinoma Reactive lymphadenopathy Metastatic disease Granulomatous mastitis Fat necrosis Inflammatory breast cancer Gynecomastia Infectious/Inflammatory changes

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## Abstract Archives of the RSNA, 2023

BREE-15

### The Role of DBT-Guided Biopsy for MRI/CEM Detected Lesions

#### Participants

Cesar Urtasun Iriarte I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To emphasize the need to correlate MRI/Contrast Enhanced Mammography (CEM) findings with DBT (Digital breast tomosynthesis). To show the advantages of DBT-guided biopsy compared to MRI-guided biopsy. To consider DBT-guided biopsy as an alternative for CEM-detected lesions.

#### TABLE OF CONTENTS/OUTLINE

**INTRODUCTION:** Both MRI and CEM are morphofunctional imaging techniques based on neoangiogenesis. These techniques are more sensitive than pure morphological techniques, such as DM or DBT. **ASSESSMENT OF MASS ENHANCEMENTS:** Second look US is of choice to evaluate these lesions. **ASSESSMENT OF NON-MASS ENHANCEMENTS:** These lesions are challenging. Although US plays an important role, in many cases it is inconclusive. DBT correlation is very important, specifically using the craneocaudal (CC) view. This view is easy to compare anatomical structures with both MRI (axial) and CEM. **DBT GUIDED BIOPSY:** This technique offers several advantages over MRI or CEM guided biopsies: Less time consuming, widely spread technique. Not all the vendors have dedicated units to perform CEM guided biopsies. Once the lesion is located with DBT, the performance of the biopsy is easy. Usually 10G vacuum assisted biopsy devices are used. **CONCLUSION:** DBT guided biopsy can offer a good alternative for MRI/CEM detected lesions, specially for non-mass enhancements.

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## Abstract Archives of the RSNA, 2023

BREE-16

### Male Breast: Common and Rare Conditions

#### Participants

Carla Sitges, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: To describe the spectrum of imaging features of benign and malignant lesions of the male breast from a review of pathologically-proved cases. To correlate imaging and pathological findings. To discuss the appropriate imaging workup of male breast cancer.

#### TABLE OF CONTENTS/OUTLINE

Introduction Gynecomastia Benign lesions Imaging features on mammography, ultrasound and MRI. Radiologic-pathologic correlation. Malignant lesions Imaging features on mammography, ultrasound and MRI. Radiologic-pathologic correlation. Conclusions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-17

### Breast Ductal Disease: Multimodality Imaging Detection and Assessment

#### TEACHING POINTS

Review normal ductal anatomy and its imaging features. Review the broad differential of benign and malignant ductal diseases, particularly in the setting of a single dilated duct. Recognize imaging abnormalities of ductal diseases and features associated with malignancy on DBT, US, and MRI. Describe appropriate diagnostic workups and management of ductal diseases.

#### TABLE OF CONTENTS/OUTLINE

Breast ductal disease is an important aspect of breast imaging and often poses challenges in diagnosis and management, particularly in the setting of a single dilated duct. Thus, radiologists should be familiar with clinical presentations, diagnostic workup, imaging features, and differentials for ductal abnormalities. Patients may present with nipple discharge, palpable abnormalities, infectious symptoms, lactational issues, or be asymptomatic. Ductal pathologies range from ductal ectasia, periductal mastitis, intraductal papillomas, to ductal carcinoma in situ, invasive ductal carcinoma, and Paget's disease. Radiologists should recognize both normal and abnormal ductal imaging features on DBT (dilated ducts, masses, and/or calcifications), on US (cystic ductal dilation, ductal wall irregularities or arborization, intraductal masses or debris), and on MRI (clustered ring non-mass enhancement, abnormal linear or segmental NME). This educational exhibit will provide a comprehensive case-based review of benign and malignant ductal diseases, their multimodality imaging features, and associated management recommendations.

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## Abstract Archives of the RSNA, 2023

BREE-18

### Breast Surgery: Changes and Findings Multimodal Diagnosis

#### Participants

Maria Jose Chico, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Identify the different post-surgical changes of breast surgery<sup>2</sup>. Learn to identify which findings are suspicious and which are not.<sup>3</sup>  
Understand and integrate the findings in the different imaging modalities.<sup>4</sup> Understand the differential diagnoses

#### TABLE OF CONTENTS/OUTLINE

The accurate interpretation of images of the postsurgical breast depends on the availability of high-quality imaging. These changes should be interpreted in conjunction with the clinical and surgical history. They may correspond to benign or suspected changes. It is useful to analyze them in the different imaging modalities to support or rule out a suspected diagnosis. They can appear in the post-surgical period due to both malignant and benign conditions

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## Abstract Archives of the RSNA, 2023

BREE-19

### Beyond the Lump: Navigating the Challenges of Cystic Breast Lesions

#### Participants

Maria Vitoria Ludwig, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Our educational exhibit is directed to review the assessment and management of cystic breast lesions through the following points: review the pathologies presented as cystic breast lesions; understand how to identify and categorize breast cysts at ultrasonography; comprehend the appropriate management according to the imaging finding, correlating with clinical history and other imaging modalities if available; enlighten biopsy modalities, indication and technique; recognize the importance of subsequent histological analysis.

#### TABLE OF CONTENTS/OUTLINE

The subject will be approached in the following sequence: pathologies presented as cystic breast lesions and their malignancy risk; diagnosis, initial evaluation and ultrasound classification of breast cysts, linked with drawing representations of each type of cyst; appropriate risk assessment and management according to the imaging finding considering correlation with clinical history and other imaging modalities, namely mammography and magnetic resonance imaging; how to choose the most suitable biopsy modality and possible pitfalls; correlation of radiological findings with histopathologic analysis, followed by revision of management if required; illustrative cases in the different imaging methods.

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## Abstract Archives of the RSNA, 2023

BREE-2

### Lipofilling: What Does Breast Radiology Need to Know?

#### Participants

Karen Caro, PhD, CABA, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.- Describe the imaging characteristics of the lesions in lipofilling  
2.- When should we consider that a lesion after a lipofilling procedure would need histological certification, in relation to the imaging findings?

#### TABLE OF CONTENTS/OUTLINE

Currently fat transfer (lipofilling) is used in breast reconstruction. In this paper we will describe its advantages and how it is seen in the different imaging studies (ultrasound, mammography and MRI). It is important to identify which are the usual benign findings in the different methods and what Bi-Rads to assign, in this way we can define those cases in which their histological evaluation should be considered. Describe the advantages and disadvantages of this method in breast remodeling. The importance of recognizing radiological manifestations and the difficulties involved in detecting suspicious lesions. Knowing how to recognize that fat necrosis is a frequent lesion after lipofilling, which should be suspected in order to avoid other more complex studies such as MRI and even biopsies

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## Abstract Archives of the RSNA, 2023

BREE-20

### Not Every Ductal Ectasia Is Evil: Spectrum of Ductal Lesions

#### Participants

Raissa Soares, MD, Sao Luis, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the imaging appearance of normal ductal anatomy; Illustrate imaging findings of ductal ectasias using different techniques, including mammography, ultrasound and magnetic resonance imaging, providing clinical images and histopathology correlation; To discuss the appropriate management of these lesions; Review a case series of benign ductal breast diagnoses from our institute, without associated malignancy;

#### TABLE OF CONTENTS/OUTLINE

Identify imaging criteria that may help in the diagnosis of ductal ectasia and, eventually, in its management; Typical multimodality imaging findings (magnetic resonance imaging, ultrasound and mammography) from cases of our radiology department; Diagnostic challenges, main differentials, and key points suspicion of this pathology; Discuss the role of percutaneous biopsy (ultrasound-guided core biopsy and vacuum - assisted biopsy) in the diagnosis of ductal ectasias; Conclusion.

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## Abstract Archives of the RSNA, 2023

BREE-21

### Understanding the BI-RADS 3 Category

#### TEACHING POINTS

By the end of this educational exhibit, learners will: 1. Accurately define BI-RADS 3 and appropriate use cases. 2. Explain BI-RADS 3 radiographic features and diagnostic considerations for mammography, ultrasound, and MRI. 3. Demonstrate proficiency in the assessment process of a BI-RADS 3 lesions, through a case-based review.

#### TABLE OF CONTENTS/OUTLINE

1. What is BI-RADS 3? a. Definition b. Appropriate use cases  
2. BI-RADS 3: Mammography a. Imaging features b. Diagnostic considerations  
3. BI-RADS 3: Ultrasound a. Imaging features b. Diagnostic considerations  
4. BI-RADS 3: MRI a. Imaging features b. Diagnostic considerations  
5. Identifying BI-RADS 3 Lesions: Case-Based Walkthrough a. Classic BI-RADS 3 cases b. Special cases

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## Abstract Archives of the RSNA, 2023

BREE-22

### Back to the Tumor: Navigating Breast Cancer Recurrence Like a Pro

#### Participants

Vitor Zanetta, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the risk and pattern of tumor recurrence according to molecular subtype. Provide visual and data-driven insights into expected imaging changes following treatment. Highlight the role that multimodality plays in differentiating expected imaging findings from treatment and imaging findings indicative of recurrence or new breast cancer. Review current follow-up protocols after breast cancer and screening for intermediate risk patients.

#### TABLE OF CONTENTS/OUTLINE

Review the influence of breast cancer subtype on the rate, timing and location of tumor recurrence. Expected imaging changes following treatment with visual and data-driven insights: Expected timeline of post-surgical changes. Details in the assessment of local recurrence in breast-conserving surgery and mastectomy. Possible changes in axillary and internal mammary lymph nodes. The role that multimodality imaging (mammogram, ultrasound, MRI and PET-CT) plays in differentiating recurrence or new breast cancer from post-treatment changes, including: Frequent dilemmas in clinical practice: evaluation of calcifications, distortions, fat necrosis and enhancements in the surgical bed. How to deal with conflicting findings between different imaging methods to avoid unnecessary biopsies without losing sensitivity for early recognition of recurrence. Subtle recurrence and the importance of serial follow-up Imaging. Examine the follow-up protocols after breast cancer and screening for intermediate-risk patients from the perspective of personalized medicine.

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## Abstract Archives of the RSNA, 2023

BREE-23

### From Flat to Fabulous - A Radiological Guide to Breast Aesthetic Fillers and Biostimulators

#### Participants

Heni Skaf, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To expose, through cases from our institution, manifestations of different breast filling and biostimulator materials in the most diverse imaging methods, such as: free silicone, acrylates (PMMA, PAAG), hyaluronic acid, vitamin D, calcium hydroxyapatite and fat grafting. To familiarize the breast radiologist with the radiological presentation of these materials, avoiding false positives and unnecessary investigations. To discuss the usual topography in which they are injected, as well as possible local and systemic complications of using such materials.

#### TABLE OF CONTENTS/OUTLINE

Introduction: The demand for percutaneous aesthetic procedures is rising in medicine, especially in the context of facial harmonization. This also applies to the breast, both for use in cancer patients, with the increase in the incidence and in diagnosis of breast cancer, as well as for purely aesthetic purposes in the breast itself or even due to migration from other injection sites. Imaging findings: on mammography, ultrasonography and magnetic resonance as well as possible complications and usual injection sites of free silicone, acrylates (PMMA, PAAG), hyaluronic acid, vitamin D, calcium hydroxyapatite and fat grafting. For the most part, non-resorbable synthetic biomaterials, fat grafting, as well as resorbable materials used recently, have radiologic representation. Conclusion: The use of aesthetic breast fillers, whether in the oncological context or not, is on the rise. Often, the patient does not have knowledge of what was used, which can limit the clinical decision of the physician. Additionally, recognition of the radiological appearance of different fillers can avoid false positives and unnecessary biopsies.

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## Abstract Archives of the RSNA, 2023

BREE-24

### Far Beyond The Axilla, What Else do We Need to See? Tips and Pitfalls of Lymph Nodes

#### Participants

Raissa Soares, MD, Sao Luis, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Aspects of normal images of axillary and supraclavicular lymph nodes and internal mammary in different methods and mainly in ultrasound; To present imaging cases of normal lymph nodes, as well as differential diagnoses of axillary, supraclavicular and internal mammary lymph node enlargement, from our database; Image-guided procedures; Show the importance of the radiological-pathological correlation.

#### TABLE OF CONTENTS/OUTLINE

Review the main spots of mammary drainage; To show imaging cases of normal findings and our histological correlation; To present some differential cases of lymph node pathologies; Discuss the types of lesions and which ones require biopsy; Conclusion.

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## Abstract Archives of the RSNA, 2023

BREE-25

### Axillary Lymphadenopathy Induced by COVID-19 Vaccination: What Have We Learned?

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- US features of reactive lymph nodes after COVID-19 vaccination in patients with and without previous COVID-19 infection- Nodal reactivity in young and middle-age patients vaccinated with different COVID-19 vaccine protocols-Association between the cortical thickness measurement of reactive post-vaccine lymphadenopathy and an effective humoral response in COVID-19-naïve patients

#### TABLE OF CONTENTS/OUTLINE

The COVID-19 pandemic led to the approval of an emerging vaccination program to contain coronavirus dissemination. One of the most commonly reported local side effects of COVID-19 vaccination has been the development of axillary lymphadenopathy. In this poster, we will discuss about this phenomenon:1. Which ultrasound features should be evaluated?2. Does nodal response differ if there exists a prior history of COVID-19 infection?3. Do the ultrasound characteristics of reactive axillary nodes change depending on the administered COVID-19 vaccination?4. What is the nodal reactivity to the COVID vaccination according to age?5. How long does reactive lymphadenopathy last?6. Does cortical thickness of reactive post-vaccine lymph nodes reflect a humoral response?Conclusions- Reactive lymphadenopathy is a common side effect of COVID-19 vaccination- It is generally a harmless and temporary condition- Healthcare providers should be aware of this potential phenomenon to provide an appropriate guidance to patients

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## Abstract Archives of the RSNA, 2023

BREE-26

### Cystic Carcinomas: Preventing Misdiagnosis and Lessons Learned

#### Participants

Hemal Grover, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Simple cysts: well circumscribed isodense masses on mammogram; well circumscribed anechoic masses on ultrasound with a thin, smooth, imperceptible wall and posterior acoustic enhancement. Complicated cysts meet all criteria for simple cysts except they contain debris/echogenic intracystic contents. Necrotic tumors (rapidly growing) can present as cystic masses. They can be anechoic, demonstrate posterior acoustic enhancement and therefore often misdiagnosed as simple or complicated cysts. However, careful evaluation of the margins is imperative as it can reveal subtle irregularity and raise suspicion for malignancy. Correlation with mammogram (particularly spot compression views) can be helpful to reveal obscured or irregular margins. Cystic carcinomas often present as palpable masses. These cases should be viewed with a higher index of suspicion before being labeled as BIRADS 2. Real time physician directed ultrasound is recommended along with a bilateral mammogram with spot compression views (including in women 30-35 years old). Family history, genetic mutations and ancestry (eg Ashkenazi Jewish descent) should be considered while evaluating these patients.

#### TABLE OF CONTENTS/OUTLINE

Imaging features of simple, complicated and complex cysts. Classification of complex cysts. Clinical history, diagnostic mammogram, ultrasound and MRI findings of authors' cases of cystic carcinomas. Errors of interpretation/misdiagnosis and lessons learnt. Differential Diagnoses.

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## Abstract Archives of the RSNA, 2023

BREE-27

### Granulomatous Mastitis: Imaging Insights into a Benign Mimicker of Breast Infection and Malignancy

#### Participants

Sravani Gampala, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the etiology and clinical presentation of granulomatous mastitis. 2. Recognize the imaging findings of granulomatous mastitis across mammography, ultrasound, and MRI. 3. Appreciate the importance of correlating imaging findings with the clinical picture. 4. Acknowledge the consequences of misdiagnosing granulomatous mastitis. 5. Emphasize the role of radiologists in considering granulomatous mastitis as a differential diagnosis. 6. Discuss the importance of a multidisciplinary approach in the accurate diagnosis of granulomatous mastitis.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction to Granulomatous Mastitis A. Etiology B. Clinical presentation II. Imaging Modalities A. Mammography 1. Findings 2. Differential diagnosis B. Ultrasound 1. Findings 2. Differential diagnosis C. MRI 1. Findings 2. Differential diagnosis III. Consequences of Misdiagnosis A. Unnecessary studies B. Patient anxiety C. Invasive procedures IV. Radiologist's Role in Diagnosis A. Considering granulomatous mastitis B. Biopsy and pathological challenges V. Multidisciplinary Approach A. Collaboration in diagnosis B. Improved diagnostic accuracy.

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## Abstract Archives of the RSNA, 2023

BREE-28

### More Than Just a Pretty Cyst - Assessment and Management of Cystic Breast Lesions

#### Participants

Vivian Ogata, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To discuss the ultrasound imaging parameters, from B-mode adjustments, Doppler imaging, to post-processing techniques, to properly evaluate cystic breast lesions.- To present the imaging findings of the listed cystic lesions according to the BI-RADS® lexicon such as: simple cyst, complicated cyst, clustered microcysts and complex solid and cystic masses, illustrating with multimodality imaging.- To discuss each subcategory of cystic lesions, its management and follow-up, illustrating with some challenging radiologic cases.- To habituate general radiologists with these findings in order to improve the diagnostic rate of such mammary lesions, reducing unnecessary biopsies.

#### TABLE OF CONTENTS/OUTLINE

- Introduction and epidemiology: breast cystic lesions are a common diagnosis in women and include a wide spectrum of diseases, from a simple apocrine cyst to complex solid cystic carcinomas.- Scanning techniques, ultrasound adjustment, artifacts and post-processing imaging: adjustment of ultrasonographic basic parameters and adequate scanning techniques are essential for an accurate diagnosis. We can also employ Doppler, elastography, as well as use imaging artifacts to our advantage, patient's position changes more recent post-processing techniques (harmonic and spatial compounding imaging) to better characterize cystic lesions.- Cystic lesions subcategories, classification, histological representation and multimodality imaging depiction.- Management and follow-up: adequate ACR BI-RADS® categorization of each subtype of cystic lesion, illustrating with some challenging cases , exploring some related pitfalls and discussing benign and malignant differential diagnosis.

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## Abstract Archives of the RSNA, 2023

BREE-29

### Can Aesthetic Procedures Interfere With Breast Cancer Screening?

#### Participants

Leticia Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The incidence of dermatological procedures to modify aesthetics in body contouring, including post-surgical reconstructions, has been increasing every year, especially minimally invasive ones with injectables. Recognizing the imaging findings provoked by these procedures will avoid possible diagnostic pitfalls and allow the radiologist to alert the dermatologist about the possible loss of breast cancer screening caused by some of these previously unregistered procedures. Further, patients should be educated about the hazards associated with improper use of injectables from non-licensed individuals. Patients must be encouraged to seek out licensed physicians who use FDA-approved products for any medical and cosmetic care.

#### TABLE OF CONTENTS/OUTLINE

To review literature data on aesthetic dermatological procedures in the breast and axillary region, with cases from our institution, and illustrate with imaging findings found, based on different imaging methods

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## Abstract Archives of the RSNA, 2023

BREE-3

### **It's Not the Same As It Was: Multimodal Review of Breast Cancer Recurrence and What the Radiologist Needs to Know**

#### **Participants**

Leticia Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Breast cancer is the most common cancer in the female population worldwide and the number of patients underwent conservative surgery is growing; - The annual risk of recurrence disease varies between 2 to 5% in 5-20 years after diagnosis; - Locoregional recurrence is defined as the detection of lesions in the ipsilateral breast, chest wall or regional lymph node. If the other parts of the body are affected, it becomes a systemic recurrence; - Some factors related to breast cancer recurrence include failure in the first treatment and non-adherence to adjuvant therapy and surgical margins, but could be related to tumor size, aggressive biology of the primary tumor, young patient age at diagnosis and presence of familial or genetic risk factors; - Tumor recurrence may or may not be similar to the primary malignancy and can simulate benign conditions; - Imaging recurrence are variable and this knowledge becomes essential in radiological practice in order to improve the diagnosis and management of the patient.

#### **TABLE OF CONTENTS/OUTLINE**

- To review the factors associated to breast cancer recurrence and the epidemiology of these cases; - To show the most common findings in breast cancer recurrence using cases of our institution; - To teach how to evaluate the different methods of imaging (mammogram, ultrasound and MRI) in these cases and give tips that may help to differentiate sequelae of treatment from suspect lesion; - Easy-to-use take home messages to facilitate the handling of challenging cases.

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## Abstract Archives of the RSNA, 2023

BREE-30

### Demystifying Gynecomastia: A Pictorial Review

#### Participants

Rocio Cortes Quezada, MEd, Tlalpan, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

\*Most male breast masses are benign and the most common reason is gynecomastia. \*Forms of breast imaging in male patients are used for diagnostic purposes. \*Pseudogynecomastia and cancer are the most common differential diagnoses. \*Mammography can show increased glandular tissue and ductal dilatation in cases of gynecomastia. Masses, calcifications or signs suggestive of malignancy can also be visualized. \*Ultrasound can help distinguish true gynecomastia from pseudogynecomastia (accumulation of fatty tissue in the breast region). \* Biopsy is the only method to determine if a breast mass in a man is benign or malignant. •  
\*Biopsy can be guided by ultrasound or mammography

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Definition 3. Epidemiology 4. Clinical presentation 5. Etiology 6. Anatomy and embryology of the male breast 7. Types of gynecomastia 8. Imaging tests of the male breast 9. Imaging findings (mammography, ultrasound) 10. Differential diagnoses 11. Cases: a. Pseudogynecomastia. b. Lipoma. c. Epidermal inclusion cyst of the breast. d. Duct ectasia. e. Fat necrosis f. Invasive ductal carcinoma 12. Conclusions

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## Abstract Archives of the RSNA, 2023

BREE-31

### Breast Cancer Surveillance in Patients with Prior History of Breast Cancer: Updates and Controversies

#### Participants

Sona Chikarmane, MD, Newtonville, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Patients with a prior history of breast cancer (PHBC) are at increased risk of recurrent or second breast cancers. PHBC are also living longer due to improved screening and advances in treatment. Developing optimal screening regimens are critical in detecting breast cancers in these high-risk patients. Expected post-treatment changes include architectural distortion, edema, and skin thickening, which stabilize around two years post-treatment. Multimodality breast imaging surveillance is available, with screening mammography (full field digital mammography or digital breast tomosynthesis), whole breast ultrasound, contrast-enhanced mammography, and breast MRI. The purpose of this educational exhibit will be to review breast cancer surveillance in PHBC, highlighting updates and controversies in screening guidelines.

#### TABLE OF CONTENTS/OUTLINE

1. Review literature on risk of recurrent/second breast cancers in PHBC
2. Discuss optimal mammography screening regimens, including screening vs diagnostic mammography, cadence of screening, and batch vs immediate interpretation.
3. Review the current societal screening guidelines, including mammography and breast MRI.
4. Show multi-modality image-rich cases of recurrent breast cancer versus expected post-treatment changes.
5. Highlight controversies in breast cancer screening guidelines, including age when to stop screening, imaging the reconstructed breast, and compliance with screening.

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## Abstract Archives of the RSNA, 2023

BREE-32

### Tales from the Breast: When Breast Problems Have Surprising Origins

#### Participants

Natalia Lima, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diseases that affect the breast, but do not originate from it, may include systemic, autoimmune, infectious or even tumoral conditions from other sites. They can cause inflammation in the breast tissue and manifest with pain, skin thickening, ulcerations and masses. It is essential to know each one of them to help the clinical practice of differentiating breast carcinoma from these pathologies.

#### TABLE OF CONTENTS/OUTLINE

Illustrated didactic cases from our Breast Radiology group showing some diseases and their presentation forms that can simulate breast carcinoma. They were classified into subgroups such as: 1. Related to the vasculonervous system (MAV and neurofibromatosis), 2. Systemic disorders (cutaneous lymphoma and congestive heart failure) , 3. Metastasis to the breast (melanoma and adrenal cortical carcinoma), 4. Soft Tissue tumors (granular cell tumor and synovial sarcoma), 5. Infectious (tuberculosis and dermatobiosis).

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## Abstract Archives of the RSNA, 2023

BREE-33

### Spectrum of Papillary Lesions of the Breast: Multimodality Imaging and Radiologic-Pathologic Correlation

#### Participants

Janice Thai, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Papillary lesions represent a heterogeneous group of entity with histologic continuum from benign, atypical to invasive and non-invasive malignant lesions. 2. To review the multimodality imaging spectrum of papillary lesions. 3. To review the unique histopathologic patterns of lesions with papillary and micropapillary features. 4. To review the clinical management algorithm for different papillary lesions diagnosed on core needle biopsy.

#### TABLE OF CONTENTS/OUTLINE

- Multimodality imaging review of common and uncommon imaging features of papillary lesions.
- Review of classification system according to WHO 5th Edition Breast Tumors (2019)
- Review of histopathology of papillary lesions.
- Review of current evidence-based management algorithm for benign, atypical and malignant papillary lesions.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-34

### A Guide to Cystic Breast Lesions

#### Participants

Christina Le, DO, Morristown, NJ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Breast imaging is often complex and can appear difficult to understand. It is rarely explored in depth throughout medical school training and can be rather limited throughout residency, especially for those pursuing other specialties for fellowship. The purpose of this exhibit is to provide a demystified review of cystic breast lesions. This is meant to supplement a resident's knowledge of breast pathology and present the information in a concise yet comprehensive manner. Throughout the presentation, the pathophysiology and patient presentation of each entity will be discussed. This will be followed by the often variable imaging findings that can be encountered on ultrasound, mammography, and MRI. Annotated pictorial examples are provided to facilitate visualization of the specific lesion characteristics. To conclude, the exhibit will discuss treatment options and the appropriate BIRADS criteria to help standardize the severity of these lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Overview/educational objectives 2. BIRADS categories 3. Simple Cyst 4. Galactocele 5. Fat necrosis/oil cyst 6. Hematoma 7. Abscess 8. Intracystic papilloma 9. Necrotic neoplasm 10. Conclusion 11. References

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-35

### Cryoablation Therapy for Breast Cancer: Procedural Technique and Imaging Review

#### Participants

Janice Thai, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the procedural techniques for performing breast cancer cryoablation. 2. To review multimodality post procedural imaging features of cryoablation to identify normal and abnormal findings.

#### TABLE OF CONTENTS/OUTLINE

- Review of proper patient selection in a multidisciplinary approach.
- Review of equipment, device and procedural technique.
- Review of post procedural imaging, including normal and abnormal findings on mammography, ultrasound, and MRI.
- Review of follow-up imaging protocol and strategies for detection of tumor recurrence.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-36

### Exploding Jelly of the Breast: The Mucocele-Like Lesion (MLL)

#### TEACHING POINTS

<Mucocele-Like Lesions are considered risk injuries (B3a). Mucin in the stroma calcifies over time, showing up as such on mammography. By mammography the type of calcifications is variable. By ultrasound it appears as microcysts, complex cysts or irregular nodules. The treatment depends on the diagnostic biopsy method.>

#### TABLE OF CONTENTS/OUTLINE

<Mucocele-Like Lesions were first described by Rosen in 1986 as a benign lesion "cysts containing mucin, lined by squamous or cuboid epithelium with or without extravasated mucin", currently considered a risk lesion. It is due to mucinous ducts that obstruct their contents, causing rupture with extravasation of the contents into the surrounding stroma, which over time can form calcifications, which are observed by mammography; less commonly, it presents as a mass. By ultrasound they are observed as a cyst with thick, mucin-like content or microcystic conglomerates. The more complex the cystic lesion, the more likely it is to be associated with Ductal Carcinoma In Situ (DCIS). With core needle biopsy, the percentage of diagnostic underestimation is less than 4% if they are lesions without atypia, but amounts to approximately 20% if they are lesions with atypia, so removal by vacuum-assisted biopsy or surgery is preferred.>

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-37

### Rare Tumors of the Breast

#### TEACHING POINTS

Rare tumors of the breast: Metaplastic carcinoma of the breast and Primary signet ring cell carcinoma of the breast. Epidemiology, image presentation of cases, clinical characteristics, imaging findings

#### TABLE OF CONTENTS/OUTLINE

Metaplastic breast carcinoma is a rare type of neoplasm that resembles a high-grade histological carcinoma, presents a high incidence of recurrences, poor prognosis, difficulties at the time of diagnosis, the establishment of therapeutic guidelines, and controversy regarding its nomenclature. The bibliography is very limited and the published descriptive studies have a low number of cases, making it difficult to obtain definitive and extrapolated conclusions, especially when making therapeutic decisions. Primary signet ring cell carcinoma of the breast is a rare tumor of controversial histogenesis, aggressive behavior and unusual metastatic pattern to the gastrointestinal tract and serous surfaces, posing differential diagnosis problems with metastasis of signet ring cell carcinoma of the breast. other origins, preferably gastrointestinal.

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## Abstract Archives of the RSNA, 2023

BREE-38

### AI Advancements in Breast Imaging: Transforming Radiology for Improved Patient Care

#### Participants

Matteo Mancino, MD, Roma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To explore the basic concepts of deep learning and machine learning in breast imaging. To examine AI-based tools and their applications in detection, diagnosis, and treatment planning for breast cancer. To assess AI performance compared to human experts. To discuss ethical considerations. To investigate AI future trends and developments for breast imaging.

#### TABLE OF CONTENTS/OUTLINE

Introduction: presenting the fundamental principles of deep learning and machine learning in the context of breast imaging. 1. Workload to explore how AI algorithms can positively influence radiologists' workload, also triaging negative mammograms and potentially replacing second readers. 2. AI accuracy to discuss how AI-based solutions contribute to improve diagnostic accuracy in mammography and enable a more precise lesion classification. 3. Cancer-Prediction evaluating the ability of AI algorithms to identify cancer-predictive features in mammograms. 4. AI role in ultrasound and MRI to examine the development and performance of AI-based solutions for detecting and classifying breast lesions in ultrasound and MRI. 5. Ethical considerations Addressing the ethical concerns surrounding AI implementation, including data privacy, algorithm fairness, and potential biases in the development process. 6. Future trends to address the future trends of AI, contemplating the potential integration of AI with other imaging modalities, exploring the role of radiogenomics in breast imaging, and anticipating novel AI advancements.

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## Abstract Archives of the RSNA, 2023

BREE-39

### Multimodal Imaging of Breast Tissue Expanders, Including Associated Complications and MRI Contraindications

#### Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To show the types of breast tissue expanders and MRI contraindications. ? To perform a multimodal review of the imaging aspects of breast tissue expanders. ? To illustrate complications associated to breast tissue expanders.

#### TABLE OF CONTENTS/OUTLINE

Breast tissue expanders are temporary devices commonly used in two-stage breast reconstruction surgery. Tissue expanders are gradually filled with saline to stretch the skin and chest tissues to make room for breast reconstruction with a permanent implant. There are different types of breast tissue expanders depending on the number of lumens (one or two), filling (saline and/or silicone) and injection dome (remote or internal). Some types have metallic components that are not suitable for MRI imaging due to the potential for image distortion or dislocation. It is important to recognize the imaging features of breast tissue expanders, to avoid misdiagnosis, since tissue expanders with small filling may mimic implant rupture on imaging. Complications associated with breast tissue expanders are rare and include infection, hematoma, rupture, and displacement.

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## Abstract Archives of the RSNA, 2023

BREE-4

### Code of Con-DUCT: An Algorithmic Approach to Multimodality Assessment and Management of Dilated Mammary Ducts

#### Participants

Rajshree Singh, MD, Lansdowne, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- The ACR BI-RADS® 5th Edition indicates that a SDD has a > 2% likelihood of malignancy, and therefore warrants a suspicious (BI-RADS 4A) assessment. Otherwise, there are few recommendations for evaluation and management of dilated ducts found at breast imaging.
- Further evaluation with MRI and/or tissue sampling may be warranted if ductal dilation (DD) is new or increasing, symptomatic, or associated with worrisome mammographic or ultrasound (US) features.
- We propose an algorithm-based approach to assessing dilated ducts, specifying worrisome features on mammogram and targeted US to guide further workup.
- This approach may potentially reduce radiologists' uncertainty, unnecessary biopsies, missed cancers, and healthcare expenditures.

#### TABLE OF CONTENTS/OUTLINE

1. Ductal anatomy
2. Definition of DD
3. Etiologies of DD
4. DD requiring further evaluation:
  - a. New or interval change
  - b. Patient symptoms and/or clinical findings
  - c. Suspicious mammographic findings
5. Worrisome US findings
6. Proposed algorithm for assessment and management
7. Identification of key findings that help guide diagnostic decisions.
8. Case-based application and examples
9. Role of ductography, US with elastography, and MR

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## Abstract Archives of the RSNA, 2023

BREE-40

### Breast Imaging Disparities in the U.S

#### Participants

Dami Olufosoye, BS, MPH, Mount Pleasant, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit is a call to action for radiologists to identify racial disparities in their own practice. We will review recent studies identifying disparities individuals of color face in breast imaging and discuss successful interventions. 1. Breast cancer is the second leading cause of cancer deaths in women in the US but the leading cause in black women. 2. Black women have less access to screening mammography 3. Black and Hispanic women have lower rates of receiving adequate breast cancer treatment and post-treatment surveillance 4. Black women have increased rates of breast cancer recurrence 5. Imaging disparities based on race and other factors can be identified by radiologists and mitigated with outreach programs

#### TABLE OF CONTENTS/OUTLINE

1 US Epidemiologic breast cancer data 2 Racial disparities in breast cancer screening • Decreased access to mammography centers, advanced imaging equipment, specialized physicians, genetic testing • Additional limitations: § Patient distrust § Provider-patient relationship 3 Racial disparities in diagnostic work-up • Increased time to diagnostic work-up and to biopsy • Later stage at diagnosis 4 Racial disparities after breast cancer diagnosis • Lower rates of receiving adequate breast cancer care and post-treatment surveillance • Lower rates of 5-year breast cancer survival • Higher rates of cancer recurrence 5 How radiologists can help • Identification and mitigation of imaging disparities is part of our professional responsibility to our patients • Examples of successful initiatives

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## Abstract Archives of the RSNA, 2023

BREE-41

### Breast Cysts: A Pictorial Exhibit of Benign and Malignant Twists

#### Participants

Flavia M. Starling, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cystic breast lesions are the most common masses found in the female breast of any age group, mainly between 30 and 50 years of age. They are derived from the terminal lobular duct unit as a result of fibrocystic change and may contain isolated liquid or even associated solid component, thus comprising a wide spectrum of variable disease entities, including benign and malignant pathologies. Simple and complicated cysts are usually benign; but on the other hand, complex cystic masses containing mixed cystic and solid components are indeterminate. Therefore, knowing that cysts are common lesions and that up to approximately 31% of complex breast cysts are associated with malignancy, the radiologist must be familiar with the main pathologies and imaging characteristics that includes this category of lesions.

#### TABLE OF CONTENTS/OUTLINE

- Didactically review the main cystic lesions of the breast and their characteristics through different imaging methods and case-based revision obtained from the digital archive of our institution.
- Take home message
- References

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-42

### Molecular Classification of Breast Cancer: Guide for the Radiologist

#### Participants

Sandra Lara, CABA, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Breast cancer is a disease that, despite having a histopathological classification, also includes molecular and genetic subtypes, being able to carry out a molecular classification that guides the clinical behavior, prognosis and different radiological characteristics based on the expression of biomarkers (HER2, ER, PR, Ki67), this classification complements the traditional classification and adds a very useful biological approach to disease management. That is why it is important for the radiologist to know and recognize the importance of classification, as well as to identify the most common imaging characteristics in the different diagnostic methods according to each molecular subtype.

#### TABLE OF CONTENTS/OUTLINE

Introduction· Breast molecular biomarkers· Revision of the classification of molecular subtypes of breast cancer· Imaging characteristics in the different methods according to each molecular subtype· Clinical cases· Conclusions

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## Abstract Archives of the RSNA, 2023

BREE-43

### Invasive Lobular Carcinoma (ILC): The Cancer With a Thousand Faces

#### Participants

Adriana Alvarez, MD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The Invasive Lobular Carcinoma (ILC) is the second most common type of invasive breast cancer. The incidence is increasing due to replacement therapy in postmenopausal women and diagnosis advances. There are two histologic variants: classic and pleomorphic. ILC is usually estrogen receptor positive and her2 negative. The loss of desmoplastic cell reaction and the low density of cells in this tumors make the clinical and the mammographic detection difficult. This entity has multiple imaging manifestations, being a challenge for the radiologist. ILC can be bilateral, multifocal or multicentric, with a unique metastatic pattern. Diagnosis is based in clinical and radiological tests. The most common manifestation is an irregular or spiculated mass in mammography and an hypoechoic irregular mass with posterior shadowing in US. MRI is the gold standard and it is used in the presence of multifocal, multicentric or bilateral disease as well as in the presence of lymphadenopathies.

#### TABLE OF CONTENTS/OUTLINE

This educational exhibit presents epidemiological and main ILC features. Tumor presentation and behaviour are explained. A multi-modality review of clinical and radiologic features through clinical cases, as well as pitfalls, are presented and they can help the radiologist in the diagnosis.

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## Abstract Archives of the RSNA, 2023

BREE-44

### **MRI-Detected US: How to Improve the Detection Rate of Non Mass Lesions Using Breast Anatomical Landmarks**

#### **TEACHING POINTS**

Nonmass lesions on US are most often observed when US is used to target mammographic asymmetries, biopsy suspicious calcifications seen on screening mammography, and to biopsy abnormalities on MRI. In a meta-analysis of 2201 lesions, the success rate of targeted US after MRI was 58% (range, 23%-82%) and detection rates varied by lesion type. Nonmass enhancement lesions on MRI are less likely to be detected on targeted US than mass lesions (66% of all masses and 30% of nonmass enhancement lesions were seen). This review introduces a new viewpoint on breast ultrasound anatomy necessary to obtain a close correlation with MRI and describes a target US method with anatomical landmarks based on this viewpoint. 1. Some US images of MRI-detected lesions are more indistinct than surrounding benign lesions and need to be correlated with precision. 2. About effective anatomical landmarks for MRI correlation including surrounding tissues and vascular routes as a new anatomical landmark. 3. Pattern classification of mammary fat and mammary gland distribution for reading anatomic landmarks in MRI correlation. 4. The anatomical mechanism of deformity and how to decipher it on US. Breast deformity during ultrasound examination is not related to breast size, but varies from individual to individual.

#### **TABLE OF CONTENTS/OUTLINE**

1. the identification rate of in each literature and its relationship to landmarks used
2. identification rates by anatomical landmarks and MRI images using those landmarks
3. classification of patterns of fat and mammary gland distribution in the breast based on anatomical understanding
4. anatomic mechanisms of breast deformity in MRI and US
5. US techniques considering breast deformity
6. case presentation

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## Abstract Archives of the RSNA, 2023

BREE-45

### Unraveling the Enigma of DCIS: A Multimodality Imaging Journey

#### Participants

Giselle Mello, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Definition and classification of DCIS-Epidemiology and risk factors-Clinical presentation and symptomsImaging modalities for DCIS detection and assessment

#### TABLE OF CONTENTS/OUTLINE

-Interpretation of mammography, ultrasound, and MRI in DCIS diagnosis-The role of breast tomosynthesis in DCIS detection-Pathologic correlation and biopsy techniques-Management options: Discuss management options for DCIS, including surgery (lumpectomy or mastectomy), radiation therapy, hormonal therapy, and surveillance.-Discuss emerging imaging technologies for DCIS detection and assessment.-Future directions: Discuss future research directions and areas of innovation in the field of DCIS detection and assessment, such as the use of artificial intelligence and machine learning in radiology, and the development of more personalized approaches.

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## Abstract Archives of the RSNA, 2023

BREE-46

### Unveiling the Mysteries of PASH in Breast Radiology: A Cutting-Edge Approach

#### Participants

Andrea Di Ninno, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Definition and classification of PASH  
Imaging modalities for PASH detection and characterization  
Differential diagnosis of PASH with other breast lesions

#### TABLE OF CONTENTS/OUTLINE

Definition and histopathology of PASH  
Clinical presentation and diagnostic workup of PASH  
Radiologic features of PASH on mammography, ultrasound, and MRI  
Differential diagnosis of PASH, including benign and malignant breast lesions  
Radiologic-pathologic correlation of PASH  
Management and follow-up of patients with PASH, including surveillance imaging and surgical options  
Association of PASH with other breast conditions, such as atypical ductal hyperplasia and breast cancer  
Multi-disciplinary approach to PASH management, involving radiologists, pathologists, and clinicians.

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## Abstract Archives of the RSNA, 2023

BREE-47

### Imaging Review of Mammography and Ultrasound Findings in Uncommon Breast Lesions: A Trainee-Focused Guide

#### Participants

Thurl Hugh Cledera, MD, Taguig, Philippines (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Differentiating uncommon breast lesions from cancerous lesions in the breast is paramount to proper diagnosis, risk stratification, and treatment in patients presenting with a breast mass in imaging. Uncommon breast lesions may vary from those arising in the glandular parenchyma (phyllodes), inflammation (mastitis and abscess), autoimmune (granulomatous mastitis), and metabolic (diabetic mastopathy) etiologies. In centers where resources are limited, knowing the value of mammography and ultrasound findings may help guide biopsy, which in turn provides adequate treatment. At the end of this exhibit, the learner will be able to review the basic findings that are seen in breast lesions on imaging and understand the role of clinical and imaging correlation in the proper identification of these lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Brief review of histology of uncommon breast lesions
3. Basic findings in mammography
4. Basic findings in ultrasound
5. Correlating findings in mammography and ultrasound
6. Cases of uncommon breast lesions

a. Lactating adenoma  
b. Intraductal papilloma  
c. Mastitis (bacterial)  
d. Granulomatous mastitis  
e. Diabetic mastopathy  
f. Mondor's disease  
g. Paget's disease  
h. Phyllodes tumor  
i. Dermatomyositis  
j. Foreign bodies

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## Abstract Archives of the RSNA, 2023

BREE-48

### Untangling the Mammary Ducts: Decoding the Complexity of Intraductal Pathology

#### Participants

Elsa Cecilia Molina Miranda, MD, Ciudad De Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

**Mammography:** Mammography can show intraductal lesions as grouped calcifications in a linear or branching pattern. **Breast ultrasound:** Ultrasound can identify intraductal lesions as masses or areas of ductal dilation. **Core needle biopsy (CNB):** This procedure is used to obtain a tissue sample from the lesion. CNB is performed guided by ultrasound or mammography. **Vacuum-assisted biopsy (VAB):** This procedure uses a suction device to obtain a tissue sample from the lesion. VAB is performed guided by ultrasound or mammography. **Contrast-enhanced mammography:** This exam uses a contrast medium to evaluate the vascularity of lesions in the breast, which may suggest the presence of a malignant lesion. Management of intraductal lesions depends on the definitive diagnosis obtained by biopsy. If the lesion is found to be malignant, treatment may include surgery, radiation therapy, and/or chemotherapy. If the lesion is benign, treatment may include observation or surgical removal.

#### TABLE OF CONTENTS/OUTLINE

Table of contents:1. Objectives2. Anatomia y fisiopatologia 3. Cases 4. Metodos diagnosticos 5. Approach 6. Conclusions  
Outline:Intraductal breast lesions are those that originate in the breast ducts and can be benign or malignant. These lesions can be detected by diagnostic methods such as mammography, breast ultrasound, core needle biopsy (CNB), vacuum-assisted biopsy (VAB), and contrast-enhanced mammography. The management of intraductal lesions depends on the definitive diagnosis obtained by biopsy, and treatment may include surgery, radiotherapy, and/or chemotherapy for malignant lesions, while benign lesions may be observed or surgically removed.

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## Abstract Archives of the RSNA, 2023

BREE-49

### Coming Out of the Bubble: Assessment and Management of Cystic Breast Lesions

#### Participants

Bruna Nantes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

An approach to the evaluation and diagnosis of cystic lesions in the breast, with the aim of helping radiologists in their daily practice. Detail the different types of cystic breast lesions and their differential diagnoses, as well as the appropriate management of these lesions.

#### TABLE OF CONTENTS/OUTLINE

Brief introduction: the prevalence of cystic breast lesions and the importance of adequate recognition and classification of these lesions. Definition and descriptors: detail the correct definition and description of the different types of cystic lesions. Flowchart on the management of cystic breast lesions. Multiple clinical cases of the different differential diagnoses of each type of cystic breast lesion, that contemplate: - Images from mammography, ultrasound and eventually MRI or CT scan; - Type of biopsy performed (if performed); - Recommendations on approaches to cystic lesions as per BI-RADS; - Recommendations on some special cases of cystic lesions; Conclusion.

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## Abstract Archives of the RSNA, 2023

BREE-5

### When Lightning Strikes the Same Place Twice: Detecting Ipsilateral Breast Cancer Recurrence in the Post Operative Breast

#### TEACHING POINTS

Illustrate the imaging features suspicious of ipsilateral breast cancer recurrence in patients with prior lumpectomy or mastectomy. Review current literature for recommendations on adjunct imaging surveillance in women with prior history of breast cancer given their increased risk of a second breast cancer. Review imaging mimickers of breast cancer recurrence and discuss management recommendations. Highlight teaching points for each case to increase confidence in making a timely diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Case base review We will present an image rich exhibit depicting imaging findings in ipsilateral breast cancer recurrence in the post lumpectomy patients who present for annual surveillance mammography or breast MRI, and in patients who present with clinical concerns. Cases will illustrate imaging findings, histopathology and management at the initial diagnosis and at time of recurrence. Examples of imaging mimickers of breast cancer will familiarize the learner with benign conditions in the post-surgical breast. At the end of the exhibit, teaching points will be summarized. Summary: Women with a prior personal history of breast cancer are at an increased breast cancer risk. Cumulative incidence of ipsilateral breast tumor recurrence rate has been reported at 14.3%. The image appearance of the post operative breast can make the detection of breast cancer recurrence more challenging. As a result, radiologists should be familiar with common and uncommon imaging findings of ipsilateral breast cancer recurrence. This presentation will review the current screening recommendations in this setting, expected post operative changes, breast cancer mimics, and the imaging findings of recurrence.

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## Abstract Archives of the RSNA, 2023

BREE-50

### **New Blossoms on the Old Tree: Advancing Ductography with Digital Breast Tomosynthesis (DBT) or Contrast-enhanced Mammography (CEM)**

#### **Participants**

Juan Tao, Wuhan, China (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Ductography is a useful tool for evaluating pathologic nipple discharge, allowing for identification and localization of intraductal lesions. 2. Ductography combined with DBT or CEM can eliminate masking of small filling defects caused by overlapping ductal branches and improve visualization of the entire ductal tree, enhancing the clarity of diagnosis. 3. Fine-tuning of the procedural steps and optimization of the contrast agent concentration are necessary for the successful implementation of ductography with DBT or CEM. 4. Potential additional risks of radiation exposure associated with combining DBT or CEM should be considered, and measures should be taken to minimize radiation dose to the patient in accordance with established protocols and guidelines for radiation safety in breast imaging.

#### **TABLE OF CONTENTS/OUTLINE**

I. The Old Tree: Overview of Ductography and Its Clinical Value in Evaluating PND. II. The New Bloom on the Tree: Clinical Cases Demonstrating the Utility of Ductography combined with DBT or CEM A. Sharper Sights Case: DBT-Ductography Increased Accuracy of Diagnosis. B. Wider Insights Case: CEM-Ductography Improved Visualization of the Entire Ductal Tree. III. Technical Aspects of Ductography combined with DBT or CEM. IV. Radiation Safety Considerations with Ductography and DBT or CEM A. Potential Additional Risks of Radiation Exposure B. Strategies to Minimize Radiation Dose to the Patient C. Importance of Adherence to Established Protocols and Guidelines for Radiation Safety in Breast Imaging. V. Conclusion A. Summary of the Key Points Regarding Ductography with DBT or CEM B. Future Directions and Potential Applications of Ductography with DBT or CEM. VI. References.

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## Abstract Archives of the RSNA, 2023

BREE-51

### Genetic Risk Assessment in the Radiology Setting: Our Nationwide Experience in 2023

#### Participants

Sean Raj, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review breast cancer risk assessment opportunities 2. Review key high-risk breast care and assessment considerations 3. Highlight key workflow, operational, and regulatory considerations from our practice's experience spanning multiple states on both coasts

#### TABLE OF CONTENTS/OUTLINE

I. Risk Assessment Guidelines a. Discuss often conflicting recommendation statements suggesting when to begin and which individuals to consider for cancer risk assessment, genetic testing, education/counseling, and modified medical management b. Spotlight recommendations for different demographics c. Examine benefits of supplemental screeningII. Higher than average risk: Breast Screening Considerations a. Mammography sensitivities: general population with breakdown by demographics and women with intermediate risk, high risk, and women with genetic mutations b. ACR/SBI guidelines for those with genetically based [and/or family history and dense breast] increased riskIII. Higher than average risk: Genetic Testing Considerations a. 32% of women qualify for genetic testing: a combination of hereditary and familial risk factors b. Simple multi-gene panel tests and risk assessment workflow can assess germline and polygenic risk for inherited cancer risk factorsIV. Review development of Risk-Assessment ChatBot, Intake and Educational Workflow and discuss our nationwide practice's experience including pearls and pitfalls

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## Abstract Archives of the RSNA, 2023

BREE-52

### Vascular Mammary Lesions: Key Features to Make an Accurate Diagnosis and Avoid Unnecessary Biopsies

#### Participants

Ladys Camargo, MD, Ciudad Autonoma de Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the normal vascular anatomy of the breast  
2. Know the most frequent vascular breast lesions  
3. Know and discuss the diagnostic modalities commonly used for the diagnosis of vascular lesions  
4. What is the imaging follow-up of vascular lesions?

#### TABLE OF CONTENTS/OUTLINE

There are various vascular mammary lesions, ranging from chronic systemic processes, congenital malformations, post-traumatic sequelae, benign masses, to malignant tumors. Accurate diagnosis of vascular lesions in breast images is very risky due to overlapping characteristics. This is why radiologists must be aware of the key features in the different diagnostic methods for interpreting images of vascular lesions in order to make an accurate diagnosis and avoid unnecessary biopsies and finally be able to discuss management recommendations and guidance.

Outline-Introduction-Vascular anatomy of the breast-Imaging characteristics of the most frequent vascular mammary lesions-Diagnostic methods for the diagnosis of vascular lesions-Discussion of management and monitoring-Clinical cases.-Conclusions.-Bibliography

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-53

### Cyst Breast Lesions: The Good, the Bad and the Ugly

#### TEACHING POINTS

Definition of cystic breast lesions and their prevalence  
Differentiation between simple cysts, complicated cysts, and complex cystic lesions  
Imaging modalities used for the assessment of cystic breast lesions, including mammography, ultrasound, and MRI

#### TABLE OF CONTENTS/OUTLINE

Symptoms and clinical presentation  
Diagnostic imaging modalities for cystic breast lesions, including mammography, ultrasound, and MRI  
Imaging features of cystic breast lesions  
Differential diagnosis of cystic breast lesions, including benign and malignant conditions  
Role of imaging-guided percutaneous biopsy techniques in the diagnosis of cystic breast lesions, including fine-needle aspiration, core needle biopsy, and vacuum-assisted biopsy, and their advantages and limitations. Discussion of the importance of a multidisciplinary approach in selecting the most appropriate biopsy technique based on lesion characteristics, patient factors, and imaging findings.  
Follow-up and surveillance after diagnosis and treatment of cystic breast lesions

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## Abstract Archives of the RSNA, 2023

BREE-54

### Everything We Need to Know About Papillary Breast Carcinoma

#### Participants

Lisett Cruzado-Quiroz, MD, Lima, Peru (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Papillary breast carcinoma is a rare subtype of invasive ductal carcinoma with infiltrative papillary growth representing about 0,5 - 0,7% of all invasive breast cancers. It is usually seen in postmenopausal in their sixth to eight decade of life. Association with carcinoma in situ is uncommon. Typically presents with bloody nipple discharge or/with slow growing palpable tumors, frequently found in the periareolar region. In general, they have better prognosis than ductal carcinoma with a 100% 10 year survival rate following treatment. Lymph node involvement and distant metastases are rare except in the invasive form. Mammography usually shows a solitary round or oval mass with circumscribed margins. Rarely they associate poorly defined margins or spiculation, given the low occurrence of desmoplastic reaction. Ultrasound generally shows a complex mass with solid and cystic components with good sound transmission. MRI may demonstrate heterogeneous lesions with septations, mural nodule and intracystic haemorrhage, the solid components typically show washout kinetics. Intracystic papillary carcinomas can occur in a pure form or may be associated with ductal carcinoma in-situ or invasive ductal carcinoma. The authors will review the clinical manifestation, imaging features and pathology correlation of this rare breast carcinoma.

#### TABLE OF CONTENTS/OUTLINE

Review of the pathophysiology of papillary breast cancers (histological and molecular aspect).Multimodal review of imaging features of papillary cancers (mammographic, ultrasonographic, and MR findings)To determine the Radiology-Pathology concordance/discordance by reviewing cases.Update on the treatment of papillary breast cancer.

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## Abstract Archives of the RSNA, 2023

BREE-55

### Decoding Ductal Pathology: Multimodality Approach to Nipple Discharge and Management of the Solitary Duct

#### TEACHING POINTS

1. Identify what differentiates physiologic nipple discharge from pathologic discharge 2. Describe an approach to the diagnostic workup of patients with nipple discharge 3. Discuss the clinical importance of a solitary dilated duct and describe an approach to management in these patients 4. Implement new strategies for biopsy of hard-to-sample intraductal masses under both ultrasound and MRI-guidance

#### TABLE OF CONTENTS/OUTLINE

Nipple discharge represents 2-5% of medical visits among women and is the third most common breast concern (pain > lump > nipple discharge). As radiologists our primary responsibility in assessment and management of these patients is to distinguish physiologic and pathologic causes of nipple discharge. This presentation will review the prevalence, epidemiology and pathologic subtypes of papillary lesions and other common pathologies resulting in pathologic nipple discharge and provide the reader with a diagnostic algorithm for management of these patients. Using a multimodality case-based approach, the reader will develop a differential diagnosis and management strategy for imaging findings in patients with nipple discharge, including management of the solitary dilated duct. We provide the reader with important tips and tricks for biopsy of intraductal lesions and solitary dilated ducts under ultrasound and MRI-guidance and address the potential challenges of radiology-pathology concordance in these cases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-56

### Uncovering False Positive Lesions Through DBT

#### Participants

Giovana D'Avila I, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points Screening mammography using DBT is replacing digital mammography as the preferred imaging modality. Recognize that DBT and mammography together minimize the effects of overlapping breast tissue and improves lesion detection and localization. Identify that digital breast tomosynthesis showed lower recall, cancer detection rate, and biopsy rate. The ability to problem solve with DBT images reduces patient anxiety associated with a callback.

#### TABLE OF CONTENTS/OUTLINE

Table of contents  
1 - Advantages of screening mammography using DBT.  
2 - Amorphous calcifications  
3 - Left axillary lymphadenopathy  
4 - Palpable finding  
5 - Solid Mass

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-57

### Ductal Carcinoma in Situ: Beyond First Impressions

#### Participants

Hannah L. Chung, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

DCIS often co-exist with invasive cancers and 19-36% of DCIS after percutaneous needle biopsy are upstaged to an invasive cancer at surgical excision. Up to 3% of DCIS demonstrate axillary nodal metastases. The morphology of the calcifications are useful in predicting the nuclear grade. DCIS may also manifest as a noncalcified mass, asymmetry or distortion. Sonography demonstrates these findings as a mass, nonmass area or ductal change. MRI demonstrates the extent of DCIS better than other imaging modalities and findings correlate with high grade DCIS. Observed recurrences and lymph node metastases pose challenges to current evaluation and treatments of DCIS.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents 1. What is DCIS a. Significance of DCIS b. Biology and evolution of DCIS 2. Clinical Presentation of DCIS a. Asymptomatic b. Nipple discharge c. Paget's disease of the nipple d. Palpable lump 3. Imaging correlates with biology and pathology a. Mammographic i. Calcifications, mass, asymmetry, distortion b. Sonographic i. Nonmass findings 1. hypoechoic areas 2. echogenic foci 3. shadowing, 4. pseudomicrocyst ii. Ductal change c. MRI- MRI is useful to demonstrate extent of disease, exclude invasive disease, and correlates with high grade DCIS. i. nonmass enhancement ii. mass. 4. Special considerations a. Occult invasive cancers or misdiagnosis- Can imaging predict invasion? b. Axillary Staging- Is axillary ultrasound with biopsy and sentinel lymph node necessary? 5. Research: Past, now, and future endeavors a. NSABP, UKANZ, ECOG-ACRIN b. Active surveillance vs standard treatment - COMET, LORIS, LORD c. Advanced imaging techniques and artificial intelligence in both radiology and pathology

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-58

### When Cysts Are Not So Simple: Tips for Complex Cystic Breast Masses Evaluation.

#### TEACHING POINTS

-To review the different entities causing the sonographic appearance of a complex cyst.-To illustrate a series of cases of complex cystic benign and malignant lesions of the breast providing correlation with imaging (US, contrast-enhanced mammography, MRI) and pathology. - To discuss the specific management of those lesions including imaging and interventional procedures. -To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Cystic breast lesions are frequently detected on breast ultrasonography. Simple cysts, complicated cysts, and oil cysts do not require further invasive diagnostic procedures. However, malignant entities may present with complex cystic and solid masses. Through sample cases, a variety of imaging and pathology findings from complex cystic lesions with management discussion will be demonstrated. 1. Introduction. US findings and technical pitfalls. 2.Cystic lesions evaluation, useful findings that could be of significant diagnostic value to distinguish between confusing cysts. Classification of cysts and suspicious findings. 3.Work-up of suspicious lesions on US: mammography/contrast-enhanced mammography (CEM) and MRI. Interventional procedures. 4. Typical benign and malignant lesions with their important findings on ultrasonography, contrast-enhanced mammography, and MRI: Benign: complicated/inflammatory cyst, seroma, oil cyst, epidermal inclusion cyst, galactocele, mucocele-like tumor, hematoma, abscess, fat necrosis, fibroadenoma, papilloma, benign Phyllodes tumor. Malignant: malignant Phyllodes tumor, papillary, medullary, colloid, and squamous cell carcinoma, sarcoma.

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## Abstract Archives of the RSNA, 2023

BREE-59

### **Differentiating Simple Cysts From Complicated Cysts, Complex Cystic and Solid Masses, and Other Cystic Breast Lesions**

#### **Participants**

Tara Retson, MD, PhD, San Diego, CA (*Presenter*) Research Consultant, CureMetrix, Inc Stock options, CureMetrix, Inc

#### **TEACHING POINTS**

Cystic diseases of the breast are common, and confusion can occur regarding their appropriate classification and management. Distinguishing between benign cysts/cystic lesions and malignant cyst-like/fluid-containing cancers may be challenging. Specifically, triple negative breast cancers and intracystic papillary carcinomas should not be dismissed as benign/probably benign. Cystic lesions may be diagnosed accurately and managed appropriately using characteristic imaging findings. It is imperative to properly classify lesions as complex cystic and solid masses vs. complicated cysts since their management differs, and the differential of complex cystic and solid masses includes cancer. This educational exhibit will define simple cysts, teach radiologists about cystic lesions that may not be benign, review their imaging appearances, and recommend management options for complicated cysts, clustered microcysts, and complex cystic and solid breast masses.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction; Definitions/illustrations of simple cysts, complicated cysts, clustered microcysts and complex cystic and solid masses; Multimodality examples of cystic breast lesions, systematic approach to the characterization of cystic lesions; How to appropriately apply BI-RADS classification and management recommendations of cystic breast lesions; Utilization of a quiz at the end of the exhibit to test yourself on the systematic approach presented.

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## Abstract Archives of the RSNA, 2023

BREE-6

### Get Your Ducts in a Row: Imaging and Management Considerations of Ductal Disease of the Breast

#### Participants

Firouzeh Arjmandi, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-In the imaging evaluation of spontaneous clear and/or bloody nipple discharge, negative diagnostic conventional imaging (mammogram and ultrasound) warrants further evaluation with breast MRI.-Nipple changes on physical exam even in the absence of imaging findings are suspicious. Clinical exam findings should guide next steps in management, and nipple tissue biopsy should be performed by the surgeon in the appropriate clinical setting.-In the setting of a small, subtle intraductal mass seen on diagnostic MRI and not well visualized at time of MR-guided biopsy, targeting the end of a blind-ending solitary duct can help to guide the biopsy.-The combination of findings of a palpable lump, nipple discharge, and nipple inversion, and the presence of associated coarse heterogeneous calcifications raises concern for malignancy, and biopsy should be recommended (despite the presence of more benign appearing rim calcifications).-Treatment of intraductal papillomas without atypia has become more conservative. Upgrade to DCIS or invasive carcinoma is more common in women >50 years, lesions >1 cm, palpable lesions and papillomas >5 cm from the nipple.

#### TABLE OF CONTENTS/OUTLINE

-Overlapping imaging features of benign and malignant calcifications, including high grade versus low grade DCIS-Utility of MRI in the evaluation of extent of disease in intermediate to high grade DCIS-Multimodality imaging and clinical evaluation of pathologic nipple discharge and nipple changes (erythema and scaling)-Imaging assessment and clinical management of a solitary dilated duct and intraductal lesions-Accurate assessment of response to neoadjuvant chemotherapy in the setting of increasing calcifications post therapy

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## Abstract Archives of the RSNA, 2023

BREE-60

### Test Your Knowledge: A Case Based Quiz of Contrast Enhanced Mammography BI-RADS Lexicon

#### Participants

Daniel Sandoval, MD, Ciudad De Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• To learn the descriptors published in the ACR 2022 BI-RADS supplement for contrast enhanced mammography by reviewing a series of daily case images. • As this supplement has only recently been published, this exhibit is intended to help radiologists become familiar with the terminology and its representation on images, through an interactive and entertaining activity.

#### TABLE OF CONTENTS/OUTLINE

• Background Contrast enhanced mammography lexicon overview (categories, terms, features and definitions) • Illustrated case based quizzeso Case #1: Background parenchymal enhancement - Level: Minimal, Mild, Moderate, Marked. - Symmetry: Symmetric, Asymmetric.o Case #2: Masses - Shape: Oval, Round, Irregular.- Margin: Circumscribed, Irregular, Spiculated. - Internal enhancement characteristics: Homogeneous, Heterogeneous, Rim enhancement. o Case #3: Non mass enhancement - Distribution; Diffuse, Multiple regions, Regional, Focal, Linear, Segmental- Internal enhancement characteristics: Homogeneous, Heterogeneous, Clumped. o Case #4: Enhancing asymmetry - Internal enhancement pattern: Homogeneous, Heterogeneous. o Case #5: Lesion conspicuity - Low - Moderate - High• References

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## Abstract Archives of the RSNA, 2023

BREE-61

### Complex Cystic Breast Masses: An MR Imaging Review

#### Participants

Jie Liu, Wuhan, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To define the concept of complex cystic breast masses. 2. To categorize complex cystic breast masses into three types based on the percentage and spatial distribution of cystic and solid components in the contrast-enhanced MRI. 3. In comparison with US, MRI affords superior visualisation of the proportion and distribution characteristics of solid and cystic components within complex cystic breast masses, which facilitates their differential diagnosis. Moreover, multi-parametric MRI such as T2WI, dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI) enables the recognition of the presence and distribution characteristics of cystic and solid components, the combination of which can serve as a complementary imaging aid for accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of complex cystic breast masses B. Importance of accurate diagnosis II. Complex cystic breast masses A. Definition of complex cystic breast masses B. Etiology of complex cystic breast masses C. Clinical manifestations of complex cystic breast masses III. Categorization of complex cystic breast masses based on MRI features Group A : thick outer wall and/or thick internal septa (> 0.5 mm). Group B: predominantly cystic component(>50%)or intracystic mural nodule. Group C:predominantly solid component and cystic component=50% IV. Comparison of MRI and ultrasound in complex cystic breast masses A. Advantages of MRI over ultrasound B. Limitations of ultrasound C. Diagnostic value of multiparametric MRI in identifying cystic components V. Conclusion A. Summary of key points B. diagnostic flow chart of complex cystic breast masses C. Future directions for research VI. References

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## Abstract Archives of the RSNA, 2023

BREE-62

### Trial by Priors: When to Call Back a Stable Mammographic Finding

#### TEACHING POINTS

1. Comparison with multiple prior studies can help identify slowly evolving malignancies. 2. Mammographic findings that warrant further evaluation include increasing number of calcifications or suspicious distributions, evolving asymmetries, architectural distortions, and slow growing or spiculated masses. 3. Early recognition of these suspicious findings allows for appropriate diagnostic workup and improved diagnosis of slow growing malignancies.

#### TABLE OF CONTENTS/OUTLINE

1. Introductory slide. This exhibit hopes to educate breast imagers about stable mammographic findings that require further evaluation. While stability of imaging findings over two years is often suggestive of benignity, comparison with multiple prior imaging studies can allow better evaluation of stability and identify features that are slowly evolving over time. There are also some imaging features that should be further evaluated and sampled regardless of apparent stability. This educational exhibit will discuss several cases of malignancy, highlighting the suspicious imaging features that prompted additional work up. 2. List of teaching points to guide the upcoming case discussion. 3. Anonymized cases demonstrating different examples of slow growing malignancies. Each case will include: Multiple prior studies to demonstrate evolution over time; Explanation of decision making that lead to diagnostic evaluation; Findings on diagnostic imaging; Pathology results after biopsy. 4. Summary slide that reviews the teaching points.

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## Abstract Archives of the RSNA, 2023

BREE-63

### Indications and Outcomes of Cryoablation in Breast Malignancies: A Single Institution Case Review

#### Participants

Sasha Kurumety, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal of this presentation is to educate radiology trainees on the use of cryoablation as a treatment option for breast malignancies, when cryoablation may be appropriate, and expected short and long term outcomes of the procedure. Using a series of cases from our institution, we will describe selection criteria to identify patients that may benefit from this minimally invasive cancer treatment option and demonstrate post treatment imaging findings. After this presentation, learners will be able to describe the utility of cryoablation in treating breast malignancies and mechanisms of action, as well as understand the complications, outcomes, and future directions/ongoing trials for cryoablation.

#### TABLE OF CONTENTS/OUTLINE

Background:- Current FDA approved indications for cryoablation and uses of cryoablation in breast cancer- Ongoing trials: discussion of ICE3, FROST, and home institution trials and preliminary outcomesDiscussion of mechanism of action:- Direct freezing and cell death, indirect immune response activation- Advantages, disadvantages, and risks/complications of cryoablationCryoablation at our institution:- Qualifying patient and tumor characteristics, preprocedural evaluation- Interdisciplinary decision-makingInstitutional cryoablation cases:- Preprocedural imaging, biopsy pathology results, imaging during procedure, and post cryoablation follow up imaging/pathologyFuture directions: pathway to FDA approval, Medicare coverage, and increasing accessibility.

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## Abstract Archives of the RSNA, 2023

BREE-64

### To Treat or Not to Treat: A Review of Papillary Lesions of the Breast

#### TEACHING POINTS

Papillary breast lesions are a heterogeneous group of proliferative changes that occur within the epithelial lining of breast ducts. These lesions have varying presentations, pathological characteristics, and treatment options, requiring careful radiological evaluation for an accurate diagnosis. The spectrum of the lesions includes intraductal papilloma with/without atypia, intraductal papillary carcinoma, encapsulated papillary carcinoma, solid papillary carcinoma, and invasive papillary carcinoma. Radiologists must be aware of these variations to accurately identify, diagnose, and provide appropriate management recommendations. The primary objective of the exhibit is to present a comprehensive pictorial review of papillary breast lesions with radiological pathological images. We will also discuss the steps in the diagnosis and current management recommendations of these lesions. By the end of this exhibit, the audience will have a better understanding of the various papillary lesions and their clinical and imaging presentations, enabling them to provide appropriate radiologic-pathologic correlation and treatment recommendation for patients.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction. 2) Definition of papillary breast lesions. 3) Pictorial review of the spectrum of papillary lesions. 4) Case examples of the spectrum of papillary lesions with pathological correlation. 5) Symptoms presentation of various papillary lesions. 6) Imaging techniques recommendations for diagnosis of papillary lesions. 7) Review of current BI-RADS terms in the description of these abnormalities. 8) Latest management recommendation for papillary lesions within the spectrum. 9) Conclusion/Summary.

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## Abstract Archives of the RSNA, 2023

BREE-65

### Case Based Review of the Modern Reconstructed Breast: Benign Imaging Findings and Complications

#### Participants

Shelby Breit, MD, Durham, KS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand imaging findings associated with modern reconstruction techniques  
2. Recognize uncommon and common benign findings  
3. Discuss complications

#### TABLE OF CONTENTS/OUTLINE

Reconstruction Methods  
Implants  
Autologous Flaps (AF)  
Imaging after implant reconstruction  
Type: silicone vs saline implant  
Acellular dermal matrix (ADM)  
Benign complications: Rupture  
Gel bleed  
Abscess/infection  
Hematoma  
Siliconoma  
Implant associated mesenchymal tumors (fibromatosis)  
Imaging after AF reconstruction  
Type: pedicled, free, perforator flaps  
Venous coupler device  
Benign complications: Fat necrosis/lipografting  
Epidermal inclusion cyst

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## Abstract Archives of the RSNA, 2023

BREE-66

### Breast MRI: What the Surgeon Wants to Know

#### TEACHING POINTS

As there is increasing need for a multidisciplinary approach to patient care, it is important for the radiologist to understand which MRI findings change clinical management. After this presentation, participants will understand: 1. Indications for breast MRI 2. Breast cancer staging 3. Indications for different types of breast cancer treatment, including surgery, radiation, and systemic 4. Breast MRI findings that change clinical/surgical management 5. MRI correlates on mammogram and ultrasound

#### TABLE OF CONTENTS/OUTLINE

A. Indications for MRI a. American College of Radiology Practice Parameter b. American Society of Breast Surgeons Consensus Guidelines B. Overview of breast cancer staging C. Surgical management a. Indications b. Mastectomy vs. lumpectomy c. Types of mastectomy D. Radiation a. Indications b. Whole vs. partial breast treatment E. Systemic a. Indications for neoadjuvant chemotherapy b. Types of systemic treatment (chemotherapy, hormone blockade, biologic therapies) F. MRI findings that impact staging and management with multimodality case examples a. Multicentric/multifocal disease b. Nodal involvement (rotter's node, level I, level II, level III, internal mammary chain node) c. Nipple enhancement d. Skin enhancement e. Chest wall involvement f. Cancer in contralateral breast g. Metastatic disease - bone/lung involvement

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## Abstract Archives of the RSNA, 2023

BREE-67

### The Not So Simple Cyst

#### TEACHING POINTS

Cystic breast lesions are frequently encountered on ultrasound, often incidentally with a broad differential diagnosis including both benign and malignant pathology. Accurate description and classification according to the BI-RADS Lexicon based on ultrasound characteristics are essential for appropriate estimation of risk for malignancy and in turn management guidance. Emphasis on optimal ultrasound techniques, BI-RADS classification based on imaging characteristics, and correlation with example cases will be given with the purpose of helping residents and radiologists feel confident on how to proceed when faced with a cystic breast lesion.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction II. Optimal Ultrasound Technique III. BI-RADS classification of cystic lesions 1. Simple cyst 2. Complicated cyst 3. Complex cystic and solid mass (classification of complex masses) IV. Sampling techniques V. Take Away Points

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## Abstract Archives of the RSNA, 2023

BREE-68

### The Cures Act: Challenges and Benefits in Breast Imaging

#### TEACHING POINTS

The 21st Century Cures Act is a federal law signed in 2016, aiming to remove barriers to health information exchange. The legislation includes a Final Rule, federally enforced as of April 2021, mandating patient access to electronic health information to increase transparency. Part of the mandate prohibits "information blocking," defined as a healthcare practice that is "likely to interfere with access, exchange, or use of electronic health information." For radiology practices, this means that reports are released to patients immediately when finalized. Immediate release allows for increased patient autonomy but reports often include sensitive information, especially in breast imaging, in addition to terminology that might be confusing to patients. Screening and diagnostic reports, previously held for a period of time at many institutions to allow time for direct patient communication, are now immediately released to patients. This educational exhibit reviews the impact of the Cures Act on breast imaging practices, including benefits, challenges, and potential solutions to navigate the legislation.

#### TABLE OF CONTENTS/OUTLINE

I. Legislation II. Positive Implications and Challenges III. Evolution of Practice

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## Abstract Archives of the RSNA, 2023

BREE-69

### How to Start Using Optoacoustic Imaging in Your Breast Practice: A Primer

#### Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Optoacoustic imaging (OAI) is a novel technique that uses non-ionizing lasers to detect endogenous tissue contrast. Gray scale ultrasound (GUS) is fused with parametric maps of relative light absorption for oxy/deoxyHgb in real-time, enabling simultaneous functional and anatomic imaging. The most frequently tested interpretation schema involves dividing mass into 3 internal and 2 external features. The 3 internal scores include the number of individually resolved vessels and their relative deoxygenation (vessel score), tumor blush, representing volume-averaged vessels too small to resolve individually (blush score), and Hgb amount (hemoglobin score). The 2 external scores reflect the amount and relative oxygenation of hemoglobin and vessel morphology within the boundary zone (bz, immediately surrounding the tumor, analogous to the thick echogenic rim surrounding tumors on GUS images) and the peripheral zone (pz, territory beyond the bz). Combined evaluation of GSUS and OAI features to classify benign and malignant masses have consistently shown to increase significantly (43.0% vs 28.1%,  $p < 0.001$ ) diagnostic specificity with high interreader (7 readers) agreement (mean kappa = 0.55;  $p < 0.001$ ). A study combining decision support tools with 15 fellowship-trained radiologists showed that interreader agreement [intraclass correlation coefficient (ICC) 0.80, 95%CI: 0.78, 9.82] and agreement between reader and decision support tool (95.3% of all reads) was high.

#### TABLE OF CONTENTS/OUTLINE

1. Optoacoustic Imaging Principles 2. Equipment Types and Current Status 3. Interpreting Optoacoustic Images: A Comprehensive Guide 4. Understanding system limitations 5. Case Demonstration 6. Test Your Knowledge

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## Abstract Archives of the RSNA, 2023

BREE-7

### Non-Malignant Papillary Lesions of the Breast: Imaging Features and Management

#### Participants

Antonio Morales Rosa, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the characteristics of non-malignant papillary lesions of the breast (B3) on different imaging techniques: mammography, US and MR. - To review the therapeutic algorithm of papillary B3 lesions of the breast and the role of vacuum assisted excision biopsy (VAE).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 1.1 Intraductal papiloma without atypia. 1.2 Intraductal papiloma with atypia. 2. Imaging features. 2.1 Mammography. 2.2 US. 2.3 MR. 3. Radiopathological correlation. 4. Management of B3 papillary breast lesions. Algorithm. Role of MR. Indications of VAE. 4.1 Follow-up. 4.2 Surgery. 4.3 Vacuum assisted excisional biopsy (VAE). 5. Conclusions

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## Abstract Archives of the RSNA, 2023

BREE-70

### **What You Need to Know About the Pediatric Breast: A Review of the Normal Breast and Diagnostic Approach of Pediatric Breast Disease.**

#### **TEACHING POINTS**

The purpose of this exhibit is to: Describe the physiologic breast development and its variants from birth to adolescence. Review the optimal imaging modalities for evaluation of breast lesions in children and adolescents. Recognize imaging appearances of benign and malignant lesions that can affect the pediatric breast. Learn the recommendations for follow-up and management of pediatric breast lesions to avoid a delayed diagnosis or unnecessary interventions.

#### **TABLE OF CONTENTS/OUTLINE**

We review: Utility of the different imaging modalities in the assessment of the pediatric breast. Breast physiologic development from birth to puberty and pathological conditions that can occur. Benign and malignant pediatric breast disease with illustrating cases. Non-mass findings: Asymmetrical breast development, accessory breast tissue, accessory nipple, pseudogynecomastia, gynecomastia, atypical ductal hyperplasia, surgical scar. Benign masses: Simple and complex cysts, retroareolar cyst, epidermal inclusion cyst, fibrocystic changes, mastitis and abscess, hematoma, intramammary lymph node, reactive lymph node to vaccines, fibroadenoma, pseudoangiomatous stromal hyperplasia, sclerosing adenosis, phyllodes tumor and tubular adenoma. Malignant masses: Metastasis and primary breast cancer. Diagnostic approach of pediatric breast disease with follow-up and management algorithm and indications for interventions such as biopsy or surgery.

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## Abstract Archives of the RSNA, 2023

BREE-71

### Localization for Nonpalpable Breast Lesions. A Pictorial Review of Different Imaging-guided Preoperative Localization Procedures in the Breast and Axilla.

#### Participants

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To know the different devices employed for nonpalpable breast lesions localization. -To review the role of imaging techniques (mammogram, US, MR, CT, gamma detector) in the localization of breast lesions for breast conserving surgery. -To understand surgeon needs including technical factors of localization and communication of the relationship of the lesion and the marker. -To become familiar with the localization process, and different tips and tricks for each device.

#### TABLE OF CONTENTS/OUTLINE

Breast-conserving surgery requires multidisciplinary communication and planning between the surgeon and the radiologist. Removal of the lesion with adequate surgical margins and avoiding resection of healthy breast tissue is essential. 1. History of wire localization, radioactive seed, and other non-needle-wire localization techniques 2. Advantages and disadvantages of using seed localization versus needle-wire localization. 3. Wire localization. 4. Non-wire devices: radioactive I125, magnetic, radar, and radiofrequency seeds 5. Technique and pitfalls. Before the procedure: review of the patient's imaging and histopathologic findings. Wire or seed placement. Preoperative detection. Operating room. Recovery. 6. Case examples of potential difficulties and problems and how to overcome them.

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## Abstract Archives of the RSNA, 2023

BREE-72

### Is it Back? Multimodality Surveillance of Breast Cancer Recurrence: Literature Review and Case Presentation

#### Participants

Mohammed Sabawi, MBChB, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Screening patients with previously treated breast cancer is challenging, because benign post treatment changes can obscure or resemble an underlying recurrence and due to technical limitations in performing a mammography on a treated breast. There are postoperative mammographic findings in a conservatively treated breast which follow expected time course. Any new mammographic finding (new masses, asymmetries or microcalcifications) should raise suspicion for recurrence. Abnormal screening mammogram is the most common presentation of breast cancer recurrence. Margin involvement and lack of radiotherapy and/ or chemotherapy are important prognostic factors of local recurrence. There is no clear guidelines to dictate ipsilateral breast screening after mastectomy and reconstruction with or without implant. Breast MRI is highly sensitive imaging modality to detect local recurrence in certain patient groups. It can be also utilized as problem solving to assess equivocal clinical or mammographic findings.

#### TABLE OF CONTENTS/OUTLINE

Introduction Review of incidence, risk factors, diagnostic performance of multimodality surveillance and presentation of breast cancer recurrence. Review of post breast conserving treatment imaging findings and their time course of evolution. Review of available national guidelines for multimodality surveillance after curative treatment for locoregional breast cancer. Case based review of different and unusual presentations of breast cancer recurrence. Conclusion. References.

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## Abstract Archives of the RSNA, 2023

BREE-73

### **A Review of the Combined Score for Quantitative Shear Wave Elastography (SWE) and Superb Microvascular Image Vascular Index (SMIVI) to Evaluate Breast Masses**

#### **Participants**

NA YOUNG LEE, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To differentiate between benign and malignant breast masses, we propose using the combined score of quantitative parameters for shear wave elastography (SWE) and superb microvascular image (SMI) with BI-RADS. We suggest using the combined score for SWEmax, SWERatio, and SMIVI and demonstrate how it can be used to differentiate between benign and malignant breast masses. 2. We calculated the combined score by adding the BI-RADS score and each quantitative parameter (SWEmax, SWERatio, and SMIVI). The BI-RADS categories were scored on a scale of 1 to 5 (C3:1, C4a:2, C4b:3, C4c:4, and C5:5), and SWEmax, SWERatio, and SMIVI were scored as 0 or 1 based on applied cutoff values. The summed score ranged from 1 to 8. We used a cutoff value of 4 for the combined score to discriminate between benign and malignant cases based on the reported AUC values. 3. The combined score of B-mode US and quantitative parameters can improve diagnostic performance and reduce unnecessary breast biopsy. However, the combined scores should be applied with caution, considering that the quantitative parameters have limitations in assessing small-sized, pure DCIS, or low-grade invasive cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review the principles of quantitative parameters for SWE (SWEmax, SWERatio) and SMIVI. 2. Review the appropriate cut off value for quantitative parameters for SWEmax, SWERatio, and SMIVI and evaluate their diagnostic performance in differentiating between benign and malignant masses. 3. Showcase the various case of combined score and pathology reviews to demonstrate how combined scores are helpful for differential diagnosis of breast masses, and which cases will be carefully applied.

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## Abstract Archives of the RSNA, 2023

BREE-74

### Threading the Needle: The Role of Breast Radiologists in Managing Suspicious Internal Mammary Lymph Nodes

#### Participants

Megan Kalambo, MD, Missouri City, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Examine Internal Mammary Lymph Nodes (IMLN) as an important component of breast lymphatic drainage. 2. Review the implications of metastatic IMLN adenopathy in the staging of breast cancer. 3. Provide an overview of IMLN basin anatomy, differential diagnosis of IM adenopathy, and the clinical indications for imaging and sampling. 4. Explain the tools and technical steps necessary for conducting a successful ultrasound biopsy of IMLNs. 5. Recognize ultrasound-guided Fine Needle Aspiration (FNA) biopsy as a feasible percutaneous sampling technique radiologists can use to provide treatment planning assistance to clinical teams.

#### TABLE OF CONTENTS/OUTLINE

Based on our experiences at a tertiary oncologic referral center, we will provide an overview of internal mammary lymph nodes (IMLN) with regard to the anatomical, clinical, imaging and procedural considerations for radiologists. • Overview of IM nodal basin anatomy • Management of indeterminate and suspicious IMLNs • Differential diagnosis of abnormal/indeterminate IMLNs • Incidence and implications of IMLN adenopathy on breast cancer staging • Indications for imaging of IMLN • Multimodality identification of IMLN on Ultrasound, MRI, PET/CT • Biopsy considerations • Indications • Tools • Technical steps • Case-based discussion of IMLNs • Tips for imaging and clinical management of patients with indeterminate/suspicious IMLN.

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## Abstract Archives of the RSNA, 2023

BREE-75

### The State of Breast Imaging in the Caribbean

#### Participants

Dami Olufosoye, BS, MPH, Mount Pleasant, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Provide an overview of the current trends in incidence and mortality of breast cancer in the Caribbean 2. Discuss the state of breast services with respect to breast exams and screening 3. Discuss the challenges in breast services including infrastructure and health workforce availability 4. Recognize patient-related barriers 5. Review main points of the global breast cancer initiative and goals for breast imaging in the Caribbean

#### TABLE OF CONTENTS/OUTLINE

- Overview of breast cancer incidence, prevalence, mortality, and stage of diagnosis in the Caribbean compared globally and to the US
- State of breast services with respect to breast exams and testing
- National guidelines on breast exams and screening
- Self-breast exams
- Clinical breast exams
- Access to mammograms
- Discuss the state of breast services pertaining to the infrastructure and health workforce availability
- Number of equipment in the region
- Type of equipment available: digital mammography vs full film digital mammography vs tomosynthesis
- Maintenance/ Audit of equipment
- Health workforce: radiologists, oncologists, physicists
- Breast treatment services
- Barriers surrounding breast cancer
- Knowledge deficits
- Patient beliefs
- 2021 Global Breast Initiative
- Key messages
- Recommendations for implementing interventions

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## Abstract Archives of the RSNA, 2023

BREE-76

### Breast Lesions Detected on CT: When to Refer for Triple Breast Assessment

#### Participants

Sharmeen Jaffer, MD, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Incidental breast lesions are a common finding on CT and unnecessary referrals can create a significant burden on the breast clinic.
- To evaluate imaging characteristics of incidental breast lesions identified on CT and suggest characteristics which warrant referral to the breast clinic.
- To identify imaging characteristics of breast lesion mimics or benign breast lesions; avoiding unnecessary referral to the breast clinic.
- To explore the limitations of CT with imaging breast lesions including post-contrast enhancement in benign and malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

- Variability of normal breast glandular tissue on CT including asymmetry and differences in density.
- Breast lesions with benign characteristics such as coarse or popcorn calcification or well defined cysts with homogenous fluid attenuation.
- Indeterminate breast lesions including intramammary lymph nodes, leiomyomas, papilloma, fat necrosis or lobular fibroadenomas which demonstrate post-contrast enhancement.
- Suspicious breast lesions and indicators of malignancy including irregular or speculate margins and global or peripheral contrast enhancement; measured in Hounsfield units (HU).
- Mimics of breast malignancy including lymphoedema, post surgical changes or radiotherapy.
- Factors that negate an unnecessary referral to breast clinic include: long term stability, lesion previously assessed on mammography/ultrasound/biopsy proven benign lesion.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-77

### Multimodality Imaging of Recurrent and Residual Breast Cancer

#### TEACHING POINTS

After this exhibit, the reader will be able to: 1. Describe the epidemiology and clinical implications of recurrent and residual breast cancer. 2. Demonstrate the importance of a multimodality approach to the detection, workup and diagnosis of recurrent and residual breast cancer. 3. Apply specific strategies to improve early detection to optimize patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

Recurrent and residual breast cancer remains a diagnostic challenge with significant clinical implications. Early and accurate detection is critical for optimizing patient outcomes. Using a case-based multi-modality approach, this exhibit will: 1. Review the epidemiology and clinical implications of recurrent and residual breast cancer. 2. Discuss current surveillance recommendations and supporting literature, including the importance of patient anxiety. 3. Review expected post-treatment findings, discussing the advantages and disadvantages of each modality (mammography, ultrasound and MRI). 4. Provide an approach to surveillance imaging and residual disease, with emphasis on the surgical pathology report, surgical margins and the importance of breast biopsy marker clips. 5. Provide tips and tricks to ensure early identification of recurrent/residual disease and avoid post-treatment surveillance pitfalls.

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## Abstract Archives of the RSNA, 2023

BREE-78

### From Benign to Malignant: Understanding the Spectrum of Phyllodes Tumors

#### Participants

Abel Gonzalez Huete, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To provide an overview of Phyllodes tumors, including their pathology features, categories and clinical presentation. 2. To discuss the role of the different imaging in the diagnosis of Phyllodes tumors. 3. To review the differential diagnosis of Phyllodes tumors and how to differentiate them from other breast tumors. 4. To highlight the importance of accurate diagnosis in the management of Phyllodes tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Breast anatomy, Fibroepithelial tumors, Epidemiology, Pathogenesis, Categories of Phyllodes Tumors (Benign, Borderline, and Malignant) 2. Clinical Presentation 3. Pathology 4. Imaging Findings: - Benign Phyllodes tumor (Mammography, Ultrasound and MRI), - Borderline Phyllodes tumor (Mammography, Ultrasound and MRI), - Malignant Phyllodes tumor (Mammography, Ultrasound and MRI). 5. Differential Diagnosis: Fibroadenoma, Primary Sarcoma of the Breast, Periductal Stromal Tumor of the Breast, Other. 6. Benign vs Malignant Phyllodes Tumors: Key Differences 7. Management, Treatment and Prognosis 8. Conclusion 9. References

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## Abstract Archives of the RSNA, 2023

BREE-79

### **A Sheep in Wolf's Clothing: The Multiple Appearances of Local Breast Cancer Recurrence After Breast Mastectomy**

#### **Participants**

Agostina Peralta I, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-Discuss the role of the different image modalities in the surveillance of breast cancer recurrence after breast mastectomy.- Recognizing the imaging and the normal anatomic changes depending on the type of breast mastectomy performed.-Illustrate the imagen findings corresponding to a breast cancer recurrence on different image modalities.-Differentiating post-surgical benign findings from a malignant relapse.

#### **TABLE OF CONTENTS/OUTLINE**

Studies have proven that the presence of local recurrence is an independent predictor for survival this is why radiologist should be familiarized to distinguish normal or benign findings after mastectomy form a recurrence. With the main objective of early detection and treatment. -Briefly review the different surveillance recommendations for these patients given by international societies. - Description of the different surgical breast reconstruction techniques used nowadays will be performed. These include the use of prosthetic implants, autologous tissue flaps, skin and fat flaps. -Illustrations will be shown of the expected anatomic changes after mastectomy on different image modalities depending on the surgical technique. -Images showing and differentiating benign findings from a post-surgical local breast cancer recurrence will be portrait.

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## Abstract Archives of the RSNA, 2023

BREE-8

### Comparison of Indications, Reading Time, and Work Flow of FDA Approved Supplemental Screening Automated Whole Breast Ultrasound Tomography in Women With Dense Breasts

#### Participants

Mary W. Yamashita, MD, South Pasadena, CA (*Presenter*) Research Grant, Delphinus Medical Technologies, Inc; Consultant, Delphinus Medical Technologies, Inc

#### TEACHING POINTS

- Ultrasound as adjunct to screening mammography for women with dense breasts increases cancer detection. - There are new ultrasound technologies available for same day supplemental dense breast screening. - Invenia ABUS from GE and SoftVue Automated Whole Breast Ultrasound Tomography (SV) from Delphinus Medical Technologies are both PMA-approved for screening and diagnostic purposes. - In clinical practice, ABUS is time-consuming and requires significant reading time. - SV offers benefits of same day supplemental screening with mammography and, unlike other ultrasound imaging, only adds 3-4 mins of reading time per case for the radiologist.

#### TABLE OF CONTENTS/OUTLINE

1. Why ultrasound is important in screening women with dense breasts 2. Overview of ultrasound technologies available for dense breast screening 3. Comparison of indications for use 4. Benefits and challenges with integrating ultrasound into practice for adjunct screening for women with dense breasts: Workflow 5. Reading time: what makes reading ABUS and HHUS challenging in clinical practice, what are the main drivers of the time it takes for radiologist to interpret images including technique and training, number of images, image quality, and artifacts 6. Overview of SV automated whole breast ultrasound 7. Image sequence and reading protocol for SV 8. Example clinical cases demonstrating SV hanging protocol 9. SV reading time study and results 10. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-80

### Do Not Miss Architectural Distortion!

#### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

#### TEACHING POINTS

The BI-RADS 5th edition manual defines architectural distortion (AD) as “distortion of the breast parenchyma with no definite mass visible.” AD of the breast is an abnormality found in multimodality breast imaging and occurs with benign and malignant lesions. The most common cause of architectural distortion is a surgical scar. However, 4% of breast cancers present with AD. In addition to being a primary imaging finding, AD may also be an associated finding. In addition, AD is notorious for being a missed mammographic lesion. It is important for radiologists to “train their eyes” to identify AD and to know the differential considerations and pitfalls associated with AD evaluation to avoid potential missed breast cancer. The goals of this educational exhibit are to 1. recognize AD by 2D mammogram, digital breast tomosynthesis (DBT), ultrasound, and MRI, 2. review the differential considerations of AD, and 3. recommend management options and perform radiology-pathology concordance.

#### TABLE OF CONTENTS/OUTLINE

Introduction; Definition of AD; Multimodality imaging examples of AD of the breast including mammography, sonography, and MRI; Learn a systematic approach to the characterization of AD; AD and DBT; How to appropriately apply the BI-RADS classification and management recommendations of AD; Challenging cases of AD; Pitfalls in evaluating AD: fat-containing, one view only, not seen at biopsy; Discordance in AD rad-path correlation; Sample cases; Conclusion.

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## Abstract Archives of the RSNA, 2023

BREE-81

### Non-mass Lesion on Breast Ultrasound: Radiologic-Pathologic Correlation and a Guide to Approach

#### Participants

Haejung Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Unlike mass, non-mass lesion does not show a three-dimensional structure, so it is more difficult than mass to detect and make an accurate diagnosis on breast ultrasound. For this reason, non-mass lesion evaluation on breast ultrasound often follows the detection of abnormality on other imaging modalities, such as mammography or MRI. This educational exhibit was prepared to increase understanding of non-mass lesions seen on breast ultrasound and to help accurately diagnose benign and malignant non-mass lesions. 1. Review the definition of non-mass lesion on breast ultrasound, 2. Correlate radiologic and pathological findings of benign and malignant non-mass lesions, and 3. Discuss a guide to approach for evaluating non-mass lesions on breast ultrasound.

#### TABLE OF CONTENTS/OUTLINE

1. Definition of non-mass lesion on breast ultrasound A. True non-mass lesion vs. Normal variants 2. Correlation between radiologic and pathologic findings of non-mass lesions on US A. Imaging features of non-mass lesions on US B. Pathologic features correlated with benign and malignant non-mass lesions 3. Approach for evaluating non-mass lesion on breast ultrasound

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-82

### The Cyst Bang Theory: When to Biopsy

#### TEACHING POINTS

1. Explain the epidemiology and pathogenesis of breast cyst. 2. Recognize the characteristics by image of breast cysts. The complex cyst is uncommon, but are suspicious of malignancy and merit biopsy. 3. Recognize criteria that will help identify a complex cyst. 4. Identify intraductal papillary nodule. Benign papillomas constitute 85% and 90%, intracystic papillary carcinomas 6% to 7%. 5. Points to help distinguish real from artifacts (echos) on ultrasonography images. 6. Recognize the most important differences in images between complicated and complex cyst. The true papillary nodules are anchored to the wall and do not move with the postural changes of the patient. 7. Analyze when to suspect malignancy in the breast cysts and categorize them based on the BIRADS.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology and pathogenesis 3. What are complex cysts 4. What should birads assign to a complex cyst 5. Review the spectrum of findings (mammography, us and contrast-enhanced mammography) 6. When to decide biopsy, a complex cyst 7. Let's practice (illustrative cases) 8. Conclusions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-83

### Solitary Dilated Duct in the Breast: A Multimodality Pictorial Review

#### TEACHING POINTS

Solitary dilated duct is associated with benign and malignant findings and the BI-RADS classification has varied over previous editions. Solitary dilated duct has characteristic imaging features on multiple modalities. Recognizing the imaging features, particularly if new, is important for management.

#### TABLE OF CONTENTS/OUTLINE

Background Review of solitary dilated duct and BIRADS classification. Pictorial Review: Cases illustrating benign and malignant lesions with multiple modalities. Case 1: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound. Pathology: Papilloma without atypia. Case 2: History: Presenting with breast pain. Imaging: Mammogram, ultrasound. Pathology: Invasive ductal carcinoma. Case 3: History: 60-year-old female presenting for screening mammogram. Imaging: Mammogram, ultrasound. Pathology: Papilloma without atypia. Case 4: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, MRI. Pathology: Papilloma with high-risk features. Case 5: History: Presenting for screening mammogram. Imaging: Mammogram, ultrasound. Pathology: Intraductal papilloma. Case 6: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, ductogram. Pathology: DCIS. Case 7: History: Presenting with bloody nipple discharge. Imaging: Mammogram, ultrasound, ductogram, MRI. Pathology: Multifocal DCIS with intraductal papillomatosis. Conclusion Review pearls for solitary dilated duct findings and management.

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## Abstract Archives of the RSNA, 2023

BREE-84

### MRI Detected Lesion in Women with a Personal History of Breast Cancer, and Then?

#### Participants

Ga-Eun Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Screening is still important for women with a history of breast cancer, because of high risk for future breast cancer. Breast MRI shows impressive resolution with high sensitivity, but specificity is relatively low.
- Second look ultrasound is a well-established approach for MRI detected lesions, and lesions found on subsequent ultrasound have a high probability of malignancy. However, second look ultrasound has limitations, such as operator dependence and the possibility of false negatives. Follow-up is required, and re-biopsy should be considered in case of image-pathology discordant.
- Correlation with mammography can sometimes be helpful. In particular, new or increasing calcifications can be objective evidence for lesion detection and confirmation of biopsy results.
- MR-guided biopsy must be considered in lesions with suspicious MRI features but occult on US or mammography.

#### TABLE OF CONTENTS/OUTLINE

<Representative cases of new enhancing lesion on breast MRI>• According to surgical method: op site after BCS, ipsilateral and contralateral breast after BCS, after mastectomy• According to detection modality: second look ultrasound (successful and missed), mammography, MR-guided biopsy for occult lesion• According to biopsy results: recurrence, false positive (benign), false negative (missed)

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## Abstract Archives of the RSNA, 2023

BREE-85

### 5 Years of False Negative Review from the Mammography Audit: Observations and Lessons Learned

#### Participants

Heather Garrett, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review of false negative (FN) cases can refine your mammography practice.-Sensitivity of mammography is limited in dense breasts.-BCT changes can make mammography difficult to interpret. ACR recommends annual screening MRI in patients with a prior history of BCT and dense breasts.-Screening MRI is more sensitive than mammography in the detection of breast cancer. High-risk patients should obtain annual mammography and annual screening MRI alternating at 6 month intervals.-Clinical symptoms (palpable breast lump, nipple discharge, skin changes and focal breast pain) should be evaluated using a multi-modality imaging approach.-BIRADS 3 cases are included in the FN review of diagnostic mammography. 0-2% of these cases may be cancers.

#### TABLE OF CONTENTS/OUTLINE

Background: False negative (FN) case review is mandated part of the annual mammography radiologist audit (MQSA/ACR). We are a large academic practice with dedicated breast imagers. We analyzed 135 FN cases from 5 years (2016-2020).Observations: -FN cases tended to be in patients with dense breasts, personal history of breast cancer, prior BCT, elevated life-time risk for breast cancer.-FN cases were mostly detected by presenting clinical symptom or screening MRI.-Some FN cases were women who had been given the assessment of BIRADS 3 in the diagnostic setting.Cases: 5-10 cases to illustrate teaching points.Lessons Learned: Overall, we found that there are many reasons for FN studies, the minority of which involved "missed cancers." Review of FN cases can refine your mammography practice.

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## Abstract Archives of the RSNA, 2023

BREE-86

### Don't Forget About the Nipple: Overview of the Anatomy and Different Lesions Involving the Nipple-areolar Complex

#### Participants

Maria Guerra, MD, Monterrey, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the normal anatomy and some anatomic variants of the nipple-areolar complex (NAC). To review imaging anatomy of the NAC by different techniques. To present a pictorial review of commonly known benign and malignant NAC lesions.

#### TABLE OF CONTENTS/OUTLINE

Anatomy of the nipple-areolar complex  
Retraction  
Inversion  
Imaging anatomy: mammogram, ultrasound, magnetic resonance  
Different lesions:  
Dermal lesions: nipple calcifications, Epidermal inclusion cyst  
Inflammatory lesions: duct ectasia, retroareolar cyst, periductal mastitis, abscess, Zuska disease  
Benign Tumors: Nipple adenoma  
Malignant tumors: papilloma, carcinoma, Paget's disease

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## Abstract Archives of the RSNA, 2023

BREE-87

### The Many Faces of Invasive Lobular Carcinoma

#### Participants

Miral Patel, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Invasive lobular carcinoma accounts for 5-15% of all breast cancers. 2. ILC is characterized by the lack of E-cadherin function, which explains the discohesive growth pattern and the subtle findings in imaging. 3. A review of radiologic and pathologic correlation of invasive lobular carcinoma and its morphologic variants can aid radiologists in recognizing patterns in the imaging presentation of invasive lobular carcinoma to facilitate early detection.

#### TABLE OF CONTENTS/OUTLINE

This educational exhibit reviews: 1- Basic review of invasive lobular carcinoma 2- Case based discussion of the radiologic presentation and pathologic correlation of the variants of invasive lobular carcinoma including classic, solid, signet ring cell, and pleomorphic 3- Pattern recognition in the presentation of invasive lobular carcinoma

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## Abstract Archives of the RSNA, 2023

BREE-88

### Breast Cancer Recurrence: Incidence and Imaging Appearance

#### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

#### TEACHING POINTS

Locoregional recurrence has been estimated to occur in 5-25% of breast cancer (BC) survivors, defined as the reappearance of the tumor at the surgical site or metastases in the regional lymph nodes. Even after mastectomy, there is a 2-10% reported lifetime risk of recurrence. Recurrence varies by molecular subtypes of BC, triple negative BC at 2-5 years after and other types at 5-15 years after treatment. Mammography remains the primary imaging modality for post-BCT surveillance. Breast MRI has the highest accuracy for differentiating post-surgical scar from recurrence. By the end of this educational exhibit, the learner will: 1. Learn the incidence, risk factors, and clinical presentation of breast cancer recurrence, 2. Review imaging recommendations for patients with a history of breast cancer and those with suspected breast cancer recurrence, 3. Recognize the common imaging appearance of recurrent breast cancer on multimodality imaging, 4. Distinguish the appearance of recurrent breast cancer from expected post-surgical changes and other differential diagnoses

#### TABLE OF CONTENTS/OUTLINE

Introduction; Incidence and definition of breast cancer recurrence; Expected recurrence rates based on molecular subtypes of BC; Clinical presentation of breast cancer recurrence; Review imaging recommendations for patients with a history of breast cancer; Review diagnostic workup for patients with suspected breast cancer recurrence; Differential considerations of in-breast recurrence and regional nodal recurrence; A pictorial review of multimodality imaging in BC recurrence; Clinical management of recurrent BC; Algorithm for imaging patients with suspected recurrence; Conclusion

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## Abstract Archives of the RSNA, 2023

BREE-89

### AI in Breast Imaging: Current Status and Future Directions

#### Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Artificial intelligence (AI) in breast imaging is being used for lesion classification, breast density and cancer risk assessment. In screening mammography setting, stand-alone sensitivity of commercially available AI system range 75-85% at radiologists' specificity of 49-79%. This indicates comparable results with radiologist performance (AUC, 0.84 vs 0.81, respectively).
- Beyond screening ,a deep learning model trained on uses mammograms and traditional risk factors showed superior performance in predicting 5 year breast cancer risk compared to the Tyrer-Cuzick model. (AUC, 0.70 vs 0.62,  $p < 0.001$ ).
- Model drift is a concept that describes degradation of AI model performance as the data it is used on changes. This raises concerns regarding the performance and reliability of AI models in real-life clinical settings.
- The FDA requires manufacturers of Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD) to be transparent and monitor the real-world performance of their products to ensure the algorithm meets the standards after deployment.
- In a recent Dutch patient survey most patients (77.8%) did not support stand-alone use of AI in screening interpretation. Furthermore, 41.7% opposed the idea of using AI to select cases for second reading and 17% objected to AI as a second reader.
- The reimbursement for breast imaging AI has not yet been established, and several proposed frameworks are currently under discussion.

#### TABLE OF CONTENTS/OUTLINE

Integrating AI Tools to Breast Imaging Workflow: Opportunities, Challenges and Potential Impact Patient Engagement Ethical and Regulatory Perspectives The Future of AI in Breast Imaging

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## Abstract Archives of the RSNA, 2023

BREE-9

### Navigating Mammary Ducts Pathologies and Anatomy: A Radiological Handbook

#### Participants

Giovanna Andreani, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The breast is an apocrine gland that contains different types of tissue: glandular, fibrous or connective, and fatty tissue. The glandular tissue is composed of mammary lobules and ducts, the latter being a tubular structure with the function of carrying the milk produced by the gland to the nipple. There are several pathologies and variations that can affect the mammary duct, ranging from benign alterations such as ductal ectasia or papilloma to even malignant ones (ductal carcinoma in situ or invasive ductal carcinoma, among others). Knowing that the majority of breast cancer arises from the ductal epithelium, it is crucial in the diagnosis and treatment of breast cancer by detecting intraductal lesions at an early stage. The objective of this study is to didactically review the anatomy and embryology of mammary ducts, as well as the main pathologies that affect this very important structure.

#### TABLE OF CONTENTS/OUTLINE

Review of the anatomy and discussion of the radiological findings in the mammary ducts, whether in their normal appearance or pathological changes through the different imaging methods obtained from the digital archive of our institution.

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## Abstract Archives of the RSNA, 2023

BREE-90

### Beyond the Norm: An Exploration of Extramammary Metastases to the Breast

#### Participants

Berat Bersu Ozcan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Metastases to the breast are rare, comprising 0.5-6.6% of all malignancies in the breast, and typically indicate widely disseminated disease and poor prognosis.
- Lymphoma (17-38.3%), melanoma (8.3-23.4%), lung (8-15%), gynecological carcinomas (8-12.8%), and sarcomas (2%-12%) are the most common primary tumors to metastasize to the breast.
- Imaging features can vary depending on the primary neoplasm and route of dissemination, hematogenous (more common) or lymphatic.
- Typically, metastases present as well-defined masses without calcifications or distortion on mammography and round hypoechoic masses on ultrasound. Hematogenous metastases present as solitary or multiple breast masses located in the skin, subcutaneous tissue, or the breast parenchyma.
- Breast findings should be characterized according to the BI-RADS lexicon and managed according to the most suspicious features. If metastatic disease to the breast is in the differential diagnosis based on patient history and/or clinical presentation, early confirmation of secondary involvement with pre-operative biopsy of breast lesions is crucial to direct appropriate management.
- Breast metastases can be highly vascular, and ultrasound technique should be optimized to not confuse with pseudoaneurysms or aneurysms, which could result in a delay of diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Literature review 2. Diagnostic algorithm 3. Key clinical and imaging features 4. The diagnostic and prognostic role of imaging modalities 5. Case demonstration and pathologic correlation

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## Abstract Archives of the RSNA, 2023

BREE-91

### Optimizing DWI for Improved Imaging in Breast Cancer and Beyond

#### Participants

Sheida Ebrahimi, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diffusion weighted imaging (DWI) is an advanced MRI technique that reflects water diffusion in tissues of interest and has been shown predicting pathologic response to neoadjuvant chemotherapy. It assists radiologists in better detecting and characterizing breast lesions. DWI can be challenging due to the breast morphology and introduction of artifacts. This exhibit reviews current state of DWI in breast cancer imaging including the physics of DWI, protocols utilized, advanced DWI techniques, and current indications. Strategies for optimizing DWI to improve image quality, diagnostic accuracy, and clinical utility will also be reviewed. At the end of this educational exhibit, learners will: 1. Recall the fundamentals of DWI and ADC Values; 2. Describe the correlation between ADC values and breast cancer prognostic factors; 3. Understand DWI challenges and limitations, and strategies for enhancing standard DWI; 4. Classify advanced DWI.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Overview of DWI and its importance in breast cancer; 2. Fundamentals of DWI: Explanation of water diffusion in tissues; ADC values and their significance in DWI; 3. ADC Values and prognostic factors in breast cancer; 4. Benefits and applications of DWI in breast cancer; 5. Quality control and factors influencing repeatability and reproducibility of ADC measure: Techniques to improve the quality of ADC measurements; 6. Comparison of DWI protocols: QIBA recommendations vs. our institute's approach; 7. Technical challenges and limitations of DWI: Techniques to Improve standard DWI; 8. Classification of advanced DWI: Overview of subtypes of advanced DWI, their differences, and advantages; 9. Conclusion.

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## Abstract Archives of the RSNA, 2023

BREE-92

### Swipe Left or Right? The Multimodality Imaging Detection and Assessment of the Solitary Dilated Duct

#### Participants

Tanya W. Moseley, MD, PhD, Houston, TX (*Presenter*) Consultant, Hologic, Inc; Consultant, Merit Medical Systems, Inc; Owner, TW Moseley, LLC; CEO, TW Moseley, LLC

#### TEACHING POINTS

- Review ductal anatomy and the epidemiology of ductal disease.
- Discuss imaging findings of benign and malignant ductal disease.
- Discuss the solitary dilated duct (SDD) and review the BI-RADS® 5th edition's recommendations for classifying and managing ductal lesions.
- Describe the role of imaging in the screening and diagnosing of ductal disease including mammography/tomosynthesis, ultrasound, magnetic resonance imaging, and galactography/ductography.
- Review methods and challenges specific to the sampling of ductal abnormalities.

#### TABLE OF CONTENTS/OUTLINE

-Introduction-Anatomy-Benign ductal findings-Malignant ductal findings-Solitary dilated duct (SDD) BI-RADS® 5th edition's recommendation-Imaging's role in screening and diagnosis and the correlation with prognosis-Imaging Techniques to evaluate the ductal anatomy and pathology-Methods to sample ductal abnormalities and tips to overcome the challenges that may be encountered-Conclusion

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## Abstract Archives of the RSNA, 2023

BREE-93

### Idiopathic Granulomatous Mastitis: A Case-Based Review

#### TEACHING POINTS

1. Idiopathic granulomatous mastitis (IGM) is estimated to affect 2.4/100,000 women, at median age of 36.5 years, and bilateral involvement in 8.8%. 2. Common symptoms are pain, erythema, palpable lump, and less frequently, fistulous drainage or nipple discharge. 3. The most common ultrasound findings are hypoechoic collection (75.9%) and skin involvement (53.5%). Mammography is often nonspecific, but common findings include focal asymmetry (51.6%), global asymmetry (18.3%), mass (17.2%), abnormal lymph nodes (8.6%). 4. IGM can mimic infectious mastitis or breast cancer on imaging and clinically. 5. Biopsy is usually required to confirm diagnosis and guide management. Often biopsy is necessary to exclude malignancy, especially inflammatory or triple-negative subtypes. Suspected IGM may be tentatively diagnosed by clinically assessing treatment response, but given overlap of imaging features and different treatment for IGM and infectious mastitis, biopsy is often needed. 6. Imaging findings often persist after resolution of clinical symptoms, thus clinical follow-up should be the mainstay for surveillance.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Typical imaging findings on mammography and ultrasound  
3. Other entities that mimic IGM  
4. Case-based review of biopsy-proven cases using key images with descriptions, treatment and clinical outcome data  
5. Biopsy and management considerations

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## Abstract Archives of the RSNA, 2023

BREE-94

### **Don't Be Fooled: Not Every Late-Onset Peri-Implant Effusion is Seroma! A Case-Based Review of Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL)**

#### **TEACHING POINTS**

We report the case of a female patient, with a history of mammoplasty six years ago, reporting sudden enlargement of the left breast. Imaging exams showed the presence of peri-implant fluid in the same breast, with the analysis of the fluid confirming the BIA-ALCL. Breast Implant-associated Anaplastic Large Cell Lymphoma (BIA-ALCL) is characterized by a late-onset peri-implant effusion, appearing on average 10 years after exposure to breast implants. The pathogenesis is not completely identified, but it is known that cases of BIA-ALCL are related to textured prostheses, with the surface of the prosthesis being the most important factor in inducing the disease. It may present only with the effusion (subtype of effusion) or associated with a peri-implant mass (mass-forming disease). The main associated symptoms are sudden edema secondary to the peri-implant effusion and, in case of mass-forming disease, the presence of a palpable nodule. Multiple imaging methods can be used in the evaluation of patients with suspected BIA-ALCL. However, diagnostic confirmation depends on the analysis of the fluid found. The diagnosis of BIA-ALCL is made with the characterization of morphologically atypical lymphocytes, with CD30 expression and negativity for ALK-1. The differential diagnosis of the effusion subtype is made with late seroma. Distant disease is rare, being a neoplasm with a high potential for cure, if identified in the early stages and when not associated with masses, with a surgical approach as a curative technique, in the case of the subtype of effusion.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction; Definition and Subtypes; Pathogenesis; Symptoms; Image Methods; Diagnosis; Differential diagnoses

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## Abstract Archives of the RSNA, 2023

BREE-95

### Cystic Breast Lesions- What to Do When It's Not Simple

#### Participants

Laura Harper, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Imaging features of benign and malignant cystic lesions may overlap, causing misclassification with the potential to produce diagnostic delay and harm. The purpose of this exhibit is to review ultrasound features of benign and malignant cystic breast masses to guide appropriate characterization and management. The Breast Imaging Reporting and Data System (BIRADS) assessment categories will be reviewed as it pertains to cystic breast masses, including review of appropriate utilization of the BIRADS-3 (probably benign) assessment category. Emphasis will be placed on recognizing suspicious imaging features warranting further evaluation with percutaneous biopsy. Teaching Points: 1. Examine imaging features of various cystic breast masses (Simple cysts, complicated cysts, and complex cystic and solid mass). 2. Discuss overlap of benign and malignant complex cystic and solid masses (ex: hematoma, abscess, cancer). 3. Review appropriate BI-RADS category assessment and management for various cystic lesions

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of the prevalence, clinical presentation and patient factors associated with cystic breast masses 2. Review distinguishing features and BI-RADS category assessments for various cystic masses 3. Multimodality (mammography, contrast-enhanced mammography, ultrasound, and magnetic resonance imaging) case-based review of benign and malignant cystic breast masses 4. Conclusion (summary of key educational points)

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## Abstract Archives of the RSNA, 2023

BREE-96

### **Patterns of Breast Cancer Recurrence in the Post-Mastectomy Breast with or without Reconstruction: A Case-Based Review**

#### **Participants**

Shannon Lanzo, MD, Stanford, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Women treated for breast cancer with mastectomy with or without reconstruction are at risk of developing loco-regional recurrence along the suture line or within residual tissue.2. Benign post-operative findings include edema, seroma, hematoma, fat necrosis, post-operative scarring and fibrosis, which evolve over time.3. Recurrence may be difficult to distinguish from these benign findings.4. Biopsy is warranted when imaging findings are equivocal.

#### **TABLE OF CONTENTS/OUTLINE**

1. This case-based exhibit will review the expected post-operative appearance post mastectomy without or with reconstruction using autologous tissue flaps (pedicled or free flap), and/or prosthetic implants.2. We will illustrate typical imaging features of benign post treatment changes (fat necrosis, fibrosis, edema, skin thickening, etc.) and malignant findings on mammogram, ultrasound, and MRI.3. We will review appropriate use of combined imaging and biopsy methods when imaging findings are equivocal.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-97

### Keep Calm, It's PASH

#### Participants

Daniela Martinez del Razo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In the daily practice of diagnostic imaging in breast cancer, we find various entities that can simulate malignant diseases and it is very interesting to know their spectrum of presentation in the different imaging modalities. There are few breast alterations that have a typical radiological characteristic, there are multiple benign and malignant pathologies with similar findings in which they overlap, for which it is essential that mastologists know and keep in mind the wide range of pathologies, to take advantage of all the tools at your fingertips and make correct diagnosis

#### TABLE OF CONTENTS/OUTLINE

I show various suspicious imaging findings that were shown to be pseudoangiomatous stromal hyperplasia by percutaneous or surgical biopsy

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-98

### Diagnostic Potential of Photon-Counting Detector Computed Tomography to Evaluate Breast Cancer Patients

#### Participants

Misugi Urano, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Photon-counting detector computed tomography (PCD-CT) has several advantages over energy-integrating computed tomography (EID-CT). It provides high spatial resolution and improves image contrast, resulting in precise visualization of soft tissue and microstructures while reducing radiation dose. In addition, a simultaneous multi-energy acquisition offers further qualitative and quantitative information in a single scan. These benefits make PCD-CT a valuable tool for systemic staging, preoperative planning, and post-treatment monitoring of breast cancer patients due to its ability to precisely depict the local extent of tumors and the presence of small lesions. This presentation will focus on PCD-CT in initial staging workup, treatment response assessment, or recurrences monitoring in breast cancer patients, comparing to EID-CT, other image modalities, and pathological results. We will also discuss the advantages and pitfalls of PCD-CT.

#### TABLE OF CONTENTS/OUTLINE

1. Current CT recommendation for breast cancer patients in guidelines
2. The potential of PCD-CT for breast cancer workup
3. Case-based review of PCD-CT in breast cancer patients compared to EID-CT, other image modalities, and pathological results.
4. Discussion of the utilities of PCD-CT for breast cancer patients, including advantages, disadvantages, and pitfalls.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

BREE-99

### Breast Ultrasound Tomography: The Essentials for the Breast Radiologist

#### Participants

Yu Zhao, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit will review the essentials of breast ultrasound tomography. 1. Understand basic concepts of breast ultrasound tomography including essential physics, the basic imaging sequences, and keys to imaging interpretation. 2. Describe the advantages of breast ultrasound tomography for evaluation of the breasts, especially in those with dense breasts. 3. Describe the specific imaging appearance on ultrasound tomography of various breast entities, benign and malignant. 4. Discuss the future practice considerations and limitations of ultrasound tomography.

#### TABLE OF CONTENTS/OUTLINE

-This educational exhibit reviews the essentials of breast ultrasound tomography for the breast radiologist. This is a new imaging modality with enormous potential to add new value to breast imaging by improving diagnostic accuracy especially in patients with dense breasts. -We will describe in simple terms the physics of breast ultrasound tomography and the basic imaging sequences including Waveform Enhanced Reflection (Wafer), Reflection, Sound Speed, and Stiffness Fusion sequences in a breast ultrasound tomographic examination. -We will review with illustrative case examples of high-yield breast lesions including cysts, fibroadenomas, and cancers comparing the distinctive imaging appearance on ultrasound tomography versus other breast imaging modalities. -This will be followed by a discussion of the specific advantages of ultrasound tomography relative to other imaging modalities, such as improved lesion localization and lesion characterization. Finally, we will present the limitations of ultrasound tomography and general considerations for future practice.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE

### Cardiac Imaging Education Exhibits

#### Sub-Events

**CAEE-1 Is It Possible to Assess Left Atrial Remodeling Using Deep Learning? An Attempt to Classify Atrial Fibrillation Types Using Contrast-Enhanced CT Images.**

#### TEACHING POINTS

Catheter ablation therapy is one of the curative treatments for atrial fibrillation (AF). It is generally known that the recurrence rate after treatment increases as attacks persist, and the factor is related to structural remodeling of the left atrium. However, standard evaluation is difficult, and the indication for catheter ablation therapy is currently determined by the surgeon's empirical judgment and the duration of disease obtained from the patient's self-report. Therefore, this study demonstrates the possibility of assessing remodeling of the left atrium from the results of the visualization of the classification basis of the two models. The major teaching points of this exhibit are 1. Evaluation of AF types using contrast-enhanced CT imaging is difficult only for experienced physicians 2. Deep learning enables evaluation of the left atrium using features such as the structure of the left atrium and pulmonary veins obtained from images. 3. Evaluation of structural remodeling of the left atrium may be useful for AF types

#### TABLE OF CONTENTS/OUTLINE

1. About Atrial Fibrillation -Classification of Atrial Fibrillation Types -Structural remodeling of the left atrium 2. Treatment options for Atrial Fibrillation -Relationship between seizure duration and treatment outcome 3. Results of experiments -How well did you recognize the shape of the left atrium?

**CAEE-10 Seeing Beyond the Surface: A Radiological Exploration of Pacemakers, CRT, and ICDs**

#### TEACHING POINTS

- Review the relevant cardiac anatomy, the different types of devices (pacemakers, CRT, and ICDs), and the positioning and integrity of the different elements of the devices.
- Understand the importance of X-ray imaging in the diagnosis and follow-up of patients with pacemakers, CRT, and ICDs.
- Identify the normal and abnormal X-ray findings for these devices, including lead placement, device positioning, and associated complications.
- Understand how X-ray imaging is used to evaluate the function of pacemakers, CRT, and ICDs, including pacing and electrical leads, and common X-ray findings associated with device malfunction.
- Recognize the potential limitations associated with X-ray imaging of these devices and the troubleshooting strategies for addressing those limitations.

1. Introduction 2. Overview of cardiac devices (pacemakers, CRT, and ICDs) 3. Anatomy and positioning of cardiac devices 4. Importance of X-ray imaging in diagnosis and follow-up 5. Differentiating between pacemakers, CRT, and ICDs on chest radiography 6. Normal and abnormal X-ray findings for pacemakers, CRT, and ICDs a. Device type and differences. b. Device positioning c. Internal elements d. Lead placement e. Lead integrity f. Associated complications 7. Troubleshooting strategies for technical limitations of X-ray 8. Take home points

**CAEE-11 AI-Assisted Autonomous Aortic Aneurysm Analysis - Status, Strengths, Slants, and Stresses: Ut Nos Ibi Nunc?**

Participants

Roshan Fahimi, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The exhibit will help the audience understand the following aspects of multiple AI algorithms pertaining to triage, measurement, detection, and report creation for aortic aneurysm and dissection. 1. Aortic evaluation with CT: Intentional and incidental 2. Scientific evidence for aortic evaluation with AI 3. Multi-vendor AI for aortic evaluation 4. Status, strengths, slants, and stresses of AI models

#### TABLE OF CONTENTS/OUTLINE

We use our multi-vendor AI experience to organize and present the exhibit content into following brackets: 1. Aortic Diseases: Incidence, importance, and imaging 2. AI for aortic aneurysm and dissection: Evidence in literature 3. Approach of multiple AI algorithms in aortic aneurysm and dissection 4. Screening and AI-based new metrics for aorta 5. Status, weaknesses, and stresses of AI algorithms 6. Autonomy for AI-assisted analysis: Should we be there now?

**CAEE-12 Boost Your Imaging Skills and Help Your Interventional Cardiologists Before and After Left Atrial Appendage Occlusion**

Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize radiologists with available LAAO devices and their clinical applications. Review the required pre-procedural measurements for LAAO. Educate radiologists with post LAAO complications and ideal imaging techniques for their detection. Review spectrum of

normal post procedural findings that should be differentiated from complications.

#### TABLE OF CONTENTS/OUTLINE

1. Review the different LAAO devices (Watchman, Watchman FLX, Amulet, and Lariat), their unique features, and patient selection criteria. 2. Recognize the importance of preprocedural Image based planning in guiding device selection and placement. 3. Pictorial review of LAAO complications A) peri-device leak B) off-axis placement, and C) device-related thrombosis. 4. Review of the clinical importance of post procedural complications with focus on the role of imaging. 5. Review of the management of device-related complications with emphasis on the role of imaging. 6. Comparison between CT and other imaging modalities (Echocardiography and MRI) for LAAO planning and surveillance.

#### CAEE-13 Fibromuscular Dysplasia: a Multifaceted Vascular Disease

Participants

Frances Ferreira De Deus, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Provide an overview of the pathophysiology and clinical manifestations of fibromuscular dysplasia (FMD). less prevalent, but more commonly underdiagnosed as related to this pathology. - To describe the role of imaging in the diagnosis and prevention of complications.

#### TABLE OF CONTENTS/OUTLINE

Fibromuscular dysplasia (FMD) is a non-inflammatory, non-atherosclerotic, idiopathic arterial disease that primarily affects Caucasian women and medium-sized vessels. The classic finding is the beaded appearance and tortuosity of the affected vessel. However, FMD also predisposes to aneurysm formation, dissection, and stenosis, which are not always suspected to be related to FMD by the imaging community. We describe and illustrate with schematic figures and cases the main sites of vessel involvement, the variable radiological findings and the complications related to the disease. The most affected sites are the renal and cerebrovascular arteries, although the aorta and other arteries may also be involved. FMD can predispose to important complications, such as stroke, myocardial or renal infarction, aneurysm rupture and progressive dissection. FMD is often a subclinical and underdiagnosed arteriopathy with catastrophic complications. The radiological community should be familiar with the different phenotypic appearances. Invasive angiography and non-invasive vascular imaging by CT and MRI play an important role in the diagnosis and prevention of complications.

#### CAEE-14 How to Distinguish Chronic Total Occlusion From Subtotal Occlusion by Distal Transluminal Attenuation Gradient in Coronary CT Angiography

#### TEACHING POINTS

Understand how to calculate distal transmural attenuation gradient (TAG<sub>distal</sub>) in coronary CT angiography (CCTA) and TAG<sub>distal</sub> can be used to distinguish chronic total occlusion (CTO) from subtotal occlusion (STO).

#### TABLE OF CONTENTS/OUTLINE

1. CTO and STO Chronic total occlusion (CTO) is a complete interruption of coronary arterial flow caused by plaque obstructing arterial lumen. Subtotal occlusion (STO) is a "functional" total occlusion and slow blood flow passes through the occluded segment. Percutaneous coronary intervention is attempted less frequently for CTO lesions and has a higher unsuccessful rate and late restenosis compared with STO lesions. 2. TAG<sub>distal</sub> TAG: linear regression coefficient between intraluminal radiological attenuations and vessel length. May be calculated manually or automatically by artificial intelligence post-processing technology TAG<sub>distal</sub>: calculated from distal to occlusion. 3. Distinguish CTO from STO by TAG<sub>distal</sub> Coronary arteries with CTO showed higher TAG<sub>distal</sub> compared with arteries with STO. TAG<sub>distal</sub> has higher accuracy in differentiating CTO from STO. 4. Improve the diagnostic efficiency of CCTA Radiologists routinely diagnose CTO and STO through CCTA, and TAG combined with CCTA can improve the diagnostic efficiency 5. Clinical Application AI-enabled TAG measurements may be used to assist radiologists to differentiate STO from CTO with moderate diagnostic accuracy, improving diagnostic workflow.

#### CAEE-15 How to Distinguish Chronic Total Occlusion from Subtotal Occlusion by Transluminal Attenuation Gradient in Coronary CT Angiography

#### TEACHING POINTS

Understand how to calculate transmural attenuation gradient (TAG) in coronary CT angiography (CCTA) and TAG can be used to distinguish chronic total occlusion (CTO) from subtotal occlusion (STO).

#### TABLE OF CONTENTS/OUTLINE

1. CTO and STO Chronic total occlusion (CTO) is a complete interruption of coronary arterial flow caused by plaque obstructing arterial lumen. Subtotal occlusion (STO) is a "functional" total occlusion and slow blood flow passes through the occluded segment. Percutaneous coronary intervention is attempted less frequently for CTO lesions and has a higher unsuccessful rate and late restenosis compared with STO lesions. 2. TAG TAG: linear regression coefficient between intraluminal radiological attenuations and vessel length. May be calculated manually or automatically by artificial intelligence post-processing technology TAG<sub>all</sub>: calculated from ostium to distal vessel TAG<sub>distal</sub>: calculated from distal to occlusion. 3. Distinguish CTO from STO by TAG<sub>all</sub> and TAG<sub>distal</sub> Coronary arteries with CTO showed lower TAG<sub>all</sub> and higher TAG<sub>distal</sub> compared with arteries with STO. TAG<sub>distal</sub> has higher accuracy in differentiating CTO from STO. 4. Improve the diagnostic efficiency of CCTA Radiologists routinely diagnose CTO and STO through CCTA, and TAG combined with CCTA can improve the diagnostic efficiency 5. Clinical Application AI-enabled TAG measurements may be used to assist radiologists to differentiate STO from CTO with moderate diagnostic accuracy, improving diagnostic workflow.

#### CAEE-16 Calcium in the Heart: A Guide to Interpret Like an Expert

Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Reviewing various calcified cardiac lesions, including calcification of the pericardium, vascular structures, myocardium, valves,

and valve annuli.2- Reviewing the morphology, location, and extent of calcification, which are often pathognomonic features that aid in identifying each type of calcified lesion as well as conditions associated with them.3- Exploring the clinical significance of various calcified lesions and outlining a structured clinical approach for their management.4- Discussing differential diagnosis of cardiac calcification and evaluation of their etiologies

#### TABLE OF CONTENTS/OUTLINE

1- Introduction to a systematic evaluation of calcified cardiac lesions2- Identifying:A) Pathognomonic features of pericardial calcifications and considering their underlying causesB) Pathognomonic features of valvular and annular calcifications based on underlying causesC) Myocardial calcifications associated with tumors (such as endothelioma and rhabdomyoma), trauma, or infarction.D) Papillary muscle calcification.E) Left atrial calcifications related to atrial fibrillation, congestive heart failure, and endocarditis.F) Intracavitary calcifications in the atria and ventricles.

#### CAEE-17 Medical Terminology in Cardiothoracic Radiology

##### TEACHING POINTS

Medical terminology includes words and phrases aiming to accurately describe anatomical structures, processes, conditions, medical procedures, and treatments. In cardiothoracic radiology, there is a plethora of words originating from Greek and they may be misused and misspelled in everyday practice. To aid colleagues in fluent and effective use of these terms, we have derived a radiologically illustrated glossary of the most frequent terms, their definitions and explanations of their origin and meaning. Typically, medical terms stemming from Greek adhere to a fixed structure of a prefix, a root, and a suffix. The prefix appears at the beginning of a medical term and usually indicates a location, direction, type, quality, or quantity. The root gives a term its essential meaning whereas the suffix appears at the end of a term and may indicate a specialty, test, procedure, function, disorder, or status.

#### TABLE OF CONTENTS/OUTLINE

In a comprehensive and schematic way, words are presented alphabetically divided in two sections: anatomy and pathology and illustrated with representative radiology images, relevant findings and key imaging references. For each word the correct orthography is demonstrated along with a brief review of its history and etymology.

#### CAEE-18 The One Ring to Rule Them Out: Deciphering Differential Diagnosis of Left Ventricular Ring-Like Late Gadolinium Enhancement

##### TEACHING POINTS

Despite being initially described as a diagnostic marker for arrhythmogenic cardiomyopathy (ACM), ring-like LGE has been increasingly reported in non-genetic heart diseaseRing-like LGE secondary to ACM may be accompanied by inverted T-waves in left precordial leads, ventricular arrhythmia with left bundle branch block morphology, and family history of premature sudden deathRing-like LGE secondary to Chagas disease may be accompanied by residency in south america, positive serology, right bundle branch block and left anterior fascicular block, and apical aneurysmRing-like LGE secondary to viral myocarditis may be accompanied by prodromal manifestations (e.g fever, flu-like symptoms and diarrhea), and myocardial edemaRing-like LGE secondary to Keshan disease may be accompanied by residency in China, disabsortive syndrome, and selenium deficiencyRing-like LGE secondary to sarcoidosis may be accompanied by extracardiac findings, right bundle branch block, 2nd- and 3rd-degree heart block, and right ventricular free wall LGE

#### TABLE OF CONTENTS/OUTLINE

Introduction: definition of left ventricular ring-like LGE, clinical significance, and objectivesDifferential diagnosis between genetic causes: left-dominant CMADifferential diagnosis between endemic causes: Chagas disease, and Keshan diseaseDifferential diagnosis between inflammatory causes: viral myocarditis, sarcoidosis, and heart transplant rejectionDifferential diagnosis between causes of non-ring-like circumferential LGE: myocardial infarction, amyloidosis, and dystrophin cardiomyopathiesDiscussion: table with distinctive features of ring-like LGE differential diagnosis

#### CAEE-19 Understanding Transesophageal Echocardiography: A Radiologist's Guide

##### TEACHING POINTS

TEACHING POINTS1. To understand the complimentary role of transesophageal echocardiography in multi-modality cardiac imaging including indications, contra-indications and potential complications.2. To have an understanding of the standard trans-esophageal examination3. Using cross modality reference be able to identify specific pathologies on TEE, CT and MRI.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE1. Introduction: Overview of the role of TEE in multimodality cardiac imaging including indications, contraindications, and complications.2. The standard transesophageal examination with cross modality reference with CT and MRI3. Specific roles of TEE in acute aortic syndromes, cardiac source of emboli, infective endocarditis and valvular assessment. Pathological appearances on TEE with cross modality reference.4. Summary.

#### CAEE-2 Role of Cardiac MRI in the Follow Up of Postoperative Congenital Heart Disease

Participants  
Harold Goerne, MD, Guadalajara, Mexico (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To review congenital heart diseases that require imaging follow up after surgical or endovascular repair. To discuss the role of cardiac MRI in the evaluation of postoperative findings in CHD repair. To demonstrate the importance of follow up imaging for detection of postoperative complications.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Congenital heart diseases - Clinical features; embryology; pathophysiology; treatment 3) Advantages and disadvantages of imaging modalities- Echo, CT, MRI. 4) MRI 5) Discussion, illustration with case examples of postoperative findings in repaired congenital heart diseases a) TOF: 1) Total repair (Pulmonary valve regurgitation, RV dilatation, RVOT wall fibrosis/aneurysms) b) TGA: 1) Jatene / Atrial switch (stenosis, thrombosis) 2) Banding (stenosis) c) DORV 1) Jatene (coronary

ostia stenosis, PA stenosis) 2) MBT 3) Rastelli (leaking, regurgitation) 6) Discussion, illustration with case examples of postoperative complications in the repair of congenital heart diseases. I. Pulmonary valve insufficiency II. Aneurysmal dilatation of patch III. Myocardial dysfunction (Structural alterations, hypertrophy and remodeling) IV. Right ventricular dysfunction

## **CAEE-20 Multimodality Imaging of the Pericardium**

Participants

Nilo Fernandes Leca Junior, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To discuss the strengths and limitations of different imaging techniques in the exploration of the pericardium. To highlight the radiological aspects of the normal pericardium and the spectrum of pathological entities such as developmental anomalies, inflammation/infection, effusion, neoplasms, iatrogenic conditions and pericardial constriction.

### **TABLE OF CONTENTS/OUTLINE**

Pericardial diseases are conditions that involve the membrane that surrounds the heart. Imaging plays a pivotal role in the assessment, which is performed by multiple non-invasive methods such as x-ray, echocardiography, CT and MRI. Echo remains as the first modality in most clinical scenarios. The most common conditions involving the pericardium are inflammation, effusions and constriction. Pericarditis is classified by symptom duration and by etiology (infection, idiopathic, neoplastic, drug related, iatrogenic and autoimmune). Pericardial constriction is a rare complication. Pericardial effusion is related to varying degrees of abnormal fluid accumulation into the pericardial space, and can evolve to tamponade. Primary and secondary masses are commonly accessed by CT and MRI. Secondary involvement is far more common than primary pericardial tumors. Congenital anomalies are relatively uncommon entities and may range from pericardial cysts to partial or total agenesis. Cardiovascular imaging plays an important role on the management of pericardial pathologies, which should be promptly recognized to help guide timely treatment.

## **CAEE-21 Utility of CT Coronary Angiography in Septal Vascular Mapping Prior to Alcohol Ablation in Hypertrophic Obstructive Cardiomyopathy**

### **TEACHING POINTS**

1. Alcohol septal ablation (ASA), an established treatment in hypertrophic obstructive cardiomyopathy (HOCM), iatrogenically induces an infarct of the target basal septum- the site of contact of mitral valve leaflet on the septum during systolic anterior motion (SAM). 2. Invasive angiography provides information about the course and size of coronary arteries but not their territorial distribution. Inaccurate infarct localisation due to alcohol injection into right ventricular side of septum and inability to identify the target vessel on invasive angiography leads to failure of ASA. 3. Computed tomography (CT) angiography has the dual benefit of detailing vascular anatomy and providing information on myocardial distribution. Mapping the septal vascular anatomy with CT coronary angiography prior to ASA improves localisation of infarct with predictable outcome and procedural success at the first attempt compared to traditional methods. The authors describe a new 5-step method of creating a CT navigational map for planning selective sub-branch micro-catheterisation.

### **TABLE OF CONTENTS/OUTLINE**

1. Mechanism and principle of ASA. 2. CT angiography protocol and 5-step mapping technique of the target basal septal vasculature. 3. Checklist of CT reporting points including the distance and angulation of the septal arteries. 4. Illustration of variant CT septal vascular anatomy. 5. Causes and demonstration of failed procedures in pre-CT traditional ASA. 6. Clinical utility of CT-guided ASA in terms of symptomatic, functional and haemodynamic improvement.

## **CAEE-22 Gray Blood and Applications**

Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purpose of this exhibition is: Review the concept and indications of the gray blood myocardial delayed enhancement (MDE) technique? Highlight the ease of execution and applicability of the method? Understand the benefits of applying gray blood in the investigation of myocardial fibrosis? Identify the radiological findings that will help in the diagnosis as well as pitfalls of this technique

### **TABLE OF CONTENTS/OUTLINE**

Gray blood is a sequence in cardiac magnetic resonance imaging (CMR) obtained by partial blood signal suppression that increases the ability to identify and localize myocardial scarring near the cavity. A pictorial essay based on cases from our collection allows for a comprehensive assessment and understanding: ? Grayblood MDE technique with a tutorial video? Main indications of grayblood MDE images? Grayblood MDE radiological findings in cases of subendocardial enhancement and papillary muscles? Grayblood MDE radiological findings in cases of post-cardiac transplantation, cardiac tumor, myocarditis and hypertrophic cardiomyopathy? Cases in which grayblood MDE did not help in the diagnosis

## **CAEE-23 Imaging of the Ductus Arteriosus**

Participants

Kaustav Bera, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. 1. To know the embryology, physiology and modalities for evaluation of the ductus arteriosus 2. 2. To learn about the pathologies of the ductus going beyond patent ductus arteriosus 3. To review the clinical and imaging findings of the above-mentioned entities with case examples

### **TABLE OF CONTENTS/OUTLINE**

1. Embryologic development of ductus arteriosus 2. Physiological significance of ductus arteriosus 3. Modalities for evaluation of pathologies of ductus arteriosus : USG, CT, MR, Invasive angiogram 4. Pathologies of Ductus: - Normal variants - Congenital/developmental o PDA § Risk factors and pathophysiology § Classification § Causes § Maintaining patency post birth for



some Congenital Heart diseases § Closure of PDA o Aneurysm of DA o Congenital vascular ring o Significance in Coarctation of aorta ( Preductal versus post ductal) - Post traumatic o Mechanism of and incidence of ductal injury o Minimal aortic injury (MAI) o Ductal Pseudoaneurysm o Penetrating ulcer o Aortic dissection - Miscellaneous o Infective aortitis associated with the nonpatent remnant of a ductus arteriosus o Atherosclerotic penetrating ulcer/ pseudoaneurysm of aortic ductus. 5. Differential diagnosis/mimics: - Aortic spindle mimicking aortic ductus pseudoaneurysm/MAI - Type III ductal diverticulum mimicking Aortic ductus pseudoaneurysm - Infundibula of the aortic branch vessels mimicking Aortic ductus pseudoaneurysm - Technical mimics of MAI :Breathing, arterial pulsation and other motion artefacts, streaming/streaking of contrast mimic minimal aortic injuries) - Anatomical mimics of MAI : Noncalcified and partially calcified atheroma

#### **CAEE-24 The Space Between: A Roadmap to Cardiac Recesses Grooves**

Participants

Katherine Cheng, MD, Stamford, CT (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The recesses, grooves, and potential spaces around the heart are defined by the vasculature and supporting fibrous structures; these areas can easily be overlooked by the radiologist. Changes in configuration and appearance of these spaces can occur with pathological processes and can be more readily identified using a standard search pattern. A structured search pattern using a vascular and fibro-skeletal based review can help the radiologist identify and differentiate pathology from normal spaces and structures.

##### **TABLE OF CONTENTS/OUTLINE**

1. Review the normal anatomy of the heart including the recesses and grooves as well as the supporting vascular and fibro-skeleton of the heart. 2. Illustrate the common pathology that can occur in these spaces including thrombus, tumor, abscesses, and pseudoaneurysm. 3. Highlight the importance of variant and abnormal processes in these spaces and the impact on medical and surgical management.

#### **CAEE-25 The Role of Imaging in Cardio-Oncology: Detecting, Preventing, and Managing Cardiovascular Disease in Cancer Patients and Survivors**

Participants

Osamu Manabe, MD, PhD, Saitama-Shi, Japan (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Cardio-oncology is a new specialty that focuses on detecting, preventing, treating, and following up on cardiovascular disease (CVD) in cancer patients and survivors. Cancer and CVD share many risk factors, such as aging, smoking, diabetes mellitus, and genetic predisposition. Furthermore, some cancer treatments have negative effects on the cardiovascular system, leading to an increased burden of cardiac complications in survivors. Cardio-oncology aims to minimize cardiovascular complications in patients with cancer and requires close collaboration between oncologists, cardiologists, and radiologists. In this presentation, we will discuss the usefulness of various imaging modalities in the field of cardio-oncology, taking into account the latest technology available.

##### **TABLE OF CONTENTS/OUTLINE**

Cardio-oncology is a new multidisciplinary field to institute appropriate surveillance, treatment, and follow-up strategies for CVD in patients with cancer (Fig.1). Imaging modalities such as MRI (Fig.2), CT (Fig.3), and nuclear medicine including PET (Fig.4) play a crucial role in diagnosing and monitoring CVD in cancer patients. These non-invasive methods can be used to assess cardiac function, tissue characteristics, metabolic activity, and also tumor size and extent. Using novel imaging technologies is essential for early detection, treatment, risk stratification, and survivorship in cardio-oncology (Fig 5).

#### **CAEE-26 Whole-body Assessment of Vasculitis and Its Complications Using CT, FDG-PET, and MRI**

Participants

Noriko Oyama-Manabe, MD, PhD, Saitama City, Japan (*Presenter*) Grant, DAIICHI SANKYO Group; Grant, Bayer AG; Grant, Eisai Co, Ltd; Grant, Canon Medical Systems Corporation

##### **TEACHING POINTS**

1. Overview of the etiology, pathophysiology, clinical presentation, diagnostic criteria, and therapeutic approaches for primary and secondary vasculitis 2. To compare image characteristics of specific vasculitis and its complications with CT, MRI and FDG-PET/CT 3. To describe the role of multimodality imaging in the quantitative evaluation of inflammation for the initial diagnosis and during follow-up after treatment

##### **TABLE OF CONTENTS/OUTLINE**

Vasculitis manifests in various clinical presentations, morphologies, and prognoses, requiring a multimodal imaging approach. Radiologists can aid in the accurate diagnosis of vasculitis and its complications, treatment planning, and patient care with multimodality imaging. In this presentation, we will cover both primary and secondary vasculitis, which can be caused by various factors, including infections and drug-induced reactions. Knowledge of systemic clinical manifestations in affected patients may help establish a specific diagnosis. 1. To review the clinical features and imaging findings of the different types of vasculitis including those that primarily involve large, medium-sized, or small vessels. 2. Tips for scanning with adequate timing and reconstruction for various complications due to infectious vasculitis including secondary to TEVAR and EVAR. 3. To describe the role of these imaging modalities in the quantitative evaluation of inflammation for the initial diagnosis and during follow-up after treatment, with an emphasis on monitoring therapeutic response using quantitative parameters.

#### **CAEE-27 Unveiling Cardiac Intracavitary 4D flow MRI**

Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Reliable analysis of intracardiac flow provides important insight for the interpretation and management of cardiovascular diseases.

Recently, non-invasive evaluation of intracardiac hemodynamics by 4D flow CMR constitute a reliable, robust, and reproducible method for the analysis of flow patterns in valvular diseases, cardiomyopathies, or congenital heart diseases (CHD). Furthermore, in virtue of its multidimensional/multidirectional capabilities it allows to calculate common (flow, velocities, and volumes) and advanced (kinetic energy and turbulent kinetic energy, vortical flow imaging and particle tracing) intracardiac chamber flow hemodynamic parameters. Recently, some of them have been shown to have important prognostic implications. Teaching points 1. To describe the physical basis of 4D flow, the main acquisition process, optimization techniques and advanced post-processing methods 2. To analyze the current and potential clinical applications of intracavitary 4D flow in cardiac imaging.

#### TABLE OF CONTENTS/OUTLINE

1. 4D flow physical basis 2. 4D flow acquisition technique and protocol 3. Conventional intracavitary flow analysis 4. Advanced intracavitary 4D flow analysis - Kinetic Energy and Turbulent Kinetic Energy - Viscous energy loss - Vortical Flow Imaging - Particle tracing 5. Current and potential clinical applications intracavitary 4D flow - Dilated cardiomyopathy - Ischemic heart disease - Atrial fibrillation and heart failure - Valvular heart disease - Hypertrophic cardiomyopathy - Congenital heart diseases 6. Intracavitary 4D flow prognostic biomarkers: Ready to primetime? 7. Take home points

#### CAEE-28 CT Imaging in Ischemic Heart Disease and Complications

Participants

Takashi Norikane, MD, PhD, Kita-gun, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac imaging plays a pivotal role in the diagnosis of ischemic heart disease. Echocardiogram, coronary angiography, nuclear medicine imaging and magnetic resonance imaging are common imaging modalities. However, conventional CT can provide important information about ischemic heart disease and complications. This presentation introduces the basic approaches of CT in ischemic heart disease and complications and follows with an overview of normal heart and coronary anatomy and frequently encountered pathologic conditions.

#### TABLE OF CONTENTS/OUTLINE

Normal anatomy Coronary artery and territories Heart chambers Pericardium Myocardial infarction Atherosclerosis, Air embolism, Coronary artery anomaly, IgG4-related disease, Aortic dissection, thromboembolism due to essential thrombocythemia, Diaphragmatic hernia (post CABG), Post aortic valve replacement Complications Myocardial rupture, ventricular septal rupture, Dressler's syndrome, Ventricular aneurysm, Calcification Myocardial persistent enhancement after percutaneous coronary intervention Differential diagnosis Myocarditis, Takotsubo-myocardiopathy

#### CAEE-29 Unravelling the Mitral Valve on CT

Participants

Vidushi Gupta JR, MD, MBBS, Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Assessment of normal valvular morphology and basic physiology of mitral valve on MDCT 2. Discuss the pearls and pitfalls relevant to planning, acquisition and interpretation of cardiac CT images 3. Enumerate various structural and functional abnormalities 4. Describe the role of CT in pre and post-procedural imaging in patients with TMVR (Transcatheter mitral valve replacement).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. ECG placement with proper planning and acquisition protocol 3. Pearls and pitfalls 4. Post processing 5. Normal mitral valvular anatomy and function 6. Assessing Structural abnormalities 7. Assessing Functional abnormalities 8. Role of CT in pre and post procedural imaging in TMVR 9. Take home message

#### CAEE-3 Robotic and Minimally Invasive Mitral Valve Surgery: Radiological Assessment and Surgery Correlation

#### TEACHING POINTS

1. Robotic and minimally invasive mitral valve surgery is a safe and less traumatic surgical approach compared to the open cardiac surgery. Besides, it can be regarded as a widely accepted technique given the volume of publications from numerous institutions. 2. Multimodality imaging assessment conducted before to surgery are essential for selecting appropriate patients, anatomical evaluation, surgical planning, and optimal patient outcomes. 3. Radiologists can assist in patient treatment by being knowledgeable about the variety of anticipated postoperative findings and potential complications following robotic and minimally invasive mitral valve surgery.

#### TABLE OF CONTENTS/OUTLINE

A. Overview of surgical techniques: Ministernotomy, minithoracotomy, robotically assisted B. Indications and contraindications C. CT angiography for pre-operative assessment 1. Scan protocol and postprocessing technique 2. Preoperative checklist 1) Aorta and iliofemoral arteries 2) Evaluation of lung, pleural plaques 3) Chest wall, diaphragm 4) Pericardium, mediastinum 5) Aorta diameter, pulmonary artery diameter, ascending aortic calcification 6) Mitral valve geometry, calcification 7) Central veins (vena cavae, coronary sinus) 8) Coronary arteries D. Procedural considerations E. Case examples F. Postoperative assessment G. Conclusion

#### CAEE-30 Need for Speed: Fast MRI in Cardiac Imaging

Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac MRI has become versatile technique for normal and diseased heart. However this results in complex and slow CMR examinations, raising the perception of CMR as a high-cost imaging method. Therefore, a more rationale and question-driven protocols are increasing acceptance in order to reduce the amount of acquisition time, increase patient acceptance and clinical value of this well-known game-changer imaging method. Teaching points 1. To describe the current technical advances, drawbacks, tips and tricks available for providing fast MRI protocols in clinical practice. 2. To detail the different proposals

described in the literature for optimizing CMR protocols (fast MRI) in a "question - driven" scenario and with a "building - blocks" strategy.

#### TABLE OF CONTENTS/OUTLINE

1. Fast MRI concept and rationale 2. Conventional CMR protocoling problems: Knowing what I need to fix. 3. Fast MRI strategies in cardiac imaging • 3.1. Cine SSFP o Free - breathing EKG gated cine SSFP o Post-contrast cine SSFP o Sparse acquisition cine SSFP o Deep Learning (DL) cine SSFP o 3D cine SSFP • 3.2 Tissue characterization/parametric mapping o Single-Shot black blood imaging o DL acquisition and reconstruction o 3D single parameter mapping o Accelerated T1 T2 mapping • 3.3. 4D flow imaging o 4D flow EPI o Accelerated 4D flow • 3.4. MR angiography o Compressed sensing o Other strategies o Non - contrast MRA • 3.5. Late Gadolinium Enhancement o Free breathing single-shot LGE o Breathold 3D LGE o 3D PSIR LGE o DL LGE 5. Fast CMR protocols in the clinical practice: The "building - blocks" strategy - Ischemic heart disease - Non-ischemic heart disease - Valvular heart disease - Arrhythmogenic cardiomyopathy - Congenital heart disease 6. Take home points

#### CAEE-31 Pulmonary Vein Anomalies Made Easy

Participants

Juliana Da Silveira, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To overview the embryology and normal anatomy of the pulmonary veins. To discuss the spectrum of anomalous pulmonary venous connections (APVCs). To describe and illustrate with schematic figures and cases the types of APVCs. To discuss the importance of the diagnosis to allow timely treatment and a better prognosis.

#### TABLE OF CONTENTS/OUTLINE

The normal PV anatomy consists of four PVs, which drain oxygenated blood from the lungs to the left atrium (LA). The LA and PVs initially develop separately, and get progressively connected during fetal development. If there is failure in any step of this embryonic process, APVCs will happen. Anomalous pulmonary venous connections are a group of abnormal drainage of one or more PVs outside of the LA and can be classified either as partial or total, depending on the number of the veins involved. We describe and illustrate with schematic figures and cases the types of anomalous pulmonary venous connections, whether partial or total, common or rare, depending on the site of pulmonary vein drainage, the number of veins involved, and the presence or absence of vein obstruction. Common and rare anatomical variations will also be demonstrated. The clinical syndromes related to abnormal pulmonary venous returns will be discussed, ranging from dramatic neonatal emergency to subclinical presentation and late development of pulmonary hypertension.

#### CAEE-32 The Changing Face of Myocarditis

Participants

Matthew McCann, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

COVID-19 ushered in a dramatic rise in public awareness of myocarditis and related complications. Mirroring this, an unprecedented utilization of imaging for assessment of cardiac events followed. Utilization of imaging for vaccine-related cardiotoxicity has similarly risen. Synchronously, other previously unrecognized causes of myocarditis are now increasingly encountered, including drug-related cardiotoxicity, as seen with new oncologic agents. Clinical history, lab assessment, and imaging remain central to establishing a diagnosis of myocarditis. Cardiac MRI plays an integral role in diagnosis, stratification, and monitoring of recovery from this changing face of myocarditis. Recognition of the evolving etiologies, imaging techniques and revised diagnostic criteria are paramount for appropriate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

This exhibit outlines the timeline of awareness, specific entities and imaging features which comprise the "changing face of myocarditis" including cardiotoxicity related to COVID-19, COVID-19 vaccination, drug reactions including immune checkpoint inhibitors, and cardiotoxicity related to environmental contaminants and other exposures. Cardiac MR plays a key role in diagnosis, stratification, and monitoring of cardiotoxicity in these entities. The specific imaging features and diagnostic considerations are outlined and described in order that the radiologist gains a better understanding of this evolving diagnosis, allowing for appropriate utilization of imaging and improved diagnostic accuracy of this complex disease.

#### CAEE-33 New CAD-RADS 2.0: What Has Changed from CAD-RADS 1.0

Participants

Janio De Paula Santos, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To reinforce the importance of applying the CAD-RADS classification for a better communication with the healthcare providers. To describe the differences between CAD-RADS versions 1.0 and 2.0. To demonstrate with cases how to apply the CAD-RADS 2.0 classification.

#### TABLE OF CONTENTS/OUTLINE

The Coronary Artery Disease Reporting and Data System (CAD-RADS) is a standardized guide created to categorize coronary CT angiography findings and to facilitate communication between the radiological community and referring physicians. A new CAD-RADS classification was recently published with the objective of adding anatomical and functional data, which may offer stronger prognostic value other than just describing the presence or absence of anatomical lesions. What's the same? The main categories (0, 1, 2, 3, 4, 5) based on stenosis severity (0, 1-24%, 25-49%, 50-69%, 70-99%, occlusion) were maintained. Complementary modifiers "G", "S" and "N" standing for the presence of Grafts, Stents, or a Non-diagnostic study were maintained. What has changed? A grading scale for calcific plaque burden was added (P1, P2, P3 and P4). For plaques with features indicating high risk of rupture, the modifier "V" was replaced to "HRP" -> high-risk plaque. An "I" modifier was added if the investigation of ischemia was performed, either by perfusion or FFR-CT. The use of CAD-RADS to report findings provides a clinically useful categorization of CAD and standardizes the way of providing results across imaging sites, which is additionally useful for research purposes.

#### CAEE-34 Multimodality Review of Common Mitral Valve Pathology and the Current Surgical Interventions

## TEACHING POINTS

As the treatments for valvular disease have evolved over the years, the assessment of cardiac valves now often requires multiple imaging modalities, including cardiac CT, cardiac MRI, and echocardiography. The aim of this exhibit is to review the normal appearance as well as common pathologies involving the mitral valve on the various modalities discussed above. Lastly, the current available treatments for mitral valve disease will be reviewed including repairs (such as annuloplasty, valvuloplasty, and mitral valve clips) and replacements (such as surgical valve replacement and transcatheter mitral valve replacement).

## TABLE OF CONTENTS/OUTLINE

1. Review of the normal appearance of mitral valve on CT, MRI, and Echo. 2. Review of common mitral valve disease including mitral regurgitation, mitral stenosis, mitral prolapse, mitral annular disjunction, flail leaflet, parachute mitral valve, mitral cleft, mitral masses (fibroelastoma, vegetations, thrombus), and mitral annular calcification. 3. Review of the current treatments. Mitral valve repairs include annuloplasty, valvuloplasty, and mitral valve clips. Mitral valve replacements including surgical and more minimally invasive techniques, such as robot-assisted or transcatheter-based TMVR.

## CAEE-35 Visualizing the Mitral: An Imager Approach to Mitral Valve Disorders

Participants

Mohamed Ibrahim, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- Overview on clinical burden of Mitral valve diseases (MVDs) and pertinent anatomy.
- Familiarity with the current imaging approach to MVDs.
- Understand the role of imaging in the management of MVDs.

## TABLE OF CONTENTS/OUTLINE

- Mitral valve diseases burden and pertinent anatomy
  - o Mitral valve anatomy
  - o Clinical burden of MVDs
- Current imaging approach to MVDs:
  - o Role of Echo as the main modality for early detection
  - o Complementary role of CT and MR
  - o Comprehensive evaluation of MVDs (Mechanism of abnormality, Quantification, Ventricular remodeling, Vascular changes, Risk stratification, Valve morphology)
- Where does imaging fit in MVDs management?
  - o Assessing etiology, mechanism, and grading
  - o Pre-procedural planning: § Surgery vs Transcatheter intervention § Repair vs replacement
- Surgical replacement: sternotomy vs Robotic, and the role of CTA and CMR
- Transcatheter replacement: transapical vs trans-septal approaches, and the role of Echo and CT § Favorable anatomical markers, predictors of challenging procedures and contraindications
  - o Intra-procedural guidance and monitoring
  - o Post-procedural Follow up; Devices (stability, leaflet motion, leaks, vegetations/thrombus), Hemodynamics, and chamber size and function)

## CAEE-36 Left Ventricular Hypertrophy: An Approach to Differential Diagnosis

Participants

Rafael Perez Milan, MD, Leon, Mexico (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- Left ventricular hypertrophy (LVH) is a common finding in cardiac magnetic resonance (CMR) with multiple diagnostic considerations.
- LVH is an independent predictor of future cardiovascular events regardless of its etiology.
- LVH can be defined as follows.
- LV myocardial thickness more 12 mm.
- Increased LV mass: Body surface area - indexed LV mass (over 95th percentile - 91 g/m<sup>2</sup> in males; 77 g/m<sup>2</sup> in females)

## TABLE OF CONTENTS/OUTLINE

- To understand basic anatomy and embryology of the left ventricle.
- To define left ventricular hypertrophy (LVH) and clinical implications.
- To describe the differential diagnosis of LVH.
- Role of cardiac magnetic resonance (CMR) in narrowing the differential diagnosis.

## CAEE-37 Complications of Acute Myocardial Infarction: Infrequent but Lethal

## TEACHING POINTS

1. Acute Myocardial Infarction (AMI) is a frequent pathology and one of the leading causes of death in the world. Early revascularization has become a standard of care, thus reducing the high associated morbi-mortality. 2. Although infrequent, several secondary complications can occur, particularly when treatment is delayed or inadequate. 3. These are divided into mechanical, inflammatory, arrhythmic, thrombotic, and embolic. 4. CT, and especially MRI, help us to adequately assess cardiac function, ventricular volumes and structure, myocardial viability and possible associated complications.

## TABLE OF CONTENTS/OUTLINE

- Introduction- General characteristics of AMI and its complications.
- Complications are divided into categories, with cases to illustrate each
- Mechanical complications are most frequently evaluated through CT and MR. In the acute phase, the most frequent are left ventricular free wall rupture, septal ventricular defect, and papillary muscle rupture. In a chronic phase, pseudoaneurysms and ventricular aneurysms are found.
- Conclusions. Complications of AMI are infrequent, but they can be potentially lethal. An accurate and early diagnosis significantly improves the prognosis. CT and MRI are the main imaging modalities used after echocardiography.

## CAEE-38 Imaging Features and Mimics of Primary and Metastatic Pericardial Tumors

## TEACHING POINTS

1. Understand the role of imaging modalities in the diagnosis and management of primary and metastatic pericardial tumors and their mimics. 2. Review the imaging features of pericardial tumors and their mimics on echocardiography, CT, MRI, and PET/CT. 3. Discuss the limitations of imaging in the diagnosis and management of pericardial tumors and their mimics.

## TABLE OF CONTENTS/OUTLINE

I. Introduction A. Epidemiology and clinical presentation of pericardial tumors and their mimics II. Role of Imaging Modalities A.

Echocardiography B. Computed Tomography (CT) C. Magnetic Resonance Imaging (MRI) D. Positron Emission Tomography/Computed Tomography (PET/CT) III. Imaging Features of Pericardial Tumors and Their Mimics A. Primary pericardial tumors B. Metastatic pericardial tumors C. Pericardial cysts D. Lipomatous hypertrophy E. Pericardial fat pad F. Hemangioma G. Thymoma IV. Limitations of Imaging in the Diagnosis and Management of Pericardial Tumors and Their Mimics V. Conclusion

### CAEE-39 Mitral Valve Diseases 101: A Comprehensive Case-Based Review for Radiology Trainees

Participants

Mangun Randhawa, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the normal anatomy of the mitral valve and imaging modalities used for its evaluation  
2. Discuss various pathologies of native and prosthetic mitral valves, their implications, and their differential diagnoses  
3. Review role of imaging for mitral valve interventions

#### TABLE OF CONTENTS/OUTLINE

1. Morphologic anatomy of the mitral valve  
2. Congenital mitral valve abnormalities : parachute mitral valve, parachute-like mitral valve, Shone complex  
3. Mitral valve prolapse (various types) and mitral annular dysjunction  
4. Mitral annular calcifications, and complications  
5. Infective endocarditis  
6. Mass (different histopathologies)  
7. Pre-procedural and Post-procedural evaluation of mitral valve implantation including prediction of left ventricular outflow tract obstruction post trans-catheter implantation.

### CAEE-4 It's All About the Pericardium

Participants

Felipe Aluja, MD, MEd, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Discuss the anatomy of the pericardium and the pericardial recesses with emphasis on CT and MRI. Identify selected entities affecting the pericardium, from benign to malignant, with a brief description of their clinical characteristics. Provide a deep review of the imaging findings from the conventional radiology to MRI, with emphasis in the ancillary findings that aid in the differential diagnosis approach. Describe the pitfalls and mimics of pericardial disease in conventional radiology, CT, MRI and PET/CT.

#### TABLE OF CONTENTS/OUTLINE

• Introduction • Anatomy of the pericardium and pericardial recesses: from the schemes to the imaging. • The pericardium in conventional radiology, CT, MRI and PET/CT. • Conditions of the pericardium: o Air, collections, hemorrhage, and pericardial tamponade o Acute and chronic inflammation (including constrictive pericarditis) o Benign neoplasms o Malignant primary and secondary neoplasms o Congenital lesions • Try your best? Take home points

### CAEE-40 Artificial Intelligence in Cardiac MRI- Applications, Pitfalls Challenges

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the principles of Artificial Intelligence (AI) techniques relevant to cardiac MRI (CMR); 2. To discuss how AI can be applied to the different steps of the CMR; 3. To illustrate common applications of AI in CMR

#### TABLE OF CONTENTS/OUTLINE

1. AI, MACHINE LEARNING, DEEP LEARNING; 2. CHALLENGES OF CMR- complex anatomy, pathology, planes, sequences 3. AI NETWORKS- Convolutional neuronal network (CNN), general adversarial network (GAN); 4. ILLUSTRATION OF CLINICAL APPLICATIONS OF AI IN CARDIAC MRI WITH CASE EXAMPLES AND TECHNIQUES USED A. Upstream- Protocolling, workflow management/prioritization B. Image acquisition- Plane prescription; Patient positioning; Automated cardiac MRI planes; Automated selection of inversion time; B. Image reconstruction- Decreased artifacts; Decreased noise; Decreased acquisition time; Improved resolution- Super resolution ; Virtual Native Enhancement without contrast (VNE); Synthetic strain; C. Segmentation of structures- Ventricular volumes, function, mass in SSFP, Vascular anatomy in MRA; D. Automated quantification- Volumes, mass, function, LGE, parametric mapping (T1, T2, ECV), flow, strain, aortic diameter; E. Automated post-processing- perfusion, 4D flow; F. Classification of disease- Scar from non-contrast cine, Cardiomyopathies, CAD, myocardial infarction, atherosclerotic plaque, valvular disease, heart failure G. Prognostic factors- Risk stratification- Predictive models; H. Radiomics /Textural analysis I. Automated reporting J. Automated CMR pipeline 5. CHALLENGES- Small, biased training datasets, black box, quality criteria for algorithm design; 6. PITFALLS - Inaccuracies; 7. FUTURE DIRECTIONS- Good Machine learning practices.

### CAEE-41 Emerging Applications of Non-Contrast Cardiac CT: Beyond Coronary Score

Participants

Masafumi Kidoh, MD, PhD, Kumamoto, Japan (*Presenter*) Endowed Chair, Koninklijke Philips NV

#### TEACHING POINTS

Teaching Points 1. Non-contrast cardiac CT is widely used to detect and quantify coronary and heart valve calcium. On the other hand, detection of fat, myocardial edema, thrombus/hematoma, and subtle myocardial calcification beyond coronary and heart valve calcification using non-contrast cardiac CT has not been widely performed, possibly due to poor image quality. 2. Recent advances in CT technology (such as model-based iterative reconstruction and dual-layer spectral/photon-counting CT) have drastically improved the low-contrast resolution of CT images, allowing the detection of small differences in CT values within soft tissue on non-contrast and delayed phase cardiac CT images. Side-by-side viewing of non-contrast cardiac CT images and delayed (or arterial) phase cardiac CT images may be useful in differentiating various pathologies. 3. In this exhibit, we report that non-contrast cardiac CT is useful for the detection and characterization of cardiac low-contrast lesions (soft tissue lesions) beyond coronary and heart valve calcification.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline 1. Scan and reconstruction techniques for non-contrast cardiac CT. Single energy CT. Dual energy CT.

Table of Contents/Outline 1. Scan and reconstruction techniques for non-contrast cardiac CT - Single-energy CT - Dual-energy CT - Photon-counting CT 2. Principle of CT number in non-contrast cardiac CT 3. Clinical applications: beyond coronary score - Calcification - Thrombus/hematoma - Anemia - Water/myocardial edema - Fat 4. Future directions 5. Summary

### **CAEE-42 From Cyan to Cinnabar - The Radiologist's Role in Operative Management of Single Ventricle Congenital Heart Disease**

Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Single ventricle congenital heart diseases are rare and challenging to manage. While historically, outcomes have been poor, recent advancements in surgical management have improved post-operative outcomes and long-term prognosis. Imaging has also advanced from morphologic characterization to assessment of function and flow dynamics. Here, we present a framework for understanding the pathophysiology of the single ventricle state and 3-stage palliation repair, review important imaging-informed decision points along the course of operative management, and present metrics important to long-term outcome and management.

#### **TABLE OF CONTENTS/OUTLINE**

1. Title slide, disclosures 2. Abbreviations 3. Table of contents 4. Normal physiology 5. Single ventricle physiology 6. Norwood/DKS 7. mBTT and RV-PA conduit 8. Glenn procedure, mention of Kawashima 9. Fontan procedure 10. Operative management, main decisions 11. Single (SVR), biventricular (BiVR), or 1.5 ventricle (1.5VR) repair? 12. SVR Ex AV canal 13. CT/MRI evaluation 14. BiVR Ex DORV 15. CT/MRI evaluation 16. 1.5VR Ex Tricuspid atresia 17. CT/MRI evaluation 18. 1.5VR Ex Ebstein anomaly 19. CT/MRI evaluation 20. Safe for hybrid/bridge-to-Norwood? 21. Example 22. Hybrid procedure, relevance of HLHS, and risk factors for retrograde aortic arch obstruction 23. CT/MRI evaluation 24. Safe for Glenn? 25. Example 26. CT/MRI evaluation 27. What features may change Fontan approach? 28. Pre-Fontan operative planning example 29. CT/MRI evaluation prior to Fontan 30. Failing Fontan and BiVR or 1.5VR conversion surgery 31. Preop. Items (e.g. LVOT widening, valvuloplasty) 32. CT/MRI evaluation prior to conversion surgery 33. Summary 34. References

### **CAEE-43 Myocardial Strain Analysis Using Feature Tracking**

Participants

Masaya Kishohara, MD, PhD, Nagoya City, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Myocardial strain refers to the deformation of the walls and chambers of the heart from a relaxed to a contracted state. 2. Feature tracking is a technique that enables the analysis of myocardial strain. 3. Strain analysis performed in the left ventricle and the left atrium is a better prognostic indicator for heart failure than left ventricular ejection fraction. 4. Strain analysis by feature tracking might apply to 4D-CT images.

#### **TABLE OF CONTENTS/OUTLINE**

1. The concept of myocardial strain and its types: Myocardial strain using feature tracking is an alteration of length in one dimension or spatial orientation. Left ventricular strain is classified as radial, circumferential, and longitudinal strain. Left atrial strain is obtained as global longitudinal strain. 2. The principle of features tracking: Template matching is a technique that follows similar templates during the process of myocardial contraction. 3. The importance of myocardial strain for patients with heart failure. 4. What is left atrial strain? The left atrial strain is an index that reflects the diastolic and contractile capacity of the left atrium. Similar to the left ventricular global longitudinal strain, it is helpful in predicting prognosis in heart failure with preserved left ventricular ejection fraction. 5. An experiment using 4D-CT for myocardial strain analysis

### **CAEE-44 The Role of Gadolinium Enhancement Patterns in Diagnosing Myocardial Diseases at Cardiac MR - Enhancing Residents' Knowledge**

Participants

Otávio Augusto Ferreira Dalla Pria, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The abnormal myocardium can depict different patterns of gadolinium contrast enhancement depending on the cause of the injury. Therefore, assessing enhancement patterns in Cardiac MR plays a pivotal role in diagnosing diverse myocardium diseases. Ischemic cardiomyopathies produce delayed vascular-distributed gadolinium enhancement, and non-ischemic patterns are not limited to vascular territories. Patterns of enhancement distribution are crucial in differentiating between ischemic and non-ischemic heart pathologies and narrowing differential etiologic diagnostics in both. This exhibit aims: 1. To review myocardium gadolinium enhancement MR patterns. 2. To illustrate differential diagnostics based on the type of enhancement. 3. To discuss challenges and confounder factors.

#### **TABLE OF CONTENTS/OUTLINE**

1- Introduction/Objectives: Cardiac MRI can help diagnose a plethora of myocardial dysfunction. The gadolinium enhancement pattern is one of the characteristics that can help identify differential diagnostics. In this presentation, we summarize and illustrate the 5 types of cardiac MRI enhancement patterns and correlate findings with main differential diagnostics. 2- Case-based approach: Present 5 Patterns of Enhancement in Cardiac MRI (Subendocardial, subepicardial, transmural, patchy, mid-myocardial/mesocardial), correlating with primary differential diagnostics through didactical cases illustration in both ischemic and non-ischemic cardiomyopathies. 3- Limitations, Conclusion, and Take-home messages.

### **CAEE-45 Role of Multi-Modality Imaging in Cardio-Obstetrics**

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Cardio-obstetrics is an expanding subspecialty that focuses on prevention, early detection, and management of cardiovascular disease (CVD) in pregnancy. 1. To review the cardiovascular complications in pregnancy; 2. To understand disease processes

exacerbated by pregnancy; 3. To discuss the role of imaging in cardiovascular complications of pregnancy and pre-conception planning; 4. To understand the concept of pregnancy heart team and risk stratification

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION ;2.PHYSIOLOGICAL CARDIOVASCULAR CHANGES OF PREGNANCY;3. ROLE OF IMAGING IN PREGNANCY;4. IMAGING MODALITIES;5. COMPLICATIONS RELATED TO PREGNANCY (Discussion, clinical features, imaging findings and differential diagnosis with case examples)-Cardiac- Heart failure, arrhythmia, thromboembolism;Obstetrics- hypertension, Preeclampsia, hemorrhage;Perinatal-miscarriage, premature delivery, restricted growth;Venous thromboembolism including PE;Amniotic fluid embolism;Peri-partum cardiomyopathy;Spontaneous coronary artery dissection;Pulmonary hypertension;Hypertensive disorders (Eclampsia/Pre-eclampsia);Heart failure and arrhythmias;6.EXACERBATION OF PRE-EXISTING CVD DURING PREGNANCY (Illustration with case examples)-Inherited aortic diseases;Congenital heart disease;Hereditary hemorrhagic telangiectasia;Valvular disorders;7. PRECONCEPTION PLANNING- Risk stratification;8. CARDIOVASCULAR CHANGES IN ABDOMINAL DISEASES;9. ISSUES RELATED TO IMAGING IN PREGNANCY;- CT- Radiation, contrast agents- MRI- Gadolinium10. APPROPRIATENESS CRITERIA for imaging in pregnancy; 11. FLOW-CHART SHOWING systematic approach to imaging pregnant patients.

#### CAEE-46 Single Ventricle: A Radiology Primer for Pre-Procedural Evaluation

Participants  
Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the spectrum of lesions that result in a single ventricle 2. To discuss the surgical options in the management of single ventricle 3. To illustrate the different types of single ventricle using case examples 4. To highlight critical imaging parameters necessary for pre-procedural planning

#### TABLE OF CONTENTS/OUTLINE

1. SINGLE VENTRICLE- Definition, types 2. ROLE OF MULTIMODALITY IMAGING- Echo, CT, MRI, Cardiac cath, nuclear medicine 3. CT AND MRI- Indications, protocols, tips and tricks 4. REVIEW AND ILLUSTRATION OF PHENOTYPES OF SINGLE VENTRICLE Right dominant- Hypoplastic left heart syndrome, mitral atresia, double inlet/outlet RV; Left dominant- Hypoplastic right heart syndrome, Tricuspid atresia, Double inlet LV ; Either- unbalanced AV canal (Right/left); Functional single ventricle- TOF with pulmonary atresia, truncus, TAPVR, Severe Ebsteins anomaly, Tricuspid atresia, Double inlet LV/RV, AV canal defect (balanced/unbalanced), heterotaxy 5. ANATOMICAL CHARACTERIZATION- Atrial situs, ventricular situs, great artery relationship, morphologic LV vs RV, functioning/rudimentary ventricles 6. CRITICAL PARAMETERS NECESSARY FOR SURGICAL/INTERVENTIONAL MANAGEMENT - Ventricular function- Poor prognosis if low - Atrial septal restriction - Bulboventricular foramen in DILV or tricuspid atresia with TGA - Atrioventricular valve- Obstruction or regurgitation - Outlet obstruction- Presence and nature - Vascular resistance- Pulmonary and systemic - Patency of ductus arteriosus - Patency of aortic arch - Pulmonary artery anatomy - Venous connections 7. MIMICS- Criss-cross heart; Superior/inferior ventricle

#### CAEE-47 Generating Cardiac Segmentation Datasets: Automated Segmentation and Tool-Based Manual Correction

Participants  
Hirohisa Oda, PhD, Shizuoka, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Easy label generation for custom AI: Manual correction tool for cardiac segmentation

#### TABLE OF CONTENTS/OUTLINE

- Application-specific custom AI for cardiac segmentation\* Our application: Modeling patient-specific therapeutic instrument- Outline\* Step 1: AI-based segmentation with a very limited number of cases for automated segmentation on other cases\* Step 2: Manual correction with our original tool- Step 1: AI-based segmentation\* Innovations from the "U-Net era"\* Trainable with limited training datasets as "seeds" of dataset generation\* Key technologies: Swin Transformer Self-supervised training [1]\* Examples of automatic segmentation- Step 2: Manual correction with our original tool\* HeartCorrect: Our original plugin for an image visualization tool MITK-Workbench\* Utilizing MITK's interpolation feature\* Automated correction for obeying the anatomical relationships of chambers- Comparison with MONAI Label[1] Hatamizadeh, Ali, et al. "Swin UNETR: Swin transformers for semantic segmentation of brain tumors in MRI images." BrainLes 2021, LNCS 12962, 2022.

#### CAEE-48 Myocardial Delayed Enhancement By Spectral CT: Our Experience

Participants  
Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Role of Late enhancement in cardiac dual-CT2. Show the protocol we are using in our centre.3. Present CT-MRI correlation in several pathologies, mainly in myocarditis

#### TABLE OF CONTENTS/OUTLINE

1. Background Quick review of the pathophysiology and usefulness of late enhancement in cardiological studies.2. Spectral CT and acquisition protocol used in our center.3. Representative cases of different diagnoses with CT-MRI correlation.4. Conclusions.5. Bibliography.

#### CAEE-49 Mitral Valve Disjunction: The Great Unknown

Participants  
Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review mitral valve disjunction (MVD)2. Role of MRI in the evaluation of radiological features associated with and pitfalls.

## TABLE OF CONTENTS/OUTLINE

1. Background Revision of mitral valve disjunction • Definition • Pathology • Classification • Location 2. Representative cases of different disjunction types. 3. Representative cases of different radiological features associated with and pitfalls. 4. Conclusion. 5. Bibliography.

### CAEE-5 **All In Vein"? Anatomy, Variations and Abnormalities of Coronary Venous System with an Emphasis on CT Findings and Clinical Importance**

Participants

Firat Atak, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Cardiac CT can provide substantial information regarding cardiac venous anatomy and anomalies although it is mainly used for the evaluation of coronary arterial system. 2. Radiologists can more readily identify cardiac venous anomalies on CT by having a basic knowledge of the normal venous anatomy, adding venous anomalies to the standard checklist, and being aware of the conditions in which these anomalies may be clinically significant. 3. Cardiac venous system anomalies may be vital in percutaneous interventions and surgical procedures as they may fundamentally influence the course of the procedure or change the operation plan.

## TABLE OF CONTENTS/OUTLINE

A. Overview of normal cardiac venous anatomy B. Scan protocol and postprocessing C. Coronary sinus (CS) variations and anomalies with case examples D. Other cardiac vein variations with case examples E. Clinical importance of the cardiac venous system -Cardiac shunts -Cardiac resynchronization therapy -Coronary sinus pacing -Retrograde cardioplegia -Percutaneous mitral anuloplasty -Percutaneous atriotomy (Levoatrial-to-coronary sinus shunting) for heart failure -Percutaneous in situ coronary venous arterialization (PICVA) -Enlargement of CS and clinical importance of PLSVC - Radiofrequency catheter ablation - Central venous interventions F. Conclusion

### CAEE-50 **State-of-the-Art Multimodality Imaging of Cardiac Transplant and Complications: A Practical Update**

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To discuss the normal appearances of cardiac transplant 2. To optimize the CT and MRI protocols for evaluation of patients with cardiac transplant 3. To illustrate the imaging appearances of various complications following cardiac transplant

## TABLE OF CONTENTS/OUTLINE

1.Introduction 2. Indications- Heart failure, intractable angina or arrhythmia, cardiomyopathies, congenital heart disease, cardiac tumor) 3. Cardiac transplant techniques- Orthotopic vs heterotopic, bicaval vs biatrial 4. Role of imaging in evaluation of cardiac transplant 5. Imaging techniques- Echo, CT, MRI, Cardiac catheterization, Intravascular ultrasound, Optical coherence tomography, nuclear medicine 6. Cardiac transplant follow up diagnostic pathway 7. Imaging protocols for follow up= CT-No premedications, Photon counting CT; MRI- Quantitative techniques, T2, T1 mapping; 8. Complications- Review of the following complications with illustrative case examples- Post procedural graft dysfunction; Post surgical- pericardial effusion, mediastinal hematoma; Cardiac Allograft Vasculopathy (CAV) - Diffuse, more aggressive, microvasculature- angiography vs CTA; Acute cellular rejection; Chronic rejection; Accelerated coronary atherosclerosis; Infections; Post-transplant lymphoproliferative disorder; Gout; Osteoporosis; Chronic kidney disease;

### CAEE-51 **The Heart of the Matter: Pearls and Pitfalls in Cardiac CT**

Participants

Katherine Chung, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac CT imaging is a valuable diagnostic resource for physicians to evaluate cardiac anatomy and function. The indications for CT imaging include evaluation of the coronary vessels for anomalies, presence of coronary artery disease (CAD) and calcium score, pre-TAVR evaluation, pre-ablation study for atrial fibrillation, and observing the patency of grafts, amongst other reasons as well. Although radiologists regularly read these types of images, radiologists-in-training may have variable levels of exposure and can come across cases that lead to confusion. The goal of this presentation is to elucidate the essential pearls of acquiring and evaluating cardiac CT scans, so radiologists-in-training are comfortable and confident with evaluating CT scans and providing appropriate recommendations. Furthermore, we will highlight the common areas of confusion through case-based examples of common pitfalls that may occur.

## TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Indications and contraindications (Efficacy in disease diagnosis) 3) Definitions and Anatomy 4) Protocols and Techniques for acquiring images 5) Pearls and Pitfalls (Pre-ablation study for atrial fibrillation, Pre-TAVR study, Calcium Score, Coronary Artery Disease, Thoracic aortic aneurysm) 6) Artifacts (Stair Step artifact, Streak artifact from CABG or TAVR patients, Motion) 7) Conclusion

### CAEE-52 **From Pumps to Waves: Understanding the Impact of Mechanical Circulatory Assist Devices on Spectral Doppler Ultrasound Analysis**

Participants

Mateus Soares, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Heart failure (HF) is a syndrome resulting from impaired ventricular filling or ejection. Many patients with HF progress to a refractory state, regardless of advanced therapies. Cardiac transplantation remains the definitive treatment for end-stage disease. Mechanical circulatory assist devices (CAD) help support patients with cardiogenic shock or end-stage HF. It may be used as a short-term



device to support hemodynamically unstable patients, including those with the possibility of heart function recovery, or as long-term device usually as a bridge to transplantation. CAD are mechanical pumps that help an impaired ventricle maintain hemodynamics and preserve satisfactory end-organ blood flow. There are commercially available devices to support both the left and right ventricle. In most cases, the spectral Doppler waveform is altered in the setting of a CAD, reflecting systemic hemodynamic changes. Despite the increasing use of these devices, there is not much information in the radiological literature about spectral Doppler changes in these patients. Accurate diagnosis requires a better understanding of CAD mechanisms and associated Doppler ultrasound findings, as well as possible vascular complications.

#### TABLE OF CONTENTS/OUTLINE

Review the normal arterial Doppler waveforms in patients with preserved cardiac function. Describe the mechanisms of various CAD and their hemodynamic impacts on arterial spectral Doppler waveforms. Discuss the main vascular-related complications and the use of ultrasound in diagnosis.

#### CAEE-53 **Blood-Flow Volume Quantification Using Phase-contrast MRI in Congenital Heart Disease: Pre- and Post-surgical Evaluation**

##### TEACHING POINTS

Phase-contrast (PC) MRI can be used to measure blood flow in patients with congenital heart disease (CHD). Although Doppler echocardiography can provide shunt flow velocities in patients with common CHD such as atrial or ventricular septal defects, it may be limited by natural or surgical variations. On the other hand, PC MRI can provide precise blood flow analysis non-invasively for patients with complex CHDs and post-surgical anatomy. We demonstrate the principles and potential pitfalls of blood flow volume quantification using PC MRI and present some cases such as a coronary fistula, anomalous origin of one pulmonary artery from the aorta, and a patient who underwent a Blalock-Taussig shunt operation.

#### TABLE OF CONTENTS/OUTLINE

1. Principles of PC flow volume measurement - A review of PC MRI technique, semi-automatically flow volume measurements 2. Pitfalls of PC flow volume measurement - Velocity encoding (VENC) selection considering aliasing and low phase shift value, spatial and temporal resolution, image plane setting, respiratory motion artifact, validation strategies 3. Blood flow volumes commonly measured in our hospital - Ascending aorta, main/right/left pulmonary artery, superior/inferior vena cava, the cross-section of mitral/tricuspid valve, right/left pulmonary vein 4. Representative cases - Right coronary artery to left ventricular fistula, right pulmonary artery from the descending aorta, post-surgical patients (modified Blalock-Taussig shunt, Glenn procedure, cardiac plug implantation, balloon angioplasty etc.)

#### CAEE-54 **A Novel Coronary CT Imaging Technique that Further Improves the Spatial Resolution of Super Resolution Deep Learning Reconstruction**

##### TEACHING POINTS

1. Review the current status in coronary CT image evaluation and summarize its limitations 2. Summarize the relationship between spatial resolution and image noise in the current various CT image reconstruction methods 3. Explain the features of the new super resolution deep learning reconstruction (SR-DLR) algorithm trained using the data acquired by the super resolution CT system 4. Proposal of a new imaging method that further improves the spatial resolution of the SR-DLR algorithm and improves the visualization capabilities of coronary arteries, stent lumens, and calcified lesions 5. Comparison of image quality and exposure dose between conventional and new imaging methods

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Summarize the limitations of assessment of STENT lumens and calcified lesions using current CT imaging 3. Explains the features and usefulness of the new super resolution deep learning reconstruction (SR-DLR) algorithm trained using data acquired by a super-resolution CT system 4. Limitations of coronary CT imaging under normal scanning conditions using the SR-DLR algorithm 5. Proposal of a new imaging method that further improves the spatial resolution of the SR-DLR algorithm 6. Description of focal spot sizes used in coronary CT for super-resolution and conventional CT systems 7. Presenting the spatial resolution and image noise of small-focus imaging combined with the SR-DLR in conventional CT systems 8. Comparison of images with different focal spot size for stents and calcified lesions in the same cases, presenting the usefulness of small-focus imaging 9. Comparison of exposure dose in imaging at each focal spot size

#### CAEE-55 **Cardiac CT Pearls and Pitfalls: What You Should Know About Anatomy to Avoid Catastrophes**

Participants

Amalia Aranaz Murillo, MD, Zaragoza, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Understanding the different visual axes in cardiac imaging is crucial for interpreting cardiac anatomy. 2. Familiarity with the characteristics and structures of the atriums and ventricles is essential for accurate diagnosis and assessment of cardiac function. 3. Knowledge of main coronary arteries and their pathways and bifurcations is vital for accurate assessment of coronary artery disease. 4. Understanding the anatomy and branches of the coronary and pulmonary veins is essential for evaluating cardiac function and assessing for potential blockages.

#### TABLE OF CONTENTS/OUTLINE

We sometimes read a poster or a review and feel quite deceived because what you expect to learn you already know. For that reason, this poster will have at the beginning a QA. If you know all the answers, please, do not waste time on it, if not, it might teach you some anatomy tricks. It will be divided into seven blocks that detail the anatomy and structures of the heart in CT. The first block describes the different visualization axes of the heart and evaluates structures such as the anterior and inferior wall of the myocardium, the left atrial appendage, and the coronary sinus. The second block focuses on the characteristics of the right atrium and its different structures. The third describes the components of the ventricles and their structure. The fourth focuses on the major arteries of the heart, including the aorta and pulmonary artery. The fifth block details the four main coronary arteries and their paths and bifurcations. In the sixth, the coronary veins and their tributaries are explained, and finally, the anatomy of the pulmonary veins and their variability in the number and arrangement of drainage orifices to the left atrium is described.

#### CAEE-56 **Complications After Cardiac and Ascending Aorta Surgery**

Participants

María Guerrero Martin, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To understand and distinguish the different types of ascending aorta surgeries 2. To evaluate the pathological findings after cardiovascular surgery, in order to differentiate them from the usual ones 3. To discern the most typical complications in relation to their chronological onset and their follow-up 4. To show the possible options in the management of patients with these complications 5. To emphasize the role of CT in the diagnosis of these conditions

#### TABLE OF CONTENTS/OUTLINE

1. Background and methods 2. Findings 2.1. Techniques used to evaluate postoperative patients 2.2. Common findings after cardiovascular surgery 2.3. Complication following aortic surgery 2.3.1. Early complications: periprosthetic haematomas, pseudoaneurysm formation, distal malperfusion 2.3.2. Late complications: aortic valve regurgitation, infection, anastomotic stenosis 2.4. Complications following cardiac valve surgery: valvular/paravalvular regurgitation, endocarditis, hypoattenuating leaflet thickening, prosthesis-patient mismatch 2.5. Complications following coronary artery procedures: stenosis, thrombosis 3. Our experience 4. Conclusion

#### CAEE-57 Cardiac MRI in Adult Orthotopic Heart Transplant

Participants

Sandra Quinn, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Outline unique CMR tissue characteristics of the transplanted heart 2. Discuss tissue characteristics suggestive of acute cardiac allograft rejection in the transplanted heart 3. Outline the role of quantitative myocardial stress perfusion in detection of epicardial and microvascular cardiac allograft vasculopathy 4. Provide an overview of the published data with respect to CMR and adult heart transplant

#### TABLE OF CONTENTS/OUTLINE

1. Cardiac MRI in Orthotopic Heart Transplant· Overview of structural and functional CMR and its role in major complications of heart transplant, i.e., acute cardiac allograft rejection and cardiac allograft vasculopathy.2. CMR Tissue Characterization in Orthotopic Heart Transplant· Describes the general considerations and overview of published values regarding CMR myocardial tissue characterization of the transplant heart.3. Acute Cardiac Allograft Rejection (ACAR)· Outline the published CMR myocardial tissue characterization values for patients with active ACAR and ACAR previous history.4. Cardiac Allograft Vasculopathy (CAV)· Illustrate with a representative clinical case the role of CMR quantitative perfusion in the identification of CAV· Describe expected resting and stress myocardial blood flow and myocardial perfusion reserve in heart transplant recipients vs healthy volunteers· Identify the role of myocardial perfusion reserve for identification of CAV.· 5. The Key Evidence in Summary· Summary table outlining the published evidence for CMR in heart transplant and complications of heart transplant.

#### CAEE-58 Pre and Postoperative CT Evaluation for Robotic and Minimally Invasive Coronary Artery Bypass

#### TEACHING POINTS

Teaching points: 1. Robotic and minimally invasive coronary artery bypass is a safe and less traumatic surgical technique than open-heart surgery. It is considered the first-choice therapy for selected patients although the adoption has been slow in some institutions. 2. Imaging assessment prior to the surgery and providing relevant information to the surgeons is crucial for identifying suitable patients, anatomic assessment, surgical planning, and predicting outcomes. 3. Being familiar with the spectrum of expected postsurgical findings and complications following robotic and minimally invasive coronary artery bypass surgery is essential for radiologists to contribute to proper patient management.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: A. Overview of surgical techniques: TECAB, MIDCAB, robotic assisted B. Indications and contraindications C. CT angiography for preoperative evaluation 1. Scan protocol and postprocessing techniques 2. Preoperative checklists 1) Aorta and iliofemoral arteries 2) Evaluation of lung, pleural plaques 3) Chest wall, diaphragm 4) Heart, pericardium, mediastinum 5) Aorta diameter, pulmonary artery diameter, ascending aortic calcification 6) Internal mammary arteries 7) LAD and other coronary arteries D. Procedural considerations E. Postoperative CCTA assessment, complications F. Conclusion

#### CAEE-59 Navigating the Vortex: Advancements in Turbulent Flow Detection Using Cardiovascular 4D Flow MRI

#### TEACHING POINTS

4D flow MRI has revolutionized the assessment of in vivo flow dynamics, leading to a better understanding of physiological flow in healthy subjects and those with thoracic aortic aneurysms, chronic aortic dissection complications, and aortic prostheses. A key finding related to altered blood flow is turbulence, which can be visually detected through vortices in 4D flow MRI. However, visual assessment is subjective, prompting the need for quantitative evaluations. Recent advancements have facilitated the quantification of turbulent parameters such as vorticity, energy loss, and turbulent kinetic energy using 4D flow MRI. This presentation will explore clinical evaluation methods for these turbulence indices while discussing specific diseases as examples.

#### TABLE OF CONTENTS/OUTLINE

1. The background of flow analysis a. Clinical demands for flow analysis b. 4D Flow MRI technique for flow analysis c. Primary and secondary flow in a healthy aorta d. Quantification of turbulence - vorticity, energy loss, and turbulent kinetic energy2. Thoracic aneurysm a. Helical flows in patients with bicuspid aortic valve b. Association between aneurysmal development and wall shear stress3. Aortic dissection a. Blood flow volume quantification - forward and backward flow in the false lumen b. Vortices in the false lumen4. Post-prosthetic graft replacement a. Quantification of turbulent blood flow induced by artificial aorta b. Mechanical hemolytic anemia due to aortic arch graft stenosis5. Hypertrophic cardiomyopathy a. Vortex flow in the ascending aorta b. Association between turbulent kinetic energy elevation and left ventricular mass increase

#### CAEE-6 Beyond Coronary Artery Calcium: Cardiovascular Findings in Non-Gated Chest CT Scans

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the most common incidental cardiac findings on routine chest CT examinations. 2. To recognize which cardiac findings are relevant and can alter the clinical course and outcome of patients.

#### TABLE OF CONTENTS/OUTLINE

1. Coronary arteries: a). Anatomical variants (dominance) b). Coronary anomalies (origin)-Benign-Malignant c). Coronary artery calcium d). Coronary aneurysm e). Coronary artery fistula 2. Cardiac chambers: a). Intracavitary thrombus 3. Myocardium a). Myocardial infarction -Acute-Chronic b). Cardiomyopathy-Dilated-Hypertrophic c). Primary tumors-Fibroma-Myxoma d). Metastases-Chordoma-Lymphoma-Lung carcinoma-Melanoma e). Pseudotumors -Lipomatous hypertrophy of the interatrial septum 4. Valvular heart disease a). Anatomical variants -Bicuspid aortic valve b). Calcifications -Mitral annulus-Aortic valve 5. Congenital heart disease and thoracic vascular disorders: a). Atrial septal defects b). Patent ductus arteriosus c). Persistent left superior vena cava d). Aortic arch anomalies-Right sided -Double aortic arch e). Anomalous pulmonary venous drainage 6. Pericardial diseases: a). Pericarditis -Infectious-Iatrogenic-Autoimmune-Constrictive b). Pericardial effusion and hematoma c). Pericardial cysts d). Malignant pericardial involvement-Direct invasion-Metastases-Venous extension e). Pericardial fat necrosis

#### CAEE-60 Quantitative Stress Perfusion Cardiac Magnetic Resonance: Why, How and When?

#### TEACHING POINTS

1. Understand differences between qualitative, semi-quantitative and quantitative stress perfusion. 2. Understand how quantitative stress cardiac MRI (QuantCMR) is performed and calculated as well as how to interpret myocardial blood flow/ myocardial perfusion reserve. 3. Demonstrate clinical role of cardiac MRI quantitative stress perfusion. 4. Illustrate different pathologies and their appearances on cardiac MRI quantitative stress perfusion.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will explain the recent interest and development of QuantCMR and how this differs from qualitative and semi-quantitative stress perfusion. Technical details of how QuantCMR is performed and quantified will be demonstrated along with tips/tricks of how to get high quality perfusion maps. The exhibit will explain differences between dual bolus and dual sequence techniques and issues to be aware of with different stress agents. The exhibit will discuss how QuantCMR is being increasingly recognized as being useful in patients with ischaemia and non-obstructive coronary arteries (INOCA) to diagnose coronary microvascular dysfunction (CMD) as well in standard assessment of obstructive coronary artery disease. Clinical examples of these pathologies will be illustrated. In addition, other cardiac diseases will also be demonstrated to illustrate how QuantCMR perfusion maps appear in different disease entities such as dilated cardiomyopathy and hypertrophic cardiomyopathy. Knowledge gaps and future directions will also be discussed.

#### CAEE-61 State of the Art on Acute Coronary Syndrome with Negative Coronary Angiography

Participants

Cesar Urtasun Iriarte I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To learn the definition of MINOCA and review the spectrum of causes that manifest as acute coronary syndrome with non-obstructive coronary arteries. To understand the role of cardiovascular imaging, learn about the management and, outline CT and MRI protocols.

#### TABLE OF CONTENTS/OUTLINE

A. Background, diagnosis, and management B. Assessment: CT and MRI protocols C. Acute coronary syndrome with negative coronary angiography a. MINOCA entities - Coronary plaque disruption- Coronary artery vasospasm- Coronary artery dissection- Coronary artery thrombosis/embolism- Coronary microvascular disorder- Myocardial oxygen demand-supply imbalance b. MINOCA-like entities Myocardial location (Tako-Tsubo, myocarditis, hypertrophic cardiomyopathy, dilated cardiomyopathy, infiltrative cardiomyopathy) Other non-cardiac mimickers (Vasculitis, pulmonary embolism, aortic dissection) D. Take-home messages

#### CAEE-62 Development in Free-Breathing Coronary CTA for Patients With High Heart Rate: Using Non-Device Respiratory Gating Method

#### TEACHING POINTS

Technological advances make Free-Breathing Coronary CTA (FB-CCTA) possible, but there are challenges for patients with higher heart rate (HR). We have developed a protocol of FB-CCTA at high HR using a non-device respiratory gating method.

#### TABLE OF CONTENTS/OUTLINE

We have developed a method to reduce motion artifacts even at high HR from free-breathing images. Since multi-segment reconstruction can improve image quality and diagnostic accuracy at higher HR, Scans and post-processing were performed to allow the segment reconstruction from free breathing images. After electrocardiogram gated Dynamic Volume Scan, to avoid motion artifacts due to breathing, the non-device respiratory gating was performed. The respiratory arrest phase was analyzed using Time-Density-Curve (TDC) plotted from the region of interest drawn on the chest wall of the dynamic image. Multi-segment reconstruction used data from multiple cardiac cycles during respiratory arrest time analyzed from the TDC was performed. In addition, the reconstruction type was applied with full-iterative model-based reconstruction algorithms for improved Signal-To-Noise ratio (SNR). The resulting image was reduced motion artifacts and improved SNR. This method is feasible to provide acceptable image quality and diagnostic performance in CCTA with free-breathing and high HR.

#### CAEE-63 Effectiveness of a Contrast Enhancement Boost Technique in Cardiac CT: Improved Detection of Late Iodine Enhancement (LIE) in Non-Ischemic Cardiomyopathy

#### TEACHING POINTS

• To learn about issues of myocardial evaluation with Single-Energy CT. • To learn about a subtraction technique with non-rigid

registration, that can be used to represent an image of the myocardium. • To learn the principles of the contrast enhancement boost technique (CE-boost) with non-rigid registration. • To learn about the contrast-improving effects of CE-boost and its diagnostic value in non-ischemic cardiomyopathy.

#### TABLE OF CONTENTS/OUTLINE

A. Comparison of CNR between Single-Energy CT and other imaging techniques for non-ischemic cardiomyopathy. B. Advantages of non-rigid registration compared to rigid registration in subtraction techniques. C. Usefulness of non-rigid registration subtraction technique with CE-boost in LIE-CT. D. Clinical case of LIE-CT using CE-boost for preoperative CT examination for TAVI. E. Advantages of CE-boost in non-ischemic cardiomyopathy and its application in clinical imaging.

#### CAEE-64 Cardiac MRI for the Beginner: A Step by Step Approach

##### TEACHING POINTS

Cardiac MRI is a non-invasive modality for anatomical, functional and myocardial tissue evaluation of the heart for a variety of cardiovascular diseases. It holds immense diagnostic potential and despite its relative high cost, it is becoming more increasingly mainstay in cardiac evaluation. Some conditions that cardiac MR renders benefits to include ischaemic heart disease, cardiomyopathy, valvular disease, congenital disease, pericardial disease and characterization of cardiac masses. It supplements the initial cardiac work-up by providing an unobstructed field of view, myocardial tissue assessment and remains the gold standard for RV and LV volumetric assessment. It is a complex study and includes an arsenal of MRI sequences including cine, myocardial perfusion, parametric mapping and flow sensitive sequences, all tailored to the specific clinical indication or question. Reading a Cardiac MR for the novice radiologist/cardiologist can be a daunting task. With the need for more Cardiac MR readers and to demystify this process, this poster will aim to provide a basic navigational chart for the novice reader which will provide a foundation for them to build upon. Teaching points: An overview of cardiac MRI sequences, basic principles and utility of each sequence An basic approach to interpreting a cardiac study An algorithm approach to common cardiac conditions with case based examples.

#### TABLE OF CONTENTS/OUTLINE

Basic cardiac MR sequences and their purpose How to approach a Cardiac MR Basic techniques on qualitative and quantitative assessment with tips and tricks Algorithm for common conditions Case based discussion

#### CAEE-65 Late Iodine Enhancement of Myocardium with Deep Learning Reconstruction Under Low Radiation Doses and Low Contrast Doses: How to Get the Best Image Quality

##### TEACHING POINTS

Late Iodine Enhancement (LIE) of myocardium in cardiac CT has been reported to reflect fibrotic lesions in myocardium similar to Late Gadolinium Enhancement (LGE) in cardiac MRI, but requires a higher contrast dose and radiation dose due to contrast enhancement and noise effects. To solve this problem, we propose three new points in using imaging, reconstruction and subtraction technology. 1. Imaging technology: Low-voltage imaging according to BMI. 2. Reconstruction technology: Deep Learning Reconstruction (Contrast enhancement parameters "AiCE"). 3. Subtraction technology: special contrast-enhancing subtraction technology "CE-Boost". Using the above three methods enables significant contrast enhancement and noise reduction, even with LIE at low radiation doses and low contrast doses. In addition, using DLR provides stability in the uniformity of CT values required for myocardial Extra Cellular Volume (ECV) quantification.

#### TABLE OF CONTENTS/OUTLINE

(1) Combination of three special technologies (2) Reconstruction and subtraction technologies (3) Deep learning reconstruction and special subtraction (4) Stable noise reduction with DLR (5) Combination of three special technologies

#### CAEE-66 Success Within Your Grasp: Planning for Mitral Valve Transcatheter Edge-to-Edge Repair

Participants

Hyun Jung Koo, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To recap the evidence of mitral edge-to-edge repair in both primary and secondary mitral regurgitation To demonstrate preprocedural imaging modalities to help appropriate patient selection and interventional guide To understand intraprocedural imaging and post-procedural imaging findings

#### TABLE OF CONTENTS/OUTLINE

1. Evaluation of mitral regurgitation (MR) 1) Etiology of MR - Primary mitral regurgitation - Secondary (functional) mitral regurgitation 2) Quantification of MR 2. Types of percutaneous mitral valve repair 3. Patient selection for M-TEER - AHA/ACC Guidelines for M-TEER - Review of Trials: EVEREST II trial, COAPT trial, MITRA-FR trial - Anatomically suitable mitral valve morphology 4. Pre-procedural planning for M-TEER - Echocardiography and cardiac CT - Evaluation parameters 5. Intra-/Post- TEER imaging of M-TEER 6. Potential complications after M-TEER

#### CAEE-67 Multimodality Imaging in Sports Cardiology: New Kid on the Block

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Although athletes' have low prevalence of coronary artery disease (CAD), they are prone for other cardiovascular disorders, which should be evaluated prior to suitability for athletic activity. 1. To review the role of Sports Cardiology, a relatively new subspecialty focused on athletes 2. To discuss the role of imaging, particularly MRI in the diagnosis of athlete's heart which is a structural adaptive change that overlaps with cardiomyopathies. 3. To illustrate with case examples the various entities that are encountered in athletes.

#### TABLE OF CONTENTS/OUTLINE

1. SPORTS CARDIOLOGY: INTRODUCTION a. Pre-athletic activity screening for diseases that may be worsened with sports activities

1. SPORTS CARDIOLOGY- INTRODUCTION a. Pre-athletic activity screening for diseases that may be worsened with sports activities b. Evaluation of diseases that cause adverse events in athletes 2. ROLE OF IMAGING- Echo, MRI, CT 3. MRI SEQUENCES AND PROTOCOL 4. ADAPTATIVE CHANGES IN ATHLETES= Endurance- Volume overload, increased wall stress, eccentric hypertrophy; Strength- Pressure overload, increased wall stress, concentric hypertrophy 5. MYOCARDIAL FIBROSIS IN ATHLETES- Prevalence and pattern 6. ATHLETE'S HEART (WITH CASE EXAMPLES)- Diagnostic criteria controversies; Distinguishing from mimics (Grey zone) a. Hypertrophic cardiomyopathy b. Dilated cardiomyopathy c. LV non compaction d. Arrhythmogenic cardiomyopathy 7. DISEASES CAUSING SUDDEN CARDIAC DEATH IN ATHLETES (with case examples) a. HCM b. ARVD C. Anomalous coronary arteries d. Commotio cordis e. Myocarditis 8. SCREENING STRATEGIES WITH IMAGING IN PROFESSIONAL ATHLETES 9. CTA IN RISK STRATIFICATION OF CORONARY ARTERY DISEASE 10. VETERAN ATHLETES AND MYOCARDIAL FIBROSIS- ARRHYTHMIA 11. ATHLETES AND COVID-19 12. MANAGEMENT OF INCIDENTAL FINDINGS IN ATHLETES

## **CAEE-68 The Minimal Essence of Machine Learning for Cardiovascular Diagnosis**

Participants

Ryo Ogawa, PhD, MD, Toon, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Various information related to medical data can be obtained by machine learning. We explain how machine learning are used to cardiovascular diagnosis. 1. To review the role of machine learning.2. To explain the application of machine learning in cardiovascular diagnosis.3. To explain the principle of machine learning.

### **TABLE OF CONTENTS/OUTLINE**

1. Linear regression; overview, algorithm, example (heart failure)2. Logistic regression; overview, algorithm, example (history of heart disease)3. Support vector machine; overview, algorithm, example (Differentiation of cardiomyopathy)4. Random forest; overview, algorithm, example (Differentiation of cardiomyopathy)5. Neural network; overview, algorithm, example (Classification of myocardial infarction)6. Explainable AI; overview, algorithm, example (Gradient-weighted class activation mapping, Guided gradient-weighted class activation mapping)7. Generative AI; overview, algorithm, example (Deep convolutional generative adversarial network)

## **CAEE-69 Denoise to Visualize: The AI-Driven Post-Hoc Denoising for High-Fidelity Cardiac CT**

Participants

Tatsuya Nishii, MD, PhD, Suita, Japan (*Presenter*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation

### **TEACHING POINTS**

In cardiac CT, maintenance the increased image noise from photon insufficiency is crucial while upholding high resolution. CT manufacturers have developed iterative and deep-learning reconstruction methods, but disparities exist. Advancements in AI enable image restoration, such as denoising through post-processing allowing radiologists to develop image-processing AI promoting the "democratization" of technology.This exhibit presents the development of a denoising method for high-fidelity cardiac CT using image-based deep learning and its clinical applications. Participants will learn about democratized image-processing AI and engage in its development and clinical application. In enhancement, we showcase cardiac CT images with the application of noise reduction technology, aiming to generate new ideas for diagnostic and prognostic imaging.

### **TABLE OF CONTENTS/OUTLINE**

1. Importance of noise reduction in cardiac CT 1.1 Cardiac CT imaging techniques 1.2 Noise's adverse effects2. AI denoising method differences 2.1 Deep-learning image reconstruction 2.2 Deep-learning post hoc denoising3. Denoising AI development Process 3.1 Optimal network selection 3.2 Data preparation essentials 3.3 Training, validation, and testing 3.4 Implementation highlights4. Clinical Showcases 4.1Exposure Reduction 4.1.1 1/4 dose coronary CT angiography 4.1.2 1/3 dose myocardial delayed enhancement CT 4.1.3 Low-dose pediatric cardiac CT 4.2 Image quality enhancements 4.2.1 Improved diagnostic performance of coronary CT angiography 4.2.2 Enhanced myocardial delayed enhancement CT 4.2.3 Enhanced 3D rendering images

## **CAEE-7 Atrial Septal Defects: A Multimodality Case-Based Approach**

### **TEACHING POINTS**

Outline the most common atrial septal defects and their associations.Demonstrate the role of cardiac MRI and CT in the diagnosis of atrial septal defects. Illustrate, through case reviews, the imaging findings of atrial septal defects.Discuss treatment options and morphological characteristics to treatment decisions.

### **TABLE OF CONTENTS/OUTLINE**

This review presents a multimodality case-based approach to the diagnosis of Atrial Septal Defects (ASDs).ASDs are the most common congenital cardiac anomaly.Ostium secundum is the most common ASD. Some congenital syndromes, including Holt Oram Syndrome and Lutembacher Syndrome, have ostium secundum type septal defects as part of their spectrum.Sinus venosus can present as a superior or inferior defect, each with different anatomical associations.Ostium primum is within the spectrum of atrioventricular septal defects and is associated with endocardial cushion defects and Trisomy 21.Coronary sinus atrial septal defect is a rare disease presenting as permeability of the coronary sinus. Raghiv syndrome is a type of coronary sinus ASD defined as a PLSVC draining to an unroofed coronary sinus.The roles of CT and MRI offer information on coronary and pulmonary diseases, as well as other anatomical variations that can impact the patient's treatment. MRI also enables functional assessment of the flow, cardiac function, and myocardial tissue characterization.Ostium primum/atrioventricular septal defects, coronary sinus defects, and sinus venosus defects are often treated surgically, while septum secundum type defects can be treated with transcatheter closure. The decision is based on the size, number, and shape of the defects.

## **CAEE-70 Quantitative Myocardial Perfusion MR: State-of-the-Art**

Participants

Roberta Catania, MD, Chicago, IL (*Presenter*) Institutional Research Grant, Siemens AG

### **TEACHING POINTS**

1. Quantitative perfusion MR is an objective and more reproducible tool to identify myocardial perfusion defects and differentiate

artifacts compared to only qualitative assessment. 2. Quantitative perfusion MR is a non-invasive tool that can add significant value in the work-up of patients with suspected coronary artery disease and surveillance of post heart transplant patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction - Physiology of myocardial circulation at rest and stress and autoregulation - Overview of current noninvasive imaging techniques for coronary artery disease assessment and their accuracy - Clinical applications of myocardial perfusion imaging including assessment for epicardial and microvascular coronary artery disease and heart transplant surveillance Imaging techniques - Pharmaceutical stress agents: mechanism of action and contraindications - Cardiac perfusion MR: physical principles, imaging sequences and protocol - Quantitative analysis: Ø Current quantification techniques (automated pixel-wise and dual sequence approach) Ø Absolute quantification and myocardial perfusion reserve (MPR) Imaging interpretation and case study- How to interpret quantitative perfusion and key information to be provided in radiology report - Normal quantitative myocardial perfusion MR - Atlas of different radiologic findings - Troubleshooting interpretations of complicated quantitative perfusion MR findings

#### CAEE-71 Utility of Non-contrast MRI for Preprocedural Assessment in Patients Undergoing TAVI

Participants

Naoki Hosoda, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To learn about the pre-procedural assessment for transcatheter aortic valve implantation. To learn about the validity of non-contrast MRI assessment. To learn about non-contrast MRI imaging protocols. To learn about the benefit patient gain by alternative non-contrast MRI.

#### TABLE OF CONTENTS/OUTLINE

A. Non-contrast MRI can be used as an alternative to contrast CT for patients with CKD and contrast allergies. B. Usefulness of non-contrast MRI to measure in the same way as contrast CT. C. Short imaging protocol focused on pre-procedural assessment of TAVI. D. Non-contrast MRI not only allows assessment comparable to contrast CT, but also avoids risks for patients with CKD and contrast allergy and allows radiation free imaging.

#### CAEE-72 Pulmonary Artery: Showcase of Congenital and Acquired Pathologies You Should Know

#### TEACHING POINTS

1. To review the normal anatomy of the of the pulmonary artery and their branches. 2. To review the acquired and congenital causes. 3. To show the frequent findings in congenital pathologies. 4. To show the repercussion of the long-term affection of the pulmonary artery.

#### TABLE OF CONTENTS/OUTLINE

1. introduccion. 2. Normal anatomy of the pulmonary artery and their branches. 3. Acquired pathologies: Complications of chronic Pulmonary embolism, Dilated arteries secondary to pulmonary hypertension, Pulmonary Artery Stenosis and Pulmonary Venocclusive Disease. 4. Congenital pathologies: Pulmonary artery agenesis associated with aortopulmonary collateral arteries (MAPCAs), Pulmonary atresia with intact ventricular septum, Anomalous Aortic Origin of Pulmonary Arteries, Aneurysm, Absent pulmonary valve syndrome, Double-Outlet Right Ventricle, Dextro-Transposition of the Great Arteries, Anomalous left coronary artery from the pulmonary artery (ALCAPA), Pulmonary Artery Sling, pulmonary arteriovenous malformations. 5. Long term repercussion in the cardiac chambers and great vessels. 6. Review of the most commons surgical options and outcomes. 7. Discussion. 8. Conclusion

#### CAEE-73 Dual-energy Late Iodine Enhancement Cardiac CT: What is Necessary to Achieve with Dual-Layer Spectral CT?

#### TEACHING POINTS

A. To learn about late iodine enhancement (LIE): Imaging technique with dual-layer spectral CT. B. To learn how spectral imaging solves conventional imaging problems. C. To learn about the use of iodine density image for myocardial extracellular volume (ECV). D. To illustrate various clinical applications of these techniques by presenting clinical images.

#### TABLE OF CONTENTS/OUTLINE

A. Methods of scanning and contrasting late iodine enhancement (LIE) using dual-slice spectral CT. And their advantages and disadvantages. B. Advantage of spectral images over conventional CT for LIE. C. LIE image analysis. LIE by image subtraction and myocardial extracellular volume (ECV) by iodine concentration images. D. Evaluation of myocardial viability by LIE. Evaluation of OMI by subtraction-LIE. E. LIE myocardial viability evaluation. Evaluation of cardiomyopathies by ECV.

#### CAEE-74 The ABC's of ECG - Practical Tips and Tricks for Salvaging ECG-Gated Cardiac CT

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Distinguish the various artifacts commonly encountered in ECG-gated cardiac CT 2. Recognize whether the artifact can be repaired, reduced, or read around 3. Employ ECG sync point editing and composing to salvage cardiac CTs degraded by artifacts from heart rate rhythm, and ECG-gating error

#### TABLE OF CONTENTS/OUTLINE

1. Introduction Basics of ECG interpretation; ECG-gating techniques, trade-offs, applications; 2. Distinguishing respiratory/patient motion vs. gating artifact 3. ECG Gating Error: Missing Data (interpolation artifact)- Pitch too high on retro helical - data gaps; Missing Sync Points; 4. ECG Gating Error: Misplaced Data (duplication artifact)- Peaked T-waves; 5. Gating Artifact with correct ECG Gating: Tachycardia or Arrhythmia- PVCs; PACs; Long pause (PVC, PAC, dropped beat); Afib other beat-to-beat Irregularity; 6. ECG-editing options- Sync point editing-Missed a beat/tagged wrong thing/helical; Sync point composing: R wave tagged, manipulation of reconstructions to read-around; 7. A systematic approach for troubleshooting ECG-gating errors and artifacts

including case examples- Respiratory motion artifact- Normal ECG; Sinus tachycardia- Multisegment reconstruction; Heart rate change- Can sometimes be read-around; PVC without pause- Eliminate PVC sync; PVC with long pause- Eliminate PVC sync; Add evenly spaced sync points in pause; PAC- eliminate PAC sync or retain it extra, even sync points in best systolic phase; Atrial tachycardia- Sync in best systolic phase; Severe bradycardia- Two separate syncs in diastole; Atrial fibrillation- Artificially space sync points at each R-R interval so they line up each beat;

## **CAEE-75 Tumors of the Heart: From the Right Side to the Left Side**

Participants

Felipe Aluja, MD, MEd, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Discuss the most common cardiac masses, including their typical manifestations and associations, and a brief discussion of clinical scenarios. Describe the imaging signs of cardiac tumors in computed tomography, magnetic resonance imaging and PET/CT. Identify selected cardiac tumors commonly encountered in daily practice and integrate them with the clinical manifestations.

### **TABLE OF CONTENTS/OUTLINE**

• Introduction • Classification with brief but concise clinical presentation • Imaging signs of cardiac tumors in computed tomography, magnetic resonance imaging and PET/CT. • Selected cardiac tumors: o Primary: § Myxoma § Fibroelastoma § Atrial hemangioma § Lipoma § Rhabdomyoma § Fibroma § Angiosarcoma § Lymphoma § Paraganglioma o Secondary: § Metastasis • Pitfalls in cardiac tumors: o Vegetations o Intracavitary thrombus o Lipomatous hypertrophy • Take a guess? • Take home points

## **CAEE-76 Solving the Mystery: Cardiac Devices on Chest Radiographs**

### **TEACHING POINTS**

Heart disease is the leading cause of mortality in the United States. Advances in clinical care leading to new devices and treatments allow patients to live longer. Radiologists encounter chest radiographs daily, many with cardiac devices. On radiographs, devices will typically be visible, and it is essential for radiologists to recognize them, know appropriate positioning, and understand complications related to the devices to provide appropriate patient management. Inaccurate interpretation may lead to inappropriate management, delayed diagnosis, and delay of necessary or harmful interventions. The purpose of this exhibit is to walk through common and uncommon cardiac devices, their appropriate positioning, and complications related to mispositioned devices, as well as discuss pathophysiology of some devices. Cardiac rhythmic controlled devices, cardiovascular support devices, stroke prevention devices, cardiac valve support and prosthetic valves, and miscellaneous devices will be reviewed.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to common cardiac devices 2. Classification of these devices 3. Expected positioning of cardiac devices 4. Visible and barely visible devices on CXR 5. Pathophysiological mechanisms of these devices 6. Examples of mispositioned devices 7. Complications related to incorrectly positioned devices 8. Less common/miscellaneous devices and their positioning 9. Flowchart of what to do with a mispositioned devices (urgent versus emergent) 10. What cardiologist expects from radiology report?

## **CAEE-77 Simplifying Semantic Segmentation in Cardiac MR: An Intuitive Guide for Radiologists using Transfer Learning**

### **TEACHING POINTS**

Understanding the importance of semantic segmentation in cardiac MR imaging  
Review of available solutions for segmentation and evaluation metrics  
Introduction to approaches for segmentation using Transfer learning  
Guided approach to a simplified segmentation process using high-level API for low-code development.  
Best practices for achieving accurate segmentation

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction to Segmentation in Cardiac MRI Imaging  
Definition of image segmentation and its types.  
Need for segmentation in cardiac MRI imaging  
Available solutions for image segmentation and metrics for assessing accuracy  
II. Introduction to TorchIO, MONAI and FAST AI Libraries for Medical Image Analysis  
Overview of libraries.  
Understanding the Data to Model pipeline.  
Importance of Using Transfer Learning.  
Use of High-level APIs for low-code model development. III. Step-by-Step Demonstration of Segmentation using Google Colab and the Heart MRI Dataset  
Setting up the Google Colab environment  
Introduction to the Heart MRI dataset from the Medical Segmentation Decathlon challenge provided by King's College London  
Step-by-step demonstration of target segmentation of the left atrium with minimal lines of code  
IV. Best Practices for Achieving Accurate Segmentation  
Tips for optimising segmentation accuracy  
Strategies for addressing common segmentation challenges  
V. Conclusion  
Summary of key teaching points  
Future directions in semantic segmentation in cardiac MR imaging (like use of generative adversarial network (GAN))

## **CAEE-78 A Precarious Path - Complications of 3-stage Palliative Surgery for Single Ventricle Congenital Heart Disease**

Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Single ventricle congenital heart diseases are most commonly managed with 3-stage palliation which culminates in the Fontan procedure. Post-operative imaging has been instrumental in assessing for complications both in the short term and long term and ensuring patient longevity. Here, we present some of the most commonly encountered complications associated with 3-stage palliation including early post-operative complications, features of physiologic decompensation, and late-stage downstream effects attributed to the unique physiology in these patients. Where appropriate, we review practical tips and pitfalls in imaging this unique set of patients.

### **TABLE OF CONTENTS/OUTLINE**

1. Title, disclosures  
2. Abbreviations  
3. Complications overview  
4. Clinical scenarios  
5. Potential workup  
6. Recent operationa. Mediastinal hematoma  
b. Pitfall: Surgical packing material  
c. Shunt/conduit occlusion  
d. Pitfall: Un/intentional occlusion  
7. Acute SOB/desaturation/chest paina. PE  
b. MIC  
c. CHF  
8. Chronic non-cyanotic SOB/desaturationa. Fontan thrombosis  
b. Pitfall:

Pseudothrombosis. Systemic AV valve dysfunction. Peri-anastomotic PA stenosis. Pitfall: Morphology/flow discrepancy RPA/LPA. Diaphragmatic paralysis. Post-Glenn SVC syndrome. Recurrent cyanosis. Pulmonary AVMs. Systemic-pulmonary venous collaterals. Practical tip: Quantifying collateral circulation. Patent fenestration. Baffle leak. Arrhythmias. Myocardial LGE. Weight gain. Liver failure. Weight loss. HCC. Protein-losing enteropathy. Chronic cough. Plastic bronchitis. Unexplained pleural effusion. Chylous pleural effusion. Potentially helpful clinical tests. References

## **CAEE-79 Left Atrial Appendage Assessment in Enhanced Cardiac CT**

Participants

Ronghui Ju, MD, PhD, Shenyang, China (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

In a recent study using cardiac computed tomography (CT) and magnetic resonance (MR), the shapes of the left atrial appendage (LAA) in patients with drug-refractory AF were classified into 4 morphological types, with "chicken wing" being the most common (48%), followed by "cactus" (30%), "windsock" (19%), and "cauliflower" (3%). Transcatheter left atrial appendage occlusion is an increasingly used alternative to oral anticoagulation in selected patients with atrial fibrillation. Pre-procedural imaging is a prerequisite to a successful intervention, with transesophageal echocardiography as the current gold standard. However, cardiac CT offers improved imaging with high-quality multiplanar and 3-dimensional reconstructed images. Nevertheless, the lack of a standardized imaging protocol has slowed the adoption of cardiac CT into clinical practice. This paper provides a protocol for the preparation, acquisition, and interpretation of cardiac CT imaging in pre-procedural planning of left atrial appendage occlusion. Orifice (OR) is defined as a line connecting the left upper pulmonary vein ridge and the circumflex coronary artery. Device landing zone (LZ) is defined as a line connecting the circumflex coronary artery and a point 1-2 mm inside the LAA, measured from the left upper pulmonary ridge tip. Length/depth of the appendage is measured as a line from the landing zone to the most distal tip of the appendage.

### **TABLE OF CONTENTS/OUTLINE**

Outline Page 1: What to assess about left atrial appendage (LAA) in an enhanced cardiac CT Page 23: 4 types of LAA morphologies (VR reconstruction) Page 4: LAA recognition and assessment of orifice and landing zone in multiplanar reconstruction images

## **CAEE-8 Coronary Artery Vasculitis, Encasement, and Mimics**

### **TEACHING POINTS**

1. Coronary artery vasculitis is an inflammatory process that is often distinguished from coronary artery encasement from benign and malignant neoplasms, although imaging appearances can overlap. 2. Coronary artery vasculitis is rare but represents an important diagnostic consideration, especially for acute coronary syndrome (ACS) patients with no traditional cardiovascular risk factors or systemic illness. 3. There are several mimics of coronary artery vasculitis, demanding careful attention to multi-organ findings and clinical presentation.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Spectrum of coronary artery vasculitis and encasement. 3. Review and illustration of coronary artery vasculitis, including: polyarteritis nodosa, Kawasaki's disease, Takayasu's arteritis, giant cell arteritis, HIV. 4. Review and illustration of coronary artery encasement, including: malignant neoplasms (lymphoma, angiosarcoma), IgG4-related disease, Histiocytic disorders (Erdheim-Chester disease, Rosai Dorfman). 5. Complications of coronary artery vasculitis: aneurysms, stenosis, CHF. 5. Mimics of coronary artery vasculitis: spontaneous coronary artery dissection (SCAD), acute plaque rupture, vasospasm.

## **CAEE-80 Women's Heart: Role of Cardiac Imaging in Early Detection and Prognostication of Heart Diseases- A Primer for Cardiac Imagers**

Participants

Barun Bagga, MBBS, Mineola, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. The diagnosis of heart disease in women poses unique challenges and remains underdiagnosed and undertreated. 2. Understanding the different etiologies of chest pain in women focusing on Acute myocardial infarction (AMI), MINOCA (myocardial ischemia with non-obstructed coronary arteries), myocarditis, Takotsubo, LV apical ballooning, and connective tissue disease-related cardiomyopathy. 3. AMI has a different presentation, underlying pathophysiology, and outcomes in women compared to men. 4. MINOCA is more common in women and in a younger population, with fewer traditional risk factors for coronary artery disease (CAD) and a higher prevalence of non-obstructive coronary plaques. 5. MINOCA has a higher all-cause mortality at 12 months compared to stable angina and has been found to have worse quality of life compared to AMI-CAD because they are less often treated with beta-blockers and less often referred to cardiac rehabilitation. 6. Cardiac MRI (CMRI) plays a crucial role in the diagnostic algorithm because of accurate myocardial characterization independent of the presence of obstructive coronary lesions. 7. CMRI has been shown to provide an etiologic diagnosis in as many as 77-87 % of cases of MINOCA and offers prognostic value with the extent of LGE involvement correlated with the risk of major cardiovascular events.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Review the different causes of chest pain in women in a case-based approach: a) MINOCA; b) SCAD; c) Myocarditis; d) Takotsubo; e) LV apical ballooning; f) AMI; g) Connective tissue disease-related cardiomyopathy. 3. Review the role of cardiac imaging in diagnosis and prognostication.

## **CAEE-81 Improved Assessment of Coronary Artery Calcium in Photon-Counting Detector CT: A Phantom Study with Various Imaging Modalities**

Participants

Nobuo Kitera, RT, MSc, Nagoya, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Accurate assessment of calcified lesions in coronary arteries can help establish better treatment strategies. 2. CT can obtain preoperative calcification information of coronary arteries, but it is difficult to completely complement intravascular imaging due to



limitations in spatial resolution and other factors. 3. Photon-counting detector (PCD) CT has higher spatial resolution than conventional energy-integrating detector CT and is expected to improve the ability to visualize microstructures. 4. PCD-CT has the potential to provide new diagnostic value as a preoperative diagnostic tool by acquiring highly accurate coronary artery calcification imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Importance of coronary artery calcification assessment in percutaneous coronary intervention. 2. Characteristics of coronary artery calcification images in various imaging modalities. 3. Features of PCD-CT, including principles of high-resolution imaging, and selection of scan mode and reconstruction kernel. 4. Comparison of PCD-CT images with other imaging modalities using calcified phantom.

#### CAEE-82 Congenital Mitral Valve Disease: From Embryology to Pathology to Repair

Participants

Jonathan Liu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Congenital mitral valve disease can present in a myriad of ways, often differing in morphology, age of presentation, and symptoms. By understanding the development of the mitral valve apparatus, congenital mitral valve disease can be categorized based on which underlying apparatus structure is maldeveloped. The most common and clinically relevant mitral valve pathologies are discussed. Next, the general approach to evaluation of these congenital mitral valve pathologies is reviewed, highlighting the strengths and weakness of each imaging modality (CT, MRI, and echocardiography). Methods for quantification are also reviewed. Finally, the general approach to mitral repair and replacement in the context of congenital heart disease will be discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Embryology and normal anatomy 3. Anomalies based on location a. Supravalvular Lesions b. Anomalies of leaflets c. Anomalies of chordae d. Anomalies of papillary muscles e. Associated congenital heart diseases 4. General approach to evaluation of congenital mitral valve disease a. Morphology i. Lesions best diagnosed by CT ii. Lesions best diagnosed by MRI iii. Lesions best diagnosed by echocardiography b. Flow i. Mitral regurgitation ii. Mitral stenosis iii. Mixed physiology 5. Correction of congenital mitral valve disease a. Mitral valve repair b. Mitral valve replacement 6. Conclusion

#### CAEE-83 Congenital Aortic Arch Anomalies: What the Clinician Wants to Know

Participants

Muhammad Naeem, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Anomalies and congenital variants of the aortic arch are important entities to be familiar with, as they are known to be associated with congenital heart disease, vascular rings, genetic syndromes, and can have significant impact in clinical management. It is postulated to occur as a result of abnormal embryonal organogenesis of the primitive aortic arches. Advanced imaging, specifically computed tomography angiography (CTA) and magnetic resonance angiography (MRA) play a crucial role in the pre-operative planning, as these cases present an anatomic challenge for surgical intervention. Imaging is essential in the diagnosis, management, surgical planning and eventual outcome in patients with congenital arch anomalies. This exhibit will outline the imaging that may be required, and the information needed by the surgeon to attain the best possible surgical outcome.

#### TABLE OF CONTENTS/OUTLINE

1. Review anatomy of various congenital aortic arch anomalies, focusing on clinically significant anomalies that require surgical correction, through case-based examples. 2. Understand what are the most salient findings that should be reported to the surgeon in these case examples, so that pre-operative planning is optimized. We will review the clinically significant variants of congenital arch anomalies that require surgical correction, which may be unfamiliar due to their rarity in clinical practice. We will utilize case-based examples to demonstrate what the important imaging findings the radiologist should review and report to the surgeon. Our focus will cover the impact a radiologist can have in detecting these variants and to provide all the critical information to the surgeon, before an operation occurs.

#### CAEE-84 Imaging findings in Cardiac and Lung Transplant Emergencies and Urgencies

Participants

Thangalakshmi Sivathapandi, MD, Johns Creek, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Having comprehensive knowledge about hyperacute/acute complications of heart and lung transplants is crucial as imaging plays a vital role in the multidisciplinary management of these patients. 2. Despite many advances, a disproportionate portion of mortality still occurs in the early post-transplant period, hence prompt recognition of these complications is essentially needed to prevent allograft failure and death. 3. Accurate reporting by the radiologist could aid the clinician for timely intervention and appropriate patient care.

#### TABLE OF CONTENTS/OUTLINE

1. Overview: To review the salient radiological findings in hyperacute and acute complications of heart and lung transplant. 2. Heart transplant: primary graft dysfunction, post operative bleeding, pericardial tamponade, inferior and superior vena cava stenosis/injury, thromboembolism, sternal dehiscence, pseudoaneurysm, pulmonary edema, infection, and acute rejection. Highlighting the key findings of cross-sectional imaging studies including ultrasound, computed tomography, and magnetic resonance imaging with primary emphasis on CT findings. 3. Lung transplant: chest wall/pleural defects like wound dehiscence, acute and hyperacute rejection, primary graft dysfunction, bronchovascular anastomotic complications such as lobar torsion, bronchial dehiscence, and pulmonary arterial and venous stenosis/thrombosis, as well as bacterial, viral, and fungal infections among others.

#### CAEE-85 The Emerging Role of Cardiac CT in Clinical Practice of Cardiac Amyloidosis

Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recent research has revealed a considerable number of hidden cardiac amyloidosis (CA) especially in patients with heart failure with left ventricular hypertrophy. CA is, however, frequently misdiagnosed as the other hypertrophic heart disease, and delayed diagnosis results in significant consequences for patients. 2. Current noninvasive diagnostic imaging strategies for CA include echocardiography, cardiac MRI, and bone scintigraphy. 3. Myocardial late iodine enhancement (LIE) and extracellular volume (ECV) quantification by cardiac CT has become clinically available and clinical evidence is accumulating. 4. Since CT is more practical than MRI and scintigraphy, it plays a clinically important role in the diagnosis and management of CA.

#### TABLE OF CONTENTS/OUTLINE

1. Basic knowledge of CA: - Classification of CA - Recent development on therapeutic agents 2. Current noninvasive diagnostic imaging strategies: - Echocardiography - Cardiac MRI - Bone scintigraphy 3. Myocardial tissue assessment using cardiac CT: - LIE imaging - ECV quantification - CT imaging protocols 4. The emerging role of cardiac CT for CA: - Efficient diagnostic flow and current evidence - Use in patients with mechanical devices - Application in patients with aortic stenosis - Application in patients with atrial fibrillation - Monitoring of therapeutic effect 5. Future directions

#### CAEE-86 **Genotype and Imaging Phenotype in Dilated and Arrhythmogenic Cardiomyopathy**

Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. With the rapid increase in the number of heart failure patients worldwide, research on personalized medicine for cardiomyopathy based on genomic information is being promoted. 2. In recent years, the relationship between genotype and phenotype in dilated cardiomyopathy (DCM) and arrhythmogenic cardiomyopathy (ACM) has been clarified. 3. Important pathogenic variants include titin (TTN), filamin C (FLNC), lamin A/C (LMNA), and desmoplakin (DSP), with characteristic genotypic-imaging phenotypes. 4. This presentation summarizes new findings on genotype-imaging phenotypes in DCM/ACM.

#### TABLE OF CONTENTS/OUTLINE

1. Evolving disease concept of DCM/ACM: - New diagnostic criteria for ACM (Padua criteria) - Arrhythmogenic right ventricular cardiomyopathy (ARVC) and arrhythmogenic left ventricular cardiomyopathy (ALVC) - Overlap of ACM and DCM 2. Genetic basis of DCM/ACM: - Genes encoding constituent proteins of cardiomyocytes - Genetic variants causing DCM/ACM 3. Genotype-imaging phenotypes in DCM/ACM: - Titin (TTN) - Filamin C (FLNC) - Lamin A/C (LMNA) - Desmoplakin (DSP) - Others 4. Important MRI, CT imaging findings: - Fibro-fatty replacement of myocardium - Ring-like delayed enhancement 5. Future directions

#### CAEE-87 **Diagnosis of Coronary Microvascular Disease, Principle, Challenges, and Emerging Technologies of CT and MRI**

Participants

Takanori Kokawa, MD, Tsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the definition, classification, and standard diagnostic steps of coronary microvascular disease (CMD). 2. To discuss the role of PET, MRI and CT in the diagnosis of CMD. 3. To illustrate emerging CT and MRI technologies for characterizing CMD.

#### TABLE OF CONTENTS/OUTLINE

A) Definition and epidemiology of CMD. B) Pathophysiology of CMD. C) Diagnostic criteria and standard approach for CMD. D) Role of non-invasive imaging modalities including PET, MRI and CT. E) Emerging technologies for assessment of CMD. a. Myocardial blood flow quantification by MR perfusion imaging and CT perfusion imaging. (Clinical example - normal CCTA, subendocardial perfusion defect, reduced CFR by MRI) b. Coronary sinus flow assessment by phase-contrast cine MRI c. Fractal analysis of dynamic myocardial CT perfusion. d. Potential of photon-counting CT for characterizing myocardium.

#### CAEE-88 **Demystifying the Mysteries of Heart Tumors and Tumor-like Conditions: A Succinct Approach for Radiologists**

Participants

Aniket Agarwal, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Highlight the basic protocol of cardiac magnetic resonance imaging and simplifying the anatomy to help alleviate the cardiac-MR phobia. Devise an algorithmic approach to narrow down the differential for cardiac masses by using the clinical history, age, signal intensity, location and enhancement characteristics of the mass. Each sequence tells its own story. Double inversion recovery sequence, Triple inversion recovery has their own advantage. Early and late gadolinium enhancement characteristics of the mass is one of the most important features in differentiating a thrombus from a myxoma and a fibroma from a sarcoma. Rhabdomyomas are usually multi-focal non-enhancing or hypoenhancing lesions. Cine sequences provide assessment of mass mobility, its attachment points and hemodynamic impact on cardiac valves. Characterization for differentiation between benign and malignant features.

#### TABLE OF CONTENTS/OUTLINE

Cardiac MR protocol and basic cardiac MRI sequences. Important anatomical landmarks. Sequence wise diagnostic approach - What to look on which sequence? Algorithms- cardiac tumor classification based on benign/malignant, age, location, imaging characteristics. Differentiating cardiac masses on MRI. Mimics of cardiac tumors including anatomical tissues. Advantages and pitfalls of cardiac MRI.

#### CAEE-9 **Novel Approach for Comprehensive Preoperative Assessment of Valvular Heart Disease via Four Dimensional CT Datasets in the Era of Minimum Invasive Cardiac Surgery**

#### TEACHING POINTS

Recent years, surgical techniques of cardiac valvuloplasty, such as minimally invasive cardiac surgery (MICS) and robotic surgery, have developed dramatically. In exchange for less invasiveness, surgical procedures turned out highly technically demanding due to narrow operative field and deep working space. Comprehensive assessment of cardiac anatomy and preoperative simulation using various modalities would be more important than ever. We summarize the usefulness of cardiac CT, especially in preoperative physiological morphology assessment.

#### **TABLE OF CONTENTS/OUTLINE**

In valvuloplasty, to assess physiological morphology of valve complex under beating is one of the most important factors. Utilizing CT datasets, valve complex structures consisting of leaflets, chordae tendineae, papillary muscles, and prolapsing leaflet were faithfully reproduced, and allowed surgeon to observe and measure using 3D or 4D datasets. Furthermore, preoperative simulations via life size 3D models and virtual reality simulation systems constructed from high spatial resolution datasets have reached to the stage of practical use. The learning curve would be shortened by development of these simulation technologies, though construction treatment strategy and judging surgical procedures had been largely dependent on surgeon's experience in the past. We propose a novel approach for assessment the whole aspect of valvular heart disease using appropriate imaging modalities comprehensively.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-1

### **Is It Possible to Assess Left Atrial Remodeling Using Deep Learning? An Attempt to Classify Atrial Fibrillation Types Using Contrast-Enhanced CT Images.**

#### **TEACHING POINTS**

Catheter ablation therapy is one of the curative treatments for atrial fibrillation (AF). It is generally known that the recurrence rate after treatment increases as attacks persist, and the factor is related to structural remodeling of the left atrium. However, standard evaluation is difficult, and the indication for catheter ablation therapy is currently determined by the surgeon's empirical judgment and the duration of disease obtained from the patient's self-report. Therefore, this study demonstrates the possibility of assessing remodeling of the left atrium from the results of the visualization of the classification basis of the two models. The major teaching points of this exhibit are 1. Evaluation of AF types using contrast-enhanced CT imaging is difficult only for experienced physicians 2. Deep learning enables evaluation of the left atrium using features such as the structure of the left atrium and pulmonary veins obtained from images. 3. Evaluation of structural remodeling of the left atrium may be useful for AF types

#### **TABLE OF CONTENTS/OUTLINE**

1. About Atrial Fibrillation -Classification of Atrial Fibrillation Types -Structural remodeling of the left atrium 2. Treatment options for Atrial Fibrillation -Relationship between seizure duration and treatment outcome 3. Results of experiments -How well did you recognize the shape of the left atrium?

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-10

### Seeing Beyond the Surface: A Radiological Exploration of Pacemakers, CRT, and ICDs

#### TEACHING POINTS

- Review the relevant cardiac anatomy, the different types of devices (pacemakers, CRT, and ICDs), and the positioning and integrity of the different elements of the devices.
- Understand the importance of X-ray imaging in the diagnosis and follow-up of patients with pacemakers, CRT, and ICDs.
- Identify the normal and abnormal X-ray findings for these devices, including lead placement, device positioning, and associated complications.
- Understand how X-ray imaging is used to evaluate the function of pacemakers, CRT, and ICDs, including pacing and electrical leads, and common X-ray findings associated with device malfunction.
- Recognize the potential limitations associated with X-ray imaging of these devices and the troubleshooting strategies for addressing those limitations.

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1. Introduction
2. Overview of cardiac devices (pacemakers, CRT, and ICDs)
3. Anatomy and positioning of cardiac devices
4. Importance of X-ray imaging in diagnosis and follow-up
5. Differentiating between pacemakers, CRT, and ICDs on chest radiography
6. Normal and abnormal X-ray findings for pacemakers, CRT, and ICDsa. Device type and differences.b. Device positioningc. Internal elementsd. Lead placemente. Lead integrityf. Associated complications
7. Troubleshooting strategies for technical limitations of X-ray
8. Take home points

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-11

### AI-Assisted Autonomous Aortic Aneurysm Analysis - Status, Strengths, Slants, and Stresses: Ut Nos Ibi Nunc?

#### Participants

Roshan Fahimi, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The exhibit will help the audience understands the following aspects of multiple AI algorithms pertaining to triage, measurement, detection, and report creation for aortic aneurysm and dissection. 1. 1.Aortic evaluation with CT: Intentional and incidental 2. 2.Scientific evidence for aortic evaluation with AI 3. 3.Multi-vendor AI for aortic evaluation 4. 4. Status, strengths, slants, and stresses of AI models

#### TABLE OF CONTENTS/OUTLINE

We use our multi-vendor AI experience to organize and present the exhibit content into following brackets: 1. 1. Aortic Diseases: Incidence, importance, and imaging 2. 2. AI for aortic aneurysm and dissection: Evidence in literature 3. 3. Approach of multiple AI algorithms in aortic aneurysm and dissection 4. 4. Screening and AI-based new metrics for aorta 5. 5. Status, weaknesses, and stresses of AI algorithms 6. 6. Autonomy for AI-assisted analysis: Should we be there now?

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-12

### Boost Your Imaging Skills and Help Your Interventional Cardiologists Before and After Left Atrial Appendage Occlusion

#### Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize radiologists with available LAAO devices and their clinical applications. Review the required pre-procedural measurements for LAAO. Educate radiologists with post LAAO complications and ideal imaging techniques for their detection. Review spectrum of normal post procedural findings that should be differentiated from complications.

#### TABLE OF CONTENTS/OUTLINE

1. Review the different LAAO devices (Watchman, Watchman FLX, Amulet, and Lariat), their unique features, and patient selection criteria.
2. Recognize the importance of preprocedural Image based planning in guiding device selection and placement.
3. Pictorial review of LAAO complications A) peri-device leak B) off-axis placement, and C) device-related thrombosis.
4. Review of the clinical importance of post procedural complications with focus on the role of imaging.
5. Review of the management of device-related complications with emphasis on the role of imaging.
6. Comparison between CT and other imaging modalities (Echocardiography and MRI) for LAAO planning and surveillance.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-13

### Fibromuscular Dysplasia: a Multifaceted Vascular Disease

#### Participants

Frances Ferreira De Deus, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Provide an overview of the pathophysiology and clinical manifestations of fibromuscular dysplasia (FMD). less prevalent, but more commonly underdiagnosed as related to this pathology.- To describe the role of imaging in the diagnosis and prevention of complications.

#### TABLE OF CONTENTS/OUTLINE

Fibromuscular dysplasia (FMD) is a non-inflammatory, non-atherosclerotic, idiopathic arterial disease that primarily affects Caucasian women and medium-sized vessels. The classic finding is the beaded appearance and tortuosity of the affected vessel. However, FMD also predisposes to aneurysm formation, dissection, and stenosis, which are not always suspected to be related to FMD by the imaging community. We describe and illustrate with schematic figures and cases the main sites of vessel involvement, the variable radiological findings and the complications related to the disease. The most affected sites are the renal and cerebrovascular arteries, although the aorta and other arteries may also be involved. FMD can predispose to important complications, such as stroke, myocardial or renal infarction, aneurysm rupture and progressive dissection. FMD is often a subclinical and underdiagnosed arteriopathy with catastrophic complications. The radiological community should be familiar with the different phenotypic appearances. Invasive angiography and non-invasive vascular imaging by CT and MRI play an important role in the diagnosis and prevention of complications.

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## Abstract Archives of the RSNA, 2023

CAEE-14

### How to Distinguish Chronic Total Occlusion From Subtotal Occlusion by Distal Transluminal Attenuation Gradient in Coronary CT Angiography

#### TEACHING POINTS

Understand how to calculate distal transluminal attenuation gradient (TAG<sub>distal</sub>) in coronary CT angiography (CCTA) and TAG<sub>distal</sub> can be used to distinguish chronic total occlusion (CTO) from subtotal occlusion (STO).

#### TABLE OF CONTENTS/OUTLINE

1. CTO and STO  
Chronic total occlusion (CTO) is a complete interruption of coronary arterial flow caused by plaque obstructing arterial lumen. Subtotal occlusion (STO) is a "functional" total occlusion and slow blood flow passes through the occluded segment. Percutaneous coronary intervention is attempted less frequently for CTO lesions and has a higher unsuccessful rate and late restenosis compared with STO lesions.  
2. TAG<sub>distal</sub>  
TAG: linear regression coefficient between intraluminal radiological attenuations and vessel length. May be calculated manually or automatically by artificial intelligence post-processing technology  
TAG<sub>distal</sub>: calculated from distal to occlusion.  
3. Distinguish CTO from STO by TAG<sub>distal</sub>  
Coronary arteries with CTO showed higher TAG<sub>distal</sub> compared with arteries with STO. TAG<sub>distal</sub> has higher accuracy in differentiating CTO from STO.  
4. Improve the diagnostic efficiency of CCTA  
Radiologists routinely diagnose CTO and STO through CCTA, and TAG combined with CCTA can improve the diagnostic efficiency  
5. Clinical Application  
AI-enabled TAG measurements may be used to assist radiologists to differentiate STO from CTO with moderate diagnostic accuracy, improving diagnostic workflow.

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## Abstract Archives of the RSNA, 2023

CAEE-15

### How to Distinguish Chronic Total Occlusion from Subtotal Occlusion by Transluminal Attenuation Gradient in Coronary CT Angiography

#### TEACHING POINTS

Understand how to calculate transluminal attenuation gradient (TAG) in coronary CT angiography (CCTA) and TAG can be used to distinguish chronic total occlusion (CTO) from subtotal occlusion (STO).

#### TABLE OF CONTENTS/OUTLINE

1. CTO and STO  
Chronic total occlusion (CTO) is a complete interruption of coronary arterial flow caused by plaque obstructing arterial lumen. Subtotal occlusion (STO) is a "functional" total occlusion and slow blood flow passes through the occluded segment. Percutaneous coronary intervention is attempted less frequently for CTO lesions and has a higher unsuccessful rate and late restenosis compared with STO lesions.  
2. TAG  
TAG: linear regression coefficient between intraluminal radiological attenuations and vessel length. May be calculated manually or automatically by artificial intelligence post-processing technology  
TAG<sub>all</sub>: calculated from ostium to distal vessel  
TAG<sub>distal</sub>: calculated from distal to occlusion  
3. Distinguish CTO from STO by TAG<sub>all</sub> and TAG<sub>distal</sub>  
Coronary arteries with CTO showed lower TAG<sub>all</sub> and higher TAG<sub>distal</sub> compared with arteries with STO. TAG<sub>distal</sub> has higher accuracy in differentiating CTO from STO.  
4. Improve the diagnostic efficiency of CCTA  
Radiologists routinely diagnose CTO and STO through CCTA, and TAG combined with CCTA can improve the diagnostic efficiency  
5. Clinical Application  
AI-enabled TAG measurements may be used to assist radiologists to differentiate STO from CTO with moderate diagnostic accuracy, improving diagnostic workflow.

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## Abstract Archives of the RSNA, 2023

CAEE-16

### Calcium in the Heart: A Guide to Interpret Like an Expert

#### Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Reviewing various calcified cardiac lesions, including calcification of the pericardium, vascular structures, myocardium, valves, and valve annuli. 2- Reviewing the morphology, location, and extent of calcification, which are often pathognomonic features that aid in identifying each type of calcified lesion as well as conditions associated with them. 3- Exploring the clinical significance of various calcified lesions and outlining a structured clinical approach for their management. 4- Discussing differential diagnosis of cardiac calcification and evaluation of their etiologies

#### TABLE OF CONTENTS/OUTLINE

1- Introduction to a systematic evaluation of calcified cardiac lesions  
2- Identifying:  
A) Pathognomonic features of pericardial calcifications and considering their underlying causes  
B) Pathognomonic features of valvular and annular calcifications based on underlying causes  
C) Myocardial calcifications associated with tumors (such as endothelioma and rhabdomyoma), trauma, or infarction.  
D) Papillary muscle calcification.  
E) Left atrial calcifications related to atrial fibrillation, congestive heart failure, and endocarditis.  
F) Intracavitary calcifications in the atria and ventricles.

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## Abstract Archives of the RSNA, 2023

CAEE-17

### Medical Terminology in Cardiothoracic Radiology

#### TEACHING POINTS

Medical terminology includes words and phrases aiming to accurately describe anatomical structures, processes, conditions, medical procedures, and treatments. In cardiothoracic radiology, there is a plethora of words originating from Greek and they may be misused and misspelled in everyday practice. To aid colleagues in fluent and effective use of these terms, we have derived a radiologically illustrated glossary of the most frequent terms, their definitions and explanations of their origin and meaning. Typically, medical terms stemming from Greek adhere to a fixed structure of a prefix, a root, and a suffix. The prefix appears at the beginning of a medical term and usually indicates a location, direction, type, quality, or quantity. The root gives a term its essential meaning whereas the suffix appears at the end of a term and may indicate a specialty, test, procedure, function, disorder, or status.

#### TABLE OF CONTENTS/OUTLINE

In a comprehensive and schematic way, words are presented alphabetically divided in two sections: anatomy and pathology and illustrated with representative radiology images, relevant findings and key imaging references. For each word the correct orthography is demonstrated along with a brief review of its history and etymology.

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## Abstract Archives of the RSNA, 2023

CAEE-18

### The One Ring to Rule Them Out: Deciphering Differential Diagnosis of Left Ventricular Ring-Like Late Gadolinium Enhancement

#### TEACHING POINTS

Despite being initially described as a diagnostic marker for arrhythmogenic cardiomyopathy (ACM), ring-like LGE has been increasingly reported in non-genetic heart disease. Ring-like LGE secondary to ACM may be accompanied by inverted T-waves in left precordial leads, ventricular arrhythmia with left bundle branch block morphology, and family history of premature sudden death. Ring-like LGE secondary to Chagas disease may be accompanied by residency in south america, positive serology, right bundle branch block and left anterior fascicular block, and apical aneurysm. Ring-like LGE secondary to viral myocarditis may be accompanied by prodromal manifestations (e.g fever, flu-like symptoms and diarrhea), and myocardial edema. Ring-like LGE secondary to Keshan disease may be accompanied by residency in China, disabsortive syndrome, and selenium deficiency. Ring-like LGE secondary to sarcoidosis may be accompanied by extracardiac findings, right bundle branch block, 2nd- and 3rd-degree heart block, and right ventricular free wall LGE.

#### TABLE OF CONTENTS/OUTLINE

Introduction: definition of left ventricular ring-like LGE, clinical significance, and objectives  
Differential diagnosis between genetic causes: left-dominant CMAD  
Differential diagnosis between endemic causes: Chagas disease, and Keshan disease  
Differential diagnosis between inflammatory causes: viral myocarditis, sarcoidosis, and heart transplant rejection  
Differential diagnosis between causes of non-ring-like circumferential LGE: myocardial infarction, amyloidosis, and dystrophin cardiomyopathies  
Discussion: table with distinctive features of ring-like LGE differential diagnosis

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## Abstract Archives of the RSNA, 2023

CAEE-19

### Understanding Transesophageal Echocardiography: A Radiologist's Guide

#### TEACHING POINTS

TEACHING POINTS1. To understand the complimentary role of transesophageal echocardiography in multi-modality cardiac imaging including indications, contra-indications and potential complications.2. To have an understanding of the standard trans-esophageal examination3. Using cross modality reference be able to identify specific pathologies on TEE, CT and MRI.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE1. Introduction: Overview of the role of TEE in multimodality cardiac imaging including indications, contraindications, and complications.2. The standard transesophageal examination with cross modality reference with CT and MRI3. Specific roles of TEE in acute aortic syndromes, cardiac source of emboli, infective endocarditis and valvular assessment. Pathological appearances on TEE with cross modality reference.4. Summary.

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## Abstract Archives of the RSNA, 2023

CAEE-2

### Role of Cardiac MRI in the Follow Up of Postoperative Congenital Heart Disease

#### Participants

Harold Goerne, MD, Guadalajara, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review congenital heart diseases that require imaging follow up after surgical or endovascular repair. To discuss the role of cardiac MRI in the evaluation of postoperative findings in CHD repair. To demonstrate the importance of follow up imaging for detection of postoperative complications.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Congenital heart diseases - Clinical features; embryology; pathophysiology; treatment 3) Advantages and disadvantages of imaging modalities- Echo, CT, MRI. 4) MRI 5) Discussion, illustration with case examples of postoperative findings in repaired congenital heart diseases a) TOF: 1) Total repair (Pulmonary valve regurgitation, RV dilatation, RVOT wall fibrosis/aneurysms) b) TGA: 1) Jatene / Atrial switch (stenosis, thrombosis) 2) Banding (stenosis) c) DORV 1) Jatene (coronary ostia stenosis, PA stenosis) 2) MBT 3) Rastelli (leaking, regurgitation) 6) Discussion, illustration with case examples of postoperative complications in the repair of congenital heart diseases. I. Pulmonary valve insufficiency II. Aneurysmal dilatation of patch III. Myocardial dysfunction (Structural alterations, hypertrophy and remodeling) IV. Right ventricular dysfunction

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## Abstract Archives of the RSNA, 2023

CAEE-20

### Multimodality Imaging of the Pericardium

#### Participants

Nilo Fernandes Leca Junior, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To discuss the strengths and limitations of different imaging techniques in the exploration of the pericardium. To highlight the radiological aspects of the normal pericardium and the spectrum of pathological entities such as developmental anomalies, inflammation/infection, effusion, neoplasms, iatrogenic conditions and pericardial constriction.

#### TABLE OF CONTENTS/OUTLINE

Pericardial diseases are conditions that involve the membrane that surrounds the heart. Imaging plays a pivotal role in the assessment, which is performed by multiple non-invasive methods such as x-ray, echocardiography, CT and MRI. Echo remains as the first modality in most clinical scenarios. The most common conditions involving the pericardium are inflammation, effusions and constriction. Pericarditis is classified by symptom duration and by etiology (infection, idiopathic, neoplastic, drug related, iatrogenic and autoimmune). Pericardial constriction is a rare complication. Pericardial effusion is related to varying degrees of abnormal fluid accumulation into the pericardial space, and can evolve to tamponade. Primary and secondary masses are commonly accessed by CT and MRI. Secondary involvement is far more common than primary pericardial tumors. Congenital anomalies are relatively uncommon entities and may range from pericardial cysts to partial or total agenesis. Cardiovascular imaging plays an important role on the management of pericardial pathologies, which should be promptly recognized to help guide timely treatment.

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## Abstract Archives of the RSNA, 2023

CAEE-21

### Utility of CT Coronary Angiography in Septal Vascular Mapping Prior to Alcohol Ablation in Hypertrophic Obstructive Cardiomyopathy

#### TEACHING POINTS

1. Alcohol septal ablation (ASA), an established treatment in hypertrophic obstructive cardiomyopathy (HOCM), iatrogenically induces an infarct of the target basal septum- the site of contact of mitral valve leaflet on the septum during systolic anterior motion (SAM). 2. Invasive angiography provides information about the course and size of coronary arteries but not their territorial distribution. Inaccurate infarct localisation due to alcohol injection into right ventricular side of septum and inability to identify the target vessel on invasive angiography leads to failure of ASA. 3. Computed tomography (CT) angiography has the dual benefit of detailing vascular anatomy and providing information on myocardial distribution. Mapping the septal vascular anatomy with CT coronary angiography prior to ASA improves localisation of infarct with predictable outcome and procedural success at the first attempt compared to traditional methods. The authors describe a new 5-step method of creating a CT navigational map for planning selective sub-branch micro-catheterisation.

#### TABLE OF CONTENTS/OUTLINE

1. Mechanism and principle of ASA. 2. CT angiography protocol and 5-step mapping technique of the target basal septal vasculature. 3. Checklist of CT reporting points including the distance and angulation of the septal arteries. 4. Illustration of variant CT septal vascular anatomy. 5. Causes and demonstration of failed procedures in pre-CT traditional ASA. 6. Clinical utility of CT-guided ASA in terms of symptomatic, functional and haemodynamic improvement.

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## Abstract Archives of the RSNA, 2023

CAEE-22

### Gray Blood and Applications

#### Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibition is: ? Review the concept and indications of the gray blood myocardial delayed enhancement (MDE) technique? Highlight the ease of execution and applicability of the method? Understand the benefits of applying gray blood in the investigation of myocardial fibrosis? Identify the radiological findings that will help in the diagnosis as well as pitfalls of this technique

#### TABLE OF CONTENTS/OUTLINE

Gray blood is a sequence in cardiac magnetic resonance imaging (CMR) obtained by partial blood signal suppression that increases the ability to identify and localize myocardial scarring near the cavity. A pictorial essay based on cases from our collection allows for a comprehensive assessment and understanding: ? Grayblood MDE technique with a tutorial video? Main indications of grayblood MDE images? Grayblood MDE radiological findings in cases of subendocardial enhancement and papillary muscles? Grayblood MDE radiological findings in cases of post-cardiac transplantation, cardiac tumor, myocarditis and hypertrophic cardiomyopathy? Cases in which grayblood MDE did not help in the diagnosis

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## Abstract Archives of the RSNA, 2023

CAEE-23

### Imaging of the Ductus Arteriosus

#### Participants

Kaustav Bera, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To know the embryology, physiology and modalities for evaluation of the ductus arteriosus 2. To learn about the pathologies of the ductus going beyond patent ductus arteriosus 3. To review the clinical and imaging findings of the above-mentioned entities with case examples

#### TABLE OF CONTENTS/OUTLINE

1. Embryologic development of ductus arteriosus 2. Physiological significance of ductus arteriosus 3. Modalities for evaluation of pathologies of ductus arteriosus : USG, CT, MR, Invasive angiogram 4. Pathologies of Ductus: - Normal variants - Congenital/developmental o PDA § Risk factors and pathophysiology § Classification § Causes § Maintaining patency post birth for some Congenital Heart diseases § Closure of PDA o Aneurysm of DA o Congenital vascular ring o Significance in Coarctation of aorta ( Preductal versus post ductal) - Post traumatic o Mechanism of and incidence of ductal injury o Minimal aortic injury (MAI) o Ductal Pseudoaneurysm o Penetrating ulcer o Aortic dissection - Miscellaneous o Infective aortitis associated with the nonpatent remnant of a ductus arteriosus o Atherosclerotic penetrating ulcer/ pseudoaneurysm of aortic ductus. 5. Differential diagnosis/mimics: - Aortic spindle mimicking aortic ductus pseudoaneurysm/MAI - Type III ductal diverticulum mimicking Aortic ductus pseudoaneurysm - Infundibula of the aortic branch vessels mimicking Aortic ductus pseudoaneurysm - Technical mimics of MAI :Breathing, arterial pulsation and other motion artefacts, streaming/streaking of contrast mimic minimal aortic injuries) - Anatomical mimics of MAI : Noncalcified and partially calcified atheroma

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## Abstract Archives of the RSNA, 2023

CAEE-24

### The Space Between: A Roadmap to Cardiac Recesses Grooves

#### Participants

Katherine Cheng, MD, Stamford, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The recesses, grooves, and potential spaces around the heart are defined by the vasculature and supporting fibrous structures; these areas can easily be overlooked by the radiologist. Changes in configuration and appearance of these spaces can occur with pathological processes and can be more readily identified using a standard search pattern. A structured search pattern using a vascular and fibro-skeletal based review can help the radiologist identify and differentiate pathology from normal spaces and structures.

#### TABLE OF CONTENTS/OUTLINE

1. Review the normal anatomy of the heart including the recesses and grooves as well as the supporting vascular and fibro-skeleton of the heart.
2. Illustrate the common pathology that can occur in these spaces including thrombus, tumor, abscesses, and pseudoaneurysm.
3. Highlight the importance of variant and abnormal processes in these spaces and the impact on medical and surgical management.

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## Abstract Archives of the RSNA, 2023

CAEE-25

### **The Role of Imaging in Cardio-Oncology: Detecting, Preventing, and Managing Cardiovascular Disease in Cancer Patients and Survivors**

#### **Participants**

Osamu Manabe, MD, PhD, Saitama-Shi, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Cardio-oncology is a new specialty that focuses on detecting, preventing, treating, and following up on cardiovascular disease (CVD) in cancer patients and survivors. Cancer and CVD share many risk factors, such as aging, smoking, diabetes mellitus, and genetic predisposition. Furthermore, some cancer treatments have negative effects on the cardiovascular system, leading to an increased burden of cardiac complications in survivors. Cardio-oncology aims to minimize cardiovascular complications in patients with cancer and requires close collaboration between oncologists, cardiologists, and radiologists. In this presentation, we will discuss the usefulness of various imaging modalities in the field of cardio-oncology, taking into account the latest technology available.

#### **TABLE OF CONTENTS/OUTLINE**

Cardio-oncology is a new multidisciplinary field to institute appropriate surveillance, treatment, and follow-up strategies for CVD in patients with cancer (Fig.1). Imaging modalities such as MRI (Fig.2), CT (Fig.3), and nuclear medicine including PET (Fig.4) play a crucial role in diagnosing and monitoring CVD in cancer patients. These non-invasive methods can be used to assess cardiac function, tissue characteristics, metabolic activity, and also tumor size and extent. Using novel imaging technologies is essential for early detection, treatment, risk stratification, and survivorship in cardio-oncology (Fig 5).

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## Abstract Archives of the RSNA, 2023

CAEE-26

### Whole-body Assessment of Vasculitis and Its Complications Using CT, FDG-PET, and MRI

#### Participants

Noriko Oyama-Manabe, MD, PhD, Saitama City, Japan (*Presenter*) Grant, DAIICHI SANKYO Group; Grant, Bayer AG; Grant, Eisai Co, Ltd; Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

1. Overview of the etiology, pathophysiology, clinical presentation, diagnostic criteria, and therapeutic approaches for primary and secondary vasculitis  
2. To compare image characteristics of specific vasculitis and its complications with CT, MRI and FDG-PET/CT  
3. To describe the role of multimodality imaging in the quantitative evaluation of inflammation for the initial diagnosis and during follow-up after treatment

#### TABLE OF CONTENTS/OUTLINE

Vasculitis manifests in various clinical presentations, morphologies, and prognoses, requiring a multimodal imaging approach. Radiologists can aid in the accurate diagnosis of vasculitis and its complications, treatment planning, and patient care with multimodality imaging. In this presentation, we will cover both primary and secondary vasculitis, which can be caused by various factors, including infections and drug-induced reactions. Knowledge of systemic clinical manifestations in affected patients may help establish a specific diagnosis. 1. To review the clinical features and imaging findings of the different types of vasculitis including those that primarily involve large, medium-sized, or small vessels. 2. Tips for scanning with adequate timing and reconstruction for various complications due to infectious vasculitis including secondary to TEVAR and EVAR. 3. To describe the role of these imaging modalities in the quantitative evaluation of inflammation for the initial diagnosis and during follow-up after treatment, with an emphasis on monitoring therapeutic response using quantitative parameters.

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## Abstract Archives of the RSNA, 2023

CAEE-27

### Unveiling Cardiac Intracavitary 4D flow MRI

#### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Reliable analysis of intracardiac flow provides important insight for the interpretation and management of cardiovascular diseases. Recently, non-invasive evaluation of intracardiac hemodynamics by 4D flow CMR constitute a reliable, robust, and reproducible method for the analysis of flow patterns in valvular diseases, cardiomyopathies, or congenital heart diseases (CHD). Furthermore, in virtue of its multidimensional/multidirectional capabilities it allows to calculate common (flow, velocities, and volumes) and advanced (kinetic energy and turbulent kinetic energy, vortical flow imaging and particle tracing) intracardiac chamber flow hemodynamic parameters. Recently, some of them have been shown to have important prognostic implications. Teaching points 1. To describe the physical basis of 4D flow, the main acquisition process, optimization techniques and advanced post-processing methods 2. To analyze the current and potential clinical applications of intracavitary 4D flow in cardiac imaging.

#### TABLE OF CONTENTS/OUTLINE

1. 4D flow physical basis 2. 4D flow acquisition technique and protocol 3. Conventional intracavitary flow analysis 4. Advanced intracavitary 4D flow analysis - Kinetic Energy and Turbulent Kinetic Energy - Viscous energy loss - Vortical Flow Imaging - Particle tracing 5. Current and potential clinical applications intracavitary 4D flow - Dilated cardiomyopathy - Ischemic heart disease - Atrial fibrillation and heart failure - Valvular heart disease - Hypertrophic cardiomyopathy - Congenital heart diseases 6. Intracavitary 4D flow prognostic biomarkers: Ready to primetime? 7. Take home points

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## Abstract Archives of the RSNA, 2023

CAEE-28

### CT Imaging in Ischemic Heart Disease and Complications

#### Participants

Takashi Norikane, MD, PhD, Kita-gun, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac imaging plays a pivotal role in the diagnosis of ischemic heart disease. Echocardiogram, coronary angiography, nuclear medicine imaging and magnetic resonance imaging are common imaging modalities. However, conventional CT can provide important information about ischemic heart disease and complications. This presentation introduces the basic approaches of CT in ischemic heart disease and complications and follows with an overview of normal heart and coronary anatomy and frequently encountered pathologic conditions.

#### TABLE OF CONTENTS/OUTLINE

Normal anatomy Coronary artery and territories Heart chambers Pericardium Myocardial infarction Atherosclerosis, Air embolism, Coronary artery anomaly, IgG4-related disease, Aortic dissection, thromboembolism due to essential thrombocythemia, Diaphragmatic hernia (post CABG), Post aortic valve replacement Complications Myocardial rupture, ventricular septal rupture, Dressler's syndrome, Ventricular aneurysm, Calcification Myocardial persistent enhancement after percutaneous coronary intervention Differential diagnosis Myocarditis, Takotsubo-myocardiopathy

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## Abstract Archives of the RSNA, 2023

CAEE-29

### Unravelling the Mitral Valve on CT

#### Participants

Vidushi Gupta JR, MD, MBBS, Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Assessment of normal valvular morphology and basic physiology of mitral valve on MDCT  
2. Discuss the pearls and pitfalls relevant to planning, acquisition and interpretation of cardiac CT images  
3. Enumerate various structural and functional abnormalities  
4. Describe the role of CT in pre and post-procedural imaging in patients with TMVR (Transcatheter mitral valve replacement).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. ECG placement with proper planning and acquisition protocol  
3. Pearls and pitfalls  
4. Post processing  
5. Normal mitral valvular anatomy and function  
6. Assessing Structural abnormalities  
7. Assessing Functional abnormalities  
8. Role of CT in pre and post procedural imaging in TMVR  
9. Take home message

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## Abstract Archives of the RSNA, 2023

CAEE-3

### Robotic and Minimally Invasive Mitral Valve Surgery: Radiological Assessment and Surgery Correlation

#### TEACHING POINTS

1. Robotic and minimally invasive mitral valve surgery is a safe and less traumatic surgical approach compared to the open cardiac surgery. Besides, it can be regarded as a widely accepted technique given the volume of publications from numerous institutions. 2. Multimodality imaging assessment conducted before to surgery are essential for selecting appropriate patients, anatomical evaluation, surgical planning, and optimal patient outcomes. 3. Radiologists can assist in patient treatment by being knowledgeable about the variety of anticipated postoperative findings and potential complications following robotic and minimally invasive mitral valve surgery.

#### TABLE OF CONTENTS/OUTLINE

A. Overview of surgical techniques: Ministernotomy, minithoracotomy, robotically assisted B. Indications and contraindications C. CT angiography for pre-operative assessment 1. Scan protocol and postprocessing technique 2. Preoperative checklist 1) Aorta and iliofemoral arteries 2) Evaluation of lung, pleural plaques 3) Chest wall, diaphragm 4) Pericardium, mediastinum 5) Aorta diameter, pulmonary artery diameter, ascending aortic calcification 6) Mitral valve geometry, calcification 7) Central veins (vena cavae, coronary sinus) 8) Coronary arteries D. Procedural considerations E. Case examples F. Postoperative assessment G. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-30

### Need for Speed: Fast MRI in Cardiac Imaging

#### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac MRI has become versatile technique for normal and diseased heart. However this results in complex and slow CMR examinations, raising the perception of CMR as a high-cost imaging method. Therefore, a more rationale and question-driven protocols are increasing acceptance in order to reduce the amount of acquisition time, increase patient acceptance and clinical value of this well-known game-changer imaging method. Teaching points 1. To describe the current technical advances, drawbacks, tips and tricks available for providing fast MRI protocols in clinical practice. 2. To detail the different proposals described in the literature for optimizing CMR protocols (fast MRI) in a "question - driven" scenario and with a "building - blocks" strategy.

#### TABLE OF CONTENTS/OUTLINE

1. Fast MRI concept and rationale 2. Conventional CMR protocoling problems: Knowing what I need to fix. 3. Fast MRI strategies in cardiac imaging • 3.1. Cine SSFP o Free - breathing EKG gated cine SSFP o Post-contrast cine SSFP o Sparse acquisition cine SSFP o Deep Learning (DL) cine SSFP o 3D cine SSFP • 3.2 Tissue characterization/parametric mapping o Single-Shot black blood imaging o DL acquisition and reconstruction o 3D single parameter mapping o Accelerated T1 T2 mapping • 3.3. 4D flow imaging o 4D flow EPI o Accelerated 4D flow • 3.4. MR angiography o Compressed sensing o Other strategies o Non - contrast MRA • 3.5. Late Gadolinium Enhancement o Free breathing single-shot LGE o Breathhold 3D LGE o 3D PSIR LGE o DL LGE 5. Fast CMR protocols in the clinical practice: The "building - blocks" strategy - Ischemic heart disease - Non-ischemic heart disease - Valvular heart disease - Arrhythmogenic cardiomyopathy - Congenital heart disease 6. Take home points

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## Abstract Archives of the RSNA, 2023

CAEE-31

### Pulmonary Vein Anomalies Made Easy

#### Participants

Juliana Da Silveira, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To overview the embryology and normal anatomy of the pulmonary veins. To discuss the spectrum of anomalous pulmonary venous connections (APVCs). To describe and illustrate with schematic figures and cases the types of APVCs. To discuss the importance of the diagnosis to allow timely treatment and a better prognosis.

#### TABLE OF CONTENTS/OUTLINE

The normal PV anatomy consists of four PVs, which drain oxygenated blood from the lungs to the left atrium (LA). The LA and PVs initially develop separately, and get progressively connected during fetal development. If there is failure in any step of this embryonic process, APVCs will happen. Anomalous pulmonary venous connections are a group of abnormal drainage of one or more PVs outside of the LA and can be classified either as partial or total, depending on the number of the veins involved. We describe and illustrate with schematic figures and cases the types of anomalous pulmonary venous connections, whether partial or total, common or rare, depending on the site of pulmonary vein drainage, the number of veins involved, and the presence or absence of vein obstruction. Common and rare anatomical variations will also be demonstrated. The clinical syndromes related to abnormal pulmonary venous returns will be discussed, ranging from dramatic neonatal emergency to subclinical presentation and late development of pulmonary hypertension.

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## Abstract Archives of the RSNA, 2023

CAEE-32

### The Changing Face of Myocarditis

#### Participants

Matthew McCann, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

COVID-19 ushered in a dramatic rise in public awareness of myocarditis and related complications. Mirroring this, an unprecedented utilization of imaging for assessment of cardiac events followed. Utilization of imaging for vaccine-related cardiotoxicity has similarly risen. Synchronously, other previously unrecognized causes of myocarditis are now increasingly encountered, including drug-related cardiotoxicity, as seen with new oncologic agents. Clinical history, lab assessment, and imaging remain central to establishing a diagnosis of myocarditis. Cardiac MRI plays an integral role in diagnosis, stratification, and monitoring of recovery from this changing face of myocarditis. Recognition of the evolving etiologies, imaging techniques and revised diagnostic criteria are paramount for appropriate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

This exhibit outlines the timeline of awareness, specific entities and imaging features which comprise the “changing face of myocarditis” including cardiotoxicity related to COVID-19, COVID-19 vaccination, drug reactions including immune checkpoint inhibitors, and cardiotoxicity related to environmental contaminants and other exposures. Cardiac MR plays a key role in diagnosis, stratification, and monitoring of cardiotoxicity in these entities. The specific imaging features and diagnostic considerations are outlined and described in order that the radiologist gains a better understanding of this evolving diagnosis, allowing for appropriate utilization of imaging and improved diagnostic accuracy of this complex disease.

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## Abstract Archives of the RSNA, 2023

CAEE-33

### New CAD-RADS 2.0: What Has Changed from CAD-RADS 1.0

#### Participants

Janio De Paula Santos, MD, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To reinforce the importance of applying the CAD-RADS classification for a better communication with the healthcare providers. To describe the differences between CAD-RADS versions 1.0 and 2.0. To demonstrate with cases how to apply the CAD-RADS 2.0 classification.

#### TABLE OF CONTENTS/OUTLINE

The Coronary Artery Disease Reporting and Data System (CAD-RADS) is a standardized guide created to categorize coronary CT angiography findings and to facilitate communication between the radiological community and referring physicians. A new CAD-RADS classification was recently published with the objective of adding anatomical and functional data, which may offer stronger prognostic value other than just describing the presence or absence of anatomical lesions. What's the same? The main categories (0, 1, 2, 3, 4, 5) based on stenosis severity (0, 1-24%, 25-49%, 50-69%, 70-99%, occlusion) were maintained. Complementary modifiers "G", "S" and "N" standing for the presence of Grafts, Stents, or a Non-diagnostic study were maintained. What has changed? A grading scale for calcific plaque burden was added (P1, P2, P3 and P4). For plaques with features indicating high risk of rupture, the modifier "V" was replaced to "HRP" -> high-risk plaque. An "I" modifier was added if the investigation of ischemia was performed, either by perfusion or FFR-CT. The use of CAD-RADS to report findings provides a clinically useful categorization of CAD and standardizes the way of providing results across imaging sites, which is additionally useful for research purposes.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-34

### Multimodality Review of Common Mitral Valve Pathology and the Current Surgical Interventions

#### TEACHING POINTS

As the treatments for valvular disease have evolved over the years, the assessment of cardiac valves now often requires multiple imaging modalities, including cardiac CT, cardiac MRI, and echocardiography. The aim of this exhibit is to review the normal appearance as well as common pathologies involving the mitral valve on the various modalities discussed above. Lastly, the current available treatments for mitral valve disease will be reviewed including repairs (such as annuloplasty, valvuloplasty, and mitral valve clips) and replacements (such as surgical valve replacement and transcatheter mitral valve replacement).

#### TABLE OF CONTENTS/OUTLINE

1. Review of the normal appearance of mitral valve on CT, MRI, and Echo. 2. Review of common mitral valve disease including mitral regurgitation, mitral stenosis, mitral prolapse, mitral annular disjunction, flail leaflet, parachute mitral valve, mitral cleft, mitral masses (fibroelastoma, vegetations, thrombus), and mitral annular calcification. 3. Review of the current treatments. Mitral valve repairs include annuloplasty, valvuloplasty, and mitral valve clips. Mitral valve replacements including surgical and more minimally invasive techniques, such as robot-assisted or transcatheter-based TMVR.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-35

### Visualizing the Mitral: An Imager Approach to Mitral Valve Disorders

#### Participants

Mohamed Ibrahim, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Overview on clinical burden of Mitral valve diseases (MVDs) and pertinent anatomy.
- Familiarity with the current imaging approach to MVDs.
- Understand the role of imaging in the management of MVDs.

#### TABLE OF CONTENTS/OUTLINE

- Mitral valve diseases burden and pertinent anatomy
  - o Mitral valve anatomy
  - o Clinical burden of MVDs
  - Current imaging approach to MVDs:
    - o Role of Echo as the main modality for early detection
    - o Complementary role of CT and MR
    - o Comprehensive evaluation of MVDs (Mechanism of abnormality, Quantification, Ventricular remodeling, Vascular changes, Risk stratification, Valve morphology)
- Where does imaging fit in MVDs management?
  - o Assessing etiology, mechanism, and grading
  - o Pre-procedural planning: § Surgery vs Transcatheter intervention § Repair vs replacement
  - Surgical replacement: sternotomy vs Robotic, and the role of CTA and CMR
- Transcatheter replacement: transapical vs trans-septal approaches, and the role of Echo and CT § Favorable anatomical markers, predictors of challenging procedures and contraindications
  - o Intra-procedural guidance and monitoring
  - o Post-procedural Follow up; Devices (stability, leaflet motion, leaks, vegetations/thrombus), Hemodynamics, and chamber size and function)

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## Abstract Archives of the RSNA, 2023

CAEE-36

### Left Ventricular Hypertrophy: An Approach to Differential Diagnosis

#### Participants

Rafael Perez Milan, MD, Leon, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Left ventricular hypertrophy (LVH) is a common finding in cardiac magnetic resonance (CMR) with multiple diagnostic considerations.- LVH is an independent predictor of future cardiovascular events regardless of its etiology.- LVH can be defined as follows.- LV myocardial thickness more 12 mm.- Increased LV mass: Body surface area - indexed LV mass (over 95th percentile - 91 g/m<sup>2</sup> in males; 77 g/m<sup>2</sup> in females)

#### TABLE OF CONTENTS/OUTLINE

- To understand basic anatomy and embryology of the left ventricle.- To define left ventricular hypertrophy (LVH) and clinical implications.- To describe the differential diagnosis of LVH.- Role of cardiac magnetic resonance (CMR) in narrowing the differential diagnosis.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-37

### Complications of Acute Myocardial Infarction: Infrequent but Lethal

#### TEACHING POINTS

1. Acute Myocardial Infarction (AMI) is a frequent pathology and one of the leading causes of death in the world. Early revascularization has become a standard of care, thus reducing the high associated morbi-mortality. 2. Although infrequent, several secondary complications can occur, particularly when treatment is delayed or inadequate. 3. These are divided into mechanical, inflammatory, arrhythmic, thrombotic, and embolic. 4. CT, and especially MRI, help us to adequately assess cardiac function, ventricular volumes and structure, myocardial viability and possible associated complications.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- General characteristics of AMI and its complications.- Complications are divided into categories, with cases to illustrate each Mechanical complications are most frequently evaluated through CT and MR. In the acute phase, the most frequent are left ventricular free wall rupture, septal ventricular defect, and papillary muscle rupture. In a chronic phase, pseudoaneurysms and ventricular aneurysms are found.- Conclusions. Complications of AMI are infrequent, but they can be potentially lethal. An accurate and early diagnosis significantly improves the prognosis. CT and MRI are the main imaging modalities used after echocardiography.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-38

### Imaging Features and Mimics of Primary and Metastatic Pericardial Tumors

#### TEACHING POINTS

1. Understand the role of imaging modalities in the diagnosis and management of primary and metastatic pericardial tumors and their mimics. 2. Review the imaging features of pericardial tumors and their mimics on echocardiography, CT, MRI, and PET/CT. 3. Discuss the limitations of imaging in the diagnosis and management of pericardial tumors and their mimics.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Epidemiology and clinical presentation of pericardial tumors and their mimics II. Role of Imaging Modalities A. Echocardiography B. Computed Tomography (CT) C. Magnetic Resonance Imaging (MRI) D. Positron Emission Tomography/Computed Tomography (PET/CT) III. Imaging Features of Pericardial Tumors and Their Mimics A. Primary pericardial tumors B. Metastatic pericardial tumors C. Pericardial cysts D. Lipomatous hypertrophy E. Pericardial fat pad F. Hemangioma G. Thymoma IV. Limitations of Imaging in the Diagnosis and Management of Pericardial Tumors and Their Mimics V. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-39

### Mitral Valve Diseases 101: A Comprehensive Case-Based Review for Radiology Trainees

#### Participants

Mangun Randhawa, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the normal anatomy of the mitral valve and imaging modalities used for its evaluation  
2. Discuss various pathologies of native and prosthetic mitral valves, their implications, and their differential diagnoses  
3. Review role of imaging for mitral valve interventions

#### TABLE OF CONTENTS/OUTLINE

1. Morphologic anatomy of the mitral valve  
2. Congenital mitral valve abnormalities : parachute mitral valve, parachute-like mitral valve, Shone complex  
3. Mitral valve prolapse (various types) and mitral annular dysjunction  
4. Mitral annular calcifications, and complications  
5. Infective endocarditis  
6. Mass (different histopathologies)  
7. Pre-procedural and Post-procedural evaluation of mitral valve implantation including prediction of left ventricular outflow tract obstruction post trans-catheter implantation.

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## Abstract Archives of the RSNA, 2023

CAEE-4

### It's All About the Pericardium

#### Participants

Felipe Aluja, MD, MEd, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Discuss the anatomy of the pericardium and the pericardial recesses with emphasis on CT and MRI. Identify selected entities affecting the pericardium, from benign to malignant, with a brief description of their clinical characteristics. Provide a deep review of the imaging findings from the conventional radiology to MRI, with emphasis in the ancillary findings that aid in the differential diagnosis approach. Describe the pitfalls and mimics of pericardial disease in conventional radiology, CT, MRI and PET/CT.

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- Anatomy of the pericardium and pericardial recesses: from the schemes to the imaging.
- The pericardium in conventional radiology, CT, MRI and PET/CT.
- Conditions of the pericardium:
  - o Air, collections, hemorrhage, and pericardial tamponade
  - o Acute and chronic inflammation (including constrictive pericarditis)
  - o Benign neoplasms
  - o Malignant primary and secondary neoplasms
  - o Congenital lesions
- Try your best? Take home points

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## Abstract Archives of the RSNA, 2023

CAEE-40

### Artificial Intelligence in Cardiac MRI- Applications, Pitfalls Challenges

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the principles of Artificial Intelligence (AI) techniques relevant to cardiac MRI(CMR); 2. To discuss how AI can be applied to the different steps of the CMR; 3. To illustrate common applications of AI in CMR

#### TABLE OF CONTENTS/OUTLINE

1. AI, MACHINE LEARNING, DEEP LEARNING; 2. CHALLENGES OF CMR- complex anatomy, pathology, planes, sequences 3. AI NETWORKS- Convolutional neuronal network (CNN), general adversarial network (GAN); 4. ILLUSTRATION OF CLINICAL APPLICATIONS OF AI IN CARDIAC MRI WITH CASE EXAMPLES AND TECHNIQUES USED A. Upstream- Protocolling, workflow management/prioritization B. Image acquisition- Plane prescription; Patient positioning; Automated cardiac MRI planes; Automated selection of inversion time; B. Image reconstruction- Decreased artifacts; Decreased noise; Decreased acquisition time; Improved resolution- Super resolution ; Virtual Native Enhancement without contrast (VNE); Synthetic strain; C. Segmentation of structures- Ventricular volumes, function, mass in SSFP, Vascular anatomy in MRA; D. Automated quantification- Volumes, mass, function, LGE, parametric mapping (T1, T2, ECV), flow, strain, aortic diameter; E. Automated post-processing- perfusion, 4D flow; F. Classification of disease- Scar from non-contrast cine, Cardiomyopathies, CAD, myocardial infarction, atherosclerotic plaque, valvular disease, heart failure G. Prognostic factors- Risk stratification- Predictive models; H. Radiomics /Textural analysis I. Automated reporting J. Automated CMR pipeline 5. CHALLENGES- Small, biased training datasets, black box, quality criteria for algorithm design; 6. PITFALLS - Inaccuracies; 7. FUTURE DIRECTIONS- Good Machine learning practices.

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## Abstract Archives of the RSNA, 2023

CAEE-41

### Emerging Applications of Non-Contrast Cardiac CT: Beyond Coronary Score

#### Participants

Masafumi Kidoh, MD, PhD, Kumamoto, Japan (*Presenter*) Endowed Chair, Koninklijke Philips NV

#### TEACHING POINTS

Teaching Points 1. Non-contrast cardiac CT is widely used to detect and quantify coronary and heart valve calcium. On the other hand, detection of fat, myocardial edema, thrombus/hematoma, and subtle myocardial calcification beyond coronary and heart valve calcification using non-contrast cardiac CT has not been widely performed, possibly due to poor image quality. 2. Recent advances in CT technology (such as model-based iterative reconstruction and dual-layer spectral/photon-counting CT) have drastically improved the low-contrast resolution of CT images, allowing the detection of small differences in CT values within soft tissue on non-contrast and delayed phase cardiac CT images. Side-by-side viewing of non-contrast cardiac CT images and delayed (or arterial) phase cardiac CT images may be useful in differentiating various pathologies. 3. In this exhibit, we report that non-contrast cardiac CT is useful for the detection and characterization of cardiac low-contrast lesions (soft tissue lesions) beyond coronary and heart valve calcification.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline 1. Scan and reconstruction techniques for non-contrast cardiac CT - Single-energy CT - Dual-energy CT - Photon-counting CT 2. Principle of CT number in non-contrast cardiac CT 3. Clinical applications: beyond coronary score - Calcification - Thrombus/hematoma - Anemia - Water/myocardial edema - Fat 4. Future directions 5. Summary

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## Abstract Archives of the RSNA, 2023

CAEE-42

### From Cyan to Cinnabar - The Radiologist's Role in Operative Management of Single Ventricle Congenital Heart Disease

#### Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Single ventricle congenital heart diseases are rare and challenging to manage. While historically, outcomes have been poor, recent advancements in surgical management have improved post-operative outcomes and long-term prognosis. Imaging has also advanced from morphologic characterization to assessment of function and flow dynamics. Here, we present a framework for understanding the pathophysiology of the single ventricle state and 3-stage palliation repair, review important imaging-informed decision points along the course of operative management, and present metrics important to long-term outcome and management.

#### TABLE OF CONTENTS/OUTLINE

1. Title slide, disclosures2. Abbreviations3. Table of contents4. Normal physiology5. Single ventricle physiology6. Norwood/DKS7. mBTT and RV-PA conduit8. Glenn procedure, mention of Kawashima9. Fontan procedure10. Operative management, main decisions11. Single (SVR), biventricular (BiVR), or 1.5 ventricle (1.5VR) repair?12. SVR Ex) AV canal13. CT/MRI evaluation14. BiVR Ex) DORV15. CT/MRI evaluation16. 1.5VR Ex) Tricuspid atresia17. CT/MRI evaluation18. 1.5VR Ex) Ebstein anomaly19. CT/MRI evaluation20. Safe for hybrid/bridge-to-Norwood?21. Example22. Hybrid procedure, relevance of HLHS, and risk factors for retrograde aortic arch obstruction23. CT/MRI evaluation24. Safe for Glenn?25. Example26. CT/MRI evaluation27. What features may change Fontan approach?28. Pre-Fontan operative planning example29. CT/MRI evaluation prior to Fontan30. Failing Fontan and BiVR or 1.5VR conversion surgery31. Preop. Items (e.g. LVOT widening, valvuloplasty)32. CT/MRI evaluation prior to conversion surgery33. Summary34. References

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## Abstract Archives of the RSNA, 2023

CAEE-43

### Myocardial Strain Analysis Using Feature Tracking

#### Participants

Masaya Kisojara, MD, PhD, Nagoya City, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Myocardial strain refers to the deformation of the walls and chambers of the heart from a relaxed to a contracted state.2. Feature tracking is a technique that enables the analysis of myocardial strain.3. Strain analysis performed in the left ventricle and the left atrium is a better prognostic indicator for heart failure than left ventricular ejection fraction.4. Strain analysis by feature tracking might apply to 4D-CT images.

#### TABLE OF CONTENTS/OUTLINE

1. The concept of myocardial strain and its types: Myocardial strain using feature tracking is an alteration of length in one dimension or spatial orientation. Left ventricular strain is classified as radial, circumferential, and longitudinal strain. Left atrial strain is obtained as global longitudinal strain.2. The principle of features tracking: Template matching is a technique that follows similar templates during the process of myocardial contraction.3. The importance of myocardial strain for patients with heart failure.4. What is left atrial strain? The left atrial strain is an index that reflects the diastolic and contractile capacity of the left atrium. Similar to the left ventricular global longitudinal strain, it is helpful in predicting prognosis in heart failure with preserved left ventricular ejection fraction.5. An experiment using 4D-CT for myocardial strain analysis

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## Abstract Archives of the RSNA, 2023

CAEE-44

### The Role of Gadolinium Enhancement Patterns in Diagnosing Myocardial Diseases at Cardiac MR - Enhancing Residents' Knowledge

#### Participants

Otavio Augusto Ferreira Dalla Pria, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The abnormal myocardium can depict different patterns of gadolinium contrast enhancement depending on the cause of the injury. Therefore, assessing enhancement patterns in Cardiac MR plays a pivotal role in diagnosing diverse myocardium diseases. Ischemic cardiomyopathies produce delayed vascular-distributed gadolinium enhancement, and non-ischemic patterns are not limited to vascular territories. Patterns of enhancement distribution are crucial in differentiating between ischemic and non-ischemic heart pathologies and narrowing differential etiologic diagnostics in both. This exhibit aims: 1. To review myocardium gadolinium enhancement MR patterns. 2. To illustrate differential diagnostics based on the type of enhancement. 3. To discuss challenges and confounder factors.

#### TABLE OF CONTENTS/OUTLINE

1- Introduction/Objectives: Cardiac MRI can help diagnose a plethora of myocardial dysfunction. The gadolinium enhancement pattern is one of the characteristics that can help identify differential diagnostics. In this presentation, we summarize and illustrate the 5 types of cardiac MRI enhancement patterns and correlate findings with main differential diagnostics. 2- Case-based approach: Present 5 Patterns of Enhancement in Cardiac MRI (Subendocardial, subepicardial, transmural, patchy, mid-myocardial/mesocardial), correlating with primary differential diagnostics through didactical cases illustration in both ischemic and non-ischemic cardiomyopathies. 3- Limitations, Conclusion, and Take-home messages.

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## Abstract Archives of the RSNA, 2023

CAEE-45

### Role of Multi-Modality Imaging in Cardio-Obstetrics

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardio-obstetrics is an expanding subspecialty that focuses on prevention, early detection, and management of cardiovascular disease (CVD) in pregnancy. 1. To review the cardiovascular complications in pregnancy; 2. To understand disease processes exacerbated by pregnancy; 3. To discuss the role of imaging in cardiovascular complications of pregnancy and pre-conception planning; 4. To understand the concept of pregnancy heart team and risk stratification

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION ;2.PHYSIOLOGICAL CARDIOVASCULAR CHANGES OF PREGNANCY;3. ROLE OF IMAGING IN PREGNANCY;4. IMAGING MODALITIES;5. COMPLICATIONS RELATED TO PREGNANCY (Discussion, clinical features, imaging findings and differential diagnosis with case examples)-Cardiac- Heart failure, arrhythmia, thromboembolism;Obstetrics- hypertension, Preeclampsia, hemorrhage;Perinatal-miscarriage, premature delivery, restricted growth;Venous thromboembolism including PE;Amniotic fluid embolism;Peri-partum cardiomyopathy;Spontaneous coronary artery dissection;Pulmonary hypertension;Hypertensive disorders (Eclampsia/Pre-eclampsia);Heart failure and arrhythmias;6.EXACERBATION OF PRE-EXISTING CVD DURING PREGNANCY (Illustration with case examples)-Inherited aortic diseases;Congenital heart disease;Hereditary hemorrhagic telangiectasia;Valvular disorders;7. PRECONCEPTION PLANNING- Risk stratification;8. CARDIOVASCULAR CHANGES IN ABDOMINAL DISEASES;9. ISSUES RELATED TO IMAGING IN PREGNANCY;- CT- Radiation, contrast agents- MRI- Gadolinium10. APPROPRIATENESS CRITERIA for imaging in pregnancy; 11. FLOW-CHART SHOWING systematic approach to imaging pregnant patients.

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## Abstract Archives of the RSNA, 2023

CAEE-46

### Single Ventricle: A Radiology Primer for Pre-Procedural Evaluation

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the spectrum of lesions that result in a single ventricle 2. To discuss the surgical options in the management of single ventricle 3. To illustrate the different types of single ventricle using case examples 4. To highlight critical imaging parameters necessary for pre-procedural planning

#### TABLE OF CONTENTS/OUTLINE

1. SINGLE VENTRICLE- Definition, types 2. ROLE OF MULTIMODALITY IMAGING- Echo, CT, MRI, Cardiac cath, nuclear medicine 3. CT AND MRI- Indications, protocols, tips and tricks 4. REVIEW AND ILLUSTRATION OF PHENOTYPES OF SINGLE VENTRICLE Right dominant- Hypoplastic left heart syndrome, mitral atresia, double inlet/outlet RV; Left dominant- Hypoplastic right heart syndrome, Tricuspid atresia, Double inlet LV ; Either- unbalanced AV canal (Right/left); Functional single ventricle- TOF with pulmonary atresia, truncus, TAPVR, Severe Ebsteins anomaly, Tricuspid atresia, Double inlet LV/RV, AV canal defect (balanced/unbalanced), heterotaxy 5. ANATOMICAL CHARACTERIZATION- Atrial situs, ventricular situs, great artery relationship, morphologic LV vs RV, functioning/rudimentary ventricles 6. CRITICAL PARAMETERS NECESSARY FOR SURGICAL/INTERVENTIONAL MANAGEMENT - Ventricular function- Poor prognosis if low - Atrial septal restriction - Bulboventricular foramen in DILV or tricuspid atresia with TGA - Atrioventricular valve- Obstruction or regurgitation - Outlet obstruction- Presence and nature - Vascular resistance- Pulmonary and systemic - Patency of ductus arteriosus - Patency of aortic arch - Pulmonary artery anatomy - Venous connections 7. MIMICS- Criss-cross heart; Superoinferior ventricle

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## Abstract Archives of the RSNA, 2023

CAEE-47

### Generating Cardiac Segmentation Datasets: Automated Segmentation and Tool-Based Manual Correction

#### Participants

Hirohisa Oda, PhD, Shizuoka, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Easy label generation for custom AI: Manual correction tool for cardiac segmentation

#### TABLE OF CONTENTS/OUTLINE

- Application-specific custom AI for cardiac segmentation\* Our application: Modeling patient-specific therapeutic instrument-  
Outline\* Step 1: AI-based segmentation with a very limited number of cases for automated segmentation on other cases\* Step 2:  
Manual correction with our original tool- Step 1: AI-based segmentation\* Innovations from the "U-Net era"\* Trainable with limited  
training datasets as "seeds" of dataset generation\* Key technologies: Swin Transformer Self-supervised training [1]\* Examples of  
automatic segmentation- Step 2: Manual correction with our original tool\* HeartCorrect: Our original plugin for an image  
visualization tool MITK-Workbench\* Utilizing MITK's interpolation feature\* Automated correction for obeying the anatomical  
relationships of chambers- Comparison with MONAI Label[1] Hatamizadeh, Ali, et al. "Swin UNETR: Swin transformers for semantic  
segmentation of brain tumors in MRI images." BrainLes 2021, LNCS 12962, 2022.

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## Abstract Archives of the RSNA, 2023

CAEE-48

### Myocardial Delayed Enhancement By Spectral CT: Our Experience

#### Participants

Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Role of Late enhancement in cardiac dual-CT. 2. Show the protocol we are using in our centre. 3. Present CT-MRI correlation in several pathologies, mainly in myocarditis

#### TABLE OF CONTENTS/OUTLINE

1. Background Quick review of the pathophysiology and usefulness of late enhancement in cardiological studies. 2. Spectral CT and acquisition protocol used in our center. 3. Representative cases of different diagnoses with CT-MRI correlation. 4. Conclusions. 5. Bibliography.

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## Abstract Archives of the RSNA, 2023

CAEE-49

### Mitral Valve Disjunction: The Great Unknown

#### Participants

Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review mitral valve disjunction (MVD) 2. Role of MRI in the evaluation of radiological features associated with and pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Background Revision of mitral valve disjunction • Definition • Pathology • Classification • Location 2. Representative cases of different disjunction types. 3. Representative cases of different radiological features associated with and pitfalls. 4. Conclusion. 5. Bibliography.

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## Abstract Archives of the RSNA, 2023

CAEE-5

### All In Vein"? Anatomy, Variations and Abnormalities of Coronary Venous System with an Emphasis on CT Findings and Clinical Importance

#### Participants

Firat Atak, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Cardiac CT can provide substantial information regarding cardiac venous anatomy and anomalies although it is mainly used for the evaluation of coronary arterial system. 2. Radiologists can more readily identify cardiac venous anomalies on CT by having a basic knowledge of the normal venous anatomy, adding venous anomalies to the standard checklist, and being aware of the conditions in which these anomalies may be clinically significant. 3. Cardiac venous system anomalies may be vital in percutaneous interventions and surgical procedures as they may fundamentally influence the course of the procedure or change the operation plan.

#### TABLE OF CONTENTS/OUTLINE

A. Overview of normal cardiac venous anatomy B. Scan protocol and postprocessing C. Coronary sinus (CS) variations and anomalies with case examples D. Other cardiac vein variations with case examples E. Clinical importance of the cardiac venous system -Cardiac shunts -Cardiac resynchronization therapy -Coronary sinus pacing -Retrograde cardioplegia -Percutaneous mitral anuloplasty -Percutaneous atriotomy (Levoatrial-to-coronary sinus shunting) for heart failure -Percutaneous in situ coronary venous arterialization (PICVA) -Enlargement of CS and clinical importance of PLSVC - Radiofrequency catheter ablation - Central venous interventions F. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-50

### State-of-the-Art Multimodality Imaging of Cardiac Transplant and Complications: A Practical Update

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To discuss the normal appearances of cardiac transplant 2. To optimize the CT and MRI protocols for evaluation of patients with cardiac transplant 3. To illustrate the imaging appearances of various complications following cardiac transplant

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Indications- Heart failure, intractable angina or arrhythmia, cardiomyopathies, congenital heart disease, cardiac tumor) 3. Cardiac transplant techniques- Orthotopic vs heterotopic, bicaval vs biatrial 4. Role of imaging in evaluation of cardiac transplant 5. Imaging techniques- Echo, CT, MRI, Cardiac catheterization, Intravascular ultrasound, Optical coherence tomography, nuclear medicine 6. Cardiac transplant follow up diagnostic pathway 7. Imaging protocols for follow up= CT-No premedications, Photon counting CT; MRI- Quantitative techniques, T2, T1 mapping; 8. Complications- Review of the following complications with illustrative case examples- Post procedural graft dysfunction; Post surgical- pericardial effusion, mediastinal hematoma; Cardiac Allograft Vasculopathy (CAV) - Diffuse, more aggressive, microvasculature- angiography vs CTA; Acute cellular rejection; Chronic rejection; Accelerated coronary atherosclerosis; Infections; Post-transplant lymphoproliferative disorder; Gout; Osteoporosis; Chronic kidney disease;

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## Abstract Archives of the RSNA, 2023

CAEE-51

### The Heart of the Matter: Pearls and Pitfalls in Cardiac CT

#### Participants

Katherine Chung, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiac CT imaging is a valuable diagnostic resource for physicians to evaluate cardiac anatomy and function. The indications for CT imaging include evaluation of the coronary vessels for anomalies, presence of coronary artery disease (CAD) and calcium score, pre-TAVR evaluation, pre-ablation study for atrial fibrillation, and observing the patency of grafts, amongst other reasons as well. Although radiologists regularly read these types of images, radiologists-in-training may have variable levels of exposure and can come across cases that lead to confusion. The goal of this presentation is to elucidate the essential pearls of acquiring and evaluating cardiac CT scans, so radiologists-in-training are comfortable and confident with evaluating CT scans and providing appropriate recommendations. Furthermore, we will highlight the common areas of confusion through case-based examples of common pitfalls that may occur.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Indications and contraindications (Efficacy in disease diagnosis) 3) Definitions and Anatomy 4) Protocols and Techniques for acquiring images 5) Pearls and Pitfalls (Pre-ablation study for atrial fibrillation, Pre-TAVR study, Calcium Score, Coronary Artery Disease, Thoracic aortic aneurysm) 6) Artifacts (Stair Step artifact, Streak artifact from CABG or TAVR patients, Motion) 7) Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-52

### From Pumps to Waves: Understanding the Impact of Mechanical Circulatory Assist Devices on Spectral Doppler Ultrasound Analysis

#### Participants

Mateus Soares, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Heart failure (HF) is a syndrome resulting from impaired ventricular filling or ejection. Many patients with HF progress to a refractory state, regardless of advanced therapies. Cardiac transplantation remains the definitive treatment for end-stage disease. Mechanical circulatory assist devices (CAD) help support patients with cardiogenic shock or end-stage HF. It may be used as a short-term device to support hemodynamically unstable patients, including those with the possibility of heart function recovery, or as long-term device usually as a bridge to transplantation. CAD are mechanical pumps that help an impaired ventricle maintain hemodynamics and preserve satisfactory end-organ blood flow. There are commercially available devices to support both the left and right ventricle. In most cases, the spectral Doppler waveform is altered in the setting of a CAD, reflecting systemic hemodynamic changes. Despite the increasing use of these devices, there is not much information in the radiological literature about spectral Doppler changes in these patients. Accurate diagnosis requires a better understanding of CAD mechanisms and associated Doppler ultrasound findings, as well as possible vascular complications.

#### TABLE OF CONTENTS/OUTLINE

Review the normal arterial Doppler waveforms in patients with preserved cardiac function. Describe the mechanisms of various CAD and their hemodynamic impacts on arterial spectral Doppler waveforms. Discuss the main vascular-related complications and the use of ultrasound in diagnosis.

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## Abstract Archives of the RSNA, 2023

CAEE-53

### **Blood-Flow Volume Quantification Using Phase-contrast MRI in Congenital Heart Disease: Pre- and Post-surgical Evaluation**

#### **TEACHING POINTS**

Phase-contrast (PC) MRI can be used to measure blood flow in patients with congenital heart disease (CHD). Although Doppler echocardiography can provide shunt flow velocities in patients with common CHD such as atrial or ventricular septal defects, it may be limited by natural or surgical variations. On the other hand, PC MRI can provide precise blood flow analysis non-invasively for patients with complex CHDs and post-surgical anatomy. We demonstrate the principles and potential pitfalls of blood flow volume quantification using PC MRI and present some cases such as a coronary fistula, anomalous origin of one pulmonary artery from the aorta, and a patient who underwent a Blalock-Taussig shunt operation.

#### **TABLE OF CONTENTS/OUTLINE**

1. Principles of PC flow volume measurement - A review of PC MRI technique, semi-automatically flow volume measurements 2. Pitfalls of PC flow volume measurement - Velocity encoding (VENC) selection considering aliasing and low phase shift value, spatial and temporal resolution, image plane setting, respiratory motion artifact, validation strategies 3. Blood flow volumes commonly measured in our hospital - Ascending aorta, main/right/left pulmonary artery, superior/inferior vena cava, the cross-section of mitral/tricuspid valve, right/left pulmonary vein 4. Representative cases - Right coronary artery to left ventricular fistula, right pulmonary artery from the descending aorta, post-surgical patients (modified Blalock-Taussig shunt, Glenn procedure, cardiac plug implantation, balloon angioplasty etc.)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CAEE-54

### **A Novel Coronary CT Imaging Technique that Further Improves the Spatial Resolution of Super Resolution Deep Learning Reconstruction**

#### **TEACHING POINTS**

1. Review the current status in coronary CT image evaluation and summarize its limitations 2. Summarize the relationship between spatial resolution and image noise in the current various CT image reconstruction methods 3. Explain the features of the new super resolution deep learning reconstruction (SR-DLR) algorithm trained using the data acquired by the super resolution CT system 4. Proposal of a new imaging method that further improves the spatial resolution of the SR-DLR algorithm and improves the visualization capabilities of coronary arteries, stent lumens, and calcified lesions 5. Comparison of image quality and exposure dose between conventional and new imaging methods

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Summarize the limitations of assessment of STENT lumens and calcified lesions using current CT imaging 3. Explains the features and usefulness of the new super resolution deep learning reconstruction (SR-DLR) algorithm trained using data acquired by a super-resolution CT system 4. Limitations of coronary CT imaging under normal scanning conditions using the SR-DLR algorithm 5. Proposal of a new imaging method that further improves the spatial resolution of the SR-DLR algorithm 6. Description of focal spot sizes used in coronary CT for super-resolution and conventional CT systems 7. Presenting the spatial resolution and image noise of small-focus imaging combined with the SR-DLR in conventional CT systems 8. Comparison of images with different focal spot size for stents and calcified lesions in the same cases, presenting the usefulness of small-focus imaging 9. Comparison of exposure dose in imaging at each focal spot size

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## Abstract Archives of the RSNA, 2023

CAEE-55

### Cardiac CT Pearls and Pitfalls: What You Should Know About Anatomy to Avoid Catastrophes

#### Participants

Amalia Aranaz Murillo, MD, Zaragoza, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understanding the different visual axes in cardiac imaging is crucial for interpreting cardiac anatomy. 2. Familiarity with the characteristics and structures of the atriums and ventricles is essential for accurate diagnosis and assessment of cardiac function. 3. Knowledge of main coronary arteries and their pathways and bifurcations is vital for accurate assessment of coronary artery disease. 4. Understanding the anatomy and branches of the coronary and pulmonary veins is essential for evaluating cardiac function and assessing for potential blockages.

#### TABLE OF CONTENTS/OUTLINE

We sometimes read a poster or a review and feel quite deceived because what you expect to learn you already know. For that reason, this poster will have at the beginning a QA. If you know all the answers, please, do not waste time on it, if not, it might teach you some anatomy tricks. It will be divided into seven blocks that detail the anatomy and structures of the heart in CT. The first block describes the different visualization axes of the heart and evaluates structures such as the anterior and inferior wall of the myocardium, the left atrial appendage, and the coronary sinus. The second block focuses on the characteristics of the right atrium and its different structures. The third describes the components of the ventricles and their structure. The fourth focuses on the major arteries of the heart, including the aorta and pulmonary artery. The fifth block details the four main coronary arteries and their paths and bifurcations. In the sixth, the coronary veins and their tributaries are explained, and finally, the anatomy of the pulmonary veins and their variability in the number and arrangement of drainage orifices to the left atrium is described.

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## Abstract Archives of the RSNA, 2023

CAEE-56

### Complications After Cardiac and Ascending Aorta Surgery

#### Participants

María Guerrero Martin, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To understand and distinguish the different types of ascending aorta surgeries 2. To evaluate the pathological findings after cardiovascular surgery, in order to differentiate them from the usual ones 3. To discern the most typical complications in relation to their chronological onset and their follow-up 4. To show the possible options in the management of patients with these complications 5. To emphasize the role of CT in the diagnosis of these conditions

#### TABLE OF CONTENTS/OUTLINE

1. Background and methods 2. Findings 2.1. Techniques used to evaluate postoperative patients 2.2. Common findings after cardiovascular surgery 2.3. Complication following aortic surgery 2.3.1. Early complications: periprosthetic haematomas, pseudoaneurysm formation, distal malperfusion 2.3.2. Late complications: aortic valve regurgitation, infection, anastomotic stenosis 2.4. Complications following cardiac valve surgery: valvular/paravalvular regurgitation, endocarditis, hypoattenuating leaflet thickening, prosthesis-patient mismatch 2.5. Complications following coronary artery procedures: stenosis, thrombosis 3. Our experience 4. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-57

### Cardiac MRI in Adult Orthotopic Heart Transplant

#### Participants

Sandra Quinn, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Outline unique CMR tissue characteristics of the transplanted heart 2. Discuss tissue characteristics suggestive of acute cardiac allograft rejection in the transplanted heart 3. Outline the role of quantitative myocardial stress perfusion in detection of epicardial and microvascular cardiac allograft vasculopathy 4. Provide an overview of the published data with respect to CMR and adult heart transplant

#### TABLE OF CONTENTS/OUTLINE

1. Cardiac MRI in Orthotopic Heart Transplant· Overview of structural and functional CMR and its role in major complications of heart transplant, i.e., acute cardiac allograft rejection and cardiac allograft vasculopathy.2. CMR Tissue Characterization in Orthotopic Heart Transplant· Describes the general considerations and overview of published values regarding CMR myocardial tissue characterization of the transplant heart.3. Acute Cardiac Allograft Rejection (ACAR)· Outline the published CMR myocardial tissue characterization values for patients with active ACAR and ACAR previous history.4. Cardiac Allograft Vasculopathy (CAV)· Illustrate with a representative clinical case the role of CMR quantitative perfusion in the identification of CAV· Describe expected resting and stress myocardial blood flow and myocardial perfusion reserve in heart transplant recipients vs healthy volunteers· Identify the role of myocardial perfusion reserve for identification of CAV.· 5. The Key Evidence in Summary· Summary table outlining the published evidence for CMR in heart transplant and complications of heart transplant.

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## Abstract Archives of the RSNA, 2023

CAEE-58

### Pre and Postoperative CT Evaluation for Robotic and Minimally Invasive Coronary Artery Bypass

#### TEACHING POINTS

Teaching points: 1. Robotic and minimally invasive coronary artery bypass is a safe and less traumatic surgical technique than open-heart surgery. It is considered the first-choice therapy for selected patients although the adoption has been slow in some institutions. 2. Imaging assessment prior to the surgery and providing relevant information to the surgeons is crucial for identifying suitable patients, anatomic assessment, surgical planning, and predicting outcomes. 3. Being familiar with the spectrum of expected postsurgical findings and complications following robotic and minimally invasive coronary artery bypass surgery is essential for radiologists to contribute to proper patient management.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: A. Overview of surgical techniques: TECAB, MIDCAB, robotic assisted B. Indications and contraindications C. CT angiography for preoperative evaluation 1. Scan protocol and postprocessing techniques 2. Preoperative checklists 1) Aorta and iliofemoral arteries 2) Evaluation of lung, pleural plaques 3) Chest wall, diaphragm 4) Heart, pericardium, mediastinum 5) Aorta diameter, pulmonary artery diameter, ascending aortic calcification 6) Internal mammary arteries 7) LAD and other coronary arteries D. Procedural considerations E. Postoperative CCTA assessment, complications F. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-59

### Navigating the Vortex: Advancements in Turbulent Flow Detection Using Cardiovascular 4D Flow MRI

#### TEACHING POINTS

4D flow MRI has revolutionized the assessment of in vivo flow dynamics, leading to a better understanding of physiological flow in healthy subjects and those with thoracic aortic aneurysms, chronic aortic dissection complications, and aortic prostheses. A key finding related to altered blood flow is turbulence, which can be visually detected through vortices in 4D flow MRI. However, visual assessment is subjective, prompting the need for quantitative evaluations. Recent advancements have facilitated the quantification of turbulent parameters such as vorticity, energy loss, and turbulent kinetic energy using 4D flow MRI. This presentation will explore clinical evaluation methods for these turbulence indices while discussing specific diseases as examples.

#### TABLE OF CONTENTS/OUTLINE

1. The background of flow analysis a. Clinical demands for flow analysis b. 4D Flow MRI technique for flow analysis c. Primary and secondary flow in a healthy aorta d. Quantification of turbulence - vorticity, energy loss, and turbulent kinetic energy  
2. Thoracic aneurysm a. Helical flows in patients with bicuspid aortic valve b. Association between aneurysmal development and wall shear stress  
3. Aortic dissection a. Blood flow volume quantification - forward and backward flow in the false lumen b. Vortices in the false lumen  
4. Post-prosthetic graft replacement a. Quantification of turbulent blood flow induced by artificial aorta b. Mechanical hemolytic anemia due to aortic arch graft stenosis  
5. Hypertrophic cardiomyopathy a. Vortex flow in the ascending aorta b. Association between turbulent kinetic energy elevation and left ventricular mass increase

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## Abstract Archives of the RSNA, 2023

CAEE-6

### Beyond Coronary Artery Calcium: Cardiovascular Findings in Non-Gated Chest CT Scans

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the most common incidental cardiac findings on routine chest CT examinations. 2. To recognize which cardiac findings are relevant and can alter the clinical course and outcome of patients.

#### TABLE OF CONTENTS/OUTLINE

1. Coronary arteries: a). Anatomical variants (dominance) b). Coronary anomalies (origin)-Benign-Malignant c). Coronary artery calcium d). Coronary aneurysm e). Coronary artery fistula 2. Cardiac chambers: a). Intracavitary thrombus 3. Myocardium a). Myocardial infarction -Acute-Chronic b). Cardiomyopathy-Dilated-Hypertrophic c). Primary tumors-Fibroma-Myxoma d). Metastases-Chordoma-Lymphoma-Lung carcinoma-Melanoma e). Pseudotumors -Lipomatous hypertrophy of the interatrial septum 4. Valvular heart disease a). Anatomical variants -Bicuspid aortic valve b). Calcifications -Mitral annulus-Aortic valve 5. Congenital heart disease and thoracic vascular disorders: a). Atrial septal defects b). Patent ductus arteriosus c). Persistent left superior vena cava d). Aortic arch anomalies-Right sided -Double aortic arch e). Anomalous pulmonary venous drainage 6. Pericardial diseases: a). Pericarditis -Infectious-Iatrogenic-Autoimmune-Constrictive b). Pericardial effusion and hematoma c). Pericardial cysts d). Malignant pericardial involvement-Direct invasion-Metastases-Venous extension e). Pericardial fat necrosis

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## Abstract Archives of the RSNA, 2023

CAEE-60

### Quantitative Stress Perfusion Cardiac Magnetic Resonance: Why, How and When?

#### TEACHING POINTS

1. Understand differences between qualitative, semi-quantitative and quantitative stress perfusion. 2. Understand how quantitative stress cardiac MRI (QuantCMR) is performed and calculated as well as how to interpret myocardial blood flow/ myocardial perfusion reserve. 3. Demonstrate clinical role of cardiac MRI quantitative stress perfusion. 4. Illustrate different pathologies and their appearances on cardiac MRI quantitative stress perfusion.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will explain the recent interest and development of QuantCMR and how this differs from qualitative and semi-quantitative stress perfusion. Technical details of how QuantCMR is performed and quantified will be demonstrated along with tips/tricks of how to get high quality perfusion maps. The exhibit will explain differences between dual bolus and dual sequence techniques and issues to be aware of with different stress agents. The exhibit will discuss how QuantCMR is being increasingly recognised as being useful in patients with ischaemia and non-obstructive coronary arteries (INOCA) to diagnose coronary microvascular dysfunction (CMD) as well in standard assessment of obstructive coronary artery disease. Clinical examples of these pathologies will be illustrated. In addition, other cardiac diseases will also be demonstrated to illustrate how QuantCMR perfusion maps appear in different disease entities such as dilated cardiomyopathy and hypertrophic cardiomyopathy. Knowledge gaps and future directions will also be discussed.

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## Abstract Archives of the RSNA, 2023

CAEE-61

### State of the Art on Acute Coronary Syndrome with Negative Coronary Angiography

#### Participants

Cesar Urtasun Iriarte I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To learn the definition of MINOCA and review the spectrum of causes that manifest as acute coronary syndrome with non-obstructive coronary arteries. To understand the role of cardiovascular imaging, learn about the management and, outline CT and MRI protocols.

#### TABLE OF CONTENTS/OUTLINE

A. Background, diagnosis, and management B. Assessment: CT and MRI protocols C. Acute coronary syndrome with negative coronary angiography a. MINOCA entities - Coronary plaque disruption- Coronary artery vasospasm- Coronary artery dissection- Coronary artery thrombosis/embolism- Coronary microvascular disorder- Myocardial oxygen demand-supply imbalance b. MINOCA-like entities Myocardial location (Tako-Tsubo, myocarditis, hypertrophic cardiomyopathy, dilated cardiomyopathy, infiltrative cardiomyopathy) Other non-cardiac mimickers (Vasculitis, pulmonary embolism, aortic dissection) D. Take-home messages

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## Abstract Archives of the RSNA, 2023

CAEE-62

### Development in Free-Breathing Coronary CTA for Patients With High Heart Rate: Using Non-Device Respiratory Gating Method

#### TEACHING POINTS

Technological advances make Free-Breathing Coronary CTA (FB-CCTA) possible, but there are challenges for patients with higher heart rate (HR). We have developed a protocol of FB-CCTA at high HR using a non-device respiratory gating method.

#### TABLE OF CONTENTS/OUTLINE

We have developed a method to reduce motion artifacts even at high HR from free-breathing images. Since multi-segment reconstruction can improve image quality and diagnostic accuracy at higher HR, Scans and post-processing were performed to allow the segment reconstruction from free breathing images. After electrocardiogram gated Dynamic Volume Scan, to avoid motion artifacts due to breathing, the non-device respiratory gating was performed. The respiratory arrest phase was analyzed using Time-Density-Curve (TDC) plotted from the region of interest drawn on the chest wall of the dynamic image. Multi-segment reconstruction used data from multiple cardiac cycles during respiratory arrest time analyzed from the TDC was performed. In addition, the reconstruction type was applied with full-iterative model-based reconstruction algorithms for improved Signal-To-Noise ratio (SNR). The resulting image was reduced motion artifacts and improved SNR. This method is feasible to provide acceptable image quality and diagnostic performance in CCTA with free-breathing and high HR.

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## Abstract Archives of the RSNA, 2023

CAEE-63

### **Effectiveness of a Contrast Enhancement Boost Technique in Cardiac CT: Improved Detection of Late Iodine Enhancement (LIE) in Non-Ischemic Cardiomyopathy**

#### **TEACHING POINTS**

- To learn about issues of myocardial evaluation with Single-Energy CT.
- To learn about a subtraction technique with non-rigid registration, that can be used to represent an image of the myocardium.
- To learn the principles of the contrast enhancement boost technique (CE-boost) with non-rigid registration.
- To learn about the contrast-improving effects of CE-boost and its diagnostic value in non-ischemic cardiomyopathy.

#### **TABLE OF CONTENTS/OUTLINE**

A. Comparison of CNR between Single-Energy CT and other imaging techniques for non-ischemic cardiomyopathy. B. Advantages of non-rigid registration compared to rigid registration in subtraction techniques. C. Usefulness of non-rigid registration subtraction technique with CE-boost in LIE-CT. D. Clinical case of LIE-CT using CE-boost for preoperative CT examination for TAVI. E. Advantages of CE-boost in non-ischemic cardiomyopathy and its application in clinical imaging.

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## Abstract Archives of the RSNA, 2023

CAEE-64

### Cardiac MRI for the Beginner: A Step by Step Approach

#### TEACHING POINTS

Cardiac MRI is a non-invasive modality for anatomical, functional and myocardial tissue evaluation of the heart for a variety of cardiovascular diseases. It holds immense diagnostic potential and despite its relative high cost, it is becoming more increasingly mainstay in cardiac evaluation. Some conditions that cardiac MR renders benefits to include ischaemic heart disease, cardiomyopathy, valvular disease, congenital disease, pericardial disease and characterization of cardiac masses. It supplements the initial cardiac work-up by providing an unobstructed field of view, myocardial tissue assessment and remains the gold standard for RV and LV volumetric assessment. It is a complex study and includes an arsenal of MRI sequences including cine, myocardial perfusion, parametric mapping and flow sensitive sequences, all tailored to the specific clinical indication or question. Reading a Cardiac MR for the novice radiologist/cardiologist can be a daunting task. With the need for more Cardiac MR readers and to demystify this process, this poster will aim to provide a basic navigational chart for the novice reader which will provide a foundation for them to build upon. Teaching points: An overview of cardiac MRI sequences, basic principles and utility of each sequence An basic approach to interpreting a cardiac study An algorithm approach to common cardiac conditions with case based examples.

#### TABLE OF CONTENTS/OUTLINE

Basic cardiac MR sequences and their purpose How to approach a Cardiac MR Basic techniques on qualitative and quantitative assessment with tips and tricks Algorithm for common conditions Case based discussion

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## Abstract Archives of the RSNA, 2023

CAEE-65

### **Late Iodine Enhancement of Myocardial with Deep Learning Reconstruction Under Low Radiation Doses and Low Contrast Doses: How to Get the Best Image Quality**

#### **TEACHING POINTS**

Late Iodine Enhancement (LIE) of myocardium in cardiac CT has been reported to reflect fibrotic lesions in myocardium similar to Late Gadolinium Enhancement (LGE) in cardiac MRI, but requires a higher contrast dose and radiation dose due to contrast enhancement and noise effects. To solve this problem, we propose three new points in using imaging, reconstruction and subtraction technology. 1. Imaging technology: Low-voltage imaging according to BMI. 2. Reconstruction technology: Deep Learning Reconstruction (Contrast enhancement parameters "AiCE"). 3. Subtraction technology: special contrast-enhancing subtraction technology "CE-Boost". Using the above three methods enables significant contrast enhancement and noise reduction, even with LIE at low radiation doses and low contrast doses. In addition, using DLR provides stability in the uniformity of CT values required for myocardial Extra Cellular Volume (ECV) quantification.

#### **TABLE OF CONTENTS/OUTLINE**

(1) Combination of three special technologies (2) Reconstruction and subtraction technologies (3) Deep learning reconstruction and special subtraction (4) Stable noise reduction with DLR (5) Combination of three special technologies

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## Abstract Archives of the RSNA, 2023

CAEE-66

### Success Within Your Grasp: Planning for Mitral Valve Transcatheter Edge-to-Edge Repair

#### Participants

Hyun Jung Koo, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To recap the evidence of mitral edge-to-edge repair in both primary and secondary mitral regurgitation To demonstrate preprocedural imaging modalities to help appropriate patient selection and interventional guide To understand intraprocedural imaging and post-procedural imaging findings

#### TABLE OF CONTENTS/OUTLINE

1. Evaluation of mitral regurgitation (MR) 1) Etiology of MR - Primary mitral regurgitation - Secondary (functional) mitral regurgitation 2) Quantification of MR 2. Types of percutaneous mitral valve repair 3. Patient selection for M-TEER - AHA/ACC Guidelines for M-TEER - Review of Trials: EVEREST II trial, COAPT trial, MITRA-FR trial - Anatomically suitable mitral valve morphology 4. Pre-procedural planning for M-TEER - Echocardiography and cardiac CT - Evaluation parameters 5. Intra-/Post- TEER imaging of M-TEER 6. Potential complications after M-TEER

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## Abstract Archives of the RSNA, 2023

CAEE-67

### Multimodality Imaging in Sports Cardiology: New Kid on the Block

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Although athletes' have low prevalence of coronary artery disease (CAD), they are prone for other cardiovascular disorders, which should be evaluated prior to suitability for athletic activity. 1. To review the role of Sports Cardiology, a relatively new subspecialty focused on athletes 2. To discuss the role of imaging, particularly MRI in the diagnosis of athlete's heart which is a structural adaptive change that overlaps with cardiomyopathies. 3. To illustrate with case examples the various entities that are encountered in athletes.

#### TABLE OF CONTENTS/OUTLINE

1. SPORTS CARDIOLOGY- INTRODUCTION a. Pre-athletic activity screening for diseases that may be worsened with sports activities b. Evaluation of diseases that cause adverse events in athletes 2. ROLE OF IMAGING- Echo, MRI, CT 3. MRI SEQUENCES AND PROTOCOL 4. ADAPTATIVE CHANGES IN ATHLETES= Endurance- Volume overload, increased wall stress, eccentric hypertrophy; Strength- Pressure overload, increased wall stress, concentric hypertrophy 5. MYOCARDIAL FIBROSIS IN ATHLETES- Prevalence and pattern 6. ATHLETE'S HEART (WITH CASE EXAMPLES)- Diagnostic criteria controversies; Distinguishing from mimics (Grey zone) a. Hypertrophic cardiomyopathy b. Dilated cardiomyopathy c. LV non compaction d. Arrhythmogenic cardiomyopathy 7. DISEASES CAUSING SUDDEN CARDIAC DEATH IN ATHLETES (with case examples) a. HCM b. ARVD C. Anomalous coronary arteries d. Commotio cordis e. Myocarditis 8. SCREENING STRATEGIES WITH IMAGING IN PROFESSIONAL ATHLETES 9. CTA IN RISK STRATIFICATION OF CORONARY ARTERY DISEASE 10. VETERAN ATHLETES AND MYOCARDIAL FIBROSIS- ARRHYTHMIA 11. ATHLETES AND COVID-19 12. MANAGEMENT OF INCIDENTAL FINDINGS IN ATHLETES

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## Abstract Archives of the RSNA, 2023

CAEE-68

### The Minimal Essence of Machine Learning for Cardiovascular Diagnosis

#### Participants

Ryo Ogawa, PhD, MD, Toon, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Various information related to medical data can be obtained by machine learning. We explain how machine learning are used to cardiovascular diagnosis. 1. To review the role of machine learning.2. To explain the application of machine learning in cardiovascular diagnosis.3. To explain the principle of machine learning.

#### TABLE OF CONTENTS/OUTLINE

1. Linear regression; overview, algorithm, example (heart failure)2. Logistic regression; overview, algorithm, example (history of heart disease)3. Support vector machine; overview, algorithm, example (Differentiation of cardiomyopathy)4. Random forest; overview, algorithm, example (Differentiation of cardiomyopathy)5. Neural network; overview, algorithm, example (Classification of myocardial infarction)6. Explainable AI; overview, algorithm, example (Gradient-weighted class activation mapping, Guided gradient-weighted class activation mapping)7. Generative AI; overview, algorithm, example (Deep convolutional generative adversarial network)

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## Abstract Archives of the RSNA, 2023

CAEE-69

### Denoise to Visualize: The AI-Driven Post-Hoc Denoising for High-Fidelity Cardiac CT

#### Participants

Tatsuya Nishii, MD, PhD, Suita, Japan (*Presenter*) Speakers Bureau, Guerbet SA; Speakers Bureau, General Electric Company; Speakers Bureau, Siemens AG; Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

In cardiac CT, maintenance of the increased image noise from photon insufficiency is crucial while upholding high resolution. CT manufacturers have developed iterative and deep-learning reconstruction methods, but disparities exist. Advancements in AI enable image restoration, such as denoising through post-processing allowing radiologists to develop image-processing AI promoting the "democratization" of technology. This exhibit presents the development of a denoising method for high-fidelity cardiac CT using image-based deep learning and its clinical applications. Participants will learn about democratized image-processing AI and engage in its development and clinical application. In enhancement, we showcase cardiac CT images with the application of noise reduction technology, aiming to generate new ideas for diagnostic and prognostic imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Importance of noise reduction in cardiac CT 1.1 Cardiac CT imaging techniques 1.2 Noise's adverse effects 2. AI denoising method differences 2.1 Deep-learning image reconstruction 2.2 Deep-learning post hoc denoising 3. Denoising AI development Process 3.1 Optimal network selection 3.2 Data preparation essentials 3.3 Training, validation, and testing 3.4 Implementation highlights 4. Clinical Showcases 4.1 Exposure Reduction 4.1.1 1/4 dose coronary CT angiography 4.1.2 1/3 dose myocardial delayed enhancement CT 4.1.3 Low-dose pediatric cardiac CT 4.2 Image quality enhancements 4.2.1 Improved diagnostic performance of coronary CT angiography 4.2.2 Enhanced myocardial delayed enhancement CT 4.2.3 Enhanced 3D rendering images

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## Abstract Archives of the RSNA, 2023

CAEE-7

### Atrial Septal Defects: A Multimodality Case-Based Approach

#### TEACHING POINTS

Outline the most common atrial septal defects and their associations. Demonstrate the role of cardiac MRI and CT in the diagnosis of atrial septal defects. Illustrate, through case reviews, the imaging findings of atrial septal defects. Discuss treatment options and morphological characteristics to treatment decisions.

#### TABLE OF CONTENTS/OUTLINE

This review presents a multimodality case-based approach to the diagnosis of Atrial Septal Defects (ASDs). ASDs are the most common congenital cardiac anomaly. Ostium secundum is the most common ASD. Some congenital syndromes, including Holt Oram Syndrome and Lutembacher Syndrome, have ostium secundum type septal defects as part of their spectrum. Sinus venosus can present as a superior or inferior defect, each with different anatomical associations. Ostium primum is within the spectrum of atrioventricular septal defects and is associated with endocardial cushion defects and Trisomy 21. Coronary sinus atrial septal defect is a rare disease presenting as permeability of the coronary sinus. Raghbir syndrome is a type of coronary sinus ASD defined as a PLSVC draining to an unroofed coronary sinus. The roles of CT and MRI offer information on coronary and pulmonary diseases, as well as other anatomical variations that can impact the patient's treatment. MRI also enables functional assessment of the flow, cardiac function, and myocardial tissue characterization. Ostium primum/atrioventricular septal defects, coronary sinus defects, and sinus venosus defects are often treated surgically, while septum secundum type defects can be treated with transcatheter closure. The decision is based on the size, number, and shape of the defects.

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## Abstract Archives of the RSNA, 2023

CAEE-70

### Quantitative Myocardial Perfusion MR: State-of-the-Art

#### Participants

Roberta Catania, MD, Chicago, IL (*Presenter*) Institutional Research Grant, Siemens AG

#### TEACHING POINTS

1. Quantitative perfusion MR is an objective and more reproducible tool to identify myocardial perfusion defects and differentiate artifacts compared to only qualitative assessment. 2. Quantitative perfusion MR is a non-invasive tool that can add significant value in the work-up of patients with suspected coronary artery disease and surveillance of post heart transplant patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction - Physiology of myocardial circulation at rest and stress and autoregulation - Overview of current noninvasive imaging techniques for coronary artery disease assessment and their accuracy - Clinical applications of myocardial perfusion imaging including assessment for epicardial and microvascular coronary artery disease and heart transplant surveillance Imaging techniques - Pharmaceutical stress agents: mechanism of action and contraindications - Cardiac perfusion MR: physical principles, imaging sequences and protocol - Quantitative analysis: Ø Current quantification techniques (automated pixel-wise and dual sequence approach) Ø Absolute quantification and myocardial perfusion reserve (MPR) Imaging interpretation and case study- How to interpret quantitative perfusion and key information to be provided in radiology report - Normal quantitative myocardial perfusion MR - Atlas of different radiologic findings - Troubleshooting interpretations of complicated quantitative perfusion MR findings

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## Abstract Archives of the RSNA, 2023

CAEE-71

### Utility of Non-contrast MRI for Preprocedural Assessment in Patients Undergoing TAVI

#### Participants

Naoki Hosoda, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To learn about the pre-procedural assessment for transcatheter aortic valve implantation. To learn about the validity of non-contrast MRI assessment. To learn about non-contrast MRI imaging protocols. To learn about the benefit patient gain by alternative non-contrast MRI.

#### TABLE OF CONTENTS/OUTLINE

A. Non-contrast MRI can be used as an alternative to contrast CT for patients with CKD and contrast allergies. B. Usefulness of non-contrast MRI to measure in the same way as contrast CT. C. Short imaging protocol focused on pre-procedural assessment of TAVI. D. Non-contrast MRI not only allows assessment comparable to contrast CT, but also avoids risks for patients with CKD and contrast allergy and allows radiation free imaging.

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## Abstract Archives of the RSNA, 2023

CAEE-72

### Pulmonary Artery: Showcase of Congenital and Acquired Pathologies You Should Know

#### TEACHING POINTS

1. To review the normal anatomy of the of the pulmonary artery and their branches. 2. To review the acquired and congenital causes. 3. To show the frequent findings in congenital pathologies. 4. To show the repercussion of the long-term affection of the pulmonary artery.

#### TABLE OF CONTENTS/OUTLINE

1. introduccion. 2. Normal anatomy of the pulmonary artery and their branches. 3. Acquired pathologies: Complications of chronic Pulmonary embolism, Dilated arteries secondary to pulmonary hypertension, Pulmonary Artery Stenosis and Pulmonary Venocclusive Disease. 4. Congenital pathologies: Pulmonary artery agenesis associated with aortopulmonary collateral arteries (MAPCAs), Pulmonary atresia with intact ventricular septum, Anomalous Aortic Origin of Pulmonary Arteries, Aneurysm, Absent pulmonary valve syndrome, Double-Outlet Right Ventricle, Dextro-Transposition of the Great Arteries, Anomalous left coronary artery from the pulmonary artery (ALCAPA), Pulmonary Artery Sling, pulmonary arteriovenous malformations. 5. Long term repercussion in the cardiac chambers and great vessels. 6. Review of the most commons surgical options and outcomes. 7. Discussion. 8. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-73

### Dual-energy Late Iodine Enhancement Cardiac CT: What is Necessary to Achieve with Dual-Layer Spectral CT?

#### TEACHING POINTS

A. To learn about late iodine enhancement (LIE): Imaging technique with dual-layer spectral CT. B. To learn how spectral imaging solves conventional imaging problems. C. To learn about the use of iodine density image for myocardial extracellular volume (ECV). D. To illustrate various clinical applications of these techniques by presenting clinical images.

#### TABLE OF CONTENTS/OUTLINE

A. Methods of scanning and contrasting late iodine enhancement (LIE) using dual-slice spectral CT. And their advantages and disadvantages. B. Advantage of spectral images over conventional CT for LIE. C. LIE image analysis. LIE by image subtraction and myocardial extracellular volume (ECV) by iodine concentration images. D. Evaluation of myocardial viability by LIE. Evaluation of OMI by subtraction-LIE. E. LIE myocardial viability evaluation. Evaluation of cardiomyopathies by ECV.

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## Abstract Archives of the RSNA, 2023

CAEE-74

### The ABC's of ECG - Practical Tips and Tricks for Salvaging ECG-Gated Cardiac CT

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Distinguish the various artifacts commonly encountered in ECG-gated cardiac CT 2. Recognize whether the artifact can be repaired, reduced, or read around 3. Employ ECG sync point editing and composing to salvage cardiac CTs degraded by artifacts from heart rate rhythm, and ECG-gating error

#### TABLE OF CONTENTS/OUTLINE

1. Introduction Basics of ECG interpretation; ECG-gating techniques, trade-offs, applications; 2. Distinguishing respiratory/patient motion vs. gating artifact 3. ECG Gating Error: Missing Data (interpolation artifact)- Pitch too high on retro helical - data gaps; Missing Sync Points; 4. ECG Gating Error: Misplaced Data (duplication artifact)- Peaked T-waves; 5. Gating Artifact with correct ECG Gating: Tachycardia or Arrhythmia- PVCs; PACs; Long pause (PVC, PAC, dropped beat); Afib other beat-to-beat Irregularity; 6. ECG-editing options- Sync point editing-Missed a beat/tagged wrong thing/helical; Sync point composing: R wave tagged, manipulation of reconstructions to read-around; 7. A systematic approach for troubleshooting ECG-gating errors and artifacts including case examples- Respiratory motion artifact- Normal ECG; Sinus tachycardia- Multisegment reconstruction; Heart rate change- Can sometimes be read-around; PVC without pause- Eliminate PVC sync; PVC with long pause- Eliminate PVC sync; Add evenly spaced sync points in pause; PAC- eliminate PAC sync or retain it extra, even sync points in best systolic phase; Atrial tachycardia- Sync in best systolic phase; Severe bradycardia- Two separate syncs in diastole; Atrial fibrillation- Artificially space sync points at each R-R interval so they line up each beat;

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## Abstract Archives of the RSNA, 2023

CAEE-75

### Tumors of the Heart: From the Right Side to the Left Side

#### Participants

Felipe Aluja, MD, MEd, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Discuss the most common cardiac masses, including their typical manifestations and associations, and a brief discussion of clinical scenarios. Describe the imaging signs of cardiac tumors in computed tomography, magnetic resonance imaging and PET/CT. Identify selected cardiac tumors commonly encountered in daily practice and integrate them with the clinical manifestations.

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- Classification with brief but concise clinical presentation
- Imaging signs of cardiac tumors in computed tomography, magnetic resonance imaging and PET/CT.
- Selected cardiac tumors:
  - o Primary: § Myxoma § Fibroelastoma § Atrial hemangioma § Lipoma § Rhabdomyoma § Fibroma § Angiosarcoma § Lymphoma § Paraganglioma
  - o Secondary: § Metastasis
- Pitfalls in cardiac tumors:
  - o Vegetations
  - o Intracavitary thrombus
  - o Lipomatous hypertrophy
- Take a guess?
- Take home points

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## Abstract Archives of the RSNA, 2023

CAEE-76

### Solving the Mystery: Cardiac Devices on Chest Radiographs

#### TEACHING POINTS

Heart disease is the leading cause of mortality in the United States. Advances in clinical care leading to new devices and treatments allow patients to live longer. Radiologists encounter chest radiographs daily, many with cardiac devices. On radiographs, devices will typically be visible, and it is essential for radiologists to recognize them, know appropriate positioning, and understand complications related to the devices to provide appropriate patient management. Inaccurate interpretation may lead to inappropriate management, delayed diagnosis, and delay of necessary or harmful interventions. The purpose of this exhibit is to walk through common and uncommon cardiac devices, their appropriate positioning, and complications related to mispositioned devices, as well as discuss pathophysiology of some devices. Cardiac rhythmic controlled devices, cardiovascular support devices, stroke prevention devices, cardiac valve support and prosthetic valves, and miscellaneous devices will be reviewed.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to common cardiac devices 2. Classification of these devices 3. Expected positioning of cardiac devices 4. Visible and barely visible devices on CXR 5. Pathophysiological mechanisms of these devices 6. Examples of mispositioned devices 7. Complications related to incorrectly positioned devices 8. Less common/miscellaneous devices and their positioning 9. Flowchart of what to do with a mispositioned devices (urgent versus emergent) 10. What cardiologist expects from radiology report?

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## Abstract Archives of the RSNA, 2023

CAEE-77

### Simplifying Semantic Segmentation in Cardiac MR: An Intuitive Guide for Radiologists using Transfer Learning

#### TEACHING POINTS

Understanding the importance of semantic segmentation in cardiac MR imaging  
Review of available solutions for segmentation and evaluation metrics  
Introduction to approaches for segmentation using Transfer learning  
Guided approach to a simplified segmentation process using high-level API for low-code development.  
Best practices for achieving accurate segmentation

#### TABLE OF CONTENTS/OUTLINE

I. Introduction to Segmentation in Cardiac MRI Imaging  
Definition of image segmentation and its types.  
Need for segmentation in cardiac MRI imaging  
Available solutions for image segmentation and metrics for assessing accuracy  
II. Introduction to TorchIO, MONAI and FAST AI Libraries for Medical Image Analysis  
Overview of libraries.  
Understanding the Data to Model pipeline.  
Importance of Using Transfer Learning.  
Use of High-level APIs for low-code model development. III. Step-by-Step Demonstration of Segmentation using Google Colab and the Heart MRI Dataset  
Setting up the Google Colab environment  
Introduction to the Heart MRI dataset from the Medical Segmentation Decathlon challenge provided by King's College London  
Step-by-step demonstration of target segmentation of the left atrium with minimal lines of code  
IV. Best Practices for Achieving Accurate Segmentation  
Tips for optimising segmentation accuracy  
Strategies for addressing common segmentation challenges  
V. Conclusion  
Summary of key teaching points  
Future directions in semantic segmentation in cardiac MR imaging (like use of generative adversarial network (GAN))

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## Abstract Archives of the RSNA, 2023

CAEE-78

### A Precarious Path - Complications of 3-stage Palliative Surgery for Single Ventricle Congenital Heart Disease

#### Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Single ventricle congenital heart diseases are most commonly managed with 3-stage palliation which culminates in the Fontan procedure. Post-operative imaging has been instrumental in assessing for complications both in the short term and long term and ensuring patient longevity. Here, we present some of the most commonly encountered complications associated with 3-stage palliation including early post-operative complications, features of physiologic decompensation, and late-stage downstream effects attributed to the unique physiology in these patients. Where appropriate, we review practical tips and pitfalls in imaging this unique set of patients.

#### TABLE OF CONTENTS/OUTLINE

1. Title, disclosures  
2. Abbreviations  
3. Complications overview  
4. Clinical scenarios  
5. Potential workup  
6. Recent operation  
7. Acute SOB/desaturation/chest pain  
8. PE  
9. MI  
10. CHF  
11. Chronic non-cyanotic SOB/desaturation  
12. Fontan thrombosis  
13. Pitfall: Pseudothrombosis  
14. Systemic AV valve dysfunction  
15. Peri-anastomotic PA stenosis  
16. Pitfall: Morphology/flow discrepancy RPA/LPA  
17. Diaphragmatic paralysis  
18. Post-Glenn SVC syndrome  
19. Recurrent cyanosis  
20. Pulmonary AVMs  
21. Systemic-pulmonary venous collaterals  
22. Practical tip: Quantifying collateral circulation  
23. Patent fenestration  
24. Baffle leak  
25. Arrhythmia  
26. Myocardial LGE  
27. Weight gain  
28. Liver failure  
29. Weight loss  
30. HCC  
31. Protein-losing enteropathy  
32. Chronic cough  
33. Plastic bronchitis  
34. Unexplained pleural effusion  
35. Chylous pleural effusion  
36. Potentially helpful clinical tests  
37. References

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## Abstract Archives of the RSNA, 2023

CAEE-79

### Left Atrial Appendage Assessment in Enhanced Cardiac CT

#### Participants

Ronghui Ju, MD, PhD, Shenyang, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In a recent study using cardiac computed tomography (CT) and magnetic resonance (MR), the shapes of the left atrial appendage (LAA) in patients with drug-refractory AF were classified into 4 morphological types, with "chicken wing" being the most common (48%), followed by "cactus" (30%), "windsock" (19%), and "cauliflower" (3%). Transcatheter left atrial appendage occlusion is an increasingly used alternative to oral anticoagulation in selected patients with atrial fibrillation. Pre-procedural imaging is a prerequisite to a successful intervention, with transesophageal echocardiography as the current gold standard. However, cardiac CT offers improved imaging with high-quality multiplanar and 3-dimensional reconstructed images. Nevertheless, the lack of a standardized imaging protocol has slowed the adoption of cardiac CT into clinical practice. This paper provides a protocol for the preparation, acquisition, and interpretation of cardiac CT imaging in pre-procedural planning of left atrial appendage occlusion. Orifice (OR) is defined as a line connecting the left upper pulmonary vein ridge and the circumflex coronary artery. Device landing zone (LZ) is defined as a line connecting the circumflex coronary artery and a point 1-2 mm inside the LAA, measured from the left upper pulmonary ridge tip. Length/depth of the appendage is measured as a line from the landing zone to the most distal tip of the appendage.

#### TABLE OF CONTENTS/OUTLINE

OutlinePage 1: What to assess about left atrial appendage(LAA) in an enhanced cardiac CT Page 23: 4 types of LAA morphologies (VR reconstruction) Page 4: LAA recognition and assessment of orifice and landing zone in multiplanar reconstruction images

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## Abstract Archives of the RSNA, 2023

CAEE-8

### Coronary Artery Vasculitis, Encasement, and Mimics

#### TEACHING POINTS

1. Coronary artery vasculitis is an inflammatory process that is often distinguished from coronary artery encasement from benign and malignant neoplasms, although imaging appearances can overlap. 2. Coronary artery vasculitis is rare but represents an important diagnostic consideration, especially for acute coronary syndrome (ACS) patients with no traditional cardiovascular risk factors or systemic illness. 3. There are several mimics of coronary artery vasculitis, demanding careful attention to multi-organ findings and clinical presentation.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Spectrum of coronary artery vasculitis and encasement. 3. Review and illustration of coronary artery vasculitis, including: polyarteritis nodosa, Kawasaki's disease, Takayasu's arteritis, giant cell arteritis, HIV. 4. Review and illustration of coronary artery encasement, including: malignant neoplasms (lymphoma, angiosarcoma), IgG4-related disease, Histiocytic disorders (Erdheim-Chester disease, Rosai Dorfman). 5. Complications of coronary artery vasculitis: aneurysms, stenosis, CHF. 5. Mimics of coronary artery vasculitis: spontaneous coronary artery dissection (SCAD), acute plaque rupture, vasospasm.

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## Abstract Archives of the RSNA, 2023

CAEE-80

### Women's Heart: Role of Cardiac Imaging in Early Detection and Prognostication of Heart Diseases- A Primer for Cardiac Imagers

#### Participants

Barun Bagga, MBBS, Mineola, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The diagnosis of heart disease in women poses unique challenges and remains underdiagnosed and undertreated. 2. Understanding the different etiologies of chest pain in women focusing on Acute myocardial infarction (AMI), MINOCA (myocardial ischemia with non-obstructed coronary arteries), myocarditis, Takostubo, LV apical ballooning, and connective tissue disease-related cardiomyopathy.3. AMI has a different presentation, underlying pathophysiology, and outcomes in women compared to men.4. MINOCA is more common in women and in a younger population, with fewer traditional risk factors for coronary artery disease (CAD) and a higher prevalence of non-obstructive coronary plaques.5. MINOCA has a higher all-cause mortality at 12 months compared to stable angina and has been found to have worse quality of life compared to AMI-CAD because they are less often treated with beta-blockers and less often referred to cardiac rehabilitation.6. Cardiac MRI (CMRI) plays a crucial role in the diagnostic algorithm because of accurate myocardial characterization independent of the presence of obstructive coronary lesions.7. CMRI has been shown to provide an etiologic diagnosis in as many as 77-87 % of cases of MINOCA and offers prognostic value with the extent of LGE involvement correlated with the risk of major cardiovascular events.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Review the different causes of chest pain in women in a case-based approach: a) MINOCA; b) SCAD; c) Myocarditis; d) Takostubo; e)LV apical ballooning; f)AMI; g)Connective tissue disease-related cardiomyopathy. 3. Review the role of cardiac imaging in diagnosis and prognostication.

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## Abstract Archives of the RSNA, 2023

CAEE-81

### Improved Assessment of Coronary Artery Calcium in Photon-Counting Detector CT: A Phantom Study with Various Imaging Modalities

#### Participants

Nobuo Kitera, RT, MSc, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Accurate assessment of calcified lesions in coronary arteries can help establish better treatment strategies. 2. CT can obtain preoperative calcification. information of coronary arteries, but it is difficult to completely complement intravascular imaging due to limitations in spatial resolution and other factors. 3. Photon-counting detector (PCD) CT has higher spatial resolution than conventional energy-integrating detector CT and is expected to improve the ability to visualize microstructures. 4. PCD-CT has the potential to provide new diagnostic value as a preoperative diagnostic tool by acquiring highly accurate coronary artery calcification imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Importance of coronary artery calcification assessment in percutaneous coronary intervention. 2. Characteristics of coronary artery calcification images in various imaging modalities. 3. Features of PCD-CT, including principles of high-resolution imaging, and selection of scan mode and reconstruction kernel. 4. Comparison of PCD-CT images with other imaging modalities using calcified phantom.

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## Abstract Archives of the RSNA, 2023

CAEE-82

### **Congenital Mitral Valve Disease: From Embryology to Pathology to Repair**

#### **Participants**

Jonathan Liu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Congenital mitral valve disease can present in a myriad of ways, often differing in morphology, age of presentation, and symptoms. By understanding the development of the mitral valve apparatus, congenital mitral valve disease can be categorized based on which underlying apparatus structure is maldeveloped. The most common and clinically relevant mitral valve pathologies are discussed. Next, the general approach to evaluation of these congenital mitral valve pathologies is reviewed, highlighting the strengths and weakness of each imaging modality (CT, MRI, and echocardiography). Methods for quantification are also reviewed. Finally, the general approach to mitral repair and replacement in the context of congenital heart disease will be discussed.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Embryology and normal anatomy  
3. Anomalies based on location  
a. Supravalvular Lesions  
b. Anomalies of leaflets  
c. Anomalies of chordae  
d. Anomalies of papillary muscles  
e. Associated congenital heart diseases  
4. General approach to evaluation of congenital mitral valve disease  
a. Morphology  
i. Lesions best diagnosed by CT  
ii. Lesions best diagnosed by MRI  
iii. Lesions best diagnosed by echocardiography  
b. Flow  
i. Mitral regurgitation  
ii. Mitral stenosis  
iii. Mixed physiology  
5. Correction of congenital mitral valve disease  
a. Mitral valve repair  
b. Mitral valve replacement  
6. Conclusion

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## Abstract Archives of the RSNA, 2023

CAEE-83

### **Congenital Aortic Arch Anomalies: What the Clinician Wants to Know**

#### **Participants**

Muhammad Naeem, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Anomalies and congenital variants of the aortic arch are important entities to be familiar with, as they are known to be associated with congenital heart disease, vascular rings, genetic syndromes, and can have significant impact in clinical management. It is postulated to occur as a result of abnormal embryonal organogenesis of the primitive aortic arches. Advanced imaging, specifically computed tomography angiography (CTA) and magnetic resonance angiography (MRA) play a crucial role in the pre-operative planning, as these cases present an anatomic challenge for surgical intervention. Imaging is essential in the diagnosis, management, surgical planning and eventual outcome in patients with congenital arch anomalies. This exhibit will outline the imaging that may be required, and the information needed by the surgeon to attain the best possible surgical outcome.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review anatomy of various congenital aortic arch anomalies, focusing on clinically significant anomalies that require surgical correction, through case-based examples. 2. Understand what are the most salient findings that should be reported to the surgeon in these case examples, so that pre-operative planning is optimized. We will review the clinically significant variants of congenital arch anomalies that require surgical correction, which may be unfamiliar due to their rarity in clinical practice. We will utilize case-based examples to demonstrate what the important imaging findings the radiologist should review and report to the surgeon. Our focus will cover the impact a radiologist can have in detecting these variants and to provide all the critical information to the surgeon, before an operation occurs.

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## Abstract Archives of the RSNA, 2023

CAEE-84

### Imaging findings in Cardiac and Lung Transplant Emergencies and Urgencies

#### Participants

Thangalakshmi Sivathapandi, MD, Johns Creek, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Having comprehensive knowledge about hyperacute/acute complications of heart and lung transplants is crucial as imaging plays a vital role in the multidisciplinary management of these patients. 2. Despite many advances, a disproportionate portion of mortality still occurs in the early post-transplant period, hence prompt recognition of these complications is essentially needed to prevent allograft failure and death. 3. Accurate reporting by the radiologist could aid the clinician for timely intervention and appropriate patient care.

#### TABLE OF CONTENTS/OUTLINE

1. Overview: To review the salient radiological findings in hyperacute and acute complications of heart and lung transplant. 2. Heart transplant: primary graft dysfunction, post operative bleeding, pericardial tamponade, inferior and superior vena cava stenosis/injury, thromboembolism, sternal dehiscence, pseudoaneurysm, pulmonary edema, infection, and acute rejection. Highlighting the key findings of cross-sectional imaging studies including ultrasound, computed tomography, and magnetic resonance imaging with primary emphasis on CT findings. 3. Lung transplant: chest wall/pleural defects like wound dehiscence, acute and hyperacute rejection, primary graft dysfunction, bronchovascular anastomotic complications such as lobar torsion, bronchial dehiscence, and pulmonary arterial and venous stenosis/thrombosis, as well as bacterial, viral, and fungal infections among others.

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## Abstract Archives of the RSNA, 2023

CAEE-85

### The Emerging Role of Cardiac CT in Clinical Practice of Cardiac Amyloidosis

#### Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recent research has revealed a considerable number of hidden cardiac amyloidosis (CA) especially in patients with heart failure with left ventricular hypertrophy. CA is, however, frequently misdiagnosed as the other hypertrophic heart disease, and delayed diagnosis results in significant consequences for patients. 2. Current noninvasive diagnostic imaging strategies for CA include echocardiography, cardiac MRI, and bone scintigraphy. 3. Myocardial late iodine enhancement (LIE) and extracellular volume (ECV) quantification by cardiac CT has become clinically available and clinical evidence is accumulating. 4. Since CT is more practical than MRI and scintigraphy, it plays a clinically important role in the diagnosis and management of CA.

#### TABLE OF CONTENTS/OUTLINE

1. Basic knowledge of CA: - Classification of CA - Recent development on therapeutic agents 2. Current noninvasive diagnostic imaging strategies: - Echocardiography - Cardiac MRI - Bone scintigraphy 3. Myocardial tissue assessment using cardiac CT: - LIE imaging - ECV quantification - CT imaging protocols 4. The emerging role of cardiac CT for CA: - Efficient diagnostic flow and current evidence - Use in patients with mechanical devices - Application in patients with aortic stenosis - Application in patients with atrial fibrillation - Monitoring of therapeutic effect 5. Future directions

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## Abstract Archives of the RSNA, 2023

CAEE-86

### Genotype and Imaging Phenotype in Dilated and Arrhythmogenic Cardiomyopathy

#### Participants

Seitaro Oda, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. With the rapid increase in the number of heart failure patients worldwide, research on personalized medicine for cardiomyopathy based on genomic information is being promoted. 2. In recent years, the relationship between genotype and phenotype in dilated cardiomyopathy (DCM) and arrhythmogenic cardiomyopathy (ACM) has been clarified. 3. Important pathogenic variants include titin (TTN), filamin C (FLNC), lamin A/C (LMNA), and desmoplakin (DSP), with characteristic genotypic-imaging phenotypes. 4. This presentation summarizes new findings on genotype-imaging phenotypes in DCM/ACM.

#### TABLE OF CONTENTS/OUTLINE

1. Evolving disease concept of DCM/ACM: - New diagnostic criteria for ACM (Padua criteria) - Arrhythmogenic right ventricular cardiomyopathy (ARVC) and arrhythmogenic left ventricular cardiomyopathy (ALVC) - Overlap of ACM and DCM 2. Genetic basis of DCM/ACM: - Genes encoding constituent proteins of cardiomyocytes - Genetic variants causing DCM/ACM 3. Genotype-imaging phenotypes in DCM/ACM: - Titin (TTN) - Filamin C (FLNC) - Lamin A/C (LMNA) - Desmoplakin (DSP) - Others 4. Important MRI, CT imaging findings: - Fibro-fatty replacement of myocardium - Ring-like delayed enhancement 5. Future directions

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## Abstract Archives of the RSNA, 2023

CAEE-87

### Diagnosis of Coronary Microvascular Disease, Principle, Challenges, and Emerging Technologies of CT and MRI

#### Participants

Takanori Kokawa, MD, Tsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the definition, classification, and standard diagnostic steps of coronary microvascular disease (CMD).2. To discuss the role of PET, MRI and CT in the diagnosis of CMD.3. To illustrate emerging CT and MRI technologies for characterizing CMD.

#### TABLE OF CONTENTS/OUTLINE

A) Definition and epidemiology of CMD.B) Pathophysiology of CMD.C) Diagnostic criteria and standard approach for CMD.D) Role of non-invasive imaging modalities including PET, MRI and CT.E) Emerging technologies for assessment of CMD. a. Myocardial blood flow quantification by MR perfusion imaging and CT perfusion imaging.(Clinical example - normal CCTA, subendocardial perfusion defect, reduced CFR by MRI) b. Coronary sinus flow assessment by phase-contrast cine MRI c. Fractal analysis of dynamic myocardial CT perfusion. d. Potential of photon-counting CT for characterizing myocardium.

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## Abstract Archives of the RSNA, 2023

CAEE-88

### Demystifying the Mysteries of Heart Tumors and Tumor-like Conditions: A Succinct Approach for Radiologists

#### Participants

Aniket Agarwal, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Highlight the basic protocol of cardiac magnetic resonance imaging and simplifying the anatomy to help alleviate the cardiac-MR phobia. Devise an algorithmic approach to narrow down the differential for cardiac masses by using the clinical history, age, signal intensity, location and enhancement characteristics of the mass. Each sequence tells its own story. Double inversion recovery sequence, Triple inversion recovery has their own advantage. Early and late gadolinium enhancement characteristics of the mass is one of the most important features in differentiating a thrombus from a myxoma and a fibroma from a sarcoma. Rhabdomyomas are usually multi-focal non-enhancing or hypoenhancing lesions. Cine sequences provide assessment of mass mobility, its attachment points and hemodynamic impact on cardiac valves. Characterization for differentiation between benign and malignant features.

#### TABLE OF CONTENTS/OUTLINE

Cardiac MR protocol and basic cardiac MRI sequences. Important anatomical landmarks. Sequence wise diagnostic approach - What to look on which sequence? Algorithms- cardiac tumor classification based on benign/malignant, age, location, imaging characteristics. Differentiating cardiac masses on MRI. Mimics of cardiac tumors including anatomical tissues. Advantages and pitfalls of cardiac MRI.

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## Abstract Archives of the RSNA, 2023

CAEE-9

### **Novel Approach for Comprehensive Preoperative Assessment of Valvular Heart Disease via Four Dimensional CT Datasets in the Era of Minimum Invasive Cardiac Surgery**

#### **TEACHING POINTS**

Recent years, surgical techniques of cardiac valvuloplasty, such as minimally invasive cardiac surgery (MICS) and robotic surgery, have developed dramatically. In exchange for less invasiveness, surgical procedures turned out highly technically demanding due to narrow operative field and deep working space. Comprehensive assessment of cardiac anatomy and preoperative simulation using various modalities would be more important than ever. We summarize the usefulness of cardiac CT, especially in preoperative physiological morphology assessment.

#### **TABLE OF CONTENTS/OUTLINE**

In valvuloplasty, to assess physiological morphology of valve complex under beating is one of the most important factors. Utilizing CT datasets, valve complex structures consisting of leaflets, chordae tendineae, papillary muscles, and prolapsing leaflet were faithfully reproduced, and allowed surgeon to observe and measure using 3D or 4D datasets. Furthermore, preoperative simulations via life size 3D models and virtual reality simulation systems constructed from high spatial resolution datasets have reached to the stage of practical use. The learning curve would be shortened by development of these simulation technologies, though construction treatment strategy and judging surgical procedures had been largely dependent on surgeon's experience in the past. We propose a novel approach for assessment the whole aspect of valvular heart disease using appropriate imaging modalities comprehensively.

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## Abstract Archives of the RSNA, 2023

CHEE

### Chest Imaging Education Exhibits

#### Sub-Events

#### CHEE-1 **The Phoenix Pulmonary Opacity**

##### TEACHING POINTS

The waxing and waning pulmonary opacity is a common finding often hiding in plain sight, akin to the mythical phoenix, which disappears only to reveal itself again later amongst the ashes. Crucial to narrowing the differential diagnosis is a broad-based knowledge of the natural course of these diseases, their laboratory and pathologic analyses, and utilization of the multi-disciplinary team. Overlapping characteristics demonstrates the importance of looking at secondary, non-parenchymal imaging characteristics, including radiographic findings outside of the thorax. Many of these are chronic and debilitating, if not fatal, which have often become treatable with the advent of chemotherapeutics and biologics. Therefore, having a systematic approach and a relationship with our clinical colleagues is critical in treating these successfully and timely to avoid associated morbidity and mortality.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Categorizing the waxing and waning pulmonary opacity 3. Demonstrate common primary imaging findings in the thorax (e.g., nodule/opacity characteristics) 4. Demonstrate common secondary imaging findings in the thorax (e.g., esophageal, lymphatic, cardiac) 5. Laboratory and pathologic correlatives 6. Role of the multi-disciplinary team in narrowing the differential diagnosis (Rheumatology, Pulmonology)

#### CHEE-10 **The 2021 WHO Classification of Lung Tumors: Takeaways for Radiologists Regarding Epithelial and Neuroendocrine Tumors**

##### Participants

Maria Clara Lorca, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

This educational exhibit will review the tumors of the lung. 1. New 2021 WHO Classification of tumors of the lung. 2. Depict radiological features of tumors of the lung. 3. Describe the importance of PET-CT in the diagnosis and follow up. 4. Describe the pearls and pitfalls that some entities demonstrate in imaging, including benign entities that can appear as a lung tumor. 5. Evaluate the sufficiency of small biopsy samples for diagnosis. 6. Discuss the spectrum of post-treatment changes of the lung.

##### TABLE OF CONTENTS/OUTLINE

This education exhibit reviews biopsy-proven cases of tumors of the lungs and their correlation with pathology. Review with illustrative case examples the different tumors of the lungs in a systematic fashion. Incorporate the new 2021 WHO classification of the tumors of the lung. Depict the imaging appearances of various types of the above tumors, with emphasis in epithelial, neuroendocrine, and hematomatous tumors. Mesenchymal tumors will not be emphasized, as they were recently described on Radiographics this year. Differentiate between the types of tumors for which small biopsy versus resection sampling are indicated for diagnosis. Depict post-treatment changes of the lung, with examples including lung toxicity, pseudo-progression, and to distinguish these changes from true tumor recurrence and their impact on future therapy.

#### CHEE-100 **Pulmonary Tuberculosis in Children and Adults: A Classic Disease with Updated Concepts. What the Clinician Needs to Know**

##### Participants

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To compare the typical appearance of pulmonary tuberculosis (TB) between adults and pediatric patients. Both the manifestations and the management differ in children and adults. 2. To review the latest evidence on pulmonary TB. Radiologists need to know what information is relevant to the clinician as well as the implications of certain imaging findings.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction: Epidemiology and transmission mechanism in children vs adults. 2. Pathophysiology: Traditional vs new concept. The latest evidence has shown that the radiological appearance of the disease mainly depends on the host immune response and not on the time from infection. 3. Classification of Pulmonary TB according to Clinical and Radiological factors. 3.1. Active Disease: Primary Tuberculosis: 1. Lymphadenopathy in adults/children. 2. Parenchymal disease in adults/children. 3. Pleural effusion in adults/children. 4. Miliary TB in adults/children. 3.2. Active Disease: Postprimary Tuberculosis: 1. Postprimary TB in children. 2. Consolidation and cavitation. 3. Centrilobular nodules. 4. Summary of the main differences between children and adults. 5. Inactive Tuberculosis: Radiological findings and their risk of reactivation. The role of the radiology report. 6. Complications: Empyema necessitatis, Rasmussen aneurysm.

#### CHEE-101 **Uncommon Story of Common Entity: Tips and Tricks in Imaging of Non-Cardiogenic Pulmonary Edema**

## Participants

Janardhana Ponnathapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary edema is a most common clinical entity in both inpatient and out-patient setting. Identifying the underlying etiology of the edema is crucial to the timely implementation of appropriate therapy. Although cardiac dysfunction and volume overload are the most common etiologies routinely encountered, there are other different etiologies and presentations of pulmonary edema. Understanding the clinical context and underlying pathophysiology of these varied uncommon causes will help radiologists in narrowing differential diagnosis, therefore help clinicians to provide definitive treatment and better patient care. Furthermore, thorough knowledge about non-cardiogenic pulmonary edema reduces the rate of invasive procedures like Swan-Ganz catheterization and related complications.

### TABLE OF CONTENTS/OUTLINE

- Etiologies of non-cardiogenic pulmonary edema
- Mechanisms of non-cardiogenic edema
- Radiopathology correlation of pulmonary edema
- Pertinent role of chest x ray in initial diagnosis of cardiogenic vs non-cardiogenic pulmonary edema
- How subtle signs on chest x-ray helps to recognize uncommon etiologies of pulmonary edema
- How to differentiate different types of noncardiogenic edema on chest x ray.
- "Leave alone" type of pulmonary edema
- When should you use CT imaging
- Edema with and without diffuse alveolar damage- Does it matter on imaging?
- Short term and long -term complications of noncardiogenic pulmonary edema
- Algorithm and next step in the management of noncardiogenic pulmonary edema

### CHEE-102 An Update on the Role of Chest Imaging in Cystic Fibrosis

## Participants

Scott Bugenhagen, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To demonstrate the characteristic imaging findings of cystic fibrosis in the chest including a variety of commonly encountered complications through a series of clinical examples. 2. To review the latest guidelines and trends in the imaging of cystic fibrosis, with a focus on how clinical practice has changed with emerging therapies. 3. To describe the evolving role of chest radiography and cross-sectional imaging in this new clinical landscape, including a review of the most common scoring systems used in clinical practice.

### TABLE OF CONTENTS/OUTLINE

I. Review of current clinical landscape A. Summary of CF genotypes and patient specific therapy B. Advances in medical therapies C. Changes in clinical practice II. Role of chest radiography A. Characteristic findings B. Direct and follow treatment C. Radiographic scoring systems II. Role of computed tomography A. Indications a. HRCT b. Contrast enhanced CT and CTA B. Characteristic findings C. Direct and follow treatment D. CT scoring systems III. Imaging of complications A. Superinfection a. Colonization with *Pseudomonas aeruginosa* and *Staphylococcus aureus* b. Nontuberculous mycobacterial infection c. *Burkholderia cepacia* infection B. Aspergillus related lung disease a. Allergic bronchopulmonary aspergillosis b. Aspergilloma c. Semi-invasive aspergillosis C. Lobar collapse and idiopathic collapsed lung D. Pneumothorax E. Pulmonary hypertension and cor pulmonale F. Hemoptysis IV. Transplant evaluation

### CHEE-103 Upright Chest CT Imaging

## Participants

Yoshitake Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of our exhibit are as follows: (1) To explain the development, background, and performance of upright CT. (2) To describe the anatomical changes in each structure of the chest due to differences in body position, that is, the direction of gravity. (3) To illustrate the clinical applications of upright CT for various chest diseases with clinical case presentations, and the potential applications in particle therapy.

### TABLE OF CONTENTS/OUTLINE

(1) Development of an upright CT and its background (2) Performance of upright CT: Physical characteristics, workflow improvement, safety, and remote operation during the infectious disease pandemic (3) Effect of gravity on the lungs, lobes, airways, heart, shoulder girdle, and chest vessels (4) Clinical applications of upright CT for various diseases such as chronic obstructive pulmonary disease, interstitial lung disease, scoliosis, diaphragmatic paralysis, and funnel chest (5) Upright 4D-CT of the chest (6) Potential applications of the upright CT in particle therapy (7) Limitation (8) Conclusion

### CHEE-104 Analysis of Fine Anatomical Structures Involved in Pulmonary Nodules by Ultra-High-Resolution CT

## Participants

Hiroshi Moriya, MD, PhD, Fukushima, Japan (*Presenter*) Advisor, California Capital Equity, LLC; Research Grant, Canon Medical Systems Corporation

### TEACHING POINTS

1. Spatial resolution of ultra-high-resolution CT (UHRCT) 2. Depiction of intralobular structure by UHRCT 3. MPR display of bronchus long-axis cross-section and short-axis cross-section (parallel pleural cross-section) 4. Typical cases: Analysis of fine anatomical structures involved in pulmonary nodules by UHRCT

### TABLE OF CONTENTS/OUTLINE

Ultra-high-resolution CT (UHRCT) is a CT that achieves high spatial resolution by reducing the detector size to 1/4. In the previous studies, the bronchial visualization ability of UHRCT was superior compared with conventional HRCT. In the depiction of lung field structure, bronchi with an inner diameter of 0.4 mm are delineated. Contrast enhancement and deep learning reconstruction method (DLR) enhances the contrast effect of peripheral blood vessels and improves visualization. By improving the resolution, it has become possible to display the intralobular structure. How to identify lobular structure: a. Bronchioles are centrally located in the

lobules. b. Identify the blood vessels that accompany the bronchi as pulmonary artery. c. Pulmonary veins are thicker than pulmonary arteries. d. Imaging of pulmonary arteries or veins in contrast-enhanced phase. e. Confirm continuity of the target vessel to the root of the pulmonary artery and vein. Lesions that spread with regularity to the lobular structure, lesions that extend independently of the lobular unit, lesions that extend beyond the lobule, and lesions confined within the lobule are presented.

### **CHEE-105 Thoracic IgG4-Related Disease: Revealing the Diverse and Heterogeneous Imaging Manifestations**

Participants

Kyubin Kim, MD, Yansan-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. IgG4-related disease (IgG4-RD) is an immune-mediated fibroinflammatory condition characterized by dense lymphoplasmacytic infiltrations with predominant IgG4-positive plasma cells, usually accompanied by storiform fibrosis, obliterative phlebitis, and elevated serum IgG4 levels. 2. Thoracic manifestations of IgG4-RD are diverse and can mimic malignant lymphoma, infection, or other systemic autoimmune disease. The most common manifestations are mediastinal lymphadenopathy and peri-bronchovascular interstitial thickening. Other findings include pulmonary nodule or mass, interstitial lung abnormalities, pleural effusion or thickening, mediastinal or chest wall mass, and thoracic arteritis. 3. IgG4-RD can present with atypical radiologic findings such as migrating or cavitary nodules, lobar or segmental consolidation, and paravertebral mass making the diagnosis challenging. 4. Early diagnosis with clinical-radiologic-pathologic correlation is important to prevent irreversible damage due to fibrosis.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definition, pathogenesis, and histopathology of IgG4-RD 2. Clinical manifestations and diagnostic criteria for thoracic IgG4-RD 3. Imaging findings of thoracic IgG4-RD: diverse and heterogeneous findings in the lungs, airway, mediastinum, pleura, chest wall, and thoracic vessels 4. Treatment and prognosis of thoracic IgG4-RD 5. Conclusion: The importance of recognizing the diverse imaging findings of thoracic IgG4-RD and reflecting them in diagnosis and treatment

### **CHEE-106 Beyond the Black Holes: A Multidisciplinary Approach to Cystic Lung Disease**

Participants

Lawrence Guan, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Diffuse cystic lung diseases (DCLD) are characterized by thin-walled, air-filled spaces with normal intervening lung parenchyma. Certain entities can mimic or be mistaken for lung cysts such as emphysema, cavitary lesions, honeycombing, and cystic bronchiectasis. These are a diverse group of disorders with a variety of underlying causes including hereditary, neoplastic, infectious, inflammatory, lymphoproliferative, and smoking-related. High-resolution chest CT plays a central role in the evaluation of patients with DCLD's and it is not uncommon for these disorders to be discovered during imaging for other reasons. Therefore it is important for the radiologist to be aware of these conditions and their associations, as they may be the first to suggest the diagnosis. An approach to the characterization of cystic lung disease will be reviewed including imaging and clinical clues which can aid in suggesting one diagnosis over another.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Examples of cases: a. Mimics of lung cysts b. Smoking-related: Pulmonary Langerhans Cell Histiocytosis, Desquamative Interstitial Pneumonia c. Inflammatory: Amyloidosis, Hypersensitivity Pneumonitis d. Hereditary: Tuberos Sclerosis/Lymphangioleiomyomatosis, Birt-Hogg-Dube, Neurofibromatosis, Ehlers Danlos Syndrome, Sickle Cell Disease e. Lymphoproliferative: Lymphocytic Interstitial Pneumonia, Follicular bronchiolitis f. Neoplastic: Cystic metastases, Treated metastases g. Disorders with cystic component: Bronchopulmonary sequestration, Congenital pulmonary airway malformation, Bronchogenic cyst h. Miscellaneous: Infectious/Postinfectious, Posttraumatic 3. Conclusion.

### **CHEE-107 Mimics of Pulmonary Embolism (PE)**

Participants

Shaimaa Fadl, MD, Glen Allen, VA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Learn technical, anatomical, and patient-related pitfalls in the diagnosis of pulmonary embolism. Illustrate common and uncommon pulmonary artery pathologies that can mimic pulmonary embolism. Discuss an imaging approach for the diagnosis and management of patients with different pulmonary artery pathologies.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Technical pitfalls. Anatomical pitfalls. Patient related pitfalls. Pulmonary artery malignancy (angiosarcoma, lymphoma). Pulmonary artery tumor embolism. Pulmonary artery in-situ thrombus (post-surgical, post radiotherapy). Pulmonary artery vasculitis. Atypical Infection. Granulomatous/Fibrosing mediastinitis. Role of different imaging modalities in evaluation of PE mimics. Diagnostic approach to PE mimics.

### **CHEE-108 Joining the Dots in Multiple Lung Nodules**

#### **TEACHING POINTS**

1. Varying etiologies cause multiple pulmonary nodules and can be mistaken for infection or metastatic disease. 2. Ancillary CT features such as air trapping with multiple pulmonary nodules are seen in DIPNECH, or chest wall vessel calcification with centrilobular nodules in renal failure suggests metastatic calcification. 3. Small calcified pulmonary nodules seen with reticulation in the lower lobes, usually in fibrotic ILD, represents dendriform ossification.

#### **TABLE OF CONTENTS/OUTLINE**

CT detected multiple lung nodules are most commonly due to infection, sarcoidosis, or metastasis. However, alternative etiologies causing lung nodules can be diagnosed on CT based on CT morphology or associated findings. These alternative causes of multiple lung nodules are often seen in patients with malignancies, and we must accurately diagnose these to prevent misinterpretation. Therefore, these lesser-known entities and their diagnostic CT findings are discussed. The etiologies are subclassified based on the

CT appearance of nodules such as non-solid, solid, cavitory, calcified, and nodules with central air bronchograms. A case-based approach will discuss meningoendotheliomatosis, DIPNECH, amyloidosis, LIP, LCH, Dendritic Ossification, metastatic calcification, Progressive massive fibrosis in silicosis, MMPH in Tuberous Sclerosis, MALT lymphoma amongst other similar disease processes. Ancillary CT features for, e.g., the air-trapping in DIPNECH, Cheerio sign in meningoendotheliomatosis, calcification in amyloidosis, vessel wall calcification in renal failure with metastatic calcification, etc., are highlighted. In addition, the next steps in the workup for diagnosis are also highlighted.

### **CHEE-109 0.55T MRI Thoracic Imaging**

Participants

Jonathan Liu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Low field (< 1T) MRI is an emerging technology that possesses certain advantages over other imaging modalities and higher field MRI that make imaging of the lungs more attractive. The purpose of this exhibit is to highlight the considerations involved in implementing clinical use of low field MRI for thoracic imaging, with the hope of introducing the audience to this new imaging paradigm. A wide variety of cases (with a cohort of 22 patients at the time of abstract submission) are shown highlighting the benefits of low field MRI imaging with the Siemens FreeMax system (0.55T, MAGNETOM FreeMax; Siemens Healthcare, Erlangen, Germany) including ultra-short TE, diffusion weighted, and non-contrast MRI ventilation/perfusion imaging. We will also review the limitations and pitfalls of lung imaging at 0.55T MRI.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Rationale for low field MRI  
a. Advantages of low field MRI over other modalities  
i. MRI versus CT  
ii. Low field versus traditional 1.5T or 3T imaging  
b. Disadvantages of low field MRI over other modalities  
i. MRI vs CT  
ii. Low field MRI compared to 1.5/3T  
3. Imaging Protocol  
4. Clinical Indications  
a. Immediate  
b. Early  
c. Long-term  
5. Five to ten cases of 0.55 MRI images with CT correlation  
a. Normal anatomy  
b. Malignancy  
c. Inflammation  
d. Post-radiation  
e. Small airways/small vessel disease  
f. Large airways  
6. Key challenges, limitations, and pitfalls of lung imaging at 0.55T  
7. Future clinical and research directions  
8. Conclusion

### **CHEE-11 Light Up the Lungs: How Contrast Enhancement Can Help Diagnose Pulmonary Lesions**

#### **TEACHING POINTS**

Non-contrast CT of the chest is often requested by clinicians in settings where the addition of iodinated contrast is warranted. Radiologists must be familiar with how contrast positively impacts evaluation of pulmonary pathology. This exhibit will showcase the value of iodinated contrast improving assessment of pulmonary parenchymal entities. Iodinated contrast improves differentiation of pneumonia from atelectasis, with the former lacking enhancement, while atelectasis enhances homogeneously. Addition of contrast material allows detection of complications of pulmonary infections such as necrosis, pulmonary artery pseudoaneurysm and chest wall involvement. In the setting of congenital pulmonary lesions, CT evaluation should include iodinated contrast to evaluate arterial supply and venous drainage. Nodule characterization is improved with iodinated contrast. Lesion localization improves with iodinated contrast: including discerning lesions from vascular structures, delineation of hilar lesions, and appraisal of vascular and chest wall invasion in the setting of aggressive processes.

#### **TABLE OF CONTENTS/OUTLINE**

Contrast Enhanced CT protocols and indications  
Pulmonary arterial phase  
Systemic arterial phase  
Venous phase  
Infection  
Pneumonia vs Atelectasis  
Complications of pneumonia: necrosis, abscess, pseudoaneurysm, wall involvement  
Lesion localization and assessment of complications  
Hilar lesions  
Discernment from broncho-vascular bundle  
Vascular, mediastinal, and chest wall invasion  
Nodule characterization  
Hypervascular metastasis  
Carcinoid tumor  
AVM  
Congenital lesion evaluation  
Vascular supply (eg. Sequestration)  
Venous anomalies (eg. Hypoplastic lung evaluation)

### **CHEE-110 Don't Be Blue... Here's a Clue! Tips to Assess Adult Cardiac Pathology on a Chest Radiograph Like a Pro**

Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

In the era where modalities such as 2-D echo, CT and MRI are being highly utilized for evaluation of cardiac pathology, a plain chest radiograph still plays a key role in contributing important information. However, the younger generation of radiologists do not seem to be optimally exposed or are unaware of the true value of a chest radiograph. Chest radiograph is convenient as it is an easily accessible, low-cost, and non-invasive diagnostic tool with minimal radiation dose. We aim to provide unique imaging clues to identify the classic signs, measurements, and differential diagnoses of various adult cardiac pathologies on a chest radiograph with confirmatory CT images. Since a chest radiograph is the first imaging modality for majority of patients with chest pain - it is very imperative for the radiologists to quickly recognize these subtle findings to provide an accurate diagnosis and proper patient management.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction to normal cardiac anatomy  
CASE BASED LEARNING:  
• How to differentiate between:- Aortic Dissection vs Aortic Aneurysm- Pneumopericardium vs Pneumomediastinum- Pericardial Effusion vs Cardiomyopathy- Intramural esophageal lesion vs LA enlargement- Enlarged azygous arch vs Paratracheal lymph node- Stages of cardiogenic pulmonary edema  
• Identify:- Pulmonary embolism- Cardiac Valves- Focal pulmonary edema- Heterotaxy syndromes- Cardiac Size: Microcardia- Pectus Excavatum- Devices  
• Compare and contrast:- Cardiomyopathies: Dilated vs Hypertrophic- Individual chamber enlargements  
• Limitations

### **CHEE-111 Aerogenous Metastasis and Spread Through The Air Spaces (STAS) - Distinct Entities or Spectrum Of The Same Process?**

#### **TEACHING POINTS**

1. To present the proposed mechanisms and pathological findings described in aerogenous metastasis (AeM) and spread through the airways (STAS) as well as areas of uncertainty and their prognostic significance. 2. Discuss the concept of continuous and discontinuous cancer spread from the primary tumor.  
2. To review the pathological and imaging characteristics of primary lung

cancers with higher probability of spreading through the airspaces. 3. To describe CT features suggestive of aerogenous metastasis and their main differential diagnoses, including distinction from multiple synchronous primary adenocarcinomas.

#### TABLE OF CONTENTS/OUTLINE

1. Definition and pathophysiology of STAS and aerogenous metastasis (AeM).2. Risk factors and predisposing histological patterns.3. Imaging predictors, diagnosis, and prognostic significance of STAS and AeM.4. Differentiating aerogenous metastases from synchronous adenocarcinomas on CT.5. Clinical relevance and impact on patient management.6. Are STAS and aerogenous metastasis distinct entities or a spectrum of the same process?7. Future directions; areas of uncertainty and further research.

#### **CHEE-112 Navigating the Difficult ICU Chest Radiograph: Distinguishing Non-standard Cardiovascular Device Placements from Device Malposition**

Participants

Danielle Struck, BA, Las Vegas, NV (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiovascular support devices are essential in the management of critically ill patients. While identifying malpositioned devices can often be straightforward, recognizing correctly positioned uncommon devices/non-standard placements and identifying malpositioned/incorrectly deployed devices can be difficult. Here, we present a case-based approach to distinguishing non-standard device placements from malposition and potential downstream complications, providing CT correlation where appropriate and specify lessons learned and practical tips in each case.

#### TABLE OF CONTENTS/OUTLINE

1. Title slide 2. Disclosures3. Abbreviations 4. Approach5. Scenarios6. Pulmonary critical care, MICUa. CVCs i. L SVC placement ii. Arterial placementb. PA catheter i. Inguinal approach ii. Peripheral placement, PA pseudoaneurysmc. ECMO i. Peripheral, situs inversus, central ii. Malposition7. Electrophysiology, CVICUa. Pacer/ICD i. Epicardial/subcutaneous leads, patient with atrial switch ii. Lead migration/fracture, ventricular perforationb. Transcatheter LAA closure i. Watchmann vs Amplatzer ii. Embolization8. Heart failure, CVICUa. Impella i. Impella RP (RV) ii. Access site hematoma, dissectionb. LVAD i. Different models ii. Infection, trauma, suck eventc. Intra-aortic balloon pump i. Upper extremity approach, adjustment ii. Malposition, visceral ischemia9. Structural cardiology, CVICUa. ASD closure device i. PDA closure device ii. Malposition, incomplete sealb. Prosthetic valves i. Transapical mitral valve prosthesis ii. Embolization10. CT surgery, SICUa. Pericardial drain i. Wraparound drain ii. Mediastinal placement11. Summary - Lessons12. Summary - Practical tips13. References

#### **CHEE-113 The Radiologist's Expedition into the Intricacies of Percutaneous Lung Biopsies and Ablations**

Participants

Megha Gupta, Glendale, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lung cancer (CA) is the second most common cancer in the US and is the leading cause of cancer related mortality.Surgery is the mainstay of therapy for patients with stage I lung cancer, although many patients with lung cancer are poor surgical candidates.Stereotactic radiation body therapy (SBRT) is offered to inoperable patients with lung CA, however, carries significant side effects and risk of lung function deterioration.Image guided tumor ablation (IGTA) is an alternative treatment option with proven outcomes in Stage I lung CA without the risk of lung function deterioration. Also, IGTA is not limited by segmental anatomy.

#### TABLE OF CONTENTS/OUTLINE

Overview of lung cancer staging, identification of suitable patients for image guided lung ablation and discuss treatment outcomes.Understand the various modalities of lung ablation (Radio frequency, Microwave and Cryoablation).Approach to difficult biopsies and difficult needle placement including the use of hydro-dissection and artificial pneumothorax creation.Learn normal and abnormal imaging appearances post lung ablation and current follow up recommendations.

#### **CHEE-114 Getting Warmer... - Chest Radiological Findings in Patients with Fever of Unknown Origin**

Participants

Alla Khashper, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fever of unknown origin (FUO) is defined as "fever = 101°F (38.3°C) for at least 3 weeks that remains undiagnosed after 3 inpatient days or at least 3 outpatient visits". FUO is a well-known clinical problem, has multiple thoracic etiologies, and commonly requires extensive workup. Imaging might identify the cause of FUO. However, no radiological recommendations have been established.

#### TABLE OF CONTENTS/OUTLINE

Historically, FUO has been divided into classic, nosocomial, immunodeficiency-related, and travel-associated categories. For imaging purposes the following classification appears more practical: infections, malignancies, inflammation and miscellaneous. The selected illustrative cases are listed in the attached presentation. The evaluation of FUO is always complex, including extended history taking, physical examination, and lab tests, followed by imaging. Chest radiography and CT are routinely performed and can usually provide putative or final diagnosis or suggest further imaging work-up, including but not limited to CT angiography, PET , MRI, and imaging-guided biopsy. This educational exhibit is a pictorial review of thoracic pathologies associated with FUO, targeting radiology trainees, general and subspecialized thoracic radiologists. It will highlight teaching points and provide clues to establish concise differential diagnosis of FUO causes.

#### **CHEE-115 Development of Color Dynamic Flow Image Using 4D-CTA for Post TEVAR Operative Case**

#### TEACHING POINTS

It is common to use 3D-CTA for postoperative evaluation of TEVAR. 3D-CTA can assess postoperative complications such as endoleak and the presence or absence of stent graft induced new entry (SINE). However, since 3D-CTA is a single time phase, it is difficult to evaluate the direction of blood flow to the aneurysm and the timing of outflow. This is where 4D-CTA comes in. 4D-CTA injects a contrast medium while continuously imaging a specific area. When 4D-CTA is displayed in Volume Rendering (VR), the



blood flow is easy to understand visually. Therefore, it is possible to observe end leakage and SINE around the stent graft. This time, we evaluated the blood flow when it was converted to VR using a color map. The color map was changed according to the CT value. In addition, the color map has been optimized to make 4D-CTA easier to observe. By displaying the blood flow as our original color map, it is possible to visually evaluate the direction of blood flow at the leak point and the timing of flow from the aorta into the aneurysm. This time, we take 4D-CTA scan and analyzed it with our original color map in the SINE case. By applying our method, it can be easy and visually to evaluate the entry point, blood flow direction, and outflow timing post TEVAR operation.

#### TABLE OF CONTENTS/OUTLINE

1. Problem analysis of conventional display method 2. Ingenuity in scanning / Exposure reduction technology 3. Ingenuity in image reconstruction 4. Evaluation by 4D-CTA 5. Creation of original color map 6. Evaluation of usefulness by clinical cases

#### CHEE-116 Cinematic Rendering of the Thoracic Aorta: A New Look at an Old Problem

##### Participants

Elliot Fishman, MD, Owings Mills, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

##### TEACHING POINTS

1. 3D imaging with Cinematic rendering can play a major role in the detection of the thoracic aorta 2. Cinematic Rendering can be optimized with development of presets to improve workflow 3. Cinematic Rendering can be used in a range of applications including suspected dissection, coarctation of the aorta, vasculitis, post aorta repair and trauma 4. Cinematic Rendering will provide critical information to the referring physician for patient management 5. the radiologist needs to work closely with the referring physician and Cinematic Rendering help play a role in this interaction

#### TABLE OF CONTENTS/OUTLINE

a. Cinematic Rendering protocols b. CT acquisition protocols c. clinical applications with case studies-suspected dissection-post aortic aneurysm repair-coarctation of the aorta-trauma-vasculitis d. pearls and pitfall e. the literature f. future directions including AI g. bibliography

#### CHEE-117 Current and Novel Techniques for Artifact Reduction on Chest CT

##### Participants

Yoichiro Ota, RT, Yokohama, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Various artifacts can be observed on chest CT. Motion artifacts are an important issue, especially in emergency cases in which patients are unable to hold their breath. Motion correction-deep learning reconstruction (MC-DLR) is a motion correction method developed using a deep learning framework to estimate patient motion in the lung region. This method comprises three major steps. First, a full-image reconstruction is decomposed into several partial-angle reconstructions. Second, a pre-trained deep convolutional neural network (DCNN) is applied to estimate the motion vector field between these partial angle reconstruction images. Finally, a motion-corrected image is reconstructed by incorporating the DCNN-predicted motion vector field (Fig. 1). An image with MC-DLR can reduce the motion artifacts in moving phantom experiments (Fig. 2) and clinical cases (Fig. 3). Radiologists should understand CT artifacts to distinguish between true lesions (Figs. 4,5). In this exhibit, we introduce the principles of CT artifacts and techniques to reduce them by presenting clinical cases.

#### TABLE OF CONTENTS/OUTLINE

Motion artifact, Streak artifact, Metal artifact, Dark band artifact, Partial volume effect

#### CHEE-118 Thoracic Manifestations of Autoimmune Diseases: From Suspicion to Diagnosis

##### Participants

Renato Fujiki, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Interstitial lung disease (ILD) is the most common thoracic manifestation of autoimmune disease (AD). Each ILD pattern is more commonly associated with a specific AD, although there is an overlap between patterns. While connective tissue diseases (CTD) are commonly associated with thoracic manifestations, it is important to recognize that other AD can also affect the lungs. Besides ILD, AD can also present with airway, vascular, pleural, and mediastinal involvement. The purpose of this exhibit is - Review CT patterns of ILD more commonly associated to each specific AD and what is important to describe - Highlight the role of radiology in diagnosing and grading thoracic manifestations of AD - Discuss the new classification system known as "interstitial pneumonia with autoimmune features" (IPAF) and its relevance in patient management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Epidemiology, physiopathology and clinical aspects of the main autoimmune diseases (AD) b. Currently available treatment options 2. Role of different imaging methods in diagnosis and assessment of disease grading - advantages, limitations, usefulness a. X-ray b. Ultrasound c. CT - with protocol recommendation d. MRI 3. ILD patterns associated with AD - Case-by-case discussion review a. Non-specific interstitial pneumonia b. Organizing pneumonia c. Usual interstitial pneumonia d. Hypersensitivity pneumonitis-like pattern e. Others 4. Other thoracic manifestations of both CTD and non-CTD AD - including vascular, pleural, mediastinal and airway involvement 5. The new statement of interstitial pneumonia with autoimmune features (IPAF) - repercussions in clinical practice and recommendations 6. Conclusions "take-home messages"

#### CHEE-119 Bronchiectasis: Differential Diagnosis for Their Cause According to Their Spatial Distribution and Complications

##### Participants

Fernando Vasquez Puelles, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Distribution of bronchiectasis, their association with different radiological findings, altogether with clinical context can aid in formulating a differential diagnosis for pathologies that cause bronchiectasis.- Bronchiectasis predisposes to complications which can be evaluated with imaging studies.

#### TABLE OF CONTENTS/OUTLINE

Bronchiectasis is irreversible bronchial dilatation, usually resulting from chronic infection, proximal airway obstruction, or congenital bronchial abnormality. Bronchiectasis can have a diffuse distribution with an upper/mid lung predominance (cystic fibrosis, sarcoidosis, tuberculosis), lower lung predominance (chronic aspiration, primary ciliary dyskinesia, Kartagener syndrome), or central predominance (Mounier-Kuhn syndrome, Williams-Campbell syndrome), or a focal distribution (endobronchial or peribronchial tumors, Swyer-James syndrome). It predisposes to chronic or recurrent infections, allergic bronchopulmonary aspergillosis, pneumothorax, hemoptysis, and pulmonary hypertension. Signs suggestive of infection include air-space disease, tree-in-bud pattern, ground-glass opacities, patchy opacification, and cavitation or abscess. Conclusion. Bronchiectasis is irreversible bronchial dilatation usually resulting from chronic infection, proximal airway obstruction, or congenital bronchial abnormality. There is a wide spectrum of causes of bronchiectasis, thus radiologists can use the morphologic features, particularly the spatial distribution, associated findings altogether with clinical information to provide a differential diagnosis for the cause of bronchiectasis and to help to find an adequate treatment.

#### CHEE-12 Cardiothoracic Imaging Findings in VEXAS Syndrome

Participants

Naim Qaqish, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-VEXAS Syndrome is an adult-onset autoinflammatory disorder found almost exclusively in adult men (x-linked gene mutation) first described in 2020. The disease is severe with a poor prognosis.-Systemic hematologic and inflammatory disease affecting multiple organs, most commonly the skin, lungs, cardiovascular, and cartilage.-Diagnosis is made on bone marrow aspirate.-Pulmonary imaging findings: consolidative, ground glass and reticular opacities, pulmonary vasculitis, pleural effusions, bronchial inflammation/stenosis.-VS-associated interstitial lung disease usually follows an organizing pneumonia or NSIP pattern.- Cardiovascular imaging findings: Venous and/or arterial thrombosis, pulmonary emboli, pericarditis, myocarditis, and cardiac amyloidosis.

#### TABLE OF CONTENTS/OUTLINE

• Introduction to VEXAS Syndrome (VS) • Useful Laboratory Tests • Clinical Presentation with Common Manifestations • Pulmonary Imaging Features o Parenchymal disease (consolidation, GGO, reticulation) o Pleural effusions o VS-associated interstitial pneumonias § NSIP and organizing pneumonia patterns o Pulmonary vasculitis o Bronchial disease and stenosis o Less common pulmonary manifestations • Cardiovascular Imaging Features o Cardiac and pericardial involvement § Typical CMR findings o VS-associated vasculitis o Recurrent thromboembolic disease § DVT, pulmonary emboli, and arterial thrombosis • Differential Diagnosis • Treatment • Prognosis • Summary of Cardiothoracic Imaging Findings • References

#### CHEE-120 Heavy Stuff: The Burden of High-Attenuation Lung Lesions

Participants

Iuri Shen De Lacerda, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Propose a pattern-based approach to most common high-attenuating lung lesions- Review specific imaging features of each CT pattern of disease- Recognize the main differential diagnosis by section and understand the pathophysiology behind each hyperattenuating lesion through a case-based pictorial discussion- Highlight the importance of radiology in narrowing diagnostic possibilities and guiding next steps in patient management

#### TABLE OF CONTENTS/OUTLINE

I - INTRODUCTION- Definition of high-attenuation lung lesions- Pattern-based approach to narrow differential diagnosisII - PATTERNS AND ASSOCIATED DIAGNOSIS A - Calcified pulmonary nodules1. Dystrophic calcifications-a. Post-infectious-b. Pulmonary hemosiderosis: Idiopathic or Secondary (chronic alveolar hemorrhage)-c. Occupational disease: Silicosis, Coal workers pneumoconiosis2. Metastatic calcification: Benign or Malignant3. Pulmonary Alveolar microlithiasisB - Non-calcified hyperattenuating nodules1. Talcosis2. Mercury embolism and vapor inhalation3. Pulmonary cement embolization after vertebroplasty4. Cyanoacrylate embolizationC - Large calcified nodules or masses1. Calcified metastasis: Medullary thyroid carcinoma, Osteosarcoma, Chondrosarcoma2. Amyloidosis3. Granuloma4. Progressive massive fibrosisD - Hyperattenuating linear or reticular opacities1. Pulmonary dendriform ossification: Idiopathic or Secondary (idiopathic pulmonary fibrosis, chronic alveolar hemorrhage)2. Diffuse pulmonary amyloidosis: alveolar septal formE - High-attenuation consolidation1. Amiodarone lung2. Pulmonary Lipidol embolismIII - CONCLUSIONSSummary of key points"Take-home" messages

#### CHEE-121 Paraneoplastic Syndromes Related to Thoracic Neoplasms: Clinical and Imaging Clues

#### TEACHING POINTS

Paraneoplastic Syndromes are systemic manifestations of neoplasia not related to metastatic disease. These rare disorders are characterized by abnormal production of proteins (i.e. antibodies), protein derivatives, or steroids generated by the immune system. The diagnosis of thoracic neoplasms associated with these syndromes often presents diagnostic challenges for radiologists and clinicians alike. Radiologists play an essential role in the identification of the specific neoplasm associated with these syndromes. Therefore, knowledge of the neoplasm associated with each paraneoplastic syndrome is valuable for quality patient care. The goals of this exhibit are to help the learner: 1. List the clinical features of specific paraneoplastic syndromes related to thoracic neoplasms 2. Identify characteristic imaging features of thoracic neoplasms associated with specific paraneoplastic syndromes

#### TABLE OF CONTENTS/OUTLINE

1. Introduction - Definition of paraneoplastic syndromes 2. Overview of paraneoplastic syndromes associated with specific types of thoracic neoplasms 3. Discussion of clinical and imaging features of thoracic neoplasms that may manifest with a paraneoplastic syndrome at presentation 4. Conclusion

## **CHEE-122 Usual Interstitial Pneumonia and Variants, a Pictorial Review**

Participants

Moises Jose Lima, MD, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To define and illustrate the classic appearance of a UIP pattern.- To describe the HRCT diagnostic categories of Usual Interstitial Pneumonia (UIP).- To comment and review the CT findings of the main differential diagnosis of UIP. - To know the 2018 Fleischner diagnostic guidelines on the diagnosis of Idiopathic pulmonary fibrosis (IPF). - To enumerate and discuss specific and general variant patterns of fibrosis.

### **TABLE OF CONTENTS/OUTLINE**

1) Background: Interstitial lung disease concept and classification. Categorization of idiopathic interstitial pneumonias. UIP pathophysiology.2) HRCT technique in UIP3) Key features of a classic UIP pattern: honeycombing, reticular pattern, traction bronchiectasis, other findings of classic UIP pattern: GGO, mediastinal lymph node enlargement, pulmonary ossification, pleuroparenchymal elastosis.4) Diagnostic categories of UIP: UIP and uncommon presentations (asymmetric distribution, uniform craniocaudal distribution and others), probable UIP, possible UIP, a review of the main alternative diagnoses: non-specific interstitial pneumonia, fibrosing hypersensitivity pneumonitis, sarcoidosis, others.5) IPF Diagnosis: clinical history, UIP histopathology, IPF diagnostic criteria.6) Variant patterns of fibrosis: anterior upper lobe, exuberant honeycombing and straight edge signs.7) Specific variant patterns of fibrosis: scleroderma: four corners sign. Systemic lupus erythematosus: "Island-like" fibrosis and heterogeneous lung destruction.8) Summary

## **CHEE-123 NTM: What the Pulmonologist Wants to Know**

### **TEACHING POINTS**

Classic and non-classic NTM have characteristic distribution and morphology of bronchopulmonary disease with variability in part associated with the presence of underlying lung disease, as well as other factors. Radiologists may be the first to suggest pulmonary NTM in patients that are asymptomatic or with nonspecific constitutional symptoms leading to earlier diagnosis and management. Baseline CT description should include description of disease extent, fibrocavitary or nodular bronchiectatic type, presence of atelectasis, cavities, and fibrosis. Pulmonary NTM infections are usually indolent/slowly progressive with CT findings waxing and waning over time. Follow-up imaging is performed to assess interval improvement or progression of the airways disease, cavities, nodules and consolidation. The focal mass like/nodular NTM type can pose diagnostic challenges, and must be distinguished from other infections and malignancy. Development of high-attenuation mucous (HAM) in bronchiectatic airways is pathognomonic for superimposed ABPA. New or growing nodule should raise concern for neoplasm. NTM should be also be considered as an allergen to incite nonfibrotic hypersensitivity pneumonitis.

### **TABLE OF CONTENTS/OUTLINE**

Epidemiology. Diagnostic criteria for pulmonary NTM. CT Manifestations of pulmonary NTM. What the Radiologist needs to know. What the Pulmonologist wants to know.

## **CHEE-124 Thoracic Complications of Stanford Type A Aortic Dissection: A Review of CT Findings and Management**

### **TEACHING POINTS**

This presentation will serve as a review of aortic root anatomy and aortic dissection. It also includes an update to the Stanford classification system published jointly by the Society for Vascular Surgery and the Society of Thoracic Surgeons which provides a more detailed description of the dissection and is suited to sites offering endovascular repair (though likely to become more universally adopted in the future). The bulk of the exhibit is concerned with the complications of Type A dissection which occur within the thorax. A framework for classifying and subclassifying complications is described as well as a more detailed description of the pathophysiology, grading, and management of these complications. This information has previously been offered separately in review articles, case series, and case reports but will now presented as a single resource. Detailed diagrams and representative CT images will support the information presented and will aid the viewer's understanding of the concepts. CT is often utilized for investigation of suspected acute aortic syndrome. This presentation will be useful for radiologists and radiology residents working in the acute care setting, to assist their search pattern and tailor their reports to provide more useful information to the cardiothoracic surgeon.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Risk factors and epidemiology 3. Classification of aortic dissection 4. CT imaging protocol recommendations 5. Complications and management of aortic dissection 6. Thoracic complications of Type A dissection 6.1 Rupture complications 6.2 Malperfusion complications 6.3 Aortic valve distortion/disruption with regurgitation 7. Conclusion

## **CHEE-125 From Acute to Chronic: A Comprehensive Guide to Aortic Injuries and the New Classification System**

Participants

Amr Wardeh, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

(1.) Learn to differentiate among the different types of acute aortic syndrome and understand their clinical significance.(2.) Explore the signs of instability and potential complications in acute aortic syndrome.(3.) Examine the appearance of subacute and chronic aortic dissection.(4.) Discuss the limitations of the Stanford classification system in addressing the complexities of acute aortic syndrome.(5.) Introduce the new Society of Vascular Surgeons and the Society of Thoracic Surgeons classification system (SVS/STS) and how it differs from the Stanford classification system.(6.) Illustrate the use of the new SVS/STS classification system with example cases.

### **TABLE OF CONTENTS/OUTLINE**

(I.) Introduction to Acute Aortic Syndrome (A.) Definition and clinical importance (B.) Overview of the four types (1.) Aortic dissection (2.) Intramural hematoma (3.) Penetrating atherosclerotic ulcer (4.) Limited intimal tear (II.) Classification Systems (A.)

Stanford Classification System and its Limitations (B.) SVS/STS Classification System (C.) Comparison of the Classification Systems (D.) Example Cases: Applying the SVS/STS Classification System.

## **CHEE-126 Reporting Response Assessment in Clinical Trials in the Era of Personalized Medicine**

### **TEACHING POINTS**

Response Evaluation Criteria in Solid Tumors (RECIST) was published in 2000 and revised to RECIST 1.1 in 2009. RECIST defines lesions as measurable and non-measurable, based on whether they are quantifiable; measurable lesions consist of target, which are followed, and non-target. RECIST 1.1 includes newer technologies like FDG-PET and MRI and clarifies lymph node criteria. Target lesions must be: Easily and reproducibly measurable; Representative of the disease; Representative of distribution Progressive disease (PD) after initial response can be depicted using RECIST 1.1. Personalized therapies targeting specific receptors are in clinical trials and allow patients with slow progression to be followed long term. RECIST criteria are used to assess response to immunotherapy. Response may vary between unidimensional and volumetric assessment methods. Genomic profiling in a lung cancer patient revealed an EGFR mutation. The tumor was successfully targeted by Erlotinib, showing 61% decrease in size at 8 weeks.

### **TABLE OF CONTENTS/OUTLINE**

Illustrate response assessment in the era of personalized medicine clinical trials  
Depict optimal strategies for response assessment using a multimodality approach  
Explore novel response assessment criteria, such as volumetric and MRI based DCE and DWI, to assess response

## **CHEE-127 Congenital Lung Anomalies in the Adult**

Participants

Marcos Mestas Nunez SR, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Although rare, congenital lung anomalies are incidentally discovered in adults and can pose a diagnostic dilemma. The radiologist must be familiar with the imaging findings and differential diagnosis. With this exhibit we will: 1) Review the typical imaging appearance of common and uncommon congenital lung anomalies as seen in the adult. 2) Review the concept of hybrid lesions. 3) Case based review of entities that can be mistaken for congenital lung anomalies, and the role of imaging in the differential diagnosis. 4) Describe complications and as well as discuss the risk of malignancy of some of these entities.

### **TABLE OF CONTENTS/OUTLINE**

1) Introduction and embryology  
2) Bronchopulmonary anomalies  
a) Bronchial atresia  
b) Lobar hyperinflation  
c) Bronchogenic cyst  
d) CPAM  
3) Combined pulmonary and vascular anomalies  
a) Pulmonary sequestration  
b) Hypogenetic lung syndrome  
c) Thoracic Isomerism  
4) "New concepts" hybrid lesions  
5) Miscellaneous  
a) Placental transmigration  
b) Proximal Interruption of the pulmonary artery  
6) Differential diagnoses: Case-based approach  
7) Complications  
a) Risk of malignancy: true or myth?  
b) Superimposed: a radiology challenge  
c) Hemoptysis and radiology in treatment

## **CHEE-128 The Family Plan: Multidisciplinary Approach to Familial Pulmonary Fibrosis (FPF)**

Participants

Katherine Cheng, MD, Stamford, CT (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Familial pulmonary fibrosis (FPF), defined as pulmonary fibrosis affecting at least two first degree relatives, is a complex group of diseases caused by a variety of genetic mutations. Diagnosis of FPF is essential as these patients have a worse prognosis than their sporadic counterparts that affects management not only of the patient, but also of first-degree relatives. However, the diagnosis of FPF can be difficult for both the radiologist and clinician as imaging patterns of fibrosis are often unclassifiable; variable penetrance exists amongst family members; and new mutations are continuously being discovered. This exhibit aims to improve understanding of FPF through a multidisciplinary approach reviewing genetic, clinical, and imaging manifestations of FPF.

### **TABLE OF CONTENTS/OUTLINE**

1. Definition and Epidemiology of FPF.  
2. Overview of the Genetic Mutations Associated with FPF including telomere, surfactant, host defense  
3. Illustrate the spectrum of imaging patterns for FPF and the variability that can exist even amongst family members including unclassifiable, UIP, NSIP, PPFE  
4. Emphasize the importance of genetic testing

## **CHEE-129 Cardiovascular and Thoracic Imaging Manifestations of Lupus**

Participants

Muhammad Naeem, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Systemic Lupus Erythematosus (SLE), also known as Lupus is a great masquerader and being a systemic illness it virtually affects every organ in the body. Cardiovascular and Thoracic manifestations are often prevalent. Over half of the patients with lupus develop pleuropulmonary involvement. Lupus patients often get delayed diagnosis and sometime radiologists can provide clue to underlying lupus by putting all the imaging findings together.  
- Thrombosis is quite prevalent in lupus given the high association with Antiphospholipid antibody (APLA). Other vascular manifestations can be coronary artery disease/aneurysms, pulmonary hypertension, venous thromboembolism, pulmonary emboli and rarely aortic dissections.  
- Heart involvement in lupus often present with myocarditis, although pericarditis is much more common due to the high prevalence of serositis in lupus.

### **TABLE OF CONTENTS/OUTLINE**

- Introduction- pathophysiological mechanisms in lupus- diagnostic criteria for lupus- Lung and Pleural involvement: Pleural disease, Lupus pneumonitis, Diffuse Alveolar Hemorrhage, Shrinking Lung Syndrome, Pulmonary fibrosis (along with classic patterns described in lupus)- Vascular involvement: Thrombosis/lupus anticoagulant/APLA antibodies, Venous thromboembolism, Pulmonary hypertension, Aortic dissections- Cardiac involvement: Pericardial involvement, Myocarditis and myocardial LGE pattern, Coronary artery disease and coronary vasculitis, Valvular disease (Libman-Sacks endocarditis)- Summary slide

## CHEE-13 Ground-Glass Opacities in Thoracic CT: Beyond the Acute Disease

Participants

Alicia Espinal Soria, MD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the spectrum of pathologic entities that manifest as ground-glass opacities in thoracic CT. To learn that ground glass opacities are not always related to acute diseases, being associated in some cases with fibrosis signs.

### TABLE OF CONTENTS/OUTLINE

Ground-glass opacities (GGO) are defined as a light increase in attenuation in pulmonary parenchyma that occur when alveolar space is compromised and/or when pulmonary capillary blood volume increases. This finding is often associated with acute pathology like pulmonary edema, alveolar hemorrhage, Pneumocystis jirovecii pneumonia, COVID-19, acute interstitial pneumonia, and acute respiratory distress syndrome. But some subacute and chronic pathologies may also manifest with GGO in CT such as cryptogenic organizing pneumonia, lepidic-predominant adenocarcinoma, chronic eosinophilic pneumonia, non-specific interstitial pneumonia, and nonfibrotic hypersensitivity pneumonitis. In addition, all of these entities can be classified according to the presence or lack of fibrosis signs, which is a determinant prognosis factor for the patients. The aim of this presentation is to review these pathologies with the most common imaging findings in order to facilitate the differential diagnosis in each case. However, in many cases the imaging findings are nonspecific therefore histologic and microbiologic studies will be necessary to make a definitive diagnosis.

## CHEE-130 ANCA-associated Vasculitis: The New 2022 ACR/EULAR Classification Criteria

Participants

Jonghyeon Kwon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Introduction and classification of ANCA-associated small vessel vasculitis 2. Review of newly updated 2022 ACR/EULAR classification criteria and cases of ANCA-associated vasculitis 3. Role of radiologists for classification of ANCA-associated vasculitis

### TABLE OF CONTENTS/OUTLINE

1. Definition of ANCA-associated vasculitis 2. Classification criteria of ANCA-associated vasculitis A. 1990 American College of Rheumatology (ACR) classification criteria B. 2012 Revised Chapel Hill consensus conference (CHCC) nomenclature of systemic vasculitides C. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology (ACR/EULAR) Classification Criteria 3. Review of image findings and application of 2022 ACR/EULAR classification criteria A. Granulomatosis with polyangiitis (GPA) B. Eosinophilic granulomatosis with polyangiitis (EGPA) C. Microscopic polyangiitis (MPA) 4. Summary

## CHEE-131 Febrile Neutropenia: A Scenario and Pattern-based Approach to a Perplexing Problem

Participants

Adam Yen, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Febrile neutropenia presents a challenging clinical dilemma, and treatment success relies on early diagnosis and targeted antimicrobial therapy. Often, clinical teams look to radiologists to help narrow the differential diagnosis when a neutropenic patient's thoracic CT contains findings concerning for infection. Here, we examine the role of imaging and CT-guided biopsy in the management of febrile neutropenia, present an approach wherein clinical information is paired with a CT pattern to help the radiologist make an educated guess as to the underlying causative agent, and specify where either clinical information or imaging appearance can serve more useful.

### TABLE OF CONTENTS/OUTLINE

1. Clinical presentation 2. Imaging workup 3. Approach by imaging patterns a. Consolidation/nodules b. Cavitary consolidation c. GGO d. Halo e. Reverse halo f. Thoracic wall involvement 4. Helpful clinical information a. Time course b. Antimicrobial response c. Procalcitonin d. B-D-Glucan e. Galactomannan f. Serologies g. BAL aspirate microscopy h. Cultures 5. Less than 1 week from onset a. Consolidation/nodules - common bacteria i. Gram+ bacteria (MRSA, VRE) ii. Gram- bacteria (pseudomonas) b. GGO - mostly viral i. EBV, CMV, other viruses ii. PJP 6. Consolidation/nodules + non-response to broad spectrum antibiotics - fungi a. Candida b. Aspergillus c. Mucormycosis 7. Other organisms to consider - uncommon bacteria a. Nocardia b. Actinomyces 8. Utility of biopsy a. Fungal infection b. Malignancy c. Non-diagnostic biopsy d. Platelet management 9. Summary by imaging appearance 10. Summary by helpful clinical information

## CHEE-132 Deciphering Acute Diffuse Pulmonary Lesions: Unraveling the Diagnostic Enigma

Participants

Daisuke Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffuse lung diseases include a wide variety of infectious, neoplastic, and allergic diseases in addition to idiopathic interstitial pneumonia. In this presentation, we will discuss what radiologists need to know about these diseases, especially those that present with diffuse lung lesions in an acute-onset.

### TABLE OF CONTENTS/OUTLINE

Presentation goals: To explain the pathophysiological mechanisms of hydrostatic and permeability pulmonary edema and describe the imaging findings. To discuss the spectrum of acute/subacute lung injury. To present information on acute diffuse pulmonary diseases classified by cause into idiopathic, infectious, allergic, drug-induced, neoplastic, and rare diseases and to describe their characteristic imaging findings. Cases include Infectious pneumonia: COVID-19 pneumonia, Cytomegalovirus pneumonia, Varicella zoster virus pneumonia, Influenza pneumonia, Pneumocystis pneumonia, Miliary tuberculosis, Legionella pneumonia, Diffuse aspergillosis after influenza viral infection Allergic lung diseases: Acute eosinophilic pneumonia, Acute hypersensitivity pneumonitis, E-cigarette, or vaping, product use associated lung injury (EVALI), Pulmonary injury associated with inhalation Drug-induced lung

injury: Caused by anti-cancer drugs and other medications  
Neoplastic diseases: Tumor embolism, Pulmonary tumor thrombotic microangiopathy, Carcinomatous lymphangiosis, Leukocytosis, Intravascular large B-cell lymphoma  
Rare diseases: Pulmonary hemorrhage, Fat embolism

### **CHEE-133 Detailed Radiologic-Pathologic Correlation in Fibrotic Hypersensitivity Pneumonitis (FHP): For Better Understanding of the HRCT Findings**

Participants

Daisuke Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Understanding the histological backgrounds is an essential clue to making a better interpretation of HRCT images. The teaching points are 1) to review the anatomical/histological basic knowledges of the lungs for HRCT diagnosis of interstitial lung diseases, 2) to recognize the meaning of representative HRCT findings in fibrotic hypersensitivity pneumonitis by precise correlation to histological findings.

#### **TABLE OF CONTENTS/OUTLINE**

Definition and pathophysiology of fHP / Review the anatomical/histological basis of the lungs  
Anatomy of secondary lobule, location of the peribronchiolar region in secondary lobule  
Radiological and pathological findings  
Demonstration of typical radiological and pathological findings of fHP  
Essential HRCT findings to know?  
small airway lesion (e.g. three-density pattern, lobules with decreased attenuation), parenchymal fibrotic lesion showing random distribution or UIP/NSIP-like pattern  
Close correlation between radiological and pathological findings  
•Centrilobular ground-glass opacities on HRCT? bronchiolitis and peribronchiolar inflammation, airway-centered mild fibrosis/organization  
•Ground-glass opacities? diffuse parenchymal inflammation or mild alveolar septal thickening  
•NSIP-like pattern fibrosis showing peribronchovascular distribution on CT? can be formed by a fusion of airway-centered lesions  
•UIP-like pattern fibrosis showing periacinar/perilobular distribution on CT? is sometimes derived from organization along lymphatic routes result in periacinar/perilobular fibrosis  
Conclusion  
The HRCT findings of fHP are varied and complex, but can be better grasped by understanding the histological background.

### **CHEE-14 Oncologic Causes of Phrenic Nerve Palsy: Where and How to Look for**

Participants

Nivedita Chakrabarty, Mumbai, India (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To illustrate normal anatomical course of phrenic nerve from skull base to diaphragm  
variant anatomy of phrenic nerve - pictorial review  
Imaging approach on when to suspect and how to report phrenic nerve compression/infiltration  
emphasis on oncologic case based approach to phrenic nerve palsy

#### **TABLE OF CONTENTS/OUTLINE**

Introduction  
Phrenic nerve; its anatomy, normal course and variants  
Various aetiologies of phrenic nerve palsy with emphasis on malignancy  
Pathophysiology of phrenic nerve palsy, infiltration vs compression  
CT and PET CT as a diagnostic modality for assessment of phrenic nerve palsy  
Pictorial illustration of cases  
Take home points

### **CHEE-15 Thoracic Involvement in Diseases Related to Dysregulated Humoral Immunity**

Participants

Jose Maluf, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Understand general concepts about immunity and humoral immunity
- Identify the main pathologies related to unfunctional humoral immunity
- Learn about the thoracic involvement in dysregulated humoral immunity states and how it can impact in patient's health
- Recognize the thoracic imaging findings related to a compromised humoral immunity

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction - General concepts about immunity:
  - o Main concepts and differences between cellular and humoral immunity
  - o Relation of the chest and respiratory tract with humoral immunity and the potential impacts in patient's health
  - o Thoracic imaging role in patients with dysregulated humoral immunity states
- Different thoracic findings:
  - o Airway abnormalities
  - o Infections
  - o Chronic Inflammatory and interstitial lung diseases
  - o Benign lymphoproliferative disorders
  - o Neoplasms
- Case based review - Pathologies and thoracic manifestations:
  - o Common Variable Immunodeficiency (CVID)
  - o IgG4-Related Respiratory Disease (IgG4-RRD)
  - o Respiratory amyloidosis
  - o Hypogammaglobulinemia
  - o Pulmonary Light-Chain Deposition Disease
  - o Other conditions
- Future perspectives
- Conclusions and key takeaways

### **CHEE-16 Rare Vasculitides: An Institutional Case-Based Radiological Review of Hughes-Stovin Syndrome**

Participants

Taylor Loon, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) Describe the clinical presentation and identify the corresponding radiographic findings of Hughes-Stovin syndrome. 2) Compare and contrast the radiological and clinical findings with other vasculitides and other causes of pulmonary artery aneurysms. 3) Discuss the possible complications and highlight the medical and surgical management of Hughes-Stovin syndrome.

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduce Hughes-Stovin Syndrome, its epidemiology, the three sequential phases of clinical presentation, and its diagnostic criteria. 2) Using cases from our institution, present the common radiologic features of Hughes-Stovin on chest radiograph and CT angiography of the thorax. 3) Using 3D-rendered images from our institution, further display the pulmonary arterial findings of Hughes-Stovin Syndrome. 4) Compare and contrast the diagnostic criteria, common radiologic findings and management of Hughes-Stovin to other pulmonary vasculitides including Behçet's disease and Granulomatosis with Polyangiitis. 5) Compare and contrast

Hughes-Stovin to other causes of pulmonary artery aneurysms including mycotic aneurysms. 6) Discuss unstable pulmonary aneurysms as a potential complication of Hughes-Stovin Syndrome and overview treatment algorithm based on CT pulmonary angiography findings. 7) Using digital subtraction angiography images from our institution, review embolization for unstable pulmonary artery aneurysms and potential complications of treatment.

### **CHEE-17 Childhood Interstitial Lung Disease: Stepwise Approach to Imaging Findings, Histopathologic Correlation, and Management**

Participants

Karen Ramirez Suarez, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Childhood interstitial lung disease is rare with challenging differential diagnosis which requires a stepwise approach to diagnosis including clinical presentation, imaging, and histology leading to the correct diagnosis in most cases. - An age-based differential diagnosis is particularly helpful for infants and young children. - Imaging evaluation of lung parenchyma, primarily on CT, helps to correctly diagnose these disorders, aids in guiding biopsy when needed, and monitor treatment response or disease progression. - Radiologic pathologic correlation is an important final step in the evaluation of childhood interstitial lung disease.

#### **TABLE OF CONTENTS/OUTLINE**

- Role of imaging of childhood interstitial lung disease with delineation of technique and pediatric protocols. - Stepwise approach to diagnosing childhood interstitial lung disease from clinical presentation to diagnostic workup including imaging, genetics, and biopsy. - Correlation of imaging findings and histology in childhood interstitial lung disease - Differential diagnosis of childhood interstitial lung disease based on clinical findings, imaging, and histology.

### **CHEE-18 Lung Cancer Interventional Oncology: Fire and Ice in the Treatment of Lung Cancer**

#### **TEACHING POINTS**

-CT-guided ablation is a viable option for treatment of multifocal lung carcinoma and patients with inoperable tumors, recurrence, prior surgery or radiation. -Choice of ablation modality depends on consideration of technical factors, size and location of target lesion, and patient comorbidities. -Target lesions > 3 cm confer a higher local recurrence rate than lesions < 3 cm. -Postablation features of successful ablation include ground-glass margins, which is crucial for confirming treatment success. -Follow up of postablation patients is the responsibility of the interventional oncologist with a standardized regimen of office visits and imaging.

#### **TABLE OF CONTENTS/OUTLINE**

-Indications for ablation in lung cancer-Comparison of ablation modalities-Mechanisms of tissue injury in ablation-Indicators of successful ablation-Postablation zone imaging features-Follow up surveillance

### **CHEE-19 Breaking Through the Sternum: Expected Post-sternotomy Imaging's Findings and Complications**

Participants

Renan Arakaki, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Median sternotomy is the incision of choice for thoracic and cardiac surgical procedures. Its incidence of complications ranges approximately between 0,5-5%, with a mortality rate reaching up to 80%. Thus, it is essential for the radiologist to recognize expected poststernotomy imaging findings and differentiate them from complications. This educational exhibit aims to illustrate the different sternal closure techniques, expected postsurgical changes and the main sternotomy complications involving hardware (wire fracture, migration, and rotation), bone (fracture, sternal dehiscence, nonunion, and osteomyelitis), and soft tissues (hematoma, gossypiboma, and abscess).

#### **TABLE OF CONTENTS/OUTLINE**

- Sternal closure techniques- Expected postsurgical imaging findings- Acute sternotomy complications- Late sternotomy complications.

### **CHEE-2 Across the Diaphragm: Thoracic Complications of Abdominal Conditions and Percutaneous Procedures**

Participants

Elisa Antolinos Macho, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-Recognize that many pathologic abdominal conditions and certain complications of percutaneous abdominal procedures may extend to the thoracic cavity -Learn the most common pathologic abdominal conditions and percutaneous procedures complications that may extend above the diaphragm -Describe the anatomical and acquired pathways through which infradiaphragmatic pathologic conditions and percutaneous procedures complications may reach the thorax -Review the appearance of these thoracic complications on different imaging modalities

#### **TABLE OF CONTENTS/OUTLINE**

1) Anatomy and physiology of the diaphragm 2) Common abdominal pathologic conditions and percutaneous procedures complications that may extend to the thorax o Liver and biliary system conditions o Pancreatic and splenic conditions o Kidneys and adrenal glands conditions o Pelvic conditions o Complications of percutaneous abdominal procedures § External biliary drainage § Percutaneous local ablative therapies of liver lesions § Embolization of portal and hepatic veins § Vertebroplasty 3) Pleural complications o Pleural effusion o Fistulas (biliopleural fistula, pancreaticopleural fistula) 4) Pulmonary complications o Infections § TB § Other mycobacteria o Inflammation § Sarcoid reaction § Pneumonitis § Mendelson syndrome o Fistulas 5) Thoracic vascular complications o Fat embolism syndrome o Foreign body embolism

## CHEE-20 Emerging Technology in Functional Lung Imaging: Hyperpolarized Xenon Gas MRI

### TEACHING POINTS

1. Hyperpolarized Xenon Gas (HXG) MRI is a new-to-market FDA approved imaging agent to evaluate lung ventilation, which offers advantages over other inhaled contrast agents. 2. Compared to traditional spirometry, HXG MRI is a promising surrogate with superior reproducibility and reliability. 3. Regulated by the FDA as a drug-device combination, HXG-MRI has some barriers and obstacles for adoption and implementation. 4. Various airway diseases, like asthma, COPD, and Cystic Fibrosis, have MR ventilation features that increase confidence in diagnosis and assessment of disease severity. 5. Ongoing investigation of HXG MRI is revealing new applications for medical imaging, which are not currently possible with existing modalities.

### TABLE OF CONTENTS/OUTLINE

1. Background/Objectives 2. Technique a. Drug Preparation --- i. Supplies, Consumables --- ii. Polarization --- iii. Dose Administration b. MR Scanner Configuration --- i. Coil --- ii. Software --- iii. Hardware c. Data Analysis --- i. Quantitative methods (Ventilation defect percent, VDP) --- ii. Qualitative methods 3. Clinical Implementation a. Regulatory b. Logistical c. Financial 4. Ventilation Characteristics a. Normal b. Pathology disease states --- i. COPD --- ii. Asthma --- iii. Cystic Fibrosis --- iv. COVID-19 (Acute and 'Long') 5. Future Frontiers a. Dissolved-Phase Imaging (Barrier Tissues and RBC) in healthy and diseased states. b. Dynamic HXG-MRI ('MR Spirometry') c. Physiological response to pharmaceutical agents

## CHEE-21 How Holey" Art Thou: Developing a Systematic Approach to Identifying and Reporting Cystic Lung Disease

Participants

Maria Clara Lorca, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Become familiarized with the different imaging appearance of cystic lung diseases and their differential diagnosis on chest CT. Differentiate true lung cysts versus their mimics: emphysema, cavities, and cystic bronchiectasis, cavitory lung metastasis. Recognize the distribution patterns of the different cystic lung diseases and formulate major differential diagnosis for solitary and multiple pulmonary cysts based on radiological appearance using a standardized approach.

### TABLE OF CONTENTS/OUTLINE

Recognize primary causes of cystic lung diseases, for example: Birt-Hogg-Dube (BHD) syndrome; spontaneous and tuberous sclerosis related lymphangioleiomyomatosis (LAM), Pulmonary Langerhans cell histiocytosis (PLCH), Lymphocytic interstitial pneumonia (LIP) Recognize acquired cystic lung diseases, for example: Light chain deposition disease, pulmonary laceration, Pneumocystis jirovecii infection, usual interstitial pneumonia, sarcoidosis, amyloidosis. Describe the role of the radiologist in the diagnosis and follow up of cystic lung diseases by CT, and when to recommend further biopsy. Our aim is to review the terminology, distribution and imaging patterns of the most common cystic lung diseases by CT and raise attention to the various mimics of cystic lung diseases, including cavitory lung metastases. The radiologist can then use this information to describe cystic lung disease utilizing a standardized reporting template to improve communication with referring providers.

## CHEE-22 Pulmonary Blood Volume Image with Dual-energy CT: Findings in Lung Cancer Patients

### TEACHING POINTS

1. To review how to obtain the pulmonary blood volume (PBV) images with dual-energy CT. 2. To describe the PBV imaging features and pathogenesis in lung cancer patients. 3. To discuss the importance of clinical implications and the pitfall.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. technical overview of dual-energy CT 3. CTPA techniques 4. the PBV imaging features and pathogenesis in lung cancer patients: vascular abnormalities, bronchial abnormalities, parenchymal abnormalities, artifacts and pitfall, and others 5. Summary

## CHEE-23 Potential Applications of Photon-Counting Detector CT in Cardiothoracic Imaging

Participants

Mauricio Barbosa, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Exemplify current and future applications of photon-counting detector CT (PCD-CT) in cardiothoracic imaging, including: 1. Improved image quality: PCD-CT provides higher spatial resolution and improved contrast-to-noise ratio, which enables more accurate and detailed imaging of the heart, vasculature and lungs. 2. Lower radiation dose: PCD-CT can allow for lower radiation doses than traditional CT. 3. Reduced artifacts: use of high keV imaging on PCD-CT can reduce metallic artifacts; combination of high-helical pitch imaging with PCD-CT can reduce motion artifacts. 4. Potential for new applications: PCD-CT technology offers new possibilities for functional imaging, including perfusion and multi-energy imaging, which may help in the diagnosis and management of cardiothoracic conditions.

### TABLE OF CONTENTS/OUTLINE

I. Introduction: ? • Explanation of physical principles? • Potential Advantages of PCD-CT over Energy-integrating detector CT (EID-CT)? • Improved image quality? • Reduction in radiation exposure? • Spectral imaging?; II. Clinical Applications of PCD-CT in Cardiothoracic Imaging?: • Coronary Artery Disease Imaging? • Lung Nodule and Mediastinal Mass Characterization? • Evaluation of Interstitial Lung Disease? • Thoracic Vascular Imaging/ Pulmonary embolism?; III. Future Possibilities: ? • Improvements in Quantitative Imaging? • Functional Imaging?; IV. Challenges and Limitations?: • Scientific and clinical validation? • Need for additional training and education?; V. Conclusion?: • Recap of current clinical applications? • Future directions for PCD-CT? • Final thoughts.

## CHEE-24 Disorders with Hand and Thoracic Involvement

Participants

Riddhi Borse, MBBS, MD, New Haven, CT (*Presenter*) Nothing to Disclose



## TEACHING POINTS

Numerous medical conditions have multiorgan imaging findings. Here, we review specifically the hand and cardiothoracic findings of selected infectious, inflammatory, connective tissue, neoplastic, and hereditary disorders. These correlations are meant to remind the astute clinician that certain hand findings should trigger a careful radiologic evaluation that includes imaging of the chest.

## TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Examples of cases:A. Connective tissue disorders- Rheumatoid arthritis, Systemic Lupus Erythematosus, Raynaud's syndrome, Dermatomyositis. B. Hereditary Conditions: Marfan's Syndrome, Ehlers Danlos Syndrome, Sickle-cell disease.C. Metabolic conditions: Hyperparathyroidism, Renal Failure with osteodystrophy and metastatic calcification in the lungs.D. Infectious Diseases: Tuberculosis, Septic Embolism.E. Neoplastic Conditions: Lung Cancer, Melanoma.3. Conclusion.

## CHEE-25 Tracheobronchomalacia x Excessive Dynamic Airway Collapse: CT and Bronchoscopy Correlation

Participants

Helena Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- To discuss the differences between tracheobronchomalacia (TBM) and Excessive Dynamic Airway Collapse (EDAC), emphasizing their pathophysiology, anatomical aspects, clinical presentation and associated comorbidities. - To point out the challenges and controversies in its diagnosis. - To discuss the role of Flexible Dynamic Bronchoscopy and Computed Tomography in the assessment of central expiratory airway collapse (ECAC), highlighting the exam protocols and the main aspects to be evaluated. - To illustrate the imaging appearance of EDAC and TBM on bronchoscopy and CT.

## TABLE OF CONTENTS/OUTLINE

1 - Introduction2 - Pathophysiology, anatomical aspects and clinical presentation of TBM and EDAC. 3 - Flexible Dynamic Bronchoscopy and Computed Tomography: techniques, protocols and main findings. 4- Cases 5- Conclusion

## CHEE-26 What's That in the Bone?"- Non-Traumatic Musculoskeletal Pathology on Chest/ Breast Imaging

Participants

Tina Roa, MD, New York, NY (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. Understand the basic musculoskeletal anatomy seen in the chest including bones, joints, muscles, tendon insertions and major nerves (including the brachial plexus origin and long thoracic nerve). 2. Recognize MSK anatomic variants and common degenerative changes. 3. Recognize MSK manifestations of infectious, autoimmune, and other systemic pathologies on chest imaging (such as septic arthritis, sickle cell disease, rheumatoid arthritis, etc.) 4. Learn how to approach bone lesions within the chest. 5. Learn how to approach soft tissue lesions within the chest. 6. Review Bone-RADS criteria.

## TABLE OF CONTENTS/OUTLINE

1. Normal Anatomy: a. Osseous Structures of the Chest, b. Musculature of the Chest, c. Joints and Tendons, d. Major Nerves; 2. Orthopedic Findings: a. MSK Anatomic Variants in the Chest, b. Degenerative MSK Changes in the Chest; 3. MSK Infections/ Autoimmune/ Other Systemic Anomalies in the Chest: a. Septic Arthritis, b. Autoimmune MSK Manifestations in the Chest, c. Other Systemic Disorders; 4. MSK Tumors of the Chest: a. Benign Tumors (Osseous and Soft Tissue), b. Malignant Tumors (Osseous and Soft Tissue); 5. Algorithm to approach incidental bone lesion/ Review of Bone-RADS.

## CHEE-27 Spotting the Airway Snags: Computer Tomography Imaging Planning For Bronchoscopy Stent and Valve Placement

Participants

Miriana Mariussi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The purpose of this exhibit is to: • Review the indications for bronchoscopy stent and valve placement. • Highlight the role of Computer Tomography in the treatment of airway stenosis, air leaks and chronic obstructive pulmonary disease (COPD). • Comprehend the application of CT planning prior to the bronchoscopy. • Correlate the radiological features with bronchoscopy findings. • Identify CT image findings during follow-up after the procedure.

## TABLE OF CONTENTS/OUTLINE

Bronchoscopy stent and valve placement have been established as a safe and effective treatment alternative for airway stenosis, air leaks and COPD. A case based pictorial essay allows for a comprehensive assessment and understanding of: • Clinical indications for bronchoscopy stent and valve placement. • Radiological features of airway stenosis, air leaks and COPD. • Pre-procedural CT planning for bronchoscopy airway stent placement. • Pre-procedural CT planning for the endobronchial unidirectional valve placement. • Imaging findings correlated with bronchoscopy. • Expected radiological findings during the follow up.

## CHEE-28 Trouble in the Air: Imaging Review of Early Complications Following Lung Transplantation and Our Institutional Experience

Participants

Bob Zhang, MBBS, BMedSc, Melbourne, Australia (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Early complications following lung transplantation are a major cause of morbidity and mortality. Imaging plays a key role in their diagnosis, and it is important for radiologists to be able to recognise these complications, as well as understand the underlying cause. This exhibit aims to 1) discuss the spectrum of complications that occur within the first week following transplantation, 2) discuss preoperative factors that may predispose to complications, 3) review surgical techniques that reduce the risk of certain complications and how to recognise these on imaging, 4) discuss our institutional experience as a major transplant centre, and 5)

review the imaging findings of early complications using a case based format.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of lung transplantation. 2. Overview of complications that occur in the first week following transplantation. 3. Preoperative factors that increase risk of complications following transplantation. 4. Surgical techniques to reduce the risk of postoperative complications and how to recognise these on imaging. 5. Review of our institutional experience as a major lung transplantation centre. 6. Case based review of imaging findings in early post-transplant complications.

#### CHEE-29 Bronchiectasis: Another Way to Approach Lung Disease

##### TEACHING POINTS

Bronchiectasis features in a wide range of pathological processes including infectious causes, bronchial aspiration, pneumoconiosis, congenital immunodeficiencies, and cartilage development disorders, among others. The spatial distribution; is considered a key point when it comes to establishing differential diagnoses in an easier and quicker way. The upper lung zones are usually compromised by cystic fibrosis, sarcoidosis, and allergic bronchopulmonary aspergillosis noticing a more central involvement while tuberculosis has an asymmetric distribution. The middle lobe and lingula frequently show bronchiectasis secondary to infection by atypical mycobacteria or adult respiratory distress syndrome. Associated findings allow radiologists and trainees to address the diagnoses. When tree-in-bud, centrilobular ground-glass nodules and bronchial wall thickening are seen in patients with lower lung zones bilateral bronchiectasis; bronchial aspiration should be suspected. Meanwhile, the presence of architectural distortion, honeycombing, and varicoid morphology bronchiectasis are commonly found in pulmonary fibrosis.

#### TABLE OF CONTENTS/OUTLINE

Location and distribution, Upper lung: Cystic fibrosis, Sarcoidosis, Allergic bronchopulmonary aspergillosis, Tuberculosis Middle/lingular: Atypical mycobacterial infection, Acute respiratory distress syndrome, Primary ciliary dyskinesia, Immunodeficiency Lower lung zone: Chronic aspiration, Pulmonary fibrosis,  $\alpha$ 1-Antitrypsin deficiency. Central: Tracheobronchomegaly, Williams Campbell syndrome Focal and diffuse: Endobronchial or peribronchial tumor, Swyer James syndrome, Bronchiolitis obliterans.

#### CHEE-3 Inside the Circuit: Radiology Insights into ECMO Placement

##### TEACHING POINTS

1. ECMO, or extracorporeal membrane oxygenation, is a life-support system that provides temporary respiratory or circulatory support to critically ill patients whose heart or lungs are failing. 2. Radiology plays an important role in ECMO, particularly in assessing the placement of the cannulas and monitoring for complications such as bleeding or clotting. 3. Sentinel events, such as malposition of the cannulation require rapid intervention and evaluation by the ECMO team and radiology. 4. There are different types of ECMO cannulation, including veno-arterial, veno-venous, veno-veno-arterial, and central cannulation. 5. Venous-arterial cannulation is used when the patient has both respiratory and circulatory failure, and it requires correct positioning to ensure optimal blood flow and oxygenation. Incorrect positioning can lead to complications such as limb ischemia or vessel injury. 6. Veno-venous ECMO is used when the patient has isolated respiratory failure, and it also requires correct positioning to avoid complications such as bleeding or pneumothorax.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1. Indications for ECMO 2. Role of Radiology in ECMO 3. Sentinel Event Types of ECMO Cannulation 1. Veno-Arterial 2. Veno-Venous 3. Veno-Veno-Arterial 4. Central Cannulation Venous-Arterial Cannula 1. Indications 2. Correct Positioning 3. Incorrect Positioning 4. Complications of Incorrect Positioning VA ECMO: Femora Cannula 1. High Arterial Cannula 2. Low Arterial Cannula 3. Low Venous Cannula 4. High Venous Cannula Veno-Venous ECMO 1. Indications 2. Correct Positioning 3. Incorrect Positioning 4. Complications of Incorrect Positioning 5. Single lumen VV ECMO Conclusions

#### CHEE-30 Chill Out! Percutaneous CT- Guided Intrathoracic Cryoablation: Applications, Imaging Appearance, and Complications

Participants

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Percutaneous cryotherapy uses liquified gases like nitrogen or argon through cryoprobes under CT guidance to create temperatures as low as - 40° C. Cytotoxic cell destruction occurs at this temperature which helps to destroy neoplastic cells. Cryotherapy allows real-time evaluation of the ablation site. It is a preferred ablation technique for central tumors close to airways, great vessels, pericardium.

#### TABLE OF CONTENTS/OUTLINE

Indications for cryotherapy: Primary lung cancer (early or advanced), metastatic lesions, mediastinal lesions, post-SBRT recurrent tumors, post-surgical recurrent tumors. Post treatment appearance - Immediately after the procedure, follow-up after 1 month, 3 months, 6 months and 12 months. Complications of cryotherapy Pneumothorax, hemoptysis, pleural effusion, parenchymal hemorrhage, pneumonia, esophageal injuries, tumor implantation, tumor recurrence, nerve injury, skin injury.

#### CHEE-31 Pleuroparenchymal Fibroelastosis: Update on Imaging with Pathological Correlation

Participants

Joel Gamble, MD, BSC, Toronto, ON (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Pleuroparenchymal Fibroelastosis (PPFE) is a rare subtype of interstitial pneumonia that historically has been difficult to diagnose, particularly in its early stages, and often misdiagnosed by radiologists. 2. PPFE can be associated with other fibrotic interstitial lung diseases or triggered by previous infections, chemotherapy, hematopoietic stem cell transplant, and lung transplant. 3. Improving awareness of PPFE allows early recognition on CT and allows for close attention on clinical and imaging follow up, including implementation of supportive measures and potential treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Pleuroparenchymal Fibroelastosis (PPFE): Definition and background; Historical context and understanding; Inclusion in American Thoracic Society/European Respiratory Society guidelines. 2. Diagnosis and Recognition of PPFE: Challenges in early-stage diagnosis; Importance of CT in the diagnosis; Pathological confirmation. 3. Causes and Associations of PPFE: Previously believed to be idiopathic; Association with other fibrotic interstitial lung diseases; triggers, including infections, chemotherapy, hematopoietic stem cell transplant, lung transplant. 4. Clinical Presentation and Prognosis: Slowly progressive or rapid clinical deterioration; Poor prognosis in most cases; Potential treatment.

### **CHEE-32 One-stop-Shop Pictorial Review of All Changes in Lung-RADS v2022**

Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1- Familiarize radiologists with the latest version of the Lung-RADS criteria (Lung-RADS v2022) for lung cancer screening (LCS). 2- Review the most recently added nomenclature and morphologic features that radiologists should consider determining the appropriate Lung-RADS categories. 3- Review important updates on assigning Lung-RADS categories on follow up studies (stepped management).

#### **TABLE OF CONTENTS/OUTLINE**

1- Introduction to the Lung-RADS tool and its various versions. 2- Comparison of important changes between the 2022 and 2019 versions of Lung-RADS in different domains, including A) Atypical pulmonary cysts B) Juxtapleural nodules C) Inflammatory or infectious findings D) Airway nodules. 3- Review of updated Lung-RADS terms and structural definitions, including the removal of the risk of malignancy table, changes in follow-up intervals, as well as reset of starting points for follow-up and different definitions for growth. 4- Brief review of the effect of changes in Lung-RADS classification criteria on clinical management.

### **CHEE-33 The Many Faces of Evil: A Pictorial Review and Algorithmic Approach to Autoimmune Diseases of the Thorax**

Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Different autoimmune diseases can involve different parts of the thorax, including but not limited to lung parenchyma, heart, esophagus, pleural and pericardial space, great vasculature, thymus gland, and thoracic chest wall.
- Patterns of lung disease could precede the development of the clinical diagnosis of autoimmune disease.
- As autoimmune disorders overlap clinically, the possibility of mixed thoracic radiological manifestations should be considered.
- Thoracic involvement in autoimmune disorders could happen due to the disease process itself, drug toxicity, or opportunistic infections from resultant immunodeficiency, which their differentiation needs meticulous clinical-radiological evaluation.
- Provide an algorithmic approach for diagnosis of autoimmune diseases with focus on intrathoracic findings.
- The European Respiratory Society/American Thoracic Society task force proposes using "Interstitial pneumonia with autoimmune features (IPAF)" for patients with idiopathic interstitial pneumonia and features suggestive of, but not definitive for a collagen vascular disease.

#### **TABLE OF CONTENTS/OUTLINE**

- Review of the thoracic findings in autoimmune disorders of the thorax based on the involved organs.
- Evaluation of lung parenchyma findings based on the pattern and prevalence.
- Assessment of autoimmune diseases of the thorax, beyond the lung parenchyma involvement.
- Review the post-treatment changes and treatment complications in the autoimmune disorders of the thorax.
- Evaluation of the natural progression of thoracic autoimmune disorders.
- An algorithmic approach for diagnosis of autoimmune diseases.

### **CHEE-34 Classical Signs on Chest Radiograph: A Primer for Residents**

Participants

Furkan Ufuk, MD, Denizli, Turkey (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

? Recognize the classic signs on chest radiographs. ? Describe each sign's anatomic and pathologic features and discuss their clinical importance.

#### **TABLE OF CONTENTS/OUTLINE**

This educational exhibit provides an overview of classic signs on chest radiographs and their clinical significance. The exhibition includes a table of contents and teaching points, such as recognizing the appearance of chest radiograph signs on Chest CT and describing the anatomic and pathologic features represented by each sign. Several imaging signs on chest radiographs are described, including Air bronchogram, Bat's wing or butterfly shadow, black pleura sign, and others, with the pathophysiologic origin of each sign and the characteristic imaging features described in detail. Radiologists must recognize these signs and understand their causes to provide accurate diagnoses of abnormalities affecting the lungs, heart, mediastinum, diaphragm, and pleura. The exhibit aims to enhance radiologists' knowledge of classic signs on chest radiographs, ultimately leading to improved diagnostic accuracy and better patient care.

### **CHEE-35 A Challenge in Diagnosing Benign Thymic Lesions as Benign**

#### **TEACHING POINTS**

1. To understand the normal/hyperplastic spectrum of the thymus and related clinical conditions 2. To understand the typical and atypical appearance of benign thymic lesions 3. To understand mimickers of thymic lesions

#### **TABLE OF CONTENTS/OUTLINE**

1. Importance of benign diagnosis of thymus a. Avoid unnecessary thymectomy or follow-up study b. Image modality selection and appropriate recommendation 2. Normal/hyperplastic spectrum of the thymus a. Various morphology of the thymus b. Demographic and clinical features related to thymic involution/hyperplasia c. Thymic hyperplasia related to COVID-19 infection or vaccination d.

2D and 3D analysis: Shape and measurement in size and volume 3. Typical appearance of common benign thymic lesions a. Thymic hyperplasia: True vs lymphoid hyperplasia b. Thymic cyst: Unilocular vs multilocular c. Thymolipoma d. Differentiation from thymic neoplasm (Thymic epithelial tumor, lymphoma) 4. Atypical appearance of benign thymic lesions a. Nodular component within the thymus b. Atypical morphologies of thymic hyperplasia (TH) • Non-suppressive TH out-of-phase T1WI MRI • Multinodular/multicystic TH (Sjogren's syndrome, HIV infection) c. Atypical features of thymic cyst • Complicated hyperattenuating cyst • Thymic/pericardial cyst within TH 5. Mimicker of thymic lesions a. Morgagni hernia b. Focal fat necrosis c. Ectopic thyroid lesion d. Tortuous internal mammary vein e. Lymph nodes 6. Summary

### **CHEE-36 A Comprehensive Pictorial Review: Vascular Anomaly and Malformation of Thorax**

Participants

Ryosuke Taiji, MD, Kashihara, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is To depict anomalies and malformations of thorax To discuss the clinical feature, significance, and management for those entities.

#### **TABLE OF CONTENTS/OUTLINE**

The mediastinum contains two distinct circulatory systems, namely the systemic and pulmonary circulations. Anomalies and malformations have been reported within the thorax. In the pediatric population, some malformations are identified promptly after birth and necessitate surgical intervention. Radiologist should be familiar with these entities. Contents 1. Pulmonary artery Absence of the right pulmonary artery, proximal interruption of the pulmonary artery, pulmonary arterial aneurysm, pulmonary sling, and Taussig-Bing syndrome, 2. Aorta Aberrant right subclavian artery, right aortic arch and Kommerell diverticulum, arterial duct (Botallo's duct), and anomalous systemic arterial supply to the basal lung 3. Pulmonary vein Partial anomalous pulmonary venous return (PAPVR); right upper and lower pulmonary vein, Scimitar syndrome, total anomalous pulmonary venous return (TAPVR); supra-cardiac, cardiac, infracardiac type, anomalous unilateral single pulmonary vein (AUSPV), and pulmonary venous aneurysm 4. Vena cava Persistent left superior vena cava, azygos continuation of inferior vena cava 5. Summary

### **CHEE-37 Granulomatosis with Polyangiitis (GPA): Thoracic Manifestations with Emphasis on Differential Diagnosis**

Participants

Roddie Moraes Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review the pathophysiology and histologic features of granulomatosis with polyangiitis (GPA); review the main clinical manifestations of GPA; recognize the most common and uncommon chest imaging findings of GPA; highlight the main differential diagnosis of thoracic manifestations of GPA in a pattern-based approach, with clinical-radiological correlation.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: definition, pathophysiology, clinical features, diagnostic criteria; case based review - pattern-based thoracic manifestations of GPA with differential diagnoses: lung nodules and masses, airspace consolidation and ground glass opacities, airway thickening, pleural involvement, rare mediastinal manifestations (lymphadenopathy, cardiac involvement, great arteries vasculitis); conclusions and key takeaways

### **CHEE-38 Clearing the Fog - What You Must Know About Smoking-related Diffuse Lung Diseases**

Participants

Gabriel Neumann Kuhn, MD, Morro Redondo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review the smoking-related diffuse lung diseases (SDLD) and its pathophysiological mechanism; Discuss the relationship between smoking and interstitial lung abnormalities (ILA) and the relevance of the imaging approach; Case-based demonstration of the main imaging findings associated in each one of the SDLD; Review the findings and implications of the combined emphysema-fibrosis syndrome.

#### **TABLE OF CONTENTS/OUTLINE**

General facts about tobacco use; Case based examples of the main SDLD (respiratory bronchiolitis / desquamative interstitial pneumonia, smoking related interstitial fibrosis / airway enlargement with fibrosis, Langerhans cell histiocytosis); Brief up-to-date approach of combined emphysema-fibrosis syndrome; Take home messages.

### **CHEE-39 Three Steps for the Success of a Lung Segmentectomy Surgery: The Role of the Radiologist**

Participants

Maria Celia Franco Issa, MD, Uberlandia, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

? Review the concepts, indications and techniques of lung anatomical segmentectomy ? Describe the most relevant imaging features of the pulmonary nodule to the surgery planning ? Discuss the role of preoperative Chest Computed Tomography (CT) in the recognition of the drainage pattern of the intersegmental vein and determination of the intersegmental plane ? Recognize the anatomical features and variations of the pulmonary venous drainage with potential impact in lung segmentectomy ? Discuss the role of 3DCT in the lung segmentectomy planning

#### **TABLE OF CONTENTS/OUTLINE**

• Introduction • The rationale of Lung Segmentectomy o Indications o Advantages and disadvantages o Minimally Invasive Techniques - Video-assisted thoracic surgery (VATS) - Robotic-assisted thoracic surgery (RATS) - Potential complications • The role of the Radiologist in three steps 1. Describe the most relevant features for anatomical segmentectomy recommendation: - Nodule size and location - Resection margin - Previous lung resection - Absence of visible regional lymph node disease 2. Identify

the intersegmental vein - Delineate the intersegmental plane - Verify if the intersegmental vein is a drainage vein from the tumor 3. Look for variations of the pulmonary venous drainage that might impact in the lung segmentectomy - Case-based review - Atypical venous outflow to the left atrium - Atypical topography of the pulmonary vein - Atypical venous vascularization of pulmonary segments • Future Directions the role of CT with 3D reconstructions and 3D printing in lung segmentectomy planning

#### **CHEE-4 Primer for Radiology Residents: Cardiothoracic Emergencies in Oncology**

Participants

Jitesh Ahuja, MD, MBBS, Houston, TX (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Familiarize radiologists with spectrum of acute cardiothoracic complications that can occur in oncology patients.

##### **TABLE OF CONTENTS/OUTLINE**

Cancer is the second most common cause of mortality in United States. Several acute cardiothoracic complications can occur in oncology patients that can be life-threatening. These complications can occur due to tumor itself, including the extent of local invasion and metastasis. In oncology patients undergoing treatment, emergencies can be the result of complications of chemo/immunotherapy, surgery and radiation therapy. Finally, patients with cancer are at increased risk of emergencies due to systemic disease from hypercoagulable state and immunosuppression. 1. Complications due to cancer itself a. Airway obstruction b. SVC syndrome c. Esophagorespiratory fistula d. Esophagoaortic fistula e. Large pleural effusion, hemothorax or pneumothorax f. Cardiac tamponade g. Lymphangitic carcinomatosis h. Spinal cord compression 2. Complications due to cancer treatment a. Pneumothorax, hemothorax b. Mediastinal hematoma, mediastinitis c. Lobar torsion d. Cardiac herniation e. Esophageal leak f. Drug or radiation pneumonitis g. Immunotherapy associated myocarditis 3. Systemic complication a. Pulmonary embolism b. Opportunistic infections c. Stress cardiomyopathy (Takotsubo)

#### **CHEE-40 Utilization of Virtual Bronchoscopy and 3D-Multiplanar Volume Reconstruction (MPVR) Correlation to Illustrate Tracheobronchial Tree Abnormalities - An Imaging Review**

##### **TEACHING POINTS**

Tracheobronchial tree abnormalities can be subtle on imaging and are not always accessible via fiberoptic bronchoscopy (FB). As healthcare shifts towards value-based care, technological innovations such as virtual bronchoscopy (VB) may not only reduce overspending but also improve clinical and patient satisfaction outcomes by providing radiologists with a visually intuitive medium to show rather than only tell complex 3D radiographic findings to non-radiologist audiences. VB is rendered by processing multi-detector row CT (MDCT) volumetric data via specialized software that assumes an artificial perspective from a lumen and then assigns opacity values and full spectrum color values based off attenuation values of different tissues and abrupt changes in attenuation between adjacent voxels. VB is underutilized, and it is better than conventional FB in specific cases where higher order subsegmental bronchial branches or regions distal to an obstruction/stenosis or are inaccessible via FB. VB enables a quick, highly accurate, and, most importantly, non-invasive visual medium to evaluate the tracheobronchial tree. It can play an invaluable role in personalized pre-procedural planning and simulations as well as in educating trainees in thoracic anatomy.

##### **TABLE OF CONTENTS/OUTLINE**

1. Briefly describe how 3D-MPVR post-processing is used in creating VB. 2. Using our institutional database, present CT imaging cases with their respective 3D-MPVR and VB images, including, but not limited to, the following tracheobronchial tree abnormalities: tracheal anomalies, tracheal stenosis, tracheal enlargement, excessive central airway collapse, endobronchial lesions, and trauma.

#### **CHEE-41 A Pictorial Review: Lymphoma and Lymphoproliferative Disease of Thorax**

Participants

Ryota Nakano, Kashihara, Japan (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To depict lymphoma and lymphoproliferative disease of thorax To discuss the clinical and radiological findings and management

##### **TABLE OF CONTENTS/OUTLINE**

Lymphoma and lymphoproliferative diseases of the thorax occur primarily in the lungs, bronchus, mediastinum, and chest wall. Radiologists need to know more about each disease, as some require differentiation from lung cancer or other malignant mediastinal tumors. Contents. 1. Pulmonary lymphoproliferative disease (LPD): follicular bronchiolitis, lymphocytic interstitial pneumonia, and nodular lymphoid hyperplasia. 2. Primary pulmonary lymphoma: MALT lymphoma, diffuse large B-cell lymphoma, and Intravascular large B-cell lymphoma. 3. Primary mediastinal lymphoma: diffuse large B-cell lymphoma, classical Hodgkin lymphoma, and T-cell lymphoblastic lymphoma. 4. Primary pleural lymphoma: pyothorax associated lymphoma, and follicular lymphoma. 5. Miscellaneous: IgG4-related disease, Uni-/Multicentric Castleman disease, and methotrexate-associated LPD.

#### **CHEE-42 The Invisible Culprit: Demystifying Autoimmune Disorders of the Lungs**

##### **TEACHING POINTS**

Autoimmune disorders affecting the lungs are a group of medical conditions characterized by the presence of autoantibodies that can cause damage to organs throughout the body. They include connective tissue diseases. CTD-ILD is defined as evidence of ILD demonstrated by CT (i.e., some combination of reticulation, ground-glass opacities, traction bronchiectasis, honeycombing, and/or cysts) in the setting of an established CTD. It includes RA, systemic sclerosis, SLE, primary Sjogren's syndrome, idiopathic inflammatory myositis, and mixed connective tissue disease. Diagnosis typically involves imaging studies such as high-resolution CT scans, lung biopsies and immunological investigations. Treatment options include corticosteroids, immunosuppressants, oxygen therapy and pulmonary rehabilitation. In severe cases, lung transplantation is considered as a last resort.

##### **TABLE OF CONTENTS/OUTLINE**

1. Antisynthetase syndrome- inflammatory myositis, polyarthritis associated with ILD and anti-synthetase autoantibodies. 2. Microscopic polyangiitis- diffuse pulmonary alveolar hemorrhage is common feature. 3. RA-ILD is commonly associated with UIP. 4. SSc-ILD is commonly associated with NSIP. Risk factors- anti-topoisomerase Ab and higher skin score. 5. Sjogren's syndrome

typically presents with NSIP, other patterns like UIP, LIP, focal lymphoid hyperplasia of the lung, small airways disease, and pulmonary vasculitis. 6. IIM-ILD is restricted to subsets of DM and PM. Usually manifests as NSIP with OP. Risk factors - anti-Jo1, anti-PL-7, anti-PL-12, and Black race. 7. Sarcoidosis - commonly affects the lungs and mediastinum with variable radiographic features depending on the stage of the disease.

#### **CHEE-43 Pinpoint It - A Pictorial Essay on Causes of Acute Chest Pain on CT**

Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Acute localized chest pain is an important and frequent complaint in patients who seek the emergency medical care and can originate from many different compartments / tissues, namely the mediastinum (including cardiovascular structures), the lungs, the pleura, the chest wall, the spine or even the upper abdomen. Placing a skin marker at the topography of pain referred by the patient is an important step in facilitating the identification of a potential cause.

##### **TABLE OF CONTENTS/OUTLINE**

Numerous diseases may present as acute localized chest pain and chest computed tomography (CT) can be an important tool to detect the cause, including pulmonary infarction caused by acute thromboembolism, lobar pneumonia, pneumothorax, bone / cartilaginous fractures, acute cardiovascular pathologies, acute pericarditis, mediastinal fat necrosis, some upper abdominal pathologies, among other diseases. The placement of a skin marker in the vicinity of the potential finding, in the location pointed by the patient as painful, plays an important role in allowing for a more accurate search pattern by the radiologist. This exhibit aims to provide a pictorial essay on several findings that are consistent with the clinical presentation of acute localized chest pain as they appear on chest CT, with a special focus on cases in which the placement of a skin marker was particularly helpful.

#### **CHEE-44 Showcasing Signs Silhouettes: Assessment of Congenital Pediatric Cardiac Pathology on a Chest Radiograph**

Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Even with the availability of modalities such as echo, CT, and MRI; a plain chest radiograph remains as the first and most basic modality to investigate suspected congenital cardiac conditions in the pediatric population. A chest radiograph is convenient as it is an easily accessible, low-cost, and non-invasive diagnostic tool with minimal radiation dose, giving us an opportunity to move one step closer to a "green radiology." While evaluating the chest radiograph, it is vital to recognize that classic cardiac signs and silhouettes. Additional emphasis should be given to the pulmonary blood flow, ribs, and spine. Since a chest radiograph is the starting point for majority of patients with suspected congenital heart conditions - it is very imperative for the radiologists to quickly recognize these classic findings to provide an accurate diagnosis for proper patient management.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction to normal pediatric cardiac silhouette  
Cyanotic Cardiac Heart disease:- Tetralogy of Fallot- Total Anomalous Pulmonary Venous Return (TAPVR)- Truncus Arteriosus- Transposition of Great Arteries- Tricuspid Atresia- Hypoplastic Left Heart Syndrome (HLHS)- Ebstein's Anomaly  
Acyanotic Cardiac Heart disease:- Atrial Septal Defect (ASD)- Ventricular Septal Defect (VSD)- Patent Ductus Arteriosus (PDA)- Coarctation of the Aorta- Aortic Stenosis- Pulmonic Stenosis  
• Technical factors  
• Limitations of Chest x-ray. Tricks and tips to radiologist for interpreting CXR.

#### **CHEE-45 Caution! Lung "Fields" Ahead: Thoracic Imaging in the Agricultural Setting**

##### **TEACHING POINTS**

The agricultural sector employs 884 million workers, over a quarter of the global labor force, yet it remains one of the three most hazardous industries in the world. High morbidity and fatality rates are largely attributable to respiratory illnesses arising from unique exposures inherent in agricultural processes. Since the last comprehensive overview of radiological manifestations of agricultural-related diseases was published in 1991 by Gurney et. al, imaging technologies have modernized, allowing for more exquisite characterization of these lung disorders. Modern agricultural practices have brought about new illnesses and mechanisms of trauma, with unique radiological manifestations that have not been sufficiently characterized in the literature. In this exhibit, we provide an updated overview of the radiological manifestations of agriculture-related lung diseases and chest traumas to help with timely diagnosis and treatment for this vulnerable population.

##### **TABLE OF CONTENTS/OUTLINE**

Outline: I. Agricultural workers as a vulnerable population II. Radiological manifestations from exposures to microorganisms in agriculture a. *Coxiella burnetii* (Q Fever) b. *Nocardia nova* c. Blastomycosis d. Acute histoplasmosis e. Pulmonary echinococcosis (hydatid disease) III. Radiological findings from exposures to organic compounds a. Organic dust toxic syndrome b. Nonfibrotic hypersensitivity pneumonitis c. Fibrotic hypersensitivity pneumonitis d. Silo filler's disease IV. Agricultural related trauma a. Blunt chest trauma b. Foreign body aspiration c. Deep vascular injury V. The final harvest: take home learning points

#### **CHEE-46 Cardiovascular Imaging in Thoracic Neoplasms**

Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Recent advances in chest MRI have expanded its use in the evaluation of chest tumors, not only for tissue characterization but also for precise depiction of invasion of adjacent structures, tumor staging and treatment monitoring. Moreover, depiction of cardiac involvement, either directly or indirectly, has been associated to worse prognosis in oncologic patients. Teaching points: 1. To detail the basic and advanced CMR techniques that may be incorporated to conventional chest MR protocols, as well as its indications and potential pitfalls. 2. To review the direct and indirect mechanisms of cardiovascular involvement in patients with thoracic malignancies. 3. To identify how combined hybrid cardiothoracic imaging may be useful for treatment surveillance and

monitoring.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. CMR in cardio-oncology: The imaging protocol 2.1. Basic chest MR protocol (starting point) 2.2. Cardiac sequences for thoracic neoplasms evaluation - T1 black blood imaging (fat invasion) - DWI with EKG triggering - First pass perfusion - Cine SSFP - Parametric mapping (tumoral/tissue characterization) - MR angiography - 4D flow CMR (great vessels and cavitory hemodynamics) - PET/MR imaging 3. Cardiac involvement in Cardio-Oncology: Direct Mechanisms - Hematogeneous metastasis - Lymphoid metastasis - Direct involvement - Intravascular growth 4. Improving tumor staging with cardiac sequences - Cardiac/vascular/mediastinal invasion - Pleural invasion - Chest wall invasion 5. Indirect involvement of the heart in oncologic patients - Thoracic irradiation - Chemotherapeutic agents - Plasma cell dyscrasia (amyloid) 6. Use of CMR in treatment monitoring: Prognostic biomarkers 7. Take home points

#### CHEE-47 Chest Computed Tomography Angiotomography with 3D Reconstructions for Preoperative Planning

Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to:- Review the evolution of surgical technique for pulmonary resections - Highlight the benefits of Computed Angiotomography with 3D reconstructions in surgical planning - Understand the application of CTA planning prior to segmentectomy to evaluate bronchovascular relations, anatomical variations and lung volumetry- Correlate the radiological findings with intraoperative findings - Identify the role of 3D images in facilitating communication between radiologists and surgeons

#### TABLE OF CONTENTS/OUTLINE

Surgical planning using imaging methods has become increasingly relevant with the advancement of robotic thoracic surgery and sublobar resections for the treatment of lung neoplasms, which has driven the growth of 3D reconstructions. A pictorial essay based on cases from our collection allows for a comprehensive assessment and understanding of:- Historical evolution of pulmonary lobectomy and current main indications for sublobar resections.- Benefits of 3D surgical planning. - How we do our 3D reconstructions with explaining videos.- Application of 3D reconstructions in robotic surgery consoles.- Radiological findings of 3D reconstructions with surgically relevant anatomical variations and bronchovascular relationships- 3D reconstruction findings with nodule volumetric and density analysis, lung segments volumetry and intersegmental resection planes

#### CHEE-48 The Role of Imaging in Bronchoscopic Lung Volume Reduction Using Endobronchial Valves

Participants

Yogesh Gupta, DO, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Provide a background on the various lung volume reduction techniques and their efficacy in the treatment of COPD with a focus on bronchoscopic lung volume reduction (BLVR) using endobronchial valves (EBV) 2. Discuss important imaging parameters in preprocedural assessment with attention to target lobe selection as well as exclusion criteria 3. Present expected postprocedural imaging findings as well as various postprocedural complications with imaging correlates

#### TABLE OF CONTENTS/OUTLINE

Of the various BLVR techniques, EBVs have the largest body of scientific data to support their safety and efficacy. Imaging plays a central role both prior to the procedure - in determining the presence of contraindications and selecting the target lobe using CT -- as well as after the procedure - in determining whether the procedure was effective and characterizing potential complications using radiography and/or CT. Outline• Overview of indications and types of lung volume reduction• Background on mechanism of action of valves, valve types, and location of valve deployment• Preprocedural role of CT in characterizing emphysema, determining exclusion criteria, and target lobe selection and role of perfusion scintigraphy in further selection• CXR and CT imaging of expected postprocedural findings (i.e. lobar collapse) and potential complications (ex: pneumothorax, infection, valve migration)• Discussion of future directions

#### CHEE-5 Atypical Pulmonary Metastases: Patterns and Clinical Significance

Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

#### TEACHING POINTS

Based on cases from an international cancer referral center, explain:Atypical metastases (morphology, evolution, sources)Clinical implications of atypical patternsAssociated risks of mimics, misdiagnosis, delayed diagnosis

#### TABLE OF CONTENTS/OUTLINE

Atypical morphology and clinical implications:Cannonball, miliary, cavitating, pneumothorax-associated, calcified, ossified, hypervascular, hemorrhagic, airspace, endobronchial, central embolized, peripheral arterial microvascular (including pulmonary tumor thrombotic microangiopathy), endovenular, perilymphatic.Atypical growth rates:Rapid: implications for incorrect pathology (e.g. rhabdoid/sarcomatoid/small cell differentiation), re-biopsy (e.g. small cell transformation), metastatectomy recurrence ratesSlow: e.g. Adenoid Cystic CarcinomaBenign metastases (leiomyoma, meningioma, giant cell tumor, HPV)

#### CHEE-50 Differential Diagnosis of Multiple Subsolid Pulmonary Nodules

Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- There are numerous etiologies to be considered in the differential diagnoses when faced with multiple subsolid nodules at high resolution computed tomography (HRCT).- Surveillance of these nodules should follow the recommendations of the Fleischner Society.- They can represent the initial manifestation of diseases that typically present with a different imaging pattern.- When

discerning upon a possible infectious etiology, the status of the patient as immunocompetent or immunosuppressed is a key to the diagnosis.- There are specific imaging signs and/or association with other conditions that may help narrow the differentials.

#### TABLE OF CONTENTS/OUTLINE

A pattern of multiple subsolid nodules is a diagnostic challenge. There are a plethora of conditions that can present with such characteristics on imaging, even more so when one considers that other imaging patterns may present as multiple subsolid nodules in the initial stages. It is important to understand the possible diagnoses that can present with such a pattern, as well as the recommendations for surveillance and the association with other conditions that may help narrow down the differentials, even to a single entity. In this exhibit, in the format of a pictorial essay, the HRCT pattern of multiple subsolid nodules is revised, as well as the multiple etiologies, manifestations and associations pertinent to the matter.

#### CHEE-51 **Keep an Eye on Diseased Lung: What to Look for in Native Lung After Unilateral Transplantation**

##### TEACHING POINTS

\* One-lung transplantation is a practice aimed at improving the survival of patients with advanced stages of pulmonary disease; its most common indications include COPD, pulmonary fibrosis, and sarcoidosis (in North America). Its practice is becoming more frequent, which has led to knowing with greater certainty both the benefits and complications associated with it. However, complications that preferentially involve the native lung have received less attention.\* Radiologists should be familiar with the most frequent complications in the native lung as well as their chronology and the most frequent form of presentation in the different imaging methods (CT and X-ray).\* Make a quick review of the management and treatment of each of them.

##### TABLE OF CONTENTS/OUTLINE

Introduction, classification, and chronology  
Infections  
Incidence  
Pathophysiology  
RX and CT findings  
Treatment  
Pulmonary thromboembolism  
Incidence  
Pathophysiology  
RX and CT findings  
Treatment  
Tumor  
Incidence  
Pathophysiology  
RX and CT findings  
Treatment  
Hyperinflation  
Incidence  
Pathophysiology  
RX and CT findings  
Treatment  
Pneumothorax  
Incidence  
Pathophysiology  
RX and CT findings  
Treatment

#### CHEE-52 **Collateral Venous Pathways In Superior Vena Cava Obstruction**

Participants

Marta Bueno, MD, Seville, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To describe the different venous collateral routes in superior vena cava obstruction. 2. To relate the level of obstruction with the pattern of collateral vessels. 3. To illustrate some unusual image findings that can occur in superior vena cava syndrome

##### TABLE OF CONTENTS/OUTLINE

1. Anatomy and embryology of superior vena cava  
2. Causes of superior vena cava obstruction  
3. Different patterns of venous collateral pathways depending on the level of blockage  
4. Major collateral pathways  
4.1. Azygos-Hemiazygos system  
4.2. Lateral thoracic route  
4.3. Internal mammary route  
4.4. Anterior cervical route  
4.5. Pericardiophrenic route  
4.6. Vertebral route  
5. Unusual collateral pathways  
5.1. Systemic to pulmonary shunt.  
5.1.1. Anatomic  
5.1.2. Congenital  
5.1.3. Acquired  
5.2. Cavoportal pathways  
5.2.1. Downhill varices  
5.2.2. Caval-superficial-umbilical-portal  
5.2.3. Caval-mammary-phrenic-hepatic capsule-portal  
6. Unusual imaging findings:  
6.1. Reopening of left superior vena cava.  
6.2. Pseudopathologic vertebral body enhancement

#### CHEE-53 **Big Fat Truth: A Pictorial Review of Fat Containing Cardiothoracic Lesions - Practical Guide for Radiologists (Case-based)**

Participants

Iandra Pacheco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Demonstrate a practical guideline with cases to help radiologists with the differential diagnosis of fat containing lesions of the heart and the thorax. Illustrate with didactic cases and review the typical appearance and the main radiological characteristics of cardiothoracic lesions that contain fat.

##### TABLE OF CONTENTS/OUTLINE

INTRODUCTION  
IMAGING GUIDELINE  
Didactic scheme of the main sites of cardiothoracic involvement by fat containing lesions  
DEMONSTRATE DIDACTIC CASES WITH A RADIOLOGICAL REVIEW  
Thoracic duct lipoma  
Pleural lipoma  
Liposarcoma  
Lipoid pneumonia  
Pulmonary hamartoma  
Extramedullary hematopoiesis  
Lipomatous hypertrophy of the interatrial septum  
Arrhythmogenic right ventricular cardiomyopathy  
Cardiac lipoma  
Cardiac rhabdomyoma  
Mediastinal teratoma  
Mediastinal lipomatosis  
Diaphragmatic hernia  
Thymolipoma  
Epicardial fat necrosis

#### CHEE-54 **Unmasking the Silent Killer: Challenges in Lung Cancer Detection due to Underlying Disease, A Case Based Presentation**

##### TEACHING POINTS

1. Lung cancer detection can be challenging when the patient has an underlying disease. This may lead to delays in diagnosing lung cancer, which can be associated with poorer outcomes. 2. Location, shape, border, and size of abnormalities, as well as any associated features should be carefully evaluated. Continuous follow-up and comparison of serial imaging are important. 3. We present lung cancer developed in a variety of underlying diseases/conditions, emphasizing teaching points to help to differentiate lung cancer from underlying lung findings. 4. A multidisciplinary approach involving radiologists, pulmonologists, thoracic surgeons, and oncologists is necessary to ensure an accurate diagnosis and appropriate management plan.

##### TABLE OF CONTENTS/OUTLINE

1. Post-treatment. A) Postsurgical. B) Post-radiation. 2. Infection/inflammation. A) Tree in bud nodularity. B) Pneumonia/consolidation. 3. Aspiration. 4. Atelectasis. A) Post obstructive. B) Dependent. C) Rounded. 5. Systemic Disease. A) Pre-existing cystic lesions. B) Underlying scarring/fibrosis. 6. Normal anatomic variants. A) Lung cancer developing within/near



normal variant.

### **CHEE-55 Chest X-ray and Mediastinal Abnormalities**

Participants

Antonio Nunez Soto, MD, A Coruna, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Plain radiography is still today the most common image technique in our hospitals. It is accessible, inexpensive, painless and non-invasive, providing much information with a great cost-effectiveness ratio. With chest X-ray we can detect and analyze mediastinal pathologies, either suspected or incidental. Recognizing normal mediastinal anatomy and anatomic variants is essential for finding out pathology.

#### **TABLE OF CONTENTS/OUTLINE**

The aim of this poster is to describe the radiological analysis of chest radiography for detecting and diagnosing mediastinal abnormalities. For this purpose, we will show normal mediastinal anatomy and mediastinal lines in chest radiographs, as well as normal changes that we can see in supine X-rays with antero-posterior view instead of postero-anterior. We will explain the radiological signs and features that can help us identify mediastinal abnormalities, with the support of several cases of different pathologies (pneumomediastinum, mediastinal masses, vascular pathologies, diaphragmatic hernia...) from a third-level-hospital. For every case, we will provide the clinical information, the X-ray image, in which we will highlight the radiological signs implicated, and a correlation with other imaging techniques. In all cases, the chest X-rays were essential in the initial management of these patients. This presentation will be of interest for radiologists, resident doctors, medical students and other healthcare professionals. The combination of the theoretical semiology with our collection of cases will provide an easy and approachable way to review the most important mediastinal pathology.

### **CHEE-56 The Sternum: The Forgotten Bone of the Thoracic Cage**

Participants

Lucas Farias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is: 1) To review the normal anatomy of the sternum. 2) To review usual and unusual cases with sternal involvement. 3) To understand the sternum (anatomy and pathologies) by associating schematic drawings with MPR and three-dimensional reconstructions (including animated gif). 4) To correlate important findings with the anatomy, embryology, and pathophysiology. 5) To discuss image findings in order to enhance radiologists' skills. 6) To review CT protocols in the evaluation of patients with suspected coronary artery anomalies. 7) To highlight their characteristics in order to familiarize radiologists with these conditions, preventing unfavorable patient outcome.

#### **TABLE OF CONTENTS/OUTLINE**

1) Imaging protocols in the evaluation of patients with suspected sternal involvement. 2) Applied embryology and anatomy of the sternum. 3) Normal sternal development. 3.1. Anatomical variations. 3.2. Metabolic. 3.3. Vascular. 3.4. Inflammation and infection. 3.5. Trauma. 3.6. Postoperative changes. 3.7. Neoplasm. 4) Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5) Summary and take-home messages.

### **CHEE-57 Pulmonary Edema: You Better Not Drown in the Basics**

Participants

Gabriel Neumann Kuhn, MD, Morro Redondo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purposes of this exhibit are: 1. To elucidate the classification of pulmonary edema according to its pathophysiological mechanisms: - Hydrostatic edema; - Permeability edema without diffuse alveolar damage; - Permeability edema with diffuse alveolar damage; - Mixed edema. 2. Review the use and peculiarities in the main imaging methods for the evaluation of pulmonary edema: - Chest X-ray; - Computed tomography (CT). 3. Highlight the current epidemiological trends and radiological findings associated with the main causes of pulmonary edema.

#### **TABLE OF CONTENTS/OUTLINE**

• Review of thoraco-pulmonary anatomy: - Cardiac silhouette; - Pulmonary interstitium; - Pulmonary vascular markings; - Costophrenic angles. • Demonstration of the main radiological findings of pulmonary edema: - Alveolar edema; - Kerley B lines; - Opacities; - Consolidations; - Ground-glass opacities. • Demonstration of common and uncommon conditions that cause pulmonary edema from our clinical case collection, such as: - Cardiogenic pulmonary edema (left heart failure, mitral regurgitation, etc.); - Postobstructive pulmonary edema; - Pulmonary edema in pulmonary thromboembolism; - Pulmonary edema in drug abuse; - Post-lung transplant pulmonary edema; - Re-expansion pulmonary edema; - Neurogenic pulmonary edema.

### **CHEE-58 Multifocal Cystic and Cavitory Lung Disease: From Thin to Thick**

Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to: - Review cystic and cavitory lung disease and a general approach to focal and multifocal/diffuse forms. - Highlight the evaluation of the wall of focal aerated lung lesions and comprehend the imaging findings in thin-walled, thick-walled cysts and cavitory lung lesions. - Correlate the radiological characteristics with the main differential diagnoses and signs of malignancy. - Identify the important imaging findings addressed in cystic lesions of the new Lung-RADS v.2022

#### **TABLE OF CONTENTS/OUTLINE**

Cysts and cavities are commonly encountered abnormalities on chest CT. Occasionally, the underlying nature of the lesions can be readily apparent as in bullae associated with emphysema. Other times, cystic and cavitory lung lesions can be a diagnostic

challenge. A pictorial essay based on cases from our collection allows a comprehensive evaluation and understanding of:- General approach to focal and diffuse cystic and cavitory lung diseases. - Propose an algorithm to facilitate the evaluation of focal cystic lesions and cavities. - Evaluation and differential diagnosis of focal thin-walled cystic lesions. - Evaluation and differential diagnosis of focal pulmonary thick-walled cysts and cavitations. - Imaging findings of focal cystic lesions correlated with Lung-RADS v.2022

### **CHEE-59 Imaging of the Diaphragm: Anatomy and Disorders**

Participants

Miriam Gallego Casals, MD, Sabadell, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The diaphragm is the physical barrier that separates the thorax from the abdomen and is the main muscle involved in ventilation. Its dysfunction can be a cause of dyspnea, and despite its importance, it is often underrated and incompletely evaluated by clinicians as well as by radiologists. We will briefly describe the anatomy of the diaphragm, and discuss its abnormalities through cases, classified as:- Dysfunction: paralysis, weakness or eventration and consequences of diaphragmatic inversion.- Hernias: congenital (Morgagni, Bochdalek) and acquired.- Rupture: traumatic and post-surgery.- Secondary: neoplastic and infectious involvement by contiguity from the abdominal cavity.- Miscellanea: Median arcuate ligament syndrome and increased uptake on PET/CT (respiratory effort, hiipo). Finally, we explain the main imaging techniques we have for both the functional and morphological study of the diaphragm, including chest radiographs, fluoroscopic tests, ultrasounds and CT.

#### **TABLE OF CONTENTS/OUTLINE**

- To describe the anatomy and physiology of the diaphragm.- To review the primary diaphragm disorders.- Learn the image techniques available for its study.

### **CHEE-6 Imaging Findings of Autoimmune Disorders: A Primer for Residents**

Participants

Furkan Ufuk, MD, Denizli, Turkey (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To provide an overview of autoimmune disorders, focusing on the most common conditions encountered in clinical practice. - To provide a primer on the imaging features of autoimmune disorders.

#### **TABLE OF CONTENTS/OUTLINE**

Autoimmune disorders are a diverse group of conditions in which the body's immune system attacks its own tissues, resulting in inflammation and damage. The spectrum of autoimmune disorders is broad, ranging from systemic diseases such as systemic lupus erythematosus and rheumatoid arthritis to organ-specific diseases such as autoimmune pancreatitis. Imaging plays a crucial role in the diagnosis and management of autoimmune disorders. This exhibit will provide a comprehensive overview of the imaging findings of autoimmune disorders and will highlight the importance of recognizing these findings in the diagnosis and management of these conditions. By the end of the exhibit, residents will have a better understanding of the role of radiologic imaging in the diagnosis and management of autoimmune disorders.

### **CHEE-60 Unmasking Septal Thickening: An Accessible Diagnostic Guide**

Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To differentiate the various patterns of septal thickening and their association with several interstitial lung diseases. To understand the pathophysiological basis of this finding. To provide a systematic and understandable guide to address the diagnostic dilemma.

#### **TABLE OF CONTENTS/OUTLINE**

Septal thickening of the lung can be the common radiological expression for many processes of different etiologies and variable severity, including pulmonary edema, lymphangitic tumor, sarcoidosis, asbestosis, amyloidosis or Erdheim-Chester disease among others. Due to the wide differential diagnosis that it poses, its presence is often perceived as confusing and challenging. To face this crossroads we must tackle it from its origin, so both the understanding of the underlying pathophysiological fundamentals and the recognition of ancillary imaging signs must be the objective of our study and the pillar for an adequate diagnostic approach. The goal of this work is to provide a tool that may help unmask the enigma: a systematic and understandable review of the different manifestations of septal thickening, focused on the underlying physiological background and exemplified with illustrative cases from our hospital.

### **CHEE-61 Take My Breath Away: MR Lungs from Maverick towards Mainstream, and Maybe Top Gun?**

Participants

Nicholas Bontrager, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

MRI for evaluation of the pulmonary parenchyma and vessels is a viable alternative to CT that eliminates patient exposure to ionizing radiation, and that can be performed using the magnet you have, sequences you already use, and table times under 20 minutes per complete exam. Pulmonary MRI and MRA have been shown to be effective for evaluation of cystic fibrosis, lung cancer screening, pulmonary nodule and mass evaluation, pulmonary embolism, and more. For lung cancer screening, pulmonary MRI has been found to have equivalent life expectancy with favorable cost-effectiveness and fewer false-positives when compared to low-dose CT. Restricted diffusion is likely more specific to lung cancer than FDG avidity on PET CT. MRA for PE has similar sensitivity, specificity and patient outcomes at 6 months, when compared to CTA.

#### **TABLE OF CONTENTS/OUTLINE**

- MR Sequence Protocol for Evaluation of Lung Parenchyma. - Cases: Primary Lung Cancer, Pulmonary Nodules, Metastases. - MRA Sequence Protocols for Pulmonary Embolism, with gadolinium-based contrast agent and with ferumoxytol (off-label). - More Cases:

PE with GBCA MRA, PE in Pregnant Patient with ferumoxytol MRA, Incidental Findings. - Limitations of MR evaluation of the lungs and pulmonary vessels. - The future of MR evaluation of the lungs.

## **CHEE-62 A Case Based Review of Chest Wall Masses: Multimodality Imaging and Differential Diagnosis**

Participants

Sehar Salman, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The goal of this presentation is to review clinical manifestations and radiologic findings of chest wall lesions. Many of these masses are discovered incidentally on routine chest imaging, and it is important for the interpreting radiologist to be able to recognize benign, indeterminate, and malignant features in order to guide management. In a series of cases, we will present different diagnoses of chest wall masses including both common and uncommon pathologies, to illustrate the spectrum of findings. After this presentation, learners should be familiar with chest wall anatomy, be able to describe imaging characteristics of lesions on multiple modalities, provide differential diagnoses, recognize indications for biopsy, and ultimately have a framework for approaching these masses.

### **TABLE OF CONTENTS/OUTLINE**

Background - Chest wall anatomy on ultrasound, CT, and MRI - The spectrum of chest wall pathologies (benign, malignant)- fat, fluid, soft tissue, bone  
Cases: lipoma, hematoma, elastofibroma dorsi, neurofibroma, fibrous dysplasia, desmoid fibromatosis, myxofibrosarcoma, metastatic disease - For each case: Clinical scenarios, multimodality imaging findings, differential - Indeterminate and malignant cases: biopsy indications, biopsy results, pathologic correlation (when available)  
Summarize key features and classic differential diagnoses  
Radiologic and clinical management of chest wall masses

## **CHEE-63 A CT Imaging Roadmap for Hemoptysis: from Etiology to Treatment Complications**

Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purpose of this exhibition is:  
• To review the most common causes of hemoptysis in clinical practice;  
• To illustrate the role of CT imaging for the evaluation of patients with hemoptysis;  
• To provide a systematic approach on hemoptysis imaging evaluation, highlighting key findings for an accurate diagnosis;  
• To explain the main therapeutic modalities employed in the treatment of hemoptysis.

### **TABLE OF CONTENTS/OUTLINE**

1. INTRODUCTION  
a. Epidemiology  
b. Vascular anatomy  
c. Physiopathology  
2. CT IMAGING: AN ETIOLOGY BASED REVIEW  
a. Infectious  
b. Inflammatory  
c. Vasculitis  
d. Congenital  
e. Neoplastic  
f. Other causes  
3. THERAPEUTIC MODALITIES  
a. Indications  
b. Techniques  
c. Complications  
4. SYSTEMATIC APPROACH: A ROADMAP  
5. SUMMARY AND TAKE-HOME MESSAGES

## **CHEE-64 Respiratory Complications from Burns Injury: A Pictorial Review**

### **TEACHING POINTS**

• Acute complications are almost always associated with smoke inhalation injury.  
• When acute lobar collapse cannot be explained by a malpositioned ETT, prompt bronchoscopy is required to assess for bronchial eschars or inspissated secretions from bronchorrhea.  
• In the subacute phase, short interval changes in heart size, parenchymal opacities and pleural effusions favors cardiogenic edema.  
• Expiratory CT is useful in assessing burns-induced chronic airways disease including tracheomalacia, bronchial webs and obliterative bronchiolitis.

### **TABLE OF CONTENTS/OUTLINE**

As many as 91% of deaths in burn patients are a result of respiratory complications. Understanding the spectrum of respiratory complications, their onset and evolution of changes over time is important in early and accurate imaging interpretation. This pictorial review aims to educate and familiarize readers with common and uncommon burns-related complications that may be detected on chest imaging. As multiple disease processes have overlapping imaging appearances, we have classified complications temporally into acute, subacute and delayed phases, and spatially classified complications according to the anatomical structures affected. This structured approach to imaging interpretation serves to facilitate understanding and provide readers with a practical approach to imaging interpretation in burns patients.

## **CHEE-65 Consolidation of Post-Lung Transplant Complications, Throughout Post-operative Course**

### **TEACHING POINTS**

Lung transplantation is a life-saving procedure for end-stage lung diseases and has been shown to improve quality of life. Currently, the median post-lung transplant survival is roughly 6 years. However, it is associated with various complications that can significantly impact post-transplant outcomes. The purposes of this exhibit are to: (1) Recall the many pathologic complications that arise with Lung Transplantation, (2) Evaluate and identify the radiological features associated with Lung Transplant complications, (3) Review the role of imaging in the diagnosis and management of these complications.

### **TABLE OF CONTENTS/OUTLINE**

Immediate and Early Postoperative Period (First 24 hours to First Week)  
Primary Graft Dysfunction  
Rejection  
Acute Rejection  
Hyperacute Rejection  
Pleural Complications  
Pleural Effusion  
Pleural Fistula  
Hemothorax  
Pneumothorax  
Intermediate Period (1 week to 4 months)  
Anastomotic (Airway) Dehiscence  
Stenosis  
Airway Stenosis  
Pulmonary Artery Stenosis  
Pulmonary Infections  
Candida  
CMV  
Aspergillus  
Late Periods (After 4 months)  
Pulmonary Infections  
Mycobacterial  
IRSV  
Chronic Lung Allograft Dysfunction (CLAD)  
Post-Transplant Lymphoproliferative Disorder (PTLD)

## **CHEE-66 Assessment of Both Fibrosis and Vascular Disease in Systemic Sclerosis: The Pivotal Role of the Radiologist and Future Perspectives**

Participants

Carlotta Zilioli, MD, Parma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To be informed of the fundamental pathogenic pathways of systemic sclerosis (SSc).- To be aware that, among the autoimmune rheumatic disease, SSc has the highest mortality due to lung complications, which mainly are fibrosis and pulmonary hypertension (PH).- To illustrate the radiological spectrum of thoracic manifestations in SSc.- To be informed about the recent advances in the imaging techniques, with specific attention to quantitative analysis, to early diagnose and monitor disease activity.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction:- Overview of underlying pathophysiology of SSc: endothelial and fibroblast dysfunction, leading to fibrosis.- Description of pulmonary manifestations of SSc, focusing on the leading cause of death: interstitial lung disease (ILD) and pulmonary hypertension (PH). 2. The use of high-resolution CT in the diagnosis of progressive SSc, particularly to early stages of ILD:- NSIP as the main histologic pattern: key finding - Other HRCT findings: pleural and pericardial, esophageal dilatation. 3. Description of the hallmark of PH:- Key findings on HRCT - Role of dual-energy CT angiography. 4. The emerging use of automated software to perform quantitative analyses on in SSc, correlating quantitative vessel parameters with ILD features.

#### CHEE-67 A Step-by-Step Approach to Pulmonary Fibrosis: What the General Radiologist Should Know

Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Expose the imaging modalities used in interstitial lung disease assessment. Provide a stepwise approach to identify the features of fibrotic lung disease and categorize the pattern of fibrosis. Review the radiological features of idiopathic pulmonary fibrosis (IPF) and the principal differential diagnoses, focusing on their distinctive features based on high-resolution computed tomography (HRCT).

#### TABLE OF CONTENTS/OUTLINE

Diffuse interstitial lung disease encompasses a heterogeneous group of processes characterized by a concrete pulmonary response to damage affecting the pulmonary interstitium and the secondary pulmonary lobule. IPF is a progressive chronic interstitial fibrotic lung disease of unknown etiology characterized by nonspecific clinical manifestations, a restrictive pattern in pulmonary function tests, and a poor prognosis. The morphologic hallmark in imaging and histopathology of IPF is the UIP pattern, characterized by subpleural reticulation, traction bronchiectasis, and honeycombing with an apex-to-basal gradient. However, it may also be present in several conditions, including asbestosis, chronic hypersensitivity pneumonitis, or connective tissue diseases. Definitive diagnosis requires clinical-radiological-pathological consistency, with imaging playing a pivotal role. An accurate classification based on the CT pattern enables early detection of fibrosis, distinguishing the UIP pattern from those that suggest an alternative diagnosis, determining the need for biopsy, and guiding subsequent treatment. We collected representative cases of pulmonary fibrosis from our institution to highlight the hallmark imaging findings that leads to accurate diagnosis.

#### CHEE-68 Through the Eye of the Needle: An Evidence-based Approach to the Benefits, Risks, and Controversies of CT-Guided Lung Biopsy

Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

CT-guided lung biopsy is a vital tool in the diagnostic armamentarium of physicians involved in the workup of pulmonary lesions in a variety of clinical settings. Having a clear understanding of the benefits, yield, and risks of CT-guided lung biopsy is important in optimizing utility of this diagnostic test and minimizing adverse outcomes. We present current evidence in the literature as it relates to benefits/yield, risks and risk reduction, and controversies in lung biopsy.

#### TABLE OF CONTENTS/OUTLINE

1. Title and disclosures 2. Abbreviations 3. Table of contents 4. Overview 5. Indications a. List of indications b. Pre-test probability c. Negative predictive value d. Diagnostic accuracy 6. Risk/reduction a. Pneumothorax b. Hemorrhage c. Air embolism 7. Controversies a. Role of CT vs bronchoscopic biopsy b. Appropriate needle size c. FNA vs core needle biopsy d. Biopsy of subsolid nodule e. Biopsy of suspected infection f. Biopsy of cavitory nodule g. Repeat biopsy after non-diagnostic result h. Biopsy in setting of pulmonary hypertension i. Biopsy in setting of fibrotic ILD j. Tumor seeding k. Techniques to avoid complications i. Utility of blood patch/plug ii. Rapid rollover iii. Intrapulmonary length 8. Summary 9. References

#### CHEE-69 To Protect and to Serve: Imaging Review of the Sternum for the Thoracic Radiologist

Participants

Michelle Bondero, MD, MSc, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The sternum "protects" the vital cardiovascular organs, "serves" as a mirror to reflect diffuse bone disorders, and may uncommonly be affected by isolated lesions. These conditions may present as non-specific chest pain, which is a common patient presentation in clinical practice. Furthermore, given its central location, the sternum is included on nearly all thoracic imaging, be that a radiograph, CT, or MR. Due to thoracic radiologists' predominant reliance on axial images and focus on the inner organs, it may be neglected in a speedy review and important diagnostic information may be missed. The goal is to (1) explain the anatomy and development of the sternum; (2) describe dedicated imaging approaches; as well as (3) define and depict the major disease processes that can be diagnosed on radiological imaging, as outlined below. In addition to the rich imaging illustration, multiple less common but important diseases will be included with corresponding clinical and surgico-pathologic correlation, when available. Board-exam questions will also be provided to emphasize key principles.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy (bony components, articulations). 2. Imaging (XR, CT, MR, US and NM). 3. Cases: a. Congenital: variants and anomalies; b. Traumatic (fractures); c. Infectious (osteomyelitis); d. Neoplastic (primary and mets); e. Metabolic (Paget's disease, renal osteodystrophy, sickle cell disease, osteopetrosis). 4. Peri-sternal joint disease (osteoarthritis, septic arthritis, inflammatory

arthritides, SAPHO). 5. Pre- and post-surgical (sternotomy, expected findings, complications, sternal measurements prior to cardiac surgery). 6. Post-radiation. 7. Artifacts.

## **CHEE-7 Dual Energy Chest Radiography in Oncological Practice**

Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

### **TEACHING POINTS**

Based on CXR implementation in a tertiary cancer center:CXR dual energy principles and techniquesPractical implementation for improved detection and accuracy, characterization, increased confidence, problem solving on chest radiographsAdvantages, disadvantages and limitations

### **TABLE OF CONTENTS/OUTLINE**

CXR Dual Energy Techniques (single exposure (SE), dual exposure (DE), weighted subtraction), new AI single exposure techniquesSoft tissue and bone-selective imagesAdvantages and disadvantages of SE DE (associated artifact recognition), dosimetryImproved lesion detection, confidence, additional lesions, growth determinationLesion characterization (soft tissue, calcification)Calcified lesions (mediastinum, lung, pleura)Bone metastases and other osseous conditions (pathological fractures, periosteal reactions, lytic lesions)Specific areas: Evaluation of the apices, cardiomeastinum, drug induced lung disease, postoperative pneumothoraxComplex evaluation: impact on accuracy, distracting pathology, missed findings, interpretation time

## **CHEE-70 Targeting the Unknown: A Stepwise Approach to CT-Guided Biopsy of Cavitory Lung Nodules**

Participants

Abhay Dhaliwal, MD, Bloomfield Hills, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-To review categories of inciting conditions that can lead to cavitory pulmonary nodules. -To discuss the role and technique of CT guided percutaneous trans-thoracic needle biopsy (PTNB) of cavitory nodules in the aid of diagnosis, ranging from pre-biopsy workup to post biopsy care. -To review the risks and complications associated with CT guided PTNB of cavitory nodules, and methods to minimize risk and manage complications. -To illustrate and discuss the key imaging features of pathology proven cases of processes that can present with cavitory pulmonary nodules, including infections (such as actinomyces and tuberculosis), inflammatory conditions (such as granulomatosis with polyangiitis and rheumatoid arthritis), and malignancies (such as primary and metastatic processes).

### **TABLE OF CONTENTS/OUTLINE**

Definition of cavity, biopsy materials, pre-biopsy work up, patient counseling, biopsy set up/technique, post-biopsy care, biopsy outcomes, biopsy risks/complications, management of complications, rad path correlation

## **CHEE-71 Avoiding Tunnel Vision: Looking Beyond Anatomic Specialization Boundaries**

Participants

Elizabeth Lee, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. While radiological sub specialization is advantageous and has firmly integrated radiologists in multidisciplinary teams, there is a potential for missed diagnoses when various anatomic regions of a cross-sectional study are interpreted separately by specialists. This is particularly relevant for junctional regions (such as diaphragm when chest and abdomen imaging are interpreted by chest and body radiologists).2. Variations in scan factors and contrast timing (for instance chest and abdominal imaging may be obtained at different phases of enhancement) can facilitate diagnosis.3. Even if studies are separately interpreted and dictated, it is important for specialists to avoid tunnel vision and check pertinent information.

### **TABLE OF CONTENTS/OUTLINE**

1. No man's zone: Junctional zones between two anatomical regions can be a cause of missed opportunities. For instance, lower ribs may only be partly included in chest CT and may be overlooked on an abdominal scan.2. Integration of imaging findings from various anatomic regions can provide a unifying diagnosis: Several diseases are multisystem pathologies, and the diagnostic process is facilitated by knowledge of involvement of other anatomic regions. Examples include neurofibromatosis, Birt-Hogg-Dube syndrome, embolized fragment of a device, etc.3. Differences in phase of enhancement: This can help in localizing as well as accurately characterizing an abnormality that is better seen on a specific phase of enhancement.4. Differences in patient positioning Arms up and arms down position for two different scans can uncover an unsuspected thoracic outlet syndrome.5. Correlating with all available imaging modalities

## **CHEE-72 Noninfectious Pulmonary Complications Following Hematopoietic Stem Cell Transplant**

Participants

Elizabeth Lee, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. There is an increase in the indications for, the potential recipient age and sources from which hematopoietic stem cell transplantation (HSCT) can be performed, with increasing numbers of the procedure performed yearly across the globe. 2. Up to one third of patients undergoing HSCT develop pulmonary complications with the rates of infectious pulmonary complications decreasing due to improvements in prophylaxis and treatment. 3. The rate of noninfectious complications has risen and now is a more common cause of death than those from infection. 4. There are a variety of noninfectious pulmonary complications which can be seen after HSCT including idiopathic pneumonia syndrome, bronchiolitis obliterans syndrome, thoracic air leak syndrome, venous thromboembolism, and pulmonary hypertension. 5. Idiopathic pneumonia syndrome has a varied presentations depending on the site of primary tissue injury which results in a varied imaging appearance such as diffuse alveolar hemorrhage or peri-engraftment respiratory distress syndrome.

### **TABLE OF CONTENTS/OUTLINE**

1. General review of hematopoietic stem cell transplantation 2. Idiopathic Pneumonia Syndrome (Acute interstitial pneumonitis, Acute respiratory distress syndrome, Delayed pulmonary toxicity syndrome, Peri-engraftment respiratory distress syndrome, Diffuse alveolar hemorrhage) 3. Bronchiolitis obliterans syndrome 4. Interstitial lung disease 5. Pleural effusions 6. Thoracic air leak syndrome 7. Venous thromboembolism 8. Pulmonary hypertension 9. Post-transplant lymphoproliferative disorder

### **CHEE-73 Bad to the Bone: Differentiating Pulmonary Ossification from Calcification on CT**

Participants

Kendrah Osei, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. The pathogenesis of pulmonary ossification and calcification is incompletely understood. 2. Pulmonary calcification and ossification can occur in both pulmonary and non-pulmonary conditions, including benign, malignant, inflammatory, infectious, and metabolic etiologies. 3. High-resolution CT imaging is important to differentiate conditions that cause dendriform pulmonary ossification and those that do not. 4. Multi-society consensus guidelines now include pulmonary ossification among high-confidence CT features of usual interstitial pneumonitis (UIP) pattern of idiopathic pulmonary fibrosis.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definitions of pulmonary calcification, pulmonary ossification, and dendriform pulmonary ossification. 2. Pathogenesis of pulmonary calcification and ossification. 3. Causes of pulmonary calcification and ossification. 4. Imaging patterns of pulmonary calcification and ossification. 5. Dendriform pulmonary ossification as a diagnostic imaging feature of idiopathic pulmonary fibrosis. 6. Clinical impact of recognizing dendriform pulmonary ossification. 7. References.

### **CHEE-74 Thoracic Complications of Sickle Cell Disease**

Participants

Malcolm Davidson, Mississauga, ON (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1 Acute chest syndrome is a leading cause of morbidity and mortality, and is characterized by the development of a new lung opacity along with fever and/or respiratory symptoms. The most common causes include infection, fat embolism, and infarction. 2 Sickle cell patients are functionally asplenic and immune compromised, making them vulnerable to pneumonia and other infections from encapsulated and atypical bacteria - a leading cause of mortality in this population. 3 Repeated pulmonary insults in sickle cell patients can lead to chronic pulmonary findings, such as pulmonary fibrosis. 4 Pulmonary embolism is more common in patients with sickle cell disease and can contribute to pulmonary hypertension (PH). PH is present in approximately 10% of sickle cell patients, and is often multifactorial in etiology (WHO group 5). Pulmonary artery dilation is associated with worse outcomes in those presenting with acute chest syndrome. 5 Bone complications in sickle cell disease can present similarly to acute chest syndrome. Patients in this population are at higher risk for osteomyelitis, and osteomyelitis should be considered if bone pain is atypical or if there are other supporting signs, symptoms, or imaging features.

#### **TABLE OF CONTENTS/OUTLINE**

1. Sickle Cell Pathophysiology 2. Acute Complications - Vaso-occlusive events, acute chest syndrome, infection 3. Chronic Complications - Lung fibrosis, cardiomyopathy, pulmonary hypertension, bone infarction

### **CHEE-75 Embracing Automation: Designing and Implementing a Robust Continuous Monitoring System for AI-Powered Radiology Applications**

Participants

Vasanth Venugopal, MD, New Delhi, India (*Presenter*) Officer, CARPL.AI Inc

#### **TEACHING POINTS**

1. Continuous monitoring is vital for AI-driven radiology platform performance and reliability. 2. Identify KPIs and benchmarks to measure AI application metrics, such as accuracy, sensitivity, and specificity in radiology. 3. Implement automated QA/QC mechanisms, like image quality checks and data validation, ensuring consistent, complete input data following standard protocols. 4. Use advanced monitoring techniques, like measuring model divergence, to detect and address model drift caused by input data changes or other factors.

#### **TABLE OF CONTENTS/OUTLINE**

I. Key Performance Indicators (KPIs) and Benchmarks A. Identifying relevant clinical and non-clinical KPIs B. Establishing performance benchmarks for AI applications II. Automated Quality Assurance and Quality Control A. Automated QA/QC mechanisms for image quality and artifacts B. Data validation techniques for ensuring input data integrity III. Performance Monitoring and Anomaly Detection A. Real-time monitoring of KPIs and other relevant metrics B. Anomaly detection algorithms for identifying unusual patterns or behaviors IV. Advanced Monitoring Techniques A. Measuring divergence between multiple models B. Benefits and challenges of using advanced monitoring techniques V. Continuous Improvement A. Iterative model development, performance evaluation, and updating B. Real-world performance data Collection VI. Regulatory Compliance and Periodic Reviews A. Ensuring monitoring system adherence to regulatory requirements B. Conducting periodic audits and reviews

### **CHEE-76 Imaging Findings in Bronchiectasis-Associated Diseases: A Comparison with Pathophysiology.**

#### **TEACHING POINTS**

Teaching Points (1) Bronchiectasis is a condition characterized by irreversible dilation of the bronchi. CT imaging categorizes it into three types: cylindrical, varicose, and cystic. (2) Bronchiectasis can occur in various disease groups, making its diagnosis challenging due to its diversity. (3) Understanding the relationship between the underlying pathophysiology and imaging findings is crucial.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline (1) About bronchiectasis (2) Congenital bronchial anomalies (3) Mucociliary transport disorder (4) Immune

hypersensitivity (5) Immune deficiency (6) Connective tissue disorder (7) Infectious disease (8) Others (9) Summary

## **CHEE-77 Manifestations of Sickle Cell Disease on Thoracic Imaging**

### **TEACHING POINTS**

- Sickle cell disease (SCD) is a systemic disease that has a wide spectrum of pulmonary, soft tissue, skeletal, and upper abdominal findings that can be seen on thoracic imaging.- There is commonly an overlap between findings of the milder pneumonia and the more clinically severe acute chest syndrome. However, knowledge of some findings can favor one diagnosis over the other.- Over time, SCD can result in chronic changes to the lung parenchyma.

### **TABLE OF CONTENTS/OUTLINE**

1. Introductiona. Backgroundb. Epidemiology, genetics, and pathogenesis of sickle cell disease2. Acute manifestationsa. Spectrum of acute chest syndrome and pneumonia• Findings on chest radiograph and CT that could aid in the diagnosis• Etiologies of pneumonia (e.g, streptococcus pneumoniae, Hemophilus influenzae, etc.)b. Pulmonary edemac. Pulmonary thromboembolism3. Chronic manifestationsa. Cardiomegalyb. Pulmonary hypertensionc. Pulmonary fibrosis, cysts, and mosaic attenuation4. Other manifestations seen on thoracic imaginga. Skeletal and soft tissue manifestations (avascular necrosis of humeral heads, extramedullary hematopoiesis, "H-shape" vertebrae, osteomyelitis)b. Upper abdominal manifestations (Splenic auto-infarction, cirrhosis, iron deposition)5. Prognosis and treatment6. Conclusion

## **CHEE-78 Post-treatment Thoracic Changes in Breast Cancer Patients**

Participants

Eloy Naranjo Moreno, MD, Mataro, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The goal of this exhibit is to provide an interactive and visual review of thoracic changes (surgical and after hormonal/chemotherapeutic treatments) that we can find in breast cancer patients who have undergone treatment or who are currently doing it. Nowadays, thanks to screening programs, breast cancer is a common pathology detected and treated precociously in many cases. This exhibit aims to present an illustrative compilation of thoracic and pulmonary changes in breast cancer treated patients; providing an algorithmic approach of these radiologic changes based on progression time and location in the lung; reviewing the most meaningful findings to allow radiologists to differentiate them from the general thoracic pathology. Post-treatment radiologic computed tomography (CT) changes in breast cancer include post-surgical changes (like removal and reconstruction of the affected breast), changes after and during hormonal/chemotherapy (appearance of interstitial pathology and other common signs in the lung) and post-radiotherapy changes (identifying irradiation regions and their findings correlation over time) that can be effectively identified through chest CT.

### **TABLE OF CONTENTS/OUTLINE**

Introduction and purpose / Background / Image findings: Post-surgical changes, changes after and during hormonal/chemotherapy and post-radiotherapy changes / Conclusion.

## **CHEE-79 Don't Forget to Check the Sternum After Thoracic Surgery: Expected Postsurgical Changes and Complications of Sternotomy and Sternal Wound Repair**

Participants

Zehavit Kirshenboim, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Various chest wall surgical methods are being used for the sternotomy for thoracic surgery.2. Identification of complications can be difficult due to a nonspecific clinical presentation which frequently overlaps with normal postsurgical changes. 3. Knowledge of expected postsurgical sternotomy imaging appearance is crucial to avoid misinterpretation and detect complications in a timely manner.

### **TABLE OF CONTENTS/OUTLINE**

1. Various sternotomy techniques, surgical methods for sternotomy wound repair and complications will be illustrated. A. Surgical techniques 1. Longitudinal vs. transverse 2. Sternal wiring vs. rigid sternal fixation 3. Debridement and sternal flap closure B. Complications 1. Pre-sternal complication - cellulitis, sinus tract 2. Sternal complication - nonunion, dehiscence, osteomyelitis, wire fracture and migration 3. Post sternal complication - mediastinitis, retrosternal abscess, empyema, retrosternal hematoma, sternal adhesion 4. Flap complication - bowel herniation, flap failure C. How to differentiate expected postsurgical appearances vs. complications 2. Strategies to detect complications, differential diagnosis - sternal metastasis, infected epicardial lead 3. Clinical implications and treatment of complications

## **CHEE-8 Into the Airway: Focal Tumors and Non-neoplastic Disorders (Detected by CT) Arising from the Bronchi**

Participants

Uxue Martinez Urabayen, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To review the multiple focal lesions that can originate in the airway, including the non-neoplastic lesions and the benign and malignant tumours. To describe and illustrate the main characteristics signs and imagine findings that may improve detection of the lesions, improving the management of this patients.

### **TABLE OF CONTENTS/OUTLINE**

**METHODS OR BACKGROUND** Neoplastic and non-neoplastic lesions of the airway track are rare. The majority are malignant. The diagnosis tends to be delayed due to the few and nonspecific symptoms. Chest radiographs are rarely diagnostic. **RESULTS OR FINDINGS** At CT benign and malignant tumours may have nonspecific characteristics, presenting as polypoid lesions or focal sessile lesions that narrow the airway lumen. Even non-neoplastic disorders may be identical. Mucus plugs have internal gas. Blood is indistinguishable from other endobronchial material. Broncholiths present calcification. Foreign bodies depend on the component of

which they are made of. Lipomas have internal fat and hamartomas are characterized by "popcorn" calcifications. Leiomyomas and papillomas look very much alike. Squamous cell carcinoma is the most common subtype of lung cancer that affects the central airway system. Carcinoid tumours tend to have intense enhancement at contrast material-enhanced CT and may present calcifications. Metastasis due to hematogenous invasion are usually multifocal. CONCLUSION The airway must be carefully evaluated on CT examinations to appreciate the slight differences in morphology of the lesions occupying the lumen. Knowing the Morphological characteristic and location of these lesions can help reduce the broad spectrum of differential diagnosis.

### **CHEE-80 Functional Lung MRI: How to Obtain Ventilation-Weighted Images from UTE MRI.**

Participants

Julius Heidenreich, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. The reader should learn about the prerequisites that are necessary for functional lung imaging (technical requirements, sequences, data types).2. The reader should understand that the basic post processing steps comprise (1: labelling of lung parenchyma; 2: image co-registration; 3: voxel-wise calculation of fractional ventilation.3. The reader should learn to interpret ventilation imaging and be able to distinguish ventilation maps from healthy subjects and patients with cystic fibrosis.4. The reader should know about pitfalls and limitations of UTE ventilation imaging and know about the alternative techniques.5. The exhibit should highlight the potential benefit of ventilation imaging. The reader should be able to understand its significance and the recent areas of application.

#### **TABLE OF CONTENTS/OUTLINE**

A. Introduction, Background and Purpose: Why is ventilation imaging relevant? B. Technical requirements: What images have to be acquired? C. Post-processing: What are the basic steps of data processing? D. Data analysis and calculation of fractional ventilation and lung function parameters. E. Image analysis: Healthy subjects vs. patients. What is the difference? F. Pitfalls and limitations. What are the alternatives?

### **CHEE-81 No Small Matter: Thoracic Manifestations of Small Vessel Vasculitis**

Participants

Sofia Gambetta I, MD, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

We will review epidemiology, clinical features and imaging manifestations of ANCA associated small vessel vasculitis in the thorax.Teaching points:1. Granulomatosis with polyangiitis presents with diverse pulmonary and airway involvement: tracheobronchial wall thickening/stenosis, lung nodules and masses that cavitate or present with ground glass halo, bronchovascular thickening or alveolar hemorrhage.2. Microscopic polyangiitis can be divided into two groups: alveolar hemorrhage and interstitial lung disease. a. 4 to 36% of patients with interstitial pneumonia at presentation have MPO-ANCA antibodies. b. Up to 10% of patients with IPF seroconvert to MPO-ANCA. c. UIP and probable UIP are the most common patterns of MPO-ANCA ILD.3. EGPA patients can be ANCA negative (eosinophilic manifestations) or ANCA positive (vasculitis features). a. Cardiac manifestations are more common than in other ANCA vasculitis and indicator of poor prognosis. b. Pulmonary manifestations include migratory/peripheral consolidations, GGOs and centrilobular nodules.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview of small vessel vasculitis. a. Etiology and Pathogenesis. b. Epidemiology. c. Serological findings2. GPA a. Clinical manifestations. b. Airway involvement. c. Pulmonary manifestations. d. Cardiac involvement3. MPA. a.Clinical manifestations. b. Pulmonary manifestations. i. MPO-ANCA associated ILD ii. Alveolar hemorrhage and hemosiderosis4. EGPA. a. Clinical manifestations. i. ANCA positive EGPA ii. ANCA negative EGPA. b. Pulmonary manifestations c. Cardiac manifestations. i. Myocarditis ii. Endocardial fibrosis iii. Pericarditis 5. Differential diagnosis

### **CHEE-82 Hypersensitivity Pneumonitis: Correlation of Radiologic and Pathologic Findings, Diagnostic Criteria and Recommendations According to the Latest Guidelines**

#### **TEACHING POINTS**

- To illustrate the key radiological and histological findings for the diagnosis of hypersensitivity pneumonitis and understand their correlation.- To review the hypersensitivity pneumonitis diagnostic criteria according to the latest guidelines and summarize recommendations.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definition and epidemiology2. Inciting agents. Exposure to inhaled agents.3. Immunopathogenesis:3.1. Immunologic mechanisms involved in the development of the disease and how they relate with the clinical and laboratory features.3.2. Risk factors: Genetic and external factors.3.3. The smoking paradox in HP.4. Clinical features.5. Non fibrotic HP:5.1. Radiologic Features: Typical and Compatible findings.5.2. Histologic Features.5.3 Radio-pathological Correlation6. Fibrotic HP6.1 Radiologic Features: Typical, Compatible and Indeterminate findings.6.2. Histologic Features6.3. Radio-pathological Correlation.7. Diagnostic criteria in the multidisciplinary team.8. Current controversies and future directions.

### **CHEE-83 Recognizing Local Recurrence After Stereotactic Body Radiotherapy in the Lung: Imaging Appearances and Pitfalls. A Picture Essay with Diagnostic Algorithm.**

#### **TEACHING POINTS**

This exhibit focuses on the imaging features and differentiation of local recurrence from normal inflammatory process after stereotactic body radiotherapy (SBRT) in the lung, and provides a diagnostic algorithm to aid in accurate diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview of SBRT as a treatment modality for primary lung cancer and lung metastases, including risk factors of local recurrence.2. Practical tips for interpreting post-SBRT studies, including the need to evaluate all examinations in three dimensions and to understand the dynamics of the entire process from early inflammation to residual scar tissue.3. Factors contributing to a



large inflammatory reaction post-SBRT, including the target size, radiation dose, absence of emphysema or presence of interstitial lung disease, target location near large bronchi, and use of immunotherapy.<sup>4</sup> Factors contributing to a small inflammatory reaction, such as small target size, peripheral tumor location, or the presence of emphysema.<sup>5</sup> Key steps and features of the normal post-SBRT inflammatory-fibrotic process, including discrete diffuse signs of inflammation, formation of a fibrotic circle, gradual consolidation, and the formation of a flat scar.<sup>6</sup> Features suggestive of local progression, including new nodular or lobular lesions with local increase in size (especially in cranio-caudal dimension), and a typical malignant contrast-enhancing pattern.<sup>7</sup> Algorithm for investigating suspected local recurrence post-SBRT, including consideration of a PET/CT, and biopsy.

#### **CHEE-84 Dis-Discombobulating" the Current State of Interstitial Lung Disease Imaging**

Participants

Jonathan Chung, MD, Chicago, IL (*Presenter*) Speaker, Veracyte, Inc; Consultant, Veracyte, Inc; Consultant, Boehringer Ingelheim GmbH; Speaker, Boehringer Ingelheim GmbH; Consultant, F. Hoffmann-La Roche Ltd; Speaker, F. Hoffmann-La Roche Ltd

##### **TEACHING POINTS**

- A systemic approach is paramount when diagnostic ILD on chest CT.
- To aid diagnosis, radiologists should familiarize themselves with current imaging guidelines and new and emerging concepts.
- Progressive pulmonary fibrosis (PPF) refers to ILDs other than idiopathic pulmonary fibrosis (IPF) with evidence of clinical, functional and/or radiologic progression over a one-year period.
- In patients with interstitial lung abnormality (ILA), clinical correlation and imaging follow-up should be considered, particularly when high-risk features for progression are present.
- Quantitative tools are valuable in the assessment of the extent and longitudinal progression of ILD.

##### **TABLE OF CONTENTS/OUTLINE**

- Practical approach to ILD on chest CT
- Updated approach to Hypersensitivity Pneumonitis (HP)
- Definition and current concepts of Progressive Pulmonary Fibrosis
- Definition and current concepts of Interstitial Lung Abnormality
- Current state of quantitative analysis and AI in ILD

#### **CHEE-85 Unusual Radiological Manifestation of Adenocarcinoma of the Lung**

##### **TEACHING POINTS**

Primary adenocarcinoma of the lung is a heterogeneous disease, varying in molecular, pathological and clinical features. Radiological features can vary from the 'typical' appearances - usually ground-glass (GGN), part-solid (PSNs) or solid nodules, or with consolidation. Awareness of atypical appearances of adenocarcinoma may result in earlier investigation and timely management.

##### **TABLE OF CONTENTS/OUTLINE**

Lung cancer remains the most common cause of cancer deaths worldwide and adenocarcinoma is the most common histologic subtype, responsible for just under half of all cases. The majority of tumours manifest radiologically with GGNs, PSNs, solid nodules or consolidation. In this review, we document our experience of atypical radiological presentations of adenocarcinoma spectrum disease, subsequently confirmed on histopathological analysis, at two tertiary centres. We include cases of adenocarcinoma presenting as a single, solid, calcified mass, as multiple micro- and macro-nodules and as widespread cystic airspaces. We describe cases presenting with unusual patterns of metastatic disease. We describe cases of atypical volume doubling times.

#### **CHEE-86 Pulmonary Hypertension: CT Signs That Point the Way**

Participants

Camilo Mieres, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

CT signs suggestive of pulmonary hypertension (PH) What to include in CT reports in the workup for PH Findings in entities associated with PH

##### **TABLE OF CONTENTS/OUTLINE**

I. Background: -Pulmonary artery diameter can suggest PH, but the threshold differs with the clinical context. -CT findings can provide clues about the underlying cause of PH. II. Content: 1. Different pulmonary diameters should be considered in patients with low, intermediate, or high risk of PH. 2. Findings to analyze in the study of PH: Cardiac vascular anomalies (can be missed on echocardiography): -Intracardiac shunts (atrial septal defect (ASD), especially sinus venosus ASD) -Anomalous pulmonary venous return (often with ASD) -Patent ductus arteriosus Signs of obstruction of the pulmonary arteries (filling defects/vascular tree-in-bud, hypertrophied systemic arteries) -Chronic pulmonary embolism -Pulmonary tumor thrombotic microangiopathy -Excipient lung disease Signs of right ventricular repercussion. Lung anomalies (fibrosis, cysts, centrilobular nodules) -Interstitial lung disease (combined pulmonary fibrosis/emphysema, Langerhans cell histiocytosis, connective tissue disease) -Pulmonary veno-occlusive disease III. Conclusions: -CT can alert to the possibility of PH and can provide valuable clues about its etiology.

#### **CHEE-87 Developmental Disorders of Lung: A Pictorial Review**

Participants

Shambo Guha Roy, MBBS, MD, Darby, PA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Mounier Kuhn syndrome affects trachea and up to 4th order bronchial tree, whereas William Campbell syndrome causes dilatation distal to 4th order bronchi.
2. Congenital pulmonary airway malformation (CPAM) has 5 subtypes: Type 1 being commonest with one or more dominant large cysts. Cyst size gets smaller in type 2 and 3. Type 4 is indistinguishable from type 1 radiologically.
3. Sequestration happens in two forms: intra lobar and extra lobar depending upon its venous drainage. Extra lobar sequestration is often associated with CPAM, called the 'hybrid lesions'.
4. Pulmonary veno-lobar syndrome or Scimitar syndrome accounts for minority of partial anomalous pulmonary venous return (PAPVR). Treatment depends upon the left to right shunt, which can be quantified using phase contrast MRI.

##### **TABLE OF CONTENTS/OUTLINE**

1. Normal development of the lungs.
2. Classification of developmental disorders.
3. Airway disorders: Tracheal and bronchial

agenesis, Tracheobronchial branching anomaly, tracheobronchomegaly (Mounier Kuhn syndrome), bronchogenic cyst, congenital pulmonary airway malformation, bronchopulmonary sequestration.4. Parenchymal disorders: Congenital lobar emphysema, Pulmonary hypoplasia, Pulmonary cystic mesenchymal hamartoma.5. Vascular disorders: Pulmonary sling, absence of unilateral pulmonary artery, pulmonary veno-lobar syndrome.

### **CHEE-88 Diffuse Pulmonary Hemorrhage: A Diagnostic Challenge**

Participants

Camilo Mieres, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-Review the causes, pathophysiology, and radiological signs of diffuse pulmonary hemorrhage (DPH).-Underline the importance of correlating the imaging findings with clinical and laboratory findings.

#### **TABLE OF CONTENTS/OUTLINE**

I.- BackgroundDPH is rare. It can occur in many diseases with histologic findings ranging from normal vessels (bland hemorrhage) to capillaritis.Clinical and radiological findings are nonspecific, determining the etiology is challenging. II.- ContentThrough a series of cases, we show how the causes of DPH relate with the histologic patterns.Pulmonary capillaritis: neutrophilic infiltration of the alveolar septa, loss of capillary integrity -Small-vessel vasculitis/Anti-GBM (Goodpasture)-Rheumatic diseases (Lupus)-DrugsBland pulmonary hemorrhage: alveolar hemorrhage without destruction or inflammation of alveolar spaces-Anticoagulants, bleeding disorders-Heart failure (HF), mitral stenosis-Idiopathic pulmonary hemosiderosisDiffuse alveolar damage: alveolar edema and hyaline membranes-Infection-Drugs-Rheumatic diseases (Lupus)III.-ConclusionsRadiologic findings of DPH are nonspecific and must be interpreted together with clinical and laboratory data.

### **CHEE-89 Chest CT Imaging in the Era of Lung-sparing Thoracic Resection**

Participants

Farah Tamizuddin, MD, New York, NY (*Presenter*) Nothing to Disclose

Jane P. Ko, MD, New York, NY (*Presenter*) Research collaboration, Siemens AG

#### **TEACHING POINTS**

Chest computed tomography (CT) has a major role in planning and follow up after lung resection. Segmentectomy and sleeve resection techniques entailing anatomical lung segmental dissection are now a major method for curative surgery of early-stage lung cancer while preserving lung function. Accurate localization of pathology is essential, with clear definition of bronchial and vascular anatomy. More recently, minimally invasive approaches such as the robotic-assisted thoracoscopic surgery (RATs) and video assisted thoracoscopic surgery (VATS) techniques are options. Therefore, the objectives are: a) To review thoracic lung-resection approaches including RATs and VATs for sublobar resection and sleeve resection, b) bronchial anatomy and imaging for lesion localization, b) to discuss essential imaging findings to communicate that impact operative approach, including variant anatomy and c) to review expected postoperative imaging findings and complications.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review of lung resection approaches: a) Sublobar, sleeve, and lobe resectionsb) RATs, VATS, open techniques, and advanced nodule localization methods 2. CT performance and essential preoperative anatomy evaluation: intersegmental plane identification: segmental bronchial anatomy, pulmonary arteries, pulmonary veins3. Essential imaging findings: airway variants and challenges, 3D techniques4. Post-operative imaging challenges: granulomas, airway distortion

### **CHEE-9 Snaking the Clogged Pipes: Imaging Findings of Central Venous Occlusions and Review of Therapeutic Options**

Participants

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Central venous obstruction can occur due to extrinsic compression or intrinsic stenosis. Clinical presentation and collateral drainage pathway development depends upon the site of obstruction and speed at which the obstruction occurs. IR based measures and surgical techniques are useful to relieve the obstruction to central vessels. We describe these techniques and their complications in this paper.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Causes of central venous obstruction • Extrinsic compression from lung cancer, lymphadenopathy, fibrosing mediastinitis • Intrinsic occlusion from catheter induced thrombosis. Imaging features of central venous obstruction- SVC narrowing, clot in the SVC, numerous chest wall collaterals, azygos vein dilatation. Collateral pathways based on the level of obstruction • pre azygos • azygos • post azygos. IR based approach for SVC recanalization- Angioplasty, stent placement. Surgical reconstruction methods for SVC- PTFE (polytetrafluoroethylene) graft, pericardial graft. Complications of reconstruction- Graft stenosis.

### **CHEE-90 Toward a New Era of CT Imaging: Current Status and Expectations of Photon Counting CT in the Thoracic Region**

Participants

Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Photon counting CT (PCCT) has appeared as a new generation of CT systems in clinical setting. PCCT can measure the energy levels of photons as they pass through an object being imaged, which differs from traditional CT scanners with energy-integrating detectors. PCCT has several advantages over traditional CT, including improved spatial resolution and contrast sensitivity, reduced radiation dose to the patient, and the ability to measure the energy spectrum of the incident radiation. PCCT is expected to bring significant improvements in various clinical applications for areas including the thorax. This education exhibit focuses on PCCT imaging in the thorax including technical perspectives, image quality, and clinical imaging. It is much appreciated if our information

would be useful in your clinical and research setting.

#### TABLE OF CONTENTS/OUTLINE

1. Comparison of PCCT equipment specifications with the traditional CT scanner with energy-integrating detector (EID-CT). 2. Improved spatial resolution: image quality according to reconstruction kernels and radiation dose. 3. Imaging by turbo flash spiral scan: high-definition images without motion artifacts even with electrocardiogram asynchrony and spectral imaging at the same time. 4. Iodine density imaging for pulmonary embolism and thoracic tumors: improved quantification due to the absence of electrical noise 5. Virtual non-contrast CT imaging created from each dynamic phase: comparison with true non-contrast CT in cases of thymic cyst, thymoma, and lung cancer. 6. Future expectations: effects on quantitative values including radiomics analysis.

#### CHEE-91 **Analysis of Solitary Lung Nodules Using Summation Images Created from Ultra-High-Resolution CT Data**

Participants

Hiroshi Moriya, MD, PhD, Fukushima, Japan (*Presenter*) Advisor, California Capital Equity, LLC; Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

1. Advantages of ultrahigh-resolution CT: Ultra-high resolution CT has excellent spatial resolution in lung field analysis. 2. 3D image analysis method using ultra-high resolution CT data: Coronal MPR and VR image are useful for chest image analysis. Summation image (SUM) can observe a X-ray projection image of the chest from any viewpoint. 3. There are two factors that make lung lesions difficult to detect: (1) lesions with little density difference from the surrounding lung, and (2) presence in areas where other structures are projected in the anterior-posterior direction. 4. Points to note when interpreting chest radiographs in routine clinical practice.

#### TABLE OF CONTENTS/OUTLINE

1. Ultra-high-resolution CT (UHRCT) is a CT that achieves high spatial resolution by reducing the detector size to 1/4 of the conventional size. The resolution can be improved by increasing the number of pixels, and the reproducibility of density can be improved by reducing the partial volume effect. 2. Summation images using UHRCT data provide images similar to chest photographs. Ability to create X-ray-like images of removed lungs, enabling analysis of clinical chest radiograph findings. 3. Small pulmonary nodules are not readily detectable on plain chest radiographs. The difficulty in detecting the target lesion is due to the averaging of the density due to the thickness of the lung and the overlapping projection of other structures (cardiovasculature and bone). Ground-glass density lesions are obscured, but solid components and pleural indentation findings can be pointed out.

#### CHEE-92 **When Lungs Turn to Stone: A Differential Diagnosis of Pulmonary Calcifications**

Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the main pathologies that can cause intrapulmonary calcifications. - Highlight the key radiological features that will allow us to establish a correct differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Pulmonary calcifications are a common imaging finding, usually seen on routine chest radiographs. Although they are usually harmless sequelae of remote processes, they provide important information for establishing a good diagnostic approach. They can be attributed to a variety of etiologies, including granulomatous disease, infection, malignancy, environmental exposure, or chronic disease. Consequently, it is necessary to correlate radiologic findings with clinical history and laboratory results. Specific radiologic features have been described, of which the appearance of pulmonary calcifications also provides valuable information regarding the underlying etiology. Therefore, a thorough differential diagnosis is necessary to identify the underlying cause and guide appropriate management. This work provides a comprehensive review of the radiologic features of pulmonary calcifications, including their distribution, size, shape, and associated findings, through cases studied at our center.

#### CHEE-93 **Proposals for the 9th edition TNM Staging for Lung Cancer - A Guide to Radiologists**

Participants

Maximiliano Klug, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Unresolved issues of the 8th edition TNM staging for lung cancer are: exclusion of post neoadjuvant patients (yp) from staging analysis, absence of nodal metastatic burden quantification, lack of granularity within the M1C category. 2- Proposed T Category - remains unchanged. 3- Proposed N Category- N2 is divided into N2a as single-station N2 disease and N2b as multiple-station N2 disease - relevant to imaging interpretation; N1 and N3 remain unchanged. 4- Proposed M Category- M1C cases that are metastatic to a single organ site have a better prognosis than M1C to multiple sites- to be determined this month whether multiple single organ will be moved to M1B. The rest of M categories are unchanged. 5- The outcomes of matched ypN v pN categories differ significantly with worse survival for ypN (e.g., ypN0 vs. pN0)- caution for imaging interpretation and patient management decisions.

#### TABLE OF CONTENTS/OUTLINE

1- To describe the proposals for the 9th edition TNM Staging for Lung Cancer. 2- To discuss the differences from the previous edition, remaining challenges, as they pertain to imaging evaluation and interpretation, and potential future directions.

#### CHEE-94 **Early and Late CT Patterns After SBRT for Lung Nodule**

Participants

Ignacio Alba, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To familiarize with the different radiological patterns observed on chest CT scans after stereotactic body radiotherapy (SBRT) for lung nodules, including early changes (within the first 6 months) and late changes (after 6 months)-To recognize cases of local and/or locoregional recurrence based on findings in our sample-To recognize evolutionary differences in chest CT findings based on the histological subtype of the treated lesion-To evaluate the ultimate success of SBRT as a therapeutic technique

#### TABLE OF CONTENTS/OUTLINE

We evaluated the different radiological patterns observed after SBRT for lung nodules using chest CT scans in 108 patients. Of the cases studied, 64 were primary tumors in early stages, 32 cases were lung metastases or metastases from other locations, and in 12 cases histology could not be identified. Among the primary lung tumors, 57% were adenocarcinomas, followed by 26% of squamous cell carcinomas. All chest CT scans were performed every 3 months during the first 2 years and every 6 months during the next 2 years after the completion of SBRT. The patterns observed in the first six months typically evolve progressively to a final stabilization pattern. The most frequently observed final radiological patterns were nodule-like and mass-like, followed scar-like and diffuse consolidation pattern. Thoracic recurrence was diagnosed by lack of parenchymal stabilization in 20% of cases, and locoregional lymph node involvement in the remaining cases. There were no significant differences in lung involvement based on the histology of the treated tumor

#### CHEE-95 CT Imaging of Lung Cancer: Exploring the Clinical Potential of CZT-based Photon Counting Detector CT

Participants

Tomoaki Sasaki, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lung cancer is the leading cause of death worldwide. CT is a powerful tool for evaluating the primary site and staging of lung cancer. On CT imaging, lung cancer appears as a subsolid nodule or solid nodule. Measuring the total tumor size and the size of the solid portion if the tumor is a subsolid nodule is the first step in both early and advanced lung cancer. Assessment of invasion to critical organs is also important in locally advanced cancer. Accurate evaluation of ipsilateral mediastinal nodal and extrathoracic metastases is required to determine treatment strategy. Photon counting detector CT (PCD-CT) has recently emerged for clinical use. Cadmium zinc telluride (CZT)-based PCD-CT, a newly developed technology, allows for more precise observation of lung cancer with lower radiation exposure, which may have a significant impact on clinical practice. This presentation aims to 1) review the clinical significance and challenges of CT evaluation in lung cancer and 2) discuss the benefits provided by CZT-based PCD-CT for lung cancer patients.

#### TABLE OF CONTENTS/OUTLINE

Key features of lung cancer evaluation: primary site and staging 1. T: size (T1-T4), chest wall invasion (T3), mediastinal invasion (T4) 2. N: ipsilateral mediastinal node metastasis (N2) 3. M: pleural dissemination (M1a), extra thoracic metastasis (M1b-c) Basic principle of CZT-based PCD-CT Clinical potential of lung cancer assessment using PCD-CT: super high resolution (SHR) image, multienergy spectral image, reduction of radiation exposure

#### CHEE-96 Pictorial Review of Tracheal Diseases: A Case-Based Approach for Radiologists

Participants

Camila Gadens Zamboni, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The evaluation of the trachea by imaging is essential to diagnose various tracheal diseases and help with surgical plans, assessment of treatment responses, and understanding surrounding structural abnormalities. In this scenario, the radiologist's role rises as an unreplacable analysis of this cartilaginous tube. This exhibit aims to summarize pertinent anatomy and review diverse tracheal diseases, congenital and acquired, through a didactic classification and presentation of the cases, including differential diagnosis, challenges, and limitations.

#### TABLE OF CONTENTS/OUTLINE

This is a case-based review of pathologies of the trachea focusing on 1- Pertinent anatomy review. 2- Best imaging methods for tracheal evaluation. 3- Classification of tracheal diseases with illustrative cases by focal vs. diffuse diseases, and the last by increased vs. decreased diameters. 4- Discussion of differential diagnoses. 5- Challenges and limitations on tracheal evaluation by imaging. 6- Take-home messages.

#### CHEE-97 Proposals for the 9th edition TNM Staging for Thymic Epithelial Tumor - A Guide to Radiologists

Participants

Maximiliano Klug, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Unresolved issues of the 8th edition TNM staging for thymic epithelial tumor (TET) are: T category refinement - focus on tumor size; granularity between N categories; better differentiation between intra and extrathoracic metastatic disease. 2- Proposed T Category- T1a ( $\leq 5$ cm) and T1b ( $> 5$ cm) regardless of involvement of mediastinal pleura; T2: invasion of the pericardium, lung, or phrenic nerve; T3: invasion of the brachiocephalic vein, superior vena cava, chest wall, or extrapericardial pulmonary arteries and veins; T4: unchanged, direct invasion of the aorta and arch vessels, intrapericardial pulmonary artery, myocardium, trachea, or esophagus. 3- Proposed N Category- The ITMIG/IASLC lymph node stations are clarified, unchanged two nodal regions: anterior (N1) and deep (N2). N1 includes the thymic bed compartment in the anterior lower neck and prevascular mediastinum. N2 includes tracheobronchial, aortopulmonary window, subcarinal, hilar, internal mammary, and the deep cervical (jugular and supraclavicular) lymph nodes. 4- Proposed M Category- Unchanged. M1a: pleural or pericardial nodules separate from the primary tumor; M1b: pulmonary intraparenchymal nodules, extrathoracic metastases, or any non-regional lymph nodes (e.g. high neck, retro-cranial, axillary or extrathoracic lymph nodes).

#### TABLE OF CONTENTS/OUTLINE

1- To describe the proposals for the 9th edition TNM Staging for TET. 2- To discuss the differences from the previous edition, remaining challenges as they pertain to imaging evaluation, and potential future directions.

## **CHEE-98 Halo and Reversed Halo Signs in Chest CT: Are They Useful?**

Participants

Adria Roset Altadill, MD, Girona, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The halo and reversed halo signs in chest CT may be caused by infections, inflammatory and vascular disorders and neoplastic diseases. These signs combined with ancillary imaging findings, additional information from PET-CT and spectral CT and proper clinical history may help the radiologist reach the final diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

The halo and reversed halo signs were initially described and thought to be specific for invasive pulmonary aspergillosis and cryptogenic organizing pneumonia, respectively. However, there is a broad spectrum of causes for these chest CT findings, including infections, inflammatory and vascular disorders and neoplastic diseases. The most common causes of the halo sign in the lung are adenocarcinoma, invasive aspergillosis and septic emboly. Less common causes include bacterial and viral infections, hemorrhagic metastases, vasculitis and other inflammatory disorders. The reversed halo sign is more frequently seen in organizing pneumonia, followed by pulmonary infarcts, invasive mucormycosis and other granulomatous diseases. Despite having lost their specificity, the halo and reversed halo sign combined with ancillary chest CT findings and an adequate clinical background can be useful to narrow the differential diagnosis. Special attention has to be paid to the nodule size, number and morphology in the halo sign. The thickness and distribution of the ring of consolidation and the presence of internal reticulation within the reversed halo sign also need to be evaluated. Moreover, metabolic information from PET-CT and perfusion data from spectral CT may help differentiate pulmonary infarcts from other inflammatory or infectious causes of the reversed halo sign.

## **CHEE-99 Cystic Lung Disease: The Common, the Rare and the Unusual**

Participants

Daniel Vargas, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

While most radiologists are aware of the most common cystic lung diseases, a group of rare and unusual diseases including genetic syndromes, lymphoproliferative disorders, environmental exposures and congenital anomalies can also result in cyst formation in the lungs. This exhibit will: 1. Review the clinical and imaging features of common and rare cystic lung diseases. 2. Discuss the underlying histopathology in each of these entities and how it translates to imaging findings. 3. Offer the radiologist an approach to help narrow the differential and guide clinical management in the multidisciplinary care of these patients. 4. Review ancillary findings and complications in patients with cystic lung disease. 5. Current concepts in amyloidosis and light chain deposition disease and their role in cyst development in lymphoid interstitial pneumonia

### **TABLE OF CONTENTS/OUTLINE**

1. Lung cyst and cystic lung disease definition  
2. Common Cystic Lung Diseases  
a. Lymphangioliomyomatosis. b. Birt-Hogg-Dube syndrome. c. Pulmonary Langerhans Cell Histiocytosis. d. Lymphoid Interstitial Pneumonia and Current Understanding of the role of Amyloidosis and Light Chain Deposition Disease. e. Desquamative Interstitial Pneumonia.  
2. Rare Cystic Lung Diseases. a. Neurofibromatosis type 1. b. Nieman-Pick Disease. c. Trisomy 21. d. Vascular Ehlers-Danlos Syndrome. e. Proteus Syndrome. f. Lymphomatoid Granulomatosis. g. Follicular Bronchiolitis. h. Atypical Infections (eg. P Jiroveci). i. Hydrocarbon Pneumonitis. j. Proximal Interruption of the Pulmonary Artery

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## Abstract Archives of the RSNA, 2023

CHEE-1

### The Phoenix Pulmonary Opacity

#### TEACHING POINTS

The waxing and waning pulmonary opacity is a common finding often hiding in plain sight, akin to the mythical phoenix, which disappears only to reveal itself again later amongst the ashes. Crucial to narrowing the differential diagnosis is a broad-based knowledge of the natural course of these diseases, their laboratory and pathologic analyses, and utilization of the multi-disciplinary team. Overlapping characteristics demonstrates the importance of looking at secondary, non-parenchymal imaging characteristics, including radiographic findings outside of the thorax. Many of these are chronic and debilitating, if not fatal, which have often become treatable with the advent of chemotherapeutics and biologics. Therefore, having a systematic approach and a relationship with our clinical colleagues is critical in treating these successfully and timely to avoid associated morbidity and mortality.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Categorizing the waxing and waning pulmonary opacity 3. Demonstrate common primary imaging findings in the thorax (e.g., nodule/opacity characteristics) 4. Demonstrate common secondary imaging findings in the thorax (e.g., esophageal, lymphatic, cardiac)5. Laboratory and pathologic correlatives6. Role of the multi-disciplinary team in narrowing the differential diagnosis (Rheumatology, Pulmonology)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-10

### The 2021 WHO Classification of Lung Tumors: Takeaways for Radiologists Regarding Epithelial and Neuroendocrine Tumors

#### Participants

Maria Clara Lorca, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit will review the tumors of the lung. 1. New 2021 WHO Classification of tumors of the lung. 2. Depict radiological features of tumors of the lung. 3. Describe the importance of PET-CT in the diagnosis and follow up. 4. Describe the pearls and pitfalls that some entities demonstrate in imaging, including benign entities that can appear as a lung tumor. 5. Evaluate the sufficiency of small biopsy samples for diagnosis. 6. Discuss the spectrum of post-treatment changes of the lung.

#### TABLE OF CONTENTS/OUTLINE

This education exhibit reviews biopsy-proven cases of tumors of the lungs and their correlation with pathology. Review with illustrative case examples the different tumors of the lungs in a systematic fashion. Incorporate the new 2021 WHO classification of the tumors of the lung. Depict the imaging appearances of various types of the above tumors, with emphasis in epithelial, neuroendocrine, and hematolymphoid tumors. Mesenchymal tumors will not be emphasized, as they were recently described on Radiographics this year. Differentiate between the types of tumors for which small biopsy versus resection sampling are indicated for diagnosis. Depict post-treatment changes of the lung, with examples including lung toxicity, pseudo-progression, and to distinguish these changes from true tumor recurrence and their impact on future therapy.

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## Abstract Archives of the RSNA, 2023

CHEE-100

### **Pulmonary Tuberculosis in Children and Adults: A Classic Disease with Updated Concepts. What the Clinician Needs to Know**

#### **Participants**

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To compare the typical appearance of pulmonary tuberculosis (TB) between adults and pediatric patients. Both the manifestations and the management differ in children and adults. 2. To review the latest evidence on pulmonary TB. Radiologists need to know what information is relevant to the clinician as well as the implications of certain imaging findings.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction: Epidemiology and transmission mechanism in children vs adults. 2. Pathophysiology: Traditional vs new concept. The latest evidence has shown that the radiological appearance of the disease mainly depends on the host immune response and not on the time from infection. 3. Classification of Pulmonary TB according to Clinical and Radiological factors. 3.1. Active Disease: Primary Tuberculosis: 1. Lymphadenopathy in adults/children. 2. Parenchymal disease in adults/children. 3. Pleural effusion in adults/children. 4. Miliary TB in adults/children. 3.2. Active Disease: Postprimary Tuberculosis: 1. Postprimary TB in children. 2. Consolidation and cavitation. 3. Centrilobular nodules. 4. Summary of the main differences between children and adults. 5. Inactive Tuberculosis: Radiological findings and their risk of reactivation. The role of the radiology report. 6. Complications: Empyema necessitatis, Rasmussen aneurysm.

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## Abstract Archives of the RSNA, 2023

CHEE-101

### Uncommon Story of Common Entity: Tips and Tricks in Imaging of Non-Cardiogenic Pulmonary Edema

#### Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pulmonary edema is a most common clinical entity in both inpatient and out-patient setting. Identifying the underlying etiology of the edema is crucial to the timely implementation of appropriate therapy. Although cardiac dysfunction and volume overload are the most common etiologies routinely encountered, there are other different etiologies and presentations of pulmonary edema. Understanding the clinical context and underlying pathophysiology of these varied uncommon causes will help radiologists in narrowing differential diagnosis, therefore help clinicians to provide definitive treatment and better patient care. Furthermore, thorough knowledge about non-cardiogenic pulmonary edema reduces the rate of invasive procedures like Swan-Ganz catheterization and related complications.

#### TABLE OF CONTENTS/OUTLINE

- Etiologies of non-cardiogenic pulmonary edema
- Mechanisms of non-cardiogenic edema
- Radiopathology correlation of pulmonary edema
- Pertinent role of chest x ray in initial diagnosis of cardiogenic vs non-cardiogenic pulmonary edema
- How subtle signs on chest x-ray helps to recognize uncommon etiologies of pulmonary edema
- How to differentiate different types of noncardiogenic edema on chest x ray.
- "Leave alone" type of pulmonary edema
- When should you use CT imaging
- Edema with and without diffuse alveolar damage- Does it matter on imaging?
- Short term and long -term complications of noncardiogenic pulmonary edema
- Algorithm and next step in the management of noncardiogenic pulmonary edema

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## Abstract Archives of the RSNA, 2023

CHEE-102

### An Update on the Role of Chest Imaging in Cystic Fibrosis

#### Participants

Scott Bugenhagen, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. To demonstrate the characteristic imaging findings of cystic fibrosis in the chest including a variety of commonly encountered complications through a series of clinical examples. 2. To review the latest guidelines and trends in the imaging of cystic fibrosis, with a focus on how clinical practice has changed with emerging therapies. 3. To describe the evolving role of chest radiography and cross-sectional imaging in this new clinical landscape, including a review of the most common scoring systems used in clinical practice.

#### TABLE OF CONTENTS/OUTLINE

I. Review of current clinical landscape A. Summary of CF genotypes and patient specific therapy B. Advances in medical therapies C. Changes in clinical practice II. Role of chest radiography A. Characteristic findings B. Direct and follow treatment C. Radiographic scoring systems II. Role of computed tomography A. Indications a. HRCT b. Contrast enhanced CT and CTA B. Characteristic findings C. Direct and follow treatment D. CT scoring systems III. Imaging of complications A. Superinfection a. Colonization with *Pseudomonas aeruginosa* and *Staphylococcus aureus* b. Nontuberculous mycobacterial infection c. *Burkholderia cepacia* infection B. *Aspergillus* related lung disease a. Allergic bronchopulmonary aspergillosis b. Aspergilloma c. Semi-invasive aspergillosis C. Lobar collapse and idiopathic collapsed lung D. Pneumothorax E. Pulmonary hypertension and cor pulmonale F. Hemoptysis IV. Transplant evaluation

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## Abstract Archives of the RSNA, 2023

CHEE-103

### Upright Chest CT Imaging

#### Participants

Yoshitake Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of our exhibit are as follows: (1) To explain the development, background, and performance of upright CT. (2) To describe the anatomical changes in each structure of the chest due to differences in body position, that is, the direction of gravity. (3) To illustrate the clinical applications of upright CT for various chest diseases with clinical case presentations, and the potential applications in particle therapy.

#### TABLE OF CONTENTS/OUTLINE

(1) Development of an upright CT and its background (2) Performance of upright CT: Physical characteristics, workflow improvement, safety, and remote operation during the infectious disease pandemic (3) Effect of gravity on the lungs, lobes, airways, heart, shoulder girdle, and chest vessels (4) Clinical applications of upright CT for various diseases such as chronic obstructive pulmonary disease, interstitial lung disease, scoliosis, diaphragmatic paralysis, and funnel chest (5) Upright 4D-CT of the chest (6) Potential applications of the upright CT in particle therapy (7) Limitation (8) Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-104

### Analysis of Fine Anatomical Structures Involved in Pulmonary Nodules by Ultra-High-Resolution CT

#### Participants

Hiroshi Moriya, MD, PhD, Fukushima, Japan (*Presenter*) Advisor, California Capital Equity, LLC; Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

1. Spatial resolution of ultra-high-resolution CT (UHRCT) 2. Depiction of intralobular structure by UHRCT 3. MPR display of bronchus long-axis cross-section and short-axis cross-section (parallel pleural cross-section) 4. Typical cases: Analysis of fine anatomical structures involved in pulmonary nodules by UHRCT

#### TABLE OF CONTENTS/OUTLINE

Ultra-high-resolution CT (UHRCT) is a CT that achieves high spatial resolution by reducing the detector size to 1/4. In the previous studies, the bronchial visualization ability of UHRCT was superior compared with conventional HRCT. In the depiction of lung field structure, bronchi with an inner diameter of 0.4 mm are delineated. Contrast enhancement and deep learning reconstruction method (DLR) enhances the contrast effect of peripheral blood vessels and improves visualization. By improving the resolution, it has become possible to display the intralobular structure. How to identify lobular structure: a. Bronchioles are centrally located in the lobules. b. Identify the blood vessels that accompany the bronchi as pulmonary artery. c. Pulmonary veins are thicker than pulmonary arteries. d. Imaging of pulmonary arteries or veins in contrast-enhanced phase. e. Confirm continuity of the target vessel to the root of the pulmonary artery and vein. Lesions that spread with regularity to the lobular structure, lesions that extend independently of the lobular unit, lesions that extend beyond the lobule, and lesions confined within the lobule are presented.

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## Abstract Archives of the RSNA, 2023

CHEE-105

### Thoracic IgG4-Related Disease: Revealing the Diverse and Heterogeneous Imaging Manifestations

#### Participants

Kyubin Kim, MD, Yansan-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. IgG4-related disease (IgG4-RD) is an immune-mediated fibroinflammatory condition characterized by dense lymphoplasmacytic infiltrations with predominant IgG4-positive plasma cells, usually accompanied by storiform fibrosis, obliterative phlebitis, and elevated serum IgG4 levels. 2. Thoracic manifestations of IgG4-RD are diverse and can mimic malignant lymphoma, infection, or other systemic autoimmune disease. The most common manifestations are mediastinal lymphadenopathy and peri-bronchovascular interstitial thickening. Other findings include pulmonary nodule or mass, interstitial lung abnormalities, pleural effusion or thickening, mediastinal or chest wall mass, and thoracic arteritis. 4. IgG4-RD can present with atypical radiologic findings such as migrating or cavitory nodules, lobar or segmental consolidation, and paravertebral mass making the diagnosis challenging. 5. Early diagnosis with clinical-radiologic-pathologic correlation is important to prevent irreversible damage due to fibrosis.

#### TABLE OF CONTENTS/OUTLINE

1. Definition, pathogenesis, and histopathology of IgG4-RD 2. Clinical manifestations and diagnostic criteria for thoracic IgG4-RD 3. Imaging findings of thoracic IgG4-RD: diverse and heterogeneous findings in the lungs, airway, mediastinum, pleura, chest wall, and thoracic vessels 4. Treatment and prognosis of thoracic IgG4-RD 5. Conclusion: The importance of recognizing the diverse imaging findings of thoracic IgG4-RD and reflecting them in diagnosis and treatment

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## Abstract Archives of the RSNA, 2023

CHEE-106

### Beyond the Black Holes: A Multidisciplinary Approach to Cystic Lung Disease

#### Participants

Lawrence Guan, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diffuse cystic lung diseases (DCLD) are characterized by thin-walled, air-filled spaces with normal intervening lung parenchyma. Certain entities can mimic or be mistaken for lung cysts such as emphysema, cavitory lesions, honeycombing, and cystic bronchiectasis. These are a diverse group of disorders with a variety of underlying causes including hereditary, neoplastic, infectious, inflammatory, lymphoproliferative, and smoking-related. High-resolution chest CT plays a central role in the evaluation of patients with DCLD's and it is not uncommon for these disorders to be discovered during imaging for other reasons. Therefore it is important for the radiologist to be aware of these conditions and their associations, as they may be the first to suggest the diagnosis. An approach to the characterization of cystic lung disease will be reviewed including imaging and clinical clues which can aid in suggesting one diagnosis over another.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Examples of cases: a. Mimics of lung cysts b. Smoking-related: Pulmonary Langerhans Cell Histiocytosis, Desquamative Interstitial Pneumonia c. Inflammatory: Amyloidosis, Hypersensitivity Pneumonitis d. Hereditary: Tuberos Sclerosis/Lymphangiomyomatosis, Birt-Hogg-Dube, Neurofibromatosis, Ehlers Danlos Syndrome, Sickle Cell Disease e. Lymphoproliferative: Lymphocytic Interstitial Pneumonia, Follicular bronchiolitis f. Neoplastic: Cystic metastases, Treated metastases g. Disorders with cystic component: Bronchopulmonary sequestration, Congenital pulmonary airway malformation, Bronchogenic cyst h. Miscellaneous: Infectious/Postinfectious, Posttraumatic 3. Conclusion.

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## Abstract Archives of the RSNA, 2023

CHEE-107

### Mimics of Pulmonary Embolism (PE)

#### Participants

Shaimaa Fadl, MD, Glen Allen, VA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learn technical, anatomical, and patient-related pitfalls in the diagnosis of pulmonary embolism. Illustrate common and uncommon pulmonary artery pathologies that can mimic pulmonary embolism. Discuss an imaging approach for the diagnosis and management of patients with different pulmonary artery pathologies.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Technical pitfalls. Anatomical pitfalls. Patient related pitfalls. Pulmonary artery malignancy (angiosarcoma, lymphoma). Pulmonary artery tumor embolism. Pulmonary artery in-situ thrombus (post-surgical, post radiotherapy). Pulmonary artery vasculitis. Atypical Infection. Granulomatous/Fibrosing mediastinitis. Role of different imaging modalities in evaluation of PE mimics. Diagnostic approach to PE mimics.

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## Abstract Archives of the RSNA, 2023

CHEE-108

### Joining the Dots in Multiple Lung Nodules

#### TEACHING POINTS

1. Varying etiologies cause multiple pulmonary nodules and can be mistaken for infection or metastatic disease. 2. Ancillary CT features such as air trapping with multiple pulmonary nodules are seen in DIPNECH, or chest wall vessel calcification with centrilobular nodules in renal failure suggests metastatic calcification. 3. Small calcified pulmonary nodules seen with reticulation in the lower lobes, usually in fibrotic ILD, represents dendriform ossification.

#### TABLE OF CONTENTS/OUTLINE

CT detected multiple lung nodules are most commonly due to infection, sarcoidosis, or metastasis. However, alternative etiologies causing lung nodules can be diagnosed on CT based on CT morphology or associated findings. These alternative causes of multiple lung nodules are often seen in patients with malignancies, and we must accurately diagnose these to prevent misinterpretation. Therefore, these lesser-known entities and their diagnostic CT findings are discussed. The etiologies are subclassified based on the CT appearance of nodules such as non-solid, solid, cavitary, calcified, and nodules with central air bronchograms. A case-based approach will discuss meningoendotheliomatosis, DIPNECH, amyloidosis, LIP, LCH, Dendritic Ossification, metastatic calcification, Progressive massive fibrosis in silicosis, MMPH in Tuberous Sclerosis, MALT lymphoma amongst other similar disease processes. Ancillary CT features for, e.g., the air-trapping in DIPNECH, Cheerio sign in meningoendotheliomatosis, calcification in amyloidosis, vessel wall calcification in renal failure with metastatic calcification, etc., are highlighted. In addition, the next steps in the workup for diagnosis are also highlighted.

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## Abstract Archives of the RSNA, 2023

CHEE-109

### 0.55T MRI Thoracic Imaging

#### Participants

Jonathan Liu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Low field (< 1T) MRI is an emerging technology that possesses certain advantages over other imaging modalities and higher field MRI that make imaging of the lungs more attractive. The purpose of this exhibit is to highlight the considerations involved in implementing clinical use of low field MRI for thoracic imaging, with the hope of introducing the audience to this new imaging paradigm. A wide variety of cases (with a cohort of 22 patients at the time of abstract submission) are shown highlighting the benefits of low field MRI imaging with the Siemens Freemax system (0.55T, MAGNETOM Freemax; Siemens Healthcare, Erlangen, Germany) including ultra-short TE, diffusion weighted, and non-contrast MRI ventilation/perfusion imaging. We will also review the limitations and pitfalls of lung imaging at 0.55T MRI.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Rationale for low field MRI  
a. Advantages of low field MRI over other modalities  
i. MRI versus CT  
ii. Low field versus traditional 1.5T or 3T imaging  
b. Disadvantages of low field MRI over other modalities  
i. MRI vs CT  
ii. Low field MRI compared to 1.5/3T  
3. Imaging Protocol  
4. Clinical Indications  
a. Immediate  
b. Early  
c. Long-term  
5. Five to ten cases of 0.55 MRI images with CT correlation  
a. Normal anatomy  
b. Malignancy  
c. Inflammation  
d. Post-radiation  
e. Small airways/small vessel disease  
f. Large airways  
6. Key challenges, limitations, and pitfalls of lung imaging at 0.55T  
7. Future clinical and research directions  
8. Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-11

### Light Up the Lungs: How Contrast Enhancement Can Help Diagnose Pulmonary Lesions

#### TEACHING POINTS

Non-contrast CT of the chest is often requested by clinicians in settings where the addition of iodinated contrast is warranted. Radiologists must be familiar with how contrast positively impacts evaluation of pulmonary pathology. This exhibit will showcase the value of iodinated contrast improving assessment of pulmonary parenchymal entities. Iodinated contrast improves differentiation of pneumonia from atelectasis, with the former lacking enhancement, while atelectasis enhances homogeneously. Addition of contrast material allows detection of complications of pulmonary infections such as necrosis, pulmonary artery pseudoaneurysm and chest wall involvement. In the setting of congenital pulmonary lesions, CT evaluation should include iodinated contrast to evaluate arterial supply and venous drainage. Nodule characterization is improved with iodinated contrast. Lesion localization improves with iodinated contrast: including discerning lesions from vascular structures, delineation of hilar lesions, and appraisal of vascular and chest wall invasion in the setting of aggressive processes.

#### TABLE OF CONTENTS/OUTLINE

Contrast Enhanced CT protocols and indications  
Pulmonary arterial phase  
Systemic arterial phase  
Venous phase  
Infection  
Pneumonia vs Atelectasis  
Complications of pneumonia: necrosis, abscess, pseudoaneurysm, wall involvement  
Lesion localization and assessment of complications  
Hilar lesions  
Discernment from broncho-vascular bundle  
Vascular, mediastinal, and chest wall invasion  
Nodule characterization  
Hypervascular metastasis  
Carcinoid tumor  
AVM  
Congenital lesion evaluation  
Vascular supply (eg. Sequestration)  
Venous anomalies (eg. Hypoplastic lung evaluation)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-110

**Don't Be Blue... Here's a Clue! Tips to Assess Adult Cardiac Pathology on a Chest Radiograph Like a Pro**

### Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In the era where modalities such as 2-D echo, CT and MRI are being highly utilized for evaluation of cardiac pathology, a plain chest radiograph still plays a key role in contributing important information. However, the younger generation of radiologists do not seem to be optimally exposed or are unaware of the true value of a chest radiograph. Chest radiograph is convenient as it is an easily accessible, low-cost, and non-invasive diagnostic tool with minimal radiation dose. We aim to provide unique imaging clues to identify the classic signs, measurements, and differential diagnoses of various adult cardiac pathologies on a chest radiograph with confirmatory CT images. Since a chest radiograph is the first imaging modality for majority of patients with chest pain - it is very imperative for the radiologists to quickly recognize these subtle findings to provide an accurate diagnosis and proper patient management.

### TABLE OF CONTENTS/OUTLINE

Introduction to normal cardiac anatomy  
CASE BASED LEARNING:• How to differentiate between:- Aortic Dissection vs Aortic Aneurysm- Pneumopericardium vs Pneumomediastinum- Pericardial Effusion vs Cardiomyopathy- Intramural esophageal lesion vs LA enlargement- Enlarged azygous arch vs Paratracheal lymph node- Stages of cardiogenic pulmonary edema• Identify:- Pulmonary embolism- Cardiac Valves- Focal pulmonary edema- Heterotaxy syndromes- Cardiac Size: Microcardia- Pectus Excavatum- Devices• Compare and contrast:- Cardiomyopathies: Dilated vs Hypertrophic- Individual chamber enlargements• Limitations

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-111

### **Aerogenous Metastasis and Spread Through The Air Spaces (STAS) - Distinct Entities or Spectrum Of The Same Process?**

#### **TEACHING POINTS**

1. To present the proposed mechanisms and pathological findings described in aerogenous metastasis (AeM) and spread through the airways (STAS) as well as areas of uncertainty and their prognostic significance. 2. Discuss the concept of continuous and discontinuous cancer spread from the primary tumor. 2. To review the pathological and imaging characteristics of primary lung cancers with higher probability of spreading through the airspaces. 3. To describe CT features suggestive of aerogenous metastasis and their main differential diagnoses, including distinction from multiple synchronous primary adenocarcinomas.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definition and pathophysiology of STAS and aerogenous metastasis (AeM). 2. Risk factors and predisposing histological patterns. 3. Imaging predictors, diagnosis, and prognostic significance of STAS and AeM. 4. Differentiating aerogenous metastases from synchronous adenocarcinomas on CT. 5. Clinical relevance and impact on patient management. 6. Are STAS and aerogenous metastasis distinct entities or a spectrum of the same process? 7. Future directions; areas of uncertainty and further research.

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## Abstract Archives of the RSNA, 2023

CHEE-112

### Navigating the Difficult ICU Chest Radiograph: Distinguishing Non-standard Cardiovascular Device Placements from Device Malposition

#### Participants

Danielle Struck, BA, Las Vegas, NV (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cardiovascular support devices are essential in the management of critically ill patients. While identifying malpositioned devices can often be straightforward, recognizing correctly positioned uncommon devices/non-standard placements and identifying malpositioned/incorrectly deployed devices can be difficult. Here, we present a case-based approach to distinguishing non-standard device placements from malposition and potential downstream complications, providing CT correlation where appropriate and specify lessons learned and practical tips in each case.

#### TABLE OF CONTENTS/OUTLINE

1. Title slide 2. Disclosures 3. Abbreviations 4. Approach 5. Scenarios 6. Pulmonary critical care, MICUa. CVCs i. L SVC placement ii. Arterial placement b. PA catheter i. Inguinal approach ii. Peripheral placement, PA pseudoaneurysm c. ECMO i. Peripheral, situs inversus, central ii. Malposition 7. Electrophysiology, CVICUa. Pacer/ICD i. Epicardial/subcutaneous leads, patient with atrial switch ii. Lead migration/fracture, ventricular perforation b. Transcatheter LAA closure i. Watchmann vs Amplatzer ii. Embolization 8. Heart failure, CVICUa. Impella i. Impella RP (RV) ii. Access site hematoma, dissection b. LVAD i. Different models ii. Infection, trauma, suck event c. Intra-aortic balloon pump i. Upper extremity approach, adjustment ii. Malposition, visceral ischemia 9. Structural cardiology, CVICUa. ASD closure device i. PDA closure device ii. Malposition, incomplete seal b. Prosthetic valves i. Transapical mitral valve prosthesis ii. Embolization 10. CT surgery, SICUa. Pericardial drain i. Wraparound drain ii. Mediastinal placement 11. Summary - Lessons 12. Summary - Practical tips 13. References

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-113

### The Radiologist's Expedition into the Intricacies of Percutaneous Lung Biopsies and Ablations

#### Participants

Megha Gupta, Glendale, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lung cancer (CA) is the second most common cancer in the US and is the leading cause of cancer related mortality. Surgery is the mainstay of therapy for patients with stage I lung cancer, although many patients with lung cancer are poor surgical candidates. Stereotactic radiation body therapy (SBRT) is offered to inoperable patients with lung CA, however, carries significant side effects and risk of lung function deterioration. Image guided tumor ablation (IGTA) is an alternative treatment option with proven outcomes in Stage I lung CA without the risk of lung function deterioration. Also, IGTA is not limited by segmental anatomy.

#### TABLE OF CONTENTS/OUTLINE

Overview of lung cancer staging, identification of suitable patients for image guided lung ablation and discuss treatment outcomes. Understand the various modalities of lung ablation (Radio frequency, Microwave and Cryoablation). Approach to difficult biopsies and difficult needle placement including the use of hydro-dissection and artificial pneumothorax creation. Learn normal and abnormal imaging appearances post lung ablation and current follow up recommendations.

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## Abstract Archives of the RSNA, 2023

CHEE-114

### Getting Warmer...” - Chest Radiological Findings in Patients with Fever of Unknown Origin

#### Participants

Alla Khashper, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fever of unknown origin (FUO) is defined as "fever = 101°F (38.3°C) for at least 3 weeks that remains undiagnosed after 3 inpatient days or at least 3 outpatient visits". FUO is a well-known clinical problem, has multiple thoracic etiologies, and commonly requires extensive workup. Imaging might identify the cause of FUO. However, no radiological recommendations have been established.

#### TABLE OF CONTENTS/OUTLINE

Historically, FUO has been divided into classic, nosocomial, immunodeficiency-related, and travel-associated categories. For imaging purposes the following classification appears more practical: infections, malignancies, inflammation and miscellaneous. The selected illustrative cases are listed in the attached presentation. The evaluation of FUO is always complex, including extended history taking, physical examination, and lab tests, followed by imaging. Chest radiography and CT are routinely performed and can usually provide putative or final diagnosis or suggest further imaging work-up, including but not limited to CT angiography, PET , MRI, and imaging-guided biopsy. This educational exhibit is a pictorial review of thoracic pathologies associated with FUO, targeting radiology trainees, general and subspecialized thoracic radiologists. It will highlight teaching points and provide clues to establish concise differential diagnosis of FUO causes.

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## Abstract Archives of the RSNA, 2023

CHEE-115

### Development of Color Dynamic Flow Image Using 4D-CTA for Post TEVAR Operative Case

#### TEACHING POINTS

It is common to use 3D-CTA for postoperative evaluation of TEVAR. 3D-CTA can assess postoperative complications such as endoleak and the presence or absence of stent graft induced new entry (SINE). However, since 3D-CTA is a single time phase, it is difficult to evaluate the direction of blood flow to the aneurysm and the timing of outflow. This is where 4D-CTA comes in. 4D-CTA injects a contrast medium while continuously imaging a specific area. When 4D-CTA is displayed in Volume Rendering (VR), the blood flow is easy to understand visually. Therefore, it is possible to observe end leakage and SINE around the stent graft. This time, we evaluated the blood flow when it was converted to VR using a color map. The color map was changed according to the CT value. In addition, the color map has been optimized to make 4D-CTA easier to observe. By displaying the blood flow as our original color map, it is possible to visually evaluate the direction of blood flow at the leak point and the timing of flow from the aorta into the aneurysm. This time, we take 4D-CTA scan and analyzed it with our original color map in the SINE case. By applying our method, it can be easy and visually to evaluate the entry point, blood flow direction, and outflow timing post TEVAR operation.

#### TABLE OF CONTENTS/OUTLINE

1. Problem analysis of conventional display method 2. Ingenuity in scanning / Exposure reduction technology 3. Ingenuity in image reconstruction 4. Evaluation by 4D-CTA 5. Creation of original color map 6. Evaluation of usefulness by clinical cases

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## Abstract Archives of the RSNA, 2023

CHEE-116

### Cinematic Rendering of the Thoracic Aorta: A New Look at an Old Problem

#### Participants

Elliot Fishman, MD, Owings Mills, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

#### TEACHING POINTS

1. 3D imaging with Cinematic rendering can play a major role in the detection of the thoracic aorta<sup>2</sup>. Cinematic Rendering can be optimized with development of presets to improve workflow<sup>3</sup>. Cinematic Rendering can be used in a range of applications including suspected dissection, coarctation of the aorta, vasculitis, post aorta repair and trauma<sup>4</sup>. Cinematic Rendering will provide critical information to the referring physician for patient management<sup>5</sup>. the radiologist needs to work closely with the referring physician and Cinematic Rendering help play a role in this interaction

#### TABLE OF CONTENTS/OUTLINE

a. Cinematic Rendering protocols<sup>b</sup>. CT acquisition protocols<sup>c</sup>. clinical applications with case studies-suspected dissection-post aortic aneurysm repair-coarctation of the aorta-trauma-vasculitis<sup>d</sup>. pearls and pitfall<sup>e</sup>. the literature<sup>f</sup>. future directions including AI<sup>g</sup>. bibliography

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## Abstract Archives of the RSNA, 2023

CHEE-117

### Current and Novel Techniques for Artifact Reduction on Chest CT

#### Participants

Yoichiro Ota, RT, Yokohama, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Various artifacts can be observed on chest CT. Motion artifacts are an important issue, especially in emergency cases in which patients are unable to hold their breath. Motion correction-deep learning reconstruction (MC-DLR) is a motion correction method developed using a deep learning framework to estimate patient motion in the lung region. This method comprises three major steps. First, a full-image reconstruction is decomposed into several partial-angle reconstructions. Second, a pre-trained deep convolutional neural network (DCNN) is applied to estimate the motion vector field between these partial angle reconstruction images. Finally, a motion-corrected image is reconstructed by incorporating the DCNN-predicted motion vector field (Fig. 1). An image with MC-DLR can reduce the motion artifacts in moving phantom experiments (Fig. 2) and clinical cases (Fig. 3). Radiologists should understand CT artifacts to distinguish between true lesions (Figs. 4,5). In this exhibit, we introduce the principles of CT artifacts and techniques to reduce them by presenting clinical cases.

#### TABLE OF CONTENTS/OUTLINE

Motion artifact, Streak artifact, Metal artifact, Dark band artifact, Partial volume effect

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-118

### Thoracic Manifestations of Autoimmune Diseases: From Suspicion to Diagnosis

#### Participants

Renato Fujiki, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Interstitial lung disease (ILD) is the most common thoracic manifestation of autoimmune disease (AD). Each ILD pattern is more commonly associated with a specific AD, although there is an overlap between patterns. While connective tissue diseases (CTD) are commonly associated with thoracic manifestations, it is important to recognize that other AD can also affect the lungs. Besides ILD, AD can also present with airway, vascular, pleural, and mediastinal involvement. The purpose of this exhibit is - Review CT patterns of ILD more commonly associated to each specific AD and what is important to describe - Highlight the role of radiology in diagnosing and grading thoracic manifestations of AD - Discuss the new classification system known as "interstitial pneumonia with autoimmune features" (IPAF) and its relevance in patient management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction
  - a. Epidemiology, pathophysiology and clinical aspects of the main autoimmune diseases (AD)
  - b. Currently available treatment options
2. Role of different imaging methods in diagnosis and assessment of disease grading - advantages, limitations, usefulness
  - a. X-ray
  - b. Ultrasound
  - c. CT - with protocol recommendation
  - d. MRI
3. ILD patterns associated with AD - Case-by-case discussion review
  - a. Non-specific interstitial pneumonia
  - b. Organizing pneumonia
  - c. Usual interstitial pneumonia
  - d. Hypersensitivity pneumonitis-like pattern
  - e. Others
4. Other thoracic manifestations of both CTD and non-CTD AD - including vascular, pleural, mediastinal and airway involvement.
5. The new statement of interstitial pneumonia with autoimmune features (IPAF) - repercussions in clinical practice and recommendations
6. Conclusions "take-home messages"

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## Abstract Archives of the RSNA, 2023

CHEE-119

### **Bronchiectasis: Differential Diagnosis for Their Cause According to Their Spatial Distribution and Complications**

#### **Participants**

Fernando Vasquez Puelles, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Distribution of bronchiectasis, their association with different radiological findings, altogether with clinical context can aid in formulating a differential diagnosis for pathologies that cause bronchiectasis.- Bronchiectasis predisposes to complications which can be evaluated with imaging studies.

#### **TABLE OF CONTENTS/OUTLINE**

Bronchiectasis is irreversible bronchial dilatation, usually resulting from chronic infection, proximal airway obstruction, or congenital bronchial abnormality. Bronchiectasis can have a diffuse distribution with an upper/mid lung predominance (cystic fibrosis, sarcoidosis, tuberculosis), lower lung predominance (chronic aspiration, primary ciliary dyskinesia, Kartagener syndrome), or central predominance (Mounier-Kuhn syndrome, Williams-Campbell syndrome), or a focal distribution (endobronchial or peribronchial tumors, Swyer-James syndrome). It predisposes to chronic or recurrent infections, allergic bronchopulmonary aspergillosis, pneumothorax, hemoptysis, and pulmonary hypertension. Signs suggestive of infection include air-space disease, tree-in-bud pattern, ground-glass opacities, patchy opacification, and cavitation or abscess. Conclusion. Bronchiectasis is irreversible bronchial dilatation usually resulting from chronic infection, proximal airway obstruction, or congenital bronchial abnormality. There is a wide spectrum of causes of bronchiectasis, thus radiologists can use the morphologic features, particularly the spatial distribution, associated findings altogether with clinical information to provide a differential diagnosis for the cause of bronchiectasis and to help to find an adequate treatment.

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## Abstract Archives of the RSNA, 2023

CHEE-12

### Cardiothoracic Imaging Findings in VEXAS Syndrome

#### Participants

Naim Qaqish, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-VEXAS Syndrome is an adult-onset autoinflammatory disorder found almost exclusively in adult men (x-linked gene mutation) first described in 2020. The disease is severe with a poor prognosis.-Systemic hematologic and inflammatory disease affecting multiple organs, most commonly the skin, lungs, cardiovascular, and cartilage.-Diagnosis is made on bone marrow aspirate.-Pulmonary imaging findings: consolidative, ground glass and reticular opacities, pulmonary vasculitis, pleural effusions, bronchial inflammation/stenosis.-VS-associated interstitial lung disease usually follows an organizing pneumonia or NSIP pattern.-Cardiovascular imaging findings: Venous and/or arterial thrombosis, pulmonary emboli, pericarditis, myocarditis, and cardiac amyloidosis.

#### TABLE OF CONTENTS/OUTLINE

- Introduction to VEXAS Syndrome (VS) • Useful Laboratory Tests • Clinical Presentation with Common Manifestations • Pulmonary Imaging Features o Parenchymal disease (consolidation, GGO, reticulation) o Pleural effusions o VS-associated interstitial pneumonias § NSIP and organizing pneumonia patterns o Pulmonary vasculitis o Bronchial disease and stenosis o Less common pulmonary manifestations • Cardiovascular Imaging Features o Cardiac and pericardial involvement § Typical CMR findings o VS-associated vasculitis o Recurrent thromboembolic disease § DVT, pulmonary emboli, and arterial thrombosis • Differential Diagnosis • Treatment • Prognosis • Summary of Cardiothoracic Imaging Findings • References

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## Abstract Archives of the RSNA, 2023

CHEE-120

### Heavy Stuff: The Burden of High-Attenuation Lung Lesions

#### Participants

Iuri Shen De Lacerda, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Propose a pattern-based approach to most common high-attenuating lung lesions- Review specific imaging features of each CT pattern of disease- Recognize the main differential diagnosis by section and understand the pathophysiology behind each hyperattenuating lesion through a case-based pictorial discussion- Highlight the importance of radiology in narrowing diagnostic possibilities and guiding next steps in patient management

#### TABLE OF CONTENTS/OUTLINE

I - INTRODUCTION- Definition of high-attenuation lung lesions- Pattern-based approach to narrow differential diagnosisII - PATTERNS AND ASSOCIATED DIAGNOSISA - Calcified pulmonary nodules1. Dystrophic calcifications-a. Post-infectious-b. Pulmonary hemosiderosis: Idiopathic or Secondary (chronic alveolar hemorrhage)-c. Occupational disease: Silicosis, Coal workers pneumoconiosis2. Metastatic calcification: Benign or Malignant3. Pulmonary Alveolar microlithiasisB - Non-calcified hyperattenuating nodules1. Talcosis2. Mercury embolism and vapor inhalation3. Pulmonary cement embolization after vertebroplasty4. Cyanoacrylate embolizationC - Large calcified nodules or masses1. Calcified metastasis: Medullary thyroid carcinoma, Osteosarcoma, Condrosarcoma2. Amyloidosis3. Granuloma4. Progressive massive fibrosisD - Hyperattenuating linear or reticular opacities1. Pulmonary dendriform ossification: Idiopathic or Secondary (idiopathic pulmonary fibrosis, chronic alveolar hemorrhage)2. Diffuse pulmonary amyloidosis: alveolar septal formE - High-attenuation consolidation1. Amiodarone lung2. Pulmonary Lipiodol embolismIII - CONCLUSIONSSummary of key points"Take-home" messages

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## Abstract Archives of the RSNA, 2023

CHEE-121

### Paraneoplastic Syndromes Related to Thoracic Neoplasms: Clinical and Imaging Clues

#### TEACHING POINTS

Paraneoplastic Syndromes are systemic manifestations of neoplasia not related to metastatic disease. These rare disorders are characterized by abnormal production of proteins (i.e. antibodies), protein derivatives, or steroids generated by the immune system. The diagnosis of thoracic neoplasms associated with these syndromes often presents diagnostic challenges for radiologists and clinicians alike. Radiologists play an essential role in the identification of the specific neoplasm associated with these syndromes. Therefore, knowledge of the neoplasm associated with each paraneoplastic syndrome is valuable for quality patient care. The goals of this exhibit are to help the learner: 1. List the clinical features of specific paraneoplastic syndromes related to thoracic neoplasms 2. Identify characteristic imaging features of thoracic neoplasms associated with specific paraneoplastic syndromes

#### TABLE OF CONTENTS/OUTLINE

1. Introduction - Definition of paraneoplastic syndromes 2. Overview of paraneoplastic syndromes associated with specific types of thoracic neoplasms 3. Discussion of clinical and imaging features of thoracic neoplasms that may manifest with a paraneoplastic syndrome at presentation 4. Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-122

### Usual Interstitial Pneumonia and Variants, a Pictorial Review

#### Participants

Moises Jose Lima, MD, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To define and illustrate the classic appearance of a UIP pattern.- To describe the HRCT diagnostic categories of Usual Interstitial Pneumonia (UIP).- To comment and review the CT findings of the main differential diagnosis of UIP. - To know the 2018 Fleischner diagnostic guidelines on the diagnosis of Idiopathic pulmonary fibrosis (IPF). - To enumerate and discuss specific and general variant patterns of fibrosis.

#### TABLE OF CONTENTS/OUTLINE

1) Background: Interstitial lung disease concept and classification. Categorization of idiopathic interstitial pneumonias. UIP pathophysiology.2) HRCT technique in UIP3) Key features of a classic UIP pattern: honeycombing, reticular pattern, traction bronchiectasis, other findings of classic UIP pattern: GGO, mediastinal lymph node enlargement, pulmonary ossification, pleuroparenchymal elastosis.4) Diagnostic categories of UIP: UIP and uncommon presentations (asymmetric distribution, uniform craniocaudal distribution and others), probable UIP, possible UIP, a review of the main alternative diagnoses: non-specific interstitial pneumonia, fibrosing hypersensitivity pneumonitis, sarcoidosis, others.5) IPF Diagnosis: clinical history, UIP histopathology, IPF diagnostic criteria.6) Variant patterns of fibrosis: anterior upper lobe, exuberant honeycombing and straight edge signs.7) Specific variant patterns of fibrosis: scleroderma: four corners sign. Systemic lupus erythematosus: "Island-like" fibrosis and heterogeneous lung destruction.8) Summary

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## Abstract Archives of the RSNA, 2023

CHEE-123

### NTM: What the Pulmonologist Wants to Know

#### TEACHING POINTS

Classic and non-classic NTM have characteristic distribution and morphology of bronchopulmonary disease with variability in part associated with the presence of underlying lung disease, as well as other factors. Radiologists may be the first to suggest pulmonary NTM in patients that are asymptomatic or with nonspecific constitutional symptoms leading to earlier diagnosis and management. Baseline CT description should include description of disease extent, fibrocavitary or nodular bronchiectatic type, presence of atelectasis, cavities, and fibrosis. Pulmonary NTM infections are usually indolent/slowly progressive with CT findings waxing and waning over time. Follow-up imaging is performed to assess interval improvement or progression of the airways disease, cavities, nodules and consolidation. The focal mass like/nodular NTM type can pose diagnostic challenges, and must be distinguished from other infections and malignancy. Development of high-attenuation mucous (HAM) in bronchiectatic airways is pathognomonic for superimposed ABPA. New or growing nodule should raise concern for neoplasm. NTM should be also be considered as an allergen to incite nonfibrotic hypersensitivity pneumonitis.

#### TABLE OF CONTENTS/OUTLINE

Epidemiology. Diagnostic criteria for pulmonary NTM. CT Manifestations of pulmonary NTM. What the Radiologist needs to know. What the Pulmonologist wants to know.

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## Abstract Archives of the RSNA, 2023

CHEE-124

### Thoracic Complications of Stanford Type A Aortic Dissection: A Review of CT Findings and Management

#### TEACHING POINTS

This presentation will serve as a review of aortic root anatomy and aortic dissection. It also includes an update to the Stanford classification system published jointly by the Society for Vascular Surgery and the Society of Thoracic Surgeons which provides a more detailed description of the dissection and is suited to sites offering endovascular repair (though likely to become more universally adopted in the future). The bulk of the exhibit is concerned with the complications of Type A dissection which occur within the thorax. A framework for classifying and subclassifying complications is described as well as a more detailed description of the pathophysiology, grading, and management of these complications. This information has previously been offered separately in review articles, case series, and case reports but will now be presented as a single resource. Detailed diagrams and representative CT images will support the information presented and will aid the viewer's understanding of the concepts. CT is often utilized for investigation of suspected acute aortic syndrome. This presentation will be useful for radiologists and radiology residents working in the acute care setting, to assist their search pattern and tailor their reports to provide more useful information to the cardiothoracic surgeon.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Risk factors and epidemiology 3. Classification of aortic dissection 4. CT imaging protocol recommendations 5. Complications and management of aortic dissection 6. Thoracic complications of Type A dissection 6.1 Rupture complications 6.2 Malperfusion complications 6.3 Aortic valve distortion/disruption with regurgitation 7. Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-125

### From Acute to Chronic: A Comprehensive Guide to Aortic Injuries and the New Classification System

#### Participants

Amr Wardeh, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1.) Learn to differentiate among the different types of acute aortic syndrome and understand their clinical significance.(2.) Explore the signs of instability and potential complications in acute aortic syndrome.(3.) Examine the appearance of subacute and chronic aortic dissection.(4.) Discuss the limitations of the Stanford classification system in addressing the complexities of acute aortic syndrome.(5.) Introduce the new Society of Vascular Surgeons and the Society of Thoracic Surgeons classification system (SVS/STS) and how it differs from the Stanford classification system.(6.) Illustrate the use of the new SVS/STS classification system with example cases.

#### TABLE OF CONTENTS/OUTLINE

(I.) Introduction to Acute Aortic Syndrome (A.) Definition and clinical importance (B.) Overview of the four types (1.) Aortic dissection (2.) Intramural hematoma (3.) Penetrating atherosclerotic ulcer (4.) Limited intimal tear (II.) Classification Systems (A.) Stanford Classification System and its Limitations (B.) SVS/STS Classification System (C.) Comparison of the Classification Systems (D.) Example Cases: Applying the SVS/STS Classification System.

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## Abstract Archives of the RSNA, 2023

CHEE-126

### Reporting Response Assessment in Clinical Trials in the Era of Personalized Medicine

#### TEACHING POINTS

Response Evaluation Criteria in Solid Tumors (RECIST) was published in 2000 and revised to RECIST 1.1 in 2009. RECIST defines lesions as measurable and non-measurable, based on whether they are quantifiable; measurable lesions consist of target, which are followed, and non-target. RECIST 1.1 includes newer technologies like FDG-PET and MRI and clarifies lymph node criteria. Target lesions must be: Easily and reproducibly measurable; Representative of the disease; Representative of distribution Progressive disease (PD) after initial response can be depicted using RECIST 1.1. Personalized therapies targeting specific receptors are in clinical trials and allow patients with slow progression to be followed long term. iRECIST criteria are used to assess response to immunotherapy. Response may vary between unidimensional and volumetric assessment methods. Genomic profiling in a lung cancer patient revealed an EGFR mutation. The tumor was successfully targeted by Erlotinib, showing 61% decrease in size at 8 weeks.

#### TABLE OF CONTENTS/OUTLINE

Illustrate response assessment in the era of personalized medicine clinical trials  
Depict optimal strategies for response assessment using a multimodality approach  
Explore novel response assessment criteria, such as volumetric and MRI based DCE and DWI, to assess response

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## Abstract Archives of the RSNA, 2023

CHEE-127

### Congenital Lung Anomalies in the Adult

#### Participants

Marcos Mestas Nunez SR, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Although rare, congenital lung anomalies are incidentally discovered in adults and can pose a diagnostic dilemma. The radiologist must be familiar with the imaging findings and differential diagnosis. With this exhibit we will: 1) Review the typical imaging appearance of common and uncommon congenital lung anomalies as seen in the adult. 2) Review the concept of hybrid lesions. 3) Case based review of entities that can be mistaken for congenital lung anomalies, and the role of imaging in the differential diagnosis. 4) Describe complications and as well as discuss the risk of malignancy of some of these entities.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction and embryology 2) Bronchopulmonary anomalies a) Bronchial atresia b) Lobar hyperinflation c) Bronchogenic cyst d) CPAM 3) Combined pulmonary and vascular anomalies a) Pulmonary sequestration b) Hypogenetic lung syndrome c) Thoracic Isomerism 4) "New concepts" hybrid lesions 5) Miscellaneous a) Placental transmogrification b) Proximal Interruption of the pulmonary artery 6) Differential diagnoses: Case-based approach 7) Complications a) Risk of malignancy: true or myth? b) Superimposed: a radiology challenge c) Hemoptysis and radiology in treatment

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## Abstract Archives of the RSNA, 2023

CHEE-128

### The Family Plan: Multidisciplinary Approach to Familial Pulmonary Fibrosis (FPF)

#### Participants

Katherine Cheng, MD, Stamford, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familial pulmonary fibrosis (FPF), defined as pulmonary fibrosis affecting at least two first degree relatives, is a complex group of diseases caused by a variety of genetic mutations. Diagnosis of FPF is essential as these patients have a worse prognosis than their sporadic counterparts that affects management not only of the patient, but also of first-degree relatives. However, the diagnosis of FPF can be difficult for both the radiologist and clinician as imaging patterns of fibrosis are often unclassifiable; variable penetrance exists amongst family members; and new mutations are continuously being discovered. This exhibit aims to improve understanding of FPF through a multidisciplinary approach reviewing genetic, clinical, and imaging manifestations of FPF.

#### TABLE OF CONTENTS/OUTLINE

1. Definition and Epidemiology of FPF.2. Overview of the Genetic Mutations Associated with FPF including telomere, surfactant, host defense3. Illustrate the spectrum of imaging patterns for FPF and the variability that can exist even amongst family members including unclassifiable, UIP, NSIP, PPFE4. Emphasize the importance of genetic testing

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## Abstract Archives of the RSNA, 2023

CHEE-129

### Cardiovascular and Thoracic Imaging Manifestations of Lupus

#### Participants

Muhammad Naeem, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Systemic Lupus Erythematosus (SLE), also known as Lupus is a great masquerader and being a systemic illness it virtually affects every organ in the body. Cardiovascular and Thoracic manifestations are often prevalent. Over half of the patients with lupus develop pleuropulmonary involvement. Lupus patients often get delayed diagnosis and sometime radiologists can provide clue to underlying lupus by putting all the imaging findings together.- Thrombosis is quite prevalent in lupus given the high association with Antiphospholipid antibody (APLA). Other vascular manifestations can be coronary artery disease/aneurysms, pulmonary hypertension, venous thromboembolism, pulmonary emboli and rarely aortic dissections.- Heart involvement in lupus often present with myocarditis, although pericarditis is much more common due to the high prevalence of serositis in lupus.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- pathophysiological mechanisms in lupus- diagnostic criteria for lupus- Lung and Pleural involvement: Pleural disease, Lupus pneumonitis, Diffuse Alveolar Hemorrhage, Shrinking Lung Syndrome, Pulmonary fibrosis (along with classic patterns described in lupus)- Vascular involvement: Thrombosis/lupus anticoagulant/APLA antibodies, Venous thromboembolism, Pulmonary hypertension, Aortic dissections- Cardiac involvement: Pericardial involvement, Myocarditis and myocardial LGE pattern, Coronary artery disease and coronary vasculitis, Valvular disease (Libman-Sacks endocarditis)- Summary slide

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## Abstract Archives of the RSNA, 2023

CHEE-13

### Ground-Glass Opacities in Thoracic CT: Beyond the Acute Disease

#### Participants

Alicia Espinal Soria, MD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the spectrum of pathologic entities that manifest as ground-glass opacities in thoracic CT. To learn that ground glass opacities are not always related to acute diseases, being associated in some cases with fibrosis signs.

#### TABLE OF CONTENTS/OUTLINE

Ground-glass opacities (GGO) are defined as a light increase in attenuation in pulmonary parenchyma that occur when alveolar space is compromised and/or when pulmonary capillary blood volume increases. This finding is often associated with acute pathology like pulmonary edema, alveolar hemorrhage, *Pneumocystis jirovecii* pneumonia, COVID-19, acute interstitial pneumonia, and acute respiratory distress syndrome. But some subacute and chronic pathologies may also manifest with GGO in CT such as cryptogenic organizing pneumonia, lepidic-predominant adenocarcinoma, chronic eosinophilic pneumonia, non-specific interstitial pneumonia, and nonfibrotic hypersensitivity pneumonitis. In addition, all of these entities can be classified according to the presence or lack of fibrosis signs, which is a determinant prognosis factor for the patients. The aim of this presentation is to review these pathologies with the most common imaging findings in order to facilitate the differential diagnosis in each case. However, in many cases the imaging findings are nonspecific therefore histologic and microbiologic studies will be necessary to make a definitive diagnosis.

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## Abstract Archives of the RSNA, 2023

CHEE-130

### ANCA-associated Vasculitis: The New 2022 ACR/EULAR Classification Criteria

#### Participants

Jonghyeon Kwon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Introduction and classification of ANCA-associated small vessel vasculitis 2. Review of newly updated 2022 ACR/EULAR classification criteria and cases of ANCA-associated vasculitis 3. Role of radiologists for classification of ANCA-associated vasculitis

#### TABLE OF CONTENTS/OUTLINE

1. Definition of ANCA-associated vasculitis 2. Classification criteria of ANCA-associated vasculitis A. 1990 American College of Rheumatology (ACR) classification criteria B. 2012 Revised Chapel Hill consensus conference (CHCC) nomenclature of systemic vasculitides C. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology (ACR/EULAR) Classification Criteria 3. Review of image findings and application of 2022 ACR/EULAR classification criteria A. Granulomatosis with polyangiitis (GPA) B. Eosinophilic granulomatosis with polyangiitis (EGPA) C. Microscopic polyangiitis (MPA) 4. Summary

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## Abstract Archives of the RSNA, 2023

CHEE-131

### Febrile Neutropenia: A Scenario and Pattern-based Approach to a Perplexing Problem

#### Participants

Adam Yen, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Febrile neutropenia presents a challenging clinical dilemma, and treatment success relies on early diagnosis and targeted antimicrobial therapy. Often, clinical teams look to radiologists to help narrow the differential diagnosis when a neutropenic patient's thoracic CT contains findings concerning for infection. Here, we examine the role of imaging and CT-guided biopsy in the management of febrile neutropenia, present an approach wherein clinical information is paired with a CT pattern to help the radiologist make an educated guess as to the underlying causative agent, and specify where either clinical information or imaging appearance can serve more useful.

#### TABLE OF CONTENTS/OUTLINE

1. Clinical presentation 2. Imaging workup 3. Approach by imaging patterns a. Consolidation/nodules b. Cavitory consolidation c. GGO d. Halo e. Reverse halo f. Thoracic wall involvement 4. Helpful clinical information a. Time course b. Antimicrobial response c. Procalcitonin d. B-D-Glucan e. Galactomannan f. Serologies g. BAL aspirate microscopy h. Cultures 5. Less than 1 week from onset a. Consolidation/nodules - common bacteria i. Gram+ bacteria (MRSA, VRE) ii. Gram- bacteria (pseudomonas) b. GGO - mostly viral i. EBV, CMV, other viruses ii. PJP 6. Consolidation/nodules + non-response to broad spectrum antibiotics - fungi a. Candida b. Aspergillus c. Mucormycosis 7. Other organisms to consider - uncommon bacteria a. Nocardia b. Actinomyces 8. Utility of biopsy a. Fungal infection b. Malignancy c. Non-diagnostic biopsy d. Platelet management 9. Summary by imaging appearance 10. Summary by helpful clinical information

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## Abstract Archives of the RSNA, 2023

CHEE-132

### Deciphering Acute Diffuse Pulmonary Lesions: Unraveling the Diagnostic Enigma

#### Participants

Daisuke Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diffuse lung diseases include a wide variety of infectious, neoplastic, and allergic diseases in addition to idiopathic interstitial pneumonia. In this presentation, we will discuss what radiologists need to know about these diseases, especially those that present with diffuse lung lesions in an acute-onset.

#### TABLE OF CONTENTS/OUTLINE

Presentation goals: To explain the pathophysiological mechanisms of hydrostatic and permeability pulmonary edema and describe the imaging findings. To discuss the spectrum of acute/subacute lung injury. To present information on acute diffuse pulmonary diseases classified by cause into idiopathic, infectious, allergic, drug-induced, neoplastic, and rare diseases and to describe their characteristic imaging findings. Cases include Infectious pneumonia: COVID-19 pneumonia, Cytomegalovirus pneumonia, Varicella zoster virus pneumonia, Influenza pneumonia, Pneumocystis pneumonia, Miliary tuberculosis, Legionella pneumonia, Diffuse aspergillosis after influenza viral infection Allergic lung diseases: Acute eosinophilic pneumonia, Acute hypersensitivity pneumonitis, E-cigarette, or vaping, product use associated lung injury (EVALI), Pulmonary injury associated with inhalation Drug-induced lung injury: Caused by anti-cancer drugs and other medications Neoplastic diseases: Tumor embolism, Pulmonary tumor thrombotic microangiopathy, Carcinomatous lymphangiosis, Leukocytosis, Intravascular large B-cell lymphoma Rare diseases: Pulmonary hemorrhage, Fat embolism

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## Abstract Archives of the RSNA, 2023

CHEE-133

### Detailed Radiologic-Pathologic Correlation in Fibrotic Hypersensitivity Pneumonitis (FHP): For Better Understanding of the HRCT Findings

#### Participants

Daisuke Yamada, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understanding the histological backgrounds is an essential clue to making a better interpretation of HRCT images. The teaching points are 1) to review the anatomical/histological basic knowledges of the lungs for HRCT diagnosis of interstitial lung diseases, 2) to recognize the meaning of representative HRCT findings in fibrotic hypersensitivity pneumonitis by precise correlation to histological findings.

#### TABLE OF CONTENTS/OUTLINE

Definition and pathophysiology of fHP / Review the anatomical/histological basis of the lungs Anatomy of secondary lobule, location of the peribronchiolar region in secondary lobule Radiological and pathological findings Demonstration of typical radiological and pathological findings of fHP Essential HRCT findings to know? small airway lesion (e.g. three-density pattern, lobules with decreased attenuation), parenchymal fibrotic lesion showing random distribution or UIP/NSIP-like pattern Close correlation between radiological and pathological findings •Centrilobular ground-glass opacities on HRCT?bronchiolitis and peribronchiolar inflammation, airway-centered mild fibrosis/organization •Ground-glass opacties?diffuse parenchymal inflammation or mild alveolar septal thickening •NSIP-like pattern fibrosis showing peribronchovascular distribution on CT? can be formed by a fusion of airway-centered lesions •UIP-like pattern fibrosis showing periacinar/perilobular distribution on CT?is sometimes derived from organization along lymphatic routes result in periacinar/perilobular fibrosis Conclusion The HRCT findings of fHP are varied and complex, but can be better grasped by understanding the histological background.

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## Abstract Archives of the RSNA, 2023

CHEE-14

### Oncologic Causes of Phrenic Nerve Palsy: Where and How to Look for

#### Participants

Nivedita Chakrabarty, Mumbai, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate normal anatomical course of phrenic nerve from skull base to diaphragm  
variant anatomy of phrenic nerve -pictorial review  
Imaging approach on when to suspect and how to report phrenic nerve compression/infiltration  
emphasis on oncologic case based approach to phrenic nerve palsy

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Phrenic nerve; its anatomy, normal course and variants  
Various aetiologies of phrenic nerve palsy with emphasis on malignancy  
Pathophysiology of phrenic nerve palsy, infiltration vs compression  
CT and PET CT as a diagnostic modality for assessment of phrenic nerve palsy  
Pictorial illustration of cases  
Take home points

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## Abstract Archives of the RSNA, 2023

CHEE-15

### Thoracic Involvement in Diseases Related to Dysregulated Humoral Immunity

#### Participants

Jose Maluf, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand general concepts about immunity and humoral immunity
- Identify the main pathologies related to unfunctional humoral immunity
- Learn about the thoracic involvement in dysregulated humoral immunity states and how it can impact in patient's health
- Recognize the thoracic imaging findings related to a compromised humoral immunity

#### TABLE OF CONTENTS/OUTLINE

- Introduction - General concepts about immunity:
  - o Main concepts and differences between cellular and humoral immunity
  - o Relation of the chest and respiratory tract with humoral immunity and the potential impacts in patient's health
  - o Thoracic imaging role in patients with dysregulated humoral immunity states
- Different thoracic findings:
  - o Airway abnormalities
  - o Infection
  - o Chronic Inflammatory and interstitial lung diseases
  - o Benign lymphoproliferative disorders
  - o Neoplasms
- Case based review - Pathologies and thoracic manifestations:
  - o Common Variable Immunodeficiency (CVID)
  - o IgG4-Related Respiratory Disease (IgG4-RRD)
  - o Respiratory amyloidosis
  - o Hypogammaglobulinemia
  - o Pulmonary Light-Chain Deposition Disease
  - o Other conditions
- Future perspectives
- Conclusions and key takeaways

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## Abstract Archives of the RSNA, 2023

CHEE-16

### Rare Vasculitides: An Institutional Case-Based Radiological Review of Hughes-Stovin Syndrome

#### Participants

Taylor Loon, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Describe the clinical presentation and identify the corresponding radiographic findings of Hughes-Stovin syndrome. 2) Compare and contrast the radiological and clinical findings with other vasculitides and other causes of pulmonary artery aneurysms. 3) Discuss the possible complications and highlight the medical and surgical management of Hughes-Stovin syndrome.

#### TABLE OF CONTENTS/OUTLINE

1) Introduce Hughes-Stovin Syndrome, its epidemiology, the three sequential phases of clinical presentation, and its diagnostic criteria. 2) Using cases from our institution, present the common radiologic features of Hughes-Stovin on chest radiograph and CT angiography of the thorax. 3) Using 3D-rendered images from our institution, further display the pulmonary arterial findings of Hughes-Stovin Syndrome. 4) Compare and contrast the diagnostic criteria, common radiologic findings and management of Hughes-Stovin to other pulmonary vasculitides including Behçet's disease and Granulomatosis with Polyangiitis. 5) Compare and contrast Hughes-Stovin to other causes of pulmonary artery aneurysms including mycotic aneurysms. 6) Discuss unstable pulmonary aneurysms as a potential complication of Hughes-Stovin Syndrome and overview treatment algorithm based on CT pulmonary angiography findings. 7) Using digital subtraction angiography images from our institution, review embolization for unstable pulmonary artery aneurysms and potential complications of treatment.

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## Abstract Archives of the RSNA, 2023

CHEE-17

### Childhood Interstitial Lung Disease: Stepwise Approach to Imaging Findings, Histopathologic Correlation, and Management

#### Participants

Karen Ramirez Suarez, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Childhood interstitial lung disease is rare with challenging differential diagnosis which requires a stepwise approach to diagnosis including clinical presentation, imaging, and histology leading to the correct diagnosis in most cases. - An age-based differential diagnosis is particularly helpful for infants and young children. - Imaging evaluation of lung parenchyma, primarily on CT, helps to correctly diagnose these disorders, aids in guiding biopsy when needed, and monitor treatment response or disease progression. - Radiologic pathologic correlation is an important final step in the evaluation of childhood interstitial lung disease.

#### TABLE OF CONTENTS/OUTLINE

- Role of imaging of childhood interstitial lung disease with delineation of technique and pediatric protocols. - Stepwise approach to diagnosing childhood interstitial lung disease from clinical presentation to diagnostic workup including imaging, genetics, and biopsy. - Correlation of imaging findings and histology in childhood interstitial lung disease - Differential diagnosis of childhood interstitial lung disease based on clinical findings, imaging, and histology.

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## Abstract Archives of the RSNA, 2023

CHEE-18

### Lung Cancer Interventional Oncology: Fire and Ice in the Treatment of Lung Cancer

#### TEACHING POINTS

-CT-guided ablation is a viable option for treatment of multifocal lung carcinoma and patients with inoperable tumors, recurrence, prior surgery or radiation.-Choice of ablation modality depends on consideration of technical factors, size and location of target lesion, and patient comorbidities.-Target lesions > 3 cm confer a higher local recurrence rate than lesions < 3 cm.-Postablation features of successful ablation include ground-glass margins, which is crucial for confirming treatment success.-Follow up of postablation patients is the responsibility of the interventional oncologist with a standardized regimen of office visits and imaging.

#### TABLE OF CONTENTS/OUTLINE

-Indications for ablation in lung cancer-Comparison of ablation modalities-Mechanisms of tissue injury in ablation-Indicators of successful ablation-Postablation zone imaging features-Follow up surveillance

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## Abstract Archives of the RSNA, 2023

CHEE-19

### Breaking Through the Sternum: Expected Post-sternotomy Imaging's Findings and Complications

#### Participants

Renan Arakaki, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Median sternotomy is the incision of choice for thoracic and cardiac surgical procedures. Its incidence of complications ranges approximately between 0,5-5%, with a mortality rate reaching up to 80%. Thus, it is essential for the radiologist to recognize expected poststernotomy imaging findings and differentiate them from complications. This educational exhibit aims to illustrate the different sternal closure techniques, expected postsurgical changes and the main sternotomy complications involving hardware (wire fracture, migration, and rotation), bone (fracture, sternal dehiscence, nonunion, and osteomyelitis), and soft tissues (hematoma, gossypiboma, and abscess).

#### TABLE OF CONTENTS/OUTLINE

- Sternal closure techniques- Expected postsurgical imaging findings- Acute sternotomy complications- Late sternotomy complications.

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## Abstract Archives of the RSNA, 2023

CHEE-2

### Across the Diaphragm: Thoracic Complications of Abdominal Conditions and Percutaneous Procedures

#### Participants

Elisa Antolinos Macho, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Recognize that many pathologic abdominal conditions and certain complications of percutaneous abdominal procedures may extend to the thoracic cavity -Learn the most common pathologic abdominal conditions and percutaneous procedures complications that may extend above the diaphragm -Describe the anatomical and acquired pathways through which infradiaphragmatic pathologic conditions and percutaneous procedures complications may reach the thorax -Review the appearance of these thoracic complications on different imaging modalities

#### TABLE OF CONTENTS/OUTLINE

1) Anatomy and physiology of the diaphragm 2) Common abdominal pathologic conditions and percutaneous procedures complications that may extend to the thorax o Liver and biliary system conditions o Pancreatic and splenic conditions o Kidneys and adrenal glands conditions o Pelvic conditions o Complications of percutaneous abdominal procedures § External biliary drainage § Percutaneous local ablative therapies of liver lesions § Embolization of portal and hepatic veins § Vertebroplasty 3) Pleural complications o Pleural effusion o Fistulas (biliopleural fistula, pancreaticopleural fistula) 4) Pulmonary complications o Infections § TB § Other mycobacteria o Inflammation § Sarcoid reaction § Pneumonitis § Mendelson syndrome o Fistulas 5) Thoracic vascular complications o Fat embolism syndrome o Foreign body embolism

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## Abstract Archives of the RSNA, 2023

CHEE-20

### Emerging Technology in Functional Lung Imaging: Hyperpolarized Xenon Gas MRI

#### TEACHING POINTS

1. Hyperpolarized Xenon Gas (HXG) MRI is a new-to-market FDA approved imaging agent to evaluate lung ventilation, which offers advantages over other inhaled contrast agents. 2. Compared to traditional spirometry, HXG MRI is a promising surrogate with superior reproducibility and reliability. 3. Regulated by the FDA as a drug-device combination, HXG-MRI has some barriers and obstacles for adoption and implementation. 4. Various airway diseases, like asthma, COPD, and Cystic Fibrosis, have MR ventilation features that increase confidence in diagnosis and assessment of disease severity. 5. Ongoing investigation of HXG MRI is revealing new applications for medical imaging, which are not currently possible with existing modalities.

#### TABLE OF CONTENTS/OUTLINE

1. Background/Objectives  
2. Technique  
a. Drug Preparation---i. Supplies, Consumables---ii. Polarization---iii. Dose Administration  
b. MR Scanner Configuration---i. Coil---ii. Software---iii. Hardware  
c. Data Analysis---i. Quantitative methods (Ventilation defect percent, VDP)---ii. Qualitative methods  
3. Clinical Implementation  
a. Regulatory  
b. Logistical  
c. Financial  
4. Ventilation Characteristics  
a. Normal  
b. Pathology disease states---i. COPD---ii. Asthma---iii. Cystic Fibrosis---iv. COVID-19 (Acute and 'Long')  
5. Future Frontiers  
a. Dissolved-Phase Imaging (Barrier Tissues and RBC) in healthy and diseased states.  
b. Dynamic HXG-MRI ('MR Spirometry')  
c. Physiological response to pharmaceutical agents

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## Abstract Archives of the RSNA, 2023

CHEE-21

### How Holey” Art Thou: Developing a Systematic Approach to Identifying and Reporting Cystic Lung Disease

#### Participants

Maria Clara Lorca, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Become familiarized with the different imaging appearance of cystic lung diseases and their differential diagnosis on chest CT. Differentiate true lung cysts versus their mimics: emphysema, cavities, and cystic bronchiectasis, cavitory lung metastasis. Recognize the distribution patterns of the different cystic lung diseases and formulate major differential diagnosis for solitary and multiple pulmonary cysts based on radiological appearance using a standardized approach.

#### TABLE OF CONTENTS/OUTLINE

Recognize primary causes of cystic lung diseases, for example: Birt-Hogg-Dube (BHD) syndrome; spontaneous and tuberous sclerosis related lymphangioleiomyomatosis (LAM), Pulmonary Langerhans cell histiocytosis (PLCH), Lymphocytic interstitial pneumonia (LIP) Recognize acquired cystic lung diseases, for example: Light chain deposition disease, pulmonary laceration, Pneumocystis jirovecii infection, usual interstitial pneumonia, sarcoidosis, amyloidosis. Describe the role of the radiologist in the diagnosis and follow up of cystic lung diseases by CT, and when to recommend further biopsy. Our aim is to review the terminology, distribution and imaging patterns of the most common cystic lung diseases by CT and raise attention to the various mimics of cystic lung diseases, including cavitory lung metastases. The radiologist can then use this information to describe cystic lung disease utilizing a standardized reporting template to improve communication with referring providers.

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## Abstract Archives of the RSNA, 2023

CHEE-22

### Pulmonary Blood Volume Image with Dual-energy CT: Findings in Lung Cancer Patients

#### TEACHING POINTS

1. To review how to obtain the pulmonary blood volume (PBV) images with dual-energy CT. 2. To describe the PBV imaging features and pathogenesis in lung cancer patients. 3. To discuss the importance of clinical implications and the pitfall.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. technical overview of dual-energy CT 3. CTPA techniques 4. the PBV imaging features and pathogenesis in lung cancer patients: vascular abnormalities, bronchial abnormalities, parenchymal abnormalities, artifacts and pitfall, and others 5. Summary

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## Abstract Archives of the RSNA, 2023

CHEE-23

### Potential Applications of Photon-Counting Detector CT in Cardiothoracic Imaging

#### Participants

Mauricio Barbosa, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Exemplify current and future applications of photon-counting detector CT (PCD-CT) in cardiothoracic imaging, including: 1. Improved image quality: PCD-CT provides higher spatial resolution and improved contrast-to-noise ratio, which enables more accurate and detailed imaging of the heart, vasculature and lungs. 2. Lower radiation dose: PCD-CT can allow for lower radiation doses than traditional CT. 3. Reduced artifacts: use of high keV imaging on PCD-CT can reduce metallic artifacts; combination of high-helical pitch imaging with PCD-CT can reduce motion artifacts. 4. Potential for new applications: PCD-CT technology offers new possibilities for functional imaging, including perfusion and multi-energy imaging, which may help in the diagnosis and management of cardiothoracic conditions.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction: ? • Explanation of physical principles? • Potential Advantages of PCD-CT over Energy-integrating detector CT (EID-CT)? • Improved image quality? • Reduction in radiation exposure? • Spectral imaging?; II. Clinical Applications of PCD-CT in Cardiothoracic Imaging?: • Coronary Artery Disease Imaging? • Lung Nodule and Mediastinal Mass Characterization? • Evaluation of Interstitial Lung Disease? • Thoracic Vascular Imaging/ Pulmonary embolism?; III. Future Possibilities: ? • Improvements in Quantitative Imaging? • Functional Imaging?; IV. Challenges and Limitations?: • Scientific and clinical validation? • Need for additional training and education?; V. Conclusion?: • Recap of current clinical applications? • Future directions for PCD-CT? • Final thoughts.

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## Abstract Archives of the RSNA, 2023

CHEE-24

### Disorders with Hand and Thoracic Involvement

#### Participants

Riddhi Borse, MBBS, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Numerous medical conditions have multiorgan imaging findings. Here, we review specifically the hand and cardiothoracic findings of selected infectious, inflammatory, connective tissue, neoplastic, and hereditary disorders. These correlations are meant to remind the astute clinician that certain hand findings should trigger a careful radiologic evaluation that includes imaging of the chest.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Examples of cases:A. Connective tissue disorders- Rheumatoid arthritis, Systemic Lupus Erythematosus, Raynaud's syndrome, Dermatomyositis. B. Hereditary Conditions: Marfan's Syndrome, Ehlers Danlos Syndrome, Sickle-cell disease.C. Metabolic conditions: Hyperparathyroidism, Renal Failure with osteodystrophy and metastatic calcification in the lungs.D. Infectious Diseases: Tuberculosis, Septic Embolism.E. Neoplastic Conditions: Lung Cancer, Melanoma.3. Conclusion.

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## Abstract Archives of the RSNA, 2023

CHEE-25

### Tracheobronchomalacia x Excessive Dynamic Airway Collapse: CT and Bronchoscopy Correlation

#### Participants

Helena Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To discuss the differences between tracheobronchomalacia (TBM) and Excessive Dynamic Airway Collapse (EDAC), emphasizing their pathophysiology, anatomical aspects, clinical presentation and associated comorbidities. - To point out the challenges and controversies in its diagnosis. - To discuss the role of Flexible Dynamic Bronchoscopy and Computed Tomography in the assessment of central expiratory airway collapse (ECAC), highlighting the exam protocols and the main aspects to be evaluated. - To illustrate the imaging appearance of EDAC and TBM on bronchoscopy and CT.

#### TABLE OF CONTENTS/OUTLINE

1 - Introduction 2 - Pathophysiology, anatomical aspects and clinical presentation of TBM and EDAC. 3 - Flexible Dynamic Bronchoscopy and Computed Tomography: techniques, protocols and main findings. 4- Cases 5- Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-26

### What's That in the Bone?"- Non-Traumatic Musculoskeletal Pathology on Chest/ Breast Imaging

#### Participants

Tina Roa, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the basic musculoskeletal anatomy seen in the chest including bones, joints, muscles, tendon insertions and major nerves (including the brachial plexus origin and long thoracic nerve). 2. Recognize MSK anatomic variants and common degenerative changes. 3. Recognize MSK manifestations of infectious, autoimmune, and other systemic pathologies on chest imaging (such as septic arthritis, sickle cell disease, rheumatoid arthritis, etc.) 4. Learn how to approach bone lesions within the chest. 5. Learn how to approach soft tissue lesions within the chest. 6. Review Bone-RADS criteria.

#### TABLE OF CONTENTS/OUTLINE

1. Normal Anatomy: a. Osseous Structures of the Chest, b. Musculature of the Chest, c. Joints and Tendons, d. Major Nerves; 2. Orthopedic Findings: a. MSK Anatomic Variants in the Chest, b. Degenerative MSK Changes in the Chest; 3. MSK Infections/ Autoimmune/ Other Systemic Anomalies in the Chest: a. Septic Arthritis, b. Autoimmune MSK Manifestations in the Chest, c. Other Systemic Disorders; 4. MSK Tumors of the Chest: a. Benign Tumors (Osseous and Soft Tissue), b. Malignant Tumors (Osseous and Soft Tissue); 5. Algorithm to approach incidental bone lesion/ Review of Bone-RADS.

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## Abstract Archives of the RSNA, 2023

CHEE-27

### Spotting the Airway Snags: Computer Tomography Imaging Planning For Bronchoscopy Stent and Valve Placement

#### Participants

Miriana Mariussi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to:

- Review the indications for bronchoscopy stent and valve placement.
- Highlight the role of Computer Tomography in the treatment of airway stenosis, air leaks and chronic obstructive pulmonary disease (COPD).
- Comprehend the application of CT planning prior to the bronchoscopy.
- Correlate the radiological features with bronchoscopy findings.
- Identify CT image findings during follow-up after the procedure.

#### TABLE OF CONTENTS/OUTLINE

Bronchoscopy stent and valve placement have been established as a safe and effective treatment alternative for airway stenosis, air leaks and COPD. A case based pictorial essay allows for a comprehensive assessment and understanding of:

- Clinical indications for bronchoscopy stent and valve placement.
- Radiological features of airway stenosis, air leaks and COPD.
- Pre-procedural CT planning for bronchoscopy airway stent placement.
- Pre-procedural CT planning for the endobronchial unidirectional valve placement.
- Imaging findings correlated with bronchoscopy.
- Expected radiological findings during the follow up.

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## Abstract Archives of the RSNA, 2023

CHEE-28

### **Trouble in the Air: Imaging Review of Early Complications Following Lung Transplantation and Our Institutional Experience**

#### **Participants**

Bob Zhang, MBBS, BMedSc, Melbourne, Australia (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Early complications following lung transplantation are a major cause of morbidity and mortality. Imaging plays a key role in their diagnosis, and it is important for radiologists to be able to recognise these complications, as well as understand the underlying cause. This exhibit aims to 1) discuss the spectrum of complications that occur within the first week following transplantation, 2) discuss preoperative factors that may predispose to complications, 3) review surgical techniques that reduce the risk of certain complications and how to recognise these on imaging, 4) discuss our institutional experience as a major transplant centre, and 5) review the imaging findings of early complications using a case based format.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview of lung transplantation. 2. Overview of complications that occur in the first week following transplantation. 3. Preoperative factors that increase risk of complications following transplantation. 4. Surgical techniques to reduce the risk of postoperative complications and how to recognise these on imaging. 5. Review of our institutional experience as a major lung transplantation centre. 6. Case based review of imaging findings in early post-transplant complications.

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## Abstract Archives of the RSNA, 2023

CHEE-29

### Bronchiectasis: Another Way to Approach Lung Disease

#### TEACHING POINTS

Bronchiectasis features in a wide range of pathological processes including infectious causes, bronchial aspiration, pneumoconiosis, congenital immunodeficiencies, and cartilage development disorders, among others. The spatial distribution; is considered a key point when it comes to establishing differential diagnoses in an easier and quicker way. The upper lung zones are usually compromised by cystic fibrosis, sarcoidosis, and allergic bronchopulmonary aspergillosis noticing a more central involvement while tuberculosis has an asymmetric distribution. The middle lobe and lingula frequently show bronchiectasis secondary to infection by atypical mycobacteria or adult respiratory distress syndrome. Associated findings allow radiologists and trainees to address the diagnoses. When tree-in-bud, centrilobular ground-glass nodules and bronchial wall thickening are seen in patients with lower lung zones bilateral bronchiectasis; bronchial aspiration should be suspected. Meanwhile, the presence of architectural distortion, honeycombing, and varicoid morphology bronchiectasis are commonly found in pulmonary fibrosis.

#### TABLE OF CONTENTS/OUTLINE

Location and distribution, Upper lung: Cystic fibrosis, Sarcoidosis, Allergic bronchopulmonary aspergillosis, Tuberculosis Middle/lingular: Atypical mycobacterial infection, Acute respiratory distress syndrome, Primary ciliary dyskinesia, Immunodeficiency Lower lung zone: Chronic aspiration, Pulmonary fibrosis,  $\alpha$ 1-Antitrypsin deficiency. Central: Tracheobronchomegaly, Williams Campbell syndrome Focal and diffuse: Endobronchial or peribronchial tumor, Swyer James syndrome, Bronchiolitis obliterans.

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## Abstract Archives of the RSNA, 2023

CHEE-3

### Inside the Circuit: Radiology Insights into ECMO Placement

#### TEACHING POINTS

1. ECMO, or extracorporeal membrane oxygenation, is a life-support system that provides temporary respiratory or circulatory support to critically ill patients whose heart or lungs are failing. 2. Radiology plays an important role in ECMO, particularly in assessing the placement of the cannulas and monitoring for complications such as bleeding or clotting. 3. Sentinel events, such as malposition of the cannulation require rapid intervention and evaluation by the ECMO team and radiology. 4. There are different types of ECMO cannulation, including veno-arterial, veno-venous, veno-veno-arterial, and central cannulation. 5. Venous-arterial cannulation is used when the patient has both respiratory and circulatory failure, and it requires correct positioning to ensure optimal blood flow and oxygenation. Incorrect positioning can lead to complications such as limb ischemia or vessel injury. 6. Venovenous ECMO is used when the patient has isolated respiratory failure, and it also requires correct positioning to avoid complications such as bleeding or pneumothorax.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1. Indications for ECMO 2. Role of Radiology in ECMO 3. Sentinel Event Types of ECMO Cannulation 1. Veno-Arterial 2. Veno-Venous 3. Veno-Veno-Arterial 4. Central Cannulation Venous-Arterial Cannula 1. Indications 2. Correct Positioning 3. Incorrect Positioning 4. Complications of Incorrect Positioning VA ECMO: Femora Cannula 1. High Arterial Cannula 2. Low Arterial Cannula 3. Low Venous Cannula 4. High Venous Cannula Venovenous ECMO 1. Indications 2. Correct Positioning 3. Incorrect Positioning 4. Complications of Incorrect Positioning 5. Single lumen VV ECMO Conclusions

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## Abstract Archives of the RSNA, 2023

CHEE-30

### **Chill Out! Percutaneous CT- Guided Intrathoracic Cryoablation: Applications, Imaging Appearance, and Complications**

#### **Participants**

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Percutaneous cryotherapy uses liquified gases like nitrogen or argon through cryoprobes under CT guidance to create temperatures as low as - 40° C. Cytotoxic cell destruction occurs at this temperature which helps to destroy neoplastic cells. Cryotherapy allows real-time evaluation of the ablation site. It is a preferred ablation technique for central tumors close to airways, great vessels, pericardium.

#### **TABLE OF CONTENTS/OUTLINE**

Indications for cryotherapy: Primary lung cancer (early or advanced), metastatic lesions, mediastinal lesions, post-SBRT recurrent tumors, post-surgical recurrent tumors. Post treatment appearance - Immediately after the procedure, follow-up after 1 month, 3 months, 6 months and 12 months. Complications of cryotherapy Pneumothorax, hemoptysis, pleural effusion, parenchymal hemorrhage, pneumonia, esophageal injuries, tumor implantation, tumor recurrence, nerve injury, skin injury.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-31

### Pleuroparenchymal Fibroelastosis: Update on Imaging with Pathological Correlation

#### Participants

Joel Gamble, MD,BSC, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Pleuroparenchymal Fibroelastosis (PPFE) is a rare subtype of interstitial pneumonia that historically has been difficult to diagnose, particularly in its early stages, and often misdiagnosed by radiologists. 2. PPFE can be associated with other fibrotic interstitial lung diseases or triggered by previous infections, chemotherapy, hematopoietic stem cell transplant, and lung transplant. 3. Improving awareness of PPFE allows early recognition on CT and allows for close attention on clinical and imaging follow up, including implementation of supportive measures and potential treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Pleuroparenchymal Fibroelastosis (PPFE): Definition and background; Historical context and understanding; Inclusion in American Thoracic Society/European Respiratory Society guidelines. 2. Diagnosis and Recognition of PPFE: Challenges in early-stage diagnosis; Importance of CT in the diagnosis; Pathological confirmation. 3. Causes and Associations of PPFE: Previously believed to be idiopathic; Association with other fibrotic interstitial lung diseases; triggers, including infections, chemotherapy, hematopoietic stem cell transplant, lung transplant. 4. Clinical Presentation and Prognosis: Slowly progressive or rapid clinical deterioration; Poor prognosis in most cases; Potential treatment.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

CHEE-32

### One-stop-Shop Pictorial Review of All Changes in Lung-RADS v2022

#### Participants

Seyedali Nabipoorashrafi, MD, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Familiarize radiologists with the latest version of the Lung-RADS criteria (Lung-RADS v2022) for lung cancer screening (LCS).2- Review the most recently added nomenclature and morphologic features that radiologists should consider determining the appropriate Lung-RADS categories.3- Review important updates on assigning Lung-RADS categories on follow up studies (stepped management).

#### TABLE OF CONTENTS/OUTLINE

1- Introduction to the Lung-RADS tool and its various versions.2- Comparison of important changes between the 2022 and 2019 versions of Lung-RADS in different domains, including A) Atypical pulmonary cysts B) Juxtapleural nodules C) Inflammatory or infectious findings D) Airway nodules.3- Review of updated Lung-RADS terms and structural definitions, including the removal of the risk of malignancy table, changes in follow-up intervals, as well as reset of starting points for follow-up and different definitions for growth.4- Brief review of the effect of changes in Lung-RADS classification criteria on clinical management.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-33

### The Many Faces of Evil: A Pictorial Review and Algorithmic Approach to Autoimmune Diseases of the Thorax

#### Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Different autoimmune diseases can involve different parts of the thorax, including but not limited to lung parenchyma, heart, esophagus, pleural and pericardial space, great vasculature, thymus gland, and thoracic chest wall.
- Patterns of lung disease could precede the development of the clinical diagnosis of autoimmune disease.
- As autoimmune disorders overlap clinically, the possibility of mixed thoracic radiological manifestations should be considered.
- Thoracic involvement in autoimmune disorders could happen due to the disease process itself, drug toxicity, or opportunistic infections from resultant immunodeficiency, which their differentiation needs meticulous clinical-radiological evaluation.
- Provide an algorithmic approach for diagnosis of autoimmune diseases with focus on intrathoracic findings.
- The European Respiratory Society/American Thoracic Society task force proposes using "Interstitial pneumonia with autoimmune features (IPAF)" for patients with idiopathic interstitial pneumonia and features suggestive of, but not definitive for a collagen vascular disease.

#### TABLE OF CONTENTS/OUTLINE

- Review of the thoracic findings in autoimmune disorders of the thorax based on the involved organs.
- Evaluation of lung parenchyma findings based on the pattern and prevalence.
- Assessment of autoimmune diseases of the thorax, beyond the lung parenchyma involvement.
- Review the post-treatment changes and treatment complications in the autoimmune disorders of the thorax.
- Evaluation of the natural progression of thoracic autoimmune disorders.
- An algorithmic approach for diagnosis of autoimmune diseases.

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## Abstract Archives of the RSNA, 2023

CHEE-34

### Classical Signs on Chest Radiograph: A Primer for Residents

#### Participants

Furkan Ufuk, MD, Denizli, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? Recognize the classic signs on chest radiographs. ? Describe each sign's anatomic and pathologic features and discuss their clinical importance.

#### TABLE OF CONTENTS/OUTLINE

This educational exhibit provides an overview of classic signs on chest radiographs and their clinical significance. The exhibition includes a table of contents and teaching points, such as recognizing the appearance of chest radiograph signs on Chest CT and describing the anatomic and pathologic features represented by each sign. Several imaging signs on chest radiographs are described, including Air bronchogram, Bat's wing or butterfly shadow, black pleura sign, and others, with the pathophysiologic origin of each sign and the characteristic imaging features described in detail. Radiologists must recognize these signs and understand their causes to provide accurate diagnoses of abnormalities affecting the lungs, heart, mediastinum, diaphragm, and pleura. The exhibit aims to enhance radiologists' knowledge of classic signs on chest radiographs, ultimately leading to improved diagnostic accuracy and better patient care.

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## Abstract Archives of the RSNA, 2023

CHEE-35

### A Challenge in Diagnosing Benign Thymic Lesions as Benign

#### TEACHING POINTS

1. To understand the normal/hyperplastic spectrum of the thymus and related clinical conditions 2. To understand the typical and atypical appearance of benign thymic lesions 3. To understand mimickers of thymic lesions

#### TABLE OF CONTENTS/OUTLINE

1. Importance of benign diagnosis of thymus a. Avoid unnecessary thymectomy or follow-up study b. Image modality selection and appropriate recommendation 2. Normal/hyperplastic spectrum of the thymus a. Various morphology of the thymus b. Demographic and clinical features related to thymic involution/hyperplasia c. Thymic hyperplasia related to COVID-19 infection or vaccination d. 2D and 3D analysis: Shape and measurement in size and volume 3. Typical appearance of common benign thymic lesions a. Thymic hyperplasia: True vs lymphoid hyperplasia b. Thymic cyst: Unilocular vs multilocular c. Thymolipoma d. Differentiation from thymic neoplasm (Thymic epithelial tumor, lymphoma) 4. Atypical appearance of benign thymic lesions a. Nodular component within the thymus b. Atypical morphologies of thymic hyperplasia (TH) • Non-suppressive TH out-of-phase T1WI MRI • Multinodular/multicystic TH (Sjogren's syndrome, HIV infection) c. Atypical features of thymic cyst • Complicated hyperattenuating cyst • Thymic/pericardial cyst within TH 5. Mimicker of thymic lesions a. Morgagni hernia b. Focal fat necrosis c. Ectopic thyroid lesion d. Tortuous internal mammary vein e. Lymph nodes 6. Summary

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## Abstract Archives of the RSNA, 2023

CHEE-36

### A Comprehensive Pictorial Review: Vascular Anomaly and Malformation of Thorax

#### Participants

Ryosuke Taiji, MD, Kashihara, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is To depict anomalies and malformations of thorax To discuss the clinical feature, significance, and management for those entities.

#### TABLE OF CONTENTS/OUTLINE

The mediastinum contains two distinct circulatory systems, namely the systemic and pulmonary circulations. Anomalies and malformations have been reported within the thorax. In the pediatric population, some malformations are identified promptly after birth and necessitate surgical intervention. Radiologist should be familiar with these entities. Contents 1. Pulmonary artery Absence of the right pulmonary artery, proximal interruption of the pulmonary artery, pulmonary arterial aneurysm, pulmonary sling, and Taussig-Bing syndrome, 2. Aorta Aberrant right subclavian artery, right aortic arch and Kommerell diverticulum, arterial duct (Botallo's duct), and anomalous systemic arterial supply to the basal lung 3. Pulmonary vein Partial anomalous pulmonary venous return (PAPVR); right upper and lower pulmonary vein, Scimitar syndrome, total anomalous pulmonary venous return (TAPVR); supra-cardiac, cardiac, infracardiac type, anomalous unilateral single pulmonary vein (AUSPV), and pulmonary venous aneurysm 4. Vena cava Persistent left superior vena cava, azygos continuation of inferior vena cava 5. Summary

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## Abstract Archives of the RSNA, 2023

CHEE-37

### Granulomatosis with Polyangiitis (GPA): Thoracic Manifestations with Emphasis on Differential Diagnosis

#### Participants

Roddie Moraes Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the pathophysiology and histologic features of granulomatosis with polyangiitis (GPA); review the main clinical manifestations of GPA; recognize the most common and uncommon chest imaging findings of GPA; highlight the main differential diagnosis of thoracic manifestations of GPA in a pattern-based approach, with clinical-radiological correlation.

#### TABLE OF CONTENTS/OUTLINE

Introduction: definition, pathophysiology, clinical features, diagnostic criteria; case based review - pattern-based thoracic manifestations of GPA with differential diagnoses: lung nodules and masses, airspace consolidation and ground glass opacities, airway thickening, pleural involvement, rare mediastinal manifestations (lymphadenopathy, cardiac involvement, great arteries vasculitis); conclusions and key takeaways

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## Abstract Archives of the RSNA, 2023

CHEE-38

### Clearing the Fog - What You Must Know About Smoking-related Diffuse Lung Diseases

#### Participants

Gabriel Neumann Kuhn, MD, Morro Redondo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the smoking-related diffuse lung diseases (SDLD) and its pathophysiological mechanism; Discuss the relationship between smoking and interstitial lung abnormalities (ILA) and the relevance of the imaging approach; Case-based demonstration of the main imaging findings associated in each one of the SDLD; Review the findings and implications of the combined emphysema-fibrosis syndrome.

#### TABLE OF CONTENTS/OUTLINE

General facts about tobacco use; Case based examples of the main SDLD (respiratory bronchiolitis / desquamative interstitial pneumonia, smoking related interstitial fibrosis / airway enlargement with fibrosis, Langerhans cell histiocytosis); Brief up-to-date approach of combined emphysema-fibrosis syndrome; Take home messages.

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## Abstract Archives of the RSNA, 2023

CHEE-39

### Three Steps for the Success of a Lung Segmentectomy Surgery: The Role of the Radiologist

#### Participants

Maria Celia Franco Issa, MD, Uberlandia, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? Review the concepts, indications and techniques of lung anatomical segmentectomy ? Describe the most relevant imaging features of the pulmonary nodule to the surgery planning ? Discuss the role of preoperative Chest Computed Tomography (CT) in the recognition of the drainage pattern of the intersegmental vein and determination of the intersegmental plane ? Recognize the anatomical features and variations of the pulmonary venous drainage with potential impact in lung segmentectomy ? Discuss the role of 3DCT in the lung segmentectomy planning

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- The rationale of Lung Segmentectomy
  - o Indications
  - o Advantages and disadvantages
  - o Minimally Invasive Techniques - Video-assisted thoracic surgery (VATS) - Robotic-assisted thoracic surgery (RATS) - Potential complications
- The role of the Radiologist in three steps
  - 1. Describe the most relevant features for anatomical segmentectomy recommendation:
    - Nodule size and location
    - Resection margin
    - Previous lung resection
    - Absence of visible regional lymph node disease
  - 2. Identify the intersegmental vein - Delineate the intersegmental plane - Verify if the intersegmental vein is a drainage vein from the tumor
  - 3. Look for variations of the pulmonary venous drainage that might impact in the lung segmentectomy - Case-based review - Atypical venous outflow to the left atrium - Atypical topography of the pulmonary vein - Atypical venous vascularization of pulmonary segments
- Future Directions the role of CT with 3D reconstructions and 3D printing in lung segmentectomy planning

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## Abstract Archives of the RSNA, 2023

CHEE-4

### Primer for Radiology Residents: Cardiothoracic Emergencies in Oncology

#### Participants

Jitesh Ahuja, MD, MBBS, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize radiologists with spectrum of acute cardiothoracic complications that can occur in oncology patients.

#### TABLE OF CONTENTS/OUTLINE

Cancer is the second most common cause of mortality in United States. Several acute cardiothoracic complications can occur in oncology patients that can be life-threatening. These complications can occur due to tumor itself, including the extent of local invasion and metastasis. In oncology patients undergoing treatment, emergencies can be the result of complications of chemo/immunotherapy, surgery and radiation therapy. Finally, patients with cancer are at increased risk of emergencies due to systemic disease from hypercoagulable state and immunosuppression. 1. Complications due to cancer itself a. Airway obstruction b. SVC syndrome c. Esophagorespiratory fistula d. Esophagoaortic fistula e. Large pleural effusion, hemothorax or pneumothorax f. Cardiac tamponade g. Lymphangitic carcinomatosis h. Spinal cord compression 2. Complications due to cancer treatment a. Pneumothorax, hemothorax b. Mediastinal hematoma, mediastinitis c. Lobar torsion d. Cardiac herniation e. Esophageal leak f. Drug or radiation pneumonitis g. Immunotherapy associated myocarditis 3. Systemic complication a. Pulmonary embolism b. Opportunistic infections c. Stress cardiomyopathy (Takotsubo)

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## Abstract Archives of the RSNA, 2023

CHEE-40

### Utilization of Virtual Bronchoscopy and 3D-Multiplanar Volume Reconstruction (MPVR) Correlation to Illustrate Tracheobronchial Tree Abnormalities - An Imaging Review

#### TEACHING POINTS

Tracheobronchial tree abnormalities can be subtle on imaging and are not always accessible via fiberoptic bronchoscopy (FB). As healthcare shifts towards value-based care, technological innovations such as virtual bronchoscopy (VB) may not only reduce overspending but also improve clinical and patient satisfaction outcomes by providing radiologists with a visually intuitive medium to show rather than only tell complex 3D radiographic findings to non-radiologist audiences. VB is rendered by processing multi-detector row CT (MDCT) volumetric data via specialized software that assumes an artificial perspective from a lumen and then assigns opacity values and full spectrum color values based off attenuation values of different tissues and abrupt changes in attenuation between adjacent voxels. VB is underutilized, and it is better than conventional FB in specific cases where higher order subsegmental bronchial branches or regions distal to an obstruction/stenosis or are inaccessible via FB. VB enables a quick, highly accurate, and, most importantly, non-invasive visual medium to evaluate the tracheobronchial tree. It can play an invaluable role in personalized pre-procedural planning and simulations as well as in educating trainees in thoracic anatomy.

#### TABLE OF CONTENTS/OUTLINE

1. Briefly describe how 3D-MPVR post-processing is used in creating VB. 2. Using our institutional database, present CT imaging cases with their respective 3D-MPVR and VB images, including, but not limited to, the following tracheobronchial tree abnormalities: tracheal anomalies, tracheal stenosis, tracheal enlargement, excessive central airway collapse, endobronchial lesions, and trauma.

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## Abstract Archives of the RSNA, 2023

CHEE-41

### A Pictorial Review: Lymphoma and Lymphoproliferative Disease of Thorax

#### Participants

Ryota Nakano, Kashihara, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To depict lymphoma and lymphoproliferative disease of thorax To discuss the clinical and radiological findings and management

#### TABLE OF CONTENTS/OUTLINE

Lymphoma and lymphoproliferative diseases of the thorax occur primarily in the lungs, bronchus, mediastinum, and chest wall. Radiologists need to know more about each disease, as some require differentiation from lung cancer or other malignant mediastinal tumors. Contents. 1. Pulmonary lymphoproliferative disease (LPD): follicular bronchiolitis, lymphocytic interstitial pneumonia, and nodular lymphoid hyperplasia. 2. Primary pulmonary lymphoma: MALT lymphoma, diffuse large B-cell lymphoma, and Intravascular large B-cell lymphoma. 3. Primary mediastinal lymphoma: diffuse large B-cell lymphoma, classical Hodgkin lymphoma, and T-cell lymphoblastic lymphoma. 4. Primary pleural lymphoma: pyothorax associated lymphoma, and follicular lymphoma. 5. Miscellaneous: IgG4-related disease, Uni-/Multicentric Castleman disease, and methotrexate-associated LPD.

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## Abstract Archives of the RSNA, 2023

CHEE-42

### The Invisible Culprit: Demystifying Autoimmune Disorders of the Lungs

#### TEACHING POINTS

Autoimmune disorders affecting the lungs are a group of medical conditions characterized by the presence of autoantibodies that can cause damage to organs throughout the body. They include connective tissue diseases. CTD-ILD is defined as evidence of ILD demonstrated by CT (i.e., some combination of reticulation, ground-glass opacities, traction bronchiectasis, honeycombing, and/or cysts) in the setting of an established CTD. It includes RA, systemic sclerosis, SLE, primary Sjogren's syndrome, idiopathic inflammatory myositis, and mixed connective tissue disease. Diagnosis typically involves imaging studies such as high-resolution CT scans, lung biopsies and immunological investigations. Treatment options include corticosteroids, immunosuppressants, oxygen therapy and pulmonary rehabilitation. In severe cases, lung transplantation is considered as a last resort.

#### TABLE OF CONTENTS/OUTLINE

1. Antisynthase syndrome- inflammatory myositis, polyarthritis associated with ILD and anti-synthetase autoantibodies. 2. Microscopic polyangiitis- diffuse pulmonary alveolar hemorrhage is common feature. 3. RA-ILD is commonly associated with UIP. 4. SSc-ILD is commonly associated with NSIP. Risk factors- anti-topoisomerase Ab and higher skin score. 5. Sjogren's syndrome typically presents with NSIP, other patterns like UIP, LIP, focal lymphoid hyperplasia of the lung, small airways disease, and pulmonary vasculitis. 6. IIM-ILD is restricted to subsets of DM and PM. Usually manifests as NSIP with OP. Risk factors - anti-Jo1, anti-PL-7, anti-PL-12, and Black race. 7. Sarcoidosis -commonly affects the lungs and mediastinum with variable radiographic features depending on the stage of the disease.

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## Abstract Archives of the RSNA, 2023

CHEE-43

### Pinpoint It - A Pictorial Essay on Causes of Acute Chest Pain on CT

#### Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Acute localized chest pain is an important and frequent complaint in patients who seek the emergency medical care and can originate from many different compartments / tissues, namely the mediastinum (including cardiovascular structures), the lungs, the pleura, the chest wall, the spine or even the upper abdomen. Placing a skin marker at the topography of pain referred by the patient is an important step in facilitating the identification of a potential cause.

#### TABLE OF CONTENTS/OUTLINE

Numerous diseases may present as acute localized chest pain and chest computed tomography (CT) can be an important tool to detect the cause, including pulmonary infarction caused by acute thromboembolism, lobar pneumonia, pneumothorax, bone / cartilaginous fractures, acute cardiovascular pathologies, acute pericarditis, mediastinal fat necrosis, some upper abdominal pathologies, among other diseases. The placement of a skin marker in the vicinity of the potential finding, in the location pointed by the patient as painful, plays an important role in allowing for a more accurate search pattern by the radiologist. This exhibit aims to provide a pictorial essay on several findings that are consistent with the clinical presentation of acute localized chest pain as they appear on chest CT, with a special focus on cases in which the placement of a skin marker was particularly helpful.

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## Abstract Archives of the RSNA, 2023

CHEE-44

### Showcasing Signs Silhouettes: Assessment of Congenital Pediatric Cardiac Pathology on a Chest Radiograph

#### Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Even with the availability of modalities such as echo, CT, and MRI; a plain chest radiograph remains as the first and most basic modality to investigate suspected congenital cardiac conditions in the pediatric population. A chest radiograph is convenient as it is an easily accessible, low-cost, and non-invasive diagnostic tool with minimal radiation dose, giving us an opportunity to move one step closer to a "green radiology." While evaluating the chest radiograph, it is vital to recognize that classic cardiac signs and silhouettes. Additional emphasis should be given to the pulmonary blood flow, ribs, and spine. Since a chest radiograph is the starting point for majority of patients with suspected congenital heart conditions - it is very imperative for the radiologists to quickly recognize these classic findings to provide an accurate diagnosis for proper patient management.

#### TABLE OF CONTENTS/OUTLINE

Introduction to normal pediatric cardiac silhouette  
Cyanotic Cardiac Heart disease:- Tetralogy of Fallot- Total Anomalous Pulmonary Venous Return (TAPVR)- Truncus Arteriosus- Transposition of Great Arteries- Tricuspid Atresia- Hypoplastic Left Heart Syndrome (HLHS)- Ebstein's Anomaly  
• Acyanotic Cardiac Heart disease:- Atrial Septal Defect (ASD)- Ventricular Septal Defect (VSD)- Patent Ductus Arteriosus (PDA)- Coarctation of the Aorta- Aortic Stenosis- Pulmonic Stenosis  
• Technical factors  
• Limitations of Chest x-ray. Tricks and tips to radiologist for interpreting CXR.

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## Abstract Archives of the RSNA, 2023

CHEE-45

### Caution! Lung "Fields" Ahead: Thoracic Imaging in the Agricultural Setting

#### TEACHING POINTS

The agricultural sector employs 884 million workers, over a quarter of the global labor force, yet it remains one of the three most hazardous industries in the world. High morbidity and fatality rates are largely attributable to respiratory illnesses arising from unique exposures inherent in agricultural processes. Since the last comprehensive overview of radiological manifestations of agriculture-related diseases was published in 1991 by Gurney et. al, imaging technologies have modernized, allowing for more exquisite characterization of these lung disorders. Modern agricultural practices have brought about new illnesses and mechanisms of trauma, with unique radiological manifestations that have not been sufficiently characterized in the literature. In this exhibit, we provide an updated overview of the radiological manifestations of agriculture-related lung diseases and chest traumas to help with timely diagnosis and treatment for this vulnerable population.

#### TABLE OF CONTENTS/OUTLINE

Outline: I. Agricultural workers as a vulnerable population II. Radiological manifestations from exposures to microorganisms in agriculture a. *Coxiella burnetii* (Q Fever) b. *Nocardia nova* c. Blastomycosis d. Acute histoplasmosis e. Pulmonary echinococcosis (hydatid disease) III. Radiological findings from exposures to organic compounds a. Organic dust toxic syndrome b. Nonfibrotic hypersensitivity pneumonitis c. Fibrotic hypersensitivity pneumonitis d. Silo filler's disease IV. Agricultural related trauma a. Blunt chest trauma b. Foreign body aspiration c. Deep vascular injury V. The final harvest: take home learning points

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## Abstract Archives of the RSNA, 2023

CHEE-46

### Cardiovascular Imaging in Thoracic Neoplasms

#### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recent advances in chest MRI have expanded its use in the evaluation of chest tumors, not only for tissue characterization but also for precise depiction of invasion of adjacent structures, tumor staging and treatment monitoring. Moreover, depiction of cardiac involvement, either directly or indirectly, has been associated to worse prognosis in oncologic patients. Teaching points: 1. To detail the basic and advanced CMR techniques that may be incorporated to conventional chest MR protocols, as well as its indications and potential pitfalls. 2. To review the direct and indirect mechanisms of cardiovascular involvement in patients with thoracic malignancies. 3. To identify how combined hybrid cardiothoracic imaging may be useful for treatment surveillance and monitoring.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. CMR in cardio-oncology: The imaging protocol 2.1. Basic chest MR protocol (starting point) 2.2. Cardiac sequences for thoracic neoplasms evaluation - T1 black blood imaging (fat invasion) - DWI with EKG triggering - First pass perfusion - Cine SSFP - Parametric mapping (tumoral/tissue characterization) - MR angiography - 4D flow CMR (great vessels and cavitory hemodynamics) - PET/MR imaging 3. Cardiac involvement in Cardio-Oncology: Direct Mechanisms - Hematogeneous metastasis - Lymphoid metastasis - Direct involvement - Intravascular growth 4. Improving tumor staging with cardiac sequences - Cardiac/vascular/mediastinal invasion - Pleural invasion - Chest wall invasion 5. Indirect involvement of the heart in oncologic patients - Thoracic irradiation - Chemotherapeutic agents - Plasma cell dyscrasia (amyloid) 6. Use of CMR in treatment monitoring: Prognostic biomarkers 7. Take home points

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## Abstract Archives of the RSNA, 2023

CHEE-47

### Chest Computed Tomography Angiotomography with 3D Reconstructions for Preoperative Planning

#### Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to:- Review the evolution of surgical technique for pulmonary resections - Highlight the benefits of Computed Angiotomography with 3D reconstructions in surgical planning - Understand the application of CTA planning prior to segmentectomy to evaluate bronchovascular relations, anatomical variations and lung volumetry- Correlate the radiological findings with intraoperative findings - Identify the role of 3D images in facilitating communication between radiologists and surgeons

#### TABLE OF CONTENTS/OUTLINE

Surgical planning using imaging methods has become increasingly relevant with the advancement of robotic thoracic surgery and sublobar resections for the treatment of lung neoplasms, which has driven the growth of 3D reconstructions. A pictorial essay based on cases from our collection allows for a comprehensive assessment and understanding of:- Historical evolution of pulmonary lobectomy and current main indications for sublobar resections.- Benefits of 3D surgical planning. - How we do our 3D reconstructions with explaining videos.- Application of 3D reconstructions in robotic surgery consoles.- Radiological findings of 3D reconstructions with surgically relevant anatomical variations and bronchovascular relationships- 3D reconstruction findings with nodule volumetric and density analysis, lung segments volumetry and intersegmental resection planes

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## Abstract Archives of the RSNA, 2023

CHEE-48

### The Role of Imaging in Bronchoscopic Lung Volume Reduction Using Endobronchial Valves

#### Participants

Yogesh Gupta, DO, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Provide a background on the various lung volume reduction techniques and their efficacy in the treatment of COPD with a focus on bronchoscopic lung volume reduction (BLVR) using endobronchial valves (EBV) 2. Discuss important imaging parameters in preprocedural assessment with attention to target lobe selection as well as exclusion criteria 3. Present expected postprocedural imaging findings as well as various postprocedural complications with imaging correlates

#### TABLE OF CONTENTS/OUTLINE

Of the various BLVR techniques, EBVs have the largest body of scientific data to support their safety and efficacy. Imaging plays a central role both prior to the procedure - in determining the presence of contraindications and selecting the target lobe using CT -- as well as after the procedure - in determining whether the procedure was effective and characterizing potential complications using radiography and/or CT. Outline• Overview of indications and types of lung volume reduction• Background on mechanism of action of valves, valve types, and location of valve deployment• Preprocedural role of CT in characterizing emphysema, determining exclusion criteria, and target lobe selection and role of perfusion scintigraphy in further selection• CXR and CT imaging of expected postprocedural findings (i.e. lobar collapse) and potential complications (ex: pneumothorax, infection, valve migration)• Discussion of future directions

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## Abstract Archives of the RSNA, 2023

CHEE-5

### Atypical Pulmonary Metastases: Patterns and Clinical Significance

#### Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd;

#### TEACHING POINTS

Based on cases from an international cancer referral center, explain: Atypical metastases (morphology, evolution, sources) Clinical implications of atypical patterns Associated risks of mimics, misdiagnosis, delayed diagnosis

#### TABLE OF CONTENTS/OUTLINE

Atypical morphology and clinical implications: Cannonball, miliary, cavitating, pneumothorax-associated, calcified, ossified, hypervascular, hemorrhagic, airspace, endobronchial, central embolized, peripheral arterial microvascular (including pulmonary tumor thrombotic microangiopathy), endovenular, perilymphatic. Atypical growth rates: Rapid: implications for incorrect pathology (e.g. rhabdoid/sarcomatoid/small cell differentiation), re-biopsy (e.g. small cell transformation), metastatectomy recurrence rates Slow: e.g. Adenoid Cystic Carcinoma Benign metastases (leiomyoma, meningioma, giant cell tumor, HPV)

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## Abstract Archives of the RSNA, 2023

CHEE-50

### Differential Diagnosis of Multiple Subsolid Pulmonary Nodules

#### Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- There are numerous etiologies to be considered in the differential diagnoses when faced with multiple subsolid nodules at high resolution computed tomography (HRCT).- Surveillance of these nodules should follow the recommendations of the Fleischner Society.- They can represent the initial manifestation of diseases that typically present with a different imaging pattern.- When discerning upon a possible infectious etiology, the status of the patient as immunocompetent or immunosuppressed is a key to the diagnosis.- There are specific imaging signs and/or association with other conditions that may help narrow the differentials.

#### TABLE OF CONTENTS/OUTLINE

A pattern of multiple subsolid nodules is a diagnostic challenge. There are a plethora of conditions that can present with such characteristics on imaging, even more so when one considers that other imaging patterns may present as multiple subsolid nodules in the initial stages. It is important to understand the possible diagnoses that can present with such a pattern, as well as the recommendations for surveillance and the association with other conditions that may help narrow down the differentials, even to a single entity. In this exhibit, in the format of a pictorial essay, the HRCT pattern of multiple subsolid nodules is revised, as well as the multiple etiologies, manifestations and associations pertinent to the matter.

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## Abstract Archives of the RSNA, 2023

CHEE-51

### Keep an Eye on Diseased Lung: What to Look for in Native Lung After Unilateral Transplantation

#### TEACHING POINTS

\* One-lung transplantation is a practice aimed at improving the survival of patients with advanced stages of pulmonary disease; its most common indications include COPD, pulmonary fibrosis, and sarcoidosis (in North America). Its practice is becoming more frequent, which has led to knowing with greater certainty both the benefits and complications associated with it. However, complications that preferentially involve the native lung have received less attention.\* Radiologists should be familiar with the most frequent complications in the native lung as well as their chronology and the most frequent form of presentation in the different imaging methods (CT and X-ray).\* Make a quick review of the management and treatment of each of them.

#### TABLE OF CONTENTS/OUTLINE

Introduction, classification, and chronology  
Infections Incidence Pathophysiology RX and CT findings Treatment  
Pulmonary thromboembolism Incidence Pathophysiology RX and CT findings Treatment  
Tumor Incidence Pathophysiology RX and CT findings Treatment  
Hyperinflation Incidence Pathophysiology RX and CT findings Treatment  
Pneumothorax Incidence Pathophysiology RX and CT findings Treatment

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## Abstract Archives of the RSNA, 2023

CHEE-52

### Collateral Venous Pathways In Superior Vena Cava Obstruction

#### Participants

Marta Bueno, MD, Seville, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To describe the different venous collateral routes in superior vena cava obstruction. 2. To relate the level of obstruction with the pattern of collateral vessels. 3. To illustrate some unusual image findings that can occur in superior vena cava syndrome

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy and embryology of superior vena cava 2. Causes of superior vena cava obstruction 3. Different patterns of venous collateral pathways depending on the level of blockage 4. Major collateral pathways 4.1. Azygos-Hemiazygos system 4.2. Lateral thoracic route 4.3. Internal mammary route 4.4. Anterior cervical route 4.5. Pericardiophrenic route 4.6. Vertebral route 5. Unusual collateral pathways 5.1. Systemic to pulmonary shunt. 5.1.1. Anatomic 5.1.2. Congenital 5.1.3. Acquired 5.2. Cavoportal pathways 5.2.1. Downhill varices 5.2.2. Caval-superficial-umbilical-portal 5.2.3. Caval-mammary-phrenic-hepatic capsule-portal 6. Unusual imaging findings: 6.1. Reopening of left superior vena cava. 6.2. Pseudopathologic vertebral body enhancement

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-53

### **Big Fat Truth: A Pictorial Review of Fat Containing Cardiothoracic Lesions - Practical Guide for Radiologists (Case-based)**

#### **Participants**

Iandra Pacheco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Demonstrate a practical guideline with cases to help radiologists with the differential diagnosis of fat containing lesions of the heart and the thorax. Illustrate with didactic cases and review the typical appearance and the main radiological characteristics of cardiothoracic lesions that contain fat.

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION  
IMAGING GUIDELINE  
Didactic scheme of the main sites of cardiothoracic involvement by fat containing lesions  
DEMONSTRATE DIDACTIC CASES WITH A RADIOLOGICAL REVIEW  
Thoracic duct lipoma  
Pleural lipoma  
Liposarcoma  
Lipoid pneumonia  
Pulmonary hamartoma  
Extramedullary hematopoiesis  
Lipomatous hypertrophy of the interatrial septum  
Arrhythmogenic right ventricular cardiomyopathy  
Cardiac lipoma  
Cardiac rhabdomyoma  
Mediastinal teratoma  
Mediastinal lipomatosis  
Diaphragmatic hernia  
Thymolipoma  
Epicardial fat necrosis

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## Abstract Archives of the RSNA, 2023

CHEE-54

### Unmasking the Silent Killer: Challenges in Lung Cancer Detection due to Underlying Disease, A Case Based Presentation

#### TEACHING POINTS

1. Lung cancer detection can be challenging when the patient has an underlying disease. This may lead to delays in diagnosing lung cancer, which can be associated with poorer outcomes. 2. Location, shape, border, and size of abnormalities, as well as any associated features should be carefully evaluated. Continuous follow-up and comparison of serial imaging are important. 3. We present lung cancer developed in a variety of underlying diseases/conditions, emphasizing teaching points to help to differentiate lung cancer from underlying lung findings. 4. A multidisciplinary approach involving radiologists, pulmonologists, thoracic surgeons, and oncologists is necessary to ensure an accurate diagnosis and appropriate management plan.

#### TABLE OF CONTENTS/OUTLINE

1. Post-treatment. A) Postsurgical. B) Post-radiation. 2. Infection/inflammation. A) Tree in bud nodularity. B) Pneumonia/consolidation. 3. Aspiration. 4. Atelectasis. A) Post obstructive. B) Dependent. C) Rounded. 5. Systemic Disease. A) Pre-existing cystic lesions. B) Underlying scarring/fibrosis. 6. Normal anatomic variants. A) Lung cancer developing within/near normal variant.

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## Abstract Archives of the RSNA, 2023

CHEE-55

### Chest X-ray and Mediastinal Abnormalities

#### Participants

Antonio Nunez Soto, MD, A Coruna, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Plain radiography is still today the most common image technique in our hospitals. It is accessible, inexpensive, painless and non-invasive, providing much information with a great cost-effectiveness ratio. With chest X-ray we can detect and analyze mediastinal pathologies, either suspected or incidental. Recognizing normal mediastinal anatomy and anatomic variants is essential for finding out pathology.

#### TABLE OF CONTENTS/OUTLINE

The aim of this poster is to describe the radiological analysis of chest radiography for detecting and diagnosing mediastinal abnormalities. For this purpose, we will show normal mediastinal anatomy and mediastinal lines in chest radiographs, as well as normal changes that we can see in supine X-rays with antero-posterior view instead of postero-anterior. We will explain the radiological signs and features that can help us identify mediastinal abnormalities, with the support of several cases of different pathologies (pneumomediastinum, mediastinal masses, vascular pathologies, diaphragmatic hernia...) from a third-level-hospital. For every case, we will provide the clinical information, the X-ray image, in which we will highlight the radiological signs implicated, and a correlation with other imaging techniques. In all cases, the chest X-rays were essential in the initial management of these patients. This presentation will be of interest for radiologists, resident doctors, medical students and other healthcare professionals. The combination of the theoretical semiology with our collection of cases will provide an easy and approachable way to review the most important mediastinal pathology.

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## Abstract Archives of the RSNA, 2023

CHEE-56

### The Sternum: The Forgotten Bone of the Thoracic Cage

#### Participants

Lucas Farias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1) To review the normal anatomy of the sternum. 2) To review usual and unusual cases with sternal involvement. 3) To understand the sternum (anatomy and pathologies) by associating schematic drawings with MPR and three-dimensional reconstructions (including animated gif). 4) To correlate important findings with the anatomy, embryology, and pathophysiology. 5) To discuss image findings in order to enhance radiologists' skills. 6) To review CT protocols in the evaluation of patients with suspected coronary artery anomalies. 7) To highlight their characteristics in order to familiarize radiologists with these conditions, preventing unfavorable patient outcome.

#### TABLE OF CONTENTS/OUTLINE

1) Imaging protocols in the evaluation of patients with suspected sternal involvement. 2) Applied embryology and anatomy of the sternum. 3) Normal sternal development. 3.1. Anatomical variations. 3.2. Metabolic. 3.3. Vascular. 3.4. Inflammation and infection. 3.5. Trauma. 3.6. Postoperative changes 3.7 Neoplasm. 4) Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5) Summary and take-home messages.

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## Abstract Archives of the RSNA, 2023

CHEE-57

### Pulmonary Edema: You Better Not Drown in the Basics

#### Participants

Gabriel Neumann Kuhn, MD, Morro Redondo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: 1. To elucidate the classification of pulmonary edema according to its pathophysiological mechanisms: - Hydrostatic edema; - Permeability edema without diffuse alveolar damage; - Permeability edema with diffuse alveolar damage; - Mixed edema. 2. Review the use and peculiarities in the main imaging methods for the evaluation of pulmonary edema: - Chest X-ray; - Computed tomography (CT). 3. Highlight the current epidemiological trends and radiological findings associated with the main causes of pulmonary edema.

#### TABLE OF CONTENTS/OUTLINE

- Review of thoraco-pulmonary anatomy: - Cardiac silhouette; - Pulmonary interstitium; - Pulmonary vascular markings; - Costophrenic angles.
- Demonstration of the main radiological findings of pulmonary edema: - Alveolar edema; - Kerley B lines; - Opacities; - Consolidations; - Ground-glass opacities.
- Demonstration of common and uncommon conditions that cause pulmonary edema from our clinical case collection, such as: - Cardiogenic pulmonary edema (left heart failure, mitral regurgitation, etc.); - Postobstructive pulmonary edema; - Pulmonary edema in pulmonary thromboembolism; - Pulmonary edema in drug abuse; - Post-lung transplant pulmonary edema; - Re-expansion pulmonary edema; - Neurogenic pulmonary edema.

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## Abstract Archives of the RSNA, 2023

CHEE-58

### Multifocal Cystic and Cavitory Lung Disease: From Thin to Thick

#### Participants

Paula Terra Amaral, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to:- Review cystic and cavitory lung disease and a general approach to focal and multifocal/diffuse forms. - Highlight the evaluation of the wall of focal aerated lung lesions and comprehend the imaging findings in thin-walled, thick-walled cysts and cavitory lung lesions. - Correlate the radiological characteristics with the main differential diagnoses and signs of malignancy. - Identify the important imaging findings addressed in cystic lesions of the new Lung-RADS v.2022

#### TABLE OF CONTENTS/OUTLINE

Cysts and cavities are commonly encountered abnormalities on chest CT. Occasionally, the underlying nature of the lesions can be readily apparent as in bullae associated with emphysema. Other times, cystic and cavitory lung lesions can be a diagnostic challenge. A pictorial essay based on cases from our collection allows a comprehensive evaluation and understanding of:- General approach to focal and diffuse cystic and cavitory lung diseases. - Propose an algorithm to facilitate the evaluation of focal cystic lesions and cavities. - Evaluation and differential diagnosis of focal thin-walled cystic lesions. - Evaluation and differential diagnosis of focal pulmonary thick-walled cysts and cavitations. - Imaging findings of focal cystic lesions correlated with Lung-RADS v.2022

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## Abstract Archives of the RSNA, 2023

CHEE-59

### Imaging of the Diaphragm: Anatomy and Disorders

#### Participants

Miriam Gallego Casals, MD, Sabadell, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The diaphragm is the physical barrier that separates the thorax from the abdomen and is the main muscle involved in ventilation. Its dysfunction can be a cause of dyspnea, and despite its importance, it is often underrated and incompletely evaluated by clinicians as well as by radiologists. We will briefly describe the anatomy of the diaphragm, and discuss its abnormalities through cases, classified as: - Dysfunction: paralysis, weakness or eventration and consequences of diaphragmatic inversion. - Hernias: congenital (Morgagni, Bochdalek) and acquired. - Rupture: traumatic and post-surgery. - Secondary: neoplastic and infectious involvement by contiguity from the abdominal cavity. - Miscellanea: Median arcuate ligament syndrome and increased uptake on PET/CT (respiratory effort, hiipo). Finally, we explain the main imaging techniques we have for both the functional and morphological study of the diaphragm, including chest radiographs, fluoroscopic tests, ultrasounds and CT.

#### TABLE OF CONTENTS/OUTLINE

- To describe the anatomy and physiology of the diaphragm. - To review the primary diaphragm disorders. - Learn the image techniques available for its study.

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## Abstract Archives of the RSNA, 2023

CHEE-6

### Imaging Findings of Autoimmune Disorders: A Primer for Residents

#### Participants

Furkan Ufuk, MD, Denizli, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To provide an overview of autoimmune disorders, focusing on the most common conditions encountered in clinical practice. - To provide a primer on the imaging features of autoimmune disorders.

#### TABLE OF CONTENTS/OUTLINE

Autoimmune disorders are a diverse group of conditions in which the body's immune system attacks its own tissues, resulting in inflammation and damage. The spectrum of autoimmune disorders is broad, ranging from systemic diseases such as systemic lupus erythematosus and rheumatoid arthritis to organ-specific diseases such as autoimmune pancreatitis. Imaging plays a crucial role in the diagnosis and management of autoimmune disorders. This exhibit will provide a comprehensive overview of the imaging findings of autoimmune disorders and will highlight the importance of recognizing these findings in the diagnosis and management of these conditions. By the end of the exhibit, residents will have a better understanding of the role of radiologic imaging in the diagnosis and management of autoimmune disorders.

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## Abstract Archives of the RSNA, 2023

CHEE-60

### Unmasking Septal Thickening: An Accessible Diagnostic Guide

#### Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To differentiate the various patterns of septal thickening and their association with several interstitial lung diseases. To understand the pathophysiological basis of this finding. To provide a systematic and understandable guide to address the diagnostic dilemma.

#### TABLE OF CONTENTS/OUTLINE

Septal thickening of the lung can be the common radiological expression for many processes of different etiologies and variable severity, including pulmonary edema, lymphangitic tumor, sarcoidosis, asbestosis, amyloidosis or Erdheim-Chester disease among others. Due to the wide differential diagnosis that it poses, its presence is often perceived as confusing and challenging. To face this crossroads we must tackle it from its origin, so both the understanding of the underlying pathophysiological fundamentals and the recognition of ancillary imaging signs must be the objective of our study and the pillar for an adequate diagnostic approach. The goal of this work is to provide a tool that may help unmask the enigma: a systematic and understandable review of the different manifestations of septal thickening, focused on the underlying physiological background and exemplified with illustrative cases from our hospital.

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## Abstract Archives of the RSNA, 2023

CHEE-61

### Take My Breath Away: MR Lungs from Maverick towards Mainstream, and Maybe Top Gun?

#### Participants

Nicholas Bontrager, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

MRI for evaluation of the pulmonary parenchyma and vessels is a viable alternative to CT that eliminates patient exposure to ionizing radiation, and that can be performed using the magnet you have, sequences you already use, and table times under 20 minutes per complete exam. Pulmonary MRI and MRA have been shown to be effective for evaluation of cystic fibrosis, lung cancer screening, pulmonary nodule and mass evaluation, pulmonary embolism, and more. For lung cancer screening, pulmonary MRI has been found to have equivalent life expectancy with favorable cost-effectiveness and fewer false-positives when compared to low-dose CT. Restricted diffusion is likely more specific to lung cancer than FDG avidity on PET CT. MRA for PE has similar sensitivity, specificity and patient outcomes at 6 months, when compared to CTA.

#### TABLE OF CONTENTS/OUTLINE

- MR Sequence Protocol for Evaluation of Lung Parenchyma. - Cases: Primary Lung Cancer, Pulmonary Nodules, Metastases. - MRA Sequence Protocols for Pulmonary Embolism, with gadolinium-based contrast agent and with ferumoxytol (off-label). - More Cases: PE with GBCA MRA, PE in Pregnant Patient with ferumoxytol MRA, Incidental Findings. - Limitations of MR evaluation of the lungs and pulmonary vessels. - The future of MR evaluation of the lungs.

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## Abstract Archives of the RSNA, 2023

CHEE-62

### A Case Based Review of Chest Wall Masses: Multimodality Imaging and Differential Diagnosis

#### Participants

Sehar Salman, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal of this presentation is to review clinical manifestations and radiologic findings of chest wall lesions. Many of these masses are discovered incidentally on routine chest imaging, and it is important for the interpreting radiologist to be able to recognize benign, indeterminate, and malignant features in order to guide management. In a series of cases, we will present different diagnoses of chest wall masses including both common and uncommon pathologies, to illustrate the spectrum of findings. After this presentation, learners should be familiar with chest wall anatomy, be able to describe imaging characteristics of lesions on multiple modalities, provide differential diagnoses, recognize indications for biopsy, and ultimately have a framework for approaching these masses.

#### TABLE OF CONTENTS/OUTLINE

Background - Chest wall anatomy on ultrasound, CT, and MRI - The spectrum of chest wall pathologies (benign, malignant)- fat, fluid, soft tissue, bone  
Cases: lipoma, hematoma, elastofibroma dorsi, neurofibroma, fibrous dysplasia, desmoid fibromatosis, myxofibrosarcoma, metastatic disease - For each case: Clinical scenarios, multimodality imaging findings, differential - Indeterminate and malignant cases: biopsy indications, biopsy results, pathologic correlation (when available)  
Summarize key features and classic differential diagnoses  
Radiologic and clinical management of chest wall masses

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## Abstract Archives of the RSNA, 2023

CHEE-63

### A CT Imaging Roadmap for Hemoptysis: from Etiology to Treatment Complications

#### Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibition is: • To review the most common causes of hemoptysis in clinical practice; • To illustrate the role of CT imaging for the evaluation of patients with hemoptysis; • To provide a systematic approach on hemoptysis imaging evaluation, highlighting key findings for an accurate diagnosis; • To explain the main therapeutic modalities employed in the treatment of hemoptysis.

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTIONa. Epidemiologyb. Vascular anatomyc. Physiopathology2. CT IMAGING: AN ETIOLOGY BASED REVIEWa. Infectiousb. Inflammatoryc. Vasculitisd. Congenitale. Neoplasticf. Other causes3. THERAPEUTIC MODALITIESa. Indicationsb. Techniquesc. Complications4. SYSTEMATIC APPROACH: A ROADMAP5. SUMMARY AND TAKE-HOME MESSAGES

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## Abstract Archives of the RSNA, 2023

CHEE-64

### Respiratory Complications from Burns Injury: A Pictorial Review

#### TEACHING POINTS

- Acute complications are almost always associated with smoke inhalation injury.
- When acute lobar collapse cannot be explained by a malpositioned ETT, prompt bronchoscopy is required to assess for bronchial eschars or inspissated secretions from bronchorrhea.
- In the subacute phase, short interval changes in heart size, parenchymal opacities and pleural effusions favors cardiogenic edema.
- Expiratory CT is useful in assessing burns-induced chronic airways disease including tracheomalacia, bronchial webs and obliterative bronchiolitis.

#### TABLE OF CONTENTS/OUTLINE

As many as 91% of deaths in burn patients are a result of respiratory complications. Understanding the spectrum of respiratory complications, their onset and evolution of changes over time is important in early and accurate imaging interpretation. This pictorial review aims to educate and familiarize readers with common and uncommon burns-related complications that may be detected on chest imaging. As multiple disease processes have overlapping imaging appearances, we have classified complications temporally into acute, subacute and delayed phases, and spatially classified complications according to the anatomical structures affected. This structured approach to imaging interpretation serves to facilitate understanding and provide readers with a practical approach to imaging interpretation in burns patients.

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## Abstract Archives of the RSNA, 2023

CHEE-65

### Consolidation of Post-Lung Transplant Complications, Throughout Post-operative Course

#### TEACHING POINTS

Lung transplantation is a life-saving procedure for end-stage lung diseases and has been shown to improve quality of life. Currently, the median post-lung transplant survival is roughly 6 years. However, it is associated with various complications that can significantly impact post-transplant outcomes. The purposes of this exhibit are to: (1) Recall the many pathologic complications that arise with Lung Transplantation, (2) Evaluate and identify the radiological features associated with Lung Transplant complications, (3) Review the role of imaging in the diagnosis and management of these complications.

#### TABLE OF CONTENTS/OUTLINE

Immediate and Early Postoperative Period (First 24 hours to First Week) Primary Graft Dysfunction Rejection Acute Rejection Hyperacute Rejection Pleural Complications Pleural Effusion Pleural Fistula Hemothorax Pneumothorax Intermediate Period (1 week to 4 months) Anastomotic (Airway) Dehiscence Stenosis Airway Stenosis Pulmonary Artery Stenosis Pulmonary Infections Candida CMV Aspergillus Late Periods (After 4 months) Pulmonary Infections Mycobacterial RSV Chronic Lung Allograft Dysfunction (CLAD) Post-Transplant Lymphoproliferative Disorder (PTLD)

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## Abstract Archives of the RSNA, 2023

CHEE-66

### Assessment of Both Fibrosis and Vascular Disease in Systemic Sclerosis: The Pivotal Role of the Radiologist and Future Perspectives

#### Participants

Carlotta Zilioli, MD, Parma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To be informed of the fundamental pathogenic pathways of systemic sclerosis (SSc).- To be aware that, among the autoimmune rheumatic disease, SSc has the highest mortality due to lung complications, which mainly are fibrosis and pulmonary hypertension (PH).- To illustrate the radiological spectrum of thoracic manifestations in SSc.- To be informed about the recent advances in the imaging techniques, with specific attention to quantitative analysis, to early diagnose and monitor disease activity.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction:- Overview of underlying pathophysiology of SSc: endothelial and fibroblast dysfunction, leading to fibrosis.- Description of pulmonary manifestations of SSc, focusing on the leading cause of death: interstitial lung disease (ILD) and pulmonary hypertension (PH). 2. The use of high-resolution CT in the diagnosis of progressive SSc, particularly to early stages of ILD:- NSIP as the main histologic pattern: key finding - Other HRCT findings: pleural and pericardial, esophageal dilatation. 3. Description of the hallmark of PH:- Key findings on HRCT - Role of dual-energy CT angiography. 4. The emerging use of automated software to perform quantitative analyses on in SSc, correlating quantitative vessel parameters with ILD features.

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## Abstract Archives of the RSNA, 2023

CHEE-67

### A Step-by-Step Approach to Pulmonary Fibrosis: What the General Radiologist Should Know

#### Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Expose the imaging modalities used in interstitial lung disease assessment. Provide a stepwise approach to identify the features of fibrotic lung disease and categorize the pattern of fibrosis. Review the radiological features of idiopathic pulmonary fibrosis (IPF) and the principal differential diagnoses, focusing on their distinctive features based on high-resolution computed tomography (HRCT).

#### TABLE OF CONTENTS/OUTLINE

Diffuse interstitial lung disease encompasses a heterogeneous group of processes characterized by a concrete pulmonary response to damage affecting the pulmonary interstitium and the secondary pulmonary lobule. IPF is a progressive chronic interstitial fibrotic lung disease of unknown etiology characterized by nonspecific clinical manifestations, a restrictive pattern in pulmonary function tests, and a poor prognosis. The morphologic hallmark in imaging and histopathology of IPF is the UIP pattern, characterized by subpleural reticulation, traction bronchiectasis, and honeycombing with an apex-to-basal gradient. However, it may also be present in several conditions, including asbestosis, chronic hypersensitivity pneumonitis, or connective tissue diseases. Definitive diagnosis requires clinical-radiological-pathological consistency, with imaging playing a pivotal role. An accurate classification based on the CT pattern enables early detection of fibrosis, distinguishing the UIP pattern from those that suggest an alternative diagnosis, determining the need for biopsy, and guiding subsequent treatment. We collected representative cases of pulmonary fibrosis from our institution to highlight the hallmark imaging findings that leads to accurate diagnosis.

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## Abstract Archives of the RSNA, 2023

CHEE-68

### Through the Eye of the Needle: An Evidence-based Approach to the Benefits, Risks, and Controversies of CT-Guided Lung Biopsy

#### Participants

Shravan Sridhar, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

CT-guided lung biopsy is a vital tool in the diagnostic armamentarium of physicians involved in the workup of pulmonary lesions in a variety of clinical settings. Having a clear understanding of the benefits, yield, and risks of CT-guided lung biopsy is important in optimizing utility of this diagnostic test and minimizing adverse outcomes. We present current evidence in the literature as it relates to benefits/yield, risks and risk reduction, and controversies in lung biopsy.

#### TABLE OF CONTENTS/OUTLINE

1. Title and disclosures  
2. Abbreviations  
3. Table of contents  
4. Overview  
5. Indications  
a. List of indications  
b. Pre-test probability  
c. Negative predictive value  
d. Diagnostic accuracy  
6. Risk/reduction  
a. Pneumothorax  
b. Hemorrhage  
c. Air embolism  
7. Controversies  
a. Role of CT vs bronchoscopic biopsy  
b. Appropriate needle size  
c. FNA vs core needle biopsy  
d. Biopsy of subsolid nodule  
e. Biopsy of suspected infection  
f. Biopsy of cavitary nodule  
g. Repeat biopsy after non-diagnostic result  
h. Biopsy in setting of pulmonary hypertension  
i. Biopsy in setting of fibrotic ILD  
j. Tumor seeding  
k. Techniques to avoid complications  
i. Utility of blood patch/plug  
ii. Rapid rollover  
iii. Intrapulmonary length  
8. Summary  
9. References

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## Abstract Archives of the RSNA, 2023

CHEE-69

### To Protect and to Serve: Imaging Review of the Sternum for the Thoracic Radiologist

#### Participants

Michelle Bondero, MD, MSc, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The sternum "protects" the vital cardiovascular organs, "serves" as a mirror to reflect diffuse bone disorders, and may uncommonly be affected by isolated lesions. These conditions may present as non-specific chest pain, which is a common patient presentation in clinical practice. Furthermore, given its central location, the sternum is included on nearly all thoracic imaging, be that a radiograph, CT, or MR. Due to thoracic radiologists' predominant reliance on axial images and focus on the inner organs, it may be neglected in a speedy review and important diagnostic information may be missed. The goal is to (1) explain the anatomy and development of the sternum; (2) describe dedicated imaging approaches; as well as (3) define and depict the major disease processes that can be diagnosed on radiological imaging, as outlined below. In addition to the rich imaging illustration, multiple less common but important diseases will be included with corresponding clinical and surgico-pathologic correlation, when available. Board-exam questions will also be provided to emphasize key principles.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy (bony components, articulations). 2. Imaging (XR, CT, MR, US and NM). 3. Cases: a. Congenital: variants and anomalies; b. Traumatic (fractures); c. Infectious (osteomyelitis); d. Neoplastic (primary and mets); e. Metabolic (Paget's disease, renal osteodystrophy, sickle cell disease, osteopetrosis). 4. Peri-sternal joint disease (osteoarthritis, septic arthritis, inflammatory arthritides, SAPHO). 5. Pre- and post-surgical (sternotomy, expected findings, complications, sternal measurements prior to cardiac surgery). 6. Post-radiation. 7. Artifacts.

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## Abstract Archives of the RSNA, 2023

CHEE-7

### Dual Energy Chest Radiography in Oncological Practice

#### Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd;

#### TEACHING POINTS

Based on CXR implementation in a tertiary cancer center: CXR dual energy principles and techniques  
Practical implementation for improved detection and accuracy, characterization, increased confidence, problem solving on chest radiographs  
Advantages, disadvantages and limitations

#### TABLE OF CONTENTS/OUTLINE

CXR Dual Energy Techniques (single exposure (SE), dual exposure (DE), weighted subtraction), new AI single exposure techniques  
Soft tissue and bone-selective images  
Advantages and disadvantages of SE DE (associated artifact recognition), dosimetry  
Improved lesion detection, confidence, additional lesions, growth determination  
Lesion characterization (soft tissue, calcification)  
Calcified lesions (mediastinum, lung, pleura)  
Bone metastases and other osseous conditions (pathological fractures, periosteal reactions, lytic lesions)  
Specific areas: Evaluation of the apices, cardiomeastinum, drug induced lung disease, postoperative pneumothorax  
Complex evaluation: impact on accuracy, distracting pathology, missed findings, interpretation time

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## Abstract Archives of the RSNA, 2023

CHEE-70

### Targeting the Unknown: A Stepwise Approach to CT-Guided Biopsy of Cavitory Lung Nodules

#### Participants

Abhay Dhaliwal, MD, Bloomfield Hills, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To review categories of inciting conditions that can lead to cavitory pulmonary nodules. -To discuss the role and technique of CT guided percutaneous trans-thoracic needle biopsy (PTNB) of cavitory nodules in the aid of diagnosis, ranging from pre-biopsy workup to post biopsy care. -To review the risks and complications associated with CT guided PTNB of cavitory nodules, and methods to minimize risk and manage complications. -To illustrate and discuss the key imaging features of pathology proven cases of processes that can present with cavitory pulmonary nodules, including infections (such as actinomyces and tuberculosis), inflammatory conditions (such as granulomatosis with polyangiitis and rheumatoid arthritis), and malignancies (such as primary and metastatic processes).

#### TABLE OF CONTENTS/OUTLINE

Definition of cavity, biopsy materials, pre-biopsy work up, patient counseling, biopsy set up/technique, post-biopsy care, biopsy outcomes, biopsy risks/complications, management of complications, rad path correlation

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## Abstract Archives of the RSNA, 2023

CHEE-71

### Avoiding Tunnel Vision: Looking Beyond Anatomic Specialization Boundaries

#### Participants

Elizabeth Lee, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. While radiological sub specialization is advantageous and has firmly integrated radiologists in multidisciplinary teams, there is a potential for missed diagnoses when various anatomic regions of a cross-sectional study are interpreted separately by specialists. This is particularly relevant for junctional regions (such as diaphragm when chest and abdomen imaging are interpreted by chest and body radiologists).2. Variations in scan factors and contrast timing (for instance chest and abdominal imaging may be obtained at different phases of enhancement) can facilitate diagnosis.3. Even if studies are separately interpreted and dictated, it is important for specialists to avoid tunnel vision and check pertinent information.

#### TABLE OF CONTENTS/OUTLINE

1. No man's zone: Junctional zones between two anatomical regions can be a cause of missed opportunities. For instance, lower ribs may only be partly included in chest CT and may be overlooked on an abdominal scan.2. Integration of imaging findings from various anatomic regions can provide a unifying diagnosis: Several diseases are multisystem pathologies, and the diagnostic process is facilitated by knowledge of involvement of other anatomic regions. Examples include neurofibromatosis, Birt-Hogg-Dube syndrome, embolized fragment of a device, etc.3. Differences in phase of enhancement: This can help in localizing as well as accurately characterizing an abnormality that is better seen on a specific phase of enhancement.4. Differences in patient positioning Arms up and arms down position for two different scans can uncover an unsuspected thoracic outlet syndrome.5. Correlating with all available imaging modalities

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## Abstract Archives of the RSNA, 2023

CHEE-72

### Noninfectious Pulmonary Complications Following Hematopoietic Stem Cell Transplant

#### Participants

Elizabeth Lee, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. There is an increase in the indications for, the potential recipient age and sources from which hematopoietic stem cell transplantation (HSCT) can be performed, with increasing numbers of the procedure performed yearly across the globe. 2. Up to one third of patients undergoing HSCT develop pulmonary complications with the rates of infectious pulmonary complications decreasing due to improvements in prophylaxis and treatment. 3. The rate of noninfectious complications has risen and now is a more common cause of death than those from infection. 4. There are a variety of noninfectious pulmonary complications which can be seen after HSCT including idiopathic pneumonia syndrome, bronchiolitis obliterans syndrome, thoracic air leak syndrome, venous thromboembolism, and pulmonary hypertension. 5. Idiopathic pneumonia syndrome has a varied presentations depending on the site of primary tissue injury which results in a varied imaging appearance such as diffuse alveolar hemorrhage or peri-engraftment respiratory distress syndrome.

#### TABLE OF CONTENTS/OUTLINE

1. General review of hematopoietic stem cell transplantation 2. Idiopathic Pneumonia Syndrome (Acute interstitial pneumonitis, Acute respiratory distress syndrome, Delayed pulmonary toxicity syndrome, Peri-engraftment respiratory distress syndrome, Diffuse alveolar hemorrhage) 3. Bronchiolitis obliterans syndrome 4. Interstitial lung disease 5. Pleural effusions 6. Thoracic air leak syndrome 7. Venous thromboembolism 8. Pulmonary hypertension 9. Post-transplant lymphoproliferative disorder

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## Abstract Archives of the RSNA, 2023

CHEE-73

### Bad to the Bone: Differentiating Pulmonary Ossification from Calcification on CT

#### Participants

Kendrah Osei, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The pathogenesis of pulmonary ossification and calcification is incompletely understood. 2. Pulmonary calcification and ossification can occur in both pulmonary and non-pulmonary conditions, including benign, malignant, inflammatory, infectious, and metabolic etiologies. 3. High-resolution CT imaging is important to differentiate conditions that cause dendriform pulmonary ossification and those that do not. 4. Multi-society consensus guidelines now include pulmonary ossification among high-confidence CT features of usual interstitial pneumonitis (UIP) pattern of idiopathic pulmonary fibrosis.

#### TABLE OF CONTENTS/OUTLINE

1. Definitions of pulmonary calcification, pulmonary ossification, and dendriform pulmonary ossification. 2. Pathogenesis of pulmonary calcification and ossification. 3. Causes of pulmonary calcification and ossification. 4. Imaging patterns of pulmonary calcification and ossification. 5. Dendriform pulmonary ossification as a diagnostic imaging feature of idiopathic pulmonary fibrosis. 6. Clinical impact of recognizing dendriform pulmonary ossification. 7. References.

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## Abstract Archives of the RSNA, 2023

CHEE-74

### Thoracic Complications of Sickle Cell Disease

#### Participants

Malcolm Davidson, Mississauga, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 Acute chest syndrome is a leading cause of morbidity and mortality, and is characterized by the development of a new lung opacity along with fever and/or respiratory symptoms. The most common causes include infection, fat embolism, and infarction.<sup>2</sup> Sickle cell patients are functionally asplenic and immune compromised, making them vulnerable to pneumonia and other infections from encapsulated and atypical bacteria - a leading cause of mortality in this population.<sup>3</sup> Repeated pulmonary insults in sickle cell patients can lead to chronic pulmonary findings, such as pulmonary fibrosis.<sup>4</sup> Pulmonary embolism is more common in patients with sickle cell disease and can contribute to pulmonary hypertension (PH). PH is present in approximately 10% of sickle cell patients, and is often multifactorial in etiology (WHO group 5). Pulmonary artery dilation is associated with worse outcomes in those presenting with acute chest syndrome.<sup>5</sup> Bone complications in sickle cell disease can present similarly to acute chest syndrome. Patients in this population are at higher risk for osteomyelitis, and osteomyelitis should be considered if bone pain is atypical or if there are other supporting signs, symptoms, or imaging features.

#### TABLE OF CONTENTS/OUTLINE

1. Sickle Cell Pathophysiology  
2. Acute Complications - Vaso-occlusive events, acute chest syndrome, infection  
3. Chronic Complications - Lung fibrosis, cardiomyopathy, pulmonary hypertension, bone infarction

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-75

### Embracing Automation: Designing and Implementing a Robust Continuous Monitoring System for AI-Powered Radiology Applications

#### Participants

Vasanth Venugopal, MD, New Delhi, India (*Presenter*) Officer, CARPL.AI Inc

#### TEACHING POINTS

1. Continuous monitoring is vital for AI-driven radiology platform performance and reliability. 2. Identify KPIs and benchmarks to measure AI application metrics, such as accuracy, sensitivity, and specificity in radiology. 3. Implement automated QA/QC mechanisms, like image quality checks and data validation, ensuring consistent, complete input data following standard protocols. 4. Use advanced monitoring techniques, like measuring model divergence, to detect and address model drift caused by input data changes or other factors.

#### TABLE OF CONTENTS/OUTLINE

I. Key Performance Indicators (KPIs) and Benchmarks A. Identifying relevant clinical and non-clinical KPIs B. Establishing performance benchmarks for AI applications  
II. Automated Quality Assurance and Quality Control A. Automated QA/QC mechanisms for image quality and artifacts B. Data validation techniques for ensuring input data integrity  
III. Performance Monitoring and Anomaly Detection A. Real-time monitoring of KPIs and other relevant metrics B. Anomaly detection algorithms for identifying unusual patterns or behaviors  
IV. Advanced Monitoring Techniques A. Measuring divergence between multiple models B. Benefits and challenges of using advanced monitoring techniques  
V. Continuous Improvement A. Iterative model development, performance evaluation, and updating B. Real-world performance data Collection  
VI. Regulatory Compliance and Periodic Reviews A. Ensuring monitoring system adherence to regulatory requirements B. Conducting periodic audits and reviews

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## Abstract Archives of the RSNA, 2023

CHEE-76

### Imaging Findings in Bronchiectasis-Associated Diseases: A Comparison with Pathophysiology.

#### TEACHING POINTS

Teaching Points(1) Bronchiectasis is a condition characterized by irreversible dilation of the bronchi. CT imaging categorizes it into three types: cylindrical, varicose, and cystic. (2) Bronchiectasis can occur in various disease groups, making its diagnosis challenging due to its diversity. (3) Understanding the relationship between the underlying pathophysiology and imaging findings is crucial.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline (1) About bronchiectasis (2) Congenital bronchial anomalies (3) Mucociliary transport disorder (4) Immune hypersensitivity (5) Immune deficiency (6) Connective tissue disorder (7) Infectious disease (8) Others (9) Summary

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

CHEE-77

### Manifestations of Sickle Cell Disease on Thoracic Imaging

#### TEACHING POINTS

- Sickle cell disease (SCD) is a systemic disease that has a wide spectrum of pulmonary, soft tissue, skeletal, and upper abdominal findings that can be seen on thoracic imaging.- There is commonly an overlap between findings of the milder pneumonia and the more clinically severe acute chest syndrome. However, knowledge of some findings can favor one diagnosis over the other.- Over time, SCD can result in chronic changes to the lung parenchyma.

#### TABLE OF CONTENTS/OUTLINE

1. Introductiona. Backgroundb. Epidemiology, genetics, and pathogenesis of sickle cell disease2. Acute manifestationsa. Spectrum of acute chest syndrome and pneumonia• Findings on chest radiograph and CT that could aid in the diagnosis• Etiologies of pneumonia (e.g, streptococcus pneumoniae, Hemophilus influenzae, etc.)b. Pulmonary edemac. Pulmonary thromboembolism3. Chronic manifestationsa. Cardiomegalyb. Pulmonary hypertensionc. Pulmonary fibrosis, cysts, and mosaic attenuation4. Other manifestations seen on thoracic imaginga. Skeletal and soft tissue manifestations (avascular necrosis of humeral heads, extramedullary hematopoiesis, "H-shape" vertebrae, osteomyelitis)b. Upper abdominal manifestations (Splenic auto-infarction, cirrhosis, iron deposition)5. Prognosis and treatment6. Conclusion

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## Abstract Archives of the RSNA, 2023

CHEE-78

### Post-treatment Thoracic Changes in Breast Cancer Patients

#### Participants

Eloy Naranjo Moreno, MD, Mataro, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal of this exhibit is to provide an interactive and visual review of thoracic changes (surgical and after hormonal/chemotherapeutic treatments) that we can find in breast cancer patients who have undergone treatment or who are currently doing it. Nowadays, thanks to screening programs, breast cancer is a common pathology detected and treated precociously in many cases. This exhibit aims to present an illustrative compilation of thoracic and pulmonary changes in breast cancer treated patients; providing an algorithmic approach of these radiologic changes based on progression time and location in the lung; reviewing the most meaningful findings to allow radiologists to differentiate them from the general thoracic pathology. Post-treatment radiologic computed tomography (CT) changes in breast cancer include post-surgical changes (like removal and reconstruction of the affected breast), changes after and during hormonal/chemotherapy (appearance of interstitial pathology and other common signs in the lung) and post-radiotherapy changes (identifying irradiation regions and their findings correlation over time) that can be effectively identified through chest CT.

#### TABLE OF CONTENTS/OUTLINE

Introduction and purpose / Background / Image findings: Post-surgical changes, changes after and during hormonal/chemotherapy and post-radiotherapy changes / Conclusion.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-79

### Don't Forget to Check the Sternum After Thoracic Surgery: Expected Postsurgical Changes and Complications of Sternotomy and Sternal Wound Repair

#### Participants

Zehavit Kirshenboim, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Various chest wall surgical methods are being used for the sternotomy for thoracic surgery. 2. Identification of complications can be difficult due to a nonspecific clinical presentation which frequently overlaps with normal postsurgical changes. 3. Knowledge of expected postsurgical sternotomy imaging appearance is crucial to avoid misinterpretation and detect complications in a timely manner.

#### TABLE OF CONTENTS/OUTLINE

1. Various sternotomy techniques, surgical methods for sternotomy wound repair and complications will be illustrated. A. Surgical techniques 1. Longitudinal vs. transverse 2. Sternal wiring vs. rigid sternal fixation 3. Debridement and sternal flap closure B. Complications 1. Pre-sternal complication - cellulitis, sinus tract 2. Sternal complication - nonunion, dehiscence, osteomyelitis, wire fracture and migration 3. Post sternal complication - mediastinitis, retrosternal abscess, empyema, retrosternal hematoma, sternal adhesion 4. Flap complication - bowel herniation, flap failure C. How to differentiate expected postsurgical appearances vs. complications 2. Strategies to detect complications, differential diagnosis - sternal metastasis, infected epicardial lead 3. Clinical implications and treatment of complications

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## Abstract Archives of the RSNA, 2023

CHEE-8

### Into the Airway: Focal Tumors and Non-neoplastic Disorders (Detected by CT) Arising from the Bronchi

#### Participants

Uxue Martinez Urabayen, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the multiple focal lesions that can originate in the airway, including the non-neoplastic lesions and the benign and malignant tumours. To describe and illustrate the main characteristics signs and imagine findings that may improve detection of the lesions, improving the management of this patients.

#### TABLE OF CONTENTS/OUTLINE

**METHODS OR BACKGROUND** Neoplastic and non-neoplastic lesions of the airway track are rare. The majority are malignant. The diagnosis tends to be delayed due to the few and nonspecific symptoms. Chest radiographs are rarely diagnostic. **RESULTS OR FINDINGS** At CT benign and malignant tumours may have nonspecific characteristics, presenting as polypoid lesions or focal sessile lesions that narrow the airway lumen. Even non-neoplastic disorders may be identical. Mucus plugs have internal gas. Blood is indistinguishable from other endobronchial material. Broncholiths present calcification. Foreign bodies depend on the component of which they are made of. Lipomas have internal fat and hamartomas are characterized by "popcorn" calcifications. Leiomyomas and papillomas look very much alike. Squamous cell carcinoma is the most common subtype of lung cancer that affects the central airway system. Carcinoid tumours tend to have intense enhancement at contrast material-enhanced CT and may present calcifications. Metastasis due to hematogenous invasion are usually multifocal. **CONCLUSION** The airway must be carefully evaluated on CT examinations to appreciate the slight differences in morphology of the lesions occupying the lumen. Knowing the Morphological characteristic and location of these lesions can help reduce the broad spectrum of differential diagnosis.

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## Abstract Archives of the RSNA, 2023

CHEE-80

### Functional Lung MRI: How to Obtain Ventilation-Weighted Images from UTE MRI.

#### Participants

Julius Heidenreich, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The reader should learn about the prerequisites that are necessary for functional lung imaging (technical requirements, sequences, data types).2. The reader should understand that the basic post processing steps comprise (1: labelling of lung parenchyma; 2: image co-registration; 3: voxel-wise calculation of fractional ventilation.3. The reader should learn to interpret ventilation imaging and be able to distinguish ventilation maps from healthy subjects and patients with cystic fibrosis.4. The reader should know about pitfalls and limitations of UTE ventilation imaging and know about the alternative techniques.5. The exhibit should highlight the potential benefit of ventilation imaging. The reader should be able to understand its significance and the recent areas of application.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction, Background and Purpose: Why is ventilation imaging relevant? B. Technical requirements: What images have to be acquired? C. Post-processing: What are the basic steps of data processing? D. Data analysis and calculation of fractional ventilation and lung function parameters. E. Image analysis: Healthy subjects vs. patients. What is the difference? F. Pitfalls and limitations. What are the alternatives?

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## Abstract Archives of the RSNA, 2023

CHEE-81

### No Small Matter: Thoracic Manifestations of Small Vessel Vasculitis

#### Participants

Sofia Gambetta I, MD, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

We will review epidemiology, clinical features and imaging manifestations of ANCA associated small vessel vasculitis in the thorax. Teaching points: 1. Granulomatosis with polyangiitis presents with diverse pulmonary and airway involvement: tracheobronchial wall thickening/stenosis, lung nodules and masses that cavitate or present with ground glass halo, bronchovascular thickening or alveolar hemorrhage. 2. Microscopic polyangiitis can be divided into two groups: alveolar hemorrhage and interstitial lung disease. a. 4 to 36% of patients with interstitial pneumonia at presentation have MPO-ANCA antibodies. b. Up to 10% of patients with IPF seroconvert to MPO-ANCA. c. UIP and probable UIP are the most common patterns of MPO-ANCA ILD. 3. EGPA patients can be ANCA negative (eosinophilic manifestations) or ANCA positive (vasculitis features). a. Cardiac manifestations are more common than in other ANCA vasculitis and indicator of poor prognosis. b. Pulmonary manifestations include migratory/peripheral consolidations, GGOs and centrilobular nodules.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of small vessel vasculitis. a. Etiology and Pathogenesis. b. Epidemiology. c. Serological findings 2. GPA a. Clinical manifestations. b. Airway involvement. c. Pulmonary manifestations. d. Cardiac involvement 3. MPA. a. Clinical manifestations. b. Pulmonary manifestations. i. MPO-ANCA associated ILD ii. Alveolar hemorrhage and hemosiderosis 4. EGPA. a. Clinical manifestations. i. ANCA positive EGPA ii. ANCA negative EGPA. b. Pulmonary manifestations c. Cardiac manifestations. i. Myocarditis ii. Endocardial fibrosis iii. Pericarditis 5. Differential diagnosis

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## Abstract Archives of the RSNA, 2023

CHEE-82

### **Hypersensitivity Pneumonitis: Correlation of Radiologic and Pathologic Findings, Diagnostic Criteria and Recommendations According to the Latest Guidelines**

#### **TEACHING POINTS**

- To illustrate the key radiological and histological findings for the diagnosis of hypersensitivity pneumonitis and understand their correlation.- To review the hypersensitivity pneumonitis diagnostic criteria according to the latest guidelines and summarize recommendations.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definition and epidemiology2. Inciting agents. Exposure to inhaled agents.3. Immunopathogenesis:3.1. Immunologic mechanisms involved in the development of the disease and how they relate with the clinical and laboratory features.3.2. Risk factors: Genetic and external factors.3.3. The smoking paradox in HP.4. Clinical features.5. Non fibrotic HP:5.1. Radiologic Features: Typical and Compatible findings.5.2. Histologic Features.5.3 Radio-pathological Correlation6. Fibrotic HP6.1 Radiologic Features: Typical, Compatible and Indeterminate findings.6.2. Histologic Features6.3. Radio-pathological Correlation.7. Diagnostic criteria in the multidisciplinary team.8. Current controversies and future directions.

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## Abstract Archives of the RSNA, 2023

CHEE-83

### **Recognizing Local Recurrence After Stereotactic Body Radiotherapy in the Lung: Imaging Appearances and Pitfalls. A Picture Essay with Diagnostic Algorithm.**

#### **TEACHING POINTS**

This exhibit focuses on the imaging features and differentiation of local recurrence from normal inflammatory process after stereotactic body radiotherapy (SBRT) in the lung, and provides a diagnostic algorithm to aid in accurate diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview of SBRT as a treatment modality for primary lung cancer and lung metastases, including risk factors of local recurrence.
2. Practical tips for interpreting post-SBRT studies, including the need to evaluate all examinations in three dimensions and to understand the dynamics of the entire process from early inflammation to residual scar tissue.
3. Factors contributing to a large inflammatory reaction post-SBRT, including the target size, radiation dose, absence of emphysema or presence of interstitial lung disease, target location near large bronchi, and use of immunotherapy.
4. Factors contributing to a small inflammatory reaction, such as small target size, peripheral tumor location, or the presence of emphysema.
5. Key steps and features of the normal post-SBRT inflammatory-fibrotic process, including discrete diffuse signs of inflammation, formation of a fibrotic circle, gradual consolidation, and the formation of a flat scar.
6. Features suggestive of local progression, including new nodular or lobular lesions with local increase in size (especially in cranio-caudal dimension), and a typical malignant contrast-enhancing pattern.
7. Algorithm for investigating suspected local recurrence post-SBRT, including consideration of a PET/CT, and biopsy.

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## Abstract Archives of the RSNA, 2023

CHEE-84

### Dis-Discombobulating" the Current State of Interstitial Lung Disease Imaging

#### Participants

Jonathan Chung, MD, Chicago, IL (*Presenter*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd

#### TEACHING POINTS

- A systemic approach is paramount when diagnostic ILD on chest CT.
- To aid diagnosis, radiologists should familiarize themselves with current imaging guidelines and new and emerging concepts.
- Progressive pulmonary fibrosis (PPF) refers to ILDs other than idiopathic pulmonary fibrosis (IPF) with evidence of clinical, functional and/or radiologic progression over a one-year period.
- In patients with interstitial lung abnormality (ILA), clinical correlation and imaging follow-up should be considered, particularly when high-risk features for progression are present.
- Quantitative tools are valuable in the assessment of the extent and longitudinal progression of ILD.

#### TABLE OF CONTENTS/OUTLINE

- Practical approach to ILD on chest CT
- Updated approach to Hypersensitivity Pneumonitis (HP)
- Definition and current concepts of Progressive Pulmonary Fibrosis
- Definition and current concepts of Interstitial Lung Abnormality
- Current state of quantitative analysis and AI in ILD

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## Abstract Archives of the RSNA, 2023

CHEE-85

### Unusual Radiological Manifestation of Adenocarcinoma of the Lung

#### TEACHING POINTS

Primary adenocarcinoma of the lung is a heterogeneous disease, varying in molecular, pathological and clinical features. Radiological features can vary from the 'typical' appearances - usually ground-glass (GGN), part-solid (PSNs) or solid nodules, or with consolidation. Awareness of atypical appearances of adenocarcinoma may result in earlier investigation and timely management.

#### TABLE OF CONTENTS/OUTLINE

Lung cancer remains the most common cause of cancer deaths worldwide and adenocarcinoma is the most common histologic subtype, responsible for just under half of all cases.. The majority of tumours manifest radiologically with GGNs, PSNs, solid nodules or consolidation. In this review, we document our experience of atypical radiological presentations of adenocarcinoma spectrum disease, subsequently confirmed on histopathological analysis, at two tertiary centres. We include cases of adenocarcinoma presenting as a single, solid, calcified mass, as multiple micro- and macro-nodules and as widespread cystic airspaces. We describe cases presenting with unusual patterns of metastatic disease. We describe cases of atypical volume doubling times.

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## Abstract Archives of the RSNA, 2023

CHEE-86

### Pulmonary Hypertension: CT Signs That Point the Way

#### Participants

Camilo Mieres, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

CT signs suggestive of pulmonary hypertension (PH) What to include in CT reports in the workup for PH Findings in entities associated with PH

#### TABLE OF CONTENTS/OUTLINE

I. Background: -Pulmonary artery diameter can suggest PH, but the threshold differs with the clinical context. -CT findings can provide clues about the underlying cause of PH. II. Content: 1. Different pulmonary diameters should be considered in patients with low, intermediate, or high risk of PH. 2. Findings to analyze in the study of PH: Cardiac vascular anomalies (can be missed on echocardiography): -Intracardiac shunts (atrial septal defect (ASD), especially sinus venosus ASD) -Anomalous pulmonary venous return (often with ASD) -Patent ductus arteriosus Signs of obstruction of the pulmonary arteries (filling defects/vascular tree-in-bud, hypertrophied systemic arteries) -Chronic pulmonary embolism -Pulmonary tumor thrombotic microangiopathy -Exipient lung disease Signs of right ventricular repercussion. Lung anomalies (fibrosis, cysts, centrilobular nodules) -Interstitial lung disease (combined pulmonary fibrosis/emphysema, Langerhans cell histiocytosis, connective tissue disease) -Pulmonary veno-occlusive disease III. Conclusions: -CT can alert to the possibility of PH and can provide valuable clues about its etiology.

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## Abstract Archives of the RSNA, 2023

CHEE-87

### Developmental Disorders of Lung: A Pictorial Review

#### Participants

Shambo Guha Roy, MBBS, MD, Darby, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Mounier Kuhn syndrome affects trachea and up to 4th order bronchial tree, whereas William Campbell syndrome causes dilatation distal to 4th order bronchi. 2. Congenital pulmonary airway malformation (CPAM) has 5 subtypes: Type 1 being commonest with one or more dominant large cysts. Cyst size gets smaller in type 2 and 3. Type 4 is indistinguishable from type 1 radiologically. 3. Sequestration happens in two forms: intra lobar and extra lobar depending upon its venous drainage. Extra lobar sequestration is often associated with CPAM, called the 'hybrid lesions'. 4. Pulmonary veno-lobar syndrome or Scimitar syndrome accounts for minority of partial anomalous pulmonary venous return (PAPVR). Treatment depends upon the left to right shunt, which can be quantified using phase contrast MRI.

#### TABLE OF CONTENTS/OUTLINE

1. Normal development of the lungs. 2. Classification of developmental disorders. 3. Airway disorders: Tracheal and bronchial agenesis, Tracheobronchial branching anomaly, tracheobronchomegaly (Mounier Kuhn syndrome), bronchogenic cyst, congenital pulmonary airway malformation, bronchopulmonary sequestration. 4. Parenchymal disorders: Congenital lobar emphysema, Pulmonary hypoplasia, Pulmonary cystic mesenchymal hamartoma. 5. Vascular disorders: Pulmonary sling, absence of unilateral pulmonary artery, pulmonary veno-lobar syndrome.

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## Abstract Archives of the RSNA, 2023

CHEE-88

### Diffuse Pulmonary Hemorrhage: A Diagnostic Challenge

#### Participants

Camilo Mieres, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review the causes, pathophysiology, and radiological signs of diffuse pulmonary hemorrhage (DPH).-Underline the importance of correlating the imaging findings with clinical and laboratory findings.

#### TABLE OF CONTENTS/OUTLINE

I.- BackgroundDPH is rare. It can occur in many diseases with histologic findings ranging from normal vessels (bland hemorrhage) to capillaritis.Clinical and radiological findings are nonspecific, determining the etiology is challenging. II.- ContentThrough a series of cases, we show how the causes of DPH relate with the histologic patterns.Pulmonary capillaritis: neutrophilic infiltration of the alveolar septa, loss of capillary integrity -Small-vessel vasculitis/Anti-GBM (Goodpasture)-Rheumatic diseases (Lupus)-DrugsBland pulmonary hemorrhage: alveolar hemorrhage without destruction or inflammation of alveolar spaces-Anticoagulants, bleeding disorders-Heart failure (HF), mitral stenosis-Idiopathic pulmonary hemosiderosisDiffuse alveolar damage: alveolar edema and hyaline membranes-Infection-Drugs-Rheumatic diseases (Lupus)III.-ConclusionsRadiologic findings of DPH are nonspecific and must be interpreted together with clinical and laboratory data.

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## Abstract Archives of the RSNA, 2023

CHEE-89

### Chest CT Imaging in the Era of Lung-sparing Thoracic Resection

#### Participants

Farah Tamizuddin, MD, New York, NY (*Presenter*) Nothing to Disclose

Jane P. Ko, MD, New York, NY (*Presenter*) Research collaboration, Siemens AG

#### TEACHING POINTS

Chest computed tomography (CT) has a major role in planning and follow up after lung resection. Segmentectomy and sleeve resection techniques entailing anatomical lung segmental dissection are now a major method for curative surgery of early-stage lung cancer while preserving lung function. Accurate localization of pathology is essential, with clear definition of bronchial and vascular anatomy. More recently, minimally invasive approaches such as the robotic-assisted thoracoscopic surgery (RATs) and video assisted thoracoscopic surgery (VATS) techniques are options. Therefore, the objectives are: a) To review thoracic lung-resection approaches including RATs and VATs for sublobar resection and sleeve resection, b) bronchial anatomy and imaging for lesion localization, b) to discuss essential imaging findings to communicate that impact operative approach, including variant anatomy and c) to review expected postoperative imaging findings and complications.

#### TABLE OF CONTENTS/OUTLINE

1. Review of lung resection approaches: a) Sublobar, sleeve, and lobe resections b) RATs, VATS, open techniques, and advanced nodule localization methods 2. CT performance and essential preoperative anatomy evaluation: intersegmental plane identification: segmental bronchial anatomy, pulmonary arteries, pulmonary veins 3. Essential imaging findings: airway variants and challenges, 3D techniques 4. Post-operative imaging challenges: granulomas, airway distortion

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## Abstract Archives of the RSNA, 2023

CHEE-9

### Snaking the Clogged Pipes: Imaging Findings of Central Venous Occlusions and Review of Therapeutic Options

#### Participants

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Central venous obstruction can occur due to extrinsic compression or intrinsic stenosis. Clinical presentation and collateral drainage pathway development depends upon the site of obstruction and speed at which the obstruction occurs. IR based measures and surgical techniques are useful to relieve the obstruction to central vessels. We describe these techniques and their complications in this paper.

#### TABLE OF CONTENTS/OUTLINE

Introduction Causes of central venous obstruction • Extrinsic compression from lung cancer, lymphadenopathy, fibrosing mediastinitis • Intrinsic occlusion from catheter induced thrombosis. Imaging features of central venous obstruction- SVC narrowing, clot in the SVC, numerous chest wall collaterals, azygos vein dilatation. Collateral pathways based on the level of obstruction • pre azygos • azygos • post azygos. IR based approach for SVC recanalization- Angioplasty, stent placement. Surgical reconstruction methods for SVC- PFTE (polytetrafluoroethylene) graft, pericardial graft. Complications of reconstruction- Graft stenosis.

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## Abstract Archives of the RSNA, 2023

CHEE-90

### Toward a New Era of CT Imaging: Current Status and Expectations of Photon Counting CT in the Thoracic Region

#### Participants

Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Photon counting CT (PCCT) has appeared as a new generation of CT systems in clinical setting. PCCT can measure the energy levels of photons as they pass through an object being imaged, which differs from traditional CT scanners with energy-integrating detectors. PCCT has several advantages over traditional CT, including improved spatial resolution and contrast sensitivity, reduced radiation dose to the patient, and the ability to measure the energy spectrum of the incident radiation. PCCT is expected to bring significant improvements in various clinical applications for areas including the thorax. This education exhibit focuses on PCCT imaging in the thorax including technical perspectives, image quality, and clinical imaging. It is much appreciated if our information would be useful in your clinical and research setting.

#### TABLE OF CONTENTS/OUTLINE

1. Comparison of PCCT equipment specifications with the traditional CT scanner with energy-integrating detector (EID-CT). 2. Improved spatial resolution: image quality according to reconstruction kernels and radiation dose. 3. Imaging by turbo flash spiral scan: high-definition images without motion artifacts even with electrocardiogram asynchrony and spectral imaging at the same time. 4. Iodine density imaging for pulmonary embolism and thoracic tumors: improved quantification due to the absence of electrical noise 5. Virtual non-contrast CT imaging created from each dynamic phase: comparison with true non-contrast CT in cases of thymic cyst, thymoma, and lung cancer. 6. Future expectations: effects on quantitative values including radiomics analysis.

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## Abstract Archives of the RSNA, 2023

CHEE-91

### Analysis of Solitary Lung Nodules Using Summation Images Created from Ultra-High-Resolution CT Data

#### Participants

Hiroshi Moriya, MD, PhD, Fukushima, Japan (*Presenter*) Advisor, California Capital Equity, LLC; Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

1. Advantages of ultrahigh-resolution CT: Ultra-high resolution CT has excellent spatial resolution in lung field analysis. 2. 3D image analysis method using ultra-high resolution CT data: Coronal MPR and VR image are useful for chest image analysis. Summation image (SUM) can observe a X-ray projection image of the chest from any viewpoint. 3. There are two factors that make lung lesions difficult to detect: (1) lesions with little density difference from the surrounding lung, and (2) presence in areas where other structures are projected in the anterior-posterior direction. 4. Points to note when interpreting chest radiographs in routine clinical practice.

#### TABLE OF CONTENTS/OUTLINE

1. Ultra-high-resolution CT (UHRCT) is a CT that achieves high spatial resolution by reducing the detector size to 1/4 of the conventional size. The resolution can be improved by increasing the number of pixels, and the reproducibility of density can be improved by reducing the partial volume effect. 2. Summation images using UHRCT data provide images similar to chest photographs. Ability to create X-ray-like images of removed lungs, enabling analysis of clinical chest radiograph findings. 3. Small pulmonary nodules are not readily detectable on plain chest radiographs. The difficulty in detecting the target lesion is due to the averaging of the density due to the thickness of the lung and the overlapping projection of other structures (cardiovasculature and bone). Ground-glass density lesions are obscured, but solid components and pleural indentation findings can be pointed out.

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## Abstract Archives of the RSNA, 2023

CHEE-92

### When Lungs Turn to Stone: A Differential Diagnosis of Pulmonary Calcifications

#### Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the main pathologies that can cause intrapulmonary calcifications. - Highlight the key radiological features that will allow us to establish a correct differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Pulmonary calcifications are a common imaging finding, usually seen on routine chest radiographs. Although they are usually harmless sequelae of remote processes, they provide important information for establishing a good diagnostic approach. They can be attributed to a variety of etiologies, including granulomatous disease, infection, malignancy, environmental exposure, or chronic disease. Consequently, it is necessary to correlate radiologic findings with clinical history and laboratory results. Specific radiologic features have been described, of which the appearance of pulmonary calcifications also provides valuable information regarding the underlying etiology. Therefore, a thorough differential diagnosis is necessary to identify the underlying cause and guide appropriate management. This work provides a comprehensive review of the radiologic features of pulmonary calcifications, including their distribution, size, shape, and associated findings, through cases studied at our center.

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## Abstract Archives of the RSNA, 2023

CHEE-93

### Proposals for the 9th edition TNM Staging for Lung Cancer - A Guide to Radiologists

#### Participants

Maximiliano Klug, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Unresolved issues of the 8th edition TNM staging for lung cancer are: exclusion of post neoadjuvant patients (yp) from staging analysis, absence of nodal metastatic burden quantification, lack of granularity within the M1C category. 2- Proposed T Category - remains unchanged. 3- Proposed N Category- N2 is divided into N2a as single-station N2 disease and N2b as multiple-station N2 disease - relevant to imaging interpretation; N1 and N3 remain unchanged. 4- Proposed M Category- M1C cases that are metastatic to a single organ site have a better prognosis than M1C to multiple sites- to be determined this month whether multiple single organ will be moved to M1B. The rest of M categories are unchanged. 5- The outcomes of matched ypN v pN categories differ significantly with worse survival for ypN (e.g., ypN0 vs. pN0)- caution for imaging interpretation and patient management decisions.

#### TABLE OF CONTENTS/OUTLINE

1- To describe the proposals for the 9th edition TNM Staging for Lung Cancer. 2- To discuss the differences from the previous edition, remaining challenges, as they pertain to imaging evaluation and interpretation, and potential future directions.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-94

### Early and Late CT Patterns After SBRT for Lung Nodule

#### Participants

Ignacio Alba, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To familiarize with the different radiological patterns observed on chest CT scans after stereotactic body radiotherapy (SBRT) for lung nodules, including early changes (within the first 6 months) and late changes (after 6 months)-To recognize cases of local and/or locoregional recurrence based on findings in our sample-To recognize evolutionary differences in chest CT findings based on the histological subtype of the treated lesion-To evaluate the ultimate success of SBRT as a therapeutic technique

#### TABLE OF CONTENTS/OUTLINE

We evaluated the different radiological patterns observed after SBRT for lung nodules using chest CT scans in 108 patients. Of the cases studied, 64 were primary tumors in early stages, 32 cases were lung metastases or metastases from other locations, and in 12 cases histology could not be identified. Among the primary lung tumors, 57% were adenocarcinomas, followed by 26% of squamous cell carcinomas. All chest CT scans were performed every 3 months during the first 2 years and every 6 months during the next 2 years after the completion of SBRT. The patterns observed in the first six months typically evolve progressively to a final stabilization pattern. The most frequently observed final radiological patterns were nodule-like and mass-like, followed scar-like and diffuse consolidation pattern. Thoracic recurrence was diagnosed by lack of parenchymal stabilization in 20% of cases, and locoregional lymph node involvement in the remaining cases. There were no significant differences in lung involvement based on the histology of the treated tumor

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## Abstract Archives of the RSNA, 2023

CHEE-95

### CT Imaging of Lung Cancer: Exploring the Clinical Potential of CZT-based Photon Counting Detector CT

#### Participants

Tomoaki Sasaki, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lung cancer is the leading cause of death worldwide. CT is a powerful tool for evaluating the primary site and staging of lung cancer. On CT imaging, lung cancer appears as a subsolid nodule or solid nodule. Measuring the total tumor size and the size of the solid portion if the tumor is a subsolid nodule is the first step in both early and advanced lung cancer. Assessment of invasion to critical organs is also important in locally advanced cancer. Accurate evaluation of ipsilateral mediastinal nodal and extrathoracic metastases is required to determine treatment strategy. Photon counting detector CT (PCD-CT) has recently emerged for clinical use. Cadmium zinc telluride (CZT)-based PCD-CT, a newly developed technology, allows for more precise observation of lung cancer with lower radiation exposure, which may have a significant impact on clinical practice. This presentation aims to 1) review the clinical significance and challenges of CT evaluation in lung cancer and 2) discuss the benefits provided by CZT-based PCD-CT for lung cancer patients.

#### TABLE OF CONTENTS/OUTLINE

Key features of lung cancer evaluation: primary site and staging<sup>1</sup>. T: size (T1-T4), chest wall invasion (T3), mediastinal invasion (T4)<sup>2</sup>. N: ipsilateral mediastinal node metastasis (N2)<sup>3</sup>. M: pleural dissemination (M1a), extra thoracic metastasis (M1b-c)  
Basic principle of CZT-based PCD-CT  
Clinical potential of lung cancer assessment using PCD-CT: super high resolution (SHR) image, multienergy spectral image, reduction of radiation exposure

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-96

### Pictorial Review of Tracheal Diseases: A Case-Based Approach for Radiologists

#### Participants

Camila Gadens Zamboni, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The evaluation of the trachea by imaging is essential to diagnose various tracheal diseases and help with surgical plans, assessment of treatment responses, and understanding surrounding structural abnormalities. In this scenario, the radiologist's role rises as an unreplaceable analysis of this cartilaginous tube. This exhibit aims to summarize pertinent anatomy and review diverse tracheal diseases, congenital and acquired, through a didactic classification and presentation of the cases, including differential diagnosis, challenges, and limitations.

#### TABLE OF CONTENTS/OUTLINE

This is a case-based review of pathologies of the trachea focusing on 1- Pertinent anatomy review. 2- Best imaging methods for tracheal evaluation. 3- Classification of tracheal diseases with illustrative cases by focal vs. diffuse diseases, and the last by increased vs. decreased diameters. 4- Discussion of differential diagnoses. 5- Challenges and limitations on tracheal evaluation by imaging. 6- Take-home messages.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-97

### Proposals for the 9th edition TNM Staging for Thymic Epithelial Tumor - A Guide to Radiologists

#### Participants

Maximiliano Klug, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Unresolved issues of the 8th edition TNM staging for thymic epithelial tumor (TET) are: T category refinement - focus on tumor size; granularity between N categories; better differentiation between intra and extrathoracic metastatic disease. 2- Proposed T Category- T1a ( $\leq 5$ cm) and T1b ( $> 5$ cm) regardless of involvement of mediastinal pleura; T2: invasion of the pericardium, lung, or phrenic nerve; T3: invasion of the brachiocephalic vein, superior vena cava, chest wall, or extrapericardial pulmonary arteries and veins; T4: unchanged, direct invasion of the aorta and arch vessels, intrapericardial pulmonary artery, myocardium, trachea, or esophagus. 3- Proposed N Category- The ITMIG/IASLC lymph node stations are clarified, unchanged two nodal regions: anterior (N1) and deep (N2). N1 includes the thymic bed compartment in the anterior lower neck and prevascular mediastinum. N2 includes tracheobronchial, aortopulmonary window, subcarinal, hilar, internal mammary, and the deep cervical (jugular and supraclavicular) lymph nodes. 4- Proposed M Category- Unchanged. M1a: pleural or pericardial nodules separate from the primary tumor; M1b: pulmonary intraparenchymal nodules, extrathoracic metastases, or any non-regional lymph nodes (e.g. high neck, retro-crural, axillary or extrathoracic lymph nodes).

#### TABLE OF CONTENTS/OUTLINE

1- To describe the proposals for the 9th edition TNM Staging for TET. 2- To discuss the differences from the previous edition, remaining challenges as they pertain to imaging evaluation, and potential future directions.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

CHEE-98

### Halo and Reversed Halo Signs in Chest CT: Are They Useful?

#### Participants

Adria Roset Altadill, MD, Girona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The halo and reversed halo signs in chest CT may be caused by infections, inflammatory and vascular disorders and neoplastic diseases. These signs combined with ancillary imaging findings, additional information from PET-CT and spectral CT and proper clinical history may help the radiologist reach the final diagnosis.

#### TABLE OF CONTENTS/OUTLINE

The halo and reversed halo signs were initially described and thought to be specific for invasive pulmonary aspergillosis and cryptogenic organizing pneumonia, respectively. However, there is a broad spectrum of causes for these chest CT findings, including infections, inflammatory and vascular disorders and neoplastic diseases. The most common causes of the halo sign in the lung are adenocarcinoma, invasive aspergillosis and septic emboly. Less common causes include bacterial and viral infections, hemorrhagic metastases, vasculitis and other inflammatory disorders. The reversed halo sign is more frequently seen in organizing pneumonia, followed by pulmonary infarcts, invasive mucormycosis and other granulomatous diseases. Despite having lost their specificity, the halo and reversed halo sign combined with ancillary chest CT findings and an adequate clinical background can be useful to narrow the differential diagnosis. Special attention has to be paid to the nodule size, number and morphology in the halo sign. The thickness and distribution of the ring of consolidation and the presence of internal reticulation within the reversed halo sign also need to be evaluated. Moreover, metabolic information from PET-CT and perfusion data from spectral CT may help differentiate pulmonary infarcts from other inflammatory or infectious causes of the reversed halo sign.

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## Abstract Archives of the RSNA, 2023

CHEE-99

### Cystic Lung Disease: The Common, the Rare and the Unusual

#### Participants

Daniel Vargas, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

While most radiologists are aware of the most common cystic lung diseases, a group of rare and unusual diseases including genetic syndromes, lymphoproliferative disorders, environmental exposures and congenital anomalies can also result in cyst formation in the lungs. This exhibit will:

1. Review the clinical and imaging features of common and rare cystic lung diseases.
2. Discuss the underlying histopathology in each of these entities and how it translates to imaging findings.
3. Offer the radiologist an approach to help narrow the differential and guide clinical management in the multidisciplinary care of these patients.
4. Review ancillary findings and complications in patients with cystic lung disease.
5. Current concepts in amyloidosis and light chain deposition disease and their role in cyst development in lymphoid interstitial pneumonia.

#### TABLE OF CONTENTS/OUTLINE

1. Lung cyst and cystic lung disease definition
2. Common Cystic Lung Diseases
  - a. Lymphangioleiomyomatosis.
  - b. Birt-Hogg-Dube syndrome.
  - c. Pulmonary Langerhans Cell Histiocytosis.
  - d. Lymphoid Interstitial Pneumonia and Current Understanding of the role of Amyloidosis and Light Chain Deposition Disease.
  - e. Desquamative Interstitial Pneumonia.
2. Rare Cystic Lung Diseases.
  - a. Neurofibromatosis type 1.
  - b. Nieman-Pick Disease.
  - c. Trisomy 21.
  - d. Vascular Ehlers-Danlos Syndrome.
  - e. Proteus Syndrome.
  - f. Lymphomatoid Granulomatosis.
  - g. Follicular Bronchiolitis.
  - h. Atypical Infections (eg. P Jiroveci).
  - i. Hydrocarbon Pneumonitis.
  - j. Proximal Interruption of the Pulmonary Artery

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## Abstract Archives of the RSNA, 2023

EREE

### Emergency Radiology Education Exhibits

#### Sub-Events

#### EREE-1 **Ankle and Foot Injuries in ER: A Checklist-Based Approach to Radiographs**

##### TEACHING POINTS

1. To recognize various anatomic bony landmarks on ankle and foot radiographs with CT correlation.2. To understand the pathophysiology and biomechanics of injuries in ankle and foot trauma.3. To be aware of the most commonly used ankle and foot trauma classification schemes.4. To understand the need for accurate diagnosis and characterization of ankle and foot injuries to guide management decisions to ensure optimal clinical outcomes.5. To understand the role of CT in foot and ankle trauma. 6. To review the management of ankle and foot traumatic injuries.

##### TABLE OF CONTENTS/OUTLINE

1. Review the anatomy of the ankle and foot using illustrations, radiographs, and CT.2. Various radiographic projection series and protocols to diagnose and characterize ankle and foot injury patterns.3. The spectrum of foot and ankle injuries with key concepts in accurate characterization on radiographs with CT correlation.4. Illustrated classifications of ankle and foot traumatic injury. 5. An algorithmic approach to accurately predict and identify subtle injuries.6. Clues to avoid common pitfalls will be included.7. Troubleshooting role of CT to be elucidated.8. Focused review of the management of foot and ankle injuries.

#### EREE-10 **A Guide to Evaluating the Post-robotic and Post-laparoscopic Abdomen**

##### Participants

Jay Pancholi, MBChB, BSc, Wilmslow, United Kingdom (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1) To illustrate new surgical techniques with robotic surgery including recent advances in anastomoses.2) To identify common post-operative complications in relation to timing since surgery.3) To highlight review areas for post operative scans.4) To review pearls and pitfalls in distinguishing expected appearances compared to complications.5) To explain considerations when protocolling imaging requests.

##### TABLE OF CONTENTS/OUTLINE

Minimally invasive surgical techniques continue to advance with robotic surgery representing one of the most recent innovations. These techniques allow previously difficult anastomoses to be more readily performed. Post operative imaging is a common challenge faced by radiologists. Knowledge of surgical technique and possible complications is important for all radiologists interpreting these scans to ensure appropriate protocolling and accurate diagnosis. The poster will show illustrations of surgical techniques, normal post operative appearances and a variety of complications presented as scrollable cases. The poster will be outlined as: -Surgical advances--Robotic surgical incision sites--New anastomotic techniques---Minimally invasive colonic anastomosis---Kono-S anastomosis-Expected appearances--Normal free gas relative to day post op--Normal free fluid relative to day post op-Complications--Anastomotic leak--Bowel ischaemia--Vascular injury---Pseudoaneurysm--AV fistula--Ureteric injury--Lymphatic injury--Incisional hernia

#### EREE-11 **Twisting Around: A Review of the Potential Locations of Torsions**

##### Participants

Laura Cavero Barreras, MD, Ordizia, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- To review the pathophysiology of a torsion. - To understand which imaging modality should be ordered depending on the location of the torsion. - To know the possible sites of torsion and review the major imaging findings at each site on the different imaging techniques. - To review the radiological signs of ischemia that may appear as a consequence of torsion and may influence surgical management of the condition.

##### TABLE OF CONTENTS/OUTLINE

Torsion is a broad term that describes a twisting of an organ around its mesentery or its vascular pedicle resulting in an impairment of its blood supply. The vein is usually the first vessel affected resulting in venous stasis or ischemia. If left untreated, arterial compromise can occur leading to arterial infarction. For this reason, they are usually surgical emergencies and a prompt diagnosis is essential to avoid organ necrosis or hollow organ perforation. Imaging techniques are necessary to establish the diagnosis. Although intestinal volvulus and gonadal torsion are broadly known, there are other organs that can rarely result in torsion such as the lung, the spleen, the gallbladder, and the Fallopian tube. This presentation aims to review the imaging findings of torsion in all potential locations and identify the signs of ischemia that may occur in this setting.

#### EREE-12 **Above the Rest: A Review of Upper Cervical Spine Injuries**

##### Participants

Jerry Cruz-Rodriguez, BA, San Juan, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Radiologists play a crucial role in characterizing acute cervical spine injuries in the emergent trauma setting using an imaging-based morphology approach.- Jefferson fractures involve the anterior and/or posterior arch of C1, lateral mass, or transverse anterior arch, and require CT for detection.- Hangman fractures involve disruption of C2's posterior elements at the pars interarticularis and can be devastating injuries.-OCFs require CT for detection and indicate serious trauma has occurred, potentially causing instability of the atlanto-occipital joint and neurological injuries.-Dens fractures are classified into 3 types, and CT is used to determine the type and guide management decisions.-AOD involves complete separation of the upper cervical spine from the skull base and requires CT for accurate diagnosis.-Traumatic atlantoaxial instability is a potentially devastating unstable injury that can be missed without careful assessment on initial CT scan.-TRS/TRF requires CT to diagnose the degree of subluxation and assess accompanying injuries, with clinical and dynamic imaging assessments needed for rotatory fixation.

#### TABLE OF CONTENTS/OUTLINE

A. IntroductionI OverviewII AO Spine Upper Cervical Injury ClassificationB. Upper Cervical Spine InjuriesI Common and uncommon important injuries of the upper cervical spineII CT characterization and discussion of typical mechanismsIII Image review and correlation with AO Spine ClassificationOccipital condyle fractures (OCF) Atlanto-Occipital Dissociation (AOD)Atlantoaxial instabilityTraumatic Rotatory Subluxation/Fixation (TRS)Atlas (Jefferson) fracturesHangman fracturesOdontoid fracturesC. ConclusionD. Self assessment

#### EREE-13 **Ultrasonographic Diagnosis of Pneumothorax: Legend or Reality?**

Participants

Guilherme del Guerra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This study aims to report the importance of chest ultrasound in the evaluation of critically ill patients with pneumothorax, highlighting the need for systematization in chest ultrasound assessment and technical recognition of pneumothorax ultrasound signs. The main echographic signs used in the detection of pneumothorax are: Absence of sliding of the two pleural leaflets, accentuated reverberation (A Lines), absence of comet tail artifacts and B lines and determination of the Pulmonary Point.In the presence of pneumothorax, trapped gas obscures visualization of the underlying pleural line, so that no pulmonary slippage is identified.The systematized technique used in chest ultrasound is based on: use of a high-frequency linear probe (5-12MHz); patient positioning in dorsal decubitus; division of each hemithorax into six quadrants. Each quadrant should be analyzed to ensure identification of the pneumothorax. The use of technically systematized chest ultrasound for the diagnosis of pneumothorax has high sensitivity, bringing a great benefit to critically ill patients, and can be used for diagnosis and decision-making quick conduct.

#### TABLE OF CONTENTS/OUTLINE

- Systematization of chest ultrasound evaluation-Normal findings on chest ultrasound - Ultrasonographic findings of pneumothorax - Cases of patients with pneumothorax diagnosed by ultrasound

#### EREE-14 **Don't Lose Your Head -- Imaging of Atlantooccipital Dissociation and Central Skull Base Fractures**

Participants

Desmin Milner, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand normal anatomy of the central/posterior skull base and craniocervical junction.2. Understand various traumatic injuries at the central/posterior skull base and craniocervical junction.3. Understand some mimics of craniocervical junction injury.

#### TABLE OF CONTENTS/OUTLINE

1. Review normal anatomy of the central/posterior skull base and craniocervical junction.2. Briefly review CT and MRI imaging protocols in the setting of trauma.3. Review traumatic injuries of the central/posterior skull base and craniocervical junction including: atlantooccipital dissociation, occipital condyle fractures, clival fractures, and transsphenoidal fractures.4. Review of other ligamentous injuries at the craniocervical junction.5. Review mimics of craniocervical junction injury.

#### EREE-15 **Blunt Cerebrovascular Injuries (BCVI): Diagnosis, Evolution, and Complications**

Participants

Elham Beheshtian, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Advances in multidetector CT angiography in the context of multitrauma have led to increased diagnosis of blunt cerebrovascular injuries (BCVI).2. Early BCVI detection and treatment can decrease the risk of complications, such as ischemic strokes, carotid cavernous fistula, and arteriovenous fistulas.3. BCVI is graded from 1-5 on the Biffi Scale, based on imaging appearance. The grading system is used to guide patient management and can predict the natural evolution of an injury.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction - epidemiology, morbidity and mortality, mechanism, imaging modalitiesII. Biffi ScaleA.Pathophysiology and imaging examples of grades1-5 injuryB.Management implications by grade C.Natural history of an injury, including complicationsIII. Diagnostic considerations 1.Imaging modalities 2.Universal vs. selective screening 3.Imaging follow-upIV. BCVI mimics - fibromuscular dysplasia, atherosclerosis, carotid web, vasospasm, true aneurysmV. Venous injuryVI. Summary

#### EREE-16 **Peer Learning Pearls: The Most Commonly Missed MSK Diagnosis on the Overnight Shift - Diagnostic Errors and Great Calls**

Participants

Thais Kuwazuru, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The aim of this exhibition is to:- Highlight the most commonly missed musculoskeletal diagnosis identified after Peer Review analysis and the great calls of difficult cases;- Demonstrate practical tips to avoid missing diagnosis;- Review the current concepts about these pathologies;- Show illustrative and didactic cases from our service, specially from emergency and urgent care units.

## TABLE OF CONTENTS/OUTLINE

INTRODUCTION- The greatest difficulties during the night shift and emergency room for the radiologist;- Impact of early accurate diagnosis of these diseases.IMAGING INTERPRETATION- The most commonly missed musculoskeletal diagnosis identified after Peer Review analysis, including:- Fractures: vertebral acute fracture, transdiscal fracture, scaphoid fracture, avulsion fracture of Chopart joint;- Infection: discitis and spondylodiscitis, abscess;- Hematoma and active bleeding;- Other causes of musculoskeletal pain such as longus colli tendinitis, disc herniation;- Great calls - difficult cases.INTERACTIVE CASE-BASED DIDACTICS- Sample cases to illustrate and solidify the concepts;- The main tips that every radiologist working the night shift should know;- Correlation with current literature data.CONCLUSION AND TAKE HOME MESSAGES- Patient assessment in emergency and urgent care scenario very often include imaging investigation;- In order to improve patient outcomes and prevent iatrogenic treatments (or lack of treatment), it is essential to know the imaging patterns of each pathology and the tips to avoid missing diagnosis.

## EREE-17 **Murphy's Law: What Can Go Wrong in Robotic and Laparoscopic Surgeries**

Participants

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Understand the main differences between open surgery, and minimally invasive surgery (MIS). Recognize the anatomy of the abdominal wall. Understand how the abdominal access is performed in MIS. Comprehend expected imaging patterns after MIS. Recognize the complications associated to MIS and its related imaging findings.

## TABLE OF CONTENTS/OUTLINE

INTRODUCTION: Open versus MIS. Modalities of MIS. Anatomy of the abdominal wall, and its relation to the abdominal access in MIS. Expected imaging findings after MIS COMPLICATIONS AFTER MIS: a case-based review - Laparoscopy-related: Epidemiology. Imaging findings. How to proceed? Robotic-related: Epidemiology. Imaging findings. How to proceed? SUMMARY AND SYSTEMATIC APPROACH: what to look for? Preoperative imaging / Postoperative imaging TAKE HOME MESSAGES

## EREE-18 **Don't Look Just for the Bowels: A Comprehensive Review of Noninvasive Vascular Imaging in Abdominal Solid Organ Ischemia**

Participants

Hermes Vinicius Pedrini Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- Review the anatomy of intra-abdominal solid organs vascularization.- Expose frequent and infrequent cases of intra-visceral vasculopathies in the context of acute abdomen.- Remember the main parenchymal changes resulting from vascular events and their differential diagnoses.- Tips on how to identify critical findings and report them.

## TABLE OF CONTENTS/OUTLINE

- Concepts of arterial and venous circulatory anatomy and solid organs vascularization.- Circulatory physiology and how it affects the different imaging modalities.- CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases.- Imaging aspects of acute vascular events, from the organ's pedicle to its parenchyma.- Intra-abdominal occlusive ischemic events (thromboembolism, torsions, dissections).- Non-occlusive ischemic events (hemodynamic shock, substance abuse).- Other vascular abnormalities that may have clinical repercussions (shunts and malformations).- Correlation between imaging and clinical signs.- Risk factors and pre-existing conditions that can help us think about solid organ ischemia.- Practical information for effective reporting and necessary information for intervention planning, including the critical imaging findings that needs immediate intervention.

## EREE-19 **Friendly Fire: A Rapid Review of Iatrogenic Intrathoracic Injuries Related to Support Devices**

Participants

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Many common interventions performed by health care providers while placing supporting devices may lead to injuries to the lungs, pleura, heart, or mediastinal structures. These injuries may range from asymptomatic findings managed conservatively to life-threatening injuries requiring emergent surgical or percutaneous intervention. The radiographic and cross-sectional imaging appearance of malpositioned intrathoracic medical devices and complications related to iatrogenic thoracic trauma secondary to medical devices or procedures will be reviewed, and recommendations for clinical teams based upon imaging findings will be discussed.

## TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Examples of cases:a. Chest tube placement- Pulmonary contusion, laceration, hemothorax, pneumothorax.b. Pacemaker placement- Hemopericardium, pneumomediastinum, pneumothorax, hemothorax, chest wall hematoma.c. Swan-Ganz catheter- Pulmonary artery pseudoaneurysm.d. Enteric tubes- Endobronchial course causing lung injuries, esophageal perforation.e. Central venous catheters- Vascular dissection, vascular perforation, pneumothorax, mediastinal hematoma.3. Conclusion.

## EREE-2 **MR Imaging of Pelvic Emergencies**

Participants

Gayatri Joshi, MD, Atlanta, GA (*Presenter*) Royalties from Elsevier.

## TEACHING POINTS

Pelvic pain is a commonly presenting symptom in the Emergency Department (ED) and while ultrasound (US) or computed tomography (CT) are often the initial imaging exam, magnetic resonance (MR) imaging plays a vital role for specific populations (such as the pregnant patient) and in clinical scenarios in which diagnosis relies on the greater sensitivity provided by MR imaging. After reviewing this exhibit, learners should be able to: 1. Understand the role of MR imaging in the emergent setting 2. Proficiently recognize emergent pelvic disorders by MR imaging 3. Utilize best practices for diagnosing pelvic emergencies in the ED, including those of infectious, inflammatory, ischemic, obstructive, traumatic, neoplastic etiologies

#### TABLE OF CONTENTS/OUTLINE

This exhibit will: 1. Systematically illustrate the clinical and imaging features of pelvic emergencies that may present in the ED, particularly those of the MSK, vascular, GI GU body systems. The spectrum of pelvic emergencies discussed in this exhibit will include those of infectious, inflammatory, ischemic, obstructive, traumatic, neoplastic etiologies 2. Discuss best imaging practices of the acute pelvis in the ED, with pearls/pitfalls for optimizing efficient accurate diagnosis 3. Briefly address relevant management as applicable to the Radiologist to aid in expedient, appropriate management

#### EREE-20 **Imaging Features and the Role of Interventional Radiology and Radiation Therapy in Oncologic Emergency**

Participants

Akihiro Nakamata, MD, Shimotsuke, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Due to the rapidly increasing elderly population and to the advancements in oncology, there has been an increase in the diagnosis of cancer, and also a rise in oncological emergencies. In oncologic emergencies, radiologists play a major role not only in diagnosis but also in the subsequent treatment of interventional radiology and radiation therapy. Therefore, radiologists should know imaging features and the treatment of oncologic emergencies in the whole body.

#### TABLE OF CONTENTS/OUTLINE

The purpose of this exhibit is: 1. To classify oncologic emergencies according to their pathology and location 2. To review oncologic emergencies in the whole body 3. To discuss the clinical and imaging features of the oncologic emergencies 4. To discuss the role of interventional radiology and radiation therapy  
Table of contents: 1) Subtypes based on imaging findings reflecting the background pathology. 2) Oncologic emergencies of various organs in this presentation. A) Central nervous system: Cerebral herniation Spinal cord compression B) Thoracic: Superior vena cava syndrome Airway obstruction Pericardial effusion with cardiac tamponade Pleural effusion Pulmonary thromboembolism, pulmonary tumor thrombotic microangiopathy (PTTM) Esophagorespiratory fistula Massive hemoptysis C) Abdomen: Abdominal compartment syndrome Biliary obstruction Biliary bleeding Intestinal obstruction Intestinal bleeding Bowel perforation Urinary tract obstruction Abdominal bleeding

#### EREE-21 **Understanding Cerebral Edema and Brain Herniation: A Simple Guide For Residents**

Participants

Gustavo Alonzo Correa I, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To recognize the basic intracranial anatomy necessary for understanding the radiological features of brain herniation. To explain the appearances, pathogenesis and classification of cerebral edema. To discuss use of a systematic approach of cerebral herniation. To identify the imaging findings, clinical manifestations and potential complications associated in cerebral herniation.

#### TABLE OF CONTENTS/OUTLINE

Introduction Normal brain anatomy Brain edema (Vasogenic, Citotoxic and Transependymal) Concept of brain herniation Physiopathology of brain herniation Key level approach to brain herniation Classification Subfalcine hernia Transtentorial descending hernia Transtentorial ascending hernia Tonsillar Extracranial hernia To take home points

#### EREE-22 **Dental Trauma: A CT Perspective for Tooth-Saving Precautions**

Participants

Erhan Akpinar, MD, Sihhiye, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To provide a basic anatomical overview of dental trauma with illustration of regions susceptible to trauma. To inform which dental fractures are important to save the tooth, and what to report for clinicians to get information about treatment options with basic points. To review the common terminology and classification of dental trauma/fractures with emphasizing the conditions that create or increase the risk of tooth loss. To present basic structural report templates for dental trauma reporting To discuss the CT imaging findings related to treatment of dental trauma and complications with illustrative cases.

#### TABLE OF CONTENTS/OUTLINE

1. Dental Anatomy, Weak Points and Crucial Structures to Keep The Tooth Alive / Functional 2. Terminology and Current Classification of Types of Dental Trauma 3. Fractures that require treatment within a few hours • Crown-Root Fractures • Root Fractures • Alveolar Fractures • Extrusive and Lateral Luxation • Avulsion 4. Fractures that require treatment within the first 24 hours • Complex Crown Fractures (Involving Pulp Structures) • Concussion and Subluxation • Intrusive Luxation 5. Treatment Options and Complications 6. A Structural Report Template for Dental Trauma

#### EREE-23 **Ultrasound in Acute Care: Point-Of-Care**

Participants

Roddie Moraes Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recognize the practical applications of point of care ultrasound in emergency care; highlight patient positioning and how to acquire images in some exams performed with POCUS; learn the well-established ultrasound imaging standards in the literature.

## TABLE OF CONTENTS/OUTLINE

Introduction: thorax, heart, abdomen, vessels; case-based review: thorax (pleural effusion, consolidation, pulmonary edema, pneumothorax), heart (pericardial effusion, pericarditis, vena cava, cardiogenic shock), abdomen (cholelithiasis, appendicitis, FAST, urolithiasis, testicular torsion / epididymo-orchitis, intussusception), vessels deep vein thrombosis, jugular thrombosis, ultrasound-guided peripheral venous catheter, aorta abdominal aneurysm); conclusions and key takeaways.

### EREE-24 Genitourinary Oncologic Emergencies: A Radiologists' Guide

Participants

Mamie Gao, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the best imaging approach for evaluating oncologic emergencies affecting the genitourinary tract. 2. Identify imaging manifestations of genitourinary oncologic emergencies. 3. Identify potential pitfalls in imaging genitourinary oncologic emergencies. 4. Recognize the important role of radiologists in the multi-disciplinary setting to communicate and collaborate findings in emergent cases.

## TABLE OF CONTENTS/OUTLINE

1. Genitourinary oncologic emergencies and imaging approach. 2. Multimodality imaging features of genitourinary oncologic emergencies. a) Hematuria: hemorrhagic cystitis. b) Obstructive uropathy: tumor burden and post-treatment (nephrostomy tube malfunction, ileal conduit). c) Infectious: pyelonephritis, renal abscess, prostatic abscess, cystitis related to prior treatment (BCG, ileal conduit). d) Miscellaneous Post-Treatment (radiotherapy, chemotherapy, surgery, urinary diversion): hemorrhage, fistulas. 3. Role of radiology in management. 4. Potential mimics and pitfalls (underdistended urinary bladder, residual malignancy, emergencies unrelated to malignancy, trauma).

### EREE-25 Stercoral Colitis- Diagnosis, Complications and Management

Participants

John J. Hines JR, MD, Huntington, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Background Information/Purpose Stercoral colitis is an inflammatory process typically involving the sigmoid colon and rectum, due to chronic constipation and rectal distention, causing increased intraluminal pressure, and eventually leading to ischemia, ulceration, perforation, peritonitis and death from feculent peritonitis and sepsis if not treated. The purpose of this exhibit is to familiarize radiologists with the spectrum of CT imaging features of uncomplicated and complicated stercoral colitis and its mimics. Key Anatomic or Pathophysiologic Issues, Imaging Findings or Imaging Technique: Common CT findings of stercoral colitis include: 1.) Stool filled and distended colon with focal colonic wall thickening 2.) Pericolonic/presacral fat stranding. 3.) Presence of localized extraluminal gas, discontinuity of the colonic or rectal wall, and extraluminal gas in cases of perforation.

## TABLE OF CONTENTS/OUTLINE

Educational Goals/Teaching Points 1. Review the risk factors, pathophysiology and clinical presentation of stercoral colitis. 2. Discuss the importance of early recognition of uncomplicated stercoral colitis, and the role of the radiologist in bring this diagnosis to the attention of the clinical team. 3. Illustrate the imaging findings of complicated and uncomplicated stercoral colitis on CT, including typical and atypical imaging findings, and unusual complications. 4. Review imaging mimics of stercoral colitis such as diverticulitis, infectious colitis, inflammatory bowel disease and ischemic colitis. 5. Discuss the management of complicated and uncomplicated stercoral colitis.

### EREE-26 Typical Findings Under Atypical Lenses: When to Suspect Endometriosis on Emergency CT

Participants

Joao Stern, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Illustrate the different appearances of endometriosis on CT Share tips, pearls and pitfalls to suspect and diagnose endometriosis on pelvic computed tomography. Correlate relevant findings from computed tomography and magnetic resonance imaging of the pelvis to consolidate learning.

## TABLE OF CONTENTS/OUTLINE

- introduction- common sites of involvement- image translation to CT of classic sign with MR correlation- discussion of the main findings of endometriosis on CT scan of the pelvis.

### EREE-27 Pain in the Bump: Acute Abdomen in Pregnancy - MRI Clues for On-Call Residents

Participants

Mili Rohilla, MD, Worcester, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To acquaint on-call residents with MR imaging signs in the acute abdomen To make residents comfortable with MR abdomen in pregnant patients

## TABLE OF CONTENTS/OUTLINE

Acute abdomen is a common ER presentation in pregnant patients, and can pose a diagnostic challenge due to the physiological changes during pregnancy. Magnetic resonance imaging (MRI) is a useful diagnostic tool due to its high contrast resolution and absence of ionizing radiation. Radiology residents need to be cognizant of the MR imaging findings of acute abdomen in pregnancy and differential diagnoses to interpret them accurately and promptly. We will discuss the common system-wise presentations and MR findings: Gastrointestinal System: Appendicitis, acute pancreatitis, inflammatory bowel disease, intestinal obstruction. Hepatobiliary system: Acute cholecystitis, choledocholithiasis, HELLP syndrome. Reproductive System: Ectopic pregnancy, ovarian torsion,

placental abruption, uterine rupture. Urinary System: Urolithiasis, acute pyelonephritis, renal abscess. Cardiovascular System: Ovarian vein thrombosis, Budd-Chiari syndrome, acute aortic syndrome. It is important to promptly diagnose and manage the underlying cause of acute abdomen in pregnancy to prevent adverse maternal and fetal outcomes.

### **EREE-28 Ocular Trauma: What Should We Keep In Mind?**

Participants

Omar Andres Pantoja Burbano I, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

Omar Andres Pantoja Burbano I, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To perform a systematic approach to the most important aspects of the ocular trauma. - Recognize the principal anatomic structures of the orbit and understand the compromise of such in the different traumatic injuries. - Identify the most relevant signs of ocular and orbit trauma in diagnostic imaging, with specific emphasis in orbit tomography. - Learn how to classify the ocular trauma according to the involvement of the anterior or posterior segments and the presence of ocular globe rupture or burst. - To consider and exclude the most relevant differential diagnoses.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Anatomy of the ocular globe. 3. Anterior segment lesions. 4. Posterior segment lesions. 5. Ocular globe rupture and foreign bodies. 6. Pitfalls and differential diagnoses. 7. Take away points. 8. References.

### **EREE-29 A Quick Guide to Pelvic Pain in the Emergency Room: MR Imaging of the Acute Female Pelvis**

Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Review the anatomy of the female pelvis on MRI- Understand the role of MR imaging in the evaluation of gynecologic emergencies- Illustrate the imaging findings non-obstetric and obstetric causes- Discuss their differential diagnosis, imaging pitfalls, and complications

#### **TABLE OF CONTENTS/OUTLINE**

1. Normal MRI anatomy of uterus and adnexa with cyclical variation 2. Advantages and disadvantages of MR Imaging 3. Non-obstetric and obstetric causes 4. Imaging assessment of critical and prevalent gynecological diseases in the emergency room 5. Pelvic inflammatory disease, including endometritis, cervicitis, salpingo-oophoritis, pyosalpinx, and tubo-ovarian abscess 6. Leiomyoma torsion and fibroid degeneration 7. Endometriosis 8. Obstetric causes, including ectopic pregnancy, molar pregnancy, retained products of conception, placenta accreta spectrum 9. Other pelvic abnormalities 10. Potential imaging pitfalls and how to avoid them 11. Complications

### **EREE-3 Shattered Chests: Lessons from Thoracic Trauma Cases**

Participants

Manuel Sebastian Paez Alvarez SR, MD, Toledo, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To present a comprehensive overview of thoracic trauma cases, highlighting the most common and not-so-common pathologies. To familiarize radiologists and radiology residents with diagnostic clues of thoracic imaging in trauma patients. To analyze key features and provide tips to identify pitfalls of traumatic chest CT.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: Importance of thoracic trauma imaging and its implications in emergency settings. Pulmonary parenchymal injury: a. Pulmonary contusions b. Pulmonary lacerations c. Pulmonary hematomas d. Traumatic pulmonary hemias Pleural space injury: a. Pneumothorax b. Hemothorax Chest wall injury: a. Rib fractures b. Sternal fractures c. Chondrocostal, chondrosternal, and cartilage injuries d. Sternoclavicular dislocations Tracheobronchial injury: a. Laceration of the trachea and bronchi Other injuries: a. Boerhaave Syndrome b. Aortic injury c. Iatrogenic cardiac perforation d. Traumatic diaphragmatic hernias This educational exhibit aims to provide a comprehensive understanding of thoracic trauma cases, emphasizing the importance of recognizing imaging findings for accurate diagnosis. Radiologists and radiology residents will benefit from the illustrative cases and diagnostic tips presented, improving their skills in traumatic chest CT interpretation.

### **EREE-30 The Contrast-Enhanced FAST Exam (cFAST) In Blunt Thoracoabdominal Trauma**

Participants

Melanie P. Caserta, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The Focused Assessment with Sonography in Trauma (FAST) is one of the most frequently performed ultrasound examinations in adults and children in the acute care setting. However, it has significant limitations since intraabdominal fluid is used as a surrogate marker for intraabdominal injury (IAI). Adding an ultrasound contrast agent to the exam can substantially improve the diagnostic accuracy of identifying solid organ injuries and rapidly identify significant organ lacerations and active intraperitoneal hemorrhage. The cFAST exam is a rapid, standardized, and systematic ultrasound examination that balances a comprehensive organ survey with the time constraints of highly structured and algorithmic trauma patient care. After reviewing this case-based exhibit, the learner will: - Understand the limitations of the traditional FAST exam and advantages of adding an ultrasound contrast agent (UCA) - Describe the cFAST exam protocol and set-up as part of the trauma resuscitation team - Recognize the limitations of the cFAST exam and next steps in imaging.

#### **TABLE OF CONTENTS/OUTLINE**

1. Objectives 2. Background a. The evolution of the FAST exam b. Contrast-enhanced ultrasound in trauma 3. Imaging a. Equipment, technical requirements, and supplies. IV access ii. Selection of the UCA iii. Ultrasound equipment b. Integration into the

trauma team c. The contrast-enhanced FAST exam protocol i. Patient population ii. Exclusion criteria iii. Special populations iv. Safety Considerations v. UCA preparation Contrast Administration vi. Imaging Protocol vii. Limitations 4. Pediatric and adult case presentations

### **EREE-31 Searching for Causes of Preventable Death - Role of Early Postmortem CT in Trauma Patients**

Participants

Lain Ibanez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To show an accurate protocol to perform a post-mortem CT in patients who died after severe trauma in a first-level trauma center
- To describe the main radiological features of different early deceased trauma patients and their potential relationship with the cause of death
- To identify the misplacement of medical devices in patients who died from trauma
- To determine if there was preventable death based on clinical and radiological findings

#### **TABLE OF CONTENTS/OUTLINE**

- Performing an early post-mortem CT protocol and CT technique
- Analysis of radiological and clinical features, injuries, and medical device misplacement
- Determining causes of death and their avoidability
- Conclusions

Outline: Despite the improvement in the management of trauma patients there is still a percentage who die during or immediately before receiving hospital care and before having an imaging test. This reason jointly with an increasingly low rate of autopsies, prevents to understand the causes of death and whether or not it had been avoidable. Since June 2022 the trauma and radiology teams at our level 1 trauma center decided to carry out a program to study preventable mortality in trauma patients who died before or during initial care. In this presentation we will show the design of our project, how we accomplish post-mortem CT studies and also present our preliminary results. We will show a clinical-radiological correlation of our cases, analyze the main injuries, misplacement of medical devices, causes of death and whether its avoidability. Finally the main concerns we faced and major limitations are exposed.

### **EREE-32 Beyond the Diagnosis of Appendicitis: CHAR(13) + CHAR(10) The Role of Computed Tomography in the Nonoperative Management of Acute Appendicitis in Adults**

Participants

Eliko Tanaka, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Diagnosis of acute appendicitis using computed tomography (CT) is highly accurate and established. The treatment of appendicitis includes surgery and conservative treatment, and the role of conservative treatment is expanding. However, conservative treatment has challenges, such as treatment failure and malignant tumors. CT diagnosis plays a significant role in determining the treatment plan. This presentation describes CT findings related to the indications for conservative treatment of appendicitis, as well as CT findings related to the course of conservative treatment. Additionally, it discusses challenges in CT diagnosis associated with conservative treatment, such as recurrent appendicitis or tumor complications, and presents a case series.

Teaching points include:

1. Understand the indications and contraindications for conservative management of appendicitis and its CT findings
2. Familiarize CT findings related to the course of conservative treatment for appendicitis
3. Recognize the potential complications of conservative management, such as treatment failure, malignancy, recurrent appendicitis, and identify the corresponding CT findings

#### **TABLE OF CONTENTS/OUTLINE**

1. Indications and contraindications of conservative treatment in the World Society of Emergency Surgery (WSES) guidelines
2. CT findings that suggest a high risk of failure in conservative treatment and a need for extended surgery
3. Imaging findings during the course of conservative treatment
4. Recurrent appendicitis and its CT findings
5. Differential diagnosis between tumor and non-tumor cases

### **EREE-33 Role of MR in the Diagnosis of Suspect Metastatic Spinal Cord Compression: A Pictorial Imaging Review With Medical and Radiological Scales**

Participants

Blanca Lumbreras-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The learning objectives of this exhibit are:

- 1- To illustrate the spectrum of metastatic spinal cord compression (MSCC) and the scales and scores that should be included in the radiological report.
- 2- To discuss the image findings of MSCC with emphasis in epidural lesions.

#### **TABLE OF CONTENTS/OUTLINE**

- 1- Pathophysiology of MSCC, including demographics.
- 2- Review of common imaging findings in the management guidelines for MSCC. Relevance of the inclusion in the radiological report of the Epidural Spinal Cord Compression (ESCC) Scale and Spinal Instability Neoplastic Score.
- 3- Evaluation of the most representative cases of MSCC collected and their differential diagnosis with other causes of cord compression, specially epidural lesions in a non-traumatic setting through imaging cases from our center.
- 4- Conclusions: Acute compressive myelopathy is a medical emergency. Early diagnosis and treatment improve the neurological prognosis. MR is the technique of choice to confirm the diagnosis or establish an alternative one as well as to determine the level, extension, degree of compression, stability of the spine and presence of myelopathy. The incorporation of the ESCC scale and SINS to the radiological report improves multidisciplinary communication and the adequacy of urgent treatment of MSCC.

### **EREE-34 Cognitive Biases and Diagnostic Errors in Emergency Neuroradiology, A Case-Based Approach**

#### **TEACHING POINTS**

1. Introduce the dual process theory of reasoning, with a focus on the "Type 1" system, heuristics, cognitive biases, and diagnostic errors. Discuss how the emergency radiology setting may predispose toward Type 1 thinking.
2. Review different types of cognitive biases and diagnostic errors via case-based emergency neuroradiology examples.
3. Describe different strategies to combat cognitive biases and reduce diagnostic errors.



## TABLE OF CONTENTS/OUTLINE

Decision making literature theorizes there is a dual process of reasoning which is comprised of a fast, intuitive "Type 1" system and a slower, more deliberative "Type 2" system. The high volume and acuity of the emergency setting may predispose toward Type 1 thinking. In Type 1 thinking, we use a number of heuristics, or shortcuts, to improve efficiency though this comes at the cost of an increased predilection toward cognitive biases and diagnostic errors. Recognition of common cognitive biases and strategies to manage them may reduce diagnostic errors. In this education exhibit, we will review common cognitive biases using an emergency neuroradiology case-based approach to illustrate these biases in action to help recognize and counter them. Some examples of cognitive biases that will be reviewed include bandwagon effect, alliterative error, framing bias, triage cueing, satisfaction of search, confirmation bias, attribution bias, availability bias, anchoring bias, and productivity bias. We will also discuss metacognition strategies to help counter these biases.

### EREE-35 **Never Fear! Peer Learning in Emergency Pelvic and First Trimester Ultrasound**

#### TEACHING POINTS

Women presenting with acute pelvic pain and/or bleeding can pose a diagnostic challenge in the emergency setting. The differential diagnosis may be broad, and these symptoms are often indications for pelvic ultrasound (US). Interpretation of pelvic US may be tricky and a source of confusion and misinterpretation. Furthermore, cognitive biases in imaging interpretation can lead to diagnostic errors. Familiarity with common and uncommon pelvic US imaging findings is imperative to assist with prompt and accurate diagnosis. Awareness of potential biases when interpreting pelvic US further helps hone interpretation. This exhibit will illustrate the imaging findings of multiple causes of pelvic pain/bleeding in non-pregnant and first trimester pregnant patients. Diagnostic errors and biases in interpretation related to these cases will also be highlighted.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will review pelvic US peer learning cases and highlight teaching pearls and potential pitfalls in diagnosis. 1. Review common and uncommon causes of acute pelvic pain/bleeding in non-pregnant patients, including ovarian/fallopian tube torsion, cysts, hydrosalpinx, fibroids, benign and malignant adnexal lesions, tuboovarian abscess. 2. Review causes of pelvic pain/bleeding in first trimester pregnant patients, including ectopic pregnancy in different locations, ruptured heterotopic pregnancy, retained products of conception, uterine AVM. 3. Review non-OB/GYN causes of pelvic/abdominal pain for which pelvic US was the initial imaging modality, including appendicitis, appendiceal mucocele, diverticulitis. 4. Review potential biases in pelvic US imaging interpretation with examples from our cases.

### EREE-36 **Plain Abdominal Radiography in the Emergency Room**

Participants

Carla Suarez Silva, MD, A Coruna, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Plain abdominal radiographs continue to be a fundamental tool in emergency rooms.- We present abdominal X-rays performed in a third-level hospital over the last few years. In all cases, the radiographs helped guide the patient's management.- The semiology of abdominal simple radiography is presented in a didactic and interactive way to achieve an adequate interpretation.- Knowing the radiological analysis of the abdominal radiograph continues to be useful for the comprehensive management of the patient.

#### TABLE OF CONTENTS/OUTLINE

This education exhibit presents a collection of 25 cases of abdominal X-rays. All cases will be presented in a structured and interactive format, beginning with an overview of the patient's clinical data, followed by the X-ray image(s), the detail of the radiological findings using visual aids, pearls and pitfalls, and the final diagnosis providing correlation with other imaging methods. Furthermore, taking advantage of the fact that all the X-rays were performed urgently, a green, yellow, or red circle will appear in the top right corner of all radiographs indicating the severity of the pathology presented by the patient. To facilitate the reading of this presentation, the name of the radiological density that will help us make an adequate interpretation of the abdominal radiograph will be displayed at the bottom of each image. The table of contents is: • Introduction • Teaching points • Table of Contents • How to approach an abdominal X-Ray? • Check all the clinical data • Technical aspects • Radiological densities • Cases • Case 1: Patient 1 • ? • Case 25: Patient 25

### EREE-37 **DECT in the Acute Setting - Bowel Trauma**

#### TEACHING POINTS

Highlight the value of Dual Energy CT (DECT) in traumatic bowel injury Understand the principles of DECT and iodine overlay map Illustrate the use of DECT and iodine overlay maps to improve diagnostic confidence and sensitivity in detecting bowel injury, contrast extravasation, free fluid, and reducing metal artifacts.

#### TABLE OF CONTENTS/OUTLINE

1. Background 2. DECT and Bowel Injury a. DECT Increases Conspicuity of Hyperattenuating Free Fluid b. Lack of Iodine Uptake in Injured Bowel c. Metal Artifact Reduction d. Contrast Extravasation 3. Conclusion

### EREE-38 **Beyond Aortoenteric and Aortocaval Fistulas - Intraabdominal Fistulas: Imaging Findings and Importance of Early Identification**

Participants

Amalia Aranaz Murillo, MD, Zaragoza, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Intraabdominal fistulas are uncommon but can be catastrophic if not identified and treated promptly. Multiphasic multidetector CT angiography (angio-MDCT) is the initial imaging choice for diagnosis. 2. The imaging signs of intraabdominal fistulas can be divided into direct and indirect signs and emergency radiologists should be familiar with them and be aware of potential mimics and maskers to avoid misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

This poster aims to provide an overview of intraabdominal fistulas, their imaging findings, and the importance of early identification and familiarize the radiologist with the mimics and maskers of intraabdominal fistulas. Intraabdominal fistulas are a rare but life-threatening condition if they are not identified and treated promptly. Imaging plays a crucial role, and angio-MDCT is often the initial imaging technique. The imaging signs of intraabdominal fistulas can be divided into direct and indirect signs. Direct signs include visualization of the fistula tract, extravasation of contrast medium, and aortic graft migration, but these signs are rarely observed. Indirect signs are often the only available evidence and include abnormalities of the aortic wall, irregularities of the interface between the aorta and the fistulizing entity, and the presence of gas or fluid collections. Although the most frequent intraabdominal fistulas are aortoenteric and aortocaval fistula, other types of fistulas and potential mimics can occur, and one should know and be aware of them. Familiarity with the different imaging modalities and the various mimics and maskers of fistulas can help in accurate diagnosis, ultimately leading to improved patient outcomes.

#### **EREE-39 Kicking, Biting, and Screaming: Common Radiological Patterns and Mechanisms of Equine-Related Injuries Presenting to the Emergency Department**

Participants

Trae Brooks, MD, BS, Lexington, KY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Thoracic injuries may occur in over half of horse-related trauma cases, including clavicle and rib fractures as well as hemothoraces and pneumothoraces. Clinical and imaging evaluation is crucial to rule-out underlying thoracic trauma (Chad Ball, 2007). Children who receive an injury while unmounted are likely to have more severe injuries than those who were mounted, with most trauma localized to the abdomen (Grace Wolyncewicz, 2018). Fractures are one of the most common injuries in mounted equestrians and should be suspected in patients presenting after a fall from a horse. The initial height of the rider, velocity of travel, and vulnerable position of landing are all key factors contributing to the severity and location of the fracture and need for prompt imaging and evaluation.

##### **TABLE OF CONTENTS/OUTLINE**

We will begin with an overview of horse-related trauma from a historical and epidemiologic perspective. Using a simplified algorithm, we will then discuss the classic patterns of various trauma such as fall from or with a horse while mounted and injuries sustained from direct injury from a horse while unmounted such as bite, kick, or stomp/trample injuries. Finally, we will use case-based examples with multimodality imaging to show the broad extent of injury concerning various systems - organized into Torso, Musculoskeletal/Extremity and Central Nervous System/Spine.

#### **EREE-4 CT of Appendicitis in Adults: Problematic Scans and Scenarios**

Participants

Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

-A non-trivial minority of CT examinations performed for suspected appendicitis - regardless of the protocol utilized - end up being challenging to interpret for a variety of reasons, in adults -This exhibit will review problematic scenarios and situations involving CT performed for right lower quadrant pain in non-pregnant adults -Review uncommon/atypical/unusual presentations of appendicitis and its potential mimics and potential pitfalls, as well as some of the more common problematic scenarios -Demonstrate examples of these CT scenarios from our practices -Briefly overview QA and medical-legal issues in suspected appendicitis in adults with an emphasis on CT

##### **TABLE OF CONTENTS/OUTLINE**

Outline: -Oral contrast - to use or not to use on CT? -Subtle/early findings -Perforated appendicitis- review of the literature -The right lower quadrant 'phlegmon' -Potential pitfalls and confounders - right colonic diverticulitis, 'secondary' appendicitis, distal/tip appendicitis, the non-visualized appendix, chronic/relapsing appendicitis, and resolving appendicitis -Appendicitis and rotation anomalies -Stump appendicitis -Appendicitis in hernias -Appendicitis and underlying neoplasms -Additional potential errors, quality assurance issues, and medical-legal issues

#### **EREE-40 Abdominal Hemorrhage on MRI: Findings and Pitfalls**

Participants

Bertin Mathai, MD, Bronx, NY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Non-traumatic intra-abdominal hemorrhage can be due to multiple etiologies and can be a source of acute abdominal pain and life threatening blood loss. Prompt radiologic identification and localization of hemorrhage is crucial for appropriate decision-making and management. Acute intra abdominal hemorrhage is usually diagnosed by computed tomography (CT). Magnetic resonance imaging (MRI), is less frequently used in the acute setting, and radiologists may be less familiar with the appearance of blood and potential etiologies of hemorrhage, such as ruptured aneurysms and hemorrhagic masses. The signal characteristics of hemorrhage can vary depending on both the age of the hemorrhage as well as its background location. The superior soft tissue resolution of MRI can help characterize intra-abdominal blood products in cases where CT is indeterminate, and can help diagnose an underlying mass in cases where it is obscured by blood on CT. This educational exhibit will discuss the timeline of hemorrhage with respect to MRI signal, show multiple causes of spontaneous intra abdominal bleeding, and highlight scenarios where MRI can provide added value in diagnosing the source of hemorrhage.

##### **TABLE OF CONTENTS/OUTLINE**

1) Background 2) Molecular and Magnetic Timeline of Blood 3) Optimizing MRI Protocol to Visualize Blood 4) Differential Diagnosis / Cases 5) Literature Review 6) Conclusion 7) References

#### **EREE-41 Pre-Hospital Emergency Medicine: A Spectrum of Imaging Findings**

##### **TEACHING POINTS**

This educational exhibit aims to: 1) Increase awareness and understanding among radiologists of the principles of Pre-Hospital

Emergency Medicine 2) Review imaging which illustrates techniques used by Emergency Medical Services (EMS) providers 3) Highlight pertinent radiologic findings which call attention to potential complications arising from pre-hospital care.

#### **TABLE OF CONTENTS/OUTLINE**

Topics covered within this presentation include: 1) Introduction to Pre-Hospital Emergency Medicine--Including Purpose of Emergency Medical Services (EMS) and Scope of practice of EMS providers; 2) Airway Management--Including Endotracheal intubation and Surgical airways; 3) Cardiopulmonary Resuscitation--Including Use and effects of mechanically-assisted chest compressions, Radiologic findings of decompressive needle thoracostomy (DNT), and Efficacy of intraosseous vascular access for resuscitation and IV contrast administration; 4) Techniques of Patient Immobilization--Including Imaging appearance and appropriate positioning of cervical spine collars, Imaging appearance and clinical benefit of hemostatic tourniquets, and Imaging appearance and appropriate positioning of pelvic binders

#### **EREE-42 Immediate-CT with Hybrid Emergency Room System for Severe Trauma Patients**

##### **TEACHING POINTS**

•Several studies have shown that trauma whole-body CT has facilitated the early identification of major injuries and a reduction in mortality and morbidity. •HERS (Hybrid-Emergency Room System) is an all-in-one concept of emergency room with the functions of CT scanner, interventional radiology and surgery, and useful in critical trauma treatment strategies. •HERS in trauma treatment can be performed from diagnosis to treatment without transporting the patient, so it is possible to significantly reduce the time.

##### **TABLE OF CONTENTS/OUTLINE**

•We devised a new trauma treatment strategy using HERS. This is "immediate CT protocol" in which CT scan is performed immediately after arrival at the hospital. •The immediate-CT(i-CT)protocol is optimized for CT scans immediately after arrival at the hospital. •This protocol enabled rapid diagnostic imaging for critical traumatized patients. And, can provide more information than ultrasound, X-ray used in "primary survey". It is also possible to find major damage earlier. •By detecting brain injury, aortic injury, retroperitoneal hematoma, lung injury, and spine injury, early activation of injuries that require referral to other departments is now possible. And we call it "BARLS". •We demonstrated that the i-CT protocol leads to reduction of the time from arrival to CT scans without adverse events. As a result, we have contributed to the planning of treatment strategies and early activation of specialized treatment. •This novel trauma treatment strategy can contribute to improving the life-saving rate

#### **EREE-43 Multiphase CT Angiography Using a Time-Variant Color Map: How Can It Contribute to the Improvement of the Diagnosis and Management of the Acute Stroke?**

##### **TEACHING POINTS**

- Multiphase CT Angiography (mCTA) offers several advantages over single-phase CTA (sCTA) and contributes to improving the diagnosis and management of the acute ischemic stroke (AIS). - mCTA increases interrater agreement for both proximal and distal vessel occlusions compared with sCTA and reduces time needed to detect the occlusion. - mCTA helps to characterize the thrombus length and thrombus permeability, which may influence the treatment. - mCTA improves characterization of collateral status, that may be a useful fact in the management of some patients with AIS. - mCTA has potential value in delineating the core ischemic area and detecting tissue at risk. - mCTA can also be useful in hemorrhagic stroke. It improves prediction of intracerebral hemorrhage expansion and improves the evaluation of venous vessels and the diagnosis of vascular malformation. - mCTA may be useful in the characterization of stroke mimics.

##### **TABLE OF CONTENTS/OUTLINE**

Multiphase CTA (mCTA) provides time-resolved images of the cerebral vasculature that are useful in patients with acute stroke. An arterial (red color) and 2 venous phases are acquired ( peak venous phase in green, and late venous phase in blue) are acquired. We review the role and potential of CTA in patients with ischemic and hemorrhagic stroke, its advantages over sCTA, its limitations and its usefulness in the evaluation of stroke mimics.

#### **EREE-44 Visceral Ischemia: What Should the Emergency Radiologist Know?**

Participants

Silvia Cayon Somacarrera, MD, Torrelavega, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To describe the key radiological features of visceral ischemia, including cases of liver, gallbladder, pancreas, spleen, renal, stomach and intestine ischemia. To understand the pathophysiology behind those radiological findings

##### **TABLE OF CONTENTS/OUTLINE**

The infarct's shape depends on the distribution of the vascular tree. The organs with hilum show wedge-shaped infarcts (eg. liver, kidney, spleen) while the organs without hilum show infarctions that extend through the different wall layers (eg. intestine). We collected the most illustrative cases of visceral ischemia of the last years in our institution to show the key characteristics to make a quick and accurate diagnosis. Mesenteric ischemia has a very high mortality rate if not properly treated. The key findings to evaluate are: mesenteric vessels, intestinal walls and the existence of gas (pneumatosis/pneumoperitoneum). Hepatic ischemia is uncommon due to its double vascular supply. The most typical finding is wedge-shaped hypodense areas but we can also find rounded or tubular areas parallel to the bile ducts. Renal ischemia is most often caused by renal artery embolism. Focal infarcts are depicted as hypodense triangular areas. Complete infarcts present as generalized hypoattenuation of the renal parenchyma. Splenic ischemia is relatively common. Acute infarcts are shown as triangular hypodensities, subacute infarcts as cystic images while in chronic infarcts calcifications or atrophy can be seen. Cortex preservation may be observed in complete renal/splenic infarcts due to collateral circulation.

#### **EREE-45 Evaluating Primary and Secondary Endpoints in Intracranial Hemorrhage AI Algorithms - A Review of Current Market Algorithms and a Proposed Retraining Model for Improving Patient Triage**

Participants

Raviteja Suryadevara, MD, Louisville, KY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The implementation of AI algorithms for intracranial hemorrhage (ICH) in the ED setting can expedite detection, triaging, and timely intervention. Most AI algorithms, in addition to their binary primary endpoint of -ICH or +ICH, also collect secondary outcome endpoint data (processing time, bleed location, bleed volume calculation). Based on trauma volume and workflow of ED practice, these algorithms should be employed accordingly. Retrospectively retraining AI algorithms to collect data on secondary outcome endpoints should be a flexible option. Retraining AI for additional primary endpoints allows for improved triaging. Specifically, in patients with intracranial hemorrhages, additional triaging of the ED reading list based on bleed volume and subtype would allow for communication and subsequent timely treatment of patients with the highest potential morbidity or mortality first. Any proposed AI retraining model, though technically sound, has challenges with acquisition of new patient data for retraining.

#### TABLE OF CONTENTS/OUTLINE

Workflow in the ED for suspected traumatic/spontaneous ICH. Where AI algorithms can help in the ED setting. Currently approved 510(k) premarket cleared algorithms for ICH detection. Quantitative evaluation of ICH AI algorithms based on primary and secondary outcomes. Retraining AI algorithms for secondary endpoints: technical logistical challenges. Conclusion. References

#### EREE-46 Life-Threatening Acute Aortic Lesions Beyond Acute Aortic Syndrome

##### TEACHING POINTS

TEACHING POINTS: - Many potentially severe acute aortic lesions exist beyond the classical spectrum of acute aortic syndrome (AAS). - Life-threatening acute aortic conditions may result from traumatic injuries, iatrogenic lesions, infectious complications or aneurismatic rupture.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS: Aortic lesions can be life-threatening and require immediate medical attention. Imaging techniques play a critical role in the diagnosis because the clinical presentation is variable and nonspecific. Moreover, CT and MRI provide fundamental information for surgical planning. AAS is a well-known medical emergency with high mortality when left untreated. However, it may show an atypical appearance and many other potentially severe acute aortic lesions beyond the classical AAS also demand immediate diagnosis. These include traumatic injuries, iatrogenic lesions, infectious complications and aneurismatic rupture. Significant traumatic injuries are classified as intramural hematomas, pseudoaneurysms and aortic ruptures. Iatrogenic lesions are usually the result of invasive coronary interventions or aortic stent placement. Mycotic pseudoaneurysms are included in the spectrum of infectious aortitis. Ruptured thoracic aneurysms are rarely imaged due to their lethality. Finally, we review atypical presentations of AAS that also need to be considered, such as intimal intussusception or dissection extension into the pulmonary arteries.

#### EREE-47 Non-Obstetric- Emergencies in Pregnancy: Imaging Pathway, Findings, and Special Considerations

##### TEACHING POINTS

1. Imaging pregnant patients require special considerations and non-ionizing radiation imaging is preferred (US/MRI). However, CT in trauma and acute settings should not be delayed due to concern for radiation. 2. Knowledge of specific non-obstetric pathologies affecting pregnant patients and their imaging appearance is crucial for timely and accurate diagnoses of acute and traumatic conditions. 3. Shared decision making? with the patient is important to weight risks and benefits of imaging tests if time permits.

#### TABLE OF CONTENTS/OUTLINE

1. Review risks and safety of different imaging modalities in pregnancy (dose of fetal radiation and associated risks, iodinated and gadolinium contrast agents). 2. Special considerations when imaging pregnant patients (positioning in scanner, contrast reaction and management, recommendations regarding lead shielding). 3. Trauma imaging in pregnancy: Review imaging pathway and traumatic pathologies at higher risk in pregnant patients (retroperitoneal hemorrhage?, liver, spleen, renal and bladder injuries?). 4. Acute non-traumatic pathologies: incidence and pathophysiology in pregnancy, imaging pathway and findings, for example: (a), Abdomen: Acute cholecystitis, choledocholithiasis, appendicitis, renal stone/urosepsis, bowel obstruction, colitis, (b) Chest: Pulmonary embolism, pneumonia, (c) Neuro: Cerebral venous thrombosis, seizures, stroke, (d) Vascular: Complicated AVM, deep venous thrombosis, arterial occlusion.

#### EREE-48 Pictorial Review of Orbital Emergencies

Participants  
Wen Wang, MD, Orlando, FL (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Teaching Points: 1. A simplified anatomic checklist-based approach can enable an emergency radiologist to accurately and efficiently identify acute temporal bone pathology, and this approach will be reviewed in this exhibit. 2. The radiologist plays an important role by identifying key imaging findings and providing diagnoses that can direct treatment by prompting an emergency physician to admit a patient for inpatient management, order a surgical consult, or order further imaging to check for related complications. The absence of these findings are also pertinent negatives that enable clinicians to proceed with treatment in the ED or discharge a patient with outpatient follow-up. 3. This exhibit will review traumatic and acute non-traumatic pathology in a case-based format, with emphasis on key imaging findings that affect management and prognosis.

#### TABLE OF CONTENTS/OUTLINE

I. Relevant anatomic review of the orbit II. Checklist for traumatic and non-traumatic pathology III. Non-traumatic Pathologies: i. Infection Preseptal cellulitis Postseptal cellulitis Dacryocystitis Subperiosteal abscess ii. Non-infectious inflammatory pathology Sarcoidosis Optic neuritis iii. Detachment Retinal detachment Choroidal detachment IV. Traumatic pathologies: i. Fractures Blowout fractures/wall fractures Lefort II and III fractures Naso-orbito-ethmoid fractures Optic canal fracture ii. Penetrating trauma Paint gun injury Gunshot injury

#### EREE-49 We've Got Your Back: How Radiologists Can Aid Surgical Decision Making By Using the AO Spine Classification System

Participants  
Andrew Simmerman, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

## TEACHING POINTS

AO Spine Injury Classification systems offer reliable and clinically relevant morphology descriptions for spinal trauma imaging. Subaxial cervical and thoracolumbar injuries are classified as A: compression, B: tension band/distraction, C: displacement/translational. A B have subtypes. The motion segment is the spine's functional unit, by which tension band and displacement injuries are labeled. Fracture morphology, neurologic signs, and patient factors influence conservative or surgical management. MRI and dynamic radiography help assess for ligamentous injuries. Rigid spines and osteoporosis affect treatment. Cervical spine specifics include facet injury, disc herniation, cerebrovascular injury, and unique ligamentous injuries at the occiput-C1-C2 levels.

## TABLE OF CONTENTS/OUTLINE

Overview Goals of classification and radiological reporting Spinal bone and ligamentous anatomy Motion segment and tension band concepts Subaxial cervical and thoracolumbar injuries Type A: Compression Type B: Distraction Type C: Translation Type F: Facets (subaxial) Modifiers Indeterminate/incomplete tension band injuries Stiffening and metabolic bone diseases Critical disc herniation Cerebrovascular injury Upper cervical injuries A: Bone-only B: Ligamentous without complete separation C: Translation

## EREE-5 Broken Beauty: How Can I Make a Good Interpretation of a Facial Trauma on CT?

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- To review the facial radiological anatomy and to remember the different systems that organize it.- To propose a systematic approach for the evaluation of the facial bone mass, depending on the functional relationships between the structures.- To know the typical radiological patterns of facial fractures, taking into account some "key ideas" that we must remember, because they sometimes modify the therapeutic management.- To recognize the complications that can be associated with facial fractures depending on their location.- To emphasize the importance of making an useful radiological report for the requesting physician, with an organized description of the fractures.

## TABLE OF CONTENTS/OUTLINE

1. Radiological facial anatomy: 1.1. Three thirds system: upper (frontal), middle (from upper orbital rim to upper maxilla) and lower (mandible). 1.2. Facial buttress system: there are 4 vertical and 4 horizontal buttresses that emphasize the functional relationships between the different facial bones.2. Systematic assessment of the facial mass: 2.1. Fractures of the upper third (frontal). 2.2. Fractures of the middle third: isolated (e.g. nasoseptal fractures) or complex (le Fort fractures, fractures of the nasal-orbital-ethmoidal complex and fractures of the zygomatic-maxillary complex). 2.3. Fractures of the lower third (mandibular). Within each section, we will discuss typical radiological fracture patterns and "key ideas" to remember.3. Complications that may be associated depending on the affected buttress.4. How to make an adequate radiological report useful for the requesting physician, without falling into the error of making a "shopping list" with the affected bones.

## EREE-50 The Role of CT in Non-occlusive Mesenteric Occlusion for Diagnosis, Therapeutic Strategy, and Patient Management

Participants

Akitoshi Inoue, MD, PhD, Otsu, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Non-occlusive mesenteric ischemia (NOMI) is characterized by segmental and skipped bowel ischemia caused by vasospasm without mechanical stenosis in the superior mesenteric artery (SMA). NOMI is a life-threatening condition, and the mortality is high. Even in survival cases, nutrient malabsorption called short bowel syndrome resulting from bowel resection for necrotized small bowel may require lifetime intravenous nutrition. CT depicts spastic SMA and branches and is considered a diagnostic tool instead of invasive angiography. Regarding the bowel, heterogeneous imaging findings, including absent enhancement, hemorrhagic necrosis, pneumatosis, and paper-thin wall appearance, can be observed, which reflects skip-segmental bowel necrosis on macroscopic findings. Additionally, CT plays an essential role in predicting the severity of bowel ischemia and reperfusion as the imaging findings reflect dynamic pathophysiology caused by vasospasms in the superior mesenteric region.

## TABLE OF CONTENTS/OUTLINE

1. To illustrate the etiology and pathophysiology of NOMI2. CT image findings in the superior mesenteric artery and branches, and small bowel 3. Challenge to predict the viability of ischemic bowel on CT 4. Case presentation with tips and pitfalls for NOMI 5. Differential diagnosis (mesenteric artery occlusion, mesenteric venous occlusion, strangulated bowel obstruction, and pneumatosis intestinalis) 6. Summary

## EREE-51 Where Is the Catheter Tip? Chest Radiograph Findings of Incorrect Placement Comparison With CT and Normal Radiographs

Participants

Masafumi Sakai, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

In the intensive care unit, catheters and tubes are inserted into patients. Incorrect catheter placement can lead to various complications; detecting incorrect placement on chest radiographs is essential for early intervention and improved patient outcomes. However, incorrect catheter placement is easily overlooked if there is no comprehensive understanding of the three-dimensional anatomy of the chest and correct placement of the catheter on chest radiographs. Furthermore, new devices have also been introduced recently, which radiologists need to be familiar with. The purpose of this exhibit is: 1. To explain chest radiographic findings of incorrect catheter placement correlating with CT and comparison with the normal position. To explain the complications and pitfalls associated with incorrect catheter placement

## TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Case presentation I Central venous catheter Arterial misplacement Misplacement in small veins (azygos veins,

etc.) Catheter fragmentation Pitfalls (vascular anomaly, etc.) | Swan-Ganz catheter Misplacement of the peripheral pulmonary artery (PA). Complications (pseudoaneurysm of the PA) | Subcutaneous implantable cardioverter defibrillator Misplacement in anterior mediastinum | Endotracheal tube One-lung ventilation Pitfalls (tube tip shifts in accordance with neck flexion and extension) | Chest tube Misplacement in the interlobar fissure Misplacement in the lung | Epidural catheter Misplacement outside the epidural space | Etc. 3. Summary 4. Conclusion

#### **EREE-52 Dual Energy CT in Acute Inflammatory and Infectious Processes of the Head and Neck. The 4 P: Protocols, Post-processing, Pearls and Pitfalls**

Participants  
Paloma Puyalto, PhD, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Dual energy CT (DECT) images combine data from a wide range of energy acquisitions without impacting patient dose. In contrast to single energy CT (SECT), which uses only energy around 70 keV, virtual monochromatic images (VMI) can be reconstructed at any level of energy within a 40-150 keV range. Lower energies allow better delimitation of inflammatory tissue enhancement although this increases image noise ratio. Higher energies enable the virtual subtraction of iodine contrast, which improves calcium identification and reduces metallic artifacts. Material decomposition maps allow better identification of neck abscesses. The main purposes of this exhibit are: 1- To describe the DECT image acquisition protocols and post-processing methods. 2- To illustrate DECT findings and main tips in head and neck inflammatory and infectious diseases within different locations and its SECT correspondence. 3- To outline the differential diagnosis, potential pitfalls in DECT, and how to avoid them.

##### **TABLE OF CONTENTS/OUTLINE**

1-DECT protocol. 2-Post-processing techniques (VMI and material decomposition maps). 3-Case-based image examples of DECT and SECT correspondence for ears, orbits, paranasal sinuses, salivary glands, dental, pharyngeal, and para-pharyngeal mucosal inflammatory and infectious processes. 4- Pearls, pitfalls, and differential diagnosis in DECT images.

#### **EREE-53 At Arm's Length: Upper Extremity CT Angiography and Neurovascular Pathology**

Participants  
Andrew Sinensky, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1) Upper extremity (UE) vascular pathology can be conceptualized anatomically: the shoulder, arm, elbow, forearm, and hand. 2) CT angiography (CTA) and digital subtraction angiography (DSA) play a vital role in diagnosis and management of acute neurovascular pathology. 3) The thoracic outlet is the neurovascular outflow of the UE; thoracic outlet syndrome (TOS) results as the consequence of disruption of this outflow. 4) Non-traumatic vascular pathology of the UE is less common than lower extremity pathology and is often thromboembolic or anatomic in etiology. 5) Trauma of the UE has classic artery/nerve injury pair associations, such as at Guyon's canal (ulnar artery + nerve) and the mid-humerus (deep brachial artery + radial nerve).

##### **TABLE OF CONTENTS/OUTLINE**

1) UE Anatomy A) Arterial B) Venous C) Brachial plexus D) Thoracic outlet 2) CTA and DSAA) Technical considerations B) Pitfalls 3) Other Modalities A) Ultrasound B) MR4) Atraumatic A) Central (thromboembolic, aortic dissection) B) Peripheral (atherosclerosis, aneurysm/pseudoaneurysm, vasospasm) C) External compression (TOS, quadrilateral space syndrome) D) Systemic (vasculitis, connective tissue disorders) E) Dialysis grafts and fistulas 5) Blunt and Penetrating Trauma A) Vascular injury (pseudoaneurysm, arteriovenous fistula, laceration) B) Neurologic injury (transection, compression) C) Neurovascular injuries by region (shoulder, arm, forearm, elbow, wrist, hand) 6) Management A) Surgical B) Endovascular C) Post-operative imaging considerations D) Complications

#### **EREE-54 Imaging Spectrum of Extremity Vascular Emergencies: CTA-Angiographic Correlation**

##### **TEACHING POINTS**

1) To discuss the common mechanisms for traumatic and non-traumatic peripheral vascular emergencies as well as their management 2) Differentiate pertinent imaging features of traumatic and non-traumatic peripheral vascular emergencies 3) To juxtapose CT angiography and conventional angiographic findings for each etiology

##### **TABLE OF CONTENTS/OUTLINE**

1) Basic mechanisms of vascular injury 2) The advantages and drawback of CTA compared to conventional angiography in the setting of traumatic vascular injury 3) Common imaging features and clinical signs that suggest vascular emergency 4) CT angiographic and conventional angiographic correlation for several traumatic peripheral vascular emergencies - Laceration - Transection - Intramural Hematoma - Arteriovenous Fistula - Vasospasm - Intimal Dissection - Pseudoaneurysm - Thrombosis 5) CT angiographic and conventional angiographic correlation for several non-traumatic peripheral vascular emergencies - Embolism - Vasculitis - Acute DVT - May Thurner's Syndrome - Vessel Entrapment 6) Discussion of each etiology's pertinent imaging, clinical features, as well as their management

#### **EREE-55 Ischemic Bowel: A Challenging Imaging Diagnosis**

##### **TEACHING POINTS**

- Briefly examine the epidemiology and common causes of ischemic bowel (IB) disease. - Master anatomic and morphologic imaging findings of IB on CT. - Understand recommendations for additional imaging to increase diagnostic certainty, including the utility of arterial phase or multiphase CT imaging. - Learn indications for surgical vs. nonsurgical management of IB and the role of the radiologist in guiding management.

##### **TABLE OF CONTENTS/OUTLINE**

CT is the preferred imaging technique for diagnosing ischemic bowel, as it outperforms laboratory and physical exam findings in reliability and accuracy. However, CT may only detect nonspecific signs of mesenteric ischemia, bowel dilatation, bowel wall thickening, bowel obstruction, mesenteric edema, mesenteric stranding, mesenteric vascular engorgement, and ascites. In this exhibit, we review the causes of IB including vascular (thrombosis, embolism, vasculitis), anatomic (volvulus, neoplastic), and

systemic (hypoperfusion). Each diagnosis is accompanied by multiple CT cases highlighting specific and subtle imaging findings with a focus on imaging findings which alter management. Follow-up via imaging (CT angiography, MRI, MR angiography) or intervention (colonoscopy, surgical, catheter based) are reviewed with multimodality cases. Timely and accurate diagnosis of IB is crucial for guiding management, preserving bowel viability, and reducing morbidity/mortality and the radiologist is central in this clinical cascade.

### **EREE-56 The Diagnostic Ability of Postmortem Imaging for the Cause of Death**

Participants

Yu Nakaki, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Postmortem imaging is widely used to identify the cause of death. Although postmortem imaging can help to determine the cause of death, its diagnostic ability depends on the subject and the methodology applied. In >65% of cases, postmortem CT (PMCT) is useful for identifying the cause of unnatural deaths because traumatic changes can be detected. On the other hand, since cardiac disease, e.g. myocardial infarction, lethal arrhythmia, and pulmonary thromboembolism cannot be diagnosed by PMCT, it is useful in only 40-50% of natural deaths. Therefore, contrast-enhanced PMCT and postmortem MRI (PMMRI) have been introduced. We describe the diagnostic ability of postmortem imaging, demonstrate the causes of deaths that can be diagnosed by postmortem imaging, and alert to interpretation pitfalls.

#### **TABLE OF CONTENTS/OUTLINE**

1. Diagnostic ability of PMCT for •Unnatural deaths •Natural deaths 2. Diagnostic ability of contrast-enhanced PMCT 3. Diagnostic ability of PMMRI 4. Causes of death that can be diagnosed by postmortem imaging •Aortic dissection •Aortic aneurysm rupture •Sub-arachnoid hemorrhage •Cerebral hemorrhage •Gastrointestinal bleeding/occlusion/perforation •Pulmonary thromboembolism 5. Pitfalls of postmortem imaging

### **EREE-57 Obstetric Ultrasound: What Not to Miss for the ER Radiologist**

#### **TEACHING POINTS**

1. Obstetric ultrasound is an excellent tool to assess maternal, fetal, and placental parameters in all trimesters due to its noninvasive nature, ease of availability, portability, and lack of ionizing radiation. It is the first-line method used in the evaluation of pregnant patients. 2. Transvaginal ultrasound is an excellent modality in the first trimester for adequate characterization of fetal abnormalities. 3. The focus of second and third trimesters should be on the evaluation of fetal viability and potentially life-threatening abnormalities.

#### **TABLE OF CONTENTS/OUTLINE**

1. Normal pregnancy parameters to look for in emergent obstetric ultrasounds. 2. Classification of obstetric emergencies by maternal, fetal, and placental anomalies. 3. Maternal abnormalities. First trimester. Ectopic pregnancy. 1. Adnexal. 2. Abdominal. Interstitial and cervical implantation. 3. Molar pregnancy. b. Second and third trimesters. i. Uterine dehiscence/rupture. ii. Cervical and adnexal abnormalities. 4. Fetal abnormalities. a. First trimester. Major fetal structural abnormalities. ii. Nonviable pregnancy. b. Second and third trimesters. i. Fetal hemorrhage. ii. Amniotic fluid abnormalities. iii. Doppler abnormalities. 5. Placental abnormalities. a. Placenta Previa. b. Placental abruption. c. Vasa Previa. d. Placenta accreta spectrum. 6. Pitfalls in the diagnosis of common obstetric emergencies. a. Corpus luteal cyst vs Ectopic pregnancy. b. Post C-section changes vs uterine dehiscence. c. Placenta previa vs contraction

### **EREE-58 An Approach to Lateral Shoulder Impact Injuries: What the Radiologists Need to Know**

Participants

Michael Lee, Vancouver, BC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review the normal anatomy of the shoulder using radiographs. 2. Varying injuries can be sustained from lateral shoulder impacts (LSIs), including soft-tissue and osseous injuries. 3. Systematic approach for LSIs is essential to avoid missing injuries. 4. Dual-energy computed tomography (DECT) can be used to support the radiological evaluation of LSI injuries. The shoulder girdle is often injured and requires imaging in lateral impacts (e.g. in sports or pedestrian impacts), and can account for up to 4% of emergency department visits. Injuries may involve the clavicle, humerus, scapula, rotator cuff muscles, and the acromioclavicular and glenohumeral joints. To increase diagnostic accuracy, systematic search patterns are often utilized by radiologists. A systematic approach to common injuries encountered in LSIs may be useful for radiologists and trainees who evaluate acutely presenting patients.

#### **TABLE OF CONTENTS/OUTLINE**

1. Disclosures 2. Learning Objectives 3. Shoulder Anatomy and Stability 4. Clavicular Fractures 5. Acromioclavicular Fractures 6. Scapular Fractures 7. Proximal Humeral Fractures 8. Anterior Shoulder Dislocations 9. Dual-Energy CT in LSI 10. References

### **EREE-59 A Technical Perspective on CT Perfusion Pitfalls and Roadmap for Troubleshooting**

Participants

Ahmed Moawad, MD, Darby, PA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Illustrate the acquisition protocols for CTP in stroke patients- Introduce the perfusion parameters and thresholds for identifying core infarction and penumbra- Highlight different image processing algorithms- Demonstrate workflow for post processing software- Case based review of technical pitfalls of CT perfusion processing and acquisition

#### **TABLE OF CONTENTS/OUTLINE**

\* Introduction about acquisition of CTP and its parameters\* Diagnostic criteria for stroke/penumbra and threshold for each parameter \* Different types of image processing: Maximum slope technique and Deconvolution. \* General workflow for automated post-processing software.\* Technical pitfalls during acquisition:# Patient motion- Effect of patient interscan motion on image

registration.- Streak artifact as a result of intrascan motion- Motion correction algorithms. # Head position- Perfusion asymmetry due to head tilt\* Types of technical pitfalls in CTP processing:# Different CT perfusion thresholds for infarction.# Image alignment and registration pitfalls- Skull stripping and brain segmentation algorithm # Arterial inflow (AIF) selection pitfalls.- Arteries to use an input Criteria of correctly selected AIF- Troubleshooting AIF selection # Region of interest (ROI) selection pitfalls- Optimum position of the venous ROI- Troubleshooting ROI selection.# Time attenuation curves (TAC) pitfalls- Normal characteristics of the TAC- Bolus arrival time and first moment time- Curve Truncation

## **EREE-6 Black Belts, Bruises, and Breaks: A Radiological Journey Through the Brutal World of Martial Arts Injuries**

### **TEACHING POINTS**

1. As the popularity of martial arts rises, injuries increase. Radiologists must recognize common and uncommon injuries associated with specific fighting disciplines. 2. Martial arts can be categorized as striking versus grappling. Understanding differences in movements and mechanisms can predict injury patterns.3. Head and limb injuries commonly occur during striking, while joint and spine injuries are often seen with grappling.4. Experience, age, and setting are important considerations.

### **TABLE OF CONTENTS/OUTLINE**

Striking:Muay Thai/ Taekwondo/ Boxing Head Skull (strikes score points)Mandible/orbit fractures and dislocations Spine Cervical sprains/strains (clinch technique)Torso Rib fractures, solid organ injury (SOI)Upper ExtremitiesFractures/dislocations/ligament injuries/bursitis (blocking kicks/punching hard surfaces/overuse)Lower ExtremitiesFractures/soft tissue/ligament injuries (repeated high kicking/kicking hard surface/rotation+jumping)Grappling:Judo/ Brazilian Jiu Jitsu/ WrestlingHeadAuricular hematomas (friction)SpineFractures/subluxations/disc herniations (hyperextension/throw injuries)Torso Pectoralis major rupture (hyperextension)Upper ExtremityDislocation/fractures/ligament tears (Kimura/fingers blocked in the swell of the Kimono)Lower ExtremityMeniscus/ligament tears/bursitis (Osotogari/footlock)

## **EREE-60 Beyond Bones on the Trauma Spine CT: Critical Injuries in the Nonfractured Spine; a Case-based Review of Subtle But Important Nonosseous Findings the Neurosurgeon Needs to Know**

Participants

Brad Wright, PhD,MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

\* A trauma spine CT that is negative for fracture may have subtle but important traumatic findings that should prompt an MRI for further workup, because they may require surgical intervention. These findings include signs of unstable ligamentous injury and signs of potential cord compression. \* Widening of an anterior disc space suggests an unstable hyperextension injury, with rupture of the anterior longitudinal ligament. \* Widening of an interspinous distance suggests an unstable hyperflexion injury, with rupture of the posterior ligamentous complex. \* Widening of one or both atlantooccipital joints and widening of one or both C1-C2 facet joints suggests atlantooccipital subluxation and atlantoaxial subluxation, respectively, with capsular injury and potential injury to other ligaments. \* Although spinal epidural hematomas and disc herniations are better evaluated on MRI, they can often be identified on CT, especially if they are large and more likely to require surgery.

### **TABLE OF CONTENTS/OUTLINE**

\* Introduction\* Hyperextension injuries\* Hyperflexion injuries\* Atlantooccipital and atlantoaxial subluxation\* More obvious malalignment (with fractures): distraction injuries and dislocations\* Spinal epidural hematoma and disc herniation

## **EREE-61 Mesenteric Pathologies in Emergency Imaging**

Participants

Christian Gomez, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-Describe the anatomy of the peritoneum, mesentery and omentum.-Review mesenteric pathologies in a systemic approach with multi-modality imaging.-Differentiate commonly encountered mesenteric pathologies according to imaging and clinical characteristics.-Understand which mesenteric pathologies require follow-up or acute intervention.

### **TABLE OF CONTENTS/OUTLINE**

Mesenteric abnormalities are often encountered during emergency imaging. The imaging findings are often nonspecific and encompass a wide range of pathologies. In this exhibit, we review a spectrum of diseases with key imaging and clinical findings. We also highlight patient symptomology, key diagnostic features, potential acute complications, and follow up recommendations. This exhibit will review the anatomy of the peritoneal cavity, mesentery, omentum, and the peritoneal fluid circulation. Pathologies discussed include:-blunt and penetrating trauma?-secondary infiltration of the mesentery from edema or bowel inflammation?-varying stages of sclerosing mesenteritis?-sclerosing encapsulating peritonitis?-tuberculosis; omental infarct ?-primary and secondary mesenteric malignancies - carcinoid, dermoid, lymphoma, metastases, carcinomatosis, primary mesenteric mesothelioma, desmoplastic round cell, GIST, and mesenteric paraganglioma ?-cystic lesions - pseudomyxoma peritonei, inclusion cyst, duplication cyst, lymphangioma, and pseudocyst.

## **EREE-62 10 Points That Force You to Think About Intraabdominal Compartment Syndrome**

Participants

Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To review intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) 2. Role of body CT in evaluation abdominal compartment syndrome

### **TABLE OF CONTENTS/OUTLINE**

Background: Revision of intra-abdominal hypertension and intra-abdominal compartment syndrome. • Definition • Risk factors • Recognition of suspicious clinical situation and analytical findings Identification of characteristic CT features associated with IAH and



ACS. • Determining the etiology • To describe the standardized measurements used in CT to radiologically suggest the diagnosis • To propose 10 key points to not miss the diagnosis • Limitations of CT Algorithm for diagnosis of this entity and management of the patients. Conclusion Bibliography.

### **EREE-63 Computed Tomographic Angiogram (CTA) of the Upper Extremities**

Participants

Richard Tsai, MD, St. Louis, MO (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Teaching Points: With the advancement of cross-sectional imaging and sub-mm isotropic data acquisition, computed tomographic angiography (CTA) has become an excellent non-invasive diagnostic tool for the evaluation of the upper extremity vasculature. CTA is able to evaluate for vessel patency, irregularity, and achieve the anatomic detail needed in pre-operative planning. It is generally performed in the setting of trauma, but can also be used to evaluate other causes and sources of acute limb ischemia, and vasculitides. In this review, the normal vasculature and common anatomic variations will be presented, with a focus on trauma, acute limb ischemia, and vasculitis.

#### **TABLE OF CONTENTS/OUTLINE**

This exhibit is on the RadioGraphics Needs List under Emergency Radiology: Upper extremity CT angiography. This exhibit will: 1) Discuss the imaging technique and rationale for upper extremity CTA 2) Illustrate normal anatomy and commonly encountered anatomic variants 3) Illustrate the utility of upper extremity CTA for the evaluation of trauma, vasculitis, acute limb ischemia, and pre-operative planning 4) Describe pitfalls in interpretation of upper extremity CTA Outline: Normal anatomy and common anatomic variants Imaging protocols and interpretation Pitfalls: -Streak (instrumentation, contrast bolus on ipsilateral side) -Motion -Outrunning the bolus Trauma: -Occlusion -Vasospasm -Active extravasation -Pseudoaneurysm -Arteriovenous fistula Acute limb ischemia: -Thromboembolism -Stents and complications Vasculitis: -Takayasu's -Buerger's -Scleroderma/CREST syndrome

### **EREE-64 CT of Knee Fractures and Dislocations in Adults: Diagnosis, Grading, and Management Implications**

Participants

David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. CT is indicated for any distal femur fracture with possible articular involvement, due to easily missed coronal plane (Hoffa) fractures which displace further if unrecognized. 2. Patellar comminution associated with transverse fracture is often missed without CT, leading to potential loss of fixation with tension band wiring. Low profile 3D matrix/basket plates are increasingly used for patellar fractures shown to be comminuted at CT. 3. Patella baja is common with early severe osteoarthritis in patients with partial patellectomy for severely comminuted inferior pole fractures. 4. Medial tibial plateau fractures are complex injuries often reflecting fracture dislocation with associated ACL and lateral collateral ligament damage and dislocation of the rest of the plateau from the femur. 5. The PTA (posterior tibial slope) and mTPA (medial tibial plateau) angles can be used to determine side of compression for primary plating.

#### **TABLE OF CONTENTS/OUTLINE**

1. Contemporary CT imaging utilization for high-energy fractures- includes comparison with x-ray and MRI 2. Distal femur. i. classification- AO/OTA system ii. Patterns of injury/biomechanics iii. CT for surgical approach and hardware selection iv. Complications 3. Patella. i. classification- AO/OTA and its limitations ii. Patterns of injury/biomechanics iii. CT for surgical approach and hardware selection iv. Complications 4. Tibia. i. classification- Schatzker and 3 column concept (Luo) ii. Patterns of injury/biomechanics iii. CT for surgical approach and hardware selection iv. Complications 5. Conclusion/summary

### **EREE-65 What You Should Know to Improve the Quality of Contrast-enhanced CT Under ECMO?**

Participants

Fuyuki Washizuka, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To learn about hemodynamics when using extracorporeal membrane oxygenation (ECMO). To understand the relationship between the degree of residual native ejection fraction and the flow rate in the ECMO system when using veno-arterial ECMO (VA-ECMO). To learn about contrast-enhanced CT precautions and contrast methods under the use of ECMO. To learn the pitfalls of contrast-enhanced CT when using veno-venous ECMO (VV-ECMO). To learn how to ensure contrast-enhanced CT under more complex assisted circulation.

#### **TABLE OF CONTENTS/OUTLINE**

A. Changes in blood flow over time during VA-ECMO use. B. ECMO is divided into two categories, with VA-ECMO subdivided into three according to left ventricular ejection fraction (LVEF) and ECMO flow rate. C. Tips for successful contrast-enhanced CT in special hemodynamic situations when using VA-ECMO. D. Secrets to ensure successful contrast-enhanced CT when using VV-ECMO.

### **EREE-66 A Hidden Killer: Abdominal Pseudoaneurysms and Their Diagnostic Challenge**

Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To understand the pathophysiology and etiological spectrum of visceral pseudoaneurysms, as well as their potential complications that can lead to urgent abdominal pathology. To define the radiological findings that guide the diagnosis of a pseudoaneurysm and its complications in the different imaging tests.

#### **TABLE OF CONTENTS/OUTLINE**

Pseudoaneurysms are abnormal focal dilations of the arterial vessels, generally produced by a disruption of the arterial wall that

conditions the passage of blood through it, but remaining contained by the tunica adventitia or the perivascular soft tissues (unlike true aneurysms consisting of focal arterial dilations formed by all layers of the arterial wall). Among the possible causes of arterial wall damage that originates pseudoaneurysms are inflammatory processes, trauma, and iatrogenesis due to invasive procedures. Abdominal visceral pseudoaneurysms can develop a series of complications that entail high morbidity and mortality, generally divided into two large groups: those derived from compression phenomena of adjacent structures due to mass effect, and those derived from aneurysm rupture with bleeding into different spaces and structures. Through this work we will carry out an orientation to the radiological management of pseudoaneurysms and their complications, reviewing the typical findings described in the literature and illustrating them with several cases from our hospital.

#### **EREE-67 Body MRI in Acute Abdomen: Primer for the On-call Radiologist and Case Based Review**

Participants

Ashlesha Udare, MBBS, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

-To evaluate the appropriateness of Body MRI in acute abdomen. -To understand the importance of abbreviated protocols in an emergency setting. -To know the typical and atypical imaging features of various acute abdominal emergencies and the appearance of incidental emergent findings via a case-based review.

##### **TABLE OF CONTENTS/OUTLINE**

Acute Abdomen: When to do MRI?: Iodinated contrast contraindication-Renal insufficiency. History of serious contrast allergy. Failed contrast-enhanced study. Pregnancy-SAR, localiser planning. Problem-solving tool-Clinical Vs CT/US mismatch-Get a "better look!". ACR appropriateness guidelines. Technical Pearls for Body MRI in acute conditions: Micro-protocolling, monitoring scans, fast sequences, safety concerns. Case-based review of various acute abdomen Body MRIs: Gastro-intestinal emergencies (appendicitis, cholecystitis, cholangitis, diverticulitis, hepatic pyogenic abscess). Acute gynaecological conditions (ovarian torsion, massive ovarian edema, tube-ovarian abscess, fibroid degeneration, hemorrhagic cyst, ruptured ovarian cystic lesion) Acute pregnancy related cases (Ectopic pregnancies, placental abnormalities). Acute genito-urinary cases (Pyelonephritis/renal abscess, peniletrauma, scrotal trauma, epididymis-orchitis, priapism) Musculoskeletal injuries presenting as acute abdomen (core muscle injuries, abdominal wall hernias/hematomas, avulsion injuries). Cardiovascular cases (acute aortic syndromes, PE). Miscellaneous: Post-intervention, Post-transplant (renal vein thrombosis, GVHD), Oncological emergencies (ruptured HCC, SVC syndrome). Incidental emergent findings (pneumoperitoneum, hemoperitoneum)

#### **EREE-7 Uncoupling the Forefoot From the Midfoot: Experience and Review of Lisfranc Injuries**

Participants

Victor Rodriguez-Laval, MD, PhD, Madrid, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To understand the anatomy of the Lisfranc ligament complex and its importance. To review the most prevalent injury mechanisms, classifications, and treatment options. To present the X-ray and CT findings in the emergency room, surgical procedures and post-treatment imaging.

##### **TABLE OF CONTENTS/OUTLINE**

We reviewed the Lisfranc injuries over the previous ten years in our institution and chose the most representative cases. The normal and pathologic anatomy will be highlighted using a multimodality approach that includes plain radiographs, CT with 3D reconstructions. A case-based methodology will be used to cover the whole spectrum of injuries, from Lisfranc ligament sprains to homolateral and divergent fracture-dislocation type injuries, and this will be followed by additional discussion. Also, a brief overview of typical classification schemes, operation approaches, gradation of injury, and postoperative imaging will be presented. It is important to understand the anatomy and injury pattern to be able to diagnose Lisfranc injuries because a delay on the diagnosis increases the risk for midfoot instability, deformity and debilitating osteoarthritis. Given the often subtle initial radiographic findings, maintaining a high index of suspicion with a low threshold to obtain supplemental imaging is key in reducing miss rates. As Lisfranc injuries comprise only a small fraction of overall foot injuries, a periodic review of the salient imaging findings is essential.

#### **EREE-8 Acute Large Bowel Diverticulitis: A Pictorial Review**

##### **TEACHING POINTS**

Acute large bowel diverticulitis is a common reason of emergency department visits and when complicated it may end up in urgent gastrointestinal surgery. Computer tomography (CT) remains as the primary diagnostic tool in the diagnosis and staging of acute diverticulitis and its complications. Our radiologic report is essential for the surgeon to establish a treatment and to determine an outcome as well as for the exclusion of alternate causes of pathology. We recommend using international diverticulitis staging classifications (as WSES Clasification or modified Hinchey classification) to improve our communication with surgeons. In this educational communication, we aimed to illustrate the key CT imaging features of diverticulitis and its complications including perforation, phlegmon, abscess, ascending septic thrombophlebitis (phylephlebitis), bleeding, intestinal obstruction, and fistula.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction, Reporting CT findings, Anatomy check, Complications, To take home notes

#### **EREE-9 Imaging the Acute Complications of Gender-Affirming Surgeries: A Primer in the Emergency Radiology Setting**

Participants

Siddhi Hegde, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Gender-affirming surgeries (GAS) and their complications are critical for radiologists to understand. GAS is often tailored to the patient; there is a diverse spectrum of post-operative appearances and complications. Typical postoperative anatomy may imitate pathology if not identified correctly. Radiologists' diagnostic expertise, knowledge of institutional GAS and common complications, and their ability to collaborate with multidisciplinary clinical team, enables them to offer valuable insights on institutional practices

and guide appropriate next steps for complications. We will highlight the diagnostic features of the acute complications that may arise following gender-affirming surgeries and provide an overview of the ideal workup in the acute setting.

#### **TABLE OF CONTENTS/OUTLINE**

Describe expected imaging appearance of post-GAS neoanatomy, including common terminology Review multi-modality emergent imaging [ultrasound, plain film, retrograde urethrogram (RUG), Computed Tomography (CT)] review of common and "can't miss" complications Neourethral- anastomotic leaks, diverticula, fistulae, stenoses/strictures Transmasculine prostheses/device/implant - abscess, hematoma, malpositioning Bladder or rectal injury after vaginectomy (leading to fistulae) Postoperative bleedingSilicone emboli Providing gender-affirming care during imaging and reporting Understand ideal workup and unique imaging protocol considerationsDiscuss pitfalls of imaging in the acute setting, pearls for long-term follow-up

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## Abstract Archives of the RSNA, 2023

EREE-1

### Ankle and Foot Injuries in ER: A Checklist-Based Approach to Radiographs

#### TEACHING POINTS

1. To recognize various anatomic bony landmarks on ankle and foot radiographs with CT correlation. 2. To understand the pathophysiology and biomechanics of injuries in ankle and foot trauma. 3. To be aware of the most commonly used ankle and foot trauma classification schemes. 4. To understand the need for accurate diagnosis and characterization of ankle and foot injuries to guide management decisions to ensure optimal clinical outcomes. 5. To understand the role of CT in foot and ankle trauma. 6. To review the management of ankle and foot traumatic injuries.

#### TABLE OF CONTENTS/OUTLINE

1. Review the anatomy of the ankle and foot using illustrations, radiographs, and CT. 2. Various radiographic projection series and protocols to diagnose and characterize ankle and foot injury patterns. 3. The spectrum of foot and ankle injuries with key concepts in accurate characterization on radiographs with CT correlation. 4. Illustrated classifications of ankle and foot traumatic injury. 5. An algorithmic approach to accurately predict and identify subtle injuries. 6. Clues to avoid common pitfalls will be included. 7. Troubleshooting role of CT to be elucidated. 8. Focused review of the management of foot and ankle injuries.

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## Abstract Archives of the RSNA, 2023

EREE-10

### A Guide to Evaluating the Post-robotic and Post-laparoscopic Abdomen

#### Participants

Jay Pancholi, MBChB, BSc, Wilmslow, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To illustrate new surgical techniques with robotic surgery including recent advances in anastomoses. 2) To identify common post-operative complications in relation to timing since surgery. 3) To highlight review areas for post operative scans. 4) To review pearls and pitfalls in distinguishing expected appearances compared to complications. 5) To explain considerations when protocolling imaging requests.

#### TABLE OF CONTENTS/OUTLINE

Minimally invasive surgical techniques continue to advance with robotic surgery representing one of the most recent innovations. These techniques allow previously difficult anastomoses to be more readily performed. Post operative imaging is a common challenge faced by radiologists. Knowledge of surgical technique and possible complications is important for all radiologists interpreting these scans to ensure appropriate protocolling and accurate diagnosis. The poster will show illustrations of surgical techniques, normal post operative appearances and a variety of complications presented as scrollable cases. The poster will be outlined as: -Surgical advances--Robotic surgical incision sites--New anastomotic techniques---Minimally invasive colonial anastomosis---Kono-S anastomosis-Expected appearances--Normal free gas relative to day post op--Normal free fluid relative to day post op-Complications--Anastomotic leak--Bowel ischaemia--Vascular injury---Pseudoaneurysm--AV fistula--Ureteric injury--Lymphatic injury--Incisional hernia

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## Abstract Archives of the RSNA, 2023

EREE-11

### Twisting Around: A Review of the Potential Locations of Torsions

#### Participants

Laura Cavero Barreras, MD, Ordizia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review the pathophysiology of a torsion. - To understand which imaging modality should be ordered depending on the location of the torsion. - To know the possible sites of torsion and review the major imaging findings at each site on the different imaging techniques. - To review the radiological signs of ischemia that may appear as a consequence of torsion and may influence surgical management of the condition.

#### TABLE OF CONTENTS/OUTLINE

Torsion is a broad term that describes a twisting of an organ around its mesentery or its vascular pedicle resulting in an impairment of its blood supply. The vein is usually the first vessel affected resulting in venous stasis or ischemia. If left untreated, arterial compromise can occur leading to arterial infarction. For this reason, they are usually surgical emergencies and a prompt diagnosis is essential to avoid organ necrosis or hollow organ perforation. Imaging techniques are necessary to establish the diagnosis. Although intestinal volvulus and gonadal torsion are broadly known, there are other organs that can rarely result in torsion such as the lung, the spleen, the gallbladder, and the Fallopian tube. This presentation aims to review the imaging findings of torsion in all potential locations and identify the signs of ischemia that may occur in this setting.

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## Abstract Archives of the RSNA, 2023

EREE-12

### Above the Rest: A Review of Upper Cervical Spine Injuries

#### Participants

Jerry Cruz-Rodriguez, BA, San Juan, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Radiologists play a crucial role in characterizing acute cervical spine injuries in the emergent trauma setting using an imaging-based morphology approach.- Jefferson fractures involve the anterior and/or posterior arch of C1, lateral mass, or transverse anterior arch, and require CT for detection.- Hangman fractures involve disruption of C2's posterior elements at the pars interarticularis and can be devastating injuries.-OCFs require CT for detection and indicate serious trauma has occurred, potentially causing instability of the atlanto-occipital joint and neurological injuries.-Dens fractures are classified into 3 types, and CT is used to determine the type and guide management decisions.-AOD involves complete separation of the upper cervical spine from the skull base and requires CT for accurate diagnosis.-Traumatic atlantoaxial instability is a potentially devastating unstable injury that can be missed without careful assessment on initial CT scan.-TRS/TRF requires CT to diagnose the degree of subluxation and assess accompanying injuries, with clinical and dynamic imaging assessments needed for rotatory fixation.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction  
I Overview  
II AO Spine Upper Cervical Injury Classification  
B. Upper Cervical Spine Injuries  
I Common and uncommon important injuries of the upper cervical spine  
II CT characterization and discussion of typical mechanisms  
III Image review and correlation with AO Spine Classification  
Occipital condyle fractures (OCF) Atlanto-Occipital Dissociation (AOD) Atlantoaxial instability  
Traumatic Rotatory Subluxation/Fixation (TRS) Atlas (Jefferson) fractures Hangman fractures Odontoid fractures  
C. Conclusion  
D. Self assessment

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## Abstract Archives of the RSNA, 2023

EREE-13

### Ultrasonographic Diagnosis of Pneumothorax: Legend or Reality?

#### Participants

Guilherme del Guerra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This study aims to report the importance of chest ultrasound in the evaluation of critically ill patients with pneumothorax, highlighting the need for systematization in chest ultrasound assessment and technical recognition of pneumothorax ultrasound signs. The main echographic signs used in the detection of pneumothorax are: Absence of sliding of the two pleural leaflets, accentuated reverberation (A Lines), absence of comet tail artifacts and B lines and determination of the Pulmonary Point. In the presence of pneumothorax, trapped gas obscures visualization of the underlying pleural line, so that no pulmonary slippage is identified. The systematized technique used in chest ultrasound is based on: use of a high-frequency linear probe (5-12MHz); patient positioning in dorsal decubitus; division of each hemithorax into six quadrants. Each quadrant should be analyzed to ensure identification of the pneumothorax. The use of technically systematized chest ultrasound for the diagnosis of pneumothorax has high sensitivity, bringing a great benefit to critically ill patients, and can be used for diagnosis and decision-making quick conduct.

#### TABLE OF CONTENTS/OUTLINE

- Systematization of chest ultrasound evaluation - Normal findings on chest ultrasound - Ultrasonographic findings of pneumothorax - Cases of patients with pneumothorax diagnosed by ultrasound

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## Abstract Archives of the RSNA, 2023

EREE-14

### Don't Lose Your Head -- Imaging of Atlantooccipital Dissociation and Central Skull Base Fractures

#### Participants

Desmin Milner, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand normal anatomy of the central/posterior skull base and craniocervical junction.2. Understand various traumatic injuries at the central/posterior skull base and craniocervical junction.3. Understand some mimics of craniocervical junction injury.

#### TABLE OF CONTENTS/OUTLINE

1. Review normal anatomy of the central/posterior skull base and craniocervical junction.2. Briefly review CT and MRI imaging protocols in the setting of trauma.3. Review traumatic injuries of the central/posterior skull base and craniocervical junction including: atlantooccipital dissociation, occipital condyle fractures, clival fractures, and transsphenoidal fractures.4. Review of other ligamentous injuries at the craniocervical junction.5. Review mimics of craniocervical junction injury.

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## Abstract Archives of the RSNA, 2023

EREE-15

### Blunt Cerebrovascular Injuries (BCVI): Diagnosis, Evolution, and Complications

#### Participants

Elham Beheshtian, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Advances in multidetector CT angiography in the context of multitrauma have led to increased diagnosis of blunt cerebrovascular injuries (BCVI). 2. Early BCVI detection and treatment can decrease the risk of complications, such as ischemic strokes, carotid cavernous fistula, and arteriovenous fistulas. 3. BCVI is graded from 1-5 on the Biffi Scale, based on imaging appearance. The grading system is used to guide patient management and can predict the natural evolution of an injury.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction - epidemiology, morbidity and mortality, mechanism, imaging modalities  
II. Biffi Scale  
A. Pathophysiology and imaging examples of grades 1-5 injury  
B. Management implications by grade  
C. Natural history of an injury, including complications  
III. Diagnostic considerations  
1. Imaging modalities  
2. Universal vs. selective screening  
3. Imaging follow-up  
IV. BCVI mimics - fibromuscular dysplasia, atherosclerosis, carotid web, vasospasm, true aneurysm  
V. Venous injury  
VI. Summary

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## Abstract Archives of the RSNA, 2023

EREE-16

### Peer Learning Pearls: The Most Commonly Missed MSK Diagnosis on the Overnight Shift - Diagnostic Errors and Great Calls

#### Participants

Thais Kuwazuru, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibition is to:- Highlight the most commonly missed musculoskeletal diagnosis identified after Peer Review analysis and the great calls of difficult cases;- Demonstrate practical tips to avoid missing diagnosis;- Review the current concepts about these pathologies;- Show illustrative and didactic cases from our service, specially from emergency and urgent care units.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- The greatest difficulties during the night shift and emergency room for the radiologist;- Impact of early accurate diagnosis of these diseases.IMAGING INTERPRETATION- The most commonly missed musculoskeletal diagnosis identified after Peer Review analysis, including:- Fractures: vertebral acute fracture, transdiscal fracture, scaphoid fracture, avulsion fracture of Chopart joint;- Infection: discitis and spondylodiscitis, abscess;- Hematoma and active bleeding;- Other causes of musculoskeletal pain such as longus colli tendinitis, disc herniation;- Great calls - difficult cases.INTERACTIVE CASE-BASED DIDACTICS- Sample cases to illustrate and solidify the concepts;- The main tips that every radiologist working the night shift should know;- Correlation with current literature data.CONCLUSION AND TAKE HOME MESSAGES- Patient assessment in emergency and urgent care scenario very often include imaging investigation;- In order to improve patient outcomes and prevent iatrogenic treatments (or lack of treatment), it is essential to know the imaging patterns of each pathology and the tips to avoid missing diagnosis.

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## Abstract Archives of the RSNA, 2023

EREE-17

### Murphy's Law: What Can Go Wrong in Robotic and Laparoscopic Surgeries

#### Participants

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the main differences between open surgery, and minimally invasive surgery (MIS). Recognize the anatomy of the abdominal wall. Understand how the abdominal access is performed in MIS. Comprehend expected imaging patterns after MIS. Recognize the complications associated to MIS and its related imaging findings.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION: Open versus MIS. Modalities of MIS. Anatomy of the abdominal wall, and its relation to the abdominal access in MIS. Expected imaging findings after MIS COMPLICATIONS AFTER MIS: a case-based review - Laparoscopy-related: Epidemiology. Imaging findings. How to proceed? Robotic-related: Epidemiology. Imaging findings. How to proceed? SUMMARY AND SYSTEMATIC APPROACH: what to look for? Preoperative imaging / Postoperative imaging TAKE HOME MESSAGES

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## Abstract Archives of the RSNA, 2023

EREE-18

### Don't Look Just for the Bowels: A Comprehensive Review of Noninvasive Vascular Imaging in Abdominal Solid Organ Ischemia

#### Participants

Hermes Vinicius Pedrini Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of intra-abdominal solid organs vascularization.- Expose frequent and infrequent cases of intra-visceral vasculopathies in the context of acute abdomen.- Remember the main parenchymal changes resulting from vascular events and their differential diagnoses.- Tips on how to identify critical findings and report them.

#### TABLE OF CONTENTS/OUTLINE

- Concepts of arterial and venous circulatory anatomy and solid organs vascularization.- Circulatory physiology and how it affects the different imaging modalities.- CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases.- Imaging aspects of acute vascular events, from the organ's pedicle to its parenchyma.- Intra-abdominal occlusive ischemic events (thromboembolism, torsions, dissections).- Non-occlusive ischemic events (hemodynamic shock, substance abuse).- Other vascular abnormalities that may have clinical repercussions (shunts and malformations).- Correlation between imaging and clinical signs.- Risk factors and pre-existing conditions that can help us think about solid organ ischemia.- Practical information for effective reporting and necessary information for intervention planning, including the critical imaging findings that needs immediate intervention.

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## Abstract Archives of the RSNA, 2023

EREE-19

### Friendly Fire: A Rapid Review of Iatrogenic Intrathoracic Injuries Related to Support Devices

#### Participants

Saumik Rahman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Many common interventions performed by health care providers while placing supporting devices may lead to injuries to the lungs, pleura, heart, or mediastinal structures. These injuries may range from asymptomatic findings managed conservatively to life-threatening injuries requiring emergent surgical or percutaneous intervention. The radiographic and cross-sectional imaging appearance of malpositioned intrathoracic medical devices and complications related to iatrogenic thoracic trauma secondary to medical devices or procedures will be reviewed, and recommendations for clinical teams based upon imaging findings will be discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Examples of cases:a. Chest tube placement- Pulmonary contusion, laceration, hemothorax, pneumothorax.b. Pacemaker placement- Hemopericardium, pneumomediastinum, pneumothorax, hemothorax, chest wall hematoma.c. Swan-Ganz catheter- Pulmonary artery pseudoaneurysm.d. Enteric tubes- Endobronchial course causing lung injuries, esophageal perforation.e. Central venous catheters- Vascular dissection, vascular perforation, pneumothorax, mediastinal hematoma.3. Conclusion.

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## Abstract Archives of the RSNA, 2023

EREE-2

### MR Imaging of Pelvic Emergencies

#### Participants

Gayatri Joshi, MD, Atlanta, GA (*Presenter*) Royalties from Elsevier.

#### TEACHING POINTS

Pelvic pain is a commonly presenting symptom in the Emergency Department (ED) and while ultrasound (US) or computed tomography (CT) are often the initial imaging exam, magnetic resonance (MR) imaging plays a vital role for specific populations (such as the pregnant patient) and in clinical scenarios in which diagnosis relies on the greater sensitivity provided by MR imaging. After reviewing this exhibit, learners should be able to: 1. Understand the role of MR imaging in the emergent setting 2. Proficiently recognize emergent pelvic disorders by MR imaging 3. Utilize best practices for diagnosing pelvic emergencies in the ED, including those of infectious, inflammatory, ischemic, obstructive, traumatic, neoplastic etiologies

#### TABLE OF CONTENTS/OUTLINE

This exhibit will: 1. Systematically illustrate the clinical and imaging features of pelvic emergencies that may present in the ED, particularly those of the MSK, vascular, GI GU body systems. The spectrum of pelvic emergencies discussed in this exhibit will include those of infectious, inflammatory, ischemic, obstructive, traumatic, neoplastic etiologies 2. Discuss best imaging practices of the acute pelvis in the ED, with pearls/pitfalls for optimizing efficient/accurate diagnosis 3. Briefly address relevant management as applicable to the Radiologist to aid in expedient, appropriate management

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## Abstract Archives of the RSNA, 2023

EREE-20

### Imaging Features and the Role of Interventional Radiology and Radiation Therapy in Oncologic Emergency

#### Participants

Akihiro Nakamata, MD, Shimotsuke, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Due to the rapidly increasing elderly population and to the advancements in oncology, there has been an increase in the diagnosis of cancer, and also a rise in oncological emergencies. In oncologic emergencies, radiologists play a major role not only in diagnosis but also in the subsequent treatment of interventional radiology and radiation therapy. Therefore, radiologists should know imaging features and the treatment of oncologic emergencies in the whole body.

#### TABLE OF CONTENTS/OUTLINE

The purpose of this exhibit is: 1. To classify oncologic emergencies according to their pathology and location 2. To review oncologic emergencies in the whole body 3. To discuss the clinical and imaging features of the oncologic emergencies 4. To discuss the role of interventional radiology and radiation therapy Table of contents: 1) Subtypes based on imaging findings reflecting the background pathology. 2) Oncologic emergencies of various organs in this presentation. A) Central nervous system: Cerebral herniation Spinal cord compression B) Thoracic: Superior vena cava syndrome Airway obstruction Pericardial effusion with cardiac tamponade Pleural effusion Pulmonary thromboembolism, pulmonary tumor thrombotic microangiopathy (PTTM) Esophagorespiratory fistula Massive hemoptysis C) Abdomen: Abdominal compartment syndrome Biliary obstruction Biliary bleeding Intestinal obstruction Intestinal bleeding Bowel perforation Urinary tract obstruction Abdominal bleeding

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## Abstract Archives of the RSNA, 2023

EREE-21

### Understanding Cerebral Edema and Brain Herniation: A Simple Guide For Residents

#### Participants

Gustavo Alonzo Correa I, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To recognize the basic intracranial anatomy necessary for understanding the radiological features of brain herniation. To explain the appearances, pathogenesis and classification of cerebral edema. To discuss use of a systematic approach of cerebral herniation. To identify the imaging findings, clinical manifestations and potential complications associated in cerebral herniation.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Normal brain anatomy  
Brain edema (Vasogenic, Citotoxic and Transependymal)  
Concept of brain herniation  
Physiopathology of brain herniation  
Key level approach to brain herniation  
Classification  
Subfalcine hernia  
Transtentorial descending hernia  
Transtentorial ascending hernia  
Tonsillar  
Extracranial hernia  
To take home points

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## Abstract Archives of the RSNA, 2023

EREE-22

### Dental Trauma: A CT Perspective for Tooth-Saving Precautions

#### Participants

Erhan Akpınar, MD, Sihhiye, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To provide a basic anatomical overview of dental trauma with illustration of regions susceptible to trauma. To inform which dental fractures are important to save the tooth, and what to report for clinicians to get information about treatment options with basic points. To review the common terminology and classification of dental trauma/fractures with emphasizing the conditions that create or increase the risk of tooth loss. To present basic structural report templates for dental trauma reporting To discuss the CT imaging findings related to treatment of dental trauma and complications with illustrative cases.

#### TABLE OF CONTENTS/OUTLINE

1. Dental Anatomy, Weak Points and Crucial Structures to Keep The Tooth Alive / Functional 2. Terminology and Current Classification of Types of Dental Trauma 3. Fractures that require treatment within a few hours • Crown-Root Fractures • Root Fractures • Alveolar Fractures • Extrusive and Lateral Luxation • Avulsion 4. Fractures that require treatment within the first 24 hours • Complex Crown Fractures (Involving Pulp Structures) • Concussion and Subluxation • Intrusive Luxation 5. Treatment Options and Complications 6. A Structural Report Template for Dental Trauma

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## Abstract Archives of the RSNA, 2023

EREE-23

### Ultrasound in Acute Care: Point-Of-Care

#### Participants

Roddie Moraes Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recognize the practical applications of point of care ultrasound in emergency care; highlight patient positioning and how to acquire images in some exams performed with POCUS; learn the well-established ultrasound imaging standards in the literature.

#### TABLE OF CONTENTS/OUTLINE

Introduction: thorax, heart, abdomen, vessels; case-based review: thorax (pleural effusion, consolidation, pulmonary edema, pneumothorax), heart (pericardial effusion, pericarditis, vena cava, cardiogenic shock), abdomen (cholelithiasis, appendicitis, FAST, urolithiasis, testicular torsion / epididymo-orchitis, intussusception), vessels deep vein thrombosis, jugular thrombosis, ultrasound-guided peripheral venous catheter, aorta abdominal aneurysm); conclusions and key takeaways.

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## Abstract Archives of the RSNA, 2023

EREE-24

### Genitourinary Oncologic Emergencies: A Radiologists' Guide

#### Participants

Mamie Gao, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the best imaging approach for evaluating oncologic emergencies affecting the genitourinary tract. 2. Identify imaging manifestations of genitourinary oncologic emergencies. 3. Identify potential pitfalls in imaging genitourinary oncologic emergencies. 4. Recognize the important role of radiologists in the multi-disciplinary setting to communicate and collaborate findings in emergent cases.

#### TABLE OF CONTENTS/OUTLINE

1. Genitourinary oncologic emergencies and imaging approach. 2. Multimodality imaging features of genitourinary oncologic emergencies. a) Hematuria: hemorrhagic cystitis. b) Obstructive uropathy: tumor burden and post-treatment (nephrostomy tube malfunction, ileal conduit). c) Infectious: pyelonephritis, renal abscess, prostatic abscess, cystitis related to prior treatment (BCG, ileal conduit). d) Miscellaneous Post-Treatment (radiotherapy, chemotherapy, surgery, urinary diversion): hemorrhage, fistulas. 3. Role of radiology in management. 4. Potential mimics and pitfalls (underdistended urinary bladder, residual malignancy, emergencies unrelated to malignancy, trauma).

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## Abstract Archives of the RSNA, 2023

EREE-25

### Stercoral Colitis- Diagnosis, Complications and Management

#### Participants

John J. Hines JR, MD, Huntington, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Background Information/Purpose Stercoral colitis is an inflammatory process typically involving the sigmoid colon and rectum, due to chronic constipation and rectal distention, causing increased intraluminal pressure, and eventually leading to ischemia, ulceration, perforation, peritonitis and death from feculent peritonitis and sepsis if not treated. The purpose of this exhibit is to familiarize radiologists with the spectrum of CT imaging features of uncomplicated and complicated stercoral colitis and its mimics. Key Anatomic or Pathophysiologic Issues, Imaging Findings or Imaging Technique: Common CT findings of stercoral colitis include: 1.) Stool filled and distended colon with focal colonic wall thickening 2.) Pericolonic/presacral fat stranding. 3.) Presence of localized extraluminal gas, discontinuity of the colonic or rectal wall, and extraluminal gas in cases of perforation.

#### TABLE OF CONTENTS/OUTLINE

Educational Goals/Teaching Points 1. Review the risk factors, pathophysiology and clinical presentation of stercoral colitis.2. Discuss the importance of early recognition of uncomplicated stercoral colitis, and the role of the radiologist in bring this diagnosis to the attention of the clinical team.3. Illustrate the imaging findings of complicated and uncomplicated stercoral colitis on CT, including typical and atypical imaging findings, and unusual complications. 4.Review imaging mimics of stercoral colitis such as diverticulitis, infectious colitis, inflammatory bowel disease and ischemic colitis.5. Discuss the management of complicated and uncomplicated stercoral colitis.

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## Abstract Archives of the RSNA, 2023

EREE-26

### Typical Findings Under Atypical Lenses: When to Suspect Endometriosis on Emergency CT

#### Participants

Joao Stern, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Illustrate the different appearances of endometriosis on CTShare tips, pearls and pitfalls to suspect and diagnose endometriosis on pelvic computed tomography. Correlate relevant findings from computed tomography and magnetic resonance imaging of the pelvis to consolidate learning.

#### TABLE OF CONTENTS/OUTLINE

- introduction- common sites of involvement- image translation to CT of classic sign with MR correlation- discussion of the main findings of endometriosis on CT scan of the pelvis.

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## Abstract Archives of the RSNA, 2023

EREE-27

### Pain in the Bump: Acute Abdomen in Pregnancy - MRI Clues for On-Call Residents

#### Participants

Mili Rohilla, MD, Worcester, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To acquaint on-call residents with MR imaging signs in the acute abdomen To make residents comfortable with MR abdomen in pregnant patients

#### TABLE OF CONTENTS/OUTLINE

Acute abdomen is a common ER presentation in pregnant patients, and can pose a diagnostic challenge due to the physiological changes during pregnancy. Magnetic resonance imaging (MRI) is a useful diagnostic tool due to its high contrast resolution and absence of ionizing radiation. Radiology residents need to be cognizant of the MR imaging findings of acute abdomen in pregnancy and differential diagnoses to interpret them accurately and promptly. We will discuss the common system-wise presentations and MR findings: Gastrointestinal System: Appendicitis, acute pancreatitis, inflammatory bowel disease, intestinal obstruction. Hepatobiliary system: Acute cholecystitis, choledocholithiasis, HELLP syndrome. Reproductive System: Ectopic pregnancy, ovarian torsion, placental abruption, uterine rupture. Urinary System: Urolithiasis, acute pyelonephritis, renal abscess. Cardiovascular System: Ovarian vein thrombosis, Budd-Chiari syndrome, acute aortic syndrome. It is important to promptly diagnose and manage the underlying cause of acute abdomen in pregnancy to prevent adverse maternal and fetal outcomes.

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## Abstract Archives of the RSNA, 2023

EREE-28

### Ocular Trauma: What Should We Keep In Mind?

#### Participants

Omar Andres Pantoja Burbano I, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

Omar Andres Pantoja Burbano I, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To perform a systematic approach to the most important aspects of the ocular trauma. - Recognize the principal anatomic structures of the orbit and understand the compromise of such in the different traumatic injuries. - Identify the most relevant signs of ocular and orbit trauma in diagnostic imaging, with specific emphasis in orbit tomography. - Learn how to classify the ocular trauma according to the involvement of the anterior or posterior segments and the presence of ocular globe rupture or burst. - To consider and exclude the most relevant differential diagnoses.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Anatomy of the ocular globe. 3. Anterior segment lesions. 4. Posterior segment lesions. 5. Ocular globe rupture and foreign bodies. 6. Pitfalls and differential diagnoses. 7. Take away points. 8. References.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

EREE-29

### A Quick Guide to Pelvic Pain in the Emergency Room: MR Imaging of the Acute Female Pelvis

#### Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the female pelvis on MRI- Understand the role of MR imaging in the evaluation of gynecologic emergencies- Illustrate the imaging findings non-obstetric and obstetric causes- Discuss their differential diagnosis, imaging pitfalls, and complications

#### TABLE OF CONTENTS/OUTLINE

1. Normal MRI anatomy of uterus and adnexa with cyclical variation 2. Advantages and disadvantages of MR Imaging 3. Non-obstetric and obstetric causes 4. Imaging assessment of critical and prevalent gynecological diseases in the emergency room 5. Pelvic inflammatory disease, including endometritis, cervicitis, salpingo-oophoritis, pyosalpinx, and tubo-ovarian abscess 6. Leiomyoma torsion and fibroid degeneration 7. Endometriosis 8. Obstetric causes, including ectopic pregnancy, molar pregnancy, retained products of conception, placenta accreta spectrum 9. Other pelvic abnormalities 10. Potential imaging pitfalls and how to avoid them 11. Complications

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## Abstract Archives of the RSNA, 2023

EREE-3

### Shattered Chests: Lessons from Thoracic Trauma Cases

#### Participants

Manuel Sebastian Paez Alvarez SR, MD, Toledo, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To present a comprehensive overview of thoracic trauma cases, highlighting the most common and not-so-common pathologies. To familiarize radiologists and radiology residents with diagnostic clues of thoracic imaging in trauma patients. To analyze key features and provide tips to identify pitfalls of traumatic chest CT.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Importance of thoracic trauma imaging and its implications in emergency settings. Pulmonary parenchymal injury: a. Pulmonary contusions b. Pulmonary lacerations c. Pulmonary hematomas d. Traumatic pulmonary hemias Pleural space injury: a. Pneumothorax b. Hemothorax Chest wall injury: a. Rib fractures b. Sternal fractures c. Chondrocostal, chondrosternal, and cartilage injuries d. Sternoclavicular dislocations Tracheobronchial injury: a. Laceration of the trachea and bronchi Other injuries: a. Boerhaave Syndrome b. Aortic injury c. Iatrogenic cardiac perforation d. Traumatic diaphragmatic hernias This educational exhibit aims to provide a comprehensive understanding of thoracic trauma cases, emphasizing the importance of recognizing imaging findings for accurate diagnosis. Radiologists and radiology residents will benefit from the illustrative cases and diagnostic tips presented, improving their skills in traumatic chest CT interpretation.

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## Abstract Archives of the RSNA, 2023

EREE-30

### The Contrast-Enhanced FAST Exam (cFAST) In Blunt Thoracoabdominal Trauma

#### Participants

Melanie P. Caserta, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The Focused Assessment with Sonography in Trauma (FAST) is one of the most frequently performed ultrasound examinations in adults and children in the acute care setting. However, it has significant limitations since intraabdominal fluid is used as a surrogate marker for intraabdominal injury (IAI). Adding an ultrasound contrast agent to the exam can substantially improve the diagnostic accuracy of identifying solid organ injuries and rapidly identify significant organ lacerations and active intraperitoneal hemorrhage. The cFAST exam is a rapid, standardized, and systematic ultrasound examination that balances a comprehensive organ survey with the time constraints of highly structured and algorithmic trauma patient care. After reviewing this case-based exhibit, the learner will:- Understand the limitations of the traditional FAST exam and advantages of adding an ultrasound contrast agent (UCA)- Describe the cFAST exam protocol and set-up as part of the trauma resuscitation team- Recognize the limitations of the cFAST exam and next steps in imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Objectives 2. Background a. The evolution of the FAST exam b. Contrast-enhanced ultrasound in trauma 3. Imaging a. Equipment, technical requirements, and supplies i. IV access ii. Selection of the UCA iii. Ultrasound equipment b. Integration into the trauma team c. The contrast-enhanced FAST exam protocol i. Patient population ii. Exclusion criteria iii. Special populations iv. Safety Considerations v. UCA preparation Contrast Administration vi. Imaging Protocol vii. Limitations 4. Pediatric and adult case presentations

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## Abstract Archives of the RSNA, 2023

EREE-31

### Searching for Causes of Preventable Death - Role of Early Postmortem CT in Trauma Patients

#### Participants

Lain Ibanez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To show an accurate protocol to perform a post-mortem CT in patients who died after severe trauma in a first-level trauma center
- To describe the main radiological features of different early deceased trauma patients and their potential relationship with the cause of death
- To identify the misplacement of medical devices in patients who died from trauma
- To determine if there was preventable death based on clinical and radiological findings

#### TABLE OF CONTENTS/OUTLINE

- Performing an early post-mortem CT protocol and CT technique
  - Analysis of radiological and clinical features, injuries, and medical device misplacement
  - Determining causes of death and their avoidability
  - Conclusions
- Outline: Despite the improvement in the management of trauma patients there is still a percentage who die during or immediately before receiving hospital care and before having an imaging test. This reason jointly with an increasingly low rate of autopsies, prevents to understand the causes of death and whether or not it had been avoidable. Since June 2022 the trauma and radiology teams at our level 1 trauma center decided to carry out a program to study preventable mortality in trauma patients who died before or during initial care. In this presentation we will show the design of our project, how we accomplish post-mortem CT studies and also present our preliminary results. We will show a clinical-radiological correlation of our cases, analyze the main injuries, misplacement of medical devices, causes of death and whether its avoidability. Finally the main concerns we faced and major limitations are exposed.

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## Abstract Archives of the RSNA, 2023

EREE-32

### **Beyond the Diagnosis of Appendicitis:CHAR(13) + CHAR(10)The Role of Computed Tomography in the Nonoperative Management of Acute Appendicitis in Adults**

#### **Participants**

Eliko Tanaka, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Diagnosis of acute appendicitis using computed tomography (CT) is highly accurate and established. The treatment of appendicitis includes surgery and conservative treatment, and the role of conservative treatment is expanding. However, conservative treatment has challenges, such as treatment failure and malignant tumors. CT diagnosis plays a significant role in determining the treatment plan. This presentation describes CT findings related to the indications for conservative treatment of appendicitis, as well as CT findings related to the course of conservative treatment. Additionally, it discusses challenges in CT diagnosis associated with conservative treatment, such as recurrent appendicitis or tumor complications, and presents a case series. Teaching points include: 1. Understand the indications and contraindications for conservative management of appendicitis and its CT findings 2. Familiarize CT findings related to the course of conservative treatment for appendicitis 3. Recognize the potential complications of conservative management, such as treatment failure, malignancy, recurrent appendicitis, and identify the corresponding CT findings

#### **TABLE OF CONTENTS/OUTLINE**

1. Indications and contraindications of conservative treatment in the World Society of Emergency Surgery (WSES) guidelines 2. CT findings that suggest a high risk of failure in conservative treatment and a need for extended surgery 3. Imaging findings during the course of conservative treatment 4. Recurrent appendicitis and its CT findings 5. Differential diagnosis between tumor and non-tumor cases

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## Abstract Archives of the RSNA, 2023

EREE-33

### Role of MR in the Diagnosis of Suspect Metastatic Spinal Cord Compression: A Pictorial Imaging Review With Medical and Radiological Scales

#### Participants

Blanca Lumbreras-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The learning objectives of this exhibit are: 1-To illustrate the spectrum of metastatic spinal cord compression (MSCC) and the scales and scores that should be included in the radiological report. 2- To discuss the image findings of MSCC with emphasis in epidural lesions.

#### TABLE OF CONTENTS/OUTLINE

1-Pathophysiology of MSCC, including demographics. 2-Review of common imaging findings in the management guidelines for MSCC. Relevance of the inclusion in the radiological report of the Epidural Spinal Cord Compression (ESCC) Scale and Spinal Instability Neoplastic Score. 3- Evaluation of the most representative cases of MSCC collected and their differential diagnosis with other causes of cord compression, specially epidural lesions in a non-traumatic setting through imaging cases from our center. 4- Conclusions: Acute compressive myelopathy is a medical emergency. Early diagnosis and treatment improve the neurological prognosis. MR is the technique of choice to confirm the diagnosis or establish an alternative one as well as to determine the level, extension, degree of compression, stability of the spine and presence of myelopathy. The incorporation of the ESCC scale and SINS to the radiological report improves multidisciplinary communication and the adequacy of urgent treatment of MSCC.

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## Abstract Archives of the RSNA, 2023

EREE-34

### Cognitive Biases and Diagnostic Errors in Emergency Neuroradiology, A Case-Based Approach

#### TEACHING POINTS

1. Introduce the dual process theory of reasoning, with a focus on the "Type 1" system, heuristics, cognitive biases, and diagnostic errors. Discuss how the emergency radiology setting may predispose toward Type 1 thinking. 2. Review different types of cognitive biases and diagnostic errors via case-based emergency neuroradiology examples. 3. Describe different strategies to combat cognitive biases and reduce diagnostic errors.

#### TABLE OF CONTENTS/OUTLINE

Decision making literature theorizes there is a dual process of reasoning which is comprised of a fast, intuitive "Type 1" system and a slower, more deliberative "Type 2" system. The high volume and acuity of the emergency setting may predispose toward Type 1 thinking. In Type 1 thinking, we use a number of heuristics, or shortcuts, to improve efficiency though this comes at the cost of an increased predilection toward cognitive biases and diagnostic errors. Recognition of common cognitive biases and strategies to manage them may reduce diagnostic errors. In this education exhibit, we will review common cognitive biases using an emergency neuroradiology case-based approach to illustrate these biases in action to help recognize and counter them. Some examples of cognitive biases that will be reviewed include bandwagon effect, alliterative error, framing bias, triage cueing, satisfaction of search, confirmation bias, attribution bias, availability bias, anchoring bias, and productivity bias. We will also discuss metacognition strategies to help counter these biases.

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## Abstract Archives of the RSNA, 2023

EREE-35

### Never Fear! Peer Learning in Emergency Pelvic and First Trimester Ultrasound

#### TEACHING POINTS

Women presenting with acute pelvic pain and/or bleeding can pose a diagnostic challenge in the emergency setting. The differential diagnosis may be broad, and these symptoms are often indications for pelvic ultrasound (US). Interpretation of pelvic US may be tricky and a source of confusion and misinterpretation. Furthermore, cognitive biases in imaging interpretation can lead to diagnostic errors. Familiarity with common and uncommon pelvic US imaging findings is imperative to assist with prompt and accurate diagnosis. Awareness of potential biases when interpreting pelvic US further helps hone interpretation. This exhibit will illustrate the imaging findings of multiple causes of pelvic pain/ bleeding in non-pregnant and first trimester pregnant patients. Diagnostic errors and biases in interpretation related to these cases will also be highlighted.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will review pelvic US peer learning cases and highlight teaching pearls and potential pitfalls in diagnosis. 1. Review common and uncommon causes of acute pelvic pain/bleeding in non-pregnant patients, including ovarian/ fallopian tube torsion, cysts, hydrosalpinx, fibroids, benign and malignant adnexal lesions, tuboovarian abscess. 2. Review causes of pelvic pain/bleeding in first trimester pregnant patients, including ectopic pregnancy in different locations, ruptured heterotopic pregnancy, retained products of conception, uterine AVM. 3. Review non-OB/GYN causes of pelvic/abdominal pain for which pelvic US was the initial imaging modality, including appendicitis, appendiceal mucocele, diverticulitis. 4. Review potential biases in pelvic US imaging interpretation with examples from our cases.

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## Abstract Archives of the RSNA, 2023

EREE-36

### Plain Abdominal Radiography in the Emergency Room

#### Participants

Carla Suarez Silva, MD, A Coruna, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Plain abdominal radiographs continue to be a fundamental tool in emergency rooms.- We present abdominal X-rays performed in a third-level hospital over the last few years. In all cases, the radiographs helped guide the patient's management.- The semiology of abdominal simple radiography is presented in a didactic and interactive way to achieve an adequate interpretation.- Knowing the radiological analysis of the abdominal radiograph continues to be useful for the comprehensive management of the patient.

#### TABLE OF CONTENTS/OUTLINE

This education exhibit presents a collection of 25 cases of abdominal X-rays. All cases will be presented in a structured and interactive format, beginning with an overview of the patient's clinical data, followed by the X-ray image(s), the detail of the radiological findings using visual aids, pearls and pitfalls, and the final diagnosis providing correlation with other imaging methods. Furthermore, taking advantage of the fact that all the X-rays were performed urgently, a green, yellow, or red circle will appear in the top right corner of all radiographs indicating the severity of the pathology presented by the patient. To facilitate the reading of this presentation, the name of the radiological density that will help us make an adequate interpretation of the abdominal radiograph will be displayed at the bottom of each image. The table of contents is: • Introduction • Teaching points • Table of Contents • How to approach an abdominal X-Ray? • Check all the clinical data • Technical aspects • Radiological densities • Cases • Case 1: Patient 1 • ? • Case 25: Patient 25

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## Abstract Archives of the RSNA, 2023

EREE-37

### DECT in the Acute Setting - Bowel Trauma

#### TEACHING POINTS

Highlight the value of Dual Energy CT (DECT) in traumatic bowel injury. Understand the principles of DECT and iodine overlay map. Illustrate the use of DECT and iodine overlay maps to improve diagnostic confidence and sensitivity in detecting bowel injury, contrast extravasation, free fluid, and reducing metal artifacts.

#### TABLE OF CONTENTS/OUTLINE

1. Background  
2. DECT and Bowel Injury  
a. DECT Increases Conspicuity of Hyperattenuating Free Fluid  
b. Lack of Iodine Uptake in Injured Bowel  
c. Metal Artifact Reduction  
d. Contrast Extravasation  
3. Conclusion

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## Abstract Archives of the RSNA, 2023

EREE-38

### Beyond Aortoenteric and Aortocaval Fistulas - Intraabdominal Fistulas: Imaging Findings and Importance of Early Identification

#### Participants

Amalia Aranaz Murillo, MD, Zaragoza, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Intraabdominal fistulas are uncommon but can be catastrophic if not identified and treated promptly. Multiphasic multidetector CT angiography (angio-MDCT) is the initial imaging choice for diagnosis. 2. The imaging signs of intraabdominal fistulas can be divided into direct and indirect signs and emergency radiologists should be familiar with them and be aware of potential mimics and maskers to avoid misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

This poster aims to provide an overview of intraabdominal fistulas, their imaging findings, and the importance of early identification and familiarize the radiologist with the mimics and maskers of intraabdominal fistulas. Intraabdominal fistulas are a rare but life-threatening condition if they are not identified and treated promptly. Imaging plays a crucial role, and angio-MDCT is often the initial imaging technique. The imaging signs of intraabdominal fistulas can be divided into direct and indirect signs. Direct signs include visualization of the fistula tract, extravasation of contrast medium, and aortic graft migration, but these signs are rarely observed. Indirect signs are often the only available evidence and include abnormalities of the aortic wall, irregularities of the interface between the aorta and the fistulizing entity, and the presence of gas or fluid collections. Although the most frequent intraabdominal fistulas are aortoenteric and aortocaval fistula, other types of fistulas and potential mimics can occur, and one should know and be aware of them. Familiarity with the different imaging modalities and the various mimics and maskers of fistulas can help in accurate diagnosis, ultimately leading to improved patient outcomes.

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## Abstract Archives of the RSNA, 2023

EREE-39

### **Kicking, Biting, and Screaming: Common Radiological Patterns and Mechanisms of Equine-Related Injuries Presenting to the Emergency Department**

#### **Participants**

Trae Brooks, MD, BS, Lexington, KY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Thoracic injuries may occur in over half of horse-related trauma cases, including clavicle and rib fractures as well as hemothoraces and pneumothoraces. Clinical and imaging evaluation is crucial to rule-out underlying thoracic trauma (Chad Ball, 2007). Children who receive an injury while unmounted are likely to have more severe injuries than those who were mounted, with most trauma localized to the abdomen (Grace Wolyncewicz, 2018). Fractures are one of the most common injuries in mounted equestrians and should be suspected in patients presenting after a fall from a horse. The initial height of the rider, velocity of travel, and vulnerable position of landing are all key factors contributing to the severity and location of the fracture and need for prompt imaging and evaluation.

#### **TABLE OF CONTENTS/OUTLINE**

We will begin with an overview of horse-related trauma from a historical and epidemiologic perspective. Using a simplified algorithm, we will then discuss the classic patterns of various trauma such as fall from or with a horse while mounted and injuries sustained from direct injury from a horse while unmounted such as bite, kick, or stomp/trample injuries. Finally, we will use case-based examples with multimodality imaging to show the broad extent of injury concerning various systems - organized into Torso, Musculoskeletal/Extremity and Central Nervous System/Spine.

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## Abstract Archives of the RSNA, 2023

EREE-4

### CT of Appendicitis in Adults: Problematic Scans and Scenarios

#### Participants

Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-A non-trivial minority of CT examinations performed for suspected appendicitis - regardless of the protocol utilized - end up being challenging to interpret for a variety of reasons, in adults -This exhibit will review problematic scenarios and situations involving CT performed for right lower quadrant pain in non-pregnant adults -Review uncommon/atypical/unusual presentations of appendicitis and its potential mimics and potential pitfalls, as well as some of the more common problematic scenarios -Demonstrate examples of these CT scenarios from our practices -Briefly overview QA and medical-legal issues in suspected appendicitis in adults with an emphasis on CT

#### TABLE OF CONTENTS/OUTLINE

Outline: -Oral contrast - to use or not to use on CT? -Subtle/early findings -Perforated appendicitis- review of the literature -The right lower quadrant 'phlegmon' -Potential pitfalls and confounders - right colonic diverticulitis, 'secondary' appendicitis, distal/tip appendicitis, the non-visualized appendix, chronic/relapsing appendicitis, and resolving appendicitis -Appendicitis and rotation anomalies -Stump appendicitis -Appendicitis in hernias -Appendicitis and underlying neoplasms -Additional potential errors, quality assurance issues, and medical-legal issues

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## Abstract Archives of the RSNA, 2023

EREE-40

### Abdominal Hemorrhage on MRI: Findings and Pitfalls

#### Participants

Bertin Mathai, MD, Bronx, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Non-traumatic intra-abdominal hemorrhage can be due to multiple etiologies and can be a source of acute abdominal pain and life threatening blood loss. Prompt radiologic identification and localization of hemorrhage is crucial for appropriate decision-making and management. Acute intra abdominal hemorrhage is usually diagnosed by computed tomography (CT). Magnetic resonance imaging (MRI), is less frequently used in the acute setting, and radiologists may be less familiar with the appearance of blood and potential etiologies of hemorrhage, such as ruptured aneurysms and hemorrhagic masses. The signal characteristics of hemorrhage can vary depending on both the age of the hemorrhage as well as its background location. The superior soft tissue resolution of MRI can help characterize intra-abdominal blood products in cases where CT is indeterminate, and can help diagnose an underlying mass in cases where it is obscured by blood on CT. This educational exhibit will discuss the timeline of hemorrhage with respect to MRI signal, show multiple causes of spontaneous intra abdominal bleeding, and highlight scenarios where MRI can provide added value in diagnosing the source of hemorrhage.

#### TABLE OF CONTENTS/OUTLINE

1) Background 2) Molecular and Magnetic Timeline of Blood 3) Optimizing MRI Protocol to Visualize Blood 4) Differential Diagnosis / Cases 5) Literature Review 6) Conclusion 7) References

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## Abstract Archives of the RSNA, 2023

EREE-41

### Pre-Hospital Emergency Medicine: A Spectrum of Imaging Findings

#### TEACHING POINTS

This educational exhibit aims to: 1) Increase awareness and understanding among radiologists of the principles of Pre-Hospital Emergency Medicine 2) Review imaging which illustrates techniques used by Emergency Medical Services (EMS) providers 3) Highlight pertinent radiologic findings which call attention to potential complications arising from pre-hospital care.

#### TABLE OF CONTENTS/OUTLINE

Topics covered within this presentation include: 1) Introduction to Pre-Hospital Emergency Medicine--Including Purpose of Emergency Medical Services (EMS) and Scope of practice of EMS providers; 2) Airway Management--Including Endotracheal intubation and Surgical airways; 3) Cardiopulmonary Resuscitation--Including Use and effects of mechanically-assisted chest compressions, Radiologic findings of decompressive needle thoracostomy (DNT), and Efficacy of intraosseous vascular access for resuscitation and IV contrast administration; 4) Techniques of Patient Immobilization--Including Imaging appearance and appropriate positioning of cervical spine collars, Imaging appearance and clinical benefit of hemostatic tourniquets, and Imaging appearance and appropriate positioning of pelvic binders

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## Abstract Archives of the RSNA, 2023

EREE-42

### Immediate-CT with Hybrid Emergency Room System for Severe Trauma Patients

#### TEACHING POINTS

- Several studies have shown that trauma whole-body CT has facilitated the early identification of major injuries and a reduction in mortality and morbidity.
- HERS (Hybrid-Emergency Room System) is an all-in-one concept of emergency room with the functions of CT scanner, interventional radiology and surgery, and useful in critical trauma treatment strategies.
- HERS in trauma treatment can be performed from diagnosis to treatment without transporting the patient, so it is possible to significantly reduce the time.

#### TABLE OF CONTENTS/OUTLINE

- We devised a new trauma treatment strategy using HERS. This is "immediate CT protocol" in which CT scan is performed immediately after arrival at the hospital.
- The immediate-CT(i-CT)protocol is optimized for CT scans immediately after arrival at the hospital.
- This protocol enabled rapid diagnostic imaging for critical traumatized patients. And, can provide more information than ultrasound, X-ray used in "primary survey". It is also possible to find major damage earlier.
- By detecting brain injury, aortic injury, retroperitoneal hematoma, lung injury, and spine injury, early activation of injuries that require referral to other departments is now possible. And we call it "BARLS".
- We demonstrated that the i-CT protocol leads to reduction of the time from arrival to CT scans without adverse events. As a result, we have contributed to the planning of treatment strategies and early activation of specialized treatment.
- This novel trauma treatment strategy can contribute to improving the life-saving rate

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## Abstract Archives of the RSNA, 2023

EREE-43

### **Multiphase CT Angiography Using a Time-Variant Color Map: How Can It Contribute to the Improvement of the Diagnosis and Management of the Acute Stroke?**

#### **TEACHING POINTS**

- Multiphase CT Angiography (mCTA) offers several advantages over single-phase CTA (sCTA) and contributes to improving the diagnosis and management of the acute ischemic stroke (AIS). - mCTA increases interrater agreement for both proximal and distal vessel occlusions compared with sCTA and reduces time needed to detect the occlusion. - mCTA helps to characterize the thrombus length and thrombus permeability, which may influence the treatment. - mCTA improves characterization of collateral status, that may be a useful fact in the management of some patients with AIS. - mCTA has potential value in delineating the core ischemic area and detecting tissue at risk. - mCTA can also be useful in hemorrhagic stroke. It improves prediction of intracerebral hemorrhage expansion and improves the evaluation of venous vessels and the diagnosis of vascular malformation. - mCTA may be useful in the characterization of stroke mimics.

#### **TABLE OF CONTENTS/OUTLINE**

Multiphase CTA (mCTA) provides time-resolved images of the cerebral vasculature that are useful in patients with acute stroke. An arterial (red color) and 2 venous phases are acquired ( peak venous phase in green, and late venous phase in blue) are acquired. We review the role and potential of CTA in patients with ischemic and hemorrhagic stroke, its advantages over sCTA, its limitations and its usefulness in the evaluation of stroke mimics.

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## Abstract Archives of the RSNA, 2023

EREE-44

### Visceral Ischemia: What Should the Emergency Radiologist Know?

#### Participants

Silvia Cayon Somacarrera, MD, Torrelavega, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the key radiological features of visceral ischemia, including cases of liver, gallbladder, pancreas, spleen, renal, stomach and intestine ischemia. To understand the pathophysiology behind those radiological findings

#### TABLE OF CONTENTS/OUTLINE

The infarct's shape depends on the distribution of the vascular tree. The organs with hilum show wedge-shaped infarcts (eg. liver, kidney, spleen) while the organs without hilum show infarctions that extend through the different wall layers (eg. intestine). We collected the most illustrative cases of visceral ischemia of the last years in our institution to show the key characteristics to make a quick and accurate diagnosis. Mesenteric ischemia has a very high mortality rate if not properly treated. The key findings to evaluate are: mesenteric vessels, intestinal walls and the existence of gas (pneumatosis/pneumoperitoneum). Hepatic ischemia is uncommon due to its double vascular supply. The most typical finding is wedge-shaped hypodense areas but we can also find rounded or tubular areas parallel to the bile ducts. Renal ischemia is most often caused by renal artery embolism. Focal infarcts are depicted as hypodense triangular areas. Complete infarcts present as generalized hypoattenuation of the renal parenchyma. Splenic ischemia is relatively common. Acute infarcts are shown as triangular hypodensities, subacute infarcts as cystic images while in chronic infarcts calcifications or atrophy can be seen. Cortex preservation may be observed in complete renal/splenic infarcts due to collateral circulation.

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## Abstract Archives of the RSNA, 2023

EREE-45

### Evaluating Primary and Secondary Endpoints in Intracranial Hemorrhage AI Algorithms - A Review of Current Market Algorithms and a Proposed Retraining Model for Improving Patient Triage

#### Participants

Raviteja Suryadevara, MD, Louisville, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The implementation of AI algorithms for intracranial hemorrhage (ICH) in the ED setting can expedite detection, triaging, and timely intervention. Most AI algorithms, in addition to their binary primary endpoint of -ICH or +ICH, also collect secondary outcome endpoint data (processing time, bleed location, bleed volume calculation). Based on trauma volume and workflow of ED practice, these algorithms should be employed accordingly. Retrospectively retraining AI algorithms to collect data on secondary outcome endpoints should be a flexible option. Retraining AI for additional primary endpoints allows for improved triaging. Specifically, in patients with intracranial hemorrhages, additional triaging of the ED reading list based on bleed volume and subtype would allow for communication and subsequent timely treatment of patients with the highest potential morbidity or mortality first. Any proposed AI retraining model, though technically sound, has challenges with acquisition of new patient data for retraining.

#### TABLE OF CONTENTS/OUTLINE

Workflow in the ED for suspected traumatic/spontaneous ICH. Where AI algorithms can help in the ED setting. Currently approved 510(k) premarket cleared algorithms for ICH detection. Quantitative evaluation of ICH AI algorithms based on primary and secondary outcomes. Retraining AI algorithms for secondary endpoints: technical logistical challenges. Conclusion. References

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## Abstract Archives of the RSNA, 2023

EREE-46

### Life-Threatening Acute Aortic Lesions Beyond Acute Aortic Syndrome

#### TEACHING POINTS

TEACHING POINTS: - Many potentially severe acute aortic lesions exist beyond the classical spectrum of acute aortic syndrome (AAS).- Life-threatening acute aortic conditions may result from traumatic injuries, iatrogenic lesions, infectious complications or aneurismatic rupture.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS: Aortic lesions can be life-threatening and require immediate medical attention. Imaging techniques play a critical role in the diagnosis because the clinical presentation is variable and nonspecific. Moreover, CT and MRI provide fundamental information for surgical planning. AAS is a well-known medical emergency with high mortality when left untreated. However, it may show an atypical appearance and many other potentially severe acute aortic lesions beyond the classical AAS also demand immediate diagnosis. These include traumatic injuries, iatrogenic lesions, infectious complications and aneurismatic rupture. Significant traumatic injuries are classified as intramural hematomas, pseudoaneurysms and aortic ruptures. Iatrogenic lesions are usually the result of invasive coronary interventions or aortic stent placement. Mycotic pseudoaneurysms are included in the spectrum of infectious aortitis. Ruptured thoracic aneurysms are rarely imaged due to their lethality. Finally, we review atypical presentations of AAS that also need to be considered, such as intimal intussusception or dissection extension into the pulmonary arteries.

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## Abstract Archives of the RSNA, 2023

EREE-47

### Non-Obstetric- Emergencies in Pregnancy: Imaging Pathway, Findings, and Special Considerations

#### TEACHING POINTS

1. Imaging pregnant patients require special considerations and non-ionizing radiation imaging is preferred (US/MRI). However, CT in trauma and acute settings should not be delayed due to concern for radiation. 2. Knowledge of specific non-obstetric pathologies affecting pregnant patients and their imaging appearance is crucial for timely and accurate diagnoses of acute and traumatic conditions. 3. Shared decision making? with the patient is important to weight risks and benefits of imaging tests if time permits.

#### TABLE OF CONTENTS/OUTLINE

1. Review risks and safety of different imaging modalities in pregnancy (dose of fetal radiation and associated risks, iodinated and gadolinium contrast agents). 2. Special considerations when imaging pregnant patients (positioning in scanner, contrast reaction and management, recommendations regarding lead shielding). 3. Trauma imaging in pregnancy: Review imaging pathway and traumatic pathologies at higher risk in pregnant patients (retroperitoneal hemorrhage?, liver, spleen, renal and bladder injuries?). 4. Acute non-traumatic pathologies: incidence and pathophysiology in pregnancy, imaging pathway and findings, for example: (a), Abdomen: Acute cholecystitis, choledocholithiasis, appendicitis, renal stone/urosepsis, bowel obstruction, colitis, (b) Chest: Pulmonary embolism, pneumonia, (c) Neuro: Cerebral venous thrombosis, seizures, stroke, (d) Vascular: Complicated AVM, deep venous thrombosis, arterial occlusion.

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## Abstract Archives of the RSNA, 2023

EREE-48

### Pictorial Review of Orbital Emergencies

#### Participants

Wen Wang, MD, Orlando, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: 1. A simplified anatomic checklist-based approach can enable an emergency radiologist to accurately and efficiently identify acute temporal bone pathology, and this approach will be reviewed in this exhibit. 2. The radiologist plays an important role by identifying key imaging findings and providing diagnoses that can direct treatment by prompting an emergency physician to admit a patient for inpatient management, order a surgical consult, or order further imaging to check for related complications. The absence of these findings are also pertinent negatives that enable clinicians to proceed with treatment in the ED or discharge a patient with outpatient follow-up. 3. This exhibit will review traumatic and acute non-traumatic pathology in a case-based format, with emphasis on key imaging findings that affect management and prognosis.

#### TABLE OF CONTENTS/OUTLINE

I. Relevant anatomic review of the orbit II. Checklist for traumatic and non-traumatic pathology III. Non-traumatic Pathologies: i. Infection Preseptal cellulitis Postseptal cellulitis Dacryocystitis Subperiosteal abscess ii. Non-infectious inflammatory pathology Sarcoidosis Optic neuritis iii. Detachment Retinal detachment Choroidal detachment IV. Traumatic pathologies: i. Fractures Blowout fractures/wall fractures Lefort II and III fractures Naso-orbito-ethmoid fractures Optic canal fracture ii. Penetrating trauma Paint gun injury Gunshot injury

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## Abstract Archives of the RSNA, 2023

EREE-49

### We've Got Your Back: How Radiologists Can Aid Surgical Decision Making By Using the AO Spine Classification System

#### Participants

Andrew Simmerman, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

AO Spine Injury Classification systems offer reliable and clinically relevant morphology descriptions for spinal trauma imaging. Subaxial cervical and thoracolumbar injuries are classified as A: compression, B: tension band/distraction, C: displacement/translational. A B have subtypes. The motion segment is the spine's functional unit, by which tension band and displacement injuries are labeled. Fracture morphology, neurologic signs, and patient factors influence conservative or surgical management. MRI and dynamic radiography help assess for ligamentous injuries. Rigid spines and osteoporosis affect treatment. Cervical spine specifics include facet injury, disc herniation, cerebrovascular injury, and unique ligamentous injuries at the occiput-C1-C2 levels.

#### TABLE OF CONTENTS/OUTLINE

Overview Goals of classification and radiological reporting Spinal bone and ligamentous anatomy Motion segment and tension band concepts Subaxial cervical and thoracolumbar injuries Type A: Compression Type B: Distraction Type C: Translation Type F: Facets (subaxial) Modifiers Indeterminate/incomplete tension band injuries Stiffening and metabolic bone diseases Critical disc herniation Cerebrovascular injury Upper cervical injuries A: Bone-only B: Ligamentous without complete separation C: Translation

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## Abstract Archives of the RSNA, 2023

EREE-5

### Broken Beauty: How Can I Make a Good Interpretation of a Facial Trauma on CT?

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review the facial radiological anatomy and to remember the different systems that organize it.- To propose a systematic approach for the evaluation of the facial bone mass, depending on the functional relationships between the structures.- To know the typical radiological patterns of facial fractures, taking into account some "key ideas" that we must remember, because they sometimes modify the therapeutic management.- To recognize the complications that can be associated with facial fractures depending on their location.- To emphasize the importance of making an useful radiological report for the requesting physician, with an organized description of the fractures.

#### TABLE OF CONTENTS/OUTLINE

1. Radiological facial anatomy: 1.1. Three thirds system: upper (frontal), middle (from upper orbital rim to upper maxilla) and lower (mandible). 1.2. Facial buttress system: there are 4 vertical and 4 horizontal buttresses that emphasize the functional relationships between the different facial bones.2. Systematic assessment of the facial mass: 2.1. Fractures of the upper third (frontal). 2.2. Fractures of the middle third: isolated (e.g, nasoseptal fractures) or complex (le Fort fractures, fractures of the nasal-orbital-ethmoidal complex and fractures of the zygomatic-maxillary complex). 2.3. Fractures of the lower third (mandibular). Within each section, we will discuss typical radiological fracture patterns and "key ideas" to remember.3. Complications that may be associated depending on the affected buttress.4. How to make an adequate radiological report useful for the requesting physician, without falling into the error of making a "shopping list" with the affected bones.

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## Abstract Archives of the RSNA, 2023

EREE-50

### The Role of CT in Non-occlusive Mesenteric Occlusion for Diagnosis, Therapeutic Strategy, and Patient Management

#### Participants

Akitoshi Inoue, MD, PhD, Otsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Non-occlusive mesenteric ischemia (NOMI) is characterized by segmental and skipped bowel ischemia caused by vasospasm without mechanical stenosis in the superior mesenteric artery (SMA). NOMI is a life-threatening condition, and the mortality is high. Even in survival cases, nutrient malabsorption called short bowel syndrome resulting from bowel resection for necrotized small bowel may require lifetime intravenous nutrition. CT depicts spastic SMA and branches and is considered a diagnostic tool instead of invasive angiography. Regarding the bowel, heterogeneous imaging findings, including absent enhancement, hemorrhagic necrosis, pneumatosis, and paper-thin wall appearance, can be observed, which reflects skip-segmental bowel necrosis on macroscopic findings. Additionally, CT plays an essential role in predicting the severity of bowel ischemia and reperfusion as the imaging findings reflect dynamic pathophysiology caused by vasospasms in the superior mesenteric region.

#### TABLE OF CONTENTS/OUTLINE

1. To illustrate the etiology and pathophysiology of NOMI 2. CT image findings in the superior mesenteric artery and branches, and small bowel 3. Challenge to predict the viability of ischemic bowel on CT 4. Case presentation with tips and pitfalls for NOMI 5. Differential diagnosis (mesenteric artery occlusion, mesenteric venous occlusion, strangulated bowel obstruction, and pneumatosis intestinalis) 6. Summary

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## Abstract Archives of the RSNA, 2023

EREE-51

### Where Is the Catheter Tip? Chest Radiograph Findings of Incorrect Placement Comparison With CT and Normal Radiographs

#### Participants

Masafumi Sakai, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In the intensive care unit, catheters and tubes are inserted into patients. Incorrect catheter placement can lead to various complications; detecting incorrect placement on chest radiographs is essential for early intervention and improved patient outcomes. However, incorrect catheter placement is easily overlooked if there is no comprehensive understanding of the three-dimensional anatomy of the chest and correct placement of the catheter on chest radiographs. Furthermore, new devices have also been introduced recently, which radiologists need to be familiar with. The purpose of this exhibit is: 1. To explain chest radiographic findings of incorrect catheter placement correlating with CT and comparison with the normal position. To explain the complications and pitfalls associated with incorrect catheter placement

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Case presentation | Central venous catheter Arterial misplacement Misplacement in small veins (azygos veins, etc.) Catheter fragmentation Pitfalls (vascular anomaly, etc.) | Swan-Ganz catheter Misplacement of the peripheral pulmonary artery (PA). Complications (pseudoaneurysm of the PA) | Subcutaneous implantable cardioverter defibrillator Misplacement in anterior mediastinum | Endotracheal tube One-lung ventilation Pitfalls (tube tip shifts in accordance with neck flexion and extension) | Chest tube Misplacement in the interlobar fissure Misplacement in the lung | Epidural catheter Misplacement outside the epidural space | Etc. 3. Summary 4. Conclusion

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## Abstract Archives of the RSNA, 2023

EREE-52

### Dual Energy CT in Acute Inflammatory and Infectious Processes of the Head and Neck. The 4 P: Protocols, Post-processing, Pearls and Pitfalls

#### Participants

Paloma Puyalto, PhD, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Dual energy CT (DECT) images combine data from a wide range of energy acquisitions without impacting patient dose. In contrast to single energy CT (SECT), which uses only energy around 70 keV, virtual monochromatic images (VMI) can be reconstructed at any level of energy within a 40-150 keV range. Lower energies allow better delimitation of inflammatory tissue enhancement although this increases image noise ratio. Higher energies enable the virtual subtraction of iodine contrast, which improves calcium identification and reduces metallic artifacts. Material decomposition maps allow better identification of neck abscesses. The main purposes of this exhibit are: 1- To describe the DECT image acquisition protocols and post-processing methods. 2- To illustrate DECT findings and main tips in head and neck inflammatory and infectious diseases within different locations and its SECT correspondence. 3- To outline the differential diagnosis, potential pitfalls in DECT, and how to avoid them.

#### TABLE OF CONTENTS/OUTLINE

1-DECT protocol. 2-Post-processing techniques (VMI and material decomposition maps). 3-Case-based image examples of DECT and SECT correspondence for ears, orbits, paranasal sinuses, salivary glands, dental, pharyngeal, and para-pharyngeal mucosal inflammatory and infectious processes. 4- Pearls, pitfalls, and differential diagnosis in DECT images.

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## Abstract Archives of the RSNA, 2023

EREE-53

### At Arm's Length: Upper Extremity CT Angiography and Neurovascular Pathology

#### Participants

Andrew Sinensky, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Upper extremity (UE) vascular pathology can be conceptualized anatomically: the shoulder, arm, elbow, forearm, and hand. 2) CT angiography (CTA) and digital subtraction angiography (DSA) play a vital role in diagnosis and management of acute neurovascular pathology. 3) The thoracic outlet is the neurovascular outflow of the UE; thoracic outlet syndrome (TOS) results as the consequence of disruption of this outflow. 4) Non-traumatic vascular pathology of the UE is less common than lower extremity pathology and is often thromboembolic or anatomic in etiology. 5) Trauma of the UE has classic artery/nerve injury pair associations, such as at Guyon's canal (ulnar artery + nerve) and the mid-humerus (deep brachial artery + radial nerve).

#### TABLE OF CONTENTS/OUTLINE

1) UE Anatomy A) Arterial B) Venous C) Brachial plexus D) Thoracic outlet 2) CTA and DSAA) Technical considerations B) Pitfalls 3) Other Modalities A) Ultrasound B) MR 4) Atraumatic A) Central (thromboembolic, aortic dissection) B) Peripheral (atherosclerosis, aneurysm/pseudoaneurysm, vasospasm) C) External compression (TOS, quadrilateral space syndrome) D) Systemic (vasculitis, connective tissue disorders) E) Dialysis grafts and fistulas 5) Blunt and Penetrating Trauma A) Vascular injury (pseudoaneurysm, arteriovenous fistula, laceration) B) Neurologic injury (transection, compression) C) Neurovascular injuries by region (shoulder, arm, forearm, elbow, wrist, hand) 6) Management A) Surgical B) Endovascular C) Post-operative imaging considerations D) Complications

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## Abstract Archives of the RSNA, 2023

EREE-54

### Imaging Spectrum of Extremity Vascular Emergencies: CTA-Angiographic Correlation

#### TEACHING POINTS

1) To discuss the common mechanisms for traumatic and non-traumatic peripheral vascular emergencies as well as their management 2) Differentiate pertinent imaging features of traumatic and non-traumatic peripheral vascular emergencies 3) To juxtapose CT angiography and conventional angiographic findings for each etiology

#### TABLE OF CONTENTS/OUTLINE

1) Basic mechanisms of vascular injury 2) The advantages and drawback of CTA compared to conventional angiography in the setting of traumatic vascular injury 3) Common imaging features and clinical signs that suggest vascular emergency 4) CT angiographic and conventional angiographic correlation for several traumatic peripheral vascular emergencies -Laceration - Transection -Intramural Hematoma--Arteriovenous Fistula -Vasospasm -Intimal Dissection -Pseudoaneurysm -Thrombosis 5) CT angiographic and conventional angiographic correlation for several non-traumatic peripheral vascular emergencies -Embolism - Vasculitis -Acute DVT -May Thurner's Syndrome—Vessel Entrapment 6) Discussion of each etiology's pertinent imaging, clinical features, as well as their management

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## Abstract Archives of the RSNA, 2023

EREE-55

### Ischemic Bowel: A Challenging Imaging Diagnosis

#### TEACHING POINTS

-Briefly examine the epidemiology and common causes of ischemic bowel (IB) disease.-Master anatomic and morphologic imaging findings of IB on CT.-Understand recommendations for additional imaging to increase diagnostic certainty, including the utility of arterial phase or multiphase CT imaging.-Learn indications for surgical vs. nonsurgical management of IB and the role of the radiologist in guiding management.

#### TABLE OF CONTENTS/OUTLINE

CT is the preferred imaging technique for diagnosing ischemic bowel, as it outperforms laboratory and physical exam findings in reliability and accuracy. However, CT may only detect nonspecific signs of mesenteric ischemia, bowel dilatation, bowel wall thickening, bowel obstruction, mesenteric edema, mesenteric stranding, mesenteric vascular engorgement, and ascites. In this exhibit, we review the causes of IB including vascular (thrombosis, embolism, vasculitis), anatomic (volvulus, neoplastic), and systemic (hypoperfusion). Each diagnosis is accompanied by multiple CT cases highlighting specific and subtle imaging findings with a focus on imaging findings which alter management. Follow-up via imaging (CT angiography, MRI, MR angiography) or intervention (colonoscopy, surgical, catheter based) are reviewed with multimodality cases. Timely and accurate diagnosis of IB is crucial for guiding management, preserving bowel viability, and reducing morbidity/mortality and the radiologist is central in this clinical cascade.

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## Abstract Archives of the RSNA, 2023

EREE-56

### The Diagnostic Ability of Postmortem Imaging for the Cause of Death

#### Participants

Yu Nakaki, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Postmortem imaging is widely used to identify the cause of death. Although postmortem imaging can help to determine the cause of death, its diagnostic ability depends on the subject and the methodology applied. In >65% of cases, postmortem CT (PMCT) is useful for identifying the cause of unnatural deaths because traumatic changes can be detected. On the other hand, since cardiac disease, e.g. myocardial infarction, lethal arrhythmia, and pulmonary thromboembolism cannot be diagnosed by PMCT, it is useful in only 40-50% of natural deaths. Therefore, contrast-enhanced PMCT and postmortem MRI (PMMRI) have been introduced. We describe the diagnostic ability of postmortem imaging, demonstrate the causes of deaths that can be diagnosed by postmortem imaging, and alert to interpretation pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Diagnostic ability of PMCT for •Unnatural deaths •Natural deaths 2. Diagnostic ability of contrast-enhanced PMCT 3. Diagnostic ability of PMMRI 4. Causes of death that can be diagnosed by postmortem imaging •Aortic dissection •Aortic aneurysm rupture •Sub-arachnoid hemorrhage •Cerebral hemorrhage •Gastrointestinal bleeding/occlusion/perforation •Pulmonary thromboembolism 5. Pitfalls of postmortem imaging

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## Abstract Archives of the RSNA, 2023

EREE-57

### Obstetric Ultrasound: What Not to Miss for the ER Radiologist

#### TEACHING POINTS

1. Obstetric ultrasound is an excellent tool to assess maternal, fetal, and placental parameters in all trimesters due to its noninvasive nature, ease of availability, portability, and lack of ionizing radiation. It is the first-line method used in the evaluation of pregnant patients. 2. Transvaginal ultrasound is an excellent modality in the first trimester for adequate characterization of fetal abnormalities. 3. The focus of second and third trimesters should be on the evaluation of fetal viability and potentially life-threatening abnormalities.

#### TABLE OF CONTENTS/OUTLINE

1. Normal pregnancy parameters to look for in emergent obstetric ultrasounds. 2. Classification of obstetric emergencies by maternal, fetal, and placental anomalies. 3. Maternal abnormalities. a. First trimester. Ectopic pregnancy. 1. Adnexal. 2. Abdominal. Interstitial and cervical implantation. iii. Molar pregnancy. b. Second and third trimesters. i. Uterine dehiscence/rupture. ii. Cervical and adnexal abnormalities. 4. Fetal abnormalities. a. First trimester. Major fetal structural abnormalities. ii. Nonviable pregnancy. b. Second and third trimesters. i. Fetal hemorrhage. ii. Amniotic fluid abnormalities. iii. Doppler abnormalities. 5. Placental abnormalities. a. Placenta Previa. b. Placental abruption. c. Vasa Previa. d. Placenta accreta spectrum. 6. Pitfalls in the diagnosis of common obstetric emergencies. a. Corpus luteal cyst vs Ectopic pregnancy. b. Post C-section changes vs uterine dehiscence. c. Placenta previa vs contraction.

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## Abstract Archives of the RSNA, 2023

EREE-58

### An Approach to Lateral Shoulder Impact Injuries: What the Radiologists Need to Know

#### Participants

Michael Lee, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the normal anatomy of the shoulder using radiographs. 2. Varying injuries can be sustained from lateral shoulder impacts (LSIs), including soft-tissue and osseous injuries. 3. Systematic approach for LSIs is essential to avoid missing injuries. 4. Dual-energy computed tomography (DECT) can be used to support the radiological evaluation of LSI injuries. The shoulder girdle is often injured and requires imaging in lateral impacts (e.g. in sports or pedestrian impacts), and can account for up to 4% of emergency department visits. Injuries may involve the clavicle, humerus, scapula, rotator cuff muscles, and the acromioclavicular and glenohumeral joints. To increase diagnostic accuracy, systematic search patterns are often utilized by radiologists. A systematic approach to common injuries encountered in LSIs may be useful for radiologists and trainees who evaluate acutely presenting patients.

#### TABLE OF CONTENTS/OUTLINE

1. Disclosures 2. Learning Objectives 3. Shoulder Anatomy and Stability 4. Clavicular Fractures 5. Acromioclavicular Fractures 6. Scapular Fractures 7. Proximal Humeral Fractures 8. Anterior Shoulder Dislocations 9. Dual-Energy CT in LSI 10. References

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## Abstract Archives of the RSNA, 2023

EREE-59

### A Technical Perspective on CT Perfusion Pitfalls and Roadmap for Troubleshooting

#### Participants

Ahmed Moawad, MD, Darby, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Illustrate the acquisition protocols for CTP in stroke patients- Introduce the perfusion parameters and thresholds for identifying core infarction and penumbra- Highlight different image processing algorithms- Demonstrate workflow for post processing software- Case based review of technical pitfalls of CT perfusion processing and acquisition

#### TABLE OF CONTENTS/OUTLINE

\* Introduction about acquisition of CTP and its parameters\* Diagnostic criteria for stroke/penumbra and threshold for each parameter \* Different types of image processing: Maximum slope technique and Deconvolution. \* General workflow for automated post-processing software.\* Technical pitfalls during acquisition:# Patient motion- Effect of patient interscan motion on image registration.- Streak artifact as a result of intrascan motion- Motion correction algorithms. # Head position- Perfusion asymmetry due to head tilt\* Types of technical pitfalls in CTP processing:# Different CT perfusion thresholds for infarction.# Image alignment and registration pitfalls- Skull stripping and brain segmentation algorithm # Arterial inflow (AIF) selection pitfalls.- Arteries to use as input Criteria of correctly selected AIF- Troubleshooting AIF selection # Region of interest (ROI) selection pitfalls- Optimum position of the venous ROI- Troubleshooting ROI selection.# Time attenuation curves (TAC) pitfalls- Normal characteristics of the TAC- Bolus arrival time and first moment time- Curve Truncation

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## Abstract Archives of the RSNA, 2023

EREE-6

### Black Belts, Bruises, and Breaks: A Radiological Journey Through the Brutal World of Martial Arts Injuries

#### TEACHING POINTS

1. As the popularity of martial arts rises, injuries increase. Radiologists must recognize common and uncommon injuries associated with specific fighting disciplines. 2. Martial arts can be categorized as striking versus grappling. Understanding differences in movements and mechanisms can predict injury patterns. 3. Head and limb injuries commonly occur during striking, while joint and spine injuries are often seen with grappling. 4. Experience, age, and setting are important considerations.

#### TABLE OF CONTENTS/OUTLINE

Striking: Muay Thai/ Taekwondo/ Boxing Head Skull (strikes score points) Mandible/orbit fractures and dislocations Spine Cervical sprains/strains (clinch technique) Torso Rib fractures, solid organ injury (SOI) Upper Extremities Fractures/dislocations/ligament injuries/bursitis (blocking kicks/punching hard surfaces/overuse) Lower Extremities Fractures/soft tissue/ligament injuries (repeated high kicking/kicking hard surface/rotation+jumping) Grappling: Judo/ Brazilian Jiu Jitsu/ Wrestling Head Auricular hematomas (friction) Spine Fractures/subluxations/disc herniations (hyperextension/throw injuries) Torso Pectoralis major rupture (hyperextension) Upper Extremity Dislocation/fractures/ligament tears (Kimura/fingers blocked in the swell of the Kimono) Lower Extremity Meniscus/ligament tears/bursitis (Osotogari/footlock)

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## Abstract Archives of the RSNA, 2023

EREE-60

### **Beyond Bones on the Trauma Spine CT: Critical Injuries in the Nonfractured Spine; a Case-based Review of Subtle But Important Nonosseous Findings the Neurosurgeon Needs to Know**

#### **Participants**

Brad Wright, PhD,MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

\* A trauma spine CT that is negative for fracture may have subtle but important traumatic findings that should prompt an MRI for further workup, because they may require surgical intervention. These findings include signs of unstable ligamentous injury and signs of potential cord compression. \* Widening of an anterior disc space suggests an unstable hyperextension injury, with rupture of the anterior longitudinal ligament.\* Widening of an interspinous distance suggests an unstable hyperflexion injury, with rupture of the posterior ligamentous complex.\* Widening of one or both atlantooccipital joints and widening of one or both C1-C2 facet joints suggests atlantooccipital subluxation and atlantoaxial subluxation, respectively, with capsular injury and potential injury to other ligaments.\* Although spinal epidural hematomas and disc herniations are better evaluated on MRI, they can often be identified on CT, especially if they are large and more likely to require surgery.

#### **TABLE OF CONTENTS/OUTLINE**

\* Introduction\* Hyperextension injuries\* Hyperflexion injuries\* Atlantooccipital and atlantoaxial subluxation\* More obvious malalignment (with fractures): distraction injuries and dislocations\* Spinal epidural hematoma and disc herniation

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## Abstract Archives of the RSNA, 2023

EREE-61

### Mesenteric Pathologies in Emergency Imaging

#### Participants

Christian Gomez, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Describe the anatomy of the peritoneum, mesentery and omentum.-Review mesenteric pathologies in a systemic approach with multi-modality imaging.-Differentiate commonly encountered mesenteric pathologies according to imaging and clinical characteristics.-Understand which mesenteric pathologies require follow-up or acute intervention.

#### TABLE OF CONTENTS/OUTLINE

Mesenteric abnormalities are often encountered during emergency imaging. The imaging findings are often nonspecific and encompass a wide range of pathologies. In this exhibit, we review a spectrum of diseases with key imaging and clinical findings. We also highlight patient symptomology, key diagnostic features, potential acute complications, and follow up recommendations. This exhibit will review the anatomy of the peritoneal cavity, mesentery, omentum, and the peritoneal fluid circulation. Pathologies discussed include:-blunt and penetrating trauma?-secondary infiltration of the mesentery from edema or bowel inflammation?-varying stages of sclerosing mesenteritis?-sclerosing encapsulating peritonitis?-tuberculosis; omental infarct ?-primary and secondary mesenteric malignancies - carcinoid, dermoid, lymphoma, metastases, carcinomatosis, primary mesenteric mesothelioma, desmoplastic round cell, GIST, and mesenteric paraganglioma ?-cystic lesions - pseudomyxoma peritonei, inclusion cyst, duplication cyst, lymphangioma, and pseudocyst.

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## Abstract Archives of the RSNA, 2023

EREE-62

### 10 Points That Force You to Think About Intraabdominal Compartment Syndrome

#### Participants

Almudena Gil Boronat, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) 2. Role of body CT in evaluation abdominal compartment syndrome

#### TABLE OF CONTENTS/OUTLINE

Background: Revision of intra-abdominal hypertension and intra-abdominal compartment syndrome. • Definition • Risk factors • Recognition of suspicious clinical situation and analytical findings Identification of characteristic CT features associated with IAH and ACS. • Determining the etiology • To describe the standardized measurements used in CT to radiologically suggest the diagnosis • To propose 10 key points to not miss the diagnosis • Limitations of CT Algorithm for diagnosis of this entity and management of the patients. Conclusion Bibliography.

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## Abstract Archives of the RSNA, 2023

EREE-63

### Computed Tomographic Angiogram (CTA) of the Upper Extremities

#### Participants

Richard Tsai, MD, St. Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: With the advancement of cross-sectional imaging and sub-mm isotropic data acquisition, computed tomographic angiography (CTA) has become an excellent non-invasive diagnostic tool for the evaluation of the upper extremity vasculature. CTA is able to evaluate for vessel patency, irregularity, and achieve the anatomic detail needed in pre-operative planning. It is generally performed in the setting of trauma, but can also be used to evaluate other causes and sources of acute limb ischemia, and vasculitides. In this review, the normal vasculature and common anatomic variations will be presented, with a focus on trauma, acute limb ischemia, and vasculitis.

#### TABLE OF CONTENTS/OUTLINE

This exhibit is on the RadioGraphics Needs List under Emergency Radiology: Upper extremity CT angiography. This exhibit will: 1) Discuss the imaging technique and rationale for upper extremity CTA 2) Illustrate normal anatomy and commonly encountered anatomic variants 3) Illustrate the utility of upper extremity CTA for the evaluation of trauma, vasculitis, acute limb ischemia, and pre-operative planning 4) Describe pitfalls in interpretation of upper extremity CTA  
Outline: Normal anatomy and common anatomic variants  
Imaging protocols and interpretation  
Pitfalls: -Streak (instrumentation, contrast bolus on ipsilateral side)-Motion-Outrunning the bolus  
Trauma: -Occlusion-Vasospasm-Active extravasation-Pseudoaneurysm-Arteriovenous fistula  
Acute limb ischemia: -Thromboembolism-Stents and complications  
Vasculitis: -Takayasu's-Buerger's-Scleroderma/CREST syndrome

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## Abstract Archives of the RSNA, 2023

EREE-64

### CT of Knee Fractures and Dislocations in Adults: Diagnosis, Grading, and Management Implications

#### Participants

David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. CT is indicated for any distal femur fracture with possible articular involvement, due to easily missed coronal plane (Hoffa) fractures which displace further if unrecognized. 2. Patellar comminution associated with transverse fracture is often missed without CT, leading to potential loss of fixation with tension band wiring. Low profile 3D matrix/basket plates are increasingly used for patellar fractures shown to be comminuted at CT. 3. Patella baja is common with early severe osteoarthritis in patients with partial patellectomy for severely comminuted inferior pole fractures. 4. Medial tibial plateau fractures are complex injuries often reflecting fracture dislocation with associated ACL and lateral collateral ligament damage and dislocation of the rest of the plateau from the femur. 5. The PTA (posterior tibial slope) and mTPA (medial tibial plateau) angles can be used to determine side of compression for primary plating.

#### TABLE OF CONTENTS/OUTLINE

1. Contemporary CT imaging utilization for high-energy fractures- includes comparison with x-ray and MRI  
2. Distal femur.  
i. classification- AO/OTA system  
ii. Patterns of injury/biomechanics  
iii. CT for surgical approach and hardware selection  
iv. Complications  
3. Patella.  
i. classification- AO/OTA and its limitations  
ii. Patterns of injury/biomechanics  
iii. CT for surgical approach and hardware selection  
iv. Complications  
4. Tibia.  
i. classification- Schatzker and 3 column concept (Luo)  
ii. Patterns of injury/biomechanics  
iii. CT for surgical approach and hardware selection  
iv. Complications  
5. Conclusion/summary

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## Abstract Archives of the RSNA, 2023

EREE-65

### What You Should Know to Improve the Quality of Contrast-enhanced CT Under ECMO?

#### Participants

Fuyuki Washizuka, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To learn about hemodynamics when using extracorporeal membrane oxygenation (ECMO). To understand the relationship between the degree of residual native ejection fraction and the flow rate in the ECMO system when using veno-arterial ECMO (VA-ECMO). To learn about contrast-enhanced CT precautions and contrast methods under the use of ECMO. To learn the pitfalls of contrast-enhanced CT when using veno-venous ECMO (VV-ECMO). To learn how to ensure contrast-enhanced CT under more complex assisted circulation.

#### TABLE OF CONTENTS/OUTLINE

A. Changes in blood flow over time during VA-ECMO use. B. ECMO is divided into two categories, with VA-ECMO subdivided into three according to left ventricular ejection fraction (LVEF) and ECMO flow rate. C. Tips for successful contrast-enhanced CT in special hemodynamic situations when using VA-ECMO. D. Secrets to ensure successful contrast-enhanced CT when using VV-ECMO.

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## Abstract Archives of the RSNA, 2023

EREE-66

### A Hidden Killer: Abdominal Pseudoaneurysms and Their Diagnostic Challenge

#### Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the pathophysiology and etiological spectrum of visceral pseudoaneurysms, as well as their potential complications that can lead to urgent abdominal pathology. To define the radiological findings that guide the diagnosis of a pseudoaneurysm and its complications in the different imaging tests.

#### TABLE OF CONTENTS/OUTLINE

Pseudoaneurysms are abnormal focal dilations of the arterial vessels, generally produced by a disruption of the arterial wall that conditions the passage of blood through it, but remaining contained by the tunica adventitia or the perivascular soft tissues (unlike true aneurysms consisting of focal arterial dilations formed by all layers of the arterial wall). Among the possible causes of arterial wall damage that originates pseudoaneurysms are inflammatory processes, trauma, and iatrogenesis due to invasive procedures. Abdominal visceral pseudoaneurysms can develop a series of complications that entail high morbidity and mortality, generally divided into two large groups: those derived from compression phenomena of adjacent structures due to mass effect, and those derived from aneurysm rupture with bleeding into different spaces and structures. Through this work we will carry out an orientation to the radiological management of pseudoaneurysms and their complications, reviewing the typical findings described in the literature and illustrating them with several cases from our hospital.

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## Abstract Archives of the RSNA, 2023

EREE-67

### Body MRI in Acute Abdomen: Primer for the On-call Radiologist and Case Based Review

#### Participants

Ashlesha Udare, MBBS, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To evaluate the appropriateness of Body MRI in acute abdomen.-To understand the importance of abbreviated protocols in an emergency setting.-To know the typical and atypical imaging features of various acute abdominal emergencies and the appearance of incidental emergent findings via a case-based review.

#### TABLE OF CONTENTS/OUTLINE

Acute Abdomen: When to do MRI?: Iodinated contrast contraindication-Renal insufficiency. History of serious contrast allergy.Failed contrast-enhanced study.Pregnancy-SAR, localiser planning.Problem-solving tool-Clinical Vs CT/US mismatch-Get a "better look!". ACR appropriateness guidelines.Technical Pearls for Body MRI in acute conditions: Micro-protocolling, monitoring scans, fast sequences, safety concerns.Case-based review of various acute abdomen Body MRIs: Gastro-intestinal emergencies (appendicitis, cholecystitis, cholangitis, diverticulitis, hepatic pyogenic abscess). Acute gynaecological conditions (ovarian torsion, massive ovarian edema, tube-ovarian abscess, fibroid degeneration, hemorrhagic cyst, ruptured ovarian cystic lesion) Acute pregnancy related cases (Ectopic pregnancies, placental abnormalities). Acute genito-urinary cases (Pyelonephritis/renal abscess, peniletrauma, scrotal trauma, epididymis-orchitis, priapism) Musculoskeletal injuries presenting as acute abdomen (core muscle injuries, abdominal wall hernias/hematomas, avulsion injuries). Cardiovascular cases (acute aortic syndromes, PE). Miscellaneous: Post-intervention, Post-transplant (renal vein thrombosis, GVHD), Oncological emergencies (ruptured HCC, SVC syndrome). Incidental emergent findings (pneumoperitoneum, hemoperitoneum)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

EREE-7

### Uncoupling the Forefoot From the Midfoot: Experience and Review of Lisfranc Injuries

#### Participants

Victor Rodriguez-Laval, MD, PhD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the anatomy of the Lisfranc ligament complex and its importance. To review the most prevalent injury mechanisms, classifications, and treatment options. To present the X-ray and CT findings in the emergency room, surgical procedures and post-treatment imaging.

#### TABLE OF CONTENTS/OUTLINE

We reviewed the Lisfranc injuries over the previous ten years in our institution and chose the most representative cases. The normal and pathologic anatomy will be highlighted using a multimodality approach that includes plain radiographs, CT with 3D reconstructions. A case-based methodology will be used to cover the whole spectrum of injuries, from Lisfranc ligament sprains to homolateral and divergent fracture-dislocation type injuries, and this will be followed by additional discussion. Also, a brief overview of typical classification schemes, operation approaches, gradation of injury, and postoperative imaging will be presented. It is important to understand the anatomy and injury pattern to be able to diagnose Lisfranc injuries because a delay on the diagnosis increases the risk for midfoot instability, deformity and debilitating osteoarthritis. Given the often subtle initial radiographic findings, maintaining a high index of suspicion with a low threshold to obtain supplemental imaging is key in reducing miss rates. As Lisfranc injuries comprise only a small fraction of overall foot injuries, a periodic review of the salient imaging findings is essential.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

EREE-8

### Acute Large Bowel Diverticulitis: A Pictorial Review

#### TEACHING POINTS

Acute large bowel diverticulitis is a common reason of emergency department visits and when complicated it may end up in urgent gastrointestinal surgery. Computer tomography (CT) remains as the primary diagnostic tool in the diagnosis and staging of acute diverticulitis and its complications. Our radiologic report is essential for the surgeon to establish a treatment and to determine an outcome as well as for the exclusion of alternate causes of pathology. We recommend using international diverticulitis staging classifications (as WSES Classification or modified Hinchey classification) to improve our communication with surgeons. In this educational communication, we aimed to illustrate the key CT imaging features of diverticulitis and its complications including perforation, phlegmon, abscess, ascending septic thrombophlebitis (phylephlebitis), bleeding, intestinal obstruction, and fistula.

#### TABLE OF CONTENTS/OUTLINE

Introduction, Reporting CT findings, Anatomy check, Complications, To take home notes

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

EREE-9

### Imaging the Acute Complications of Gender-Affirming Surgeries: A Primer in the Emergency Radiology Setting

#### Participants

Siddhi Hegde, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Gender-affirming surgeries (GAS) and their complications are critical for radiologists to understand. GAS is often tailored to the patient; there is a diverse spectrum of post-operative appearances and complications. Typical postoperative anatomy may imitate pathology if not identified correctly. Radiologists' diagnostic expertise, knowledge of institutional GAS and common complications, and their ability to collaborate with multidisciplinary clinical team, enables them to offer valuable insights on institutional practices and guide appropriate next steps for complications. We will highlight the diagnostic features of the acute complications that may arise following gender-affirming surgeries and provide an overview of the ideal workup in the acute setting.

#### TABLE OF CONTENTS/OUTLINE

Describe expected imaging appearance of post-GAS neoanatomy, including common terminology Review multi-modality emergent imaging [ultrasound, plain film, retrograde urethrogram (RUG), Computed Tomography (CT)] review of common and "can't miss" complications Neourethral- anastomotic leaks, diverticula, fistulae, stenoses/strictures Transmasculine prostheses/device/implant - abscess, hematoma, malpositioning Bladder or rectal injury after vaginectomy (leading to fistulae) Postoperative bleeding Silicone emboli Providing gender-affirming care during imaging and reporting Understand ideal workup and unique imaging protocol considerations Discuss pitfalls of imaging in the acute setting, pearls for long-term follow-up

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE

### Gastrointestinal Imaging Education Exhibits

#### Sub-Events

**GIEE-1 A Deep Dive into Essential Predictive Imaging Features of Abdominal Neoplasms in the Era of Personalized Therapy: Insight into the Correlation with Pathological, Molecular, and Genetic Background**

#### TEACHING POINTS

Recognizing imaging findings regarding the tumor microenvironment and molecular function of abdominal neoplasms is not only the key to appropriate diagnosis, but also to early prediction of treatment options and response to various therapies. This exhibit aims to provide a better understanding of the essential predictive imaging findings of abdominal neoplasms in correlation with their pathological, molecular, and genetic background, which has the potential to lead to personalized treatment strategies in the coming era.

#### TABLE OF CONTENTS/OUTLINE

The treatment options for abdominal malignancies have become more diverse with advances in surgery, chemo and immunotherapy, making pre-treatment risk stratification even more important. Radiologists are now required not only to diagnose but also to predict the prognosis and efficacy of treatment based on images, and to contribute to the selection of appropriate treatment. Understanding of predictive imaging findings can also help us to speculate upon the tumor microenvironment, which might be required in the future. We summarize these imaging findings for the following neoplasms; (i)HCC, (ii) Liver metastases from colorectal cancer, (iii) Pancreatic cancer, (vi) Intrahepatic cholangiocarcinoma. We also focused on the application of these findings to treatment strategies for each abdominal malignancy to explore the usefulness of these predictive findings in the era of personalized treatment.

#### GIEE-10 Fibropolycystic Liver Disease: An MRI Review with Pearls and Pitfalls

Participants

Jordan LeGout, MD, Ponte Vedra Beach, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fibropolycystic liver disease comprises a spectrum of interrelated conditions that range from congenital hepatic fibrosis to choledochal cysts. In this exhibit we will: -Review the MRI appearance of the various fibropolycystic liver diseases and associated conditions-Highlight imaging pitfalls using real errors encountered in clinical practice-Introduce imaging pearls for the various conditions that can help arrive at the correct diagnosis-Differentiate between those conditions that are benign and incidental and those that pose risk for development of malignancy

#### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Congenital hepatic fibrosis a. Pearl: Liver morphology, segment IV hypertrophy b. Pitfall: FNH-like lesionsIII. Biliary hamartomas a. Pearl: Use high b-value diffusion to uncover lesions b. Pitfall: Polycystic liver disease, infiltrative malignancyIV: Peribiliary cysts a. Pearl: Anatomic sequences over MRCP b. Pitfall: PSCV. Polycystic liver disease a. Pearl: Use subtraction imaging b. Pitfall: Mucinous cystic neoplasmVI. Caroli Disease/Syndrome a. Pearl: Different degrees of involvement (diffuse vs. segmental) b. Pitfall: Recurrent pyogenic cholangitis VII. Choledochal cysts a. Review appearance of subtypes b. Pearl: Field defect and risk for cholangiocarcinoma c. Pitfall: Age related and cholecystectomy related ductal dilation

#### GIEE-100 Post-neoadjuvant MRI Changes and Challenges in Rectal Adenocarcinoma: What to Look for

Participants

Mayra V. Soares, MD, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the pivotal role of MRI in the post-neoadjuvant restaging of rectal cancer.To highlight the main imaging changes in post-neoadjuvant MRI, which reflect histopathologic changes that may occur after chemoradiation treatment.To recognize how fibrosis or increased mucin production, addressed by high-resolution MRI, impacts risk stratification post-neoadjuvant therapy.To learn about some challenges in MRI morphological and DWI evaluation regarding new treatment optionsUnderstand the role of radiologists as part of patient care, helping to enroll patients eligible to "watch-and-wait" programs.

#### TABLE OF CONTENTS/OUTLINE

Introduction:Primary tumor and nodal assessment with MRI.Rectal cancer treatment guidelines overview.When neoadjuvant treatment is the best approach.Neoadjuvant treatment options: CRT x TNT.Recognizing tumoral changes after CRT Posttreatment changes in the primary tumor - a systematic approachTumor Restaging: a response classification based on histopathologic and DWI changesPatterns of tumor responseMRI tumor regression grades - a risk stratification incomplete/poor x "near-complete"/complete responders"Watch-and-wait": patient selection and current controversies.Immunotherapy - the new kid on the blockFuture considerations: potential biomarkers in rectal cancer and game-changer?Conclusion.

## **GIEE-101 Getting Started in Bariatric Surgery Imaging: Postoperative Anatomy and Complications**

### **TEACHING POINTS**

Review postoperative anatomy changes in bariatric procedures. Discuss the approach to postoperative evaluation. Identify imaging findings of common bariatric surgery complications.

### **TABLE OF CONTENTS/OUTLINE**

Background. Eligibility criteria. Types of bariatric surgery and techniques. Postoperative evaluation. Cased based review of common postoperative complications. Imaging findings in weight regain and insufficient weight loss after bariatric surgery.

## **GIEE-102 Principles and Clinical Applications of Dual-layer Spectral CT in Gastrointestinal Imaging**

Participants

Chiara Spasiano, Vedano Al Lambro, Italy (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To summarize the fields of application of Spectral-CT technology and define the actual advantages and benefits in clinical imaging, derived from recent literature review.

### **TABLE OF CONTENTS/OUTLINE**

Dual-energy computed tomography (DECT) or spectral-CT is an advanced CT that acquires data at different energy levels to enhance material differentiation and tissue characterization. Conventional CT utilizes a polychromatic beam, but energy levels are not separated in image generation while in a dual-layer detector, the thinner top layer measures low-energy photons, and the thicker bottom layer measures high-energy photons. Complex material decomposition algorithms are used to generate images for routine clinical interpretation or for more advantage material characterization, including virtual non-contrast (VNC), iodine maps, and effective atomic number, as well as virtual monochromatic image sets, from 40 to 200keV. The most common use has been characterizing urinary calculi (different composition), gallstones (isoattenuating to bile on conventional CT), detection and correct definitions of incidental cystic lesions. While added value of multi-energy CT in body imaging include: characterization of incidental lesions (very common event in body imaging), iodine detection and subtraction (possibility to reconstruct several Iodine-Map, at monoenergetic images, both with Low and High energy levels), assessment of tissue perfusion (using organ iodine distribution as surrogate of perfusion, especially in pulmonary embolism), contrast dose reduction, tissue characterization, and finally the possibility to decrease the number of scan.

## **GIEE-103 Beyond TNM Staging System: Evaluation of Colon Cancer Prognostic Factors by CT and MRI**

### **TEACHING POINTS**

To review the diagnostic accuracy of CT and MRI for staging colon cancer. To define locally advanced colon tumors. To enumerate colon cancer prognostic factors and critical information that should be present in radiological reports in this context.

### **TABLE OF CONTENTS/OUTLINE**

1 - Anatomic considerations of colon and retroperitoneal surgical margin 2 - TNM Staging of colon cancer 3 - Colon cancer prognostic factors (primary tumor extramural extension, retroperitoneal surgical margin involvement, extramural vessel invasion, and lymph node metastases) 4 - Locally advanced colon tumors 5 - Current treatment of colon tumors 6 - Promising treatment (neoadjuvant systemic therapy) 7 - Role of imaging in stratification of patients with colon cancer according to their risk group, contributing to better patient selection and optimization of colon cancer treatment

## **GIEE-104 Gastrointestinal Neuroendocrine Neoplasms, Imaging, Pathology, Classification and Management: 2023 Update**

Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Gastrointestinal (GI) neuroendocrine neoplasms (NENs) are rare heterogeneous epithelial tumors with characteristic histological, and biological behavior. 2. The most recent WHO 2019 classifies NENs into well-differentiated (G1-G3) and poorly differentiated neuroendocrine carcinomas (NECs). Numerous studies have been published since then describing the effectiveness of this classification, diagnostic implications, and management. 3. Most often clinical, imaging and molecular features have to be integrated in order to appropriately correlate with pathologic classification, particularly to differentiate between G3-NET and NECs. As the tumor grade progresses the FDG-PET is more likely to be useful rather than DOTATE-PET which correlates with a poorly differentiated grade (NEC). The NETPET scoring system based on dual-tracer imaging can help better characterize well-differentiated metastatic NET lesions. 4. Surgery remains the mainstay of treatment for locoregional GI-NENs. Treatment of G3-NENs includes peptide receptor radionuclide therapy (PRRT), Somatostatin analogs, Everolimus, or sunitinib. Everolimus is an mTOR inhibitor while Sunitinib malate inhibits multiple receptor kinases such as VEGFR and PDGFR. Platinum-based chemotherapy with cisplatin/carboplatin and etoposide/irinotecan is recommended for patients with poorly-differentiated NECs

### **TABLE OF CONTENTS/OUTLINE**

1) Background, 2) WHO 2019 classification of the NENs, 3) 2023 Imaging update with emphasis on molecular techniques and NETPET Scoring, 4) Update on the management of NENs with emphasis on medical treatment, 5) Conclusion.

## **GIEE-105 Tricks and Pitfalls of Multi-parametric MRI Restaging of Rectal Cancer After Preoperative Chemoradiotherapy**

Participants

Giovanni Sussan, MD, Padova, Italy (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To describe the MRI protocol for rectal cancer evaluation after preoperative chemo-radiotherapy (pCRT), dealing also with the



debated practices<sup>2</sup>. To describe the correct evaluation and the most common pitfalls of T staging after chemoradiation, using both DWI and contrast-enhanced sequences<sup>3</sup>. To describe the correct evaluation and the most common pitfalls of N staging after pCRT, including the MRI evaluation of the lateral pelvic lymph nodes<sup>4</sup>. To describe the other fundamental features that should be reported while evaluating an MRI for rectal cancer restaging (such as Mesorectal Fascia/peritoneal reflection involvement, Extramural Vascular Invasion [EMVI], etc.)

#### TABLE OF CONTENTS/OUTLINE

1. Protocol of study<sup>2</sup>. Localization and Reported Template tips<sup>3</sup>. ycT staging MRI evaluation<sup>4</sup>. mrTRG evaluation of the primary lesion<sup>5</sup>. ycN staging MRI evaluation<sup>6</sup>. Mesorectal fascia (MRF) involvement<sup>7</sup>. Peritoneal Reflection involvement<sup>8</sup>. EMVI<sup>9</sup>. Tumor deposits

#### GIEE-106 The Watch-and-Wait Program in Rectal Cancer. A Primer for Radiologists

Participants

Lautaro Florentin, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

HING POINTS  
The watch-and-wait (WW) program is an organ-preserving approach for those patients with locally advanced rectal cancer who have no evidence of residual tumor after neoadjuvant therapy. The aim of WW is to improve the quality of life of these patients avoiding unnecessary resective surgeries in disease-free rectum. MRI plays a pivotal role in the selection process of patients who are suitable for this approach. The combination of high-resolution T2-weighted sequences (T2HR) and diffusion weighted images (DWI) are essential for detecting early regrowth during the monitoring of these patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
History  
Why WW strategy?  
Initial assessment  
To whom?  
How to?  
i) Defining locally advanced rectal cancer (LARC). The role of MRI  
Candidates selection. Response after neoadjuvant chemoradiotherapy (nCRT)  
Tumor regression grading system  
The concept of clinical complete response (cCR). Clinical, endoscopic and radiologic aspects.  
i) Primary tumor- Complete, near complete and incomplete responders  
Radiological features  
Endoscopic findings  
ii) Lymph nodes - Complete, near complete and incomplete responders  
Radiological features  
Surveillance  
What does regrowth mean? Outcome implications  
Detecting regrowth. The advantage of MRI  
Regrowth types: intraluminal, mesorectal and lateral internal iliac/obturator nodes  
Regrowth patterns

#### GIEE-107 Primary Hepatic Neuroendocrine Neoplasm (PHNEN) and Neuroendocrine Liver Metastasis (NELM): Imaging Update and Management

Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points  
Primary hepatic neuroendocrine neoplasms (PHNENs) are rare heterogeneous neoplasms arising from the intrahepatic neuroendocrine cells, ectopic pancreatic or adrenal tissue in the liver. Imaging appearances of these tumors are rarely been reported. Neuroendocrine liver metastases (NELM) are more common arising from gastro-enteropancreatic primary and are heterogeneous in clinical presentation and prognosis. After reviewing this exhibit, the learner will be able to: 1. Understand the basic pathophysiology of PHNENs and NELMs. 2. Understand the imaging diagnosis of these tumors and common differentials. 3. Get a basic understanding of principles of management of these tumors. 4. Imaging of Post-operative complications of liver directed therapy

#### TABLE OF CONTENTS/OUTLINE

A. Pathophysiology of PHNENs and NELMs  
B. Clinical and biochemical assessment.  
C. Imaging protocol for liver disease.  
D. Common and uncommon imaging appearance with CT, MRI and PET-CTs  
E. Updated management guidelines  
F. Assessment of post treatment complications

#### GIEE-108 CT Imaging of Peritoneal Carcinomatosis and Its Mimics: Pictorial Review

#### TEACHING POINTS

Multidetector computed tomography (MDCT) is the most commonly used technique for the detection of peritoneal carcinomatosis and for the evaluation of the extend of the disease. The objectives of this study are: 1) Review the pathophysiologic mechanism of the tumor spread and the most common sites and forms of peritoneal involvement 2) Assessment of the peritoneal cancer index (PCI) that provides important information for the surgical planning 3) Illustrate a wide variety of tumorous and inflammatory conditions that can occur in the peritoneal surface and mimic peritoneal carcinomatosis

#### TABLE OF CONTENTS/OUTLINE

Representative cases of peritoneal carcinomatosis and its mimics are illustrated in this exhibit, grouped according the following headings: 1) Anatomy of the peritoneum and the physiology of circulation and resorption of peritoneal fluid 2) CT imaging findings and patterns of peritoneal carcinomatosis 3) Peritoneal cancer index 4) Mimics of peritoneal carcinomatosis including tuberculous peritonitis, peritoneal lymphomatosis, pseudomyxoma peritonei, primary peritoneal mesothelioma, sclerosing peritonitis, fat saponification, leiomyomatosis 5) Take home points.

#### GIEE-109 Facing the 'Celiac Iceberg': What Role can Cross-sectional Imaging Play

Participants

Xinyue Wang, Guangzhou, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

As a condition described as 'celiac iceberg', celiac disease (CD) remains underdiagnosed and undertreated. Radiological evaluation of CD deserves more attention because cross-sectional imaging is helpful in clinical management of CD, including disease diagnosis, complications identification, treatment response evaluation, and prognostic prediction, which should be considered the examination of choice in patients suspected of having CD. The purpose of this exhibit is: 1. To introduce the challenges of diagnosis and treatment in CD; 2. To introduce what role of cross-sectional imaging can play in CD; 3. To introduce the imaging features of CD and

its complications;

#### TABLE OF CONTENTS/OUTLINE

-The profile of CD and the challenges facing  
Role of cross-sectional imaging in CD- Disease diagnosis- Complications identification- Disease activity and severity evaluation- Treatment response evaluation- Prognostic prediction  
Imaging features of CD- Jejunoileal fold pattern reversal- Mesenteric vascular engorgement - Enlarged mesenteric lymph nodes- A decreased size of spleen- Small bowel wall thickening- Diffusely dilated bowels with excess fluid or gas- Intramural fat deposition  
A complication of CD: Mesenteric lymph node cavitation syndrome- Imaging features of mesenteric lymph node cavitation syndrome - Enlarged mesenteric lymph nodes that contain fat-fluid levels

#### GIEE-111 Unveiling the Mysteries of Pancreas Transplantation through Imaging

##### TEACHING POINTS

Understand the clinical relevance, indications, and surgical techniques of pancreas transplantation. Learn about the role of multimodality imaging (US, CT, MRI and CEUS) in the assessment and management of pancreas transplantation.

#### TABLE OF CONTENTS/OUTLINE

Introduction: an overview  
Clinical importance of pancreas transplantation  
Epidemiology: United States and Global context  
Pancreas transplantation: surgical aspects  
Types of pancreas transplant: indications and outcomes  
Surgical techniques: arterial anastomosis, enteric drainage of exocrine secretions and venous anastomosis  
Multimodality imaging assessment of pancreas graft recipients  
US, CR and MRI: advantages and limitations  
Graft's normal appearance  
Complications: a case-based review  
Early versus late complications  
Rejection: radiological-pathological correlations  
Perspectives  
Artificial intelligence and novel imaging techniques  
Contrast enhanced ultrasound (CEUS): focus on graft's perfusion and rejection  
Take home messages

#### GIEE-110 Abdominopelvic Actinomycosis

Participants

Yong-Soo Kim, MD, PhD, (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To review microbiological and clinical features of actinomycosis this may involve the abdominopelvic organs. To illustrate various CT features of actinomycosis involving abdominopelvic organs.

#### TABLE OF CONTENTS/OUTLINE

Actinomycosis is a chronic inflammatory disease which can involve a variety of human organs. This disease commonly occurs in three distinct forms; a cervicofacial form, an abdominopelvic form and a thoracopulmonic form. After penetrating through the mucosal barrier, the route of propagation is direct spread to adjacent tissue. The aggressive nature of infiltration of actinomycosis may be confused with neoplasm and other inflammatory diseases, especially tuberculosis or fungal infection. Various abdominal organs may be infected by actinomycosis. Abdominal infection has been associated with abdominal surgery, such as appendectomy, or a perforation of the intestinal mucosa; a rupture of appendix, diverticulitis, foreign body perforation of the transverse or sigmoid colon, peptic ulcer. Pelvic actinomycosis may be associated with any type of intrauterine contraceptive device or with an intra-abdominal portal entry. Abdominal actinomycosis can present as an abscess or as a mass that is often fixed to the underlying tissue, as a sinus tract with drainage, perirectal or perianal disease.

#### GIEE-111 Comprehensive Image-based Overview Of Percutaneous Enteral Access

##### TEACHING POINTS

Image-guided percutaneous enteral catheters offer a minimally invasive alternative to endoscopic or surgical techniques to provide patients access for important nutrition and medication administration. This exhibit discusses the indications, contraindications, techniques, and peri-procedural management of image-guided percutaneous gastrostomy, gastrojejunostomy (including AbbVie PEG-J pull-type technique for Duopa infusion), jejunostomy, and transesophageal gastrostomy.

#### TABLE OF CONTENTS/OUTLINE

- Pre-Procedural Considerations
- Indications/Contraindications for percutaneous enteral catheter placement
- Image-guided technique for percutaneous gastrostomy/gastrojejunostomy
- Image-guided technique for percutaneous jejunostomy
- Image-guided technique for percutaneous transesophageal gastrostomy
- Image-guided technique for percutaneous pull-type AbbVie PEG-J
- Post-procedural evaluation and complication management

#### GIEE-112 Duodenal Diseases: Illustrated Cases for Radiologists

Participants

Manuel Sebastian Paez Alvarez SR, MD, Toledo, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To provide a comprehensive, illustrative guide for diagnosing duodenal diseases in radiology practice. To review and emphasize the imaging characteristics of various duodenal pathologies on CT studies. To highlight the importance of recognizing subtle findings and common anatomical anomalies for accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Duodenal diseases encompass a broad spectrum of conditions that can originate in the duodenum or result from processes involving neighboring organs. This exhibit aims to educate radiologists on various duodenal pathologies, emphasizing illustrative cases through CT studies. Introduction: Overview of duodenal diseases and their significance in gastrointestinal imaging. Congenital anomalies. Inflammatory diseases. Neoplastic diseases. Vascular pathologies. Iatrogenic complications involving the duodenum. Other duodenal entities and pathologies. Conclusion. In this educational exhibit, we will provide a thorough understanding of the duodenum's anatomy and various diseases, emphasizing the importance of recognizing subtle imaging findings in the context of duodenal pathology. This resource will serve as a valuable guide for radiology residents and radiologists seeking to improve their diagnostic skills in abdominal CT imaging.

## **GIEE-113 Usual and Unusual GI Tract Diverticula, Clinical Presentation, Imaging Characteristics and Management**

### **TEACHING POINTS**

Review the pathophysiology of diverticula formation throughout the gastrointestinal tract. Describe the presentation and demonstrate the imaging characteristics of typical and atypical diverticula throughout the entire gastrointestinal tract. Discuss potential complications of diverticula, as well as their management.

### **TABLE OF CONTENTS/OUTLINE**

-Overview of the pathophysiology of diverticular disease-Overview of radiological findings, complications, and management of diverticular disease--For each type, examples from our database will be provided Foregut----Zenker's diverticulum----Traction and pulsion diverticulum----Pseudodiverticulum----Epiphrenic diverticulum----Gastric diverticulum----Duodenal diverticulum-----Duodenal diverticulitis-----Lemmel syndrome-----Duodenal diverticular lithiasis-----Intraluminal duodenal diverticulum Midgut---- Jejunum diverticulum-----Jejunum diverticulitis---- Meckel's diverticulum-----Bleeding Meckel's diverticulum-----Meckel's diverticulitiso Hindgut----Colonic diverticulum-----Right Colon-----Acute diverticulitis-----Appendiceal diverticulum-----Diverticular abscess-----Left Colon-----Acute diverticulitis-----Diverticular abscess secondary to ruptured diverticula-----Fistula-----Colo-vesical fistula-----Colo-iliopsoas fistula-----Fecal peritonitis and purulent peritonitis secondary to ruptured diverticula-----Septic Thrombophlebitis-----Bleeding colonic diverticulum-----Giant colonic diverticulum

## **GIEE-114 Infiltrative Hepatocellular Carcinoma: Challenging Cases and Its Benign Mimics**

Participants

Elhamy Heba, MD, MD, Lexington, KY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Various histopathologic and morphologic subtypes of hepatocellular carcinoma (HCC) are described throughout the literature. Among all these subtypes, the infiltrative appearance of HCC presents unique challenges in detection, both clinically and radiographically. Infiltrative appearance of HCC is characterized by diffuse permeative spread throughout the liver parenchyma, without forming a mass-like lesion, in a manner that sometimes it is difficult to detect on a background abnormal liver parenchyma. Radiologist must distinguish the infiltrative pattern of HCC from processes that may mimic such as: confluent fibrosis, diffuse fat or iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic microabscesses.

### **TABLE OF CONTENTS/OUTLINE**

1. Incidence and prevalence of infiltrative HCC  
2. Review imaging features of infiltrative HCC, including multimodality case-based review of typical and challenging cases of infiltrative HCC with pathological correlation  
3. Discussion of Tumor in vein as a common imaging feature of infiltrative appearance of HCC  
4. Mimics of infiltrative appearance of HCC including confluent fibrosis, diffuse fat/iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses  
5. Review of prognosis, management and post treatment imaging of infiltrative appearance of HCC

## **GIEE-115 Autoimmune Diseases of the Liver and Biliary Tract**

### **TEACHING POINTS**

Understand mechanisms behind self-tolerance and autoimmunity  
Review spectrum of autoimmune disorders of the liver and biliary tract  
Review the typical and atypical imaging appearance of autoimmune liver and biliary disorders on CT And MRI.

### **TABLE OF CONTENTS/OUTLINE**

Autoimmune disorders involving liver and biliary tract can be broadly classified into Autoimmune hepatitis (AIH)- Type 1 and Type 2  
Primarily biliary cholangitis (PBC)  
Large duct and small duct primary sclerosing cholangitis (PSC)  
Overlap syndromes: AIH+PBC; PBC+PSC; AIH+PSC  
IgG4 sclerosing cholangitis  
Drug-induced autoimmune injury  
Liver involvement in systemic autoimmune disorder (SAD)  
Diagnostic approach  
Role of MRCP in the diagnosis of autoimmune biliary disorders  
Illustration of imaging findings of AIH  
Heterogeneous enhancement of parenchyma  
Periportal edema  
Normal MRCP  
Responsive to steroids  
PBC  
Lace-like fibrosis  
"Periportal halo" sign  
Portal lymphadenopathy  
Normal MRCP in the early stage  
gt pruned tree appearance in later stage  
PSC  
Predilection for peripheral intrahepatic ducts  
Beaded appearance of ducts on MRCP  
High risk of perihilar cholangiocarcinoma  
Small duct PSC  
Normal MRCP  
Typical PSC histology  
IgG4 disease  
Circumferential thickening  
Predilection for extrahepatic and hilar ducts  
Drug-induced (biologic agents)  
Appropriate clinical context  
Rapid progression  
Systemic autoimmune disorder  
Immune-mediated hepatitis may be seen in systemic lupus erythematosus and rheumatoid arthritis

## **GIEE-116 Gastrointestinal Pharmacoradiology: Updated Review of the Indications, Pharmacodynamics, and Adverse Effects of Bowel Preparation Agents, Gastrointestinal Contrasts and Motility-Modifying Medications**

### **TEACHING POINTS**

The purpose of the exhibit is: • To review the liquid diet and different cathartics used for bowel preparation including their pharmacodynamics, mechanisms of action, dosage, contraindications, precautions and adverse reactions. • To address patients' frequent questions about bowel preparation before radiologic examinations. • To explain the chemical characteristics and non-active component of the enteric contrast agents used for fluoroscopic, CT and MRI examinations. • To discuss the indications, pros and cons, concentrations, contraindications of enteric contrast, and strategies to prevent adverse reactions and mitigate legal consequences. • To review motility-modifying agents used to optimize GI tract imaging, including their common indications, mechanisms of action, administration route, dosage, peak action, risks, and contraindications. • To describe sedative agents used for intubation.

### **TABLE OF CONTENTS/OUTLINE**

AGENTS USED FOR: Bowel preparation • Liquid diet • Action mechanisms of cathartics • Saline osmotic cathartics: magnesium citrate • Stimulant cathartics: bisacodyl GI tract endoluminal contrasts for • Fluoroscopic exams: barium sulfate, iodinated water-soluble contrasts, gas. • CT studies • MRI examinations Motility modifiers of GI tract • Antiperistalsis/hypotonia: glucagon, Buscopan • Prokinetics: metoclopramide Mild sedation • Benzodiazepines Topical anesthesia • Lidocaine Lubricants for intubation

## **GIEE-117 Oh No, I Thought It Was a Hemangioma!!!**

Participants

Matteo Bonatti, MD, Bolzano, Italy (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Liver hemangiomas are frequently encountered during imaging studies and have peculiar features on US, CEUS, CT and MRI.- Various benign and malignant liver lesions may show imaging features resembling hemangiomas.- At US, echogenic liver lesions are not always hemangiomas, particularly in cirrhotic patients and in patients with known malignancies: CEUS might be helpful as a quick problem-solving technique in these cases.- Contrast enhancement pattern must be accurately evaluated: centripetal enhancement alone might be misleading if not associated with globular pattern. - On MRI, hemangiomas must show "fluid-like" T2-hyperintensity; moderately T2-hyperintense lesions are almost never hemangiomas.- Always have a look to ADC values.- Hemangiomas do not have perilesional nodules.- Hemangiomas may slowly grow over time

### **TABLE OF CONTENTS/OUTLINE**

To briefly review the typical imaging features that hemangiomas must show on US, CEUS, CT and MRI in order to confidently diagnose them. To show a series of liver hemangioma mimickers (e.g. mass forming intrahepatic cholangiocarcinoma, angiosarcoma, neuroendocrine tumor metastases, colorectal tumor metastases, mucinous tumor metastases,?) on various imaging modalities. For every case the misleading feature(s) will be highlighted.

## **GIEE-118 Constipation, Hirschsprung's Disease, and Stercoral Colitis: Detection, Classification and Treatment**

Participants

Rohan Kulkarni, Southgate, KY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Differentiate and classify different forms of colonic dysfunction to distinguish neurogenic, drug-induced, metabolic, functional, and mechanical causes of constipation  
2. Identify and describe radiological features of constipation and its complications Explain the role of abdominal radiographs, CT, fluoroscopic defecography, and MR defecography in detection and classification of constipation.  
3. Recommend the next appropriate step in management and describe potential image-guided intervention that can contribute to treatment of constipation

### **TABLE OF CONTENTS/OUTLINE**

Defining Constipation - Defecatory straining, hard lumpy stools, sensation of incomplete evacuation, sensation of anorectal obstruction or blockage, need for manual maneuvers such as digital evacuation, and or fewer than 3 stools per week. Etiologies of Constipation  
1. Neurogenic: Diabetes mellitus, Hirschsprung's Disease, Intestinal Pseudo obstruction  
2. Drug-Induced Anticholinergics, Neutrally active agents  
3. Metabolic Hypokalemia, hypothyroidism  
4. Functional Pelvic floor dysfunction  
5. Mechanical Neoplasm, stricture, volvulus  
Radiologic features of constipation and its complications on Radiographs, CT, Fluoroscopy and MR-Colonic dilation- Large stool burden- Fecaloma or fecal impaction- Wall thickening- Pericolonic stranding- Perforation- Abscess  
Treatment of Constipation- Laxative/enemas- Manual dis-impaction- Water soluble fluoroscopic enema- Biofeedback- Surgery

## **GIEE-119 Imaging in Pancreas Transplantation: Conventional and Novel Approaches**

### **TEACHING POINTS**

- Pancreas graft location and vascular anatomy are unique and must be understood for radiologic evaluation- Ultrasound, CT, MRI all play roles in graft evaluation- Contrast enhanced ultrasound (CEUS), novel MRI techniques, graft biopsy, and alternative transplant approaches all may be part of comprehensive patient care

### **TABLE OF CONTENTS/OUTLINE**

- Indications for pancreas transplant- Review of expected surgical technique / post surgical anatomy  
Correlation with intra-operative pictures can assist- Rationale for pancreas graft imaging ; how does radiology make a difference  
Graft parenchymal and vascular evaluation  
Graft environment+ Fluid collections, bowel obstruction, enteric anastomosis evaluation- Advances in Ultrasound  
Grayscale, Doppler, CEUS  
CEUS novel techniques identify vascular insufficiency in grafts and change surgical management  
CEUS used to follow rejection over time- CT  
Multiphase CT evaluation for graft and vessel  
Examples of common pathology (vascular, pancreatitis, bowel complications)- Standard and investigational MRI  
Evaluation for fluid around graft, may assess vessels with or without angiography  
Evaluation with gadolinium-based as well as iron-based contrast agents- Biopsy  
Image guided percutaneous approach- Alternate transplant approaches  
Islet cell transplant  
Composite transplant

## **GIEE-12 A Primer for Pancreatic Head Pathologies- What the Surgeons Want to Know at the Multidisciplinary Conference**

Participants

Kazi Irfan, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review the malignant and benign solid lesions in relation to the pancreatic head and their imaging appearance  
2. Differentiation of the cystic pancreatic lesions and approach to their differential diagnosis  
3. Discuss the NCCN guidelines for the assessment of vascular involvement to ascertain resectability  
4. Illustrate the surgical technique of Whipple's procedure  
5. Enumerate the important anatomical variants in the celiac and superior mesenteric arteries which would alter the surgical technique  
6. Provide a roadmap to distinguish normal post operative changes from tumor recurrence

### **TABLE OF CONTENTS/OUTLINE**

- Imaging appearance of mass forming lesions involving the pancreatic head  
\* Primary malignancies  
\* Metastases  
\* Neuroendocrine tumors  
\* Benign lesions  
\* Mass forming chronic pancreatitis- Multidisciplinary approach in the diagnosis and management of the solid lesions- Role of imaging in staging and assessment for surgical resectability- Different cystic lesions involving the pancreatic head  
\* IPMN  
\* Serous cystadenoma  
\* Mucinous cystadenoma  
\* Pseudocyst- Imaging evaluation to differentiate between the cystic pancreatic lesions- Multidisciplinary approach in the diagnosis and management the cystic pancreatic lesions- Indications of

Whipple's surgery and the surgical technique-Review the anatomical variants of significance involving the celiac and superior mesenteric vasculature-Multidisciplinary approach in assessment of local tumor recurrence and distant metastases

## **GIEE-120 Deep Learning Reconstructions in the Abdomen: An Update**

Participants

Corey Jensen, MD, Houston, TX (*Presenter*) Research Grant, General Electric Company

### **TEACHING POINTS**

- DLR markedly reduces image noise and preserves image texture
- Increasing evidence suggests significant capacity for radiation dose reduction of 46-61% compared to hybrid IR
- o Including for low contrast > 5mm liver lesion detection task
- o Limited evidence suggests less aggressive dose reduction for lesions < 5mm
- No free lunch
- o Next gen DLR algorithms will address mild loss of high spatial frequency information in clinical images

### **TABLE OF CONTENTS/OUTLINE**

- Reconstruction Background - how did we get here?
- o Reconstruction history
- o Iterative recon (IR) limitations
- o Unique QA issues for IR
- o Case examples
- What is DLR?
- Phantom Evidence Update
- Clinical Evidence Update from Literature Review
- DLR Implementation
- o Assessing your practice baseline
- o Determining intended clinical tasks
- DLR pitfalls
- Conclusion

## **GIEE-121 Rectum, Set, Go: A Radiologist's Perspective of a New NAPRC Accredited Multidisciplinary Rectal Cancer Tumor Board at a Large Cancer Center**

### **TEACHING POINTS**

1. NAPRC offers standardized, risk-adapted management of rectal cancer, while Rectal Cancer Multidisciplinary Teams (RC-MDT) provide structure and resources for accreditation and compliance.
2. Radiologists will learn NAPRC standards which involve utilizing synoptic reporting formats for 95% of all staging MRI exams, having 90% of pre-treatment MRI exams read by RC-MDT member radiologists, and fulfilling minimum attendance requirements.
3. Radiologists are key members of RC-MDT, meeting at least bimonthly with surgeons, pathologists, radiation oncologists, and medical oncologists. Uniform MRI image acquisition and interpretation, along with standardized reporting, are crucial for effective staging.

### **TABLE OF CONTENTS/OUTLINE**

A) Requirements for NAPRC-accredited RC-MDT

1. Multispecialty services and program management
2. RC-MDT meeting structure
- a. Radiologist's requirements
- i. American College of Radiology (ACR) education module
- ii. Radiologist's mandatory presence for all meetings with individual attendance requirements
- iii. Internal record review to audit MR exams
- iv. Measures of compliance for synoptic reports

B) RC-MDT member radiologist's contributions

1. Radiologists read 90% of pre-treatment staging MRI exams.
2. Post-treatment restaging and tumor regression grading (TRG)
3. Surgical planning
4. Surveillance

C) MR Rectal cancer exams

1. Technical uniqueness of acquisition
2. Imaging features of local disease
3. Standard synoptic report used in 95% of staging MR exams
4. Prediction of local recurrence and metastasis

D) Secondary initiatives

1. Rectal cancer education program and goals of care
2. Data management
3. Quality improvement

## **GIEE-122 CRS (Cytoreductive surgery) + HIPEC or PIPAC: The Radiologist Verdict**

Participants

Raquel Acosta Hernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The therapeutic management of peritoneal carcinomatosis (PC) and pseudomixoma peritonei (PMP) requires an assessment in multidisciplinary committees. The radiologist must report where each tumor burden is addressed using the a) PCI (peritoneal carcinomatosis index), b) presence of distant secondary disease (extraperitoneal) and c) tumor implants location in "danger zones" that would condition an incomplete CRS (Cytoreductive surgery). Not only the extent of the disease must be taken into account, but also other patients' individual factors and comorbidities as well as the resources available in each center. Multidisciplinary interaction constitutes the main pillar for a correct selection of patients who are candidates for CRS and subsequent intraperitoneal chemotherapy or, given the risk of incomplete CRS, consideration of other possibilities innovative palliative therapies, such as PIPAC.

### **TABLE OF CONTENTS/OUTLINE**

Review the first peritoneal carcinomatosis (CP) evaluation approach: a) PCI (Peritoneal cancer index) b) Implant zones due to peritoneal fluid stasis. c) Implant zones: "Key locations" and d) Ascites and e) Extraperitoneal disease. Illustrate the "danger zones" and unfavourable tumor implants location: beyond the first CP check-points. Update of pseudomyxoma peritonei (PMP): a misunderstanding and controversial disease. Analyze the different types of treatment (surgery, HIPEC and PIPAC): assessment in multidisciplinary committees and focus on the role of radiologist in multidisciplinary committees.

## **GIEE-123 Pre-operative Evaluation in Living Donor Liver Transplantation: A Roadmap for Radiologist**

Participants

Hande Ozen Atalay, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Liver transplantation is the most effective treatment for liver failure. Because the number of cadaveric donors is not enough considering the high demand, the number of living donor liver transplantations (LDLT) has been on the rise, and right lobe transplantation accounts for 70 % of all LDLT. In pre-transplant imaging, there are many important issues that should be evaluated and noted in the report. Radiologists play a pivotal role in a transplantation unit and surgical planning. In the pre-operative evaluation of LDLT, choosing the appropriate liver segment for the recipient (right lobe, left lateral segment, etc.) and evaluating the liver in the donor candidate in terms of parenchymal lesions and diseases constitute the initial steps. The liver segmentation should next be done; the total liver volume and the volume of the liver segment to be transplanted are calculated. This step is essential for avoiding small-for-size syndrome in the recipient as well as liver insufficiency in the donor candidate. Recognition of vascular and biliary anatomical variations is critical because certain anatomical variations are accepted as contraindications to LDLT and may cause post-operative ischemia in the donor and recipient. To conclude, radiologists must be aware of their crucial role in

the pre-operative imaging of LDLT.

#### TABLE OF CONTENTS/OUTLINE

-Living donor liver transplantation (LDLT) definition, types, and indications-Liver parenchymal evaluation, segmentation, and volume rendering-Important vascular and biliary variations in the LDLT-Contraindications of the right lobe and left lateral segment LDLT-Important issues to be noted in the pre-transplant radiological report -Conclusion

#### GIEE-124 Gelatinous Jigsaw: A Pictorial Review of Mucinous Cystic Pancreatic Neoplasms

Participants

Milini Rana, MD, Shreveport, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal is to educate the audience in recognizing the multi-modal imaging features of mucinous cystic pancreatic neoplasms (MCPN), with an emphasis on their clinical and pathological correlation. We will also characterize morphological features of different pancreatic cystic lesions and elucidate the imaging and histopathologic features of MCPN subtypes including mucinous cystadenoma, mucinous cystadenocarcinoma and intraductal papillary mucinous neoplasm (IPMN).

#### TABLE OF CONTENTS/OUTLINE

Mucinous cystic pancreatic neoplasm (MCPN) clinical overview Epidemiology Pathophysiology Classifying non-neoplastic and neoplastic MCPN subtypes Review MCPN multi-modal imaging features on Ultrasound (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) Imaging and histologic features of Mucinous Cystadenoma Imaging and histologic features of Mucinous Cystadenocarcinoma Key features of differentiating Intraductal Papillary Mucinous Neoplasm (IPMN) and its subtypes Treatment and Prognosis

#### GIEE-125 CT Guided Gastrostomy Placement: An Alternative Approach without Placement of Nasogastric Tube

Participants

Mohanad Kurdi, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Computed Tomographic (CT) guided gastrostomy tube (G-tube) placement is an alternative to fluoroscopic techniques. CT guided G-tubes forego the placement of a nasogastric (NG) tube as insufflation of the stomach is performed via anterior abdominal wall percutaneous access. NG tubes cause a variety of problems, including patient discomfort, challenging placement, premature removal and malplacement. Cross sectional imaging allows for a global view of intra-abdominal structures, with more accurate localization of soft tissue structures. Compare and contrast CT and fluoroscopic guided techniques with pitfalls of both.

#### TABLE OF CONTENTS/OUTLINE

Background Indications and Contraindications Gastrostomy Tube Placement Techniques Disadvantages of Nasogastric Tubes CT Guided G-Tube Overview Technical Considerations CT versus Fluoroscopy Our Experience Discussion References

#### GIEE-126 Worry or Go with the Flow: Perfusion Anomalies and Vascular Disorders of the Liver - A Primer for the Radiologist

#### TEACHING POINTS

1. Understanding the imaging appearances and physiology of transient hepatic attenuation differences (THADs) on CT and transient hepatic intensity differences (THIDs) on MRI is crucial to aid the radiologist in diagnosing hepatic disease processes. 2. Recognizing perfusion anomalies in the liver is essential to avoid misinterpretation of "pseudolesions", a common pitfall for the training radiologist. 3. Familiarity with the pathogenesis and imaging features of hepatic vascular disorders helps guide correct diagnosis and patient management.

#### TABLE OF CONTENTS/OUTLINE

1. Physiology of hepatic perfusion a. Nutrient rich mesenteric venous inflow b. Compensatory nature of hepatic arterial and portal venous blood flow 2. Concept of THADs/THIDs a. Pathophysiology b. Case-based review of common etiologies: "Cs" of THAD/THID c. Strategies to avoid misinterpretation 3. Concept of streamline phenomenon a. Implications with case-based review 4. Concept of third inflow a. Implications with case-based review 5. Case-based review of miscellaneous vascular diseases a. Sinusoidal occlusion syndrome b. Budd Chiari c. Cavernous transformation and portal biliopathy d. Hepatic peliosis e. Hepatic ischemia secondary to TIPS

#### GIEE-127 Borderline Pancreatic Cancer: Role of Cross Sectional Imaging in Therapeutic Decision Making

#### TEACHING POINTS

Borderline pancreatic ductal adenocarcinoma (BR-PDAC) is defined as a tumor potentially resectable but with anatomical (vascular involvement), biological (serum biomarkers) or clinical (performance status) conditions that may impact in free margin resections or postoperative outcomes. Anatomical BR-PDAC is at high risk for margin positive when surgery is upfront, so neoadjuvant chemotherapy and/or radiotherapy is considered to increase the chance of a R0 resections. Radiology is a significant tool concerning anatomical dimension, evaluating tumor - vessel relationships, being a pillar in decision making to choose the best therapeutic option for each patient. The images are also fundamental evaluating post-neoadjuvant response, contributing to evaluate tumor biology and responding patients. The objective of this exhibit is: 1) To review the role of imaging determining resectability status of tumors with detailed analysis in tumor - vessel contact of BR-PDAC. 2) To evaluate anatomical conditions that influences in surgical technique, particularly when vascular reconstructions are needed. 3) To review imaging response criteria post neoadjuvant therapy.

#### TABLE OF CONTENTS/OUTLINE

a) Tumor - venous contact analysis using Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). b) Tumor - artery contact evaluation and its differences when comparing to vein analysis. c) How proper radiological identification of the characteristics of venous and/or artery involvement influence on surgical approach and vascular reconstruction techniques required for a successful surgery.

## **GIEE-128 Make it Simple-Imaging of the Postoperative Whipple**

Participants

Ali Agely, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The Whipple procedure (pancreaticoduodenectomy) is performed to resect pancreatic head or periampullary neoplasms. CT and (increasingly) MRI are performed in the acute and delayed postoperative settings, notably in patients with a complicated course. This presentation provides a comprehensive overview of various postoperative imaging findings after a Whipple procedure with emphasis on MRI. Familiarity with expected findings and postoperative complications gives the radiologist the knowledge to render a prompt and accurate diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

1) Surgical review 2) Normal, expected findings in the acute and delayed postoperative settings 3) Complications: Pancreatic fistula, Leak (gastrojejunostomy and biliary-enteric), anastomotic strictures, pancreatitis (acute and acute on chronic), hemorrhage, abscess, portomesenteric venous thrombus, tumor recurrence, delayed gastric emptying, and stent migration

## **GIEE-129 GI and GU Fluoroscopy In Common Post-op Oncologic Surgeries: What You Need to Know About This Leaky Business**

### **TEACHING POINTS**

1. Describe common gastrointestinal and genitourinary fluoroscopic procedures in oncology 2. Illustrate the different techniques and indications for post op fluoroscopic examinations with key teaching points 3. Demonstrate normal and abnormal fluoroscopic examinations including complications with emphasis on leaks

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Endoscopic evaluation versus double contrast studies. 3. Surgical techniques of Ivor Lewis esophagectomy and its complications. 4. Indications, techniques and imaging findings of single-contrast esophagram. 5. Colonic and jejunal interposition. 6. Surgical techniques for rectal surgeries and their complications. 7. Indications, technique and imaging findings on single contrast enema. 8. Indications, techniques and imaging findings of bladder surgeries and urinary diversions on cystogram, loopogram and pouchogram. 11. Take-home messages. 12. References.

## **GIEE-13 Late Postoperative GI Tract Evaluation: Identifying Complications Based on Surgical Technique**

Participants

Daniel Montel, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To recognize and understand the surgical techniques performed at gastrointestinal tract surgeries. To enumerate the main late postoperative complications of the gastrointestinal tract surgeries and their imaging features. To correlate imaging findings in the evaluation of late postoperative period with the particularities of each gastrointestinal tract surgery. This enables the characterization of complications that may be related to postoperative anatomical changes, anastomosis, stomas, surgical incision on abdominal wall, or intra-abdominal adhesions.

### **TABLE OF CONTENTS/OUTLINE**

• Introduction. • Overview of late complications in gastrointestinal tract surgery. • Review of surgical techniques in gastrointestinal tract surgery. • Complications related to anastomosis. • Complications related to postoperative anatomical changes. • Complications related to adhesions. • Complications related to intestinal stomas. • Complications related to surgical incisions in the abdominal wall. • Teaching points.

## **GIEE-130 Constipation, Stercoral Colitis, Hirschsprung Disease and Complications in Adults**

Participants

Joel Gamble, MD, BSC, Toronto, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Imaging is unreliable in establishing the diagnosis of constipation and directing routine management. Severe or chronic constipation can lead to serious complications, for which imaging is essential. Stercoral colitis is a potentially fatal complication of fecal impaction. High attenuation mucosa and perfusion defect are the most accurate features for fatal cases. The natural history of Hirschsprung disease epitomizes the complications of constipation. Despite surgical resection, many adults have chronic constipation, and a subset have serious constipation-related complications.

### **TABLE OF CONTENTS/OUTLINE**

Constipation: Clinical diagnosis; recent literature that imaging does not correlate with bowel habit, predict symptoms of constipation, or reliably direct management decisions; imaging for complications of constipation. Stercoral colitis: Mucosal ulceration due to pressure ischemia, possible perforation; spectrum of findings severity. Hirschsprung disease: Absent ganglion cells in the submucosal and myenteric plexuses; symptoms into adulthood include constipation, straining, incomplete evacuation. various mechanisms of chronic constipation; late presentation of Hirschsprung in adulthood; complications include adhesional obstruction; fistula formation; obstipation; perforation

## **GIEE-131 The Pinch and the Squeeze: A Review of Vascular Compression Syndromes**

Participants

Hannah Lamberg, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Diagnosis of almost all vascular compression syndromes is largely clinically based. However, certain imaging findings can be

suggestive of these syndromes, aiding in diagnosis and treatment.2. Findings suggestive of a vascular compression syndrome include pre-stenotic vessel dilation, formation of varices, and compression of other structures (e.g. ureter, duodenum).

#### **TABLE OF CONTENTS/OUTLINE**

1. Brief introduction of vascular compression syndromes2. Radiologic findings with accompanying CT examples including:- Nutcracker Syndrome- May-Thurner Syndrome- Pelvic Venous Congestion Syndrome (non-vascular compression syndrome)- Median Arcuate Ligament Syndrome- Superior Mesenteric Artery Syndrome- Chronic Ureteropelvic Junction Obstruction by crossing vessels- Ovarian vein syndrome.3. Summary/Conclusions: Review of high-yield teaching points

#### **GIEE-132 Imaging of Gallstones and Complications**

Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to:1. Identify various types of gallstones and discuss imaging techniques2. Multimodality imaging review of the features of gallstones and their complications3. Discuss pitfalls and mimics of gallstones.

#### **TABLE OF CONTENTS/OUTLINE**

There are three main types of gallstones: Cholesterol (10%), Pigmented (10%) and mixed (80%).Ultrasound is the superior imaging modality for detection of gallstones as up to 20% stones are not calcified and CT occult. CT is better to detect gallstone complications. Dual Energy CT utilizes low KV, calcium-based and lipid-based imaging and more sensitive than single energy CT to detect gallstones.Gallstone complications: Acute cholecystitis; Acute cholangitis; Mirrizi Syndrome; Biliary-enteric fistulae; infected fallen gallstones; post-cholecystectomy syndrome.Pitfalls and Mimics: Assessment of stone impaction; gallbladder polyps; cystic artery pseudoaneurysm, enteroliths.Summary: Gallstones are common seen on imaging and can serve as a nidus for infection/inflammation; cause biliary outflow obstruction or fistulize to adjacent structures necessitating prompt diagnosis sometimes utilizing multimodality imaging, treatment and intervention.

#### **GIEE-133 Don't Judge a Gallbladder by Its Wall**

Participants

Sara Siguenza-Gonzalez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Radiologists are very used to cholecystitis in daily clinical practice, but there are other entities that affect the gallbladder (GB):Classification and description of those entities according to a pathological point of view.Principal radiographic features of each disorder in ultrasound (without and with contrast), CT (including spectral CT) and MRI.Key points to guide the differential diagnosis of the main pathology of the GB.

#### **TABLE OF CONTENTS/OUTLINE**

1. An approach to the anatomy and physiology of the GB. Description of normal anatomy, anatomic variants and congenital features.2. Describe benign entities, idiopathic diseases (cholesterolosis and adenomyomatosis) and bile stasis diseases. 3. An update of premalignant gallbladder polyps.4. Analyze malignant pathology, including primary tumours (gallbladder carcinoma and cholangiocarcinoma) and secondary tumours (metastasis and lymphoma).5. A portrayal of others disorders in the GB: traumatic pathology, secondary causes of diffuse gallbladder wall thickening and inflammatory diseases beyond acute cholecystitis.

#### **GIEE-134 Hepatobiliary and Pancreatic Manifestations of Immunochemotherapy: A Practical Guide**

Participants

Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. An update on the commonly used cancer immunotherapy and chemotherapy agents that affect the liver, biliary system and pancreas. 2. Delve into the pathogenesis of these therapy-related hepatobiliary and pancreatic manifestations. 3. Illustrate the role of imaging in diagnosis of these therapy-related manifestations in the context of cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1. Background 2. Cancer immunotherapy and chemotherapy agents that can affect the liver, biliary system and pancreas a) CTLA-4 inhibitor - Ipilimumab b) PD-1 inhibitor- Nivolumab, Pembrolizumab c) PD-L1 inhibitor - Durvalumab, Atezolizumab d) Alkylating agents - Oxaliplatin e) Anti-metabolites - Pyrimidine analogues (5-fluorouracil, Gemcitabine), 6-mercaptopurine, methotrexate f) Vinca alkaloids - Vincristine, Vinblastine g) Topoisomerase I inhibitors - Irinotecan 3.) Therapy related adverse effects - Hepatic - Biliary - Pancreatic 4. Steatosis 5. Diffuse hepatitis 6. Fibrosis 7. Pseudocirrhosis 8. Sinusoidal obstruction syndrome 9. Focal nodular hyperplasia - like lesions 10. Nodular regenerative hyperplasia

#### **GIEE-135 Primary Peritoneal Malignant Mesothelioma: Everything a Resident Needs to Know**

Participants

Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Distinguish the various subtypes of mesothelioma based on clinical and radiological features. Illustrate the spectrum of imaging features of primary peritoneal mesothelioma. Be cognizant of the mimics of primary peritoneal malignant mesothelioma in our daily reporting.

#### **TABLE OF CONTENTS/OUTLINE**

1. Background on mesothelioma 2. Subtypes of peritoneal mesothelioma a) Cystic mesothelioma b) Primary peritoneal malignant mesothelioma (PPMM) c) Well-differentiated papillary mesothelioma 3. Spectrum of imaging features of primary peritoneal malignant mesothelioma 4. Cases - a) Peritoneal thickening b) Peritoneal masses c) Omental fat stranding and nodularity d) Extensive disease



5. Mimics a) Peritoneal carcinomatosis b) Lymphoma c) Tuberculous peritonitis

### **GIEE-136 All About the Gallbladder: From Normal to Rare**

#### **TEACHING POINTS**

Review of normal anatomy and common conditions of the gallbladder, demonstrating the role of the available imaging methods. Illustrate unusual cases of the gallbladder, highlighting the main imaging findings for the correct approach and diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Brief demonstration of the gallbladder anatomy as well the imaging findings related to its most frequent conditions. Case-based illustration of multiple uncommon gallbladder pathologies according to their nature: - Anatomical variants and malformations; - Inflammation; - Neoplasms; - Others (trauma, torsion etc.).

### **GIEE-137 Imaging Characteristics of Pancreatic Serous Cystadenoma and Common Imitators**

Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) Pathophysiology of Pancreatic serous cystadenoma.2) MR characteristics of Pancreatic serous cystadenoma and its subtypes.3) Cystic pancreatic lesions mimicking serous cystadenoma.4) Aggressive features of atypical serous cystadenomas.5) Utility of endoscopic ultrasound and fluid aspiration for definitive diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Pancreatic cystic neoplasms are commonly encountered in practice and reported on 20-40% of abdominal MRI scans compared to only 3% of CT scans. Serous cystadenoma of the pancreas can have similar characteristics to other benign and malignant pancreatic lesions. The microcystic form of Pancreatic serous cystadenoma has classic features with a pathognomonic enhancing scar and stellate calcifications seen in 30% of cases.1) MR features of microcystic, macrocystic, oligocystic, and solid pancreatic serous cystadenoma subtypes.2) Atypical aggressive features including parenchymal atrophy, ductal dilatation, and vascular/local invasion.3) Common mimics including Mucinous cystic pancreatic neoplasm(MCPN), Solid pseudopapillary epithelial neoplasm(SPEN), Intraductal papillary mucinous neoplasm(IPMN), pseudocyst, lymphoepithelial cyst, cystic neuroendocrine tumor(NET), and adenocarcinoma.4) Von Hippel-Lindau syndrome- Increased incidence of developing Pancreatic serous cystadenoma and other benign and malignant tumors of various organs.

### **GIEE-138 Barriers to Adopting LI-RADS and Steps to Overcome**

Participants

James Lee, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) The Liver Imaging Reporting and Data System (LI-RADS) is a reporting system for the classification of hepatocellular carcinoma (HCC) that continues to grow in adoption throughout North America including important steps of alignment with both the American Association for the Study of Liver Disease (AASLD 2018) and the Organ Procurement Transplant Network (OPTN 2022) 2) Despite growing adoption, radiologist still encounter barriers to implementation within their own clinical academic departments, from referring physicians and surround community practices.3) An understanding of different barriers that may face radiologists and referrers towards the adoption of LI-RADS is an important step to overcoming these obstacles.

#### **TABLE OF CONTENTS/OUTLINE**

I. Review LI-RADS purpose to standardize reporting and data collection for patients at risk for developing HCCII. Illustrate the growth of LI-RADS adoption over the past decadeIII. Describe the barriers to adoption of LI-RADS from both the radiologist and referring providers point of viewIV. Explain how to overcome barriers from the experiences encountered from our multiple (12) institution collaborative.

### **GIEE-139 Crohn's Disease: Step by Step in MRI**

Participants

Natalia Zuniga, MD, Cali, Colombia (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Active disease is characterized by wall thickening and edema and or ulceration. Wall thickening alone, without the supporting features of oedema or ulceration, often indicates inactive disease, particularly if the wall is dark on fat-suppressed T2WI. Functional techniques such as DWI and motility imaging provide ways to quantify disease activity, monitor, and even predict therapeutic response. Complications can be divided into stricturing, penetrating, related to short bowel and development of malignancy. Characterization of strictures requires a fixed luminal narrowing with upstream dilatation greater than 3 cm. The strictures should be differentiated between inflammatory luminal narrowing or fixed fibrosis, and should be measured the length of the stricture. Contrast enhancement may be useful, but active and fibrotic disease both enhance. Early enhancement is more typical for active CD whereas delayed enhancement may indicate established fibrosis. It is useful to distinguish between response to treatment and imaging remission. Response implies a significant reduction of the inflammatory burden, and imaging remission implies the abolition of all activity. Scores are not routinely applied in clinical practice, however their knowledge is necessary for the description of mild, moderate and severe disease, which is sufficient.

#### **TABLE OF CONTENTS/OUTLINE**

Definition and initial diagnosis. Disease Activity. Disease phenotype. Non-stricturing, non-penetrating (inflammatory). Stricturing Disease. Penetrating Disease. Depict and quantify the degree of inflammatory activity. Severity. Therapeutic monitoring and response to treatment. Preoperative mapping. Postoperative recurrence

### **GIEE-14 What Goes Up Must Come Down: Multimodality Imaging Evaluation of Reflux Disease, Related Surgeries and Complications**

Participants

Moataz Ahmed Sayed Mohammed Soliman, MSc, CHICAGO, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Explain the causes and mechanisms of reflux disease and its effects on the esophagus and stomach Review imaging modalities and findings for diagnosis and assessment of reflux severity Describe the surgical procedures utilized for treatment of reflux disease, their advantages and disadvantages Recognize the post-operative imaging findings and potential complications of reflux surgery with possible management options

#### TABLE OF CONTENTS/OUTLINE

Introduction: Define reflux disease Epidemiology Complications Pathophysiology: Role of the lower esophageal sphincter, hiatal hernia, gastric acid, and other factors in reflux disease Diagnostic tests: Upper endoscopy, pH monitoring, manometry Review the indications, techniques, and findings of different imaging modalities for reflux disease Imaging possible disease complications Treatment Medical therapy (prescription and non-prescription medications) Surgery: Compare types, outcomes, and risks of different surgical options for reflux disease, such as Fundoplication LINX Device Transoral incisionless fundoplication (TIF) Stretta procedure Post-operative imaging: Expected post-operative imaging findings Complications: Identify the common and rare complications of reflux surgery and their imaging features and management strategies Dysphagia and difficult Infection Bleeding Esophagogastric perforation, leakage Fistula Unwrapping of fundoplication LINX device migration Conclusion: An algorithmic approach to imaging evaluation

#### GIEE-140 Abdominal Tuberculosis: Think About It

Participants

Nerea Torena, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review abdominal tuberculosis, findings, and possible differential diagnoses. 2. To present cases of abdominal tuberculosis diagnosed at our centre in the last 5 years.

#### TABLE OF CONTENTS/OUTLINE

In Europe Tuberculosis has an average incidence of 26 cases per 100000 inhabitants. Pulmonary disease is the most frequent, abdominal involvement occurs in 11-12% of patients with extrapulmonary tuberculosis. Most frequently it affects the genitourinary tract, lymph nodes, peritoneum, and solid viscera, mainly the liver, spleen, and pancreas. Symptoms can be nonspecific; most commonly fever, abdominal pain, and weight loss. The radiological findings are not pathognomonic, but may be suggestive if considered with clinical, immunological status, and demographic origin. Abdominal disease can simulate multiple conditions: lymphoma, Crohn's disease, adenocarcinoma, carcinomatosis, etc. Tuberculosis cases diagnosed at our hospital in the last 5 years have been reviewed, 262 cases. 18 patients (6.8%) with abdominal involvement detected by imaging techniques. Radiological findings of each location will be discussed and depicted. Genitourinary, hepato-splenic, peritoneal, intestinal, lymph node and pancreatic tuberculosis will be shown. Differential diagnoses of each location will be reviewed. Abdominal tuberculosis diagnosis is complicated. Imaging findings are usually nonspecific and present in a very diverse way mimicking different diseases. It is important to suspect this pathology and establish its diagnosis to start the most appropriate treatment as soon as possible.

#### GIEE-141 Post-operative Complications of Cholecystectomy: What the Radiologist Needs to Know

Participants

Kazi Irfan, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Surgical anatomy of the gall bladder fossa. 2. Variants in the vasculature and biliary anatomy predisposing to injuries. 3. Types of cholecystectomy surgical approaches. 4. Imaging overview of indications of cholecystectomy. 5. Algorithm for imaging approach to diagnose acute cholecystitis. 6. Appropriate use of multimodality imaging in the diagnosis of post-operative complications. 7. Expected post-surgical changes. 8. Spectrum of post-surgical complications

#### TABLE OF CONTENTS/OUTLINE

Introduction: -Cholecystectomy is among the most commonly performed abdominal surgeries -Can be performed by either laparoscopic or open approaches Common indications for cholecystectomy: Acute/chronic cholecystitis, symptomatic cholelithiasis, gallstone pancreatitis, gall bladder masses/ polyps Multimodality imaging in diagnosis and management of post-surgical complications: -Computed Tomography (CT): primary imaging modality -Magnetic resonance Imaging (MRI): Ideal for biliary anatomy. Hepatobiliary excreted contrast (Eovist) can confirm bile leak -Ultrasound -Hepatobiliary scintigraphy -Fluoroscopy: Transhepatic and T-tube cholangiograms -Angiography Postsurgical complications of cholecystectomy: -Collections? \*Expected postsurgical seroma/hematoma? \*Bile leak or biloma (can be secondarily infected)? \*Hematoma? \*Abscess? -Bile duct injuries (can be associated with bile leak or biloma)? \*Stricture? \*Ligation or transection? -Gallstone related? \*Retained or new gallstones in CBD or remnant cystic duct? \*Dropped gallstones? -Vascular? \*Active bleed? \*Pseudoaneurysms? \*Vascular occlusions? -Other? \*Cholecystitis in residual gall bladder? \*Bowel injury? \*Clip migration?

#### GIEE-142 Navigating the Labyrinth of Peritoneal and Retroperitoneal Anatomy: Abdominal Disease Spread Made Easy

Participants

Janardhana Ponnathapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Essential to understanding disease spread in abdomen is to separate the peritoneum from the retroperitoneum. These areas have distinct anatomy with well-defined separate pathways. The peritoneum is comprised of connected recesses that are potential spaces, normally not imaged except when containing excess fluid or air. Peritoneal recesses are formed by the opposing peritoneal surfaces and subdivided by the attachments of the ligaments and mesenteries to the parietal peritoneum. Disease flows within the recesses by changes in abdominal pressure. This forms a distinct spread pattern. The retroperitoneum is stratified by the renal

fascia into the anterior and posterior pararenal spaces and the perirenal space. The fascia contains and directs spread from the contained organs with the compartments. Each space has a unique spread pattern defined by the containing fascia. The anterior pararenal space is connected to the mesenteries and ligaments forming the subperitoneal space. This space interconnects the retroperitoneum with the mesenteries allowing for the normal continuum of blood vessels, lymphatics, and nerves but also forms the pathways for bidirectional spread of disease.

#### TABLE OF CONTENTS/OUTLINE

• Anatomy • Clinical embryology • Fundamental concept of the subperitoneal space • Distinguishing intraperitoneal spread from subperitoneal spread • New planes of retroperitoneum • Patterns of spread of disease from the; -Liver-Distal esophagus and stomach- Pancreas-Small intestine-Large intestine-Renal and adrenal • Mechanisms of spread of disease (fluid, gas and soft tissue)- Subperitoneal-Intraperitoneal-Contiguous invasion • Clinical and radiological applications

#### GIEE-143 Hepatic Transplantation Assessment: What Radiologists Should Know

Participants

Carmen Gonzalez-Carrero Sixto, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the surgical techniques used in liver transplantation for vascular anastomosis. Describe the normal findings immediately after the procedure. Expose the most frequent acute postoperative vascular complications.

#### TABLE OF CONTENTS/OUTLINE

1. BACKGROUND: Liver transplant is the treatment of choice for end stage liver disease. Morbidity and mortality have significantly been reduced thanks to advances in surgical techniques, immunosuppressive therapy and multidisciplinary team approach. We radiologists play a key role in the diagnose and follow-up of possible complications.2. SURGICAL TECHNIQUE 3. NORMAL FINDINGS: in the first 24 to 48 hours after a liver transplant, US must be performed. 4. VASCULAR COMPLICATIONS: - Hepatic artery: thrombosis, stenosis, pseudoaneurisma. - Portal vein: thrombosis, stenosis. - Suprahepatic veins: thrombosis, stenosis.5. CONCLUSION: After a liver transplant imaging techniques are important to rule out and follow up possible complications. There are some normal findings in the immediate postoperative period but radiologists need to know how to identify abnormal features suspicious of complications.

#### GIEE-144 Head with Two Tales: Early Spread of Disease from the Pancreas

Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The head of the pancreas can be considered as two separate entity with distinct embryological variations. During embryology the ventral pancreatic bud becomes the caudal portion and the uncinat process of the head of the pancreas, while the dorsal bud becomes the cranial portion of the head. This embryology results in anterior and posterior components of the head of the pancreas each having their distinct vascular supply, nerve supply and lymphatic drainage. It is essential for the radiologist to appreciate that this results in two distinct spread patterns from the head of the pancreas. This knowledge about the early disease spread from the head of the pancreas becomes important particularly in the case of tumor as the radiologist can confidently predict, and diagnose the metastatic spread knowing the origin of the tumor.

#### TABLE OF CONTENTS/OUTLINE

• Anatomy of the pancreas • Clinical embryology of the head of the pancreas • Fundamental concept of the two heads of the pancreas • Distinct vascular supply • Distinct nerve supply • Distinct lymphatic supply • Distinguishing the different disease spread from the anterior head and posterior head • How imaging helps in successfully identifying the early spread • Important anatomical landmarks to help recognizing the spread of the disease • Patterns and mechanisms of early spread of the tumor • Clinical and radiological applications • Algorithm to predict the spread of metastatic disease from the head of the pancreas

#### GIEE-145 The 'New' 2023 American Association for the Study of the Liver Disease (AASLD) Practice Guidance on the Diagnosis and Management of Nonalcoholic Fatty Liver Disease (NAFLD): Radiologists' Perspective

Participants

Eri Osta, BS, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• Familiarize audience with 2023 AASLD practice guidance statement for diagnosis management of Nonalcoholic fatty liver disease (NAFLD) with special emphasis on imaging-related statements. • Discuss imaging biomarkers other non-invasive tests in risk assessment of NAFLD patients. • Review complementary roles of liver function tests, Fibroscan, shear wave Elastography MRI PDFF in assessing hepatic steatosis, fibrosis "at-risk" nonalcoholic steatohepatitis (NASH). • Discuss ongoing research advances role of AI-based tests in NAFLD

#### TABLE OF CONTENTS/OUTLINE

• Introduction • Epidemiology: Prevalence and demographics of NAFLD. • Spectrum of NAFLD: Pathophysiology, stages, and progression - Nonalcoholic fatty liver (NAFL), Nonalcoholic steatohepatitis (NASH), at-risk NASH, advanced fibrosis cirrhosis • Predictors of clinical outcomes in NAFLD: Identifying high-risk patients: fibrosis-4 (FIB-4) scoring system • Diagnosis and Assessment of NAFLD • Hepatic steatosis: Ultrasound, Fibroscan/Controlled attenuation parameters (CAP) MRI-PDFF techniques • "At-risk" NASH Evaluating FAST (Fibroscan + AST levels), MAST (MRE + AST levels), MEFIB (MRE + FIB-4) scoring systems. • Advanced fibrosis: Assessing extent of fibrosis with Fibroscan/VCTE MRE • Cirrhosis Rule in/out irreversible fibrosis • Future directions Ongoing research • Conclusion Recent developments in NAFLD have led to substantial advancements in biomarkers therapeutics, with significant implications for radiologists collaborating with multidisciplinary care teams. Emerging imaging non-imaging biomarkers can exclude advanced liver disease or identify patients at an increased risk for cirrhosis.

#### GIEE-146 Pancreatic Duct Anomalies: A Primer for Trainees

Participants

Hatem Al Kashroom, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Pancreatic duct anomalies are rare but can cause significant health problems if not detected early. 2. The two main types of congenital pancreatic duct anomalies are pancreas divisum and annular pancreas. 3. Symptoms of pancreatic duct anomalies may include abdominal pain, nausea, vomiting, and weight loss. 4. Diagnosis usually involves imaging tests such as MRI (MRCP) and/or CT scan. 5. Overview of the acquired pancreatic duct anomalies 6. Patients with a family history of pancreatic duct anomalies or pancreatitis may be at higher risk and should discuss screening options with their healthcare provider.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to normal pancreatic anatomy and embryology 2. Pancreatic divisum and divisum types 3. Annular pancreas 4. Acquired pancreatic duct anomalies 5. Diagnostic tests and preferred imaging modalities

#### GIEE-147 What The Radiologist Needs To Know About Pseudomyxoma Peritonei And HIPEC

Participants

Natalia Zuniga, MD, Cali, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The mucinous deposits tend to follow routes of normal peritoneal fluid flow, there are watershed regions in the peritoneal cavity where cells can be deposited to form implants. Signs of peritoneal metastases include the presence of peritoneal nodules, thickening, or fat stranding. A peritoneal cancer index greater than 20 is considered a poor prognostic factor. CT provides anatomic imaging. MRI provides a combination of anatomic imaging and tumor functional imaging. PET imaging provides functional imaging based upon an assessment of the tumor's metabolism of glucose. T1WI and T2WI sequences provide anatomic details to precisely localize the larger peritoneal tumors and nodules, but are relatively insensitive for depicting small peritoneal tumors and subtle fat stranding. DWI are particularly useful for depicting mucinous lesions due to the conspicuity of high signal intensity mucin and fluid within these tumors. Peritoneal tumors enhance with intravenous gadolinium increasing their conspicuity. The combination of hyperthermia and high concentration chemotherapy used in HIPEC can also alter physiological healing, which may increase the incidence of vascular, lymphatic, gastrointestinal, urological and diaphragmatic complications.

#### TABLE OF CONTENTS/OUTLINE

Terminology. Pseudomyxoma peritonei. Hyperthermic Intraperitoneal Chemotherapy (HIPEC). Peritoneal anatomy and physiology. Preoperative imaging. Establish the presence or absence of peritoneal metastases. Quantitation of the radiologic Peritoneal Cancer Index. Description of extraperitoneal metastases. Postoperative imaging. Normal findings. Features indicative of complications.

#### GIEE-148 Off the Wall: Incidental Muscle Pathology on Abdominopelvic Imaging

Participants

Benjamin Northrup, MD, Chesterfield, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The use of cross-sectional imaging has increased exponentially, and incidental musculoskeletal findings have become commonplace. These are frequently referred to as "the radiologist's blind spot." Recent publications offer detailed review of abdominal wall pathology. However, the differential diagnosis for abnormalities of the paraspinal and pelvic musculature is often distinct. This review will familiarize radiologists with these unique and often overlooked pathologies and with management recommendations.

#### TABLE OF CONTENTS/OUTLINE

1. Abdominopelvic muscle anatomy 2. Congenital and structural abnormalities 3. Metabolic abnormalities (diabetic myonecrosis, rhabdomyolysis, hyperparathyroidism) 4. Vascular (arteriovenous malformations, ischemic myonecrosis) 5. Inflammatory myopathy (inflammatory myositis, sarcoidosis, drug-related, HIV, radiation, crystalline) 6. Infectious (poliomyelitis, cysticercosis, infectious myositis) 7. Sequelae of injury and trauma (DOMS, tears, hematoma, bursitis, heterotopic ossification, myositis ossificans) 8. Neoplasia (primary and metastatic malignant neoplasms, benign neoplasms) 9. Atrophy (denervation myopathy, end-stage inflammation, sarcopenia) 10. Normal variants and pitfalls (accessory and anomalous muscles, injection granulomata, lipohypertrophy) 11. An algorithmic approach to incidental musculoskeletal abdominal findings

#### GIEE-149 Peritoneal Carcinomatosis and HIPEC

Participants

Victoria John, MBChB, Stockport, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Peritoneal carcinomatosis occurs from spread of a primary cancer to the peritoneum, most commonly from the gastrointestinal tract and ovary. Pseudomyxoma peritonei is a rare type of peritoneal carcinomatosis characterised by accumulation of mucinous ascites and mucinous peritoneal deposits secondary to intraperitoneal spread of a mucin-producing primary tumour. Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) in suitable patients offers a chance for cure and is the mainstay of treatment in lower grades tumours, for which current chemotherapy regimes are of limited effect. Pre-operative imaging is key in determining patients' suitability for CRS/HIPEC with regards to tumour burden. Factors include the Sugarbaker Peritoneal Cancer Index (PCI), ascites and abdominal wall involvement, unfavourable sites of disease, presence of small bowel and mesenteric disease, as well as extra-peritoneal metastases. The most commonly used imaging modalities are CT and dedicated abdominal MRI. It is recognised that CT may underestimate the degree of disease, whilst MRI with peritoneal protocol has a higher sensitivity and may provide more accurate description of disease extent for the operating surgeon.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Peritoneal Anatomy. 3. Imaging techniques in peritoneal carcinomatosis including recommended protocols in CT and MRI. 4. Types of peritoneal carcinomatosis including pseudomyxoma peritonei. 5. Treatment of peritoneal carcinomatosis with cytoreductive surgery and HIPEC. 6. Adverse sites of disease on imaging. 7. Summary.

## **GIEE-15 Contrast-enhanced Ultrasound (CEUS), More Than Just Bubbles: Diagnostic and Interventional Applications in Daily Clinical Practice**

Participants

Paul Lopez, MBBS, Donostia-San Sebastian, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-To learn the potential applications of CEUS throughout the body. -To understand the value of CEUS both in diagnostic and interventional procedures.

### **TABLE OF CONTENTS/OUTLINE**

Since its introduction into clinical practice in the late 1990s, CEUS has gained popularity among radiologists as a diagnostic tool in multiple organ systems, and more recently in radiological interventionism. This is due to its great advantages, which include real-time imaging, high contrast resolution and absence of nephrotoxicity among others. This work will review the potential applications of CEUS in daily clinical practice based on cases of our center. -Liver: characterization of benign and malignant focal lesions, role in hepatocellular carcinoma, interventional procedures. -Gallbladder: tumor versus inflammatory process and biliary mold. -Kidney: complex cystic lesions and tumors, interventional procedures. -Urinary tract and bladder: tumor versus clot, grading vesicoureteral reflux in children. -Thyroid: ablation procedures. -Inflammatory bowel disease: evaluation of inflammatory activity, treatment monitoring, fibrous versus inflammatory strictures? -Interventional radiology: guide for percutaneous biopsies, tumor ablations and drain placement, post-ablation surveillance? -Vascular applications: thrombus detection and evaluation, hemorrhage detection?

## **GIEE-150 Metastatic Lobular Breast Cancer: What the Abdominal Radiologist Needs to Know**

Participants

David Fidler, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-Invasive lobular breast carcinoma (ILC) has a predilection for abdominal and pelvic metastases, with a distinctive distribution and distinctive imaging features. -Three important patterns of abdominal metastasis: Infiltrative submucosal and subserosal metastasis to abdominal and pelvic viscera, mimicking primary abdominal and pelvic malignancy, for example stomach carcinoma (linitis plastica type), colonic carcinoma, uterine and bladder carcinoma; Diffuse peritoneal metastasis, mimicking metastatic ovarian cancer/primary peritoneal neoplasm; Retroperitoneal metastasis, mimicking lymphoma or retroperitoneal fibrosis. -Appears on imaging as smooth, infiltrative lesions, without extramural extension and without desmoplastic reaction. Long segment and multi-organ involvement is typical. MRI signal partially reflects the target organ. -Metastases can occur many years after primary malignancy, and therefore may not be clinically suspected. The radiologist at the MDT may be the first to suggest the diagnosis. -The lesions may not be evident at endoscopy and may be missed on superficial biopsy, therefore radiological suspicion is key

### **TABLE OF CONTENTS/OUTLINE**

-Patterns of abdominal metastasis: GI and GU tract; Peritoneum; Retroperitoneum. -Imaging features. -Why is this important to me?

## **GIEE-151 Transplantation for Type 1 Diabetes: Radiologist's Primer on Pancreatic, Pancreatic-kidney and Islet Cell Transplantation Imaging**

### **TEACHING POINTS**

1) Overview of transplantation procedures for type 1 diabetes with imaging of pancreatic, pancreatic-kidney and novel strategy of islet cell transplantation. 2) Highlight the clinical indications, surgical anatomy, procedure techniques, pre and post-transplantation imaging. 3) Review expected imaging acquisition parameters for US, CT and MRI. 4) Describe immediate, early and delayed complications of pancreatic, pancreatic kidney and islet cell transplantation.

### **TABLE OF CONTENTS/OUTLINE**

• Introduction: Multimodality imaging of pancreatic, pancreatic-kidney and islet cell transplantation with emphasis on transplantation-related complications. Outline • Pancreatic and pancreatic-kidney transplant-Assessment of donor pancreas and graft implantation.-Imaging modalities: US, CT, MRI, angiography.-Complications: Vascular (Thrombosis, Pseudoaneurysm), transplant pancreatitis, intestinal complications (Leak, Bowel obstruction, Fistula). • Islet cell transplantation-Pretransplant imaging: Chest x ray, abdominal US-Technique: Portal venogram, islet cell infusion, tract embolization.-Post-transplant imaging: Ultrasound, PET, SPIO MR imaging-Complications: Early (Hemorrhage, Portal vein thrombosis, Arteriportal fistula) and delayed (Heterogenous hepatic steatosis, Immunosuppression related effects).

## **GIEE-152 Mucking Up the Abdomen: Common and Uncommon Presentations of Pseudomyxoma Peritonei**

Participants

Ethan Zaccagnino, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Pseudomyxoma Peritonei (PMP) is an entity characterized by mucinous ascites due to the spread of mucin producing neoplasms. It commonly presents as acute appendicitis or RLQ pain with imaging revealing a mucocele of the appendix. Mucocele rupture may cause spread of tumor into the abdomen resulting in peritoneal implantation. Less common sites of origin include gallbladder, small intestine, pancreas, breast and ovary/fallopian tubes. Imaging findings include mucinous or soft-tissue peritoneal implantations and mass effect or scalloping of the abdominal viscera. Ultrasound may detect mucinous ascites or discrete tumors, however cross-sectional imaging with CT or MR is preferred to characterize PMP. Treatment options include surgical debulking and Hyperthermic Intraperitoneal Chemotherapy (HIPEC). Serial imaging is often warranted, as recurrence is common.

### **TABLE OF CONTENTS/OUTLINE**

1. Intro to pseudomyxoma peritonei (PMP). 2. Mucinous tumors (low and high grade appendiceal mucinous neoplasms, as well as mucinous adenocarcinoma) and sites of origin. 3. Epidemiology of mucinous tumors and PMP. 4. Multimodality imaging features of mucinous tumors and PMP. 5. Treatment (HIPEC and surgical debulking) and complications (mucinous ascites and recurrence) of

PMP. 6. Mimics of PMP as well as situations in which mucinous tumors and PMP can mimic non-neoplastic entities. 7. Common and uncommon presentations. 8. Summary and conclusion.

### **GIEE-153 Diagnosis of Biliary Atresia: Featured Images for the Radiologist**

#### **TEACHING POINTS**

- -Identify the normal liver and bile duct findings in different imaging modalities and the main characteristics and classification of biliary atresia.
- -Illustrate the featured signs and imaging data in the diagnosis of biliary atresia and their post-operative complications.

#### **TABLE OF CONTENTS/OUTLINE**

- Normal pediatric liver ultrasound.
- Some facts about biliary atresia.
- Ultrasound findings.
- Normal and pathological hepatobiliary scintigraphy.
- Findings in percutaneous procedures.
- Imaging in post-operative complications.

### **GIEE-154 Integrating Intestinal Ultrasound (IUS) into an Inflammatory Bowel Disease (IBD) Imaging Service**

#### **TEACHING POINTS**

- Successful control of Crohn's Disease (CD) relies on effectively suppressing inflammation which requires ongoing monitoring.
- A number of trials have validated intestinal ultrasound (IUS) as having excellent diagnostic accuracy in patients with CD, performing comparably to established modalities such as MRI. International guidelines recommend that newly diagnosed CD patients undergo small bowel assessment with IUS or MR enterography.
- Additionally, ultrasound is cost-effective, widely available and better tolerated by patients which is crucial when regular monitoring is required.
- A one-stop clinic where patients undergo IUS with subsequent assessment by a gastroenterologist enables timely implementation of a targeted management plan for better disease control.
- Operators must have appropriate training and experience with IUS as well as a methodical and reproducible technique for accurate disease assessment.
- With sufficient operators trained in IUS, it may also be offered as a point-of-care test in the emergency department.
- Oral and intravenous contrast may be used in IUS selectively to provide additional information.
- A reporting template can serve as a useful aid to performing a comprehensive study. Successful implementation requires multidisciplinary input involving radiology, gastroenterology, and surgery.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. One-stop clinic 3. Resources 4. Technique 5. Sonographic appearances of IBD: Case Studies 6. Summary

### **GIEE-155 The Hepatic Angiomyolipoma: A Guide to Avoiding a Big Fat Mistake**

Participants

Ana Paula Fraga Cintra Gonzaga, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Provide an overview of hepatic angiomyolipoma (HAML). Discuss typical and atypical cases of HAML with an emphasis on imaging features. Review the main differential diagnoses of HAML with a didactic approach. Offer useful tips for challenging cases to enhance accurate diagnosis and patient outcomes. Develop a radiological survival guide for interpreting fat hepatic nodules.

#### **TABLE OF CONTENTS/OUTLINE**

HAML is a rare tumor with a combination of blood vessels, smooth muscle, and varying degrees of mature fat. Despite limited research on HAML, this presentation aims to offer a comprehensive overview of the key features of this lesion, including epidemiology, associations (such as tuberous sclerosis), pathology, radiographic features, prognosis, and treatment. Using case-based presentations, we will explore both classical and uncommon imaging manifestations of HAML, including potential malignant behavior. Additionally, the presentation will discuss the differential diagnosis of HAML, ranging from benign lesions (lipoma, nodular hepatic steatosis, steatotic adenoma, and focal nodular hyperplasia) to malignant neoplasms (HCC and metastasis). Tips for differentiating these diagnoses based on imaging and other clinical factors will be provided. Provide tips for challenging cases where the diagnosis may not be apparent from imaging alone, and radiologists can still play a critical role in contributing to better patient outcomes. Propose a radiological survival guide. This guide will summarize key radiographic and non-radiographic features of HAML, along with differential diagnoses and important clinical considerations, to assist radiologists in accurate diagnosis and appropriate patient management.

### **GIEE-156 Bariatric Surgery: A Pictorial Review. From Post-Surgical Anatomy to Complications**

Participants

Maria Galante I, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To describe the normal postsurgical anatomy of the most common bariatric surgery techniques.
- To analyze the most frequent complications of each of them, with CT and fluoroscopic imaging.
- To present CT images of interesting cases of patients that have undergone bariatric surgery procedures. In this exhibit we will review the most frequent bariatric techniques and their complications, that are divided in late and early depending on the postoperative period in which that may appear (more or less than one month). Older procedures such as vertical-banded gastroplasty and jejuno-ileal bypass will not be assessed.

#### **TABLE OF CONTENTS/OUTLINE**

1. Generalities and indications of bariatric surgery 2. Classification 3. Post-surgical imaging control protocol 4. Restrictive Surgeries: Anatomical imaging features and main complications 4.1 Adjustable Gastric Banding 4.2 Sleeve Gastrectomy 5. Restrictive and Malabsorptive Procedures: Anatomical imaging features and main complications 5.1 Roux-en-Y- Gastric Bypass 5.2 Anastomosis duodenoileal bypass (SADI-s), minigastric bypass, duodenal switch 6. Conclusions

### **GIEE-157 Tricky abdominal cases: Practical approach using Spectral CT**

Participants

Ana Villanueva, MD, Toronto, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. To learn the benefits of spectral CT applications in challenging abdominal imaging cases  
2. Role of spectral CT in patient's care, how we can change management decisions

## TABLE OF CONTENTS/OUTLINE

1. Background: Revision of basic concepts of spectral CT.  
• Definition  
• Types of Spectral CT available in the market  
• Review of different material decomposition applications  
2. Review of challenging abdominal and pelvic cases.  
• Case-based and interactive format- The reader will be able to click on different stories to go through broad spectrum of cases covering most of abdominal and pelvic organs- We will display daily situations where the radiologist could feel stuck while reporting the CT- Companion quiz questions and teaching points/tips will be shown- Updated literature will be provided for each case. By clicking on each reference, the reader will be redirected straight to the actual paper  
• To propose an algorithm to guide the radiologist to accurately reach the diagnosis  
• To demonstrate how spectral CT is useful for problem solving and the radiologist could aid in successful decision-making and avoid additional imaging or procedures  
3. Limitations of spectral CT  
4. Conclusion

## GIEE-158 Don't Be Thrown for a Loop! A Review of Internal Hernias for the Abdominal Imager

### TEACHING POINTS

Internal hernias are herniations of abdominal viscera, usually small bowel, through congenital or acquired openings of the peritoneum or mesentery. Internal hernias can obstruct and are considered surgical emergencies due to the high risk of bowel strangulation. If complications such as bowel obstruction or ischemia are not present, then imaging findings of internal hernia will consist primarily of displacement of normal abdominal structures. After reviewing this exhibit, the viewer will be familiar with the various kinds of congenital and acquired hernias, as well as the epidemiology, surgical risk factors, imaging appearance, and complications associated with internal hernias.

### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Congenital Hernias  
2a. Brief review of embryology and general anatomy  
Types of Hernias with accompanying cases.  
2b. Lesser Sac (Foramen of Winslow).  
2c. Left paraduodenal (Fossa of Landzert).  
2d. Right paraduodenal (Fossa of Waldeyer)  
2e. Pericecal  
2f. Transomental: Greater Omentum and Lesser Omentum  
2g. Sigmoid  
2h. Broad Ligament  
3. Acquired/Iatrogenic  
3a. Introduction to Acquired Hernias and commonly associated surgeries  
3b. Roux en Y/ Gastric Bypass: Description of Procedure and Associated Hernias  
3c and d. Epidemiology, Anatomy, and Imaging appearance of: transmesenteric and jejuno-jejunostomy hernias  
3e. Left colectomy and low anterior resection  
3f. Epidemiology, Anatomy, and Imaging appearance of the following: herniation of the small bowel inferior to the neorectum.  
4. Complications  
4a. Bowel obstruction, including closed loop  
4b. Strangulation and Ischemia  
5. Summary

## GIEE-159 Periportal Lesions - Tiny Space, Huge Possibilities

Participants

Cynthia Borborema, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review the anatomy of the periportal space and its pathophysiology;  
• To present the most relevant anatomical variants.  
• To compartmentalize the periportal lesions through a series of cases.  
• To introduce the disorders that may affect that space with a brief review of the clinical context and imaging findings.

### TABLE OF CONTENTS/OUTLINE

• The periportal region is the anatomic space around the portal vein and its intrahepatic branches composed of hepatic artery branches, bile duct branches, lymphatics, and nerves that can be affected by a variety of pathological conditions. Due to its complex anatomical architecture and the wide possibility of lesion natures, involvement of the periportal space can be a diagnostic challenge for radiologists.  
• Review of periportal anatomy with didactic illustrations of the main anatomical variants.  
• In this presentation periportal lesions will be divided into the following categories: vascular (pathologies of the portal vein and hepatic artery), lymphatic (pathologies of periportal lymphatics), neural (pathologies of periportal nerves), periportal space as a pathway for diseases to spread and miscellaneous.  
• A complete case-based review of common (periportal edema, portal biliopathy, peribiliary cysts, infectious diseases) and unusual disorders involving the periportal space, such as segmental arterial mediolysis, metastatic calcifications, plexiform neurofibroma, extramedullary hematopoiesis, amyloidosis, lymphangioma, hepatic artery giant pseudoaneurysm, ganglioneuroma, schwannoma.

## GIEE-16 Imaging of Pancreas Transplants: A Comprehensive, Multimodality Review

Participants

Rachel Perez, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Anatomy and surgical technique  
2. Key imaging features and techniques  
3. Pancreas transplant complications

### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Review of normal/donor pancreatic anatomy  
2a. Donor arterial supply, venous drainage, and exocrine drainage  
3. Surgical technique/transplant anatomy  
3a. Systemic-venous drainage  
3b. Portal-venous drainage  
3c. Exocrine Bowel drainage  
3d. Exocrine Bladder drainage  
3e. Stepwise approach to identifying anatomy  
4. Imaging  
4a. Ultrasound and Contrast-Enhanced Ultrasound  
4b. CT/CTA  
4c. MRI/MRA (including ferumoxytol)  
5. Biopsy technique  
6. Complications  
6a. Parenchymal  
6a1. Rejection  
6a2. Pancreatitis  
6b. Vascular  
6b1. Thrombosis  
6b2. Stenosis  
6b3. Hemorrhage  
6b4. Pseudoaneurysm  
6b5. Arteriovenous Fistula  
6c. Bowel  
6c1. Small Bowel Obstruction  
6c2. Exocrine leak  
7. Summary of key learning points

## GIEE-160 The Anatomy of Normal and Abnormal Swallowing

Participants

Nancy J. McNulty, MD, (*Presenter*) Book contract, Oxford University Press

### TEACHING POINTS

The oral cavity, pharynx, larynx, and surrounding muscles, bones and cartilaginous structures work together in a sophisticated and coordinated way to achieve normal swallowing. Accurate diagnosis of swallowing dysfunction requires a comprehensive understanding of what is normal, and how normal structures work in a coordinated fashion to achieve deglutition. This exhibit will review the components of swallowing that are voluntary, such as chewing, forming a bolus of food on the tongue, and initiating deglutition, and the involuntary reflexes that are initiated by stimulation of the palate or touch receptors in the pharynx. The pertinent anatomy, including muscles and their innervation, will be highlighted and reinforced. Clinically, swallowing dysfunction can be assessed with a video fluoroscopic barium swallow study. Normal swallowing exams will be used to demonstrate normal function, and highlight the components of a normal swallow.

#### TABLE OF CONTENTS/OUTLINE

Outline the sequence of events that occur during normal swallowing. Explain the muscles involved in the voluntary and involuntary tasks of swallowing and their innervation. Identify the anatomy and the role of structures of the head and neck during normal swallowing, and how they work to prevent nasopharyngeal regurgitation and aspiration. Review components of normal swallowing function on video swallowing examinations with audio narration. Observe video swallowing examinations with audio narration highlighting commonly encountered types of swallowing dysfunction.

#### **GIEE-161 The Invaluable Role of CEUS in HCC imaging: Planning and Guidance of Ablative Therapy and Secondary Surveillance Following Treatment**

Participants

Shayan Hemmati, BSc, Calgary, AB (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) The unique benefits of hepatocellular carcinoma (HCC) diagnosis with contrast enhanced ultrasound (CEUS) include dynamic real time imaging and bubble tracking techniques, along with exquisite sensitivity for detection of arterial phase hyperenhancement (APHE) and washout (WO). (2) The advantages of performing CEUS prior to ultrasound guided ablative therapy for HCC include accurate identification of the nodule and grayscale occult lesions, determination of the best ultrasound technique (probe selection, patient positioning/breath hold), and identification of any unexpected findings that would alter or preclude ablative therapy (ex. additional lesions or tumour in vein). (3) Performance of CEUS at the time of ablation is essential to guide probe placement for grayscale occult or difficult to visualize nodules allowing the interventionalist to target either foci of APHE or areas of WO. (4) Performance of immediate post ablation CEUS to assess for completeness of ablation increases the number of successful ablations by allowing immediate identification and re-treatment of residual tumour or non-target ablations. (5) Inclusion of CEUS in secondary surveillance optimally resolves indeterminate or equivocal MRI results. Recognition of non-linear artifact on CEUS, arising from the microwave ablation probe tract, is essential to avoid misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

- Background - Diagnosis of HCC with CEUS - Ablation Planning with CEUS - Ablation Targeting with CEUS - Immediate Post-ablation Assessment with CEUS - Secondary Surveillance with CEUS - Conclusion - References

#### **GIEE-162 Role of Imaging in Systemic Therapy for HCC**

Participants

Kevin Zand, MD, Washington, DC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Multiple combined and single systemic therapies are currently FDA approved for intermediate and advanced stage HCC. 2. Systemic therapy for HCC improves overall survival in patients who are not candidates for curative or locoregional therapies or who have failed locoregional therapy. 3. Imaging has a key role in the post treatment evaluation, response assessment, and diagnosis of potential complications. 4. LI-RADS treatment response algorithm is not applicable to the systemically treated HCC. 5. HCC response to immunotherapy is different compared to chemotherapy, and should be considered in tumor response assessment by imaging.

#### TABLE OF CONTENTS/OUTLINE

1. The current role and survival benefit of immunotherapy for HCC. 2. Review of response assessment criteria in the systemically treated HCC (RECIST, mRECIST, and other criteria) and their use in clinical trials that lead to FDA approval of the new agents. 3. Post treatment imaging assessment. Representative cases will illustrate the imaging before and after systemic therapy (at multiple time points when relevant) with correlation with the clinical course and overall outcomes. (a) Representative cases from patients with favorable/stable outcomes. (b) Representative cases from patients with poor outcome. (c) Representative cases showing treatment related complications. 4. Review of emerging literature on combined immunotherapy with locoregional therapy. 5. Limitations of treatment response assessment after systemic therapy for HCC and future directions

#### **GIEE-163 Hypointense Hepatic Findings on Hepatobiliary Phase Imaging**

Participants

Kelly Harper, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the mechanism of hepatocellular contrast agent uptake and factors affecting it - Liver parenchyma hypointensities in hepatobiliary phase (HBP) can be diffuse, regional, and focal - Parenchymal hypointensities can be due to technical, parenchymal, vascular, and biliary causes - Both hepatocellular and non-hepatocellular lesions can show hypointensity - Hypointensity of a lesion is useful for its characterization - Hypointensity around a neoplasm may be associated with aggressive nature with management implications

#### TABLE OF CONTENTS/OUTLINE

- Parenchymal hypointensity
  - o Diffuse
    - o Technical- timing; opposed phase imaging; no fat suppression, low flip angle.
    - o Parenchymal § Poor hepatocyte function-chronic liver disease § Diffuse hepatic steatosis. § Iron overload § Infiltrative disorders- fibrosis, amyloidosis, malignancy etc § Drug injury § Genetic polymorphism of OATPB1
    - o Vascular § Acute portal vein-narrowing or occlusion § Portal hypertension Sinusoidal obstruction syndrome
    - o Distal biliary obstruction- common bile duct
    - o Regional (lobar/segmental/geographical)
    - o Parenchymal § Radiation- SBRT
    - o Vascular § Acute portal vein branch occlusion § Portal vein



embolization § Hepatic vein occlusion o Bile duct branch occlusion o Focal o Focal fat deposits o Focal confluent fibrosis o Arterioportal shunts o Infective/inflammatory- cholangitis • Hypointense lesions • Hepatocellular lesions o Hepatocellular carcinoma o Hepatic adenoma • Non hepatocellular lesions o Cysts o Metastases o Hemangioma o Cholangiocarcinoma

## **GIEE-164 Inclusion of Liver CEUS in Current Practice Guidelines**

Participants

Stephanie Wilson, MD, Calgary, AB (*Presenter*) Equipment support, Koninklijke Philips NV; Equipment support, Siemens AG; Equipment support, Samsung Electronics Co, Ltd; Research support, Samsung Electronics Co, Ltd;

### **TEACHING POINTS**

(1) Current North American guidelines of relevance for liver imaging with CEUS include those from AASLD, American Association for the Study of Liver Disease; NCCN, National Comprehensive Cancer Network; and LI-RADS, Liver Imaging Reporting and Data Systems, a classification for those at risk for HCC including an algorithm for categorization of nodules shown on imaging. (2) CEUS was originally not favored for liver imaging because of misconceptions about its ability to differentiate hepatocellular carcinoma from cholangiocarcinoma. (3) Current data shows CEUS performs equivalent and often superior to CT/MR for characterization of liver nodules. (4) CEUS techniques for metastasis detection and diagnosis include sweeping the liver in the portal venous phase to show washout zones and on top injections to show the arterial enhancement of washout lesions. (5) CEUS STRENGTHS include: - Resolution of indeterminate nodules from CT/MRI, with reduction of biopsy - High specificity for HCC within LI-RADS allowing treatment of HCC following CEUS without biopsy. - Accurate characterization of nodules found on surveillance US for HCC. - Better correlation of nodules from surveillance US than shown with MRI, making CEUS the modality of choice as the first test following positive surveillance US. - Optimal diagnosis of small metastases

### **TABLE OF CONTENTS/OUTLINE**

-Introduction of Guidelines for Liver Imaging -AASLD emphasizing imaging for suspect or confirmed HCC. -NCCN emphasizing long-term surveillance of patients at risk for development of metastases. -LI-RADS and its algorithm for categorization of liver nodules, with integration of CEUS LI-RADS with LI-RADS for CT/MRI. -Our perspective on Liver Imaging with CEUS.

## **GIEE-165 Recognizing Benign Lesions in Cirrhotic Liver: Moving Beyond Odds and Enhancing Interpretation**

### **TEACHING POINTS**

1 - This review aims to enhance the recognition and interpretation of benign lesions in patients with cirrhotic liver that may arise due to underlying cirrhosis or occur incidentally. 2 - Illustrate with cases the typical and atypical features of these lesions using computed tomography (CT) and magnetic resonance imaging (MRI). 3 - Provide practical considerations and diagnostic clues to minimize misunderstandings in interpretation and ensure accurate assignment of the Liver Imaging Reporting and Data System (LI-RADS®) category.

### **TABLE OF CONTENTS/OUTLINE**

1 - Definition of cirrhosis and its impact on the appearance of benign lesions. 2 - Describing the imaging presentations of various benign entities in cirrhotic liver on CT and MRI, distinguishing between their typical and atypical features. 3 - Practical considerations and diagnostic clues to differentiate from malignancy and how to assign the correct LI-RADS® category.

## **GIEE-166 What's New in Classification, Pathology, Imaging Findings, and Management of Cystic Liver Diseases: 2023 Update**

Participants

Sriram Jaganathan, MBBS, Little Rock, AR (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• Discuss 2023 updates on the classification, nomenclature, and pathology of developmental, non-neoplastic neoplastic cystic liver disease • Review spectrum of imaging findings role of different imaging modalities in diagnosis management • Discuss current updates in management strategies with special emphasis on the 2022 European Association for the Study of the Liver (EASL) clinical practice guidelines

### **TABLE OF CONTENTS/OUTLINE**

Introduction Classification Nomenclature of hepatic cystic diseases Molecular pathogenesis hepatic cystogenesis updates Imaging Techniques: US/CT/MRI PET/CT Polycystic liver disease (PLD) Role of imaging in assessing cyst volumes, total liver volumes treatment follow-up; Gigot Schnellendorfer classifications; Complications Management Non-neoplastic Cysts Simple hepatic cysts (malformation of the ductal plate): cystic bile duct hamartoma; Infections: Abscess, Echinococcal cyst; Congenital: choledochal cyst Caroli disease, foregut cyst, von Meyenberg complex; Miscellaneous: peribiliary cysts, organizing hematoma, fibrous cyst pseudocyst Cystic Neoplasms Mucinous cystic neoplasms, Intraductal papillary neoplasm, tubulopapillary oncocytic papillary neoplasms, cystic metastases, HCC, cholangiocarcinoma rare tumors. Imaging spectrum of cystic liver diseases Management: EASL 2022 clinical practice guidelines with the central role of imaging Conclusion Imaging is pivotal in diagnosing, guiding appropriate treatment, and assessing complications for cystic liver diseases. By emphasizing up-to-date imaging findings and recommendations, radiologists are better equipped to provide effective patient care.

## **GIEE-167 Liver Transplant Complications; Case Review from Our Hospital**

Participants

Iskander Artech Amaid, MD, Barakaldo, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Get to know the normal findings of the immediate postoperative period of liver transplantation. Mention the most frequent complications classified into arterial, venous and biliary based on cases seen in our Hospital.

### **TABLE OF CONTENTS/OUTLINE**

OLT (orthotopic liver transplantation) is the definitive treatment for patients with end-stage liver disease, acute fulminant liver failure, some neoplasms (HCC, metastases...increasingly broad indications). The surgical technique consists of extracting the donor

(dissection of the hepatic hilum on a bench +- arterial reconstruction if variants) and subsequent implantation. The first step to take when evaluating a liver graft will be to read the surgical report to later understand the images. An ultrasound is mainly performed 24 hours after the transplant, in which we assess the parenchyma, the bile duct, and the flow of the arterial and venous vessels. It will be important to know the normal ultrasound findings. Complications are divided into arterial, venous and biliary. Regarding arterial complications, we have occlusion of the hepatic artery due to dissection/thrombosis of the latter (the most serious complication), hepatic artery stenosis, and pseudoaneurysms. Regarding biliary complications, we have, on the one hand, biliary strictures, most of them anastomotic (they may be non-anastomotic in the intrahepatic bile duct but are related to other causes such as ischemia) and on the other hand the bile leakage. Venous complications are the least frequent, and can affect both the suprahepatic veins and the portal vein, and consist mainly of thrombosis and stenosis.

### **GIEE-168 Uncommon Pancreas Solid Lesions: Spectrum of Imaging Appearance and Radiologic-Pathologic Correlation**

Participants

Yoshihiko Fukukura, MD, PhD, Kurashiki, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

TEACHING POINTS Pancreatic solid lesions display a wide spectrum of histology, including exocrine and endocrine tumors. The most common tumors of exocrine and endocrine tumors of the pancreas are ductal adenocarcinoma and neuroendocrine tumor, respectively. Uncommon tumors that need to be differentiated from the common pancreas solid tumors include adenosquamous carcinoma, colloid carcinoma, undifferentiated carcinoma, acinar cell carcinoma, solid-pseudopapillary neoplasm, etc. Familiarity of imaging findings of the uncommon tumors is important to arrive at the correct diagnosis of pancreas solid lesions because a precise diagnosis determines the treatment and surgical approach. The purpose of this exhibit is: 1. To describe the imaging and histopathologic features of uncommon pancreas solid tumors 2. To recognize and describe the imaging appearance of some mimics of pancreas solid tumors 3. To discuss the imaging differential diagnosis of pancreas solid tumors

#### **TABLE OF CONTENTS/OUTLINE**

1. Review of CT and MR imaging findings of uncommon pancreas solid tumors, with histopathological correlation. 2. Highlight key differential diagnostic points of pancreas solid tumors. 3. Summary: Awareness of radiological findings of uncommon pancreas solid tumor is important to arrive at the correct diagnosis of pancreas tumors.

### **GIEE-169 Non-contrast Vascular Reconstruction in Patients with a History of Contrast Agent Allergy**

#### **TEACHING POINTS**

Depiction of vascular information by contrast-enhanced CT is required for preoperative examination of surgery. However, there are often cases where it is difficult to use a contrast medium due to allergies to the contrast medium. We have developed a virtual abdominal contrast CT image as a preoperative vascular image by non-contrast CT image for such cases. We performed CT without contrast medium infusion in the abdomen. High-definition scanning conditions were set for image reconstruction. Vascular extraction was performed on the obtained CT volume data using workstation automatic tracking. After that, the multi-planar reconstruction display (MPR) was created from the CT image. By combining the blood vessel information and the MPR display, it was possible to create a virtual abdominal contrast CT image similar to the conventional contrast CT without injecting a contrast medium. The images we developed were evaluated to have important information for the surgeon.

#### **TABLE OF CONTENTS/OUTLINE**

1. Necessity of vascular information and problems of contrast agent allergy 2. Scan technique for blood vessel extraction 3. Extraction of abdominal blood vessels using automatic tracking 4. Creating an MPR display 5. Composite display of blood vessel image MPR display 6. Clinical significance of virtual abdominal contrast CT images

### **GIEE-17 Misdiagnosis of Pancreatic Intraductal Papillary Mucinous Neoplasms and the Challenge of Mimicking Lesions: Imaging Diagnosis and Differentiation Strategies**

#### **TEACHING POINTS**

1. Accurate diagnosis of lesions that mimic IPMNs is crucial to determine appropriate surveillance or resection. 2. There is a risk of overdiagnosis and overtreatment of potentially neoplastic lesions with up to half of cystic lesions mischaracterized on imaging. 3. Using dedicated pancreatic protocol CT and noting unique features such as a bulging ampulla for IPMNs or the extracapsular cystic sign of SCAs can aid in distinguishing subtle differences. Additionally, a "cysts-within-a-cyst" appearance is often present in MCN, giving them a multilocular appearance, as opposed to the "cyst-by-cyst" presentation of IPMNs. 4. Cystic pancreatic neuroendocrine tumors have peripheral hypervascular rim on arterial phase CT. 5. Lymphoepithelial cysts have a cheerios-like appearance with signal drop out on out of phase images. 6. Pancreatic schwannoma has progressive homogeneous enhancement with areas of necrosis. 7. Chronic pancreatitis has a chain of lake appearance with strictures, intraductal calculi, and parenchymal calcifications. 8. EUS, FNA, fluid analysis, cytology, radiomics, and artificial intelligence are all useful tools for definitive diagnosis when CT and MRI are not specific enough.

#### **TABLE OF CONTENTS/OUTLINE**

1. IPMN diagnosis and misdiagnosis 2. Misdiagnosis of mimicking lesions and strategies to accurate diagnosis-Macrocytic Serous Cystadenoma-Cystic Pancreatic Neuroendocrine Tumor-Mucinous Cystic Neoplasm-Lymphoepithelial Cyst-Duodenal Diverticulum-Pancreatic Schwannoma-Chronic Pancreatitis-Retention Cyst and Cystic Fibrosis-Intrapancreatic Accessory Spleen and Epidermoid Cyst-Pancreatic Lipoma or Interdigitating Fat-Choledochal Cyst 3. Conclusion

### **GIEE-170 Advanced Ultrasound Techniques for Liver Transplantation Evaluation**

Participants

Gonzalo Martin Ordonez, MD, Majadahonda, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To describe the usual Doppler technique for liver graft follow-up and for evaluation of complications. To describe the use of contrast enhanced ultrasound (CEUS) in the evaluation of vascular complications and graft ischaemia. To describe the use of shear wave elastography in the evaluation of medical complications.

## TABLE OF CONTENTS/OUTLINE

Liver transplantation is the treatment of multiple end-stage liver diseases. Medical and surgical complications are an important source of morbidity and mortality, and radiological examinations are essential for their early detection. Doppler ultrasound is the preferred imaging technique in the initial evaluation of the liver graft and during follow-up due to its portability and the unique hemodynamic information it provides. The use of CEUS allows to confirm vascular complications to define the location and the extension of ischemic areas, and to ascertain biliary tract ischemic involvement, what that is key for deciding the optimal treatment. Shear-wave elastography provides a non-specific but interesting quantitative information that allows for a sequential evaluation of the liver parenchyma. It is useful in the diagnosis and follow-up of medical complications including rejection and the rarer obstructive sinusoidal syndrome. The liver rigidity also aids to decide in which patients a biopsy should be done. We show a pictorial review of cases from our institution to illustrate the vascular, biliary and medical complications that can be evaluated with these techniques.

### GIEE-171 Advanced Abdominal MRI Techniques and Problem-solving Strategies

Participants

Yoonhee Lee, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Magnetic resonance imaging (MRI) plays an important role in abdominal imaging owing to its ability of detection and characterization of focal lesions. Nowadays, techniques for reducing scan time with an acceptable image quality such as parallel imaging, compressed sensing (CS) technique, and nowadays cutting edge deep learning (DL) techniques have arisen for problem solving strategies. Also free breathing techniques using dynamic phase involving extra-dimensional (XD)-volumetric interpolated breath-hold examination (VIBE), and golden-angle radial sparse parallel (GRASP) can help patients with severe dyspnea or under sedation perform abdomen MRI. Therefore, this pictorial review aims to show various advanced abdomen MRI techniques for reducing scan time with maintaining image quality and free breathing techniques during dynamic phase, and representative cases with aforementioned techniques.

## TABLE OF CONTENTS/OUTLINE

•I. Reducing scan time and improving image quality 1.Parallel imaging : Dynamic phase (Controlled Aliasing in Parallel Imaging Results in Higher Acceleration), Half-Fourier-acquisition single-shot turbo spin-echo (HASTE) 2.Compressed sensing technique : Dynamic phase, Magnetic resonance cholangiopancreatography 3.Deep learning (DL) : T2 weighted image, Diffusion weighted image •Strength and pitfalls of DL while radiologists interpreting lesions 4.Motion corrected diffusion weighted image • •II. Free breathing technique during dynamic phase 1.Stack of Stars volumetric interpolated breath-hold examination (StarVIBE) 2.Extra-dimensional (XD)-VIBE 3.Golden-angle radial sparse parallel (GRASP)

### GIEE-172 Imaging of Pancreatic Cystic Lesions: What Radiologists Should Know

Participants

Akihiko Kanki, MD, Kurashiki, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this presentation is:1) To demonstrate the common and uncommon computed tomography and magnetic resonance imaging findings of neoplastic pancreatic cystic lesions, including the radiologic-pathologic correlation.2) To learn about the non-neoplastic and cyst-like lesions of the pancreas that can mimic pancreatic cystic neoplasms.

## TABLE OF CONTENTS/OUTLINE

Classification of Pancreatic Cystic LesionsImaging findings of common pancreatic cystic lesionsNeoplastic pancreatic cystic lesions•Mucinous cystic neoplasm•Serous neoplasm•Intraductal papillary mucinous neoplasm•Intraductal tubulopapillary neoplasm•Intraductal oncocytic papillary neoplasmImaging findings of uncommon pancreatic cystic lesions•Intraductal papillary mucinous neoplasm complicated with intraductal hemorrhage, perforation and fistula formation•Mucinous cystic neoplasm occurring with side branch-type intraductal papillary mucinous neoplasmNon-neoplastic and cyst-like lesions of the pancreas that can mimic pancreatic cystic neoplasmsNon-neoplastic pancreatic cystic lesions•Squamous lined cyst•Acinar cystic transformationVarious pancreatic tumors with cystic degeneration•Solid pseudopapillary neoplasm•Others

### GIEE-173 Pseudomyxoma Peritonei: Imaging Features and Current Therapies

Participants

Laura Jorgenson, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Define pseudomyxoma peritonei. Understand and describe the histopathology, pathophysiology, and etiologies of PMP, with a focus on appendiceal and ovarian neoplasms. Describe the multimodality imaging features of pseudomyxoma peritonei. Recognize complications related to PMP, mucinous tumor burden, and cytoreductive surgery. Discuss specific imaging findings which are essential to the surgical oncologist in determining resectability and cytoreductive surgery planning. Review current therapies available to patients with PMP.

## TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE 1. Definition of PMP and imaging featuresDefineOptimizing US, CT, MR, and PET image acquisitionImaging features on different modalitiesNatural History 2. Tumor OriginAppendicealOvarianNon-malignant causesDifferentiation from multicystic mesotheliomaBrief review of pathologies of peritoneal surface malignancies 3. Potential Complications and related imaging features4. Example reporting template5. What the surgeon needs to know and current therapiesPeritoneal Carcinomatosis Index (PCI)Cytoreductive SurgeryHIPECSystemic chemotherapy - understanding response to therapy vs. progression

### GIEE-174 Dual Energy CT Angiography in Acute Mesenteric Ischemia - A Review

Participants

Aachi Kaushik Chary, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- To define the clinical presentation of acute mesenteric ischemia and dual energy CT angiography protocol for its diagnosis-To illustrate the types and various imaging features of acute mesenteric ischemia on dual energy CT- To discuss the benefits of dual energy CT in acute mesenteric ischemia

## TABLE OF CONTENTS/OUTLINE

Acute mesenteric ischemia (AMI) is a common potentially fatal condition requiring accurate and prompt image-based diagnosis to ensure quick treatment to save the bowel. The exhibit includes the following contents-Depiction of the clinical presentation of AMI along with the details of dual energy CT angiography protocol-Enumeration of the various causes and types of AMI-Detailed illustration of the vascular, bowel and associated findings on dual energy CT angiography in patients presenting with different types of AMI, with emphasis on the ominous signs-Elaborate discussion with illustrations on the benefits of dual energy CT including generation of virtual non-contrast images which reduce radiation dose, iodine maps representing tissue perfusion, and mono-energetic images which improve image contrast and thus diagnostic ability-Brief depiction of the role of interventional radiology in AMI

## GIEE-175 Ancillary Features Are Coming to LI-RADS Treatment Response Algorithm: Let's Get You Ready

### TEACHING POINTS

- The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for assessing and reporting treatment response after locoregional therapy (LRT) for hepatocellular carcinoma (HCC).- Emerging radiology-pathology and inter-reader studies have highlight the potential for ancillary features to improve detection of incomplete necrosis with greater radiology-pathology concordance.- This exhibit highlights the updates in the LR-TRA v2023 (compared to v2018), especially pertaining to the role of newly incorporated ancillary features. The overall objective of the changes is to improve diagnostic accuracy of post-treatment imaging assessment.

### TABLE OF CONTENTS/OUTLINE

- Summarize the role of the TRA in the context of the currently used treatments for HCC.- Provide an evidence-based review of current literature highlighting the value of incorporating ancillary features in treatment response assessment after locoregional therapy in HCC.- Highlight key updates of the LI-RADS v2023 TRA pertaining to use of ancillary features after various forms of LRT for response assessment, using a case-based and illustrative approach.

## GIEE-176 Ischemic Cholangiopathy: Imaging Patterns and Other Biliary Complications Following DCD Liver Transplant

Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to:1. Describe various imaging patterns of ischemic cholangiopathy post DCD liver transplant on MRI/MRCP2. Elaborate prognostic significance of these imaging patterns.3. Discuss additional biliary complications post liver transplant.

### TABLE OF CONTENTS/OUTLINE

Four different patterns of IC: have been identified, each correlating with DCD allograft prognosis. • Diffuse necrosis: Most severe form with nearly 100% need for retransplant, characterized by multifocal biliary strictures, wall necrosis and bile lakes. Usually, hepatic artery is severely stenosed or occluded. • Multifocal progressive: Starts as mild to moderate multifocal stricturing cholangiopathy that progresses in a few months to more severe form with worsening strictures or even biliary necrosis. >50% need for retransplant. • Confluence dominant: Mild to moderate cholangiopathy that involves the biliary confluence. Most cases can be managed without need for retransplant. • Minor Form: Mild areas of multifocal stricturing that remain stable or resolve. Other liver transplant biliary complications: • Anastomotic stricture • Bile leak/anastomotic dehiscence • Vanishing bile duct syndrome (ductopenia) • Biliary stones; Biliary cast syndrome; hemobilia • Cystic duct remnant mucocele • Roux limb bleeding, Roux limb stasis or obstruction. Summary IC post DCD liver transplant is a major source of allograft complications. Identifying different patterns of IC can help stratify need for stenting and predict allograft prognosis.

## GIEE-177 Multimodality Imaging Biomarkers for Crohn's Disease Strictures

Participants

Safa Hoodshenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To understand the role and characteristics of existing and future biomarkers in Crohn's disease strictures • To review existing diagnostic and prognostic Crohn's imaging biomarkers and potential surrogate clinical endpoints • To describe potential imaging biomarkers that reflect stricture histopathology or pathophysiology • To describe the strengths and weaknesses of existing and future biomarkers for Crohn's disease strictures.

### TABLE OF CONTENTS/OUTLINE

• Existing diagnostic and prognostic biomarkers of Crohn's disease strictures • Using CT or MR enterography to measure response biomarkers and/or efficacy endpoints for Crohn's strictures • Stiffness, fibrosis, and smooth muscle hypertrophy are histopathologic and physiologic targets for an emerging array of MR, ultrasound, and PET biomarkers • MRI-based biomarkers include delayed gadolinium enhancement, normalized magnetization transfer, DWI and intravoxel incoherent motion, T1 mapping, intramural T2 signal, and quantified small bowel motility • Ultrasound-based biomarkers include wall thickness, elastography to measure shear stiffness, contrast-enhanced ultrasound, and ultrasensitive microvessel imaging • Molecular imaging targets at PET-MRE include inflammation and fibrosis

## GIEE-178 Kidney Pancreatic Transplantation: Anatomy and Surgical Technique Guide for Residents

Participants

#### TEACHING POINTS

Pancreas transplant is a complex procedure which represents a surgical alternative for the treatment of diabetic patients with the goal of avoiding the systemic complications associated with the disease. The most frequent approach is the SPK transplant in which both grafts of a single donor are inserted in one surgical act, on the right and the left fossa respectively. Transplanted kidney is implanted extraperitoneally in an iliac fossa. The most widely used technique is end-to-side anastomosis of the donor's renal artery to the recipient's external iliac artery. Transplantation of the pancreatic graft is performed together with a duodenal segment. Enteric exocrine drainage will be through anastomosis of the donor duodenal segment to a small bowel loop of the recipient whereas systemic endocrine drainage will be through the portal vein of the graft which is anastomosed directly to the primitive iliac vein. To learn surgical technique and post-operative anatomy. To know normal postoperative imaging assessment. To recognize all the complications.

#### TABLE OF CONTENTS/OUTLINE

Introduction and normal anatomy Surgical techniques Normal post-operative imaging appearance Complications Take-home messages

#### GIEE-179 Hepatic Sinusoidal Disorders

Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand pathophysiology behind hepatic sinusoidal disorders
- Review the typical imaging appearances sinusoidal obstruction caused by different etiologies and characteristic findings for differentiation of etiologies.
- Review conditions that cause sinusoidal and perisinusoidal infiltration and may mimic sinusoidal obstruction.

#### TABLE OF CONTENTS/OUTLINE

- Normal hepatic sinusoid structure and physiology
- Mechanisms causing sinusoidal dilatation and/or obstruction.
- Histopathological correlation of imaging findings
- Sinusoidal dilatation
  - o Outflow obstruction
  - § Post sinusoidal causes.
- Congestive hepatopathy
  - Heart failure
  - Pericarditis
  - Congenital heart diseases
- Budd-Chiari syndrome
- Sinusoidal obstruction syndrome
  - o Myeloablative conditioning for stem cell transplantation.
  - § Utility of ultrasound in diagnosis of SOS in children
  - o Chemotherapy-oxaliplatin based therapies, immunotherapy.
  - o Radiotherapy
- Sinusoidal dilatation without obstruction
  - o Vascular disorders
  - § Arterioportal shunts
  - § Decreased portal flow.
  - § Porto-sinusoidal vascular disorder
  - o Extrahepatic acute inflammatory/infective conditions
  - o Use of oral contraceptives or hormones
  - o Hepatic peliosis
  - o Extrahepatic malignancy without liver infiltration
- Sinusoidal and/or perisinusoidal infiltration with or without dilatation
  - o Perisinusoidal fibrosis
  - o Amyloidosis
  - o Myeloproliferative disorders
  - o Malignancy

#### GIEE-18 The Dark Side of the Bowel Disease: Algorithmic Approach Step by Step

#### TEACHING POINTS

Review through different imaging modalities the evaluation of the intestinal wall. To revise the general features of the normal bowel wall. Create an algorithm that allows quick < easy evaluation to guide the diagnosis. To discuss the different imaging findings we may see in different pathologies. To study different pathologic entities that present with bowel wall thickening.

#### TABLE OF CONTENTS/OUTLINE

Introduction Anatomy basic bowel wall. Step by step > interpretation of < analyzed by categorizing attenuation changes in the intestinal wall. Diagnostic Algorithm description. Descriptions of the commonest causes Key points. Conclusions References

#### GIEE-180 CT Approach to Acute Mesenteric Ischemia

#### TEACHING POINTS

-Acute mesenteric ischemia it's an infrequent pathology, but the mortality rate is high because of the nonspecific symptoms and the delayed diagnosis, so the role of the imaging and the radiologist are fundamental to reduce the mortality rates.-Appropriate protocols of CT imaging should be used to optimize the radiation and contrast medium use, because there is a disbalance in the homeostasis of the patient and every minute counts to make de diagnosis.-If there is a kidney failure, there are protocols for a safety use of the iodinated contrast medium.-To establish an adequate diagnosis, the histopathology and anatomy of the arteries and the bowel should be evaluated.-There are three main structures that we must evaluate to have an adequate approach to mesenteric ischemia: bowel lumen, bowel walls and abdominal localization.-When there is an acute mesenteric ischemia, other abdominal organs like adrenal glands, inferior cava vein, aorta, liver, spleen, and kidneys have changes and findings that can predict complications and mortality.

#### TABLE OF CONTENTS/OUTLINE

Gross anatomy Abdominal artery anatomy. Relevant anastomoses. Abdominal vein anatomy. Histology of the bowel. Pathophysiology of acute mesenteric ischemia. CT imaging protocols. Indications, Simple, artery and portal phases with timing and technique (kVp, mA, rotation, PITCH). What to do if there is an acute kidney failure Classification of the acute mesenteric ischemia. Systematic approach to acute mesenteric ischemia. Bowel Wall thickness. Diameter. Wall enhancement. Mesentery Fat. Liquid. Localization. Vessels. Artery. Vein. Other abdominal organs Liver. Kidneys. Adrenal glands. Pulmonary embolism. Conclusions. Bibliography.

#### GIEE-181 Gastric Cancer CT Staging: Radiologic Patterns with Radiologic-Pathologic Correlation

#### TEACHING POINTS

State of the art treatment of locally advanced gastric cancer is multimodal and involves combined surgical and medical therapy. CT has a central role in the staging of gastric cancer, being the method of choice for this purpose; a local and distant staging as accurate as possible is crucial for a correct treatment planning, avoiding under- or over-treatment of the Patient. To obtain a correct staging, a thorough knowledge of normal and pathologic gastric radiological anatomy and the pathways of tumor spread is crucial. Through the analysis of illustrative cases: To know the normal and pathologic gastric radiologic anatomy and the lymphatic and hematogenous pathways of spread of gastric cancer. To know the TNM classification (8th edition) for gastric cancer and

correctly use the CT criteria necessary for its application. To correlate radiologic patterns of gastric cancer with macroscopic and microscopic pathologic patterns. To correlate clinical CT staging and pathologic staging with regard to T and N parameters. To understand the limitations and pitfalls of imaging and the causes of radiological overstaging and understaging.

#### TABLE OF CONTENTS/OUTLINE

1. Concepts of normal and pathologic gastric radiologic anatomy and lymphatic and hematogenous tumor spread pathways are explained. 2. Some illustrative cases of early-stage, locally advanced and oligometastatic gastric cancer are presented, with clinical staging obtained by CT imaging applying the TNM 8th edition classification. Correlation of CT images with macroscopic and microscopic pathologic findings is shown by detailed explanation of the findings. 3. Some examples of CT understaging and overstaging and their possible explanations are presented.

#### GIEE-182 Abdominal Inflammatory Lesions Unmasked: A Radiological Hunt for Tumor Impostors!

Participants

Abrahamo Elias Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the abdominal inflammatory diseases which mimic tumor-like lesions. To present diagnostic challenging cases of inflammatory diseases that can mimic tumoral lesions. To be aware of non-malignant conditions as differential diagnoses at the initial presentation of lesions suspicious for neoplasms, and which imaging features may help in the differentiation. To highlight clinical and laboratory data that can help the radiologist not fall into pitfalls.

#### TABLE OF CONTENTS/OUTLINE

Abdominopelvic inflammatory lesions can present a diagnostic challenge for radiologists, particularly when distinguishing between tumor and non-tumor involvement. This can have a significant impact on patient outcomes, as the management and prognosis of these conditions can vary dramatically. Overview of the main inflammatory diseases that mimic neoplasms. Key radiological findings in cross-section abdominal images that aid in distinguishing between tumor and non-tumor lesions. The role of clinical and laboratory information in the differential diagnosis of inflammatory lesions. Didactic exposition of illustrative cases in which inflammatory diseases mimic neoplasms, such as rectal syphilis, peritoneal tuberculosis, focal pyelonephritis, glandular cystitis, hepatic inflammatory pseudotumor, xanthogranulomatous cholecystitis, complicated appendicitis, focal pancreatitis, vaginal vault abscess, and lobular endocervical glandular hyperplasia. Recap of the importance of accurately differentiating between tumor and non-tumor involvement in abdominopelvic inflammatory lesions, with the key takeaways from this educational exhibition.

#### GIEE-183 Expanding the Role for Biopsy in HCC: It's Not Just About Diagnosis

Participants

Mansur Ghani, MD, San Diego, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Traditionally, clinical indications for biopsy of hepatocellular carcinoma (HCC) have included circumstances when imaging diagnosis is uncertain or for HCC that does not respond as expected to therapy. 2. More recently, developments in the understanding of pathological and molecular alterations in HCC at the cellular level have created additional opportunities for biopsy for the purposes of prognosis, treatment selection and treatment monitoring.

#### TABLE OF CONTENTS/OUTLINE

Review of traditional indications for biopsy in HCC (Fig. 1)- Diagnosis in the case of LR-4 (Fig. 2), LR-M (Fig. 3) and LR-TIV- Lesions that do not respond as expected to therapy Additional potential roles for biopsy in HCC- Diagnosis- Lesions in non-cirrhotic livers or scenarios where LI-RADS currently cannot be applied (e.g. cardiac cirrhosis and Fontan related liver disease)- LR-3 lesions (Fig. 4)- Prognosis- There are several histological HCC sub-classes, each with distinct molecular patterns and prognostic implications (Fig. 5)- Microscopic vascular invasion (MVI) can be incidentally detected on biopsy, and surrogate molecular markers can be used to predict MVI- Stemness-related biomarkers are associated with more aggressive clinical behavior- Treatment selection- Potentially targetable genetic alterations are found in approximately 24% of HCC.- Treatment monitoring- Genetic sequencing of biopsy tissue can be performed to design specific liquid biopsy panels to monitor efficacy of treatment.- Biopsy Techniques- Biopsy types: fine-needle aspiration, needle-core biopsy, micro-histology, liquid biopsy- Types of image guidance- Ultrasound with an emphasis on the emerging role of contrast-enhanced ultrasound- CT-guided

#### GIEE-184 Getting to the Bottom of the Pelvic Floor: A Primer on MR Defecography Technique, Reporting and Implications for Surgical Management

Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Indications for MR defecography (MRD); advantages over fluoroscopic defecography and correlation of both techniques
- Anatomic considerations: compartments, measurements, pathophysiology of the pelvic floor
- Technique and phases of examination for functional assessment
- Standardized terminology and reporting
- Imaging findings of common and rare diagnoses
- Surgical management of pelvic organ prolapse: choice of procedure, techniques and post-op imaging findings

#### TABLE OF CONTENTS/OUTLINE

Review pelvic compartmental anatomy, important lines and measurements:- Pubococcygeal line- H-line- M-line- Urethral axis- Vaginal axis Variations of technique and equipment:- Phases: rest, contraction, defecation- Sequences- Open vs. closed MRI technique- Coil design Standardized terminology and reporting, consensus guidelines by SAR and AJR. Step by step interpretation of a case with sample reporting template. Entities discussed:- Peritoneocele, Enterocoele, Sigmoidocoele- Cystocoele- Urethral Hypermobility- Uterine/Vaginal prolapse- Descending perineal syndrome- Structural Outlet Obstruction: Rectocoele, Rectal prolapse, Intussusception, Rectal mass- Functional Outlet Obstruction: Puborectalis dyskinesia, Anismus anorectal incontinence- Spastic pelvic floor syndrome Surgical management of pelvic descent- Pre-op considerations Obliterative vs. reconstructive techniques Abdominal vs. vaginal approach Concomitant urinary or fecal incontinence repair, colporrhaphy Hysterectomy vs. uterine-sparing Risk calculator for prophylactic urinary incontinence prevention Indications for mesh augmentation- Post-op imaging findings and

complications

### **GIEE-185 MRI-Based Body Composition Analysis: We Can See the Fat That Hides Inside You**

Participants

Luciana Belem, MD, MSc, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Review how MRI of the abdomen may help identify high-risk adiposity phenotypes in the obesity context.- Review the literature on obesity, addressing the impact of visceral and ectopic fat in health.- Discuss which measurements can be made on MRI of the abdomen to assess visceral and ectopic fat.- Teach how to measure visceral and ectopic fat on MRI of the abdomen.

#### **TABLE OF CONTENTS/OUTLINE**

- Definition: what is visceral and ectopic fat.- Review the pathophysiology of obesity and discuss how to differentiate the adiposity phenotypes on MRI.- Body composition measures on MRI: Visceral adipose tissue, subcutaneous adipose tissue and skeletal muscle. Area or volume? If area, which level? Which muscle groups to include in skeletal muscle quantity assessment.- Protocol: which sequences use to assess body composition parameters and quantify ectopic fat.- Chemical shift-encoded (CSE) MRI with estimation of proton density fat fraction (PDFF): potential biomarker in obesity.- Ectopic fat measures on MRI: Muscle fat: which abdominal muscle group to measure? Pancreas fat: where and how to measure? Liver fat: where and how to measure?

### **GIEE-186 Mind The gap! The Tubes and Pipes in Crohn's Disease: Technical Aspects and Diagnostic Findings of CT and MRI-Enterography**

Participants

Mayra V. Soares, MD, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To review relevant points in the anatomy of the small intestine, in the context of Crohn's Disease, highlighting the main sites of involvement. To review the indications, protocol, and technical aspects of CT and RM-enterography (CT-e and MR-e). To point out differences and similarities, advantages and disadvantages between CT-e and RM-e. To show typical and atypical imaging findings of Crohn's disease and main complications. To distinguish phenotypic patterns of presentation of Crohn's disease in CT-e and RM-e.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Review of the anatomy of the small intestine Review of the typical and atypical imaging findings of Crohn's disease and its phenotypes CT-e and MR-e protocols Main diagnostic findings in Crohn's disease: Segmental mural enhancement mural thickening stenosis ulcerations vasa recta ingurgitation lymph node enlargement Complications related to Crohn's Disease: fistulas inflammatory mass Abscess

### **GIEE-187 The Mystery of Internal Hernias: What Should the Radiologists Know?**

Participants

Basem Jaber, MD, Darby, PA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Reviewing the different types of the internal hernias- Discussing the imaging features of various types of internal hernias- Identifying possible complications of internal hernias- Providing case-based review of common and uncommon pathologies

#### **TABLE OF CONTENTS/OUTLINE**

Internal hernias are defined as protrusion of small bowel loops through normal apertures and/or defects in the peritoneum or mesentery into a compartment within the abdominal cavity, commonly presenting as an acute intestinal obstruction. The incidence of internal hernias is increasing with the new surgical procedures now being performed. It is crucial for radiologists to be familiar with and understand the different types of internal hernias and the possible complications since they have high mortality rate and they are often challenging to recognize. Key points:- Introduction to peritoneum anatomy- Internal hernia different types- The diagnostic approach for internal hernias- Pearls and pitfalls for recognizing internal hernias complications imaging features

### **GIEE-188 Just Not GIST: Non-GIST Mesenchymal Neoplasms of the Alimentary Tract**

Participants

Rashmi Balasubramanya, MD, Philadelphia,, PA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

There is a heterogeneous group of non-GIST, mesenchymal neoplasms of the gastrointestinal tract that are characterized by distinctive histopathology tumor genetics as well as variable clinico-biological profiles and imaging findings. Characteristic disease distribution: While glomus tumors and plexiform fibromyxomas display distinct predilection for the gastric antrum, smooth muscle tumors of the gut preferentially occur in the esophagus and colorectum. Distinctive genetic markers: Based on MDM2 gene amplifications, esophageal giant fibrovascular polyps are now considered well-differentiated liposarcomas. Other tumors with distinctive cytogenetics include lipomas (HMGA2 gene rearrangements), granular cell tumors (inactivating AP6AP gene mutations), gastroblastomas (MALAT1-GLI1 fusions), plexiform fibromyxomas (GLI activating mutations), malignant neuroectodermal tumors (EWSR1-ATF1 gene fusions), IMTs (ALK gene rearrangements) and SFTs (STAT6 NAB2 gene fusions).

#### **TABLE OF CONTENTS/OUTLINE**

Introduction, taxonomy, demographics, clinical manifestations, pathological features, Multimodality cross sectional imaging findings on CT, MRI, PET-CT, management, prognosis, conclusion. Entities discussed: Esophageal granular tumor and well- differentiated liposarcoma; distinctive gastric tumors such as synovial sarcoma, IMT, plexiform fibromyxoma, and glomus tumor; smooth muscle tumors, lipomatous/neurogenic tumors, malignant neuroectodermal tumor, Kaposi sarcoma, sclerosing epithelioid fibrosarcoma.

## **GIEE-189 Not Always What It Seems: Exploring Mimickers of Liver Malignancy**

Participants

Kumi Ozaki, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

· Review of several mimickers of liver malignancy based on characteristic imaging findings. · Comprehension of key clinical and imaging findings that may help distinguishing mimickers from malignant liver lesions.

### **TABLE OF CONTENTS/OUTLINE**

1. Overview of characteristic imaging and clinical features of typical liver malignancy. 2. Overview of mimickers of liver malignancy based on each characteristic imaging findings; patterns of enhancement (early staining and prolonged enhancement, early staining and wash-out, gradual enhancement, peripheral enhancement), fat component, lower ADC values, growth rate, cystic lesion with mural nodule, periportal lesion and so on. 3. Overview of mimickers of liver malignancy in the patients with chronic liver disease or cirrhosis. 4. Overview of mimickers of liver malignancy in the patients with a known malignancy. 5. Undistinguishable mimickers from liver malignancy. 6. Take home points

## **GIEE-19 Precision Medicine and Early Detection of Pancreatic Cancer**

Participants

Linda C. Chu, MD, Lutherville, MD (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Patients with pancreatic cancer often present with non-specific clinical symptoms and are diagnosed at advanced disease stage. Recent advances in imaging techniques, molecular analysis, and artificial intelligence can lead to earlier detection of pancreatic cancer, which can significantly improve patient outcomes. The purposes of this exhibit are to review the current guidelines in high-risk screening of pancreatic cancer, review the role of liquid biopsy and pancreatic cyst fluid molecular markers in earlier detection, and the potential role of artificial intelligence in automated detection of pancreatic cancer.

### **TABLE OF CONTENTS/OUTLINE**

Current guidelines in high-risk screening of pancreatic cancer. Role of liquid biopsy and pancreatic cyst fluid molecular markers in early detection. Artificial intelligence assisted automated detection of pancreatic cancer.

## **GIEE-190 CT Imaging for Assessment of Hepatic Steatosis**

### **TEACHING POINTS**

1. To illustrate a pictorial review of focal and diffuse steatosis in the liver. 2. To explain the principles of quantitative assessment of liver fat using CT. 3. To review the accuracy of fat quantification by using single-energy CT (including quantitative CT) and dual/multienergy CT. 4. To demonstrate application to visual display of quantitative results.

### **TABLE OF CONTENTS/OUTLINE**

1. Clinical significance 2. Etiology of diffuse fatty liver diseases 3. Beware of localized fat: neoplastic and non-neoplastic lesions 4. CT techniques for quantification. 4-1. Conventional single-energy CT and quantitative CT 4-2. Dual-energy CT a) CT attenuation value b) Fat fraction c) Electron density d) Virtual non-contrast imaging 4-3. Photon-counting CT 5. Visual tools for pre- and post-therapy assessment 5-1. Fat quantification of each liver lobe/segment 5-2. Fat distribution and its statistics

## **GIEE-191 Computer-Aided Diagnosis for Hepatic MRI: What is Needed and Expected**

Participants

Shogo Maeda, Hiroshima, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

a. As gadoteric acid-enhanced MRI has combined perfusion and hepatocyte-selective properties, it is widely used to detect and diagnose focal hepatic lesions. b. Gadoteric acid-enhanced hepatobiliary phase (HBP) images are highly sensitive for the detection of hepatic lesions. However, small lesions, especially those near hepatic vessels, may be missed because they and the vessels are low signal-intense on HBP images. Computer-Aided Diagnosis (CAD) may be effective, especially for detecting small lesions on HBP images. c. Because many hepatic lesions, benign or malignant, are low signal-intense on HBP images, a differential diagnosis requires comprehensive evaluation with other sequences. CAD can differentiate between benign and malignant lesions by integrating information from EOB-MRI and sequences such as T2- and diffusion-weighted scans. Therefore, CAD is particularly useful for differential diagnosis in a single case of mixed benign and malignant lesions. d. A diagnosis of hepatic lesions is reached by integrating findings from various modalities and clinical information. A CAD that integrates all information is required.

### **TABLE OF CONTENTS/OUTLINE**

a. History and classification of CAD in radiology b. Possibility of CAD for detecting hepatic lesions on MR images c. Possibility of CAD for diagnosis of hepatic lesions on MR images d. Future prospects of CAD for diagnosing hepatic lesions

## **GIEE-192 Update on Histology, Staging, and Treatment of Intrahepatic Cholangiocarcinoma: The Role of the Radiologist**

Participants

Wyanne Law, MD, Unionville, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Describe the morphologic and histopathologic classification of intrahepatic cholangiocarcinoma (ICC) 2. Discuss differential diagnosis of ICC, including hepatocellular carcinoma (HCC), metastasis and benign entities 3. Describe American Joint Committee on Cancer (AJCC) 8TH edition staging for ICC and resection criteria 4. Discuss non-surgical options and recognize response/progression disease and complications



## TABLE OF CONTENTS/OUTLINE

Classification Location: intrahepatic 10% vs perihilar 50- 60% vs distal 20-30% Morphologic: periductal infiltrating, mass forming, intraductal growing-Histopathologic: large duct vs small duct Imaging characteristics of ICC Peripherally enhancing, hypervascular, delayed enhancement Update on staging AJCC 8th edition for ICC TNM Surgical Resection Adequate future liver remnant (FLR) with intact hepatic arterial, portal venous, hepatic venous, and biliary drainage, excluding distant metastases, bilobar tumor and nonregional nodes Chemotherapy Gemcitabine + cisplatin Response: RECIST Immunotherapy TOPAZ-1 trial - Durvalumab -New inhibitors targeting genetic alterations in small duct, Pemigatinib, infigratinib Response: iRECIST-Complications: colitis, hepatitis, pneumonitis, renal failure, myocarditis Hepatic arterial infusion pump Floxuridine-Complications: gastroduodenal artery aneurysm, extravasation from catheter Ablative radiotherapy Complications: Radiation-based liver parenchymal changes (RILD), delayed onset of radiation necrosis Transarterial radioembolization (TARE) Yttrium 90 Complications: Post-radioembolization syndrome, gastroduodenal ulcer, cholecystitis

## GIEE-193 Gastrointestinal Ectopic Pancreas: Cross-sectional Imaging Spectrum and Differential Diagnosis

### TEACHING POINTS

1. Describe the clinical manifestations and the spectrum of cross-sectional imaging findings of the ectopic pancreas (EP) in the gastrointestinal tract. 2. Discuss the diagnosis of the gastrointestinal EP with emphasis to formulate a differential diagnosis for gastrointestinal submucosal tumors.

### TABLE OF CONTENTS/OUTLINE

1. The definition and overview of clinical manifestations of gastrointestinal ectopic pancreas (EP). 2. The pathologic gross manifestation and histological classification of EP. 3. A list of the common morphological manifestations of EP on cross-sectional images including sites and incidences, location, size, shape, contour, margin, attenuation/intensity signals, growth pattern, enhancement pattern, picking out those specific signs which are essential clues to indicate the diagnosis, such as duct-like structure in the lesion, hyperenhancement of the overlying mucosa, central umbilication, perilesional fat or low attenuation. 4. Describe the uncommon findings of EP with a comprehensive case series, including rare histological types and with secondary complications, including pancreatitis, pseudocyst formation, malignant degeneration, gastrointestinal bleeding, bowel obstruction. 5. Differential diagnosis between EP and other gastrointestinal submucosal tumors, such as gastrointestinal stromal tumors (GISTs), gastroduodenal glomus tumors, neuroendocrine tumor, leiomyomas and schwannomas. 6. Summary 7. Suggesting reading

## GIEE-2 Squamoid Cyst of Pancreatic Ducts: Rare Cystic Lesion of Pancreas

Participants

Duygu Cengiz, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Develop an awareness of squamoid cyst of pancreatic ducts (SCOP) Learn imaging features of SCOP Compare SCOP to other similar cystic lesions to make differential diagnosis. Discuss relation of SCOP and PDAC

### TABLE OF CONTENTS/OUTLINE

Cystic lesions of pancreas Rare pancreatic cystic lesion: Squamoid cyst of Pancreatic Ducts (SCOP) Pathologic definition of SCOP Misnomer or not: Is SCOP really related to pancreatic ducts? Imaging features of SCOP Differential diagnosis of SCOP Simple Mucinous Cyst (SMC): Is it possible to differentiate SMC from SCOP? SCOP and PDAC: Is there a relation?

## GIEE-20 Distinguishing Inflammatory Conditions from Cancer of the Gastrointestinal Tract: What Radiologists Should Know

Participants

Camila Vendrami, MD, Chicago, IL (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review imaging technique to assess gastrointestinal (GI) inflammatory conditions and cancer
- Review and illustrate the typical imaging appearances that allow differentiation of these inflammatory conditions and cancer
- Review and illustrate potential complications from these entities

### TABLE OF CONTENTS/OUTLINE

- Introduction: overview of GI inflammatory conditions and tumors
- Imaging techniques: US, CT, MR including enterography
- Gastric inflammation and gastric tumors
  - o Clinical findings, detection and imaging features to differentiate the entities
- Small bowel enteritis and other small bowel pathology and SB cancers (adenocarcinoma, carcinoid, lymphoma, GIST, metastases etc.)
  - o Clinical findings, detection and imaging features to differentiate the entities
- Diverticulitis and colon cancer
  - o Clinical findings, detection and imaging features to differentiate the entities
- Appendicitis and appendiceal cancers [adenocarcinoma, neuroendocrine (carcinoid), lymphoma and colon cancer associated with appendicitis], endometriosis of appendix
  - o Clinical findings, detection and imaging features to differentiate the entities
- Potential complications such as perforation and fistulas
- Conclusion

## GIEE-21 It's Not Just a Question of Size: Unveiling the Secret World of Abdominopelvic Lymph Nodes for a Proper Radiological Assessment

Participants

Ana Lopes Potente, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review individual lymph node anatomy, names, and abdominal and pelvic lymph node group locations. Demonstrate through illustrative cases which clues the lymph nodes can reveal to us about diagnostic possibilities.

### TABLE OF CONTENTS/OUTLINE

- Importance of lymph node evaluation. Limitations of size-based evaluation.
- Didactic drawings to review anatomy and pathophysiology.
- Review of updated literature on normal dimensions of lymph nodes.
- Video map to point out nomenclature and

location of abdominal and pelvic lymph node chains, such as (but not limited to) retrocrural, retroperitoneal, gastrohepatic ligament, porta hepatis, celiac and superior mesenteric artery, pancreaticoduodenal, perisplenic, mesenteric, and pelvic nodes. - Demonstration of the main imaging techniques for lymph node evaluation. Importance of adequate protocols. Discussion of benefits and limitations of each method. - Case studies to highlight pitfalls and findings that may simulate lymphadenopathy, such as splenosis, accessory spleen, papillary process of the caudate lobe, vascular anomalies, prominent vascular structures like gonadal veins, and scalloped diaphragmatic crus. Tips to avoid misdiagnosis. - Special cases in which lymph node morphology can point to specific diagnoses. - Importance of lymph node features beyond size in diagnosis. - Exposition of rare cases where lymph node enlargement causes vascular and nervous complications. Discussion of diagnosis and management. - Summary of teaching points.

## **GIEE-22 Spectrum of Heterotopic Ectopic Splenic Conditions**

Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

### **TEACHING POINTS**

1. To describe the spectrum of heterotopic and ectopic splenic conditions, including the underlying embryologic basis. 2. To demonstrate the role of cross-sectional and imaging and scintigraphy in asymptomatic detection and symptomatic diagnosis of these splenic-related conditions, through a series of clinical examples.

### **TABLE OF CONTENTS/OUTLINE**

- Introduction- Embryologic development of the spleen o Normal splenic development o Spectrum of abnormal development - Splenic-specific imaging techniques o Nuclear medicine (heat-treated RBC > sulfur colloid scans) o MRI (ferumoxytol) - Heterotopic splenic conditions o Splenules § Pancreatic tail splenules o Splenogonadal fusion § Discontinuous form § Continuous form - Ectopic splenic conditions o Splenosis o Wandering spleen § Incidental asymptomatic detection § Symptomatic torsion o Polysplenia (heterotaxy) § Associated findings- Concluding remarks

## **GIEE-23 Peritoneal Carcinomatosis: The Role of the Radiologist in Selecting Patients for Curative Treatment**

Participants

Alicia Espinal Soria, MD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To know the different presentations of the peritoneal carcinomatosis in CT. To get familiar with the term Peritoneal Cancer Index and the website used to calculate it "e-Promise". To make a differential diagnosis with the pathologies that may mimic peritoneal implants.

### **TABLE OF CONTENTS/OUTLINE**

Intraabdominal malignancies often spread to peritoneal cavity causing peritoneal carcinomatosis. The most common primary neoplasms are colorectal, small bowel, stomach, ovaries and pancreas. Peritoneal carcinomatosis (PC) may present in CT like ascites, peritoneal thickening, peritoneal nodules or masses, "omental cake" pattern or pseudomyxoma peritonei. This presentation forms in CT are also seen in other pathologies such as peritoneal tuberculosis, acute peritonitis, splenosis, peritoneal lymphomatosis, and peritoneal mesothelioma. Histologic analysis must be made to obtain a definitive diagnosis in doubtful cases. Until recently, PC was considered an end-stage disease where supportive care was the only possible treatment. The cytoreductive surgery (CRS) followed by Hyperthermic intraperitoneal chemotherapy (HIPEC) is a combined treatment that has given a curative option to properly selected patients. It is important to know the most frequent shapes and locations of peritoneal implants to calculate the Peritoneal Cancer Index (PCI) using CT imaging, which is part of the selection criteria. The website "e-Promise.org" is useful to calculate this Index and help the clinician deciding the most suitable treatment for each patient.

## **GIEE-24 Comprehensive Review of Imaging in Pancreatic Transplantation: A Panorama of Good and Bad!**

Participants

Shravya Srinivas Rao, MD, Boston, MA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To learn pancreas transplant- indications, types, surgical procedure- To discuss post-transplant imaging surveillance of pancreas - To review the spectrum of post-transplant complications- visceral, vascular, intestinal\*?aB?e ?? ???te?ts/?t???e 1. Pancreas transplantation procedure- Indications- Types of transplantation (whole organ vs islet cell)- Surgical procedures2. Role of imaging in pancreas transplantation- Preoperative imaging- Imaging modalities- Technique and protocol- Post-operative surveillance3. Imaging manifestations after pancreas transplantation- Normal appearance- Post-operative complications- Differential diagnosis- Radio-pathologic correlation- Pitfalls and challenges

## **GIEE-25 Rectum MRI: Beyond the basics**

Participants

Thiago Jose Pinheiro Lopes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- High-resolution MRI is a cornerstone in the evaluation of the rectum, notably for cancer. In the past years, its use has been expanded far beyond TNM staging, enabling post-neoadjuvant therapy follow-up, patient selection for the "Watch and Wait" approach, predicting response to Total Neoadjuvant Treatment (TNT), and much more. - MRI imaging has enabled less invasive treatment approaches, with improved quality of life for patients and similar outcomes, and radiologists should be aware of these developments. - Our purpose is to review emerging applications of rectal resonance in the radiological routine and bring tips for deepening the anatomy of the rectum.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Delving into the anatomy of the rectum. 3. Recognizing post-CRT changes in rectum cancer. 4. Selecting patients for the "Watch and Wait" approach. 5. Using MRI to predict response to Total Neoadjuvant Treatment (TNT). 6. Identifying mucinous tumors. 7. Recognizing mesorectal fascia involvement. 8. Evaluating sphincter invasion in low rectal cancer. 9. Future directions. 10. Take home messages.

## **GIEE-26 Quantitative CT for Diffuse Liver Diseases: Steatosis, Iron, and Fibrosis**

Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

### **TEACHING POINTS**

1. To demonstrate the ability of CT to quantify fat, iron, and fibrosis content within the liver, analogous to MRI approaches. 2. Explain the rationale for opportunistic screening at abdominal CT for detecting unsuspected diffuse liver disease, including steatosis, hemochromatosis, and compensated cirrhosis. 3. Describe a battery of CT-based liver biomarkers that can now be obtained in a fully-automated fashion using AI-based methodology.

### **TABLE OF CONTENTS/OUTLINE**

- Overview of diffuse liver diseases o Hepatic steatosis and NAFLD o Hepatic iron overload and hemochromatosis o Hepatic fibrosis and cirrhosis - Quantification methods for hepatic fat, iron, and fibrosis content: o Liver biopsy o Advanced MRI methods o CT-based biomarkers - Opportunistic CT-based screening for diffuse liver disease o Rationale o Manual and automated techniques o Brief review of evidence to date o Pitfalls o Prospects for the (near) future - Concluding remarks

## **GIEE-27 Imaging in HIPEC- All You Need To Know!**

Participants

Shravva Srinivas Rao, MD, Boston, MA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Peritoneal malignancies like pseudomyxoma peritonei, metastatic carcinomatosis from colon adenocarcinoma, mucinous carcinomas of ovary, stomach, pancreas etc., can be treated with cytoreduction surgery and hyperthermic intraperitoneal chemotherapy (HIPEC) or early postoperative intraperitoneal chemotherapy (EPIC). Objectives of this exhibit are:- To discuss imaging manifestations of peritoneal malignancies - To review the technique, principles, and complications of HIPEC therapy- To learn the role of imaging in the assessment of HIPEC patients before and after therapy

### **TABLE OF CONTENTS/OUTLINE**

1. HIPEC- technique and principles 2. Peritoneal tumors- classification and imaging features 3. Radiological, surgical and pathological correlation 4. Criteria for CRS and HIPEC- selection of patients for HIPEC 5. Calculation of Peritoneal Cancer Index: principles and method of estimation 6. Imaging in response assessment

## **GIEE-28 Peritoneal Carcinomatosis Versus Primary and Secondary Peritoneal Tumors and Other Traps**

Participants

Ghina Jardali, MD, Villejuif, France (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• Review of the imaging features of common and uncommon peritoneal diseases, neoplastic (such as pseudomyxoma peritonei) and non-neoplastic, that mimic peritoneal carcinomatosis. • Emphasis on the CT/MRI findings and the additional imaging clues that may allow the radiologist to appropriately narrow the differential diagnosis and, in some cases, make an imaging-specific diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

I. Imaging appearance of peritoneal carcinomatosis II. Imaging clues to the diagnosis of differential diagnosis: a. Secondary peritoneal-based neoplasms i. Pseudomyxoma peritonei b. Primary peritoneal neoplasms i. Malignant peritoneal mesothelioma c. Primary peritoneal mesenchymal tumors i. Gastrointestinal stromal tumor (GIST) with peritoneal sarcomatosis ii. Fibromatosis (Desmoid tumor) d. Non-neoplastic mimics of peritoneal carcinomatosis: i. Mesothelial cysts ii. Cystic lymphangioma iii. Lymphangiomyomatosis iv. Mesenteric fat necrosis / lipophagic granuloma v. Atypical infections: Tuberculosis, Actinomycosis

## **GIEE-29 Gastro-Intestinal Devices: from Esophagus to Anus. Imaging Appearance Review of Common and Less Common GI Foreign Bodies**

Participants

Emre Aslan, MD, Ville Mont-Royal, QC (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Review of imaging appearance of common and less common gastrointestinal (GI) devices. 2) Summarize common device-specific complications. 3) Review of MRI safety profiles for each GI device.

### **TABLE OF CONTENTS/OUTLINE**

1) Introduction: As minimally invasive procedures become more ubiquitous and technology keeps advancing, new GI devices are being used by interventional radiologists and interventional gastroenterologists. 2) Clinical use Radiologists and radiology trainees must stay up to date with new GI devices to recognize and prevent complications whenever possible. Each device's indications, normal imaging appearances, potential complications and MRI safety profiles will be discussed. 3) Endoscopically placed devices esophageal, duodenal, rectal stents, AXIOS stent, and Ovesco device. 4) Surgically placed devices LINX reflux management system, gastric pacemaker, gastric band, Ray-Tec X-rayable sponge and laparotomy sponge. 5) Tubes and balloons Blakemore tube, cecostomy tube, intragastric balloon, and Minnesota tube. 6) Other Amplatzer plug and capsule endoscopy device. 7) Conclusion Summary of key teaching points.

## **GIEE-3 The Washout of Hepatocellular Carcinoma at Portal Venous Phase versus Equilibrium Phase: Radiological and Clinicopathological Implication**

Participants

Kengo Yoshimitsu, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

•To learn that there are two distinct types of hepatocellular carcinoma (HCC) washout to be recognized: one at the portal venous phase (PVP) and the other at the equilibrium phase (EqP). •To learn that these two represents two different phenomena; a dynamic, and a static one, respectively. •To learn that PVP washout is a consequence of rapid hemodynamic change of HCC and background liver (BGL). •To learn that EqP washout represents static condition of contrast medium distribution in the extracellular space of HCC and BGL. •To learn that PVP washout is significantly related to histological grades of HCC, or its status of microvascular invasion. •To learn that EqP washout might be related to immunohistochemical subgroup of HCC.

#### TABLE OF CONTENTS/OUTLINE

1. Basic concept of two types of "WASHOUT" of HCC 2. Washout at PVP: radiological consideration 3. Washout at PVP: clinicopathological implication 4. Washout at EqP: radiological consideration 5. Washout at EqP: clinicopathological implication 6. Washout on dynamic MRI using extracellular contrast medium or gadoxetate 7. Summary

#### GIEE-30 Focal Liver Lesions: A Case-based Quiz

Participants

Laura Cavero Barreras, MD, Ordizia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To highlight the importance of the clinical context of patients with focal liver lesions. - To review the typical and atypical imaging findings of focal liver lesions in multimodality imaging techniques through cases studied in our center. - To know the current guidelines and define a practical approach to the radiologic management of liver lesions. - To identify potential pitfalls and key imaging findings to make the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Focal liver lesions represent a widespread, heterogeneous group of disorders that can be benign or malignant, solitary or multiple. Diagnosis is usually challenging as many lesions may mimic each other. Radiologists must consider the appearance and the enhancement pattern of the nodule on different imaging techniques, such as US, CT, and MRI. Moreover, contrast-enhanced US (CEUS) can help to resolve doubts and establish the diagnosis in cases where other imaging techniques do not provide a definite diagnosis. On the other hand, it is necessary to consider the clinical context of the patient, as this will determine the further management of the lesion. This presentation will take the form of a quiz to discuss the typical and atypical imaging findings and the management of focal liver lesions based on current guidelines.

#### GIEE-31 Laxative-free Photon-counting CT Colonography for Colorectal Cancer Screening

Participants

Yasuji Ryu, MD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The teaching points of this exhibit are to (1) explain the emerging role of laxative-free CT colonography in colorectal cancer (CRC) screening, (2) explain the role of photon-counting CT in addressing the challenges of conventional CT colonography, and (3) explain the role of artificial intelligence (AI) in unlocking the potential of laxative-free photon-counting CT colonography as a CRC screening test.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: the importance of CRC screening; the emerging role and challenges of laxative-free CT colonography. 2. Photon-counting CT: benefits over conventional CT; how photon-counting CT addresses the challenges of laxative-free CT colonography. 3. AI enables an effective laxative-free photon-counting CT colonography examination: computer-aided detection; virtual bowel cleansing; risk assessment; putting it all together. 4. What we know and don't know: outcomes from clinical laxative-free CT colonography trials; initial observations from photon-counting CT colonography studies. 5. Summary.

#### GIEE-33 Pancreas Transplantation: What Should the Radiologist Know?

Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To expose the existing surgical techniques in pancreatic transplantation. To highlight the role of the different imaging tests in graft evaluation. To make a pictorial review of the postoperative complications according to the time after transplantation.

#### TABLE OF CONTENTS/OUTLINE

Pancreatic transplantation is a valid therapeutic option for poorly controlled diabetes mellitus and advanced diabetic nephropathy. Knowledge of the surgical techniques, location of the anastomoses and related complications will assist the radiologist in performing an accurate assessment that leads to adequate management and long-term survival of pancreatic grafts. There are three types of pancreas transplantations regarding the drainage method: systemic venous and bladder exocrine drainage, systemic venous and enteric exocrine drainage, and portal venous and enteric exocrine drainage. Radiological assessment of the pancreas graft is usually multimodal. Ultrasound is the first-line imaging modality for the initial post-surgical evaluation performed within the first 24 hours. CT is preferred if complications are presumed. Postoperative complications include parenchymal, infectious, enteric or vascular disorders, which can be classified according to the time lapse after transplantation in which they occur: immediate (< 24 hours), early (24-72 hours), intermediate (72 hours-weeks) and late (months). We gathered the most illustrative cases of postoperative complications from recent years at our institution to show the key features of imaging that enable rapid and accurate management.

#### GIEE-34 Retrospectively Defined Missed Early Signs of Pancreatic Cancer on CT

Participants

Satomi Kawamoto, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review cases of missed early pancreatic ductal adenocarcinoma (PDAC) and early changes of PDAC on CT. 2. Small,

isoattenuating PDAC without contour deformity can be easily missed.<sup>3</sup> CT findings to suggest early PDAC include pancreatic duct dilatation with or without abrupt duct cutoff, vascular invasion, focal parenchymal atrophy, and focal enhancement.

#### TABLE OF CONTENTS/OUTLINE

1. Background: Delay in diagnosis can contribute to poor outcomes in PDAC, and imaging plays a crucial role in the diagnosis of early PDAC. 2. Review of cases of missed early PDAC and early changes of PDAC before clinical diagnosis on CT. (1) Small, isoattenuating PDAC without contour deformity. (2) Pancreatic duct dilatation is most common secondary finding (3) Abrupt pancreatic duct cut-off (4) Vascular invasion is not a common finding but high likelihood of missing (5) Parenchymal atrophy (6) Focal enhancement. 3. Cognitive errors (1) Underlying pancreatitis (2) Unexpected finding. 4. Discussion of future direction

#### **GIEE-35 Plan to Scan the Pancreas Transplant: A Sweet Review of Anatomy, Imaging Technique, and Complications**

Participants

Maham Siddique, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: • Pancreas transplant aims to restore normal glycemic control, often in young patients with diabetes and manifesting end-stage renal disease. • Ultrasound is performed to evaluate the pancreas and transplant vessels in the perioperative period. • Ultrasound, CT, and MRI can diagnose transplant-related complications. Common vascular complications include arterial and venous thrombosis and arterial pseudoaneurysm. Transplant pancreatitis has similar complications to inflammation of the native pancreas and can impact the renal transplant. • Radiologists should be familiar with normal pancreas transplant anatomy, vascular and non-vascular complications of pancreas transplants, as early recognition of these entities may improve outcomes.

#### TABLE OF CONTENTS/OUTLINE

Outline: Pancreas transplant background and demographics, Normal pancreas transplant anatomy and surgical technique, Normal transplant evaluation on ultrasound and reporting template, Acute and necrotizing graft pancreatitis, Vascular complications: arterial and venous stenosis and thrombosis, pseudoaneurysm, acute arterial bleeding, Non-vascular complications: Peripancreatic collections, hematoma, post-transplant lymphoproliferative disease.

#### **GIEE-36 Why Oh Y-Grafts: Understanding the Anatomy, Imaging, and Complications of Pancreas Transplantation**

Participants

Melanie P. Caserta, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pancreas transplant is the treatment for severe Type I diabetes mellitus complicated by end stage renal disease, poorly controlled Type I or II diabetes, and cystic fibrosis. Pancreas transplantation is most commonly performed simultaneously with kidney transplantation (80%) or following kidney transplantation (16%), and least commonly performed alone. Ultrasound is the first line modality for evaluating the allograft and vasculature and to look for complications. Contrast enhanced ultrasound, CT and MRI can be used as problem solving tools to further evaluate complications. After reviewing this case-based exhibit, the learner will: - Understand indications for pancreas transplantation - Describe the surgical anatomy of pancreas transplants - Describe ultrasound technique for evaluating the transplant pancreas - Recognize complications of pancreas transplant - Determine when additional imaging of the pancreas transplant is needed

#### TABLE OF CONTENTS/OUTLINE

Outline: 1. Objectives 2. Background - Pancreas Transplant a. Benefits of pancreas transplantation b. Review of surgical technique 3. Imaging a. Ultrasound - First line imaging i. Ultrasound protocol ii. Normal appearance iii. Complications 1. Vascular 2. Parenchymal 3. Perigraft 4. Bowel b. Problem solving i. Contrast enhanced ultrasound to assess allograft perfusion and vascular complications ii. CT - peripancreatic fluid collections, suspected intestinal obstruction, multiphase evaluation to assess graft and vasculature iii. MRI - Ferumoxytol MRI to assess transplant vasculature 4. Treatment and Intervention a. Medical b. Ultrasound guided c. Endovascular d. Surgical

#### **GIEE-37 Navigating Through the Esophageal Disorders in Chest CT Scans: What Radiologists Should Know**

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To know basic anatomy and histology of the esophagus To learn the role of CT imaging in the detection and characterization of esophageal pathology. To recognize the most important imaging findings of non-malignant and malignant esophageal diseases.

#### TABLE OF CONTENTS/OUTLINE

1. Esophageal anatomy and histology 2. Benign esophageal disorders a). Benign esophageal tumors - Leiomyoma - Fibrovascular polyps - Esophageal schwannomas b). Congenital lesions: - Duplication cysts c). Esophageal diverticula - Pharyngo-esophageal junction: Zenker diverticula - Middle esophagus diverticulum - Epiphrenic diverticulum d). Infectious diseases - Candida - HIV - CMV - Herpes simplex virus - Chagas e). Inflammatory disorders - Reflux esophagitis and Barrett's esophagus - Eosinophilic esophagitis (EoE) - Radiotherapy-induced esophagitis - Scleroderma - CREST f). Traumatic and fistulas - Esophageal impaction - Hematoma - Perforation - Actinic - Esophageal-airway fistula - Esophageal mediastinal fistula g). Others - Achalasia - Acute esophageal necrosis (AEN) - Hiatal hernia - Esophageal and para-esophageal varices 3. Primary malignant esophageal tumors a). Squamous carcinoma (SCC) b). Adenocarcinoma c). Lymphoma d). Primary malignant melanoma

#### **GIEE-38 Diffuse and Focal Liver Fat: Pearls and Pitfalls**

#### TEACHING POINTS

To review the imaging features of liver fat in different methods. To discuss and illustrate the main causes and consequences of fatty liver disease, as well as its associated conditions To demonstrate common and uncommon patterns of liver fat distribution and

discuss the underlying pathophysiology. To recognize that classic liver lesions can have different patterns of imaging presentation in the setting of steatosis. To present challenging cases and mimic lesions, highlighting the clues that can be helpful for the correct diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Liver fat in different imaging methods (US, CT and MRI). Main findings of several causes of fatty liver disease (alcoholism, metabolic syndrome, chemotherapy, drug toxicity, infection, PCOS). Patterns of liver fat distribution (diffuse, focal, geographic, multinodular, perivascular), including uncommon oncologic and cirrhotic cases. Patterns of presentation of the classic liver lesions in the setting of steatosis (FNH, hemangioma etc). Differential diagnosis between true lesions and pseudolesions.

#### **GIEE-39      Ultrasound Of the Gastrointestinal Tract: Contributions of Ancillary Ultrasound Techniques**

Participants

Nameerah Wajahat, Calgary, AB (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

(1.) Greyscale ultrasound evaluation comprises the fundamental basis of diagnostic evaluation of the bowel in inflammatory bowel disease (IBD) (2.) Wall thickness, inflammatory fat and signal on color doppler imaging (CDI) are the markers which increase in proportion to active inflammation. (3.) Ancillary Ultrasound techniques including: endovaginal sonography (EVS), contrast enhanced ultrasound (CEUS) and shear wave elastography (SWE) contribute greatly to final diagnosis and patient outcome. (4.) EVS provides information about anatomy and pathology in the deep pelvis with high resolution. (5.) CEUS allows for subjective and objective information about blood flow at the capillary level, allowing characterization of inflammatory masses as representative of active inflammation (phlegmon) or abscess formation (liquid pus) (6.) SWE measures bowel wall stiffness aiding with characterization of strictures. Soft inflammatory strictures- medical management. Stiff chronic strictures - surgical management

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction to ultrasound of the bowel with emphasis on greyscale imaging - Ancillary features what are they and what do they do? - Endovaginal Sonography and its role in deep bowel evaluation - CEUS (Contrast Enhanced Ultrasound) and its contribution to activity assessment - SWE (Shear wave elastography) and its contribution to stricture assessment - Change of management with ancillary techniques

#### **GIEE-4      Comprehensive Review of Abdominal Manifestations of Melanoma with Emphasis on Liver Metastasis**

#### **TEACHING POINTS**

The purpose of this exhibit is 1. To review imaging findings of primary and secondary melanoma in the abdomen and pelvis 2. To discuss multimodality imaging of liver metastasis from melanoma 3. To present an imaging atlas of gadoteric acid-enhanced MRI for liver metastasis and to discuss its potential value 4. To discuss surveillance protocols for intraabdominal metastasis of melanoma

#### **TABLE OF CONTENTS/OUTLINE**

1. Clinical aspects of melanoma (1) Epidemiology (2) Staging (3) Treatment and prognosis 2. Primary melanoma in the abdomen 3. Metastatic melanoma in the abdomen (1) Liver (2) Pancreaticobiliary system (3) Gastrointestinal tract (4) Other involvement 4. Multimodality imaging of liver metastasis (1) Ultrasound (2) CT (3) MRI i. Lesion detection and characterization ii. Special considerations for gadoteric acid-enhanced MRI for melanoma iii. MR findings of liver metastasis according to the primary origin of melanoma 5. Surveillance and prognosis (1) Surveillance protocol for metastatic melanoma in the abdomen (2) Prognostic implications of imaging features

#### **GIEE-40      Step-by-step Assessment in Colon Cancer Risk Stratification. Assessment by Virtual Colonography and Dual Energy Support**

Participants

Omar Gamboa Abundis, MD, Ciudad de Mexico, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Colorectal cancer represents the third most diagnosed cancer and corresponds to the second cause of death in the world. The recognized precursor lesion is the adenoma, and the risk of malignant transformation is significantly increased. Virtual colonography is a noninvasive screening method for colon cancer and avoids the unnecessary risk of bleeding or perforation present in colonoscopy. Learn to describe and categorize the findings and pitfalls in lesions found during image processing and viewing.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents: Teaching points. Introduction. What is CRADS. Virtual colonography acquisition protocol. Image processing and anatomical considerations. Description of the results. CRADS categories. CRADS 1 to 4. Extracolonic findings. E0 to E4. Main pitfalls to consider. Conclusions. References. Outline: Colorectal cancer is the third most common cancer and is the second leading cause of cancer death in the world. It is important to carry out a screening test in patients over 45 years of age and even more so in those who present a high risk of suffering from this disease. Virtual colonography provides an excellent alternative with rapid acquisition protocols and high sensitivity and specificity. Useful in highrisk patients during the colonoscopy intervention, also avoiding the possible risk of perforation and bleeding.

#### **GIEE-41      Deep Learning for Electronic Cleansing in Fecal-tagging CT Colonography**

#### **TEACHING POINTS**

This exhibit reviews the historical perspectives of Electronic Cleansing (EC), the major cleansing artifacts and pitfalls in the conventional deterministic EC methods, the recent technical advances of deep-learning based EC (Deep-EC) methods, comparison between Deep-EC and conventional deterministic EC, and the future trend of Deep-EC development fecal-tagging CT Colonography (CTC). The teaching points of this exhibit are: 1. EC requires accurate classification or segmentation of tagging fecal residuals and their mixtures. Conventional deterministic EC methods exhibit various artifacts and pitfalls. 2. State-of-the-art deep-learning models and training techniques provide an effective solution to reduction of EC artifacts and pitfalls. 3. Intracolonic lumen segmentation (ILS), which combines EC and colon segmentation into a single procedure in the CTC workflow, is a promising Deep-EC method in

CTC.

#### TABLE OF CONTENTS/OUTLINE

1. Review of deterministic EC methods with discussion of the limitations and clinical challenges.2. Describe the challenges of building a large-scale CTC dataset for EC.3. Present recent technical advances of Deep-EC by applying deeper and larger Convolutional Neural Network (CNN) and various model training techniques to reduce EC artifacts.4. Present a cutting-edge Deep-EC procedure, Intracolonic lumen segmentation, built on the two-stream U-Net (BiS-UNet) model.5. Compare the image quality of EC and Deep-EC in 3D visualization of cleansed colon in non-cathartic fecal-tagging CTC.6. Discuss the technique trend and future developments of Deep-EC.

#### GIEE-43 Peribiliary Cystic Lesions: Uncommon Mimickers of Hepatic and Biliary Cystic Lesions

##### TEACHING POINTS

To describe and demonstrate with radiological cases the common and uncommon peri-biliary entities.To identify the imaging features indicative of pathologies of the peri-biliary space and emphasize the radiological differences with hepatic and biliary lesions.To propose a practical systematization in the evaluation of intrahepatic peri-biliary cystic lesions.To suggest a step-by-step guide for clinical-radiological reasoning.

##### TABLE OF CONTENTS/OUTLINE

Intrahepatic peribiliary cystic lesions are usually benign and result from cystic dilatation of tubule-alveolar glands with acini of serous and mucinous cholangio-ctyes with various stages of maturation. The term intrahepatic refers to cystic changes located above the hepatic hilum that have the portal vein, hepatic artery, and portal neurovascular bundle as anatomical landmarks. They are usually multiple, small, thin-walled, serous content, and by definition do not exhibit communication with adjacent bile ducts. They may take on a confluent appearance resembling multiloculated malignancies or even mimic intraductal biliary pathologies. This intrahepatic peri-biliary region is susceptible to several pathologies that include inflammatory, infectious, neoplastic, congenital and acquired nature. The objective of this review is to systematize the evaluation of peribiliary cystic lesions taking into consideration their intrahepatic location and their radiological aspects that may have some peculiar characteristics.

#### GIEE-44 More Than Atlanta... The Entire Acute Pancreatitis Map. A Comprehensive Review Of Acute Pancreatitis Complications

Participants

Lucia Chagas, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To review the concepts of the Atlanta criteria, both related to the initial diagnosis (edematous interstitial pancreatitis / necrotizing pancreatitis) and their complications (pancreatic pseudocyst / walled-off necrosis). To provide context for other complications of acute pancreatitis, such as thrombosis, pseudoaneurysm, hemorrhage, infection and ductal disconnected syndrome, regarding the associated risk for their development and diagnosis on imaging exams.

##### TABLE OF CONTENTS/OUTLINE

Schematic drawings and computed tomography and magnetic resonance images aimed at understanding imaging findings that precede certain complications, as well as aspects related to their diagnosis. Differential diagnosis approach between edematous interstitial and necrotizing pancreatitis, as well as the complications that may arise from each of them.

#### GIEE-45 LI-RADS Treatment Response Algorithm v2023: Roadmap for Post Radiation Treatment Response

Participants

Aadithya Nalla, Okemos, MI (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for assessing and reporting treatment response after locoregional therapy (LRT) for hepatocellular carcinoma (HCC).2. When compared to other LRTs, radiation-based therapies (transarterial radioembolization (TARE) and stereotactic beam radiation therapy (SBRT)) have distinct post-treatment imaging appearances, including persistence of arterial phase hyperenhancement (APHE), which makes response assessment challenging using the current TRAs which use APHE as a surrogate imaging biomarker for viability. Changes in the LR-TRA v2023 are intended to address this challenge.3. This exhibit highlights the updates in the LR-TRA v2023, including the correct application of the new algorithm after radiation therapy to HCC, with the overall objective of improving diagnostic accuracy of post-treatment imaging assessment.

##### TABLE OF CONTENTS/OUTLINE

1. Summarize the role of the TRA in the context of radiation therapy for HCC.2. Case-based and illustrative review of expected imaging features after radiation-based treatments to HCC and identify pitfalls in response assessment.3. Introduce and highlight key updates of the new component of the LR-TRA v2023 pertaining to its application after radiation-based treatments for response assessment using a case-based review.

#### GIEE-46 From Guidelines to Radiology Practice: Navigating the 2023 ASCO Guidelines for Advanced Gastroesophageal Cancer

Participants

Charit Tippareddy, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Discuss new 2023 ASCO guidelines for advanced gastroesophageal cancer therapies2. Radiologic imaging findings related to treatment sequelae3. Differentiate treatment related response versus disease progression on radiologic imaging

##### TABLE OF CONTENTS/OUTLINE

1 Pathophysiology, demographics, risk factors of gastroesophageal cancer2 New 2023 ASCO Guidelines and their implications for

1. Pathophysiology, demographics, risk factors of gastroesophageal cancer2. New 2023 ASCO Guidelines and their implications for treatment3. Imaging modalities used in diagnosis and staging of advanced gastroesophageal cancer4. Role of imaging in staging and management of advanced gastroesophageal cancer5. Demonstrate patient imaging cases that relate to the following:5a. Treatment related effects of immune checkpoint inhibitors5b. Treatment related effects of platinum-based chemotherapy5c. Treatment related effects of fluoropyrimidines5d. Treatment related effects of tyrosine kinase inhibitors5e. Post-radiation effects5f. Post-esophagectomy complications6. Conclusions

#### **GIEE-47 Internalize It!: An Insider's Case-Based Guide to Internal Hernias**

Participants

Collin Edwards, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- Internal hernias occur due to herniation of viscera, most often small bowel, through the mesentery or peritoneum, and considered in the differential for intestinal obstruction. - Internal hernias are classified by different systems based on distribution of bowel loops in the abdomen and pelvis. - Post-operative internal hernias occur after roux-en-Y anastomosis for gastric bypass and liver transplant. - CT with IV and PO contrast is the imaging modality of choice for evaluating internal hernias. - "Sac-like" appearance of dilated small bowel loops on imaging should raise concern for internal hernia. - Radiologists should have a clear understanding of normal peritoneal anatomy, surgical history, and the characteristic location of common and uncommon internal hernias on imaging.

##### **TABLE OF CONTENTS/OUTLINE**

- Introduction and background - Normal peritoneal anatomy and boundaries - Case-based review, management, and surgical outcome - Paraduodenal hernia - Lesser Sac/Foramen of Winslow hernia - Pericecal hernia - Intersigmoid hernia - Transmesenteric hernia - Pelvic and broad ligament hernia - Post Roux-en-Y hernias: Petersen's, Roux limb mesentery, enteroenterostomy

#### **GIEE-48 Islet Insurgents: A Radio-Pathologic Review of Pancreatic Neuroendocrine Tumors**

Participants

David Mata, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Purpose/Aim:The goal is to educate the audience in recognizing the multi-modal imaging features of pancreatic neuroendocrine tumors (pNET), with an emphasis on clinical and pathological correlation. We will also elucidate the histopathologic features of pancreatic neuroendocrine neoplasm subtypes.

##### **TABLE OF CONTENTS/OUTLINE**

Content organization:1. Pancreatic Neuroendocrine neoplasm clinical overview. 2. Differentiating syndromic vs nonsyndromic subtypes. 3. Multi-modal radiographic features on Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). 4. Histopathological and gross pathologic characteristics of pNET. 5. Treatment and Prognosis. 6. Summary.

#### **GIEE-49 Have you Ever Seen the Rain? Cross-sectional Imaging of Pancreatic Leak**

Participants

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Recognize the pancreatic anatomy and its relation to other structures. Understand what can cause a pancreatic fistula (PF) and its mechanisms . Comprehend the imaging patterns of PF. Recognize the potential pitfalls of PF.

##### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: Pancreatic anatomy and relationship with other abdominal structures. Pancreas imaging patterns on Computed Tomography (CT), and Magnetic Resonance Imaging (MRI). Pancreas patterns after surgery (gastroduodenopancreatectomy, and distal pancreatectomy). Epidemiology of PF, and its causes. DIAGNOSIS AND IMAGING FINDINGS: PF - How to identify on CT? How to identify on MRI? How to proceed? Potential pitfalls of PF, don't get caught! SUMMARY AND SYSTEMATIC APPROACH. TAKE HOME MESSAGES.

#### **GIEE-5 Selected Portal Venous Anomalies: An Institutional Multimodality Case-based Review of Portal Varices and Intrahepatic Congenital Shunts**

Participants

Abtin Jafroodifar, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Review portal venous (PV) varices and aneurysms, including congenital, acquired, true and pseudoaneurysms, with review of extrahepatic and intrahepatic classifications. Learn to properly communicate and report PV varices and aneurysms and their complications such as thrombosis, portal hypertension, or compressive syndromes. Discuss congenital intrahepatic portosystemic shunts subtypes. Review PV embryological development as it relates to a radiologist's practice. Explore the diagnostic clues to recognize PV varices, aneurysms, and intrahepatic shunts using multimodality imaging including ultrasound, CT, MR, and cinematic 3D rendering.

##### **TABLE OF CONTENTS/OUTLINE**

(1)Review normal and variant portal vein anatomy using CT, MR, angiography, and original diagrams. Briefly review portal vein embryological development from the vitelline and umbilical venous systems.(2)Discuss the diagnostic criteria, relevant presentation, and epidemiology of PV varices and aneurysms. Optimal imaging protocols will be outlined.(3)A case-based review of different types of PV varices, including congenital, acquired, and isolated subtypes. Case-based review of intrahepatic portal vein aneurysms and eventual thrombosis.(4)A case-based review of five types of congenital intrahepatic portosystemic shunts classified by Park et al. (AJR, 1990). Present pre- and post closure of a congenital intrahepatic shunt case in a patient with bilateral Wilm's tumors. (5)Present a rare case of splenic vein aneurysm with eventual thrombosis and recanalization using cross-sectional imaging; of note, splenic vein aneurysms are so rare that a true prevalence has not been reported. Discuss mesenteric and splenic vein aneurysms.



## **GIEE-50 Ensuring High-Reliability Anatomic Evaluation for Living Liver Donors Using Multi-Contrast-Agent MRCP**

### Participants

Valerie Khaykin, Ann Arbor, MI (*Presenter*) Nothing to Disclose  
Reve Chahine, MD, Beirut, MI (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Living donor liver transplantation (LDLT) expands access to transplantation but has the challenges of substantial technical complexity and simultaneous risk for both donor and recipient. 2. Precise understanding of the anatomy of the central liver (biliary drainage, hepatic venous drainage, arterial and venous anomalies) and segment 4 is critical to living donor success. 3. Contrast-enhanced MRCP is used to assess anatomy but suffers from suboptimal reliability due to motion artifacts (eg, respiratory motion at MRCP, arterial phase tachypnea with gadoxetate disodium) and technical factors. 4. We implemented a multi-contrast agent MRCP imaging protocol using gadoxetate disodium and gadobenate dimeglumine to enable high-reliability imaging in the arterial phase (gadobenate) and of the bile ducts (non-contrast MRCP + gadoxetate hepatobiliary phase) and prevent the need for repeat or adjunctive imaging (eg, CTA).

### TABLE OF CONTENTS/OUTLINE

1. Background on LDLT 2. Highlight key anatomic considerations for assessing eligibility for donation 3. Targeted review of conventional single-contrast agent MRCP imaging protocols for living liver donor evaluation a. MRCP with extracellular gadolinium-based contrast material b. MRCP with gadoxetate disodium c. Single contrast agent MRCP followed by CTA 4. Demonstration of successful multi-contrast agent MRCP for assessing living liver donor eligibility a. Protocol b. Technical considerations c. Advantages d. Pictorial review e. Limitations

## **GIEE-51 MR Imaging Biomarkers: Can Aggressive Imaging Features of Hepatocellular Carcinoma Predict Early Post-Treatment Recurrence?**

### TEACHING POINTS

1. Hepatocellular carcinoma (HCC) diagnosis and management is almost exclusively imaging based without the need for pathologic confirmation. 2. Certain MR imaging features have shown to be predictive of more aggressive biologic subtypes of HCC, resulting in increased likelihood of early post-treatment recurrence and worse overall survival. 3. In order to optimally treat HCC, it is important to recognize the multifactorial etiology for tumor recurrence and/or progression including a basic understanding of the complex immunologic tumor microenvironment.

### TABLE OF CONTENTS/OUTLINE

1. Review the histopathology of HCC, including the histologic variants using a pictorial representation of the heterogeneity in the histology and biology of HCC. 2. Pictorial review of MR imaging biomarkers predictive of aggressive tumor biology. 3. Review of the hepatic and tumor microenvironment and its role in treatment response after locoregional therapy. 4. Review clinical outcomes after locoregional therapy to HCC by various locoregional modalities with an emphasis on HCC with aggressive pre-treatment imaging features by using a case-based approach. 5. Demonstrate a proposed mechanism to use various MR imaging biomarkers to risk stratify patients with aggressive versus less-aggressive HCC to reduce the chance of early post-treatment progression and improve overall management.

## **GIEE-52 Solid Pseudopapillary Tumors of the Pancreas: Old Friend, New Meme**

### Participants

David Mata, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit will depict typical image findings of solid pseudopapillary tumors (SPT) of the pancreas, with an emphasis of epidemiological, clinical, and pathological correlation. Illustrated as well are common mimics of SPT, including neuroendocrine and malignant tumors of the pancreas. A review of epidemiology and clinical features of SPT. Identify relevant Ultrasound (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) appearances of typical SPT. Correlate morphologic findings with Positron Emission Tomography (PET), pathologic microscopy, and gross surgical specimens. Provide key features to differentiate SPT from other retroperitoneal tumors.

### TABLE OF CONTENTS/OUTLINE

SPT are rare epithelial tumors of exocrine pancreas with low malignant potential and overall good prognosis. Mostly found in young adults and Caucasian women, these tumors are often asymptomatic but can present with abdominal pain and a palpable mass. Since there are SPT mimics, it is important to obtain clinical history and know the epidemiology of SPT. Upon diagnosis, SPT are normally large, circumscribed masses comprised of both solid, hemorrhagic, and necrotic components with no associated ductal dilation. It is important to note, smaller presenting SPT (< 3cm) often have image findings of a solid, homogenous appearance. The intralosomal appearance depends on the degree of hemorrhage, calcification, tumor necrosis, or cystic degeneration. These tumors are commonly found in the body and tail of the pancreas. To avoid erroneous interpretation or delay in diagnosis, appropriate knowledge of SPT imaging patterns and presentations is required.

## **GIEE-53 Mimics of Inflammatory Bowel Disease: Not everything is Crohn's or Ulcerative Colitis**

### TEACHING POINTS

1. Inflammatory bowel disease (IBD; Crohn's disease and Ulcerative colitis) represents a group of diseases characterized by chronic inflammation of the gastrointestinal tract. 2. Patients frequently present with nonspecific symptoms such as abdominal pain, weight loss, diarrhea, nausea, vomiting and obstruction. 3. Various infectious and non-infectious diseases can mimic IBD including malabsorption syndromes, autoimmune diseases, drug-induced conditions, diverticulitis, appendicitis, vascular etiologies and malignancy. 4. Imaging is a crucial tool in identifying IBD mimics as it helps clinicians in making accurate diagnoses and implementing appropriate treatment strategies.

### TABLE OF CONTENTS/OUTLINE

1. Typical imaging characteristics of IBD (Crohn's disease and Ulcerative colitis) 2. Differential diagnoses of infectious causes with

1. Typical imaging characteristics of IBD (Crohn's disease and ulcerative colitis); 2. Differential diagnoses of infectious causes with common imaging features and corresponding cases. 3. Differential diagnoses of non-infectious causes with common imaging features and corresponding cases.

#### **GIEE-54 Unveiling Internal Hernias A Comprehensive Review of CT Imaging Patterns**

Participants

Patricia Dantas I, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The purpose of this exhibit is: Review peritoneal cavity anatomy with emphasis on the most common internal hernia sites. Discuss the role of computed tomography (CT) in the diagnosis and management of patients. Illustrate imaging patterns of the main types of internal hernia, highlighting the specific characteristics of congenital, oncologic and bariatric surgery cases. Identify key CT features that help differentiate open-loop from closed-loop obstruction and those that may predict ischemic injury of the small bowel loops. Recognize the main differential diagnoses and pitfalls of internal hernias, addressing diagnostic challenges. Propose an algorithm to aid in the interpretation of CT images in cases of intestinal obstruction.

##### **TABLE OF CONTENTS/OUTLINE**

1) Introduction: epidemiology, clinical and pathophysiological aspects of bowel obstruction 2) Role of CT in the evaluation of obstructive acute abdomen, including CT protocol recommendations. 3) Review of peritoneal cavity anatomy: - Main peritoneal spaces; - Ligaments; - Normal recesses and foramina. 4) To demonstrate, through a case-based review, the imaging patterns of the following types of internal hernias: - Paraduodenal Through foramen of Winslow - Intersigmoid - Falciform ligament - Pericecal - Supravesical - Transmesenteric / Transomental - Acquired (postoperative/trauma). 5) To discuss and illustrate major complications of internal hernias: - Ischaemia - Perforation - Illustrative key points. 6) Differential diagnosis and pitfalls. 7) Relevant imaging findings that aid surgical decisions. 8) Algorithm for the diagnosis of internal hernias. 9) Conclusions and "take-home messages".

#### **GIEE-55 Preoperative Assessment in Pancreatic Ductal Adenocarcinoma: Understanding the Impact of Staging and Anatomical Variants on Surgical Planning**

Participants

Davi Romao, MD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

It is critical to understand the radiologic features of pancreatic ductal adenocarcinoma and how they affect surgical planning. In this pictorial review, we will focus on the assessment of vascular invasion and its impact on surgical planning. We will also review the major anatomic variants associated with the vascular anatomy of the celiac trunk, superior mesenteric artery and its branches.

##### **TABLE OF CONTENTS/OUTLINE**

1. Review of pancreatic adenocarcinoma staging 2. Assessment of vascular invasion in pancreatic adenocarcinoma 2a. Venous involvement 2b. Artery involvement 3. Anatomical variants 3a. Celiac trunk variants 3b. Superior mesenteric artery variants 3c. Venous variants 4. Surgical Technique 4a. Cephalic pancreaticoduodenectomy 4b. Distal pancreatectomy 4c. Types of venous reconstruction 4d. Celiac axis resection - when is this feasible?

#### **GIEE-56 Learning From Failure: Non-Target Embolization with Yttrium-90 in the Treatment of Hepatic Tumors**

##### **TEACHING POINTS**

1. The role of hepatic trans-arterial radioembolization (TARE) loco-regional therapy is expanding with new applications particularly in earlier stages of disease 2. Optimized TARE workflow involves careful pre-procedural selection, peri-procedural monitoring, and post-procedural evaluation 3. Peri-procedural imaging and dosimetry allows identification of non-target intra- and extra-hepatic dose delivery as well as target dose estimation 4. Identifying potential causes of discordance between Y-90 microsphere delivery and intended target with multi-modality imaging can impact patient outcomes and may be a valuable area of future research

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to transarterial radioembolization (TARE) 2. Indications and approaches to Y90 radioembolization in hepatic tumors 3. Workflow and evaluation of Y90 Treatment (Pre-, peri- and post-procedural) 4. Examples of non-target delivery, complications, and clinical outcome based on peri-therapy scans 5. Potential causes of non-target delivery 6. Future directions of research

#### **GIEE-57 Update on Multi Energy CT Applications for Pancreatic Diseases**

Participants

Yasunori Nagayama, MD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Multi-energy CT provides spectral-based imaging such as virtual non-contrast imaging (VNC), virtual monochromatic imaging (VMI), and material density maps, potentially facilitating the optimal lesion assessment and management for patients with pancreatic diseases. The aim of this presentation is to provide the state-of-the-art clinical applications of multi-energy CT technologies for pancreatic imaging by presenting the numerous representative examples.

##### **TABLE OF CONTENTS/OUTLINE**

I. Principle of multi-energy CT technology II. Multi-energy CT systems III. Post-processed spectral CT imaging IV. Clinical applications of spectral imaging in pancreatic diseases A) Improved lesion delineation 1. Iso-attenuating pancreatic ductal adenocarcinoma (PDAC) 2. Incidental PDAC on routine abdominal CT 3. Staging of PDAC on routine portal-venous phase CT 4. Neuroendocrine tumor (NET) 5. Acute pancreatitis B) Spectral-based lesion characterization 1. Chronic mass forming pancreatitis vs. PDAC 2. NET vs. intrapancreatic accessory spleen 3. Local recurrence of PDAC vs. post-operative perivascular fibrosis 4. Pancreatic cyst C) Prediction of clinical outcome 1. Chemotherapy response for PDAC 2. Risk stratification for post-operative pancreatic fistula (POPF) 3. Prediction of future PDAC development D) Improve patient safety by reducing radiation dose and iodine doses

#### **GIEE-58 Gastrointestinal Oncologic Emergencies: A Radiologists' Guide**

Participants  
Mindy Wang, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Describe the imaging approach for evaluating oncologic emergencies affecting gastrointestinal tract.
- Identify imaging manifestations of gastrointestinal oncologic emergencies.
- Identify potential pitfalls in imaging of gastrointestinal oncologic emergencies.

#### TABLE OF CONTENTS/OUTLINE

- Gastrointestinal oncologic emergencies and imaging approach
- Multimodality imaging features of gastrointestinal oncologic emergencies
  - o Intestinal obstruction
  - o Intestinal ischemia
  - o Intestinal perforation
  - o Intussusception
  - o Inflammatory/infectious changes (including superinfection of tumor necrosis/abscess formation)
  - o Graft versus host disease
  - o Tumor torsion/volvulus
  - o Peritonitis
  - o Lymphatic obstruction
  - o Vascular complications
    - § Hemorrhage (including active extravasation and intramural hematoma)
    - § Thrombosis (microangiopathy, venous and arterial thrombosis or thrombophlebitis)
    - § Arteritis
    - § Aneurysm/pseudoaneurysm
  - o Emergencies related to paraneoplastic syndrome
- Management
- Mimics and potential pitfalls

#### GIEE-59 Hepatic Artery Infusion Pump: A Multi-institutional Comprehensive Case-based Review

Participants  
Harit Kapoor, MD, MBBS, Poughkeepsie, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) HAIP is a novel surgically placed intraarterial pharmacotherapeutic option with three salient indications: unresectable burden of colorectal liver metastases (CRLM), adjuvant therapy post CRLM resection and in unresectable intrahepatic cholangiocarcinoma (ICC).2) Post-procedure Tc-MAA SPECT are vital to ensure isolated and maximal bilobar hepatic perfusion for safe and efficacious drug delivery.3) Patient selection is multi-factorial including presence of intra- and extrahepatic disease, anatomy and patency of vasculature, hepatic function, extent of prior chemotherapy treatment, and performance status.4) All HAI devices are MRI conditional however the Medtronic Synchronised II device is set to automatically stall while in the scanner and must be interrogated post-scan to assure the motor has restarted.5) HAIP therapy is associated with unique complications, many of which are delayed and unsuspected. Meticulous interrogation of the catheter tip position and a low threshold for further investigations on follow-up imaging can help decrease complication rates.

#### TABLE OF CONTENTS/OUTLINE

1) Role of HAIP therapy for different clinical indications.2) Technical aspects of HAIP placement and trouble shooting in extrahepatic perfusion3) Expected imaging appearances of HAIP devices in both normal and variant anatomic situations4) Role, interpretation and management implications of Tc-MAA SPECT pump perfusion imaging5) Tabulated overview and Case-based examples of HAIP complications (Pump pocket-related, Catheter-related and Hepatobiliary).6) Summary

#### GIEE-6 Improving the Gall Stone Detectability by Using the Monochromatic Images with a Fast kVp-Switching Single-Source Spectral Computed Tomography: A Phantom Experiment with Gall Stone Specimen

#### TEACHING POINTS

1. In the conventional polychromatic (kVp) scan mode, gall stones detectability such as the cholesterol, pigment, and rare were lower because the small difference of computed tomography (CT) value (hounsfield unit: HU).2. Nowadays, with the application of fast kVp switching single source dual energy scan, its spectral mode enables the ability to reconstruct monochromatic images at different energy level. The purpose of this study is to compare the gall stones detectability between the dual energy scan mode and conventional polychromatic scan mode during a phantom study. 3.The monochromatic display method (cine display mode and spectral HU curve) with dual energy scan mode was possible for improving the detection of various gallstones compare with the conventional polychromatic scan mode (kVp).

#### TABLE OF CONTENTS/OUTLINE

CONTENT ORGANIZATION 1: Clinical case (Cholelithiasis) :MRI and CT images 2: Gall stone specimens :dual energy CT scan mode images(keV) and conventional scan mode images (kVp). 3: Spectral HU curve 4: Gall stone specimens (cholesterol): cine display mode 5: Clinical case (Cholelithiasis): performed dual energy CT

#### GIEE-60 A "Cyst"ematic Approach to Cystic Pancreatic Lesions

#### TEACHING POINTS

The target audience of this educational activity is for all radiologists who read CT or MR imaging of the abdomen.1. Demonstrate multimodality imaging features and patterns of common cystic pancreatic lesions2. Illustrate a systematic approach to distinguishing between pancreatic cystic lesions3. Review case-based clinical management including histopathologic correlation

#### TABLE OF CONTENTS/OUTLINE

Content: A systematic multi-modality imaging review of pancreatic cystic lesions will be included including an explanation for key diagnostic features, differentiation between lesions, histopathologic correlation, and review of management.The case selection includes:1. Mucinous cystic neoplasms2. Serous cystadenomas3. Solid pseudopapillary epithelial neoplasms4. Intraductal papillary mucinous neoplasms5. Cystic neuroendocrine tumors6. Sequela of pancreatitis (pseudocysts and walled off necrosis)

#### GIEE-61 Exploring the Uncommon: Lesser-Known Abdominal Syndromes and Their Presentation

Participants  
Priyanka Prajapati, MBBS, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points1. Illustrate rare abdominal syndromes with clinical and radiological features.Highlight the constellation of associated findings and complications.3. Emphasize the importance of a multimodality approach when diagnosing rare abdominal syndromes.

## TABLE OF CONTENTS/OUTLINE

Table of contents  
1. Background  
2. Normal anatomy relevant to the syndromes  
3. Importance of Pathology, Molecular tests, Imaging, Laboratory tests  
4. Case based illustrations of:  
a) TEMPI Syndrome  
b) Abernethy Syndrome  
c) DRESS Syndrome  
d) Li-Fraumeni Syndrome  
5. Classical clinical presentation and laboratory findings  
6. Pertinent Imaging findings of the syndromes  
7. Associated pathologies found  
8. Other Rare Abdominal Syndromes

### GIEE-62 Imaging Overview of Peritoneal Mesothelioma

Participants

Suren Reddy Satti, Preston, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A comprehensive overview of peritoneal mesothelioma with a focus on the histological subtypes, key distinguishing imaging features and understanding the common pitfalls involved in diagnosis.

## TABLE OF CONTENTS/OUTLINE

The aim is to improve understanding of peritoneal mesothelioma and the subtypes to aid with diagnosis and subsequent management. We present a radiological case-based review of the subtypes of peritoneal mesothelioma with accompanying histological and intra operative findings. Clinical features along with specific imaging findings for each subtype will be shown along with some pitfalls in interpretation. Subtypes of peritoneal mesothelioma: 1. Multicystic mesothelioma 2. Well differentiated papillary mesothelioma 3. Epithelioid mesothelioma 4. Sarcomatoid mesothelioma 5. Biphasic mesothelioma  
Mimics of mesothelioma - Lymphangioma - IgG4 peritoneal disease - Tuberculosis

### GIEE-63 Burn the Cake: The Role of HIPEC in Pseudomyxoma Peritonei

Participants

Vitor Bichuette, MD, Uberaba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To review concepts involving epidemiology, imaging findings and surgical techniques used in the treatment of pseudomyxoma peritonei (PP). ? To illustrate the use of peritoneal cancer index (PCI) to assess the peritoneal cavity. ? To review how hyperthermic Intraperitoneal chemotherapy (HIPEC) is performed, the techniques involved, indications and contraindications, and related complications. ? To discuss how radiologists can help surgeons in the management of PP.

## TABLE OF CONTENTS/OUTLINE

- Introduction - General concepts
  - o The use of CT to assess the PCI
  - Pseudomyxoma peritonei:
    - o Definition, clinical presentation, imaging features and treatment.
    - o Imaging aspects of peritoneal pseudomyxoma and peritoneal carcinomatosis: how to differentiate
    - o Surgical treatment
  - HIPEC:
    - o A step-by-step explanation of how HIPEC is performed.
    - o Advantages, indications and contraindications.
    - o Most common outcomes and complications.
  - Case-Based Review:
    - o Sample cases explaining and demonstrating image findings of PP and how CT can be used before and after the surgery
    - o Assessment of PCI
    - o HIPEC: normal and abnormal findings
  - Future Directions: new perspectives in the use of HIPEC to treat peritoneal tumors.
  - Conclusion and key takeaways.

### GIEE-64 Sonazoid-Enhanced Ultrasonography: What Can We Do in Abdominal Radiology and Intervention?

Participants

Jae Woong Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Sonazoid-enhanced ultrasonography (SEUS) is recently introduced contrast-enhanced ultrasonography using Sonazoid (GE Healthcare) offering the vascular phase and the unique post-vascular Kupffer phase for helping diagnose focal liver lesions (FLL). Its role has been primarily focused on differentiating benign and malignant FLLs. However SEUS can be used in diverse clinical settings such as evaluating the hepatic vasculature, and a guiding tool for interventional procedures of the liver. In conclusion, we believe that CEUS can be applied to diverse clinical settings, not only for the diagnostic purposes but also for the interventional procedures as an excellent guiding tool.

## TABLE OF CONTENTS/OUTLINE

1) Physics of SEUS, 2) Diagnostic roles of SEUS, 3) Application of SEUS in evaluation of hepatic vasculature, 4) Introduction of SEUS during liver biopsy, 5) SEUS as a guidance tool for radiofrequency ablation, 6) Tips and limitations of SEUS.

### GIEE-65 Fundamental of Pancreatic Adenocarcinoma Imaging on CT: What a Resident Should Know

Participants

Carlos M. Campana SR, MD, CDMX, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the pancreas, its vasculature and lymphatic drainage.  
- Illustrate the CT features of pancreatic adenocarcinoma.  
- Understand the staging of the pancreatic adenocarcinoma and the surgical criteria.

## TABLE OF CONTENTS/OUTLINE

- Introduction.  
- Anatomic considerations.  
- Teaching points.  
- CT features of pancreatic adenocarcinoma.  
- Case based approach.  
- Staging and surgical criteria.  
- Conclusions.

### GIEE-66 Fake Liver Lesions: Can You Help Me? An Illustrative Guide to Liver Pseudo-lesions and Tumor Mimickers

Participants

Roberta Sasso, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review importance of epidemiology for diagnosis of liver lesions. Illustrate clinical and imaging findings that might help distinguishing benign and malignant liver lesions. Practical tips and imaging features that could help achieve an accurate diagnosis and avoid unnecessary procedures. Highlight potential pitfalls related to different treatments that may mimic liver lesions.

#### TABLE OF CONTENTS/OUTLINE

Introduction - General concepts: epidemiology of liver lesions, including risk factors, incidence, and mortality. Imaging findings on CT and MRI of several liver lesions. Liver lesions: illustrative cases of different benign hepatic lesions and pseudolesions that mimic malignant hepatic lesions. Pitfalls: expected post-treatment changes that might be confused with true lesions. Normal findings after surgery, transplant, ablation, embolization, radiation and immunotherapy are reviewed. Case-Based Review: series of cases demonstrating imaging findings of liver lesions and how different modalities can be used. Conclusion and key takeaways.

#### GIEE-67 Imaging Review of Pseudomyxoma Peritonei

#### TEACHING POINTS

Comprehensive radiological overview of pseudomyxoma peritonei (PMP), and its patterns of disease spread. Common appearances of appendix mucinous tumours and frequently encountered interpretation pitfalls leading to misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

Diagnosis of PMP is often delayed in the non-specialist setting due to minimal exposure to appendix tumours and a lack of awareness. The aim is to improve the knowledge of pseudomyxoma peritonei and aid in the radiological diagnosis through understanding of its various aetiologies and the common pitfalls in imaging diagnosis. We present a case-based exhibit of PMP with reference to histology and intra-operative findings. To include: • Common radiologic findings at presentation, predominant patterns of disease spread and complications of PMP with key review areas when reporting. • Examples of delayed diagnosis from misinterpretation with tips and tricks to aid with accurate diagnosis. The cases include: o Primary appendix tumours, misdiagnosed as an abnormal ovary or fallopian tube. o Krukenberg tumours reported as a primary ovarian tumour. o Diffuse peritoneal disease with a primary appendix tumour (initially not identified). o Complicated appendicitis with an underlying tumour. • Other origins of pseudomyxoma other than the appendix, such as urachus and mature teratoma of the ovary. • How to optimize imaging to aid with diagnosis, utilizing positive oral contrast in computed tomography (CT) imaging of pseudomyxoma peritonei, use of MRP re-formats and MRI protocols.

#### GIEE-68 Role of Radiological Imaging in the Diagnosis and Management of ERCP Complications

#### TEACHING POINTS

- What is Endoscopic Retrograde Cholangiopancreatography (ERCP), and in which situations is it performed?
- What are the complications of ERCP and how often do we encounter them?
- Diagnosis of ERCP complications with the help of imaging methods. Tips for radiologists
- The importance of imaging methods in the early diagnosis of complications
- The role of imaging in management of complications

#### TABLE OF CONTENTS/OUTLINE

Table of Contents • Terminology and anatomy of the bile ducts and pancreatic duct • Post-ERCP expected imaging findings • Complications of ERCP • Demonstration of pathologies in imaging methods for the diagnosis of complications • The importance of early diagnosis in case of complications and correlation of imaging finding with clinical symptoms and signs • Demonstration of possible complications with sample cases • Follow up imaging findings during the treatment process of patients with complications

Outline • Endoscopic retrograde cholangiopancreatography (ERCP) is an application that is increasingly used to treat biliopancreatic disorders. This situation leads to a rise in the number of cases with complications. • It is important to distinguish between expected findings and pathological findings in post ERCP images. • It is important to evaluate the history and physical examination together with imaging methods for early diagnosis of complications and to decrease morbidity. • Imaging methods play a guiding role in the classification of complications.

#### GIEE-69 Multimodality Imaging in the Detection and Characterization of Anatomic Variants, Benign, and Malignant Conditions of the Peri-Ampullary Region

Participants

Kelvin Cortis, FRCR, Msida, Malta (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the conventional and variant anatomy of the ampullary and periampullary region. To provide a structured differential of the various conditions that may present at the ampullary and peri-ampullary regions. To describe the imaging features of pathologies at these regions.

#### TABLE OF CONTENTS/OUTLINE

The periampullary region is an anatomically and pathologically complex region. It encompasses the pancreatic head, second part of the duodenum, pancreatico-biliary junction, and associated neurovascular structures. All these structures are within a 2cm radius from the major duodenal papilla. Familiarity with this area and its variants will increase diagnostic accuracy and recognition of associated complications, thereby guiding proper management. This pictorial exhibit will display the multimodality imaging findings of developmental, benign, and neoplastic entities that may arise at the ampullary and peri-ampullary regions. Developmental entities include duodenal webs, pancreas divisum, pancreaticobiliary malunion, and annular pancreas. Para-duodenal pancreatitis, papillitis, Lemmel's syndrome, choledocholithiasis, and vascular abnormalities, are benign conditions that might involve the ampullary region. Neoplastic conditions that can involve the periampullary region include ampullary carcinoma, periampullary duodenal carcinoma, pancreatic tumours, distal common bile duct tumours, gastrointestinal stromal tumours, and neuroendocrine tumours. Abdominal radiologists should have a thorough anatomical understanding of the ampullary region in order to formulate a structured differential diagnosis that will lead to timely and precise diagnosis and management.

#### GIEE-7 Anorectal Fistula - Detection, Classification, and Post Treatment Follow-up

Participants

Joseph Owen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Identify and describe anorectal fistula based on the Parks classification system on MR2. Explain the options for treatment of anorectal fistula and associated complications based on their classification3. Recognize and describe the post treatment appearance of anorectal fistula and abscesses on CT and MR

#### TABLE OF CONTENTS/OUTLINE

The predisposing factors for development of anorectal fistula: Crohn's Disease; Prior pelvic radiation; Obstetric injuries; Infection; Foreign body insertio; MalignancyDiagnoses and characterization: MR; Exam under anesthesiaClassification of anorectal fistula with the Parks classification Inter-sphincteric; Trans-sphincteric; Supra-sphincteric; Extra-sphinctericClassification of Anorectal Abscess: Ischiorectal; Inter-sphincteric; Supra-levator; HorseshoeTreatment Abscess- Incision and drainage; Simple fistula - Primary fistulotomy; Complex fistula - Sphincter-sparing staged treatmentPost-treatment imaging appearance and characterization Seton; Endoanal advancement flap; Residual scar tissue; and inflammation; Recurrent fistula; Recurrent abscess

#### GIEE-70 **Advanced Pancreatic Imaging: 10 Tips and Tricks**

Participants

Mariana Peleja, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pancreatic ductal adenocarcinoma (PDAC) and other pancreatic conditions can be very difficult to diagnose and be a real challenge even to an experienced radiologist.The purpose of this exhibit is to present, through a serie of challenging cases, the direct and indirect signs of focal and diffuse pancreatic disease, and how can the radiologist help to establish the correct diagnosis using different imaging methods, such as Ultrasound (US), Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) CT. Some of the presented tips include:- Careful evaluation of main pancreatic duct or biliary tree dilation;- Importance of the T1-weighted images to evaluate the pancreatic parenchyma;- Look for asymmetrical parenchyma atrophy;- Pay attention to abnormalities involving the surrounding vessels;- Search for secondary lesions if uncertain about malignancy (such as liver and lymph nodes).

#### TABLE OF CONTENTS/OUTLINE

- Cases of pancreatic neoplasms and inflammatory conditions, with subtle findings that should raise a suspicion for a pancreatic disease;- Brief Review of pancreatic anatomy with multimodality imaging;- Image assessment of PDAC, with its features spectrum and tricky findings;- Importance of imaging for staging and resectability evaluation;- Other challenging cases in pancreatic cancer imaging, which the radiologist expertise is crucial to the correct management of disease.

#### GIEE-71 **Peritoneal carcinomatosis: A Comprehensive Review of Peritoneal MRI. Primer for Residents**

#### TEACHING POINTS

Peritoneal carcinomatosis is a common metastatic manifestation in several malignancies, with a higher incidence in gastrointestinal and gynecological tumors. Imaging techniques are essential in assessing the extent of the disease and guiding treatment decisionsPeritoneal MRI is a noninvasive technique that provides high-quality imaging of the peritoneum with excellent soft tissue contrast and high spatial resolution, with no exposure to ionizing radiation. Specific imaging protocols with DCE and DWI sequences allow a better assessment of peritoneal disease, especially unfavorable sites such as mesenteric and intestinal involvement, with enhanced sensitivity for detecting small lesionsClinical applications of peritoneal MRI include diagnosis, staging, and monitoring of peritoneal metastases, with a crucial role in guiding therapeutic strategies and prognostic utility in patients undergoing cytoreductive surgery or HIPECThe "PAUSE" method offers a structured approach to reporting peritoneal involvement, providing a precise description of the location and extent of the disease, serving as a road map for the surgeon and facilitating surgical planning.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Peritoneal metastases and diagnostic challenges. Advantages over CT and PET/CT. Peritoneal MRI: Dedicated protocol. Clinical applications: Diagnosis, staging, and monitoring of peritoneal metastases. Advantages and limitations. The "PAUSE" method: A structured reporting tool. Case examples. Conclusions. References

#### GIEE-72 **Photon-counting CT: Technical Features and Clinical Impact on Abdominal Imaging**

Participants

Hirimitsu Onishi, MD, PhD, Suita, Japan (*Presenter*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company

#### TEACHING POINTS

The photon-counting CT system is equipped with a photon-counting detector that can measure the number of photons and the energy of each photon, allowing the acquisition of images with high spatial resolution and virtual monochromatic contrast. One of the major advantages of photon-counting CT in abdominal examinations is that it provides virtual monochromatic images with high image quality and high spatial resolution. The purpose of this presentation is: 1. To illustrate the technical features of photon-counting CT system compared with conventional CT system with energy integrating detector, 2. To introduce the effective use of photon-counting CT for the evaluation of abdominal diseases, and 3. To discuss the clinical impact of photon-counting CT on the diagnosis of abdominal diseases.

#### TABLE OF CONTENTS/OUTLINE

1. Technical overview of photon-counting CT; 2. Scan modes; ultra-high resolution mode, multi-energy mode, and dual source mode; 3. A variety of image reconstruction kernels; 4. Quantum iterative reconstruction algorithm; 5. High spatial resolution; 6. Valuable virtual monochromatic imaging; 7. Possibility of radiation dose reduction; 8. Scanning protocols optimized for the abdominal diseases; 9. Clinical implications for the diagnosis of abdominal diseases; 10. Summary

## **GIEE-73 Pearls and Pitfalls of Rectal MRI: The Only Stool You Need**

Participants

Hala Khasawneh, MBBS, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Highlight essential imaging findings in staging. Illustrate essential key points and common pitfalls to serve as a guiding tool for radiologists through an interactive approach. Overview of current treatment options including surgical and nonsurgical approaches, such as "watch and wait" will be discussed.

### **TABLE OF CONTENTS/OUTLINE**

Over the past few decades, rectal MRI has created a paradigm shift in the management options of rectal cancer by providing accurate TNM staging and restaging as well as post-treatment assessment. However, a few controversies remain in reporting TNM staging for rectal cancer which radiologists need to be aware of to provide more reproducible and standardized reporting. The benefit of rectal MRI in guiding disease management relies on obtaining high-quality scan for accurate TNM staging, assessment of Circumferential Resection Margin, Extramural Vascular Invasion, anal canal involvement and tumor relation with surrounding pelvic structures. Using an evidence-based approach, we aim to clarify controversial key points in reporting rectal MRI, including staging of T4b tumor, utilizing diffusion weighted imaging in restaging, evaluation of mucinous lesions, differentiating lymph nodes from tumor deposits, and morphological assessment and localization of lateral pelvic lymph nodes in staging and restaging. Rectal MRI is essential for tailoring treatment plans in rectal cancer. Therefore, it is paramount to have standardized and reproducible interpretation of scans to enhance consistency in disease staging.

## **GIEE-74 The Magic Eye: Advantages of Spectral CT Imaging over Conventional CT in Liver and Pancreatic Pathology**

Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To review the most important spectral CT reconstructions for abdominal imaging and the improvement in material differentiation with this technique. - To show Spectral CT imaging advantages over conventional CT through some cases of liver and pancreatic pathologies.

### **TABLE OF CONTENTS/OUTLINE**

Background: Spectral CT is gaining increasing clinical importance with multiple potential applications including abdominal and oncology imaging. We present different cases with liver and pancreatic pathologies where spectral CT images offer multiple advantages over conventional CT, as low-energy virtual monoenergetic images and iodine maps for the detection of hyper- and hypovascularized liver lesions. The purpose of this review is to provide an overview of potential useful abdominal applications of spectral CT focused on liver and pancreatic pathology. Details of content: We present different types of cases (such as characterization of liver and pancreatic lesions, improving vascular contrast for surgical planning or evaluation the response of tumour therapy) and review and analyze the most important spectral CT reconstructions for each case (virtual unenhanced, iodine maps and virtual monochromatic reconstructions). These reconstructions allow better detection and characterizations of findings and reduce the need for correlative or follow-up imaging. Conclusion: Spectral CT imaging offers multiple advantages in the abdominal area. The combination of different types of spectral reconstructions improves better detection and characterization of liver and pancreatic lesions. It also allows precise treatment planning and could be a potential therapy monitoring parameter.

## **GIEE-75 Going, Going, Gone: Case-Based Review of Sclerosing Hemangiomas**

Participants

Bryson Jones, BS, Georgetown, KY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Hepatic hemangiomas are the most common benign neoplasm encounter in the liver and most are discovered incidentally. 2) The appearance of hemangiomas may change over time and may be influenced by senescent changes of the liver or diffuse disease of the surrounding hepatic parenchyma. 3) Hemangiomas undergoing degeneration has been described as sclerosing/sclerosed, hyalinized, or thrombosed and present a diagnostic dilemma for radiologist 4) Understanding the imaging appearance and crucial importance of prior comparative imaging is key to making the diagnosis and avoiding unnecessary additional imaging and invasive procedures.

### **TABLE OF CONTENTS/OUTLINE**

I. Briefly review the classic appearance of hepatic hemangiomas, incidence and natural history, as well as illustrative pathological changes that are proposed to occur as hemangiomas sclerosed. II. Propose a diagnostic algorithmic approach to a suspected sclerosing/sclerosed hemangioma. III. Provide case-based imaging examples of hemangiomas as they evolve over time, including US, CT, MRI and CEUS. IV. Provide case-based imaging example of pitfalls in attempting to prospectively diagnose sclerosing hemangiomas.

## **GIEE-76 Pitfalls of Contrast-enhanced Ultrasound (CEUS) in Liver Lesions: Early Arterial Enhancement Patterns and Washout**

Participants

Elhamy Heba, MD, MD, Lexington, KY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Understand the utility of CEUS in a patient population in which CT and MRI contrast agents are contraindicated. 2. Discuss different enhancement patterns of benign and malignant liver lesions. 3. Explain pitfalls in interpreting washout (most associated with malignancy) including understanding true intravascular nature of microbubbles contrast agent and that additional factors related to technique can lead to early bubble rupture and appearance of false washout in benign lesions. 4. Discuss possible pathophysiology of earlier rupture of the microbubbles in benign subcapsular liver lesions compared to lesions located deeper in the

liver.5. Discuss potential false positive washout scenarios in benign liver lesions on a background of hepatic steatosis due to echogenic liver parenchyma resulting in lesion appearing relatively hypoechoic compared to adjacent liver parenchyma.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview: review of the utility of CEUS and mention the advantages, disadvantages and indications in liver imaging.2. Understanding the mechanism of CEUS agent (microbubbles), explaining how that might contribute to false washout in different circumstances.3. Different enhancement pattern of benign and malignant liver lesion with emphasis on washout as an important feature to suggest malignancy of liver lesion.4. False washout in benign liver lesions as a pitfall of CEUS, case-based approach.5. True washout in cases of hepatocellular carcinoma, metastases, and cholangiocarcinoma for comparison.

#### **GIEE-77 Imaging Evaluation in Living Liver and Kidney Donors: What to Report**

Participants

Thamy Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1- Illustrate the main imaging standards in the pre-transplant evaluation of live liver and kidney donors through conventional radiology images, such as computed tomography (CT) and magnetic resonance imaging (MRI), from the digital archive of our institution.2- Improve the understanding of vascular variants (arterial and venous) and their implications in the pre-renal and liver transplant evaluation of potential living donors using a didactic approach, through illustrations.3- Evaluation of donors' pre-transplant images, understanding the procedure and identification of anatomical variants that may interfere with the surgical technique, in addition to possible pathologies that may prevent a possible transplant.4- Describe and prepare a structured report of the main findings that may contraindicate the candidate for transplants, in addition to assisting in the surgical technique to be performed.

#### **TABLE OF CONTENTS/OUTLINE**

1 - Review of vascular variants, pathologies and anatomical reconstructions of candidates for pre-transplantation of live liver and kidney donors through illustrative images.2 - Illustration of vascular variants and pathologies supported by the use of illustrative images that may imply or prevent transplantation.3 - Preoperative knowledge of hepatic and renal vascular anatomical variants is mandatory for surgical planning and to help reduce postoperative complications. This information must pertain to the structured report.4 - Summary and messages to take home.

#### **GIEE-78 The Many Faces of FNH: MRI Findings**

Participants

Enzo Casali SR, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Describe the typical presentation of FNH. Analyze uncommon MRI findings in FNH. Evaluate the importance of liver-specific contrast agents in achieving correct diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Focal nodular hyperplasia (FNH) is the second most common benign liver tumor after hemangioma. Magnetic Resonance (MRI) is an extremely useful tool for the diagnosis of FNH due to its high sensitivity and specificity. The correct diagnosis of FNH and its distinction from other differential diagnoses is essential because asymptomatic patients with FNH do not require treatment. FNH is classified as classic or nonclassic and MRI findings vary according to this. Lesions typically shows iso or hypointense signal on T1-weighted images, slightly hyper or isointense signal on T2-weighted images, an hyperintense central scar on T2-weighted images, an intense homogeneous enhancement during the arterial phase of gadolinium-enhanced imaging and enhancement of the central scar during later phases. Other more infrequent findings are: increase in size, T1 hyperintensity, the presence of a pseudocapsule, the appearance of multiple HNF all at once and the association with other benign liver lesions. Using liver-specific contrast agents may facilitate the diagnosis in these cases. Recognizing these different MRI patterns allows us to establish a correct diagnosis of FNH, preventing treatment in asymptomatic patients.

#### **GIEE-79 Abbreviated MRI Techniques for HCC Screening**

Participants

Diana Kadi, MD, Durham, NC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. US has low sensitivity for HCC, especially in early-stage tumors, cirrhosis and obesity. 2. To improve sensitivity over US for early detection of HCC, while remaining cost-effective, Abbreviated MRI (AMRI) protocols have been developed. 3. This exhibit will review emerging concepts in AMRI-based HCC surveillance, including technical aspects, diagnostic performance, current gaps in knowledge, and future directions.

#### **TABLE OF CONTENTS/OUTLINE**

1. Current guidelines for HCC surveillance 2. Limitations of US 3. CT and MRI a. Superior reported diagnostic sensitivity, especially for small and early HCC b. Limitations 4. Three general AMRI approaches a. Non-contrast AMRI i. Technique o T1 weighted imaging a. Low sensitivity for early-stage HCC o T2 weighted imaging a. Help differentiate suspicious/benign lesions b. Low sensitivity for small HCC o Diffusion weighted imaging a. Restricted diffusion favors malignancy b. Higher lesion conspicuity ii. Reporting iii. Advantages iv. Disadvantages b. Dynamic AMRI i. Technique o Pre-contrast o Arterial phase a. Assess APHE o Portal venous and delayed phases a. Washout b. Capsule ii. Reporting iii. Advantages iv. Disadvantages 5. Hepatobiliary Phase AMRI a. Technique i. Hepatobiliary phase imaging o High liver to lesion contrast ii. T2 weighted imaging o Excludes some benign lesions iii. DWI o Mixed data regarding benefit of DWI b. Reporting c. Advantages d. Disadvantages 6. Gaps and current needs a. Prospective studies are needed to implement AMRI in guidelines b. Current utilization should be in patients whose US-based HCC surveillance is compromised SUMMARY AMRI is a high-sensitivity alternative to US for surveillance of early-stage HCC in patients at risk for HCC.

#### **GIEE-8 Intrahepatic Cholangiocarcinoma: A Review of Current and Emerging Imaging Techniques and Treatment Options**



Participants

Julia Saltalamacchia, MD, Portland, OR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Intrahepatic cholangiocarcinoma makes up a small percentage of total CCA cases, but treatment and surgical options differ from extrahepatic cholangiocarcinoma. 2. Improvements in MRCP imaging and PET/MRI serve as complimentary modalities to standard MR and CT imaging for staging, problem solving, and follow up. 3. Recent developments in systemic and locoregional therapies have expanded treatment options and therapy considerations including radiation therapy, interventional oncology, expanded neoadjuvant therapies, and expanded surgical resectability (including transplantation)

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Intrahepatic cholangiocarcinoma work-up a. NCCN guidelines 3. Imaging considerations a. Characteristic findings b. Mimics and pitfalls c. The emerging role of FDG PET MRI 4. Treatment options a. General principles - locoregional and systemic options b. Chemotherapy 1. Systemic therapy 2. Targeted a. Transarterial chemoembolization b. Hepatic arterial infusion pump 3. Downstaging after neoadjuvant therapy c. Radiation 1. External beam radiation therapy 2. Y-90 radioembolization (lobar and radiation segmentectomy) d. Surgical 1. Preoperative considerations 2. Patient selection 3. Surgical options a. Wedge resection b. Segmentectomy +/- hepaticojejunostomy (HJ) c. Hepatectomy +/- HJ d. Transplantation

#### GIEE-80 Role of Radiology in a Multidisciplinary Approach of Hepatocellular Carcinoma

Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review international diagnostic HCC guidelines and LI-RADS with examples- To review the classical imaging appearance and patterns of HCC- To understand imaging features that correlate with favorable versus poor outcome and those associated with post-treatment response and recurrence

#### TABLE OF CONTENTS/OUTLINE

1. Background 2. When to use each imaging modality? 3. Optimal study protocol of the liver 4. What contrast agent to use? Hepatobiliary versus extracellular contrast agent 5. Characterization of hepatocarcinoma nodules 6. How to use LI-RADS? 7. International diagnostic HCC guidelines 8. Mimickers and Overdiagnosis of HCC: Flash-filling hemangioma, focal confluent fibrosis, intrahepatic cholangiocarcinoma, hepatic lymphoma 9. Staging, treatment decision-making, and follow-up of HCC 10. Evaluating beyond the liver: Common sites of extrahepatic metastasis 11. How to select patients with HCC for liver transplantation, resection or locoregional treatment? 12. Advanced disease: Locoregional therapies or systemic therapies

#### GIEE-81 Pseudomyxoma Peritonei: Concepts, Classification, Imaging Spectrum and HIPEC

#### TEACHING POINTS

To describe and demonstrate the imaging features of pseudomyxoma peritonei in the various diagnostic modalities. To propose a systematization of the evaluation of pseudomyxoma peritonei. Contextualize the role of imaging to predict the extent and quantification of disease that may result in a more aggressive surgical approach combined with or without HIPEC.

#### TABLE OF CONTENTS/OUTLINE

Peritoneal pseudomyxoma (PPM) is a clinical syndrome characterized by the accumulation of mucinous ascites in the peritoneal cavity. The most common cause of peritoneal pseudomyxoma is mucinous neoplasms in the appendix and according to the new consensus statement, PPM is classified based on the histology of the peritoneal disease and not based on the primary neoplasm. Peritoneal pseudomyxoma is classified into: acellular mucin, low-grade mucinous carcinoma peritonei (G1), high-grade mucinous carcinoma peritonei (G2) and high-grade mucinous carcinoma peritonei with signet ring cells (G3). The imaging spectrum of PPM is variable and suggestive findings include mucinous ascites, peritoneal nodules and omental. It is essential to be familiar with this pathology since accurate staging, with details of the sites affected, is essential to define therapy which may include cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (HIPEC). The role of imaging is well documented and each diagnostic modality has its indications and limitations in the staging and follow-up of PPM. This review provides an updated and comprehensive summary of the histologic classification of PPM, imaging findings, and describes the role of the radiologist in the multidisciplinary setting to predict the extent and quantification of disease.

#### GIEE-82 Peeking Inside the Pancreas: A Radiological Journey through Imaging of Unusual and Rare Pancreatic Tumors

Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the imaging approach for evaluating unusual and rare pancreatic tumors. 2. Identify imaging manifestations of unusual and rare pancreatic tumors. 3. Identify potential pitfalls in imaging of unusual and rare pancreatic tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Unusual and rare pancreatic tumors and imaging approach 2. Multimodality imaging features of unusual and rare pancreatic tumors a. Primary malignant tumors: i. Acinar cell adenocarcinoma ii. Pancreatic small cell carcinoma iii. Pancreatic adenosquamous carcinoma iv. Pancreatic lymphoma v. Hepatoid pancreatic adenocarcinoma vi. Pancreatic mucinous carcinoma vii. Pancreatic primary lymphoma viii. Clear cell acinar cell carcinoma ix. Pancreatic carcinosarcoma x. Pancreatic hemangiopericytoma xi. Pancreatic rhabdomyosarcoma b. Primary tumors with malignant potential: i. Solid pseudopapillary tumor ii. Intraductal tubulopapillary neoplasm iii. Teratoma iv. Solid serous cystadenoma c. Secondary Malignant Tumors i. Unusual metastases to pancreas d. Benign Tumors i. Pancreatic lipoma ii. Intraductal papillary neoplasm (IPMN) iii. Lymphoepithelial cysts iv. Focal pancreatitis 3. Mimics and Pitfalls (tumor like conditions; IgG4-RD; biliary tract tumors; duodenal tumors (duodenal dystrophy, gastrointestinal stromal tumor (von Recklinghausen), Brunner's duodenal hamartoma)

**GIEE-83 Adding Insult to Injury: Unexpected Gastric Cancer Presentations That Can Make Radiologist's Life Difficult**

Participants

Dequiter Machado, DC, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To demonstrate the variability in presentations of gastric carcinoma and the dissemination patterns. 2. To understand and learn how to differentiate fibrosis from disease progression and primary tumor involvement. 3. To identify recurrence in the esophagus-gastric junction 4. To illustrate the role of radiology in the differential diagnosis, staging, and surveillance of patients with gastric carcinoma.

**TABLE OF CONTENTS/OUTLINE**

- Gastric normal anatomy and possible secondary implant pathways . Epidemiology of gastric cancer . Variability in presentations in gastric adenocarcinoma.- Rare patterns of tumor recurrence, that we should not miss.

**GIEE-84 The Solution is Right at Your Fingertips: Linear Probe and Improvement of US Gallbladder Evaluation**

Participants

Pilar Navarro Azurmendi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1 To analyze the benefits and limitations of linear and curved transducers used in US evaluation of the gallbladder with cine and imaging findings throughout different cases. 2 To review the most advantageous sonographic technique and knobology optimization. 3 To identify potential pitfalls in US evaluation and the technics to prevent them. 4 To assess the available tools to minimize the risk of misinterpretation in biliary pathology imaging.

**TABLE OF CONTENTS/OUTLINE**

1 Types of transducers used for gallbladder evaluation. Characteristics, benefits and limitations. 2 Sonographic technique and knobology optimization through cine videos and images. 3 Anatomy, useful landmarks and choice of sonographic window. 4 Ultrasound artifacts: making use of imaging artifacts to aid in diagnosis. 5 Identify potential pitfalls in gallbladder ultrasound evaluation and how to avoid them. 6 Diagnostic criteria for gallbladder wall pathologies. 7 Test your knowledge: interactive review for integration of clinical cases with imaging findings. 8 Take-home messages.

**GIEE-85 Lymphoma: What to Expect from the Unexpected**

Participants

Fabio Yoshimura, Santana De Parnaiba, Brazil (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lymphoma is a disease that can manifest itself in multiple ways. It is important to know the sites of involvement in its most varied forms and the possible imaging characteristics. This work aims to improve the literature with illustrated teaching cases from our department about suspicious lesions, allowing for early diagnosis and adequate follow-up.

**TABLE OF CONTENTS/OUTLINE**

This work aims to review with illustrated cases and their characteristic images from main abdominal organs affected by Lymphoma:- Liver;- Spleen;- Gastrointestinal tract;- Pancreas;- Kidney;- Peritoneal cavity.

**GIEE-86 Uses, Finding, Pitfalls, and Advanced Applications in Gadoteric Acid-Enhanced MR Imaging of the Liver**

Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To understand the Pharmacokinetics of gadoteric acid- To review clinical applications, pitfalls and of gadoteric acid-enhanced MRI- To discuss advanced and future applications such as multiparametric liver MRI, magnetic resonance cholangiography, and liver function assessment

**TABLE OF CONTENTS/OUTLINE**

1. Background 2. Pharmacokinetics of gadoteric acid 3. Magnetic resonance protocol and technique: abbreviated and multiparametric protocols 4. Optimizing the workflow 5. Clinical applications of gadoteric acid-enhanced MRI: Focal nodular hyperplasia, hepatocellular adenomas, hepatocellular carcinoma, cholangiocellular carcinoma, liver metastases, hepatic fibrosis, biliary imaging 6. Evaluation of treatment response of liver metastases 7. Gadoteric acid-enhanced MRI for staging treatment decision-making, and follow-up of HCC 8. Incidental discovery of focal liver lesions 9. Pitfalls and solutions: arterial phase limitations, hepatobiliary phase limitations, focal nodular hyperplasia, "pseudowashout", uptake in lesions other than FNH. 10. Advanced and future applications

**GIEE-87 Bad Connections: Review of Intestinal Fistulae**

Participants

Allison Forrest, MD, Burlington, VT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Intestinal fistulae in the abdomen and pelvis are common and result in significant morbidity. Fistulae occur between hollow viscous organs and can occur in the setting of surgery, trauma, inflammation, and malignancy. Multiple imaging modalities are used for both initial evaluation and follow up, with selection of technique depending on the anatomy involved. Fluoroscopic evaluation is often helpful in the evaluation as it provides real-time, dynamic evaluation of fistulae and can further delineate complex anatomy in

conjunction with cross-sectional imaging. Selection of route of contrast administration and catheter selection for evaluation of enterocutaneous fistulae are particularly important for successful fluoroscopic evaluation. An understanding of the spectrum of fistulae and the tools available to radiologists are critical for accurate characterization of fistulae.

#### TABLE OF CONTENTS/OUTLINE

1. Review the pathophysiology of intestinal fistulae. 2. Provide an overview of indications and protocols for imaging evaluation of fistulae, with emphasis on fluoroscopic evaluation with cross-sectional correlation. Specific tips for evaluation of enterocutaneous, esophageal, small bowel, and colonic fistulae will be discussed. 3. Display case examples of common and uncommon intestinal fistulae, including those due to surgery, malignancy, inflammation, and trauma. 4. Review factors that are commonly implicated in delayed fistulae healing. 5. Brief overview of treatment principles and available therapies.

#### GIEE-88 Fibro-polycystic Liver Disease: What Radiologists Need to Know

Participants

Lautaro Florentin, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fibropolycystic liver disease refers to a group of different liver and biliary anomalies caused by abnormal embryologic development of ductal plates. Congenital hepatic fibrosis, biliary hamartomas, autosomal dominant polycystic disease, Caroli disease, and choledochal cysts are included in this group. Fibropolycystic liver diseases usually do not exist as single entities and can be found in combined forms. Each entity shows characteristic imaging findings, specially at computed tomography (CT) and magnetic resonance (MR). Radiologists should be familiar with this spectrum of lesions to properly guide the management of these patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
What is fibropolycystic liver disease?  
Embryologic development  
Congenital hepatic fibrosis  
What is?  
Imaging findings  
Biliary hamartomas (Von Meyenburg complex)  
What is?  
Imaging findings  
Autosomal dominant polycystic disease  
What is?  
Imaging findings  
Complications  
Caroli Disease  
What is?  
Caroli disease vs. Caroli Syndrome  
Imaging findings  
Choledochal cysts  
Pathogenesis  
controversy. Bilio-pancreatic maljunction association. Todani's Classification  
Imaging findings

#### GIEE-89 New Concepts in Staging and Treatment of Colon Cancer: What the Radiologist Needs to Know

Participants

Amit Choudhari, MBBS, FRCR, Mumbai, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand types of colon cancer surgeries, including multivisceral resection
- Comprehend the elements which need to be covered while reporting a clinically relevant colon cancer staging CT report
- Review the questions asked in multidisciplinary tumor boards
- Updates on the recent advances in colon cancer management
- Discuss the advantages of neoadjuvant chemotherapy prior to surgery as per recent literature

#### TABLE OF CONTENTS/OUTLINE

- Pathophysiology of colon cancer
- Types of colon cancer surgeries and nodal resections
- Discuss common and uncommon presentations in colon cancer (extramural vascular invasion, aneurysmal dilatation, vascular involvement, tumor bowel fistula, uncommon pathologies)
- What the surgeon wants to know from the radiologist for planning surgery; e.g., a patient with ascending colon cancer with duodenal involvement can undergo colo-pancreaticoduodenectomy
- dMMR/MSI-H, ctDNA, FoxTROT, Niche-2: What they mean and why do we need to know about them

#### GIEE-9 Internal Hernia after Roux-en-Y Gastric Bypass: Clues to a Challenging Diagnosis

#### TEACHING POINTS

- Internal hernias are a complication in up to 10% of patients after Roux-en-Y gastric bypass (RYGB).
- Risk factors for internal hernia after RYGB include retrocolic technique, non-closure of mesenteric defects and amount of weight loss after surgery.
- Untreated internal hernias place the patient at risk for bowel ischemia.
- Several signs of varying sensitivity and specificity have been described for internal hernias after RYGB.
- A structured approach should be taken to assess for internal hernias in all patients who have undergone RYGB—especially those who are presenting with abdominal pain.

#### TABLE OF CONTENTS/OUTLINE

- Description of RYGB procedure.
- Three types of internal hernia after RYGB: Transmesocolic, Petersen and jejuno-jejunostomy hernias.
- Incidence of internal hernia after RYGB.
- Risk factors for internal hernia after RYGB.
- Clinical presentation of internal hernias after RYGB.
- Prognosis of untreated internal hernia after RYGB.
- Treatment of internal hernia after RYGB.
- Accuracy of CT in diagnosing internal hernia after RYGB.
- CT findings of internal hernia after RYGB and their sensitivity and specificity in detecting internal hernias. All signs will be accompanied by example images and/or image stacks.
- Vascular Signs: SMV beaking sign, vascular swirl sign and hooking intestine sign.
- Mesenteric Signs: Mesenteric edema, mesenteric lymph nodes and eye of the hurricane sign.
- Bowel signs: Small bowel obstruction, right sided jejunojejunal anastomosis, mushroom sign, small bowel behind SMA, small bowel between transverse colon and stomach and clustered loops of small bowel.
- Structured approach to assessing the presence of internal hernia in patients with RYGB.

#### GIEE-90 Tips for Differentiation Between Pancreatic Ductal Adenocarcinoma with Bile duct Invasion and Cholangiocarcinoma with Pancreas Invasion

Participants

Shintaro Ichikawa, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Both pancreatic ductal adenocarcinoma (PDAC) and cholangiocarcinoma are mostly adenocarcinomas and share common pathological features. Therefore, their imaging findings are similar, and when a mass stretching from the head of the pancreas to the distal common bile duct is found, it may be difficult to distinguish whether it is bile duct invasion from PDAC or pancreatic invasion from cholangiocarcinoma. To differentiate between the two, it may be useful to focus on whether the pancreatic or bile

duct lesion is the predominant finding and whether the main pancreatic duct is dilated.

#### TABLE OF CONTENTS/OUTLINE

The following tips for differentiating between PDAC with bile duct invasion and cholangiocarcinoma with pancreatic invasion are discussed along with their key imaging findings:1. Predominant lesion Pancreatic lesions of PDAC are larger than those of cholangiocarcinoma. The range of common bile duct lesions in cholangiocarcinomas is greater than that of lesions in PDAC.2. Double-duct sign Both the main pancreatic and common bile ducts are often dilated in PDAC, whereas the main pancreatic duct is rarely dilated in cholangiocarcinoma. The following differential diagnoses are discussed along with their key imaging findings:1. Ampullary masses (adenoma, adenocarcinoma, and neuroendocrine neoplasms)2. Pancreatic groove cancer3. Groove pancreatitis4. Mass-forming pancreatitis5. Sclerosing cholangitis

#### GIEE-91 Complications of Colorectal Cancer Treatment

Participants

Kelly Cox, DO, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: Colorectal cancer remains the third most common cancer and is the second leading cause for cancer related deaths in the United States. Colorectal cancer is highly treatable and often curable with early detection. After a quick review of colorectal cancer and its most current treatment algorithms, we will take an in depth look at the complications of treatment including those related to surgery, liver directed therapy, chemotherapy and immune checkpoint inhibitors. As colorectal cancer treatment has rapidly changed in recent years, new and unexpected imaging complications of treatment must be recognized in our daily practice to direct immediate patient care and future colorectal cancer treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Review of colorectal cancer and its most current treatment algorithms 2. Surgical Complications a. Perforation/Anastomotic Leak b. Abscess c. Fistula d. Local recurrence with and without obstruction 3. Liver Directed Therapies a. Intrahepatic artery infusion chemotherapy - biliary strictures b. Radiofrequency ablation i. Thermal injury ii. Injury to adjacent organs c. Radioembolization 4. Chemotherapy Induced Injuries a. Steatohepatitis b. FNH-like lesions 5. Checkpoint Inhibitor complications a. Pseudoprogression b. Pneumonitis c. Diarrhea, enteritis and colitis d. Bowel perforation e. Pancreatitis

#### GIEE-92 Deep-learning CT Reconstruction in the Abdomen: Principles, Techniques, Current Practice and Future Perspective

Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understanding the background and important principles of image reconstruction methods in CT with the advantages and disadvantages of each modality 2. Comprehensive review on the deep learning imaging reconstruction and why it outperforms other modalities 3. To discuss clinical impact of deep-learning CT reconstruction in abdominal imaging 4. Future perspective and implementation

#### TABLE OF CONTENTS/OUTLINE

1. CT image reconstruction and deep learning a. Definition principles of CT image reconstruction b. History and advances of CT image reconstruction until now c. Common quantitative and qualitative parameters for image quality d. Explain the advantages and disadvantages of each reconstruction technique (filtered back projection, iterative reconstruction, full model-based iterative reconstruction, hybrid iterative reconstruction)2. Deep-learning image reconstruction (DLIR) in the abdomen CT a. Understanding the basics of convolutional neural networks (CNNs) b. The role of DLIR in CT image quality improvement and noise reduction c. Factors influencing the performance of deep-learning CT reconstruction3. Where DLIR in CT abdomen now a. DLIR algorithms available b. Current evidence and practice of deep-learning CT reconstruction in the abdomen c. Clinical impact on the diagnosis of abdominal organs diseases4. DLIR limitations and potential future developments

#### GIEE-93 Radiologic Features of Abdominal Multimodality Imaging Related to Cardiovascular Disorders

Participants

Yeju Kang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To classify various cardiovascular disorders causing changes on abdominal multimodality imaging. 2. To comprehensively review the pathophysiology of intra-abdominal changes caused by cardiovascular disorders. 3. To present various radiologic features of abdominal multimodality imaging in patients with cardiovascular disorders.

#### TABLE OF CONTENTS/OUTLINE

1. Cardiac disorders-related changes: Congestive heart failure: hepatic congestion, cardiac cirrhosis/Infective endocarditis: infection due to septic embolism, infarction, mesenteric ischemia/Atrial fibrillation: infarction, mesenteric ischemia/Valvular heart disease: hemosiderin deposition due to mechanical cardiac valve/Cardiac arrest: cardiopulmonary resuscitation-related change 2. Vascular disorders-related changes: Obstruction of the vena cava: liver cirrhosis due to membranous obstruction of inferior vena cava, hepatic neoplasm, third flow due to superior vena cava obstruction/Vasculitis: systemic lupus erythematosus, IgA vasculitis, Behcet disease, etc. 3. Cardiovascular drug-related changes: anticoagulants-related changes, anti-arrhythmic agents-related changes

#### GIEE-94 Signet Ring Cell Adenocarcinomas of the GI Tract: Clinical, Radiological, and Pathological Correlation

Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### TEACHING POINTS

1. T1. To describe the key epidemiological, clinical, radiological, and pathological features of signet ring cell adenocarcinoma of the

1. To describe the key epidemiological, clinical, radiological, and pathological features of signet ring cell adenocarcinomas of the GI tract. 2. To review the specific features of gastric, colorectal, esophageal, appendiceal, and pancreaticobiliary signet ring cancers, with radiologic-pathologic correlation. 3. To illustrate linitis plastica, scirrhous tumors, and the "malignant target sign" associated with these aggressive cancers.

#### TABLE OF CONTENTS/OUTLINE

- Introduction - Signet ring cell adenocarcinomas of the GI tract o Histopathological definition o Epidemiology and prognosis o The malignant target sign - Clinical-Pathological-Radiological correlation o Gastric signet ring cell adenocarcinoma (linitis plastica) o Colorectal signet ring cell adenocarcinoma o Esophageal signet ring cell adenocarcinoma o Appendiceal signet ring cell adenocarcinoma o Pancreaticobiliary signet ring cell adenocarcinoma o Metastatic signet ring cell adenocarcinoma - Concluding remarks

#### GIEE-95 The Many Forms of Acute Pancreatitis

##### TEACHING POINTS

The morphological expression of acute pancreatitis (AP) is highly variable and in its more complex forms it can be a difficult challenge for the radiologist in training to decipher. Therefore, the main objective of this paper is to present a guide for understanding the morphological classification of AP, related complications and differential diagnoses using the standardized terminology established in the revised Atlanta classification system. Other objectives are: To recognize the general clinical features of AP and the bases of the Atlanta classification system. To understand the current role of the radiologist in the diagnosis and treatment of acute pancreatitis. To emphasize the importance of the implementation of standardized reporting schemas and a well-defined lexicon into the radiology practice to facilitate accurate communication among members of a multidisciplinary team.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Clinical overview: diagnostic criteria, pathogenesis and etiology, disease severity and risk stratification, clinical classification according to the revised Atlanta classification (RAC): phases of evolution and severity. Imaging guidelines: how, when and why to image. General overview of the RAC system. Morphologic classification interstitial edematous pancreatitis (IEP) vs necrotizing pancreatitis (NP). Pancreatic and peripancreatic collections APFC, pseudocyst, ANC and WON. Local complications: Infection, inflammation and mass effect on adjacent organs, biliary obstruction, pancreatic duct stricture, disconnected pancreatic duct, vascular complications (hemorrhage, venous thrombosis, pseudoaneurysm). Other complications. Imaging mimics of AP.

#### GIEE-96 Pseudomyxoma Peritonei and HIPEC: What Am I Missing?

Participants  
Matheus Gomes SR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Pseudomyxoma peritonei (PMP) is a rare and complex clinical syndrome characterized by the intraperitoneal accumulation of mucinous material, which arises from a variety of neoplasms, mainly from appendiceal mucinous neoplasm. The purpose of this exhibit is • Review the main CT and MRI imaging findings of PMP. • Recognize the most common tumor sites which may cause pseudomyxoma peritonei • Illustrate through a diagram the pathways of disease spread into peritoneal spaces • Discuss HIPEC therapy and surgery indications, different outcomes and complications • Highlight the radiologist role in decision-making in a multidisciplinary team

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Epidemiology, clinical and pathophysiological aspects of pseudomyxoma peritonei- CT and MRI protocol recommendation 2. Current treatment options- To discuss for each of the following treatment modalities indications, contraindications, advantages and limitations (HIPEC, Surgical treatment and Systemic treatment)- To review through illustrative clinical cases the main CT and MRI findings of: Initial assessment of disease • Most common sites of disease • Hints at first evaluation of images • Difficult sites of resection • Potential "blind spots" Evaluation of treatment response • Disease progression • Stable disease / No evidence of disease • Response to treatment 3. "Take-home messages": To improve radiology communication with the multidisciplinary team and ensure prompt diagnosis and proper treatment of PMP, it is essential to understand the major clinical and imaging aspects of the disease and its treatment options.

#### GIEE-97 Non-cirrhotic Portal Hypertension: Etiologies and Workup

Participants  
Alba Pugliesi, MD, Ludwigsburg, Germany (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Noncirrhotic portal hypertension (NCPH), defined as elevated portal pressures in absence of advanced hepatic fibrosis, can be seen in association with multiple pre-sinusoidal, sinusoidal, and post-sinusoidal pathologic conditions. 2. Many of the aforementioned etiologies can result in liver dysmorphism (despite the absence of advanced hepatic fibrosis), resulting in incorrect diagnosis of cirrhosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction • Definition and review of mechanisms of portal hypertension Pre-hepatic etiologies of NCPH • Case-based review of pre-hepatic etiologies of NCPH with emphasis on chronic inflow obstruction Intrahepatic etiologies of NCPH • Case-based review of pre-sinusoidal, sinusoidal, and post-sinusoidal etiologies of NCPH. Post-hepatic etiologies of NCPH • Case-based review of post-hepatic etiologies of NCPH with emphasis on outflow obstruction and cardiac etiologies (including Fontan-associated liver disease). Architectural and morphological changes of liver • Review of non-fibrotic pathways of response to injury by hepatocytes, with focus on regenerative nodular hyperplasia Diagnostic Workup, Challenges and Pitfalls • Discussing role of biopsy, hepatic venous wedge pressure, and elastography Conclusion

#### GIEE-98 Tips and Tricks for CT Optimization of the Abdomen

Participants  
Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The educational exhibit discusses CT dose optimization in abdominal imaging, and how it is important to reduce radiation exposure while maintaining diagnostic accuracy. Strategies for reducing radiation dose and optimizing contrast media administration, managing image artifacts and noise, and incorporating AI-based deep learning image reconstruction (DLIR) can also contribute to dose optimization. Tailoring the imaging protocol based on the clinical indication, patient age, medical history, and comorbidities is crucial for achieving the best diagnostic outcome. Advice from the experts and emphasizing the importance of staff education and collaboration in CT optimization.

## TABLE OF CONTENTS/OUTLINE

Review the background and understand the basic principles of the CT optimization in abdominal imaging  
Strategies for reducing radiation dose in abdominal CT  
Methods used to optimize the dose in abdominal CT  
Future directions of embedding AI into abdominal imaging  
CT optimization  
Tailoring the imaging protocol to the clinical question and patient presentation  
Factors to be considered when tailoring imaging protocol (the clinical indication, patient age, medical history, and comorbidities)  
Electing the appropriate imaging protocol for achieving the best diagnostic outcome  
Unlocking the Secrets of the CT optimization of the Abdomen: Tips and Tricks from the Pros  
a. Port injections - "How to inject like the pros"  
b. Helical pitch- "Low pitch isn't what it used to be"

## GIEE-99 Clinical Application of Artificial Intelligence (AI) in Chronic Liver Diseases Management

Participants

Mohamed Eltaher, MD, Houston, TX (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. Understand the function of artificial intelligence (AI) in tumor segmentation. 2. Review the existing medical uses of liver segmentation. 3. Grasp the advantages and disadvantages of different methods for segmenting liver tissues. 4. Understand the imaging criteria that must be met for a liver segmentation project to be successful. 5. Explore possible future developments in liver segmentation.

## TABLE OF CONTENTS/OUTLINE

1. Brief introduction to artificial intelligence (AI). 2. Overview of different architectures used in deep learning methods. 3. Application of AI in the medical field. a new era of healthcare services. 4. Available Liver segmentation methods and techniques. 5. Advantages and disadvantages of different segmentation methods. 6. Challenges facing manual and automated liver segmentation. 7. Current uses of liver volumetry: a) assessment of response to intervention or surgery in liver malignancy. b) prediction of clinical outcomes including disease behavior, overall survival. C) virtual surgical planning. d) prediction of future liver remnant volume after hepatectomy surgery. 8. Future directions: a) Vascular sub-segmentation. b) Radiogenomics. c) Fully automated segmental volumetry. d) Automated volumetric RECIST measurements.

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## Abstract Archives of the RSNA, 2023

GIEE-1

### **A Deep Dive into Essential Predictive Imaging Features of Abdominal Neoplasms in the Era of Personalized Therapy: Insight into the Correlation with Pathological, Molecular, and Genetic Background**

#### **TEACHING POINTS**

Recognizing imaging findings regarding the tumor microenvironment and molecular function of abdominal neoplasms is not only the key to appropriate diagnosis, but also to early prediction of treatment options and response to various therapies. This exhibit aims to provide a better understanding of the essential predictive imaging findings of abdominal neoplasms in correlation with their pathological, molecular, and genetic background, which has the potential to lead to personalized treatment strategies in the coming era.

#### **TABLE OF CONTENTS/OUTLINE**

The treatment options for abdominal malignancies have become more diverse with advances in surgery, chemo and immunotherapy, making pre-treatment risk stratification even more important. Radiologists are now required not only to diagnose but also to predict the prognosis and efficacy of treatment based on images, and to contribute to the selection of appropriate treatment. Understanding of predictive imaging findings can also help us to speculate upon the tumor microenvironment, which might be required in the future. We summarize these imaging findings for the following neoplasms; (i)HCC, (ii) Liver metastases from colorectal cancer, (iii) Pancreatic cancer, (vi) Intrahepatic cholangiocarcinoma. We also focused on the application of these findings to treatment strategies for each abdominal malignancy to explore the usefulness of these predictive findings in the era of personalized treatment.

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## Abstract Archives of the RSNA, 2023

GIEE-10

### Fibropolycystic Liver Disease: An MRI Review with Pearls and Pitfalls

#### Participants

Jordan LeGout, MD, Ponte Vedra Beach, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fibropolycystic liver disease comprises a spectrum of interrelated conditions that range from congenital hepatic fibrosis to choledochal cysts. In this exhibit we will: -Review the MRI appearance of the various fibropolycystic liver diseases and associated conditions-Highlight imaging pitfalls using real errors encountered in clinical practice-Introduce imaging pearls for the various conditions that can help arrive at the correct diagnosis-Differentiate between those conditions that are benign and incidental and those that pose risk for development of malignancy

#### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Congenital hepatic fibrosis a. Pearl: Liver morphology, segment IV hypertrophy b. Pitfall: FNH-like lesionsIII. Biliary hamartomas a. Pearl: Use high b-value diffusion to uncover lesions b. Pitfall: Polycystic liver disease, infiltrative malignancyIV: Peribiliary cysts a. Pearl: Anatomic sequences over MRCP b. Pitfall: PSCV. Polycystic liver disease a. Pearl: Use subtraction imaging b. Pitfall: Mucinous cystic neoplasmVI. Caroli Disease/Syndrome a. Pearl: Different degrees of involvement (diffuse vs. segmental) b. Pitfall: Recurrent pyogenic cholangitis VII. Choledochal cysts a. Review appearance of subtypes b. Pearl: Field defect and risk for cholangiocarcinoma c. Pitfall: Age related and cholecystectomy related ductal dilation

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## Abstract Archives of the RSNA, 2023

GIEE-100

### Post-neoadjuvant MRI Changes and Challenges in Rectal Adenocarcinoma: What to Look for

#### Participants

Mayra V. Soares, MD, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the pivotal role of MRI in the post-neoadjuvant restaging of rectal cancer. To highlight the main imaging changes in post-neoadjuvant MRI, which reflect histopathologic changes that may occur after chemoradiation treatment. To recognize how fibrosis or increased mucin production, addressed by high-resolution MRI, impacts risk stratification post-neoadjuvant therapy. To learn about some challenges in MRI morphological and DWI evaluation regarding new treatment options. Understand the role of radiologists as part of patient care, helping to enroll patients eligible to "watch-and-wait" programs.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Primary tumor and nodal assessment with MRI. Rectal cancer treatment guidelines overview. When neoadjuvant treatment is the best approach. Neoadjuvant treatment options: CRT x TNT. Recognizing tumoral changes after CRT. Posttreatment changes in the primary tumor - a systematic approach. Tumor Restaging: a response classification based on histopathologic and DWI changes. Patterns of tumor response. MRI tumor regression grades - a risk stratification incomplete/poor x "near-complete"/complete responders. "Watch-and-wait": patient selection and current controversies. Immunotherapy - the new kid on the block. Future considerations: potential biomarkers in rectal cancer and game-changer? Conclusion.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-101

### Getting Started in Bariatric Surgery Imaging: Postoperative Anatomy and Complications

#### TEACHING POINTS

Review postoperative anatomy changes in bariatric procedures. Discuss the approach to postoperative evaluation. Identify imaging findings of common bariatric surgery complications.

#### TABLE OF CONTENTS/OUTLINE

Background. Eligibility criteria. Types of bariatric surgery and techniques. Postoperative evaluation. Cased based review of common postoperative complications. Imaging findings in weight regain and insufficient weight loss after bariatric surgery.

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## Abstract Archives of the RSNA, 2023

GIEE-102

### Principles and Clinical Applications of Dual-layer Spectral CT in Gastrointestinal Imaging

#### Participants

Chiara Spasiano, Vedano Al Lambro, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To summarize the fields of application of Spectral-CT technology and define the actual advantages and benefits in clinical imaging, derived from recent literature review.

#### TABLE OF CONTENTS/OUTLINE

Dual-energy computed tomography (DECT) or spectral-CT is an advanced CT that acquires data at different energy levels to enhance material differentiation and tissue characterization. Conventional CT utilizes a polychromatic beam, but energy levels are not separated in image generation while in a dual-layer detector, the thinner top layer measures low-energy photons, and the thicker bottom layer measures high-energy photons. Complex material decomposition algorithms are used to generate images for routine clinical interpretation or for more advantage material characterization, including virtual non-contrast (VNC), iodine maps, and effective atomic number, as well as virtual monochromatic image sets, from 40 to 200keV. The most common use has been characterizing urinary calculi (different composition), gallstones (isoattenuating to bile on conventional CT), detection and correct definitions of incidental cystic lesions. While added value of multi-energy CT in body imaging include: characterization of incidental lesions (very common event in body imaging), iodine detection and subtraction (possibility to reconstruct several Iodine-Map, at monoenergetic images, both with Low and High energy levels), assessment of tissue perfusion (using organ iodine distribution as surrogate of perfusion, especially in pulmonary embolism), contrast dose reduction, tissue characterization, and finally the possibility to decrease the number of scan.

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## Abstract Archives of the RSNA, 2023

GIEE-103

### Beyond TNM Staging System: Evaluation of Colon Cancer Prognostic Factors by CT and MRI

#### TEACHING POINTS

To review the diagnostic accuracy of CT and MRI for staging colon cancer. To define locally advanced colon tumors. To enumerate colon cancer prognostic factors and critical information that should be present in radiological reports in this context.

#### TABLE OF CONTENTS/OUTLINE

1 - Anatomic considerations of colon and retroperitoneal surgical margin 2 - TNM Staging of colon cancer 3 - Colon cancer prognostic factors (primary tumor extramural extension, retroperitoneal surgical margin involvement, extramural vessel invasion, and lymph node metastases) 4 - Locally advanced colon tumors 5 - Current treatment of colon tumors 6 - Promising treatment (neoadjuvant systemic therapy) 7 - Role of imaging in stratification of patients with colon cancer according to their risk group, contributing to better patient selection and optimization of colon cancer treatment

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## Abstract Archives of the RSNA, 2023

GIEE-104

### Gastrointestinal Neuroendocrine Neoplasms, Imaging, Pathology, Classification and Management: 2023 Update

#### Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Gastrointestinal (GI) neuroendocrine neoplasms (NENs) are rare heterogeneous epithelial tumors with characteristic histological, and biological behavior. 2. The most recent WHO 2019 classifies NENs into well-differentiated (G1-G3) and poorly differentiated neuroendocrine carcinomas (NECs). Numerous studies have been published since then describing the effectiveness of this classification, diagnostic implications, and management. 3. Most often clinical, imaging and molecular features have to be integrated in order to appropriately correlate with pathologic classification, particularly to differentiate between G3-NET and NECs. As the tumor grade progresses the FDG-PET is more likely to be useful rather than DOTATE-PET which correlates with a poorly differentiated grade (NEC). The NETPET scoring system based on dual-tracer imaging can help better characterize well-differentiated metastatic NET lesions. 4. Surgery remains the mainstay of treatment for locoregional GI-NENs. Treatment of G3-NENs includes peptide receptor radionuclide therapy (PRRT), Somatostatin analogs, Everolimus, or sunitinib. Everolimus is an mTOR inhibitor while Sunitinib malate inhibits multiple receptor kinases such as VEGFR and PDGFR. Platinum-based chemotherapy with cisplatin/carboplatin and etoposide/irinotecan is recommended for patients with poorly-differentiated NECs

#### TABLE OF CONTENTS/OUTLINE

1) Background, 2) WHO 2019 classification of the NENs, 3) 2023 Imaging update with emphasis on molecular techniques and NETPET Scoring, 4) Update on the management of NENs with emphasis on medical treatment, 5) Conclusion.

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## Abstract Archives of the RSNA, 2023

GIEE-105

### Tricks and Pitfalls of Multi-parametric MRI Restaging of Rectal Cancer After Preoperative Chemoradiotherapy

#### Participants

Giovanni Sussan, MD, Padova, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To describe the MRI protocol for rectal cancer evaluation after preoperative chemo-radiotherapy (pCRT), dealing also with the debated practices  
2. To describe the correct evaluation and the most common pitfalls of T staging after chemoradiation, using both DWI and contrast-enhanced sequences  
3. To describe the correct evaluation and the most common pitfalls of N staging after pCRT, including the MRI evaluation of the lateral pelvic lymph nodes  
4. To describe the other fundamental features that should be reported while evaluating an MRI for rectal cancer restaging (such as Mesorectal Fascia/peritoneal reflection involvement, Extramural Vascular Invasion [EMVI], etc.)

#### TABLE OF CONTENTS/OUTLINE

1. Protocol of study  
2. Localization and Reported Template tips  
3. ycT staging MRI evaluation  
4. mrTRG evaluation of the primary lesion  
5. ycN staging MRI evaluation  
6. Mesorectal fascia (MRF) involvement  
7. Peritoneal Reflection involvement  
8. EMVI  
9. Tumor deposits

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## Abstract Archives of the RSNA, 2023

GIEE-106

### The Watch-and-Wait Program in Rectal Cancer. A Primer for Radiologists

#### Participants

Lautaro Florentin, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

**TEACHING POINTS** The watch-and-wait (WW) program is an organ-preserving approach for those patients with locally advanced rectal cancer who have no evidence of residual tumor after neoadjuvant therapy. The aim of WW is to improve the quality of life of these patients avoiding unnecessary resective surgeries in disease-free rectum. MRI plays a pivotal role in the selection process of patients who are suitable for this approach. The combination of high-resolution T2-weighted sequences (T2HR) and diffusion weighted images (DWI) are essential for detecting early regrowth during the monitoring of these patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
History  
Why WW strategy?  
Initial assessment  
To whom?  
How to?  
i) Defining locally advanced rectal cancer (LARC). The role of MRI  
Candidates selection. Response after neoadjuvant chemoradiotherapy (nCRT)  
Tumor regression grading system  
The concept of clinical complete response (cCR). Clinical, endoscopic and radiologic aspects.  
i) Primary tumor- Complete, near complete and incomplete responders  
Radiological features  
Endoscopic findings  
ii) Lymph nodes - Complete, near complete and incomplete responders  
Radiological features  
Surveillance  
What does regrowth mean? Outcome implications  
Detecting regrowth. The advantage of MRI  
Regrowth types: intraluminal, mesorectal and lateral internal iliac/obturator nodes  
Regrowth patterns

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## Abstract Archives of the RSNA, 2023

GIEE-107

### Primary Hepatic Neuroendocrine Neoplasm (PHNEN) and Neuroendocrine Liver Metastasis (NELM): Imaging Update and Management

#### Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points Primary hepatic neuroendocrine neoplasms (PHNENs) are rare heterogeneous neoplasms arising from the intrahepatic neuroendocrine cells, ectopic pancreatic or adrenal tissue in the liver. Imaging appearances of these tumors are rarely been reported. Neuroendocrine liver metastases (NELM) are more common arising from gastro-enteropancreatic primary and are heterogeneous in clinical presentation and prognosis. After reviewing this exhibit, the learner will be able to: 1. Understand the basic pathophysiology of PHNENs and NELMs. 2. Understand the imaging diagnosis of these tumors and common differentials. 3. Get a basic understanding of principles of management of these tumors. 4. Imaging of Post-operative complications of liver directed therapy

#### TABLE OF CONTENTS/OUTLINE

A. Pathophysiology of PHNENs and NELMs B. Clinical and biochemical assessment. C. Imaging protocol for liver disease. D. Common and uncommon imaging appearance with CT, MRI and PET-CTs E. Updated management guidelines F. Assessment of post treatment complications

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

GIEE-108

### CT Imaging of Peritoneal Carcinomatosis and Its Mimics: Pictorial Review

#### TEACHING POINTS

Multidetector computed tomography (MDCT) is the most commonly used technique for the detection of peritoneal carcinomatosis and for the evaluation of the extent of the disease. The objectives of this study are: 1) Review the pathophysiologic mechanism of the tumor spread and the most common sites and forms of peritoneal involvement 2) Assessment of the peritoneal cancer index (PCI) that provides important information for the surgical planning 3) Illustrate a wide variety of tumorous and inflammatory conditions that can occur in the peritoneal surface and mimic peritoneal carcinomatosis

#### TABLE OF CONTENTS/OUTLINE

Representative cases of peritoneal carcinomatosis and its mimics are illustrated in this exhibit, grouped according to the following headings: 1) Anatomy of the peritoneum and the physiology of circulation and resorption of peritoneal fluid 2) CT imaging findings and patterns of peritoneal carcinomatosis 3) Peritoneal cancer index 4) Mimics of peritoneal carcinomatosis including tuberculous peritonitis, peritoneal lymphomatosis, pseudomyxoma peritonei, primary peritoneal mesothelioma, sclerosing peritonitis, fat saponification, leiomyomatosis 5) Take home points.

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## Abstract Archives of the RSNA, 2023

GIEE-109

### Facing the 'Celiac Iceberg': What Role can Cross-sectional Imaging Play

#### Participants

Xinyue Wang, Guangzhou, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

As a condition described as 'celiac iceberg', celiac disease (CD) remains underdiagnosed and undertreated. Radiological evaluation of CD deserves more attention because cross-sectional imaging is helpful in clinical management of CD, including disease diagnosis, complications identification, treatment response evaluation, and prognostic prediction, which should be considered the examination of choice in patients suspected of having CD. The purpose of this exhibit is: 1. To introduce the challenges of diagnosis and treatment in CD; 2. To introduce what role of cross-sectional imaging can play in CD; 3. To introduce the imaging features of CD and its complications;

#### TABLE OF CONTENTS/OUTLINE

-The profile of CD and the challenges facing  
Role of cross-sectional imaging in CD- Disease diagnosis- Complications identification- Disease activity and severity evaluation- Treatment response evaluation- Prognostic prediction  
Imaging features of CD- Jejunoileal fold pattern reversal- Mesenteric vascular engorgement - Enlarged mesenteric lymph nodes- A decreased size of spleen- Small bowel wall thickening- Diffusely dilated bowels with excess fluid or gas- Intramural fat deposition  
A complication of CD: Mesenteric lymph node cavitation syndrome- Imaging features of mesenteric lymph node cavitation syndrome - Enlarged mesenteric lymph nodes that contain fat-fluid levels

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## Abstract Archives of the RSNA, 2023

GIEE-11

### Unveiling the Mysteries of Pancreas Transplantation through Imaging

#### TEACHING POINTS

Understand the clinical relevance, indications, and surgical techniques of pancreas transplantation. Learn about the role of multimodality imaging (US, CT, MRI and CEUS) in the assessment and management of pancreas transplantation.

#### TABLE OF CONTENTS/OUTLINE

Introduction: an overview  
Clinical importance of pancreas transplantation  
Epidemiology: United States and Global context  
Pancreas transplantation: surgical aspects  
Types of pancreas transplant: indications and outcomes  
Surgical techniques: arterial anastomosis, enteric drainage of exocrine secretions and venous anastomosis  
Multimodality imaging assessment of pancreas graft recipients  
US, CR and MRI: advantages and limitations  
Graft's normal appearance  
Complications: a case-based review  
Early versus late complications  
Rejection: radiological-pathological correlations  
Perspectives  
Artificial intelligence and novel imaging techniques  
Contrast enhanced ultrasound (CEUS): focus on graft's perfusion and rejection  
Take home messages

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## Abstract Archives of the RSNA, 2023

GIEE-110

### Abdominopelvic Actinomycosis

#### Participants

Yong-Soo Kim, MD, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review microbiological and clinical features of actinomycosis this may involve the abdominopelvic organs. To illustrate various CT features of actinomycosis involving abdominopelvic organs.

#### TABLE OF CONTENTS/OUTLINE

Actinomycosis is a chronic inflammatory disease which can involve a variety of human organs. This disease commonly occurs in three distinct forms; a cervicofacial form, an abdominopelvic form and a thoracopulmonic form. After penetrating through the mucosal barrier, the route of propagation is direct spread to adjacent tissue. The aggressive nature of infiltration of actinomycosis may be confused with neoplasm and other inflammatory diseases, especially tuberculosis or fungal infection. Various abdominal organs may be infected by actinomycosis. Abdominal infection has been associated with abdominal surgery, such as appendectomy, or a perforation of the intestinal mucosa; a rupture of appendix, diverticulitis, foreign body perforation of the transverse or sigmoid colon, peptic ulcer. Pelvic actinomycosis may be associated with any type of intrauterine contraceptive device or with an intra-abdominal portal entry. Abdominal actinomycosis can present as an abscess or as a mass that is often fixed to the underlying tissue, as a sinus tract with drainage, perirectal or perianal disease.

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## Abstract Archives of the RSNA, 2023

GIEE-111

### Comprehensive Image-based Overview Of Percutaneous Enteral Access

#### TEACHING POINTS

Image-guided percutaneous enteral catheters offer a minimally invasive alternative to endoscopic or surgical techniques to provide patients access for important nutrition and medication administration. This exhibit discusses the indications, contraindications, techniques, and peri-procedural management of image-guided percutaneous gastrostomy, gastrojejunostomy (including AbbVie PEG-J pull-type technique for Duopa infusion), jejunostomy, and transesophageal gastrostomy.

#### TABLE OF CONTENTS/OUTLINE

- Pre-Procedural Considerations
- Indications/Contraindications for percutaneous enteral catheter placement
- Image-guided technique for percutaneous gastrostomy/gastrojejunostomy
- Image-guided technique for percutaneous jejunostomy
- Image-guided technique for percutaneous transesophageal gastrostomy
- Image-guided technique for percutaneous pull-type AbbVie PEG-J
- Post-procedural evaluation and complication management

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## Abstract Archives of the RSNA, 2023

GIEE-112

### Duodenal Diseases: Illustrated Cases for Radiologists

#### Participants

Manuel Sebastian Paez Alvarez SR, MD, Toledo, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To provide a comprehensive, illustrative guide for diagnosing duodenal diseases in radiology practice. To review and emphasize the imaging characteristics of various duodenal pathologies on CT studies. To highlight the importance of recognizing subtle findings and common anatomical anomalies for accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Duodenal diseases encompass a broad spectrum of conditions that can originate in the duodenum or result from processes involving neighboring organs. This exhibit aims to educate radiologists on various duodenal pathologies, emphasizing illustrative cases through CT studies. Introduction: Overview of duodenal diseases and their significance in gastrointestinal imaging. Congenital anomalies. Inflammatory diseases. Neoplastic diseases. Vascular pathologies. Iatrogenic complications involving the duodenum. Other duodenal entities and pathologies. Conclusion. In this educational exhibit, we will provide a thorough understanding of the duodenum's anatomy and various diseases, emphasizing the importance of recognizing subtle imaging findings in the context of duodenal pathology. This resource will serve as a valuable guide for radiology residents and radiologists seeking to improve their diagnostic skills in abdominal CT imaging.

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## Abstract Archives of the RSNA, 2023

GIEE-113

### Usual and Unusual GI Tract Diverticula, Clinical Presentation, Imaging Characteristics and Management

#### TEACHING POINTS

Review the pathophysiology of diverticula formation throughout the gastrointestinal tract. Describe the presentation and demonstrate the imaging characteristics of typical and atypical diverticula throughout the entire gastrointestinal tract. Discuss potential complications of diverticula, as well as their management.

#### TABLE OF CONTENTS/OUTLINE

-Overview of the pathophysiology of diverticular disease-Overview of radiological findings, complications, and management of diverticular disease--For each type, examples from our database will be providedo Foregut----Zenker's diverticulum----Traction and pulsion diverticulum----Pseudodiverticulum----Epiphrenic diverticulum----Gastric diverticulum----Duodenal diverticulum-----Duodenal diverticulitis-----Lemmel syndrome-----Duodenal diverticular lithiasis-----Intraluminal duodenal diverticulumo Midgut---- Jejunum diverticulum-----Jejunum diverticulitis---- Meckel's diverticulum-----Bleeding Meckel's diverticulum-----Meckel's diverticulitiso Hindgut----Colonic diverticulum-----Right Colon-----Acute diverticulitis-----Appendiceal diverticulum-----Diverticular abscess-----Left Colon-----Acute diverticulitis-----Diverticular abscess secondary to ruptured diverticula-----Fistula-----Colo-vesical fistula-----Colo-iliopsoas fistula-----Fecal peritonitis and purulent peritonitis secondary to ruptured diverticula-----Septic Thrombophlebitis-----Bleeding colonic diverticulum-----Giant colonic diverticulum

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## Abstract Archives of the RSNA, 2023

GIEE-114

### Infiltrative Hepatocellular Carcinoma: Challenging Cases and Its Benign Mimics

#### Participants

Elhamy Heba, MD, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Various histopathologic and morphologic subtypes of hepatocellular carcinoma (HCC) are described throughout the literature. Among all these subtypes, the infiltrative appearance of HCC presents unique challenges in detection, both clinically and radiographically. Infiltrative appearance of HCC is characterized by diffuse permeative spread throughout the liver parenchyma, without forming a mass-like lesion, in a manner that sometimes it is difficult to detect on a background abnormal liver parenchyma. Radiologist must distinguish the infiltrative pattern of HCC from processes that may mimic such as: confluent fibrosis, diffuse fat or iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic microabscesses.

#### TABLE OF CONTENTS/OUTLINE

1. Incidence and prevalence of infiltrative HCC
2. Review imaging features of infiltrative HCC, including multimodality case-based review of typical and challenging cases of infiltrative HCC with pathological correlation
3. Discussion of Tumor in vein as a common imaging feature of infiltrative appearance of HCC
4. Mimics of infiltrative appearance of HCC including confluent fibrosis, diffuse fat/iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses
5. Review of prognosis, management and post treatment imaging of infiltrative appearance of HCC

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## Abstract Archives of the RSNA, 2023

GIEE-115

### Autoimmune Diseases of the Liver and Biliary Tract

#### TEACHING POINTS

Understand mechanisms behind self-tolerance and autoimmunity  
Review spectrum of autoimmune disorders of the liver and biliary tract  
Review the typical and atypical imaging appearance of autoimmune liver and biliary disorders on CT And MRI.

#### TABLE OF CONTENTS/OUTLINE

Autoimmune disorders involving liver and biliary tract can be broadly classified into  
Autoimmune hepatitis (AIH)- Type 1 and Type 2  
Primarily biliary cholangitis (PBC)  
Large duct and small duct primary sclerosing cholangitis (PSC)  
Overlap syndromes: AIH+PBC; PBC+PSC; AIH+PSC  
IgG4 sclerosing cholangitis  
Drug-induced autoimmune injury  
Liver involvement in systemic autoimmune disorder (SAD)  
Diagnostic approach  
Role of MRCP in the diagnosis of autoimmune biliary disorders  
Illustration of imaging findings of AIH  
Heterogeneous enhancement of parenchyma  
Periportal edema  
Normal MRCP  
Responsive to steroids  
PBCLace-like fibrosis  
"Periportal halo" sign  
Portal lymphadenopathy  
Normal MRCP in the early stage  
gt pruned tree appearance in later stage  
PSCPredilection for peripheral intrahepatic ducts  
Beaded appearance of ducts on MRCP  
High risk of perihilar cholangiocarcinoma  
Small duct PSC  
Normal MRCP  
Typical PSC histology  
IgG4 disease  
Circumferential thickening  
Predilection for extrahepatic and hilar ducts  
Drug-induced (biologic agents)  
Appropriate clinical context  
Rapid progression  
Systemic autoimmune disorder  
Immune-mediated hepatitis may be seen in systemic lupus erythematosus and rheumatoid arthritis

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## Abstract Archives of the RSNA, 2023

GIEE-116

### **Gastrointestinal Pharmacoradiology: Updated Review of the Indications, Pharmacodynamics, and Adverse Effects of Bowel Preparation Agents, Gastrointestinal Contrasts and Motility-Modifying Medications**

#### **TEACHING POINTS**

The purpose of the exhibit is: • To review the liquid diet and different cathartics used for bowel preparation including their pharmacodynamics, mechanisms of action, dosage, contraindications, precautions and adverse reactions. • To address patients' frequent questions about bowel preparation before radiologic examinations. • To explain the chemical characteristics and non-active component of the enteric contrast agents used for fluoroscopic, CT and MRI examinations. • To discuss the indications, pros and cons, concentrations, contraindications of enteric contrast, and strategies to prevent adverse reactions and mitigate legal consequences. • To review motility-modifying agents used to optimize GI tract imaging, including their common indications, mechanisms of action, administration route, dosage, peak action, risks, and contraindications. • To describe sedative agents used for intubation.

#### **TABLE OF CONTENTS/OUTLINE**

AGENTS USED FOR: Bowel preparation • Liquid diet • Action mechanisms of cathartics • Saline osmotic cathartics: magnesium citrate • Stimulant cathartics: bisacodyl GI tract endoluminal contrasts for • Fluoroscopic exams: barium sulfate, iodinated water-soluble contrasts, gas. • CT studies • MRI examinations Motility modifiers of GI tract • Antiperistalsis/hypotonia: glucagon, Buscopan • Prokinetics: metoclopramide Mild sedation • Benzodiazepines Topical anesthesia • Lidocaine Lubricants for intubation

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## Abstract Archives of the RSNA, 2023

GIEE-117

### Oh No, I Thought It Was a Hemangioma!!!

#### Participants

Matteo Bonatti, MD, Bolzano, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Liver hemangiomas are frequently encountered during imaging studies and have peculiar features on US, CEUS, CT and MRI.- Various benign and malignant liver lesions may show imaging features resembling hemangiomas.- At US, echogenic liver lesions are not always hemangiomas, particularly in cirrhotic patients and in patients with known malignancies: CEUS might be helpful as a quick problem-solving technique in these cases.- Contrast enhancement pattern must be accurately evaluated: centripetal enhancement alone might be misleading if not associated with globular pattern. - On MRI, hemangiomas must show "fluid-like" T2-hyperintensity; moderately T2-hyperintense lesions are almost never hemangiomas.- Always have a look to ADC values.- Hemangiomas do not have perilesional nodules.- Hemangiomas may slowly grow over time

#### TABLE OF CONTENTS/OUTLINE

To briefly review the typical imaging features that hemangiomas must show on US, CEUS, CT and MRI in order to confidently diagnose them.To show a series of liver hemangioma mimickers (e.g. mass forming intrahepatic cholangiocarcinoma, angiosarcoma, neuroendocrine tumor metastases, colorectal tumor metastases, mucinous tumor metastases,?) on various imaging modalities. For every case the misleading feature(s) will be highlighted.

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## Abstract Archives of the RSNA, 2023

GIEE-118

### Constipation, Hirschsprung's Disease, and Stercoral Colitis: Detection, Classification and Treatment

#### Participants

Rohan Kulkarni, Southgate, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Differentiate and classify different forms of colonic dysfunction to distinguish neurogenic, drug-induced, metabolic, functional, and mechanical causes of constipation  
2. Identify and describe radiological features of constipation and its complications Explain the role of abdominal radiographs, CT, fluoroscopic defecography, and MR defecography in detection and classification of constipation.  
3. Recommend the next appropriate step in management and describe potential image-guided intervention that can contribute to treatment of constipation

#### TABLE OF CONTENTS/OUTLINE

Defining Constipation - Defecatory straining, hard lumpy stools, sensation of incomplete evacuation, sensation of anorectal obstruction or blockage, need for manual maneuvers such as digital evacuation, and or fewer than 3 stools per week. Etiologies of Constipation  
1. Neurogenic: Diabetes mellitus, Hirschsprung's Disease, Intestinal Pseudo obstruction  
2. Drug-Induced Anticholinergics, Neutrally active agents  
3. Metabolic Hypokalemia, hypothyroidism  
4. Functional Pelvic floor dysfunction  
5. Mechanical Neoplasm, stricture, volvulus  
Radiologic features of constipation and its complications on Radiographs, CT, Fluoroscopy and MR- Colonic dilation- Large stool burden- Fecaloma or fecal impaction- Wall thickening- Pericolonic stranding- Perforation- Abscess  
Treatment of Constipation- Laxative/enemas- Manual dis-impaction- Water soluble fluoroscopic enema- Biofeedback- Surgery

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## Abstract Archives of the RSNA, 2023

GIEE-119

### Imaging in Pancreas Transplantation: Conventional and Novel Approaches

#### TEACHING POINTS

- Pancreas graft location and vascular anatomy are unique and must be understood for radiologic evaluation- Ultrasound, CT, MRI all play roles in graft evaluation- Contrast enhanced ultrasound (CEUS), novel MRI techniques, graft biopsy, and alternative transplant approaches all may be part of comprehensive patient care

#### TABLE OF CONTENTS/OUTLINE

- Indications for pancreas transplant- Review of expected surgical technique / post surgical anatomyo Correlation with intra-operative pictures can assist- Rationale for pancreas graft imaging ; how does radiology make a differenceo Graft parenchymal and vascular evaluationo Graft environment+ Fluid collections, bowel obstruction, enteric anastomosis evaluation- Advances in Ultrasoundo Grayscale, Doppler, CEUSo CEUS novel techniques identify vascular insufficiency in grafts and change surgical managemento CEUS used to follow rejection over time- CT o Multiphase CT evaluation for graft and vesselso Examples of common pathology (vascular, pancreatitis, bowel complications)- Standard and investigational MRIo Evaluation for fluid around graft, may assess vessels with or without angiographyo Evaluation with gadolinium-based as well as iron-based contrast agents- Biopsyo Image guided percutaneous approach- Alternate transplant approacheso Islet cell transplanto Composite transplant

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## Abstract Archives of the RSNA, 2023

GIEE-12

### A Primer for Pancreatic Head Pathologies- What the Surgeons Want to Know at the Multidisciplinary Conference

#### Participants

Kazi Irfan, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the malignant and benign solid lesions in relation to the pancreatic head and their imaging appearance  
2. Differentiation of the cystic pancreatic lesions and approach to their differential diagnosis  
3. Discuss the NCCN guidelines for the assessment of vascular involvement to ascertain resectability  
4. Illustrate the surgical technique of Whipple's procedure  
5. Enumerate the important anatomical variants in the celiac and superior mesenteric arteries which would alter the surgical technique  
6. Provide a roadmap to distinguish normal post operative changes from tumor recurrence

#### TABLE OF CONTENTS/OUTLINE

-Imaging appearance of mass forming lesions involving the pancreatic head\*Primary malignancies\*Metastases\*Neuroendocrine tumors\*Benign lesions\*Mass forming chronic pancreatitis-Multidisciplinary approach in the diagnosis and management of the solid lesions-Role of imaging in staging and assessment for surgical resectability-Different cystic lesions involving the pancreatic head\*IPMN\*Serous cystadenoma\*Mucinous cystadenoma\*Pseudocyst-Imaging evaluation to differentiate between the cystic pancreatic lesions-Multidisciplinary approach in the diagnosis and management the cystic pancreatic lesions- Indications of Whipple's surgery and the surgical technique-Review the anatomical variants of significance involving the celiac and superior mesenteric vasculature-Multidisciplinary approach in assessment of local tumor recurrence and distant metastases

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5i, 1/2i, 1/2i, 1/2i, 1/2i, 1/2i, 1/2

## Abstract Archives of the RSNA, 2023

GIEE-121

### **Rectum, Set, Go: A Radiologist's Perspective of a New NAPRC Accredited Multidisciplinary Rectal Cancer Tumor Board at a Large Cancer Center**

#### **TEACHING POINTS**

1. NAPRC offers standardized, risk-adapted management of rectal cancer, while Rectal Cancer Multidisciplinary Teams (RC-MDT) provide structure and resources for accreditation and compliance. 2. Radiologists will learn NAPRC standards which involve utilizing synoptic reporting formats for 95% of all staging MRI exams, having 90% of pre-treatment MRI exams read by RC-MDT member radiologists, and fulfilling minimum attendance requirements. 3. Radiologists are key members of RC-MDT, meeting at least bimonthly with surgeons, pathologists, radiation oncologists, and medical oncologists. Uniform MRI image acquisition and interpretation, along with standardized reporting, are crucial for effective staging.

#### **TABLE OF CONTENTS/OUTLINE**

A) Requirements for NAPRC-accredited RC-MDT 1. Multispecialty services and program management 2. RC-MDT meeting structure a. Radiologist's requirements i. American College of Radiology (ACR) education module ii. Radiologist's mandatory presence for all meetings with individual attendance requirements iii. Internal record review to audit MR exams iv. Measures of compliance for synoptic reports B) RC-MDT member radiologist's contributions 1. Radiologists read 90% of pre-treatment staging MRI exams. 2. Post-treatment restaging and tumor regression grading (TRG) 3. Surgical planning 4. Surveillance C) MR Rectal cancer exams 1. Technical uniqueness of acquisition 2. Imaging features of local disease 3. Standard synoptic report used in 95% of staging MR exams 4. Prediction of local recurrence and metastasis D) Secondary initiatives 1. Rectal cancer education program and goals of care 2. Data management 3. Quality improvement

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## Abstract Archives of the RSNA, 2023

GIEE-122

### CRS (Cytoreductive surgery) + HIPEC or PIPAC: The Radiologist Verdict

#### Participants

Raquel Acosta Hernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The therapeutic management of peritoneal carcinomatosis (PC) and pseudomyxoma peritonei (PMP) requires an assessment in multidisciplinary committees. The radiologist must report where each tumor burden is addressed using the a) PCI (peritoneal carcinomatosis index), b) presence of distant secondary disease (extraperitoneal) and c) tumor implants location in "danger zones" that would condition an incomplete CRS (Cytoreductive surgery). Not only the extent of the disease must be taken into account, but also other patients' individual factors and comorbidities as well as the resources available in each center. Multidisciplinary interaction constitutes the main pillar for a correct selection of patients who are candidates for CRS and subsequent intraperitoneal chemotherapy or, given the risk of incomplete CRS, consideration of other possibilities innovative palliative therapies, such as PIPAC.

#### TABLE OF CONTENTS/OUTLINE

Review the first peritoneal carcinomatosis (CP) evaluation approach: a) PCI (Peritoneal cancer index) b) Implant zones due to peritoneal fluid stasis. c) Implant zones: "Key locations" and d) Ascites and e) Extraperitoneal disease. Illustrate the "danger zones" and unfavourable tumor implants location: beyond the first CP check-points. Update of pseudomyxoma peritonei (PMP): a misunderstanding and controversial disease. Analyze the different types of treatment (surgery, HIPEC and PIPAC): assessment in multidisciplinary committees and focus on the role of radiologist in multidisciplinary committees.

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## Abstract Archives of the RSNA, 2023

GIEE-123

### Pre-operative Evaluation in Living Donor Liver Transplantation: A Roadmap for Radiologist

#### Participants

Hande Ozen Atalay, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Liver transplantation is the most effective treatment for liver failure. Because the number of cadaveric donors is not enough considering the high demand, the number of living donor liver transplantations (LDLT) has been on the rise, and right lobe transplantation accounts for 70 % of all LDLT. In pre-transplant imaging, there are many important issues that should be evaluated and noted in the report. Radiologists play a pivotal role in a transplantation unit and surgical planning. In the pre-operative evaluation of LDLT, choosing the appropriate liver segment for the recipient (right lobe, left lateral segment, etc.) and evaluating the liver in the donor candidate in terms of parenchymal lesions and diseases constitute the initial steps. The liver segmentation should next be done; the total liver volume and the volume of the liver segment to be transplanted are calculated. This step is essential for avoiding small-for-size syndrome in the recipient as well as liver insufficiency in the donor candidate. Recognition of vascular and biliary anatomical variations is critical because certain anatomical variations are accepted as contraindications to LDLT and may cause post-operative ischemia in the donor and recipient. To conclude, radiologists must be aware of their crucial role in the pre-operative imaging of LDLT.

#### TABLE OF CONTENTS/OUTLINE

-Living donor liver transplantation (LDLT) definition, types, and indications-Liver parenchymal evaluation, segmentation, and volume rendering-Important vascular and biliary variations in the LDLT-Contraindications of the right lobe and left lateral segment LDLT-Important issues to be noted in the pre-transplant radiological report -Conclusion

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## Abstract Archives of the RSNA, 2023

GIEE-124

### **Gelatinous Jigsaw: A Pictorial Review of Mucinous Cystic Pancreatic Neoplasms**

#### **Participants**

Milind Rana, MD, Shreveport, TX (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The goal is to educate the audience in recognizing the multi-modal imaging features of mucinous cystic pancreatic neoplasms (MCPN), with an emphasis on their clinical and pathological correlation. We will also characterize morphological features of different pancreatic cystic lesions and elucidate the imaging and histopathologic features of MCPN subtypes including mucinous cystadenoma, mucinous cystadenocarcinoma and intraductal papillary mucinous neoplasm (IPMN).

#### **TABLE OF CONTENTS/OUTLINE**

Mucinous cystic pancreatic neoplasm (MCPN) clinical overview Epidemiology Pathophysiology Classifying non-neoplastic and neoplastic MCPN subtypes Review MCPN multi-modal imaging features on Ultrasound (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) Imaging and histologic features of Mucinous Cystadenoma Imaging and histologic features of Mucinous Cystadenocarcinoma Key features of differentiating Intraductal Papillary Mucinous Neoplasm (IPMN) and its subtypes Treatment and Prognosis

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## Abstract Archives of the RSNA, 2023

GIEE-125

### CT Guided Gastrostomy Placement: An Alternative Approach without Placement of Nasogastric Tube

#### Participants

Mohanad Kurdi, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Computed Tomographic (CT) guided gastrostomy tube (G-tube) placement is an alternative to fluoroscopic techniques. CT guided G-tubes forego the placement of a nasogastric (NG) tube as insufflation of the stomach is performed via anterior abdominal wall percutaneous access. NG tubes cause a variety of problems, including patient discomfort, challenging placement, premature removal and malplacement. Cross sectional imaging allows for a global view of intra-abdominal structures, with more accurate localization of soft tissue structures. Compare and contrast CT and fluoroscopic guided techniques with pitfalls of both.

#### TABLE OF CONTENTS/OUTLINE

Background Indications and Contraindications Gastrostomy Tube Placement Techniques Disadvantages of Nasogastric Tubes CT Guided G-Tube Overview Technical Considerations CT versus Fluoroscopy Our Experience Discussion References

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## Abstract Archives of the RSNA, 2023

GIEE-126

### **Worry or Go with the Flow: Perfusion Anomalies and Vascular Disorders of the Liver - A Primer for the Radiologist**

#### **TEACHING POINTS**

1. Understanding the imaging appearances and physiology of transient hepatic attenuation differences (THADs) on CT and transient hepatic intensity differences (THIDs) on MRI is crucial to aid the radiologist in diagnosing hepatic disease processes. 2. Recognizing perfusion anomalies in the liver is essential to avoid misinterpretation of "pseudolesions", a common pitfall for the training radiologist. 3. Familiarity with the pathogenesis and imaging features of hepatic vascular disorders helps guide correct diagnosis and patient management.

#### **TABLE OF CONTENTS/OUTLINE**

1. Physiology of hepatic perfusion a. Nutrient rich mesenteric venous inflow b. Compensatory nature of hepatic arterial and portal venous blood flow 2. Concept of THADs/THIDs a. Pathophysiology b. Case-based review of common etiologies: "Cs" of THAD/THID c. Strategies to avoid misinterpretation 3. Concept of streamline phenomenon a. Implications with case-based review 4. Concept of third inflow a. Implications with case-based review 5. Case-based review of miscellaneous vascular diseases a. Sinusoidal occlusion syndrome b. Budd Chiari c. Cavernous transformation and portal biliopathy d. Hepatic peliosis e. Hepatic ischemia secondary to TIPS

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## Abstract Archives of the RSNA, 2023

GIEE-127

### Borderline Pancreatic Cancer: Role of Cross Sectional Imaging in Therapeutic Decision Making

#### TEACHING POINTS

Borderline pancreatic ductal adenocarcinoma (BR-PDAC) is defined as a tumor potentially resectable but with anatomical (vascular involvement), biological (serum biomarkers) or clinical (performance status) conditions that may impact in free margin resections or postoperative outcomes. Anatomical BR-PDAC is at high risk for margin positive when surgery is upfront, so neoadjuvant chemotherapy and/or radiotherapy is considered to increase the chance of a R0 resections. Radiology is a significant tool concerning anatomical dimension, evaluating tumor - vessel relationships, being a pillar in decision making to choose the best therapeutic option for each patient. The images are also fundamental evaluating post-neoadjuvant response, contributing to evaluate tumor biology and responding patients. The objective of this exhibit is: 1) To review the role of imaging determining resectability status of tumors with detailed analysis in tumor - vessel contact of BR-PDAC. 2) To evaluate anatomical conditions that influences in surgical technique, particularly when vascular reconstructions are needed. 3) To review imaging response criteria post neoadjuvant therapy.

#### TABLE OF CONTENTS/OUTLINE

a) Tumor - venous contact analysis using Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). b) Tumor - artery contact evaluation and its differences when comparing to vein analysis. c) How proper radiological identification of the characteristics of venous and/or artery involvement influence on surgical approach and vascular reconstruction techniques required for a successful surgery.

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## Abstract Archives of the RSNA, 2023

GIEE-128

### Make it Simple-Imaging of the Postoperative Whipple

#### Participants

Ali Agely, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The Whipple procedure (pancreaticoduodenectomy) is performed to resect pancreatic head or periampullary neoplasms. CT and (increasingly) MRI are performed in the acute and delayed postoperative settings, notably in patients with a complicated course. This presentation provides a comprehensive overview of various postoperative imaging findings after a Whipple procedure with emphasis on MRI. Familiarity with expected findings and postoperative complications gives the radiologist the knowledge to render a prompt and accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1) Surgical review 2) Normal, expected findings in the acute and delayed postoperative settings 3) Complications: Pancreatic fistula, Leak (gastrojejunostomy and biliary-enteric), anastomotic strictures, pancreatitis (acute and acute on chronic), hemorrhage, abscess, portomesenteric venous thrombus, tumor recurrence, delayed gastric emptying, and stent migration

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## Abstract Archives of the RSNA, 2023

GIEE-129

### **GI and GU Fluoroscopy In Common Post-op Oncologic Surgeries: What You Need to Know About This Leaky Business**

#### **TEACHING POINTS**

1. Describe common gastrointestinal and genitourinary fluoroscopic procedures in oncology  
2. Illustrate the different techniques and indications for post op fluoroscopic examinations with key teaching points  
3. Demonstrate normal and abnormal fluoroscopic examinations including complications with emphasis on leaks

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction.  
2. Endoscopic evaluation versus double contrast studies.  
3. Surgical techniques of Ivor Lewis esophagectomy and its complications.  
4. Indications, techniques and imaging findings of single-contrast esophagram.  
5. Colonic and jejunal interposition.  
6. Surgical techniques for rectal surgeries and their complications.  
7. Indications, technique and imaging findings on single contrast enema.  
8. Indications, techniques and imaging findings of bladder surgeries and urinary diversions on cystogram, loopogram and pouchogram.  
11. Take-home messages.  
12. References.

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## Abstract Archives of the RSNA, 2023

GIEE-13

### Late Postoperative GI Tract Evaluation: Identifying Complications Based on Surgical Technique

#### Participants

Daniel Montel, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To recognize and understand the surgical techniques performed at gastrointestinal tract surgeries. To enumerate the main late postoperative complications of the gastrointestinal tract surgeries and their imaging features. To correlate imaging findings in the evaluation of late postoperative period with the particularities of each gastrointestinal tract surgery. This enables the characterization of complications that may be related to postoperative anatomical changes, anastomosis, stomas, surgical incision on abdominal wall, or intra-abdominal adhesions.

#### TABLE OF CONTENTS/OUTLINE

- Introduction.
- Overview of late complications in gastrointestinal tract surgery.
- Review of surgical techniques in gastrointestinal tract surgery.
- Complications related to anastomosis.
- Complications related to postoperative anatomical changes.
- Complications related to adhesions.
- Complications related to intestinal stomas.
- Complications related to surgical incisions in the abdominal wall.
- Teaching points.

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## Abstract Archives of the RSNA, 2023

GIEE-130

### Constipation, Stercoral Colitis, Hirschsprung Disease and Complications in Adults

#### Participants

Joel Gamble, MD,BSC, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Imaging is unreliable in establishing the diagnosis of constipation and directing routine management. Severe or chronic constipation can lead to serious complications, for which imaging is essential. Stercoral colitis is a potentially fatal complication of fecal impaction. High attenuation mucosa and perfusion defect are the most accurate features for fatal cases. The natural history of Hirschsprung disease epitomizes the complications of constipation. Despite surgical resection, many adults have chronic constipation, and a subset have serious constipation-related complications.

#### TABLE OF CONTENTS/OUTLINE

Constipation: Clinical diagnosis; recent literature that imaging does not correlate with bowel habit, predict symptoms of constipation, or reliably direct management decisions; imaging for complications of constipation. Stercoral colitis: Mucosal ulceration due to pressure ischemia, possible perforation; spectrum of findings severity. Hirschsprung disease: Absent ganglion cells in the submucosal and myenteric plexuses; symptoms into adulthood include constipation, straining, incomplete evacuation. various mechanisms of chronic constipation; late presentation of Hirschsprung in adulthood; complications include adhesional obstruction; fistula formation; obstipation; perforation

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## Abstract Archives of the RSNA, 2023

GIEE-131

### The Pinch and the Squeeze: A Review of Vascular Compression Syndromes

#### Participants

Hannah Lamberg, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Diagnosis of almost all vascular compression syndromes is largely clinically based. However, certain imaging findings can be suggestive of these syndromes, aiding in diagnosis and treatment. 2. Findings suggestive of a vascular compression syndrome include pre-stenotic vessel dilation, formation of varices, and compression of other structures (e.g. ureter, duodenum).

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction of vascular compression syndromes 2. Radiologic findings with accompanying CT examples including:- Nutcracker Syndrome- May-Thurner Syndrome- Pelvic Venous Congestion Syndrome (non-vascular compression syndrome)- Median Arcuate Ligament Syndrome- Superior Mesenteric Artery Syndrome- Chronic Ureteropelvic Junction Obstruction by crossing vessels- Ovarian vein syndrome. 3. Summary/Conclusions: Review of high-yield teaching points

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## Abstract Archives of the RSNA, 2023

GIEE-132

### Imaging of Gallstones and Complications

#### Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Identify various types of gallstones and discuss imaging techniques 2. Multimodality imaging review of the features of gallstones and their complications 3. Discuss pitfalls and mimics of gallstones.

#### TABLE OF CONTENTS/OUTLINE

There are three main types of gallstones: Cholesterol (10%), Pigmented (10%) and mixed (80%). Ultrasound is the superior imaging modality for detection of gallstones as up to 20% stones are not calcified and CT occult. CT is better to detect gallstone complications. Dual Energy CT utilizes low KV, calcium-based and lipid-based imaging and more sensitive than single energy CT to detect gallstones. Gallstone complications: Acute cholecystitis; Acute cholangitis; Mirizzi Syndrome; Biliary-enteric fistulae; infected fallen gallstones; post-cholecystectomy syndrome. Pitfalls and Mimics: Assessment of stone impaction; gallbladder polyps; cystic artery pseudoaneurysm, enteroliths. Summary: Gallstones are common seen on imaging and can serve as a nidus for infection/inflammation; cause biliary outflow obstruction or fistulize to adjacent structures necessitating prompt diagnosis sometimes utilizing multimodality imaging, treatment and intervention.

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## Abstract Archives of the RSNA, 2023

GIEE-133

### Don't Judge a Gallbladder by Its Wall

#### Participants

Sara Siguenza-Gonzalez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiologists are very used to cholecystitis in daily clinical practice, but there are other entities that affect the gallbladder (GB): Classification and description of those entities according to a pathological point of view. Principal radiographic features of each disorder in ultrasound (without and with contrast), CT (including spectral CT) and MRI. Key points to guide the differential diagnosis of the main pathology of the GB.

#### TABLE OF CONTENTS/OUTLINE

1. An approach to the anatomy and physiology of the GB. Description of normal anatomy, anatomic variants and congenital features. 2. Describe benign entities, idiopathic diseases (cholesterolosis and adenomyomatosis) and bile stasis diseases. 3. An update of premalignant gallbladder polyps. 4. Analyze malignant pathology, including primary tumours (gallbladder carcinoma and cholangiocarcinoma) and secondary tumours (metastasis and lymphoma). 5. A portrayal of others disorders in the GB: traumatic pathology, secondary causes of diffuse gallbladder wall thickening and inflammatory diseases beyond acute cholecystitis.

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## Abstract Archives of the RSNA, 2023

GIEE-134

### Hepatobiliary and Pancreatic Manifestations of Immunochemotherapy: A Practical Guide

#### Participants

Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. An update on the commonly used cancer immunotherapy and chemotherapy agents that affect the liver, biliary system and pancreas. 2. Delve into the pathogenesis of these therapy-related hepatobiliary and pancreatic manifestations. 3. Illustrate the role of imaging in diagnosis of these therapy-related manifestations in the context of cancer.

#### TABLE OF CONTENTS/OUTLINE

1. Background 2. Cancer immunotherapy and chemotherapy agents that can affect the liver, biliary system and pancreas a) CTLA-4 inhibitor - Ipilimumab b) PD-1 inhibitor- Nivolumab, Pembrolizumab c) PD-L1 inhibitor - Durvalumab, Atezolizumab d) Alkylating agents - Oxaliplatin e) Anti-metabolites - Pyrimidine analogues (5-fluorouracil, Gemcitabine), 6-mercaptopurine, methotrexate f) Vinca alkaloids - Vincristine, Vinblastine g) Topoisomerase I inhibitors - Irinotecan 3.) Therapy related adverse effects - Hepatic - Biliary - Pancreatic 4. Steatosis 5. Diffuse hepatitis 6. Fibrosis 7. Pseudocirrhosis 8. Sinusoidal obstruction syndrome 9. Focal nodular hyperplasia - like lesions 10. Nodular regenerative hyperplasia

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## Abstract Archives of the RSNA, 2023

GIEE-135

### Primary Peritoneal Malignant Mesothelioma: Everything a Resident Needs to Know

#### Participants

Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Distinguish the various subtypes of mesothelioma based on clinical and radiological features. Illustrate the spectrum of imaging features of primary peritoneal mesothelioma. Be cognizant of the mimics of primary peritoneal malignant mesothelioma in our daily reporting.

#### TABLE OF CONTENTS/OUTLINE

1. Background on mesothelioma 2. Subtypes of peritoneal mesothelioma a) Cystic mesothelioma b) Primary peritoneal malignant mesothelioma (PPMM) c) Well-differentiated papillary mesothelioma 3. Spectrum of imaging features of primary peritoneal malignant mesothelioma 4. Cases - a) Peritoneal thickening b) Peritoneal masses c) Omental fat stranding and nodularity d) Extensive disease 5. Mimics a) Peritoneal carcinomatosis b) Lymphoma c) Tuberculous peritonitis

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## Abstract Archives of the RSNA, 2023

GIEE-136

### All About the Gallbladder: From Normal to Rare

#### TEACHING POINTS

Review of normal anatomy and common conditions of the gallbladder, demonstrating the role of the available imaging methods. Illustrate unusual cases of the gallbladder, highlighting the main imaging findings for the correct approach and diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Brief demonstration of the gallbladder anatomy as well the imaging findings related to its most frequent conditions. Case-based illustration of multiple uncommon gallbladder pathologies according to their nature: - Anatomical variants and malformations; - Inflammation; - Neoplasms; - Others (trauma, torsion etc.).

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## Abstract Archives of the RSNA, 2023

GIEE-137

### Imaging Characteristics of Pancreatic Serous Cystadenoma and Common Imitators

#### Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Pathophysiology of Pancreatic serous cystadenoma.2) MR characteristics of Pancreatic serous cystadenoma and its subtypes.3) Cystic pancreatic lesions mimicking serous cystadenoma.4) Aggressive features of atypical serous cystadenomas.5) Utility of endoscopic ultrasound and fluid aspiration for definitive diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Pancreatic cystic neoplasms are commonly encountered in practice and reported on 20-40% of abdominal MRI scans compared to only 3% of CT scans. Serous cystadenoma of the pancreas can have similar characteristics to other benign and malignant pancreatic lesions. The microcystic form of Pancreatic serous cystadenoma has classic features with a pathognomonic enhancing scar and stellate calcifications seen in 30% of cases.1) MR features of microcystic, macrocystic, oligocystic, and solid pancreatic serous cystadenoma subtypes.2) Atypical aggressive features including parenchymal atrophy, ductal dilatation, and vascular/local invasion.3) Common mimics including Mucinous cystic pancreatic neoplasm(MCPN), Solid pseudopapillary epithelial neoplasm(SPEN), Intraductal papillary mucinous neoplasm(IPMN), pseudocyst, lymphoepithelial cyst, cystic neuroendocrine tumor(NET), and adenocarcinoma.4) Von Hippel-Lindau syndrome- Increased incidence of developing Pancreatic serous cystadenoma and other benign and malignant tumors of various organs.

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## Abstract Archives of the RSNA, 2023

GIEE-138

### Barriers to Adopting LI-RADS and Steps to Overcome

#### Participants

James Lee, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) The Liver Imaging Reporting and Data System (LI-RADS) is a reporting system for the classification of hepatocellular carcinoma (HCC) that continues to grow in adoption throughout North America including important steps of alignment with both the American Association for the Study of Liver Disease (AASLD 2018) and the Organ Procurement Transplant Network (OPTN 2022) 2) Despite growing adoption, radiologist still encounter barriers to implementation within their own clinical academic departments, from referring physicians and surround community practices.3) An understanding of different barriers that may face radiologists and referrers towards the adoption of LI-RADS is an important step to overcoming these obstacles.

#### TABLE OF CONTENTS/OUTLINE

I. Review LI-RADS purpose to standardize reporting and data collection for patients at risk for developing HCCII. Illustrate the growth of LI-RADS adoption over the past decadeIII. Describe the barriers to adoption of LI-RADS from both the radiologist and referring providers point of viewIV. Explain how to overcome barriers from the experiences encountered from our multiple (12) institution collaborative.

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## Abstract Archives of the RSNA, 2023

GIEE-139

### Crohn's Disease: Step by Step in MRI

#### Participants

Natalia Zuniga, MD, Cali, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Active disease is characterized by wall thickening and edema and or ulceration. Wall thickening alone, without the supporting features of oedema or ulceration, often indicates inactive disease, particularly if the wall is dark on fat-suppressed T2WI. Functional techniques such as DWI and motility imaging provide ways to quantify disease activity, monitor, and even predict therapeutic response. Complications can be divided into stricturing, penetrating, related to short bowel and development of malignancy. Characterization of strictures requires a fixed luminal narrowing with upstream dilatation greater than 3 cm. The strictures should be differentiated between inflammatory luminal narrowing or fixed fibrosis, and should be measured the length of the stricture. Contrast enhancement may be useful, but active and fibrotic disease both enhance. Early enhancement is more typical for active CD whereas delayed enhancement may indicate established fibrosis. It is useful to distinguish between response to treatment and imaging remission. Response implies a significant reduction of the inflammatory burden, and imaging remission implies the abolition of all activity. Scores are not routinely applied in clinical practice, however their knowledge is necessary for the description of mild, moderate and severe disease, which is sufficient.

#### TABLE OF CONTENTS/OUTLINE

Definition and initial diagnosis. Disease Activity. Disease phenotype. Non-stricturing, non-penetrating (inflammatory). Stricturing Disease. Penetrating Disease. Depict and quantify the degree of inflammatory activity. Severity. Therapeutic monitoring and response to treatment. Preoperative mapping. Postoperative recurrence

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## Abstract Archives of the RSNA, 2023

GIEE-14

### What Goes Up Must Come Down: Multimodality Imaging Evaluation of Reflux Disease, Related Surgeries and Complications

#### Participants

Moataz Ahmed Sayed Mohammed Soliman, MSc, CHICAGO, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Explain the causes and mechanisms of reflux disease and its effects on the esophagus and stomach Review imaging modalities and findings for diagnosis and assessment of reflux severity Describe the surgical procedures utilized for treatment of reflux disease, their advantages and disadvantages Recognize the post-operative imaging findings and potential complications of reflux surgery with possible management options

#### TABLE OF CONTENTS/OUTLINE

Introduction: Define reflux disease Epidemiology Complications Pathophysiology: Role of the lower esophageal sphincter, hiatal hernia, gastric acid, and other factors in reflux disease Diagnostic tests: Upper endoscopy, pH monitoring, manometry Review the indications, techniques, and findings of different imaging modalities for reflux disease Imaging possible disease complications Treatment Medical therapy (prescription and non-prescription medications) Surgery: Compare types, outcomes, and risks of different surgical options for reflux disease, such as Fundoplication LINX Device Transoral incisionless fundoplication (TIF) Stretta procedure Post-operative imaging: Expected post-operative imaging findings Complications: Identify the common and rare complications of reflux surgery and their imaging features and management strategies Dysphagia and difficult Infection Bleeding Esophagogastric perforation, leakage Fistula Unwrapping of fundoplication LINX device migration Conclusion: An algorithmic approach to imaging evaluation

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## Abstract Archives of the RSNA, 2023

GIEE-140

### Abdominal Tuberculosis: Think About It

#### Participants

Nerea Torena, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review abdominal tuberculosis, findings, and possible differential diagnoses. 2. To present cases of abdominal tuberculosis diagnosed at our centre in the last 5 years.

#### TABLE OF CONTENTS/OUTLINE

In Europe Tuberculosis has an average incidence of 26 cases per 100000 inhabitants. Pulmonary disease is the most frequent, abdominal involvement occurs in 11-12% of patients with extrapulmonary tuberculosis. Most frequently it affects the genitourinary tract, lymph nodes, peritoneum, and solid viscera, mainly the liver, spleen, and pancreas. Symptoms can be nonspecific; most commonly fever, abdominal pain, and weight loss. The radiological findings are not pathognomonic, but may be suggestive if considered with clinical, immunological status, and demographic origin. Abdominal disease can simulate multiple conditions: lymphoma, Crohn's disease, adenocarcinoma, carcinomatosis, etc. Tuberculosis cases diagnosed at our hospital in the last 5 years have been reviewed, 262 cases. 18 patients (6.8%) with abdominal involvement detected by imaging techniques. Radiological findings of each location will be discussed and depicted. Genitourinary, hepato-splenic, peritoneal, intestinal, lymph node and pancreatic tuberculosis will be shown. Differential diagnoses of each location will be reviewed. Abdominal tuberculosis diagnosis is complicated. Imaging findings are usually nonspecific and present in a very diverse way mimicking different diseases. It is important to suspect this pathology and establish its diagnosis to start the most appropriate treatment as soon as possible.

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## Abstract Archives of the RSNA, 2023

GIEE-141

### Post-operative Complications of Cholecystectomy: What the Radiologist Needs to Know

#### Participants

Kazi Irfan, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Surgical anatomy of the gall bladder fossa. 2. Variants in the vasculature and biliary anatomy predisposing to injuries. 3. Types of cholecystectomy surgical approaches. 4. Imaging overview of indications of cholecystectomy. 5. Algorithm for imaging approach to diagnose acute cholecystitis. 6. Appropriate use of multimodality imaging in the diagnosis of post-operative complications. 7. Expected post-surgical changes. 8. Spectrum of post-surgical complications

#### TABLE OF CONTENTS/OUTLINE

Introduction:-Cholecystectomy is among the most commonly performed abdominal surgeries-Can be performed by either laparoscopic or open approaches  
Common indications for cholecystectomy: Acute/chronic cholecystitis, symptomatic cholelithiasis, gallstone pancreatitis, gall bladder masses/ polyps  
Multimodality imaging in diagnosis and management of post-surgical complications:-Computed Tomography (CT): primary imaging modality-Magnetic resonance Imaging (MRI): Ideal for biliary anatomy. Hepatobiliary excreted contrast (Eovist) can confirm bile leak-Ultrasound-Hepatobiliary scintigraphy-Fluoroscopy: Transhepatic and T-tube cholangiograms-Angiography  
Postsurgical complications of cholecystectomy:-Collections? \*Expected postsurgical seroma/hematoma? \*Bile leak or biloma (can be secondarily infected)? \*Hematoma? \*Abscess?-Bile duct injuries (can be associated with bile leak or biloma)? \*Stricture? \*Ligation or transection?-Gallstone related? \*Retained or new gallstones in CBD or remnant cystic duct? \*Dropped gallstones?-Vascular? \*Active bleed? \*Pseudoaneurysms? \*Vascular occlusions?-Other? \*Cholecystitis in residual gall bladder? \*Bowel injury? \*Clip migration?

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## Abstract Archives of the RSNA, 2023

GIEE-142

### Navigating the Labyrinth of Peritoneal and Retroperitoneal Anatomy: Abdominal Disease Spread Made Easy

#### Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Essential to understanding disease spread in abdomen is to separate the peritoneum from the retroperitoneum. These areas have distinct anatomy with well-define separate pathways. The peritoneum is comprised of connected recesses that are potential spaces, normally not imaged except when containing excess fluid or air. Peritoneal recesses are formed by the opposing peritoneal surfaces and subdivided by the attachments of the ligaments and mesenteries to the parietal peritoneum. Disease flows within the recesses by changes in abdominal pressure. This forms a distinct spread pattern. The retroperitoneum is stratified by the renal fascia into the anterior and posterior pararenal spaces and the perirenal space. The fascia contains and directs spread from the contained organs with the compartments. Each space has a unique spread pattern defined by the containing fascia. The anterior pararenal space is connected to the mesenteries and ligaments forming the subperitoneal space. This space interconnects the retroperitoneum with the mesenteries allowing for the normal continuum of blood vessels, lymphatics, and nerves but also forms the pathways for bidirectional spread of disease.

#### TABLE OF CONTENTS/OUTLINE

- Anatomy
- Clinical embryology
- Fundamental concept of the subperitoneal space
- Distinguishing intraperitoneal spread from subperitoneal spread
- New planes of retroperitoneum
- Patterns of spread of disease from the;- Liver-Distal esophagus and stomach- Pancreas-Small intestine-Large intestine-Renal and adrenal
- Mechanisms of spread of disease (fluid, gas and soft tissue)- Subperitoneal-Intraperitoneal-Contiguous invasion
- Clinical and radiological applications

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-143

### Hepatic Transplantation Assessment: What Radiologists Should Know

#### Participants

Carmen Gonzalez-Carrero Sixto, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the surgical techniques used in liver transplantation for vascular anastomosis. Describe the normal findings immediately after the procedure. Expose the most frequent acute postoperative vascular complications.

#### TABLE OF CONTENTS/OUTLINE

1. BACKGROUND: Liver transplant is the treatment of choice for end stage liver disease. Morbidity and mortality have significantly been reduced thanks to advances in surgical techniques, immunosuppressive therapy and multidisciplinary team approach. We radiologists play a key role in the diagnose and follow-up of possible complications. 2. SURGICAL TECHNIQUE 3. NORMAL FINDINGS: in the first 24 to 48 hours after a liver transplant, US must be performed. 4. VASCULAR COMPLICATIONS: - Hepatic artery: thrombosis, stenosis, pseudoaneurisma. - Portal vein: thrombosis, stenosis. - Suprahepatic veins: thrombosis, stenosis. 5. CONCLUSION: After a liver transplant imaging techniques are important to rule out and follow up possible complications. There are some normal findings in the immediate postoperative period but radiologists need to know how to identificate abnormal features suspicious of complications.

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## Abstract Archives of the RSNA, 2023

GIEE-144

### Head with Two Tales: Early Spread of Disease from the Pancreas

#### Participants

Janardhana Ponnatapura, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The head of the pancreas can be considered as two separate entity with distinct embryological variations. During embryology the ventral pancreatic bud becomes the caudal portion and the uncinata process of the head of the pancreas, while the dorsal bud becomes the cranial portion of the head. This embryology results in anterior and posterior components of the head of the pancreas each having their distinct vascular supply, nerve supply and lymphatic drainage. It is essential for the radiologist to appreciate that this results in two distinct spread patterns from the head of the pancreas. This knowledge about the early disease spread from the head of the pancreas becomes important particularly in the case of tumor as the radiologist can confidently predict, and diagnose the metastatic spread knowing the origin of the tumor.

#### TABLE OF CONTENTS/OUTLINE

- Anatomy of the pancreas
- Clinical embryology of the head of the pancreas
- Fundamental concept of the two heads of the pancreas
- Distinct vascular supply
- Distinct nerve supply
- Distinct lymphatic supply
- Distinguishing the different disease spread from the anterior head and posterior head
- How imaging helps in successfully identifying the early spread
- Important anatomical landmarks to help recognizing the spread of the disease
- Patterns and mechanisms of early spread of the tumor
- Clinical and radiological applications
- Algorithm to predict the spread of metastatic disease from the head of the pancreas

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## Abstract Archives of the RSNA, 2023

GIEE-145

### The 'New' 2023 American Association for the Study of the Liver Disease (AASLD) Practice Guidance on the Diagnosis and Management of Nonalcoholic Fatty Liver Disease (NAFLD): Radiologists' Perspective

#### Participants

Eri Osta, BS, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Familiarize audience with 2023 AASLD practice guidance statement for diagnosis management of Nonalcoholic fatty liver disease (NAFLD) with special emphasis on imaging-related statements.
- Discuss imaging biomarkers other non-invasive tests in risk assessment of NAFLD patients.
- Review complementary roles of liver function tests, Fibroscan, shear wave Elastography MRI PDFF in assessing hepatic steatosis, fibrosis "at-risk" nonalcoholic steatohepatitis (NASH).
- Discuss ongoing research advances role of AI-based tests in NAFLD

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- Epidemiology: Prevalence and demographics of NAFLD.
- Spectrum of NAFLD: Pathophysiology, stages, and progression - Nonalcoholic fatty liver (NAFL), Nonalcoholic steatohepatitis (NASH), at-risk NASH, advanced fibrosis cirrhosis
- Predictors of clinical outcomes in NAFLD: Identifying high-risk patients: fibrosis-4 (FIB-4) scoring system
- Diagnosis and Assessment of NAFLD
- Hepatic steatosis: Ultrasound, Fibroscan/Controlled attenuation parameters (CAP) MRI-PDFF techniques
- "At-risk" NASH Evaluating FAST (Fibroscan + AST levels), MAST (MRE + AST levels), MEFIB (MRE + FIB-4) scoring systems.
- Advanced fibrosis: Assessing extent of fibrosis with Fibroscan/VCTE MRE
- Cirrhosis Rule in/out irreversible fibrosis
- Future directions Ongoing research
- Conclusion Recent developments in NAFLD have led to substantial advancements in biomarkers therapeutics, with significant implications for radiologists collaborating with multidisciplinary care teams. Emerging imaging non-imaging biomarkers can exclude advanced liver disease or identify patients at an increased risk for cirrhosis.

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## Abstract Archives of the RSNA, 2023

GIEE-146

### Pancreatic Duct Anomalies: A Primer for Trainees

#### Participants

Hatem Al Kashroom, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Pancreatic duct anomalies are rare but can cause significant health problems if not detected early. 2. The two main types of congenital pancreatic duct anomalies are pancreas divisum and annular pancreas. 3. Symptoms of pancreatic duct anomalies may include abdominal pain, nausea, vomiting, and weight loss. 4. Diagnosis usually involves imaging tests such as MRI (MRCP) and/or CT scan. 5. Overview of the acquired pancreatic duct anomalies 6. Patients with a family history of pancreatic duct anomalies or pancreatitis may be at higher risk and should discuss screening options with their healthcare provider.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to normal pancreatic anatomy and embryology 2. Pancreatic divisum and divisum types 3. Annular pancreas 4. Acquired pancreatic duct anomalies 5. Diagnostic tests and preferred imaging modalities

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## Abstract Archives of the RSNA, 2023

GIEE-147

### What The Radiologist Needs To Know About Pseudomyxoma Peritonei And HIPEC

#### Participants

Natalia Zuniga, MD, Cali, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The mucinous deposits tend to follow routes of normal peritoneal fluid flow, there are watershed regions in the peritoneal cavity where cells can be deposited to form implants. Signs of peritoneal metastases include the presence of peritoneal nodules, thickening, or fat stranding. A peritoneal cancer index greater than 20 is considered a poor prognostic factor. CT provides anatomic imaging. MRI provides a combination of anatomic imaging and tumor functional imaging. PET imaging provides functional imaging based upon an assessment of the tumor's metabolism of glucose. T1WI and T2WI sequences provide anatomic details to precisely localize the larger peritoneal tumors and nodules, but are relatively insensitive for depicting small peritoneal tumors and subtle fat stranding. DWI are particularly useful for depicting mucinous lesions due to the conspicuity of high signal intensity mucin and fluid within these tumors. Peritoneal tumors enhance with intravenous gadolinium increasing their conspicuity. The combination of hyperthermia and high concentration chemotherapy used in HIPEC can also alter physiological healing, which may increase the incidence of vascular, lymphatic, gastrointestinal, urological and diaphragmatic complications.

#### TABLE OF CONTENTS/OUTLINE

Terminology. Pseudomyxoma peritonei. Hyperthermic Intraperitoneal Chemotherapy (HIPEC). Peritoneal anatomy and physiology. Preoperative imaging. Establish the presence or absence of peritoneal metastases. Quantitation of the radiologic Peritoneal Cancer Index. Description of extraperitoneal metastases. Postoperative imaging. Normal findings. Features indicative of complications.

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## Abstract Archives of the RSNA, 2023

GIEE-148

### Off the Wall: Incidental Muscle Pathology on Abdominopelvic Imaging

#### Participants

Benjamin Northrup, MD, Chesterfield, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The use of cross-sectional imaging has increased exponentially, and incidental musculoskeletal findings have become commonplace. These are frequently referred to as “the radiologist’s blind spot.” Recent publications offer detailed review of abdominal wall pathology. However, the differential diagnosis for abnormalities of the paraspinal and pelvic musculature is often distinct. This review will familiarize radiologists with these unique and often overlooked pathologies and with management recommendations.

#### TABLE OF CONTENTS/OUTLINE

1. Abdominopelvic muscle anatomy
2. Congenital and structural abnormalities
3. Metabolic abnormalities (diabetic myonecrosis, rhabdomyolysis, hyperparathyroidism)
4. Vascular (arteriovenous malformations, ischemic myonecrosis)
5. Inflammatory myopathy (inflammatory myositis, sarcoidosis, drug-related, HIV, radiation, crystalline)
6. Infectious (poliomyelitis, cysticercosis, infectious myositis)
7. Sequelae of injury and trauma (DOMS, tears, hematoma, bursitis, heterotopic ossification, myositis ossificans)
8. Neoplasia (primary and metastatic malignant neoplasms, benign neoplasms)
9. Atrophy (denervation myopathy, end-stage inflammation, sarcopenia)
10. Normal variants and pitfalls (accessory and anomalous muscles, injection granulomata, lipohypertrophy)
11. An algorithmic approach to incidental musculoskeletal abdominal findings

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## Abstract Archives of the RSNA, 2023

GIEE-149

### Peritoneal Carcinomatosis and HIPEC

#### Participants

Victoria John, MBChB, Stockport, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Peritoneal carcinomatosis occurs from spread of a primary cancer to the peritoneum, most commonly from the gastrointestinal tract and ovary. Pseudomyxoma peritonei is a rare type of peritoneal carcinomatosis characterised by accumulation of mucinous ascites and mucinous peritoneal deposits secondary to intraperitoneal spread of a mucin-producing primary tumour. Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) in suitable patients offers a chance for cure and is the mainstay of treatment in lower grades tumours, for which current chemotherapy regimes are of limited effect. Pre-operative imaging is key in determining patients' suitability for CRS/HIPEC with regards to tumour burden. Factors include the Sugarbaker Peritoneal Cancer Index (PCI), ascites and abdominal wall involvement, unfavourable sites of disease, presence of small bowel and mesenteric disease, as well as extra-peritoneal metastases. The most commonly used imaging modalities are CT and dedicated abdominal MRI. It is recognised that CT may underestimate the degree of disease, whilst MRI with peritoneal protocol has a higher sensitivity and may provide more accurate description of disease extent for the operating surgeon.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Peritoneal Anatomy. 3. Imaging techniques in peritoneal carcinomatosis including recommended protocols in CT and MRI. 4. Types of peritoneal carcinomatosis including pseudomyxoma peritonei. 5. Treatment of peritoneal carcinomatosis with cytoreductive surgery and HIPEC. 6. Adverse sites of disease on imaging. 7. Summary.

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## Abstract Archives of the RSNA, 2023

GIEE-15

### Contrast-enhanced Ultrasound (CEUS), More Than Just Bubbles: Diagnostic and Interventional Applications in Daily Clinical Practice

#### Participants

Paul Lopez, MBBS, Donostia-San Sebastian, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To learn the potential applications of CEUS throughout the body. -To understand the value of CEUS both in diagnostic and interventional procedures.

#### TABLE OF CONTENTS/OUTLINE

Since its introduction into clinical practice in the late 1990s, CEUS has gained popularity among radiologists as a diagnostic tool in multiple organ systems, and more recently in radiological interventionism. This is due to its great advantages, which include real-time imaging, high contrast resolution and absence of nephrotoxicity among others. This work will review the potential applications of CEUS in daily clinical practice based on cases of our center. -Liver: characterization of benign and malignant focal lesions, role in hepatocellular carcinoma, interventional procedures. -Gallbladder: tumor versus inflammatory process and biliary mold. -Kidney: complex cystic lesions and tumors, interventional procedures. -Urinary tract and bladder: tumor versus clot, grading vesicoureteral reflux in children. -Thyroid: ablation procedures. -Inflammatory bowel disease: evaluation of inflammatory activity, treatment monitoring, fibrous versus inflammatory strictures? -Interventional radiology: guide for percutaneous biopsies, tumor ablations and drain placement, post-ablation surveillance? -Vascular applications: thrombus detection and evaluation, hemorrhage detection?

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## Abstract Archives of the RSNA, 2023

GIEE-150

### Metastatic Lobular Breast Cancer: What the Abdominal Radiologist Needs to Know

#### Participants

David Fidler, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Invasive lobular breast carcinoma (ILC) has a predilection for abdominal and pelvic metastases, with a distinctive distribution and distinctive imaging features. -Three important patterns of abdominal metastasis: Infiltrative submucosal and subserosal metastasis to abdominal and pelvic viscera, mimicking primary abdominal and pelvic malignancy, for example stomach carcinoma (linitis plastica type), colonic carcinoma, uterine and bladder carcinoma; Diffuse peritoneal metastasis, mimicking metastatic ovarian cancer/primary peritoneal neoplasm; Retroperitoneal metastasis, mimicking lymphoma or retroperitoneal fibrosis. -Appears on imaging as smooth, infiltrative lesions, without extramural extension and without desmoplastic reaction. Long segment and multi-organ involvement is typical. MRI signal partially reflects the target organ. -Metastases can occur many years after primary malignancy, and therefore may not be clinically suspected. The radiologist at the MDT may be the first to suggest the diagnosis. -The lesions may not be evident at endoscopy and may be missed on superficial biopsy, therefore radiological suspicion is key

#### TABLE OF CONTENTS/OUTLINE

-Patterns of abdominal metastasis: GI and GU tract; Peritoneum; Retroperitoneum. -Imaging features. -Why is this important to me?

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## Abstract Archives of the RSNA, 2023

GIEE-151

### Transplantation for Type 1 Diabetes: Radiologist's Primer on Pancreatic, Pancreatic-kidney and Islet Cell Transplantation Imaging

#### TEACHING POINTS

1) Overview of transplantation procedures for type 1 diabetes with imaging of pancreatic, pancreatic-kidney and novel strategy of islet cell transplantation. 2) Highlight the clinical indications, surgical anatomy, procedure techniques, pre and post-transplantation imaging. 3) Review expected imaging acquisition parameters for US, CT and MRI. 4) Describe immediate, early and delayed complications of pancreatic, pancreatic kidney and islet cell transplantation.

#### TABLE OF CONTENTS/OUTLINE

- Introduction: Multimodality imaging of pancreatic, pancreatic-kidney and islet cell transplantation with emphasis on transplantation-related complications. Outline
- Pancreatic and pancreatic-kidney transplant-Assessment of donor pancreas and graft implantation.-Imaging modalities: US, CT, MRI, angiography.-Complications: Vascular (Thrombosis, Pseudoaneurysm), transplant pancreatitis, intestinal complications (Leak, Bowel obstruction, Fistula).
- Islet cell transplantation-Pretransplant imaging: Chest x ray, abdominal US-Technique: Portal venogram, islet cell infusion, tract embolization.-Post-transplant imaging: Ultrasound, PET, SPIO MR imaging-Complications: Early (Hemorrhage, Portal vein thrombosis, Arteriportal fistula) and delayed (Heterogenous hepatic steatosis, Immunosuppression related effects).

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## Abstract Archives of the RSNA, 2023

GIEE-152

### Mucking Up the Abdomen: Common and Uncommon Presentations of Pseudomyxoma Peritonei

#### Participants

Ethan Zaccagnino, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pseudomyxoma Peritonei (PMP) is an entity characterized by mucinous ascites due to the spread of mucin producing neoplasms. It commonly presents as acute appendicitis or RLQ pain with imaging revealing a mucocele of the appendix. Mucocele rupture may cause spread of tumor into the abdomen resulting in peritoneal implantation. Less common sites of origin include gallbladder, small intestine, pancreas, breast and ovary/fallopian tubes. Imaging findings include mucinous or soft-tissue peritoneal implantations and mass effect or scalloping of the abdominal viscera. Ultrasound may detect mucinous ascites or discrete tumors, however cross-sectional imaging with CT or MR is preferred to characterize PMP. Treatment options include surgical debulking and Hyperthermic Intraperitoneal Chemotherapy (HIPEC). Serial imaging is often warranted, as recurrence is common.

#### TABLE OF CONTENTS/OUTLINE

1. Intro to pseudomyxoma peritonei (PMP). 2. Mucinous tumors (low and high grade appendiceal mucinous neoplasms, as well as mucinous adenocarcinoma) and sites of origin. 3. Epidemiology of mucinous tumors and PMP. 4. Multimodality imaging features of mucinous tumors and PMP. 5. Treatment (HIPEC and surgical debulking) and complications (mucinous ascites and recurrence) of PMP. 6. Mimics of PMP as well as situations in which mucinous tumors and PMP can mimic non-neoplastic entities. 7. Common and uncommon presentations. 8. Summary and conclusion.

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## Abstract Archives of the RSNA, 2023

GIEE-153

### Diagnosis of Biliary Atresia: Featured Images for the Radiologist

#### TEACHING POINTS

- -Identify the normal liver and bile duct findings in different imaging modalities and the main characteristics and classification of biliary atresia.
- -Illustrate the featured signs and imaging data in the diagnosis of biliary atresia and their post-operative complications.

#### TABLE OF CONTENTS/OUTLINE

- Normal pediatric liver ultrasound.
- Some facts about biliary atresia.
- Ultrasound findings.
- Normal and pathological hepatobiliary scintigraphy.
- Findings in percutaneous procedures.
- Imaging in post-operative complications.

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## Abstract Archives of the RSNA, 2023

GIEE-154

### Integrating Intestinal Ultrasound (IUS) into an Inflammatory Bowel Disease (IBD) Imaging Service

#### TEACHING POINTS

- Successful control of Crohn's Disease (CD) relies on effectively suppressing inflammation which requires ongoing monitoring. - A number of trials have validated intestinal ultrasound (IUS) as having excellent diagnostic accuracy in patients with CD, performing comparably to established modalities such as MRI. International guidelines recommend that newly diagnosed CD patients undergo small bowel assessment with IUS or MR enterography. - Additionally, ultrasound is cost-effective, widely available and better tolerated by patients which is crucial when regular monitoring is required. - A one-stop clinic where patients undergo IUS with subsequent assessment by a gastroenterologist enables timely implementation of a targeted management plan for better disease control. - Operators must have appropriate training and experience with IUS as well as a methodical and reproducible technique for accurate disease assessment. - With sufficient operators trained in IUS, it may also be offered as a point-of-care test in the emergency department. - Oral and intravenous contrast may be used in IUS selectively to provide additional information. - A reporting template can serve as a useful aid to performing a comprehensive study. Successful implementation requires multidisciplinary input involving radiology, gastroenterology, and surgery.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. One-stop clinic 3. Resources 4. Technique 5. Sonographic appearances of IBD: Case Studies 6. Summary

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## Abstract Archives of the RSNA, 2023

GIEE-155

### The Hepatic Angiomyolipoma: A Guide to Avoiding a Big Fat Mistake

#### Participants

Ana Paula Fraga Cintra Gonzaga, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Provide an overview of hepatic angiomyolipoma (HAML). Discuss typical and atypical cases of HAML with an emphasis on imaging features. Review the main differential diagnoses of HAML with a didactic approach. Offer useful tips for challenging cases to enhance accurate diagnosis and patient outcomes. Develop a radiological survival guide for interpreting fat hepatic nodules.

#### TABLE OF CONTENTS/OUTLINE

HAML is a rare tumor with a combination of blood vessels, smooth muscle, and varying degrees of mature fat. Despite limited research on HAML, this presentation aims to offer a comprehensive overview of the key features of this lesion, including epidemiology, associations (such as tuberous sclerosis), pathology, radiographic features, prognosis, and treatment. Using case-based presentations, we will explore both classical and uncommon imaging manifestations of HAML, including potential malignant behavior. Additionally, the presentation will discuss the differential diagnosis of HAML, ranging from benign lesions (lipoma, nodular hepatic steatosis, steatotic adenoma, and focal nodular hyperplasia) to malignant neoplasms (HCC and metastasis). Tips for differentiating these diagnoses based on imaging and other clinical factors will be provided. Provide tips for challenging cases where the diagnosis may not be apparent from imaging alone, and radiologists can still play a critical role in contributing to better patient outcomes. Propose a radiological survival guide. This guide will summarize key radiographic and non-radiographic features of HAML, along with differential diagnoses and important clinical considerations, to assist radiologists in accurate diagnosis and appropriate patient management.

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## Abstract Archives of the RSNA, 2023

GIEE-156

### Bariatric Surgery: A Pictorial Review. From Post-Surgical Anatomy to Complications

#### Participants

Maria Galante I, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the normal postsurgical anatomy of the most common bariatric surgery techniques.- To analyze the most frequent complications of each of them, with CT and fluoroscopic imaging.- To present CT images of interesting cases of patients that have undergone bariatric surgery procedures.In this exhibit we will review the most frequent bariatric techniques and their complications, that are divided in late and early depending on the postoperative period in which that may appear (more or less than one month). Older procedures such as vertical-banded gastroplasty and jejuno-ileal bypass will not be assessed.

#### TABLE OF CONTENTS/OUTLINE

1. Generalities and indications of bariatric surgery  
2. Classification  
3. Post- surgical imaging control protocol  
4. Restrictive Surgeries: Anatomical imaging features and main complications  
4.1 Adjustable Gastric Banding  
4.2 Sleeve Gastrectomy  
5. Restrictive and Malabsorptive Procedures: Anatomical imaging features and main complications  
5.1 Roux-en-Y- Gastric Bypass  
5.2 Anastomosis duodenoileal bypass (SADI-s), minigastric bypass, duodenal switch  
6. Conclusions

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## Abstract Archives of the RSNA, 2023

GIEE-157

### Tricky abdominal cases: Practical approach using Spectral CT

#### Participants

Ana Villanueva, MD, Toronto, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn the benefits of spectral CT applications in challenging abdominal imaging cases  
2. Role of spectral CT in patient's care, how we can change management decisions

#### TABLE OF CONTENTS/OUTLINE

1. Background: Revision of basic concepts of spectral CT.  
• Definition  
• Types of Spectral CT available in the market  
• Review of different material decomposition applications  
2. Review of challenging abdominal and pelvic cases.  
• Case-based and interactive format- The reader will be able to click on different stories to go through broad spectrum of cases covering most of abdominal and pelvic organs- We will display daily situations where the radiologist could feel stuck while reporting the CT- Companion quiz questions and teaching points/tips will be shown- Updated literature will be provided for each case. By clicking on each reference, the reader will be redirected straight to the actual paper  
• To propose an algorithm to guide the radiologist to accurately reach the diagnosis  
• To demonstrate how spectral CT is useful for problem solving and the radiologist could aid in successful decision-making and avoid additional imaging or procedures  
3. Limitations of spectral CT  
4. Conclusion

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## Abstract Archives of the RSNA, 2023

GIEE-158

### Don't Be Thrown for a Loop! A Review of Internal Hernias for the Abdominal Imager

#### TEACHING POINTS

Internal hernias are herniations of abdominal viscera, usually small bowel, through congenital or acquired openings of the peritoneum or mesentery. Internal hernias can obstruct and are considered surgical emergencies due to the high risk of bowel strangulation. If complications such as bowel obstruction or ischemia are not present, then imaging findings of internal hernia will consist primarily of displacement of normal abdominal structures. After reviewing this exhibit, the viewer will be familiar with the various kinds of congenital and acquired hernias, as well as the epidemiology, surgical risk factors, imaging appearance, and complications associated with internal hernias.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Congenital Hernias 2a. Brief review of embryology and general anatomy Types of Hernias with accompanying cases. 2b. Lesser Sac (Foramen of Winslow). 2c. Left paraduodenal (Fossa of Landzert). 2d. Right paraduodenal (Fossa of Waldeyer) 2e. Pericecal 2f. Transomental: Greater Omentum and Lesser Omentum 2g. Sigmoid 2h. Broad Ligament 3. Acquired/Iatrogenic 3a. Introduction to Acquired Hernias and commonly associated surgeries 3b. Roux en Y/ Gastric Bypass: Description of Procedure and Associated Hernias 3c and d. Epidemiology, Anatomy, and Imaging appearance of: transmesenteric and jejuno-jejunostomy hernias 3e. Left colectomy and low anterior resection 3f. Epidemiology, Anatomy, and Imaging appearance of the following: herniation of the small bowel inferior to the neorectum. 4. Complications 4a. Bowel obstruction, including closed loop 4b. Strangulation and Ischemia 5. Summary

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## Abstract Archives of the RSNA, 2023

GIEE-159

### Periportal Lesions - Tiny Space, Huge Possibilities

#### Participants

Cynthia Borborema, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review the anatomy of the periportal space and its pathophysiology;
- To present the most relevant anatomical variants.
- To compartmentalize the periportal lesions through a series of cases.
- To introduce the disorders that may affect that space with a brief review of the clinical context and imaging findings.

#### TABLE OF CONTENTS/OUTLINE

- The periportal region is the anatomic space around the portal vein and its intrahepatic branches composed of hepatic artery branches, bile duct branches, lymphatics, and nerves that can be affected by a variety of pathological conditions. Due to its complex anatomical architecture and the wide possibility of lesion natures, involvement of the periportal space can be a diagnostic challenge for radiologists.
- Review of periportal anatomy with didactic illustrations of the main anatomical variants.
- In this presentation periportal lesions will be divided into the following categories: vascular (pathologies of the portal vein and hepatic artery), lymphatic (pathologies of periportal lymphatics), neural (pathologies of periportal nerves), periportal space as a pathway for diseases to spread and miscellanea.
- A complete case-based review of common (periportal edema, portal biliopathy, peribiliary cysts, infectious diseases) and unusual disorders involving the periportal space, such as segmental arterial mediolysis, metastatic calcifications, plexiform neurofibroma, extramedullary hematopoiesis, amyloidosis, lymphangioma, hepatic artery giant pseudoaneurysm, ganglioneuroma, schwannoma.

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## Abstract Archives of the RSNA, 2023

GIEE-16

### Imaging of Pancreas Transplants: A Comprehensive, Multimodality Review

#### Participants

Rachel Perez, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Anatomy and surgical technique 2. Key imaging features and techniques 3. Pancreas transplant complications

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review of normal/donor pancreatic anatomy 2a. Donor arterial supply, venous drainage, and exocrine drainage 3. Surgical technique/transplant anatomy 3a. Systemic-venous drainage 3b. Portal-venous drainage 3c. Exocrine Bowel drainage 3d. Exocrine Bladder drainage 3e. Stepwise approach to identifying anatomy 4. Imaging 4a. Ultrasound and Contrast-Enhanced Ultrasound 4b. CT/CTA 4c. MRI/MRA (including ferumoxytol) 5. Biopsy technique 6. Complications 6a. Parenchymal 6a1. Rejection 6a2. Pancreatitis 6b. Vascular 6b1. Thrombosis 6b2. Stenosis 6b3. Hemorrhage 6b4. Pseudoaneurysm 6b5. Arteriovenous Fistula 6c. Bowel 6c1. Small Bowel Obstruction 6c2. Exocrine leak 7. Summary of key learning points

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## Abstract Archives of the RSNA, 2023

GIEE-160

### The Anatomy of Normal and Abnormal Swallowing

#### Participants

Nancy J. McNulty, MD, (*Presenter*) Book contract, Oxford University Press

#### TEACHING POINTS

The oral cavity, pharynx, larynx, and surrounding muscles, bones and cartilaginous structures work together in a sophisticated and coordinated way to achieve normal swallowing. Accurate diagnosis of swallowing dysfunction requires a comprehensive understanding of what is normal, and how normal structures work in a coordinated fashion to achieve deglutition. This exhibit will review the components of swallowing that are voluntary, such as chewing, forming a bolus of food on the tongue, and initiating deglutition, and the involuntary reflexes that are initiated by stimulation of the palate or touch receptors in the pharynx. The pertinent anatomy, including muscles and their innervation, will be highlighted and reinforced. Clinically, swallowing dysfunction can be assessed with a video fluoroscopic barium swallow study. Normal swallowing exams will be used to demonstrate normal function, and highlight the components of a normal swallow.

#### TABLE OF CONTENTS/OUTLINE

Outline the sequence of events that occur during normal swallowing. Explain the muscles involved in the voluntary and involuntary tasks of swallowing and their innervation. Identify the anatomy and the role of structures of the head and neck during normal swallowing, and how they work to prevent nasopharyngeal regurgitation and aspiration. Review components of normal swallowing function on video swallowing examinations with audio narration. Observe video swallowing examinations with audio narration highlighting commonly encountered types of swallowing dysfunction.

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## Abstract Archives of the RSNA, 2023

GIEE-161

### The Invaluable Role of CEUS in HCC imaging: Planning and Guidance of Ablative Therapy and Secondary Surveillance Following Treatment

#### Participants

Shayan Hemmati, BSc, Calgary, AB (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) The unique benefits of hepatocellular carcinoma (HCC) diagnosis with contrast enhanced ultrasound (CEUS) include dynamic real time imaging and bubble tracking techniques, along with exquisite sensitivity for detection of arterial phase hyperenhancement (APHE) and washout (WO).(2) The advantages of performing CEUS prior to ultrasound guided ablative therapy for HCC include accurate identification of the nodule and grayscale occult lesions, determination of the best ultrasound technique (probe selection, patient positioning/beat hold), and identification of any unexpected findings that would alter or preclude ablative therapy (ex. additional lesions or tumour in vein).(3) Performance of CEUS at the time of ablation is essential to guide probe placement for grayscale occult or difficult to visualize nodules allowing the interventionalist to target either foci of APHE or areas of WO.(4) Performance of immediate post ablation CEUS to assess for completeness of ablation increases the number of successful ablations by allowing immediate identification and re-treatment of residual tumour or non-target ablations.(5) Inclusion of CEUS in secondary surveillance optimally resolves indeterminate or equivocal MRI results. Recognition of non-linear artifact on CEUS, arising from the microwave ablation probe tract, is essential to avoid misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

- Background - Diagnosis of HCC with CEUS - Ablation Planning with CEUS - Ablation Targeting with CEUS - Immediate Post-ablation Assessment with CEUS - Secondary Surveillance with CEUS - Conclusion - References

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## Abstract Archives of the RSNA, 2023

GIEE-162

### Role of Imaging in Systemic Therapy for HCC

#### Participants

Kevin Zand, MD, Washington, DC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Multiple combined and single systemic therapies are currently FDA approved for intermediate and advanced stage HCC.2. Systemic therapy for HCC improves overall survival in patients who are not candidates for curative or locoregional therapies or who have failed locoregional therapy.3. Imaging has a key role in the post treatment evaluation, response assessment, and diagnosis of potential complications.4. LI-RADS treatment response algorithm is not applicable to the systemically treated HCC.5. HCC response to immunotherapy is different compared to chemotherapy, and should be considered in tumor response assessment by imaging.

#### TABLE OF CONTENTS/OUTLINE

1. The current role and survival benefit of immunotherapy for HCC2. Review of response assessment criteria in the systemically treated HCC (RECIST, mRECIST, and other criteria) and their use in clinical trials that lead to FDA approval of the new agents3. Post treatment imaging assessment. Representative cases will illustrate the imaging before and after systemic therapy (at multiple time points when relevant) with correlation with the clinical course and overall outcomes.(a) Representative cases from patients with favorable/stable outcomes.(b) Representative cases from patients with poor outcome.(c) Representative cases showing treatment related complications4. Review of emerging literature on combined immunotherapy with locoregional therapy 5. Limitations of treatment response assessment after systemic therapy for HCC and future directions

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## Abstract Archives of the RSNA, 2023

GIEE-163

### Hypointense Hepatic Findings on Hepatobiliary Phase Imaging

#### Participants

Kelly Harper, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the mechanism of hepatocellular contrast agent uptake and factors affecting it - Liver parenchyma hypointensities in hepatobiliary phase (HBP) can be diffuse, regional, and focal - Parenchymal hypointensities can be due to technical, parenchymal, vascular, and biliary causes - Both hepatocellular and non-hepatocellular lesions can show hypointensity - Hypointensity of a lesion is useful for its characterization - Hypointensity around a neoplasm may be associated with aggressive nature with management implications

#### TABLE OF CONTENTS/OUTLINE

- Parenchymal hypointensity
  - o Diffuse
    - o Technical- timing; opposed phase imaging; no fat suppression, low flip angle.
    - o Parenchymal
      - § Poor hepatocyte function-chronic liver disease
      - § Diffuse hepatic steatosis.
      - § Iron overload
      - § Infiltrative disorders- fibrosis, amyloidosis, malignancy etc
      - § Drug injury
      - § Genetic polymorphism of OATPB1
    - o Vascular
      - § Acute portal vein-narrowing or occlusion
      - § Portal hypertension Sinusoidal obstruction syndrome
    - o Distal biliary obstruction- common bile duct
    - o Regional (lobar/segmental/geographical)
      - o Parenchymal
        - § Radiation- SBRT
      - o Vascular
        - § Acute portal vein branch occlusion
        - § Portal vein embolization
        - § Hepatic vein occlusion
      - o Bile duct branch occlusion
    - o Focal
      - o Focal fat deposits
      - o Focal confluent fibrosis
      - o Arterioportal shunts
      - o Infective/inflammatory- cholangitis
  - Hypointense lesions
    - Hepatocellular lesions
      - o Hepatocellular carcinoma
      - o Hepatic adenoma
    - Non hepatocellular lesions
      - o Cysts
      - o Metastases
      - o Hemangioma
      - o Cholangiocarcinoma

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## Abstract Archives of the RSNA, 2023

GIEE-164

### Inclusion of Liver CEUS in Current Practice Guidelines

#### Participants

Stephanie Wilson, MD, Calgary, AB (*Presenter*) Equipment support, Koninklijke Philips NV; Equipment support, Siemens AG; Equipment support, Samsung Electronics Co, Ltd; Research support, Samsung Electronics Co, Ltd;

#### TEACHING POINTS

(1) Current North American guidelines of relevance for liver imaging with CEUS include those from AASLD, American Association for the Study of Liver Disease; NCCN, National Comprehensive Cancer Network; and LI-RADS, Liver Imaging Reporting and Data Systems, a classification for those at risk for HCC including an algorithm for categorization of nodules shown on imaging. (2) CEUS was originally not favored for liver imaging because of misconceptions about its ability to differentiate hepatocellular carcinoma from cholangiocarcinoma. (3) Current data shows CEUS performs equivalent and often superior to CT/MR for characterization of liver nodules. (4) CEUS techniques for metastasis detection and diagnosis include sweeping the liver in the portal venous phase to show washout zones and on top injections to show the arterial enhancement of washout lesions. (5) CEUS STRENGTHS include: - Resolution of indeterminate nodules from CT/MRI, with reduction of biopsy - High specificity for HCC within LI-RADS allowing treatment of HCC following CEUS without biopsy. - Accurate characterization of nodules found on surveillance US for HCC. - Better correlation of nodules from surveillance US than shown with MRI, making CEUS the modality of choice as the first test following positive surveillance US. - Optimal diagnosis of small metastases

#### TABLE OF CONTENTS/OUTLINE

-Introduction of Guidelines for Liver Imaging -AASLD emphasizing imaging for suspect or confirmed HCC. -NCCN emphasizing long-term surveillance of patients at risk for development of metastases. -LI-RADS and its algorithm for categorization of liver nodules, with integration of CEUS LI-RADS with LI-RADS for CT/MRI. -Our perspective on Liver Imaging with CEUS.

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## Abstract Archives of the RSNA, 2023

GIEE-165

### Recognizing Benign Lesions in Cirrhotic Liver: Moving Beyond Odds and Enhancing Interpretation

#### TEACHING POINTS

1 - This review aims to enhance the recognition and interpretation of benign lesions in patients with cirrhotic liver that may arise due to underlying cirrhosis or occur incidentally. 2 - Illustrate with cases the typical and atypical features of these lesions using computed tomography (CT) and magnetic resonance imaging (MRI). 3 - Provide practical considerations and diagnostic clues to minimize misunderstandings in interpretation and ensure accurate assignment of the Liver Imaging Reporting and Data System (LI-RADS®) category.

#### TABLE OF CONTENTS/OUTLINE

1 - Definition of cirrhosis and its impact on the appearance of benign lesions. 2 - Describing the imaging presentations of various benign entities in cirrhotic liver on CT and MRI, distinguishing between their typical and atypical features. 3 - Practical considerations and diagnostic clues to differentiate from malignancy and how to assign the correct LI-RADS® category.

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## Abstract Archives of the RSNA, 2023

GIEE-166

### What's New in Classification, Pathology, Imaging Findings, and Management of Cystic Liver Diseases: 2023 Update

#### Participants

Sriram Jaganathan, MBBS, Littlerock, AR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Discuss 2023 updates on the classification, nomenclature, and pathology of developmental, non-neoplastic neoplastic cystic liver disease
- Review spectrum of imaging findings role of different imaging modalities in diagnosis management
- Discuss current updates in management strategies with special emphasis on the 2022 European Association for the Study of the Liver (EASL) clinical practice guidelines

#### TABLE OF CONTENTS/OUTLINE

Introduction Classification Nomenclature of hepatic cystic diseases Molecular pathogenesis hepatic cystogenesis updates Imaging Techniques: US/CT/MRI PET/CT Polycystic liver disease (PLD) Role of imaging in assessing cyst volumes, total liver volumes treatment follow-up; Gigot Schnelldorfer classifications; Complications Management Non-neoplastic Cysts Simple hepatic cysts (malformation of the ductal plate): cystic bile duct hamartoma; Infections: Abscess, Echinococcal cyst; Congenital: choledochal cyst Caroli disease, foregut cyst, von Meyenberg complex; Miscellaneous: peribiliary cysts, organizing hematoma, fibrous cyst pseudocyst Cystic Neoplasms Mucinous cystic neoplasms, Intraductal papillary neoplasm, tubulopapillary oncocytic papillary neoplasms, cystic metastases, HCC, cholangiocarcinoma rare tumors. Imaging spectrum of cystic liver diseases Management: EASL 2022 clinical practice guidelines with the central role of imaging Conclusion Imaging is pivotal in diagnosing, guiding appropriate treatment, and assessing complications for cystic liver diseases. By emphasizing up-to-date imaging findings and recommendations, radiologists are better equipped to provide effective patient care.

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## Abstract Archives of the RSNA, 2023

GIEE-167

### Liver Transplant Complications; Case Review from Our Hospital

#### Participants

Iskander Arteche Arnaiz, MD, Barakaldo, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Get to know the normal findings of the immediate postoperative period of liver transplantation. Mention the most frequent complications classified into arterial, venous and biliary based on cases seen in our Hospital.

#### TABLE OF CONTENTS/OUTLINE

OLT (orthotopic liver transplantation) is the definitive treatment for patients with end-stage liver disease, acute fulminant liver failure, some neoplasms (HCC, metastases...increasingly broad indications). The surgical technique consists of extracting the donor (dissection of the hepatic hilum on a bench + arterial reconstruction if variants) and subsequent implantation. The first step to take when evaluating a liver graft will be to read the surgical report to later understand the images. An ultrasound is mainly performed 24 hours after the transplant, in which we assess the parenchyma, the bile duct, and the flow of the arterial and venous vessels. It will be important to know the normal ultrasound findings. Complications are divided into arterial, venous and biliary. Regarding arterial complications, we have occlusion of the hepatic artery due to dissection/thrombosis of the latter (the most serious complication), hepatic artery stenosis, and pseudoaneurysms. Regarding biliary complications, we have, on the one hand, biliary strictures, most of them anastomotic (they may be non-anastomotic in the intrahepatic bile duct but are related to other causes such as ischemia) and on the other hand the bile leakage. Venous complications are the least frequent, and can affect both the suprahepatic veins and the portal vein, and consist mainly of thrombosis and stenosis.

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## Abstract Archives of the RSNA, 2023

GIEE-168

### Uncommon Pancreas Solid Lesions: Spectrum of Imaging Appearance and Radiologic-Pathologic Correlation

#### Participants

Yoshihiko Fukukura, MD, PhD, Kurashiki, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS Pancreatic solid lesions display a wide spectrum of histology, including exocrine and endocrine tumors. The most common tumors of exocrine and endocrine tumors of the pancreas are ductal adenocarcinoma and neuroendocrine tumor, respectively. Uncommon tumors that need to be differentiated from the common pancreas solid tumors include adenosquamous carcinoma, colloid carcinoma, undifferentiated carcinoma, acinar cell carcinoma, solid-pseudopapillary neoplasm, etc. Familiarity of imaging findings of the uncommon tumors is important to arrive at the correct diagnosis of pancreas solid lesions because a precise diagnosis determines the treatment and surgical approach. The purpose of this exhibit is: 1. To describe the imaging and histopathologic features of uncommon pancreas solid tumors 2. To recognize and describe the imaging appearance of some mimics of pancreas solid tumors 3. To discuss the imaging differential diagnosis of pancreas solid tumors

#### TABLE OF CONTENTS/OUTLINE

1. Review of CT and MR imaging findings of uncommon pancreas solid tumors, with histopathological correlation. 2. Highlight key differential diagnostic points of pancreas solid tumors. 3. Summary: Awareness of radiological findings of uncommon pancreas solid tumor is important to arrive at the correct diagnosis of pancreas tumors.

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## Abstract Archives of the RSNA, 2023

GIEE-169

### Non-contrast Vascular Reconstruction in Patients with a History of Contrast Agent Allergy

#### TEACHING POINTS

Depiction of vascular information by contrast-enhanced CT is required for preoperative examination of surgery. However, there are often cases where it is difficult to use a contrast medium due to allergies to the contrast medium. We have developed a virtual abdominal contrast CT image as a preoperative vascular image by non-contrast CT image for such cases. We performed CT without contrast medium infusion in the abdomen. High-definition scanning conditions were set for image reconstruction. Vascular extraction was performed on the obtained CT volume data using workstation automatic tracking. After that, the multi-planar reconstruction display (MPR) was created from the CT image. By combining the blood vessel information and the MPR display, it was possible to create a virtual abdominal contrast CT image similar to the conventional contrast CT without injecting a contrast medium. The images we developed were evaluated to have important information for the surgeon.

#### TABLE OF CONTENTS/OUTLINE

1. Necessity of vascular information and problems of contrast agent allergy 2. Scan technique for blood vessel extraction 3. Extraction of abdominal blood vessels using automatic tracking 4. Creating an MPR display 5. Composite display of blood vessel image MPR display 6. Clinical significance of virtual abdominal contrast CT images

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## Abstract Archives of the RSNA, 2023

GIEE-17

### **Misdiagnosis of Pancreatic Intraductal Papillary Mucinous Neoplasms and the Challenge of Mimicking Lesions: Imaging Diagnosis and Differentiation Strategies**

#### **TEACHING POINTS**

1. Accurate diagnosis of lesions that mimic IPMNs is crucial to determine appropriate surveillance or resection. 2. There is a risk of overdiagnosis and overtreatment of potentially neoplastic lesions with up to half of cystic lesions mischaracterized on imaging. 3. Using dedicated pancreatic protocol CT and noting unique features such as a bulging ampulla for IPMNs or the extracapsular cystic sign of SCAs can aid in distinguishing subtle differences. Additionally, a "cysts-within-a-cyst" appearance is often present in MCN, giving them a multilocular appearance, as opposed to the "cyst-by-cyst" presentation of IPMNs. 4. Cystic pancreatic neuroendocrine tumors have peripheral hypervascular rim on arterial phase CT. 5. Lymphoepithelial cysts have a cheerios-like appearance with signal drop out on out of phase images. 6. Pancreatic schwannoma has progressive homogeneous enhancement with areas of necrosis. 7. Chronic pancreatitis has a chain of lake appearance with strictures, intraductal calculi, and parenchymal calcifications. 8. EUS, FNA, fluid analysis, cytology, radiomics, and artificial intelligence are all useful tools for definitive diagnosis when CT and MRI are not specific enough.

#### **TABLE OF CONTENTS/OUTLINE**

1. IPMN diagnosis and misdiagnosis 2. Misdiagnosis of mimicking lesions and strategies to accurate diagnosis-Macrocytic Serous Cystadenoma-Cystic Pancreatic Neuroendocrine Tumor-Mucinous Cystic Neoplasm-Lymphoepithelial Cyst-Duodenal Diverticulum-Pancreatic Schwannoma-Chronic Pancreatitis-Retention Cyst and Cystic Fibrosis-Intrapancreatic Accessory Spleen and Epidermoid Cyst-Pancreatic Lipoma or Interdigitating Fat-Choledochal Cyst 3. Conclusion

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## Abstract Archives of the RSNA, 2023

GIEE-170

### Advanced Ultrasound Techniques for Liver Transplantation Evaluation

#### Participants

Gonzalo Martin Ordonez, MD, Majadahonda, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the usual Doppler technique for liver graft follow-up and for evaluation of complications. To describe the use of contrast enhanced ultrasound (CEUS) in the evaluation of vascular complications and graft ischaemia. To describe the use of shear wave elastography in the evaluation of medical complications.

#### TABLE OF CONTENTS/OUTLINE

Liver transplantation is the treatment of multiple end-stage liver diseases. Medical and surgical complications are an important source of morbidity and mortality, and radiological examinations are essential for their early detection. Doppler ultrasound is the preferred imaging technique in the initial evaluation of the liver graft and during follow-up due to its portability and the unique hemodynamic information it provides. The use of CEUS allows to confirm vascular complications to define the location and the extension of ischemic areas, and to ascertain biliary tract ischemic involvement, what that is key for deciding the optimal treatment. Shear-wave elastography provides a non-specific but interesting quantitative information that allows for a sequential evaluation of the liver parenchyma. It is useful in the diagnosis and follow-up of medical complications including rejection and the rarer obstructive sinusoidal syndrome. The liver rigidity also aids to decide in which patients a biopsy should be done. We show a pictorial review of cases from our institution to illustrate the vascular, biliary and medical complications that can be evaluated with these techniques.

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## Abstract Archives of the RSNA, 2023

GIEE-171

### Advanced Abdominal MRI Techniques and Problem-solving Strategies

#### Participants

Yoonhee Lee, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Magnetic resonance imaging (MRI) plays an important role in abdominal imaging owing to its ability of detection and characterization of focal lesions. Nowadays, techniques for reducing scan time with an acceptable image quality such as parallel imaging, compressed sensing (CS) technique, and nowadays cutting edge deep learning (DL) techniques have arisen for problem solving strategies. Also free breathing techniques using dynamic phase involving extra-dimensional (XD)-volumetric interpolated breath-hold examination (VIBE), and golden-angle radial sparse parallel (GRASP) can help patients with severe dyspnea or under sedation perform abdomen MRI. Therefore, this pictorial review aims to show various advanced abdomen MRI techniques for reducing scan time with maintaining image quality and free breathing techniques during dynamic phase, and representative cases with aforementioned techniques.

#### TABLE OF CONTENTS/OUTLINE

•I. Reducing scan time and improving image quality 1.Parallel imaging : Dynamic phase (Controlled Aliasing in Parallel Imaging Results in Higher Acceleration), Half-Fourier-acquisition single-shot turbo spin-echo (HASTE) 2.Compressed sensing technique : Dynamic phase, Magnetic resonance cholangiopancreatography 3.Deep learning (DL) : T2 weighted image, Diffusion weighted image  
•Strength and pitfalls of DL while radiologists interpreting lesions 4.Motion corrected diffusion weighted image • •II. Free breathing technique during dynamic phase 1.Stack of Stars volumetric interpolated breath-hold examination (StarVIBE) 2.Extra-dimensional (XD)-VIBE 3.Golden-angle radial sparse parallel (GRASP)

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## Abstract Archives of the RSNA, 2023

GIEE-172

### Imaging of Pancreatic Cystic Lesions: What Radiologists Should Know

#### Participants

Akihiko Kanki, MD, Kurashiki, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this presentation is: 1) To demonstrate the common and uncommon computed tomography and magnetic resonance imaging findings of neoplastic pancreatic cystic lesions, including the radiologic-pathologic correlation. 2) To learn about the non-neoplastic and cyst-like lesions of the pancreas that can mimic pancreatic cystic neoplasms.

#### TABLE OF CONTENTS/OUTLINE

Classification of Pancreatic Cystic Lesions  
Imaging findings of common pancreatic cystic lesions  
Neoplastic pancreatic cystic lesions  
• Mucinous cystic neoplasm  
• Serous neoplasm  
• Intraductal papillary mucinous neoplasm  
• Intraductal tubulopapillary neoplasm  
• Intraductal oncocytic papillary neoplasm  
Imaging findings of uncommon pancreatic cystic lesions  
• Intraductal papillary mucinous neoplasm complicated with intraductal hemorrhage, perforation and fistula formation  
• Mucinous cystic neoplasm occurring with side branch-type intraductal papillary mucinous neoplasm  
Non-neoplastic and cyst-like lesions of the pancreas that can mimic pancreatic cystic neoplasms  
Non-neoplastic pancreatic cystic lesions  
• Squamous lined cyst  
• Acinar cystic transformation  
Various pancreatic tumors with cystic degeneration  
• Solid pseudopapillary neoplasm  
• Others

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## Abstract Archives of the RSNA, 2023

GIEE-173

### Pseudomyxoma Peritonei: Imaging Features and Current Therapies

#### Participants

Laura Jorgenson, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Define pseudomyxoma peritonei. Understand and describe the histopathology, pathophysiology, and etiologies of PMP, with a focus on appendiceal and ovarian neoplasms. Describe the multimodality imaging features of pseudomyxoma peritonei. Recognize complications related to PMP, mucinous tumor burden, and cytoreductive surgery. Discuss specific imaging findings which are essential to the surgical oncologist in determining resectability and cytoreductive surgery planning. Review current therapies available to patients with PMP.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE 1. Definition of PMP and imaging features  
Define  
Optimizing US, CT, MR, and PET image acquisition  
Imaging features on different modalities  
Natural History 2. Tumor Origin  
Appendiceal  
Ovarian  
Non-malignant causes  
Differentiation from multicystic mesothelioma  
Brief review of pathologies of peritoneal surface malignancies 3. Potential Complications and related imaging features 4. Example reporting template 5. What the surgeon needs to know and current therapies  
Peritoneal Carcinomatosis Index (PCI)  
Cytoreductive Surgery  
HIPEC  
Systemic chemotherapy - understanding response to therapy vs. progression

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## Abstract Archives of the RSNA, 2023

GIEE-174

### Dual Energy CT Angiography in Acute Mesenteric Ischemia - A Review

#### Participants

Aachi Kaushik Chary, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To define the clinical presentation of acute mesenteric ischemia and dual energy CT angiography protocol for its diagnosis-To illustrate the types and various imaging features of acute mesenteric ischemia on dual energy CT- To discuss the benefits of dual energy CT in acute mesenteric ischemia

#### TABLE OF CONTENTS/OUTLINE

Acute mesenteric ischemia (AMI) is a common potentially fatal condition requiring accurate and prompt image-based diagnosis to ensure quick treatment to save the bowel .The exhibit includes the following contents-Depiction of the clinical presentation of AMI along with the details of dual energy CT angiography protocol-Enumeration of the various causes and types of AMI-Detailed illustration of the vascular, bowel and associated findings on dual energy CT angiography in patients presenting with different types of AMI, with emphasis on the ominous signs-Elaborate discussion with illustrations on the benefits of dual energy CT including generation of virtual non-contrast images which reduce radiation dose, iodine maps representing tissue perfusion, and mono-energetic images which improve image contrast and thus diagnostic ability-Brief depiction of the role of interventional radiology in AMI

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## Abstract Archives of the RSNA, 2023

GIEE-175

### Ancillary Features Are Coming to LI-RADS Treatment Response Algorithm: Let's Get You Ready

#### TEACHING POINTS

- The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for assessing and reporting treatment response after locoregional therapy (LRT) for hepatocellular carcinoma (HCC).- Emerging radiology-pathology and inter-reader studies have highlight the potential for ancillary features to improve detection of incomplete necrosis with greater radiology-pathology concordance.- This exhibit highlights the updates in the LR-TRA v2023 (compared to v2018), especially pertaining to the role of newly incorporated ancillary features. The overall objective of the changes is to improve diagnostic accuracy of post-treatment imaging assessment.

#### TABLE OF CONTENTS/OUTLINE

- Summarize the role of the TRA in the context of the currently used treatments for HCC.- Provide an evidence-based review of current literature highlighting the value of incorporating ancillary features in treatment response assessment after locoregional therapy in HCC.- Highlight key updates of the LI-RADS v2023 TRA pertaining to use of ancillary features after various forms of LRT for response assessment, using a case-based and illustrative approach.

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## Abstract Archives of the RSNA, 2023

GIEE-176

### Ischemic Cholangiopathy: Imaging Patterns and Other Biliary Complications Following DCD Liver Transplant

#### Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Describe various imaging patterns of ischemic cholangiopathy post DCD liver transplant on MRI/MRCP. 2. Elaborate prognostic significance of these imaging patterns. 3. Discuss additional biliary complications post liver transplant.

#### TABLE OF CONTENTS/OUTLINE

Four different patterns of IC: have been identified, each correlating with DCD allograft prognosis.

- Diffuse necrosis: Most severe form with nearly 100% need for retransplant, characterized by multifocal biliary strictures, wall necrosis and bile lakes. Usually, hepatic artery is severely stenosed or occluded.
- Multifocal progressive: Starts as mild to moderate multifocal stricturing cholangiopathy that progresses in a few months to more severe form with worsening strictures or even biliary necrosis. >50% need for retransplant.
- Confluence dominant: Mild to moderate cholangiopathy that involves the biliary confluence. Most cases can be managed without need for retransplant.
- Minor Form: Mild areas of multifocal stricturing that remain stable or resolve.

Other liver transplant biliary complications:

- Anastomotic stricture
- Bile leak/anastomotic dehiscence
- Vanishing bile duct syndrome (ductopenia)
- Biliary stones; Biliary cast syndrome; hemobilia
- Cystic duct remnant mucocele
- Roux limb bleeding, Roux limb stasis or obstruction.

Summary IC post DCD liver transplant is a major source of allograft complications. Identifying different patterns of IC can help stratify need for stenting and predict allograft prognosis.

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## Abstract Archives of the RSNA, 2023

GIEE-177

### Multimodality Imaging Biomarkers for Crohn's Disease Strictures

#### Participants

Safa Hoodeshenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To understand the role and characteristics of existing and future biomarkers in Crohn's disease strictures
- To review existing diagnostic and prognostic Crohn's imaging biomarkers and potential surrogate clinical endpoints
- To describe potential imaging biomarkers that reflect stricture histopathology or pathophysiology
- To describe the strengths and weaknesses of existing and future biomarkers for Crohn's disease strictures.

#### TABLE OF CONTENTS/OUTLINE

- Existing diagnostic and prognostic biomarkers of Crohn's disease strictures
- Using CT or MR enterography to measure response biomarkers and/or efficacy endpoints for Crohn's strictures
- Stiffness, fibrosis, and smooth muscle hypertrophy are histopathologic and physiologic targets for an emerging array of MR, ultrasound, and PET biomarkers
- MRI-based biomarkers include delayed gadolinium enhancement, normalized magnetization transfer, DWI and intravoxel incoherent motion, T1 mapping, intramural T2 signal, and quantified small bowel motility
- Ultrasound-based biomarkers include wall thickness, elastography to measure shear stiffness, contrast-enhanced ultrasound, and ultrasensitive microvessel imaging
- Molecular imaging targets at PET-MRE include inflammation and fibrosis

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## Abstract Archives of the RSNA, 2023

GIEE-178

### Kidney Pancreatic Transplantation: Anatomy and Surgical Technique Guide for Residents

#### Participants

Juan Bautista Rolla, MD, Ciudad Autonoma De Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pancreas transplant is a complex procedure which represents a surgical alternative for the treatment of diabetic patients with the goal of avoiding the systemic complications associated with the disease. The most frequent approach is the SPK transplant in which both grafts of a single donor are inserted in one surgical act, on the right and the left fossa respectively. Transplanted kidney is implanted extraperitoneally in an iliac fossa. The most widely used technique is end-to-side anastomosis of the donor's renal artery to the recipient's external iliac artery. Transplantation of the pancreatic graft is performed together with a duodenal segment. Enteric exocrine drainage will be through anastomosis of the donor duodenal segment to a small bowel loop of the recipient whereas systemic endocrine drainage will be through the portal vein of the graft which is anastomosed directly to the primitive iliac vein. To learn surgical technique and post-operative anatomy. To know normal postoperative imaging assessment. To recognize all the complications.

#### TABLE OF CONTENTS/OUTLINE

Introduction and normal anatomy Surgical techniques Normal post-operative imaging appearance Complications Take-home messages

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## Abstract Archives of the RSNA, 2023

GIEE-179

### Hepatic Sinusoidal Disorders

#### Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand pathophysiology behind hepatic sinusoidal disorders
- Review the typical imaging appearances sinusoidal obstruction caused by different etiologies and characteristic findings for differentiation of etiologies.
- Review conditions that cause sinusoidal and perisinusoidal infiltration and may mimic sinusoidal obstruction.

#### TABLE OF CONTENTS/OUTLINE

- Normal hepatic sinusoid structure and physiology
- Mechanisms causing sinusoidal dilatation and/or obstruction.
- Histopathological correlation of imaging findings
- Sinusoidal dilatation
  - o Outflow obstruction
  - § Post sinusoidal causes.
- Congestive hepatopathy
  - Heart failure
  - Pericarditis
  - Congenital heart diseases
- Budd-Chiari syndrome
- Sinusoidal obstruction syndrome
  - o Myeloablative conditioning for stem cell transplantation.
  - § Utility of ultrasound in diagnosis of SOS in children
  - o Chemotherapy-oxaliplatin based therapies, immunotherapy.
  - o Radiotherapy
- Sinusoidal dilatation without obstruction
  - o Vascular disorders
  - § Arteriportal shunts
  - § Decreased portal flow.
  - § Porto-sinusoidal vascular disorder
  - o Extrahepatic acute inflammatory/infective conditions
  - o Use of oral contraceptives or hormones
  - o Hepatic peliosis
  - o Extrahepatic malignancy without liver infiltration
- Sinusoidal and/or perisinusoidal infiltration with or without dilatation
  - o Perisinusoidal fibrosis
  - o Amyloidosis
  - o Myeloproliferative disorders
  - o Malignancy

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## Abstract Archives of the RSNA, 2023

GIEE-18

### The Dark Side of the Bowel Disease: Algorithmic Approach Step by Step

#### TEACHING POINTS

Review through different imaging modalities the evaluation of the intestinal wall. To revise the general features of the normal bowel wall. Create an algorithm that allows quick & easy evaluation to guide the diagnosis. To discuss the different imaging findings we may see in different pathologies. To study different pathologic entities that present with bowel wall thickening.

#### TABLE OF CONTENTS/OUTLINE

Introduction Anatomy basic bowel wall. Step by step > interpretation of < analyzed by categorizing attenuation changes in the intestinal wall. Diagnostic Algorithm description. Descriptions of the commonest causes Key points. Conclusions References

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## Abstract Archives of the RSNA, 2023

GIEE-180

### CT Approach to Acute Mesenteric Ischemia

#### TEACHING POINTS

-Acute mesenteric ischemia it's an infrequent pathology, but the mortality rate is high because of the nonspecific symptoms and the delayed diagnosis, so the role of the imaging and the radiologist are fundamental to reduce the mortality rates.-Appropriate protocols of CT imaging should be used to optimize the radiation and contrast medium use, because there is a disbalance in the homeostasis of the patient and every minute counts to make de diagnosis.-If there is a kidney failure, there are protocols for a safety use of the iodinated contrast medium.-To establish an adequate diagnosis, the histopathology and anatomy of the arteries and the bowel should be evaluated.-There are three main structures that we must evaluate to have an adequate approach to mesenteric ischemia: bowel lumen, bowel walls and abdominal localization.-When there is an acute mesenteric ischemia, other abdominal organs like adrenal glands, inferior cava vein, aorta, liver, spleen, and kidneys have changes and findings that can predict complications and mortality.

#### TABLE OF CONTENTS/OUTLINE

Gross anatomy Abdominal artery anatomy. Relevant anastomoses. Abdominal vein anatomy. Histology of the bowel.Pathophysiology of acute mesenteric ischemia. CT imaging protocols. Indications, Simple, artery and portal phases with timing and technique (kVp, mA, rotation, PITCH). What to do if there is an acute kidney failureClassification of the acute mesenteric ischemia.Systematic approach to acute mesenteric ischemia. Bowel Wall thickness. Diameter. Wall enhancement. Mesentery Fat. Liquid. Localization. Vessels. Artery. Vein. Other abdominal organs Liver. Kidneys. Adrenal glands. Pulmonary embolism.Conclusions. Bibliography.

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## Abstract Archives of the RSNA, 2023

GIEE-181

### Gastric Cancer CT Staging: Radiologic Patterns with Radiologic-Pathologic Correlation

#### TEACHING POINTS

State of the art treatment of locally advanced gastric cancer is multimodal and involves combined surgical and medical therapy. CT has a central role in the staging of gastric cancer, being the method of choice for this purpose; a local and distant staging as accurate as possible is crucial for a correct treatment planning, avoiding under- or over-treatment of the Patient. To obtain a correct staging, a thorough knowledge of normal and pathologic gastric radiological anatomy and the pathways of tumor spread is crucial. Through the analysis of illustrative cases: To know the normal and pathologic gastric radiologic anatomy and the lymphatic and hematogenous pathways of spread of gastric cancer. To know the TNM classification (8th edition) for gastric cancer and correctly use the CT criteria necessary for its application. To correlate radiologic patterns of gastric cancer with macroscopic and microscopic pathologic patterns. To correlate clinical CT staging and pathologic staging with regard to T and N parameters. To understand the limitations and pitfalls of imaging and the causes of radiological overstaging and understaging.

#### TABLE OF CONTENTS/OUTLINE

1. Concepts of normal and pathologic gastric radiologic anatomy and lymphatic and hematogenous tumor spread pathways are explained. 2. Some illustrative cases of early-stage, locally advanced and oligometastatic gastric cancer are presented, with clinical staging obtained by CT imaging applying the TNM 8th edition classification. Correlation of CT images with macroscopic and microscopic pathologic findings is shown by detailed explanation of the findings. 3. Some examples of CT understaging and overstaging and their possible explanations are presented.

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## Abstract Archives of the RSNA, 2023

GIEE-182

### Abdominal Inflammatory Lesions Unmasked: A Radiological Hunt for Tumor Impostors!

#### Participants

Abrahao Elias Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the abdominal inflammatory diseases which mimic tumor-like lesions. To present diagnostic challenging cases of inflammatory diseases that can mimic tumoral lesions. To be aware of non-malignant conditions as differential diagnoses at the initial presentation of lesions suspicious for neoplasms, and which imaging features may help in the differentiation. To highlight clinical and laboratory data that can help the radiologist not fall into pitfalls.

#### TABLE OF CONTENTS/OUTLINE

Abdominopelvic inflammatory lesions can present a diagnostic challenge for radiologists, particularly when distinguishing between tumor and non-tumor involvement. This can have a significant impact on patient outcomes, as the management and prognosis of these conditions can vary dramatically. Overview of the main inflammatory diseases that mimic neoplasms. Key radiological findings in cross-section abdominal images that aid in distinguishing between tumor and non-tumor lesions. The role of clinical and laboratory information in the differential diagnosis of inflammatory lesions. Didactic exposition of illustrative cases in which inflammatory diseases mimic neoplasms, such as rectal syphilis, peritoneal tuberculosis, focal pyelonephritis, glandular cystitis, hepatic inflammatory pseudotumor, xanthogranulomatous cholecystitis, complicated appendicitis, focal pancreatitis, vaginal vault abscess, and lobular endocervical glandular hyperplasia. Recap of the importance of accurately differentiating between tumor and non-tumor involvement in abdominopelvic inflammatory lesions, with the key takeaways from this educational exhibition.

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## Abstract Archives of the RSNA, 2023

GIEE-183

### Expanding the Role for Biopsy in HCC: It's Not Just About Diagnosis

#### Participants

Mansur Ghani, MD, San Diego, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Traditionally, clinical indications for biopsy of hepatocellular carcinoma (HCC) have included circumstances when imaging diagnosis is uncertain or for HCC that does not respond as expected to therapy. 2. More recently, developments in the understanding of pathological and molecular alterations in HCC at the cellular level have created additional opportunities for biopsy for the purposes of prognosis, treatment selection and treatment monitoring.

#### TABLE OF CONTENTS/OUTLINE

Review of traditional indications for biopsy in HCC (Fig. 1)- Diagnosis in the case of LR-4 (Fig. 2), LR-M (Fig. 3) and LR-TIV- Lesions that do not respond as expected to therapy Additional potential roles for biopsy in HCC- Diagnosis- Lesions in non-cirrhotic livers or scenarios where LI-RADS currently cannot be applied (e.g. cardiac cirrhosis and Fontan related liver disease)- LR-3 lesions (Fig. 4)- Prognosis- There are several histological HCC sub-classes, each with distinct molecular patterns and prognostic implications (Fig. 5)- Microscopic vascular invasion (MVI) can be incidentally detected on biopsy, and surrogate molecular markers can be used to predict MVI- Stemness-related biomarkers are associated with more aggressive clinical behavior- Treatment selection- Potentially targetable genetic alterations are found in approximately 24% of HCC.- Treatment monitoring- Genetic sequencing of biopsy tissue can be performed to design specific liquid biopsy panels to monitor efficacy of treatment.- Biopsy Techniques- Biopsy types: fine-needle aspiration, needle-core biopsy, micro-histology, liquid biopsy- Types of image guidance- Ultrasound with an emphasis on the emerging role of contrast-enhanced ultrasound- CT-guided

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## Abstract Archives of the RSNA, 2023

GIEE-184

### Getting to the Bottom of the Pelvic Floor: A Primer on MR Defecography Technique, Reporting and Implications for Surgical Management

#### Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Indications for MR defecography (MRD); advantages over fluoroscopic defecography and correlation of both techniques
- Anatomic considerations: compartments, measurements, pathophysiology of the pelvic floor
- Technique and phases of examination for functional assessment
- Standardized terminology and reporting
- Imaging findings of common and rare diagnoses
- Surgical management of pelvic organ prolapse: choice of procedure, techniques and post-op imaging findings

#### TABLE OF CONTENTS/OUTLINE

Review pelvic compartmental anatomy, important lines and measurements:- Pubococcygeal line- H-line- M-line- Urethral axis- Vaginal axis  
Variations of technique and equipment:- Phases: rest, contraction, defecation- Sequences- Open vs. closed MRI technique- Coil design  
Standardized terminology and reporting, consensus guidelines by SAR and AJR. Step by step interpretation of a case with sample reporting template.  
Entities discussed:- Peritoneocele, Enterocele, Sigmoidocele- Cystocele- Urethral Hypermobility- Uterine/Vaginal prolapse- Descending perineal syndrome- Structural Outlet Obstruction: Rectocele, Rectal prolapse, Intussusception, Rectal mass- Functional Outlet Obstruction: Puborectalis dyskinesia, Anismus anorectal incontinence- Spastic pelvic floor syndrome  
Surgical management of pelvic descent- Pre-op considerations  
Obliterative vs. reconstructive techniques  
Abdominal vs. vaginal approach  
Concomitant urinary or fecal incontinence repair, colporrhaphy  
Hysterectomy vs. uterine-sparing  
Risk calculator for prophylactic urinary incontinence prevention  
Indications for mesh augmentation- Post-op imaging findings and complications

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## Abstract Archives of the RSNA, 2023

GIEE-185

### **MRI-Based Body Composition Analysis: We Can See the Fat That Hides Inside You**

#### **Participants**

Luciana Belem, MD, MSc, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Review how MRI of the abdomen may help identify high-risk adiposity phenotypes in the obesity context.- Review the literature on obesity, addressing the impact of visceral and ectopic fat in health.- Discuss which measurements can be made on MRI of the abdomen to assess visceral and ectopic fat.- Teach how to measure visceral and ectopic fat on MRI of the abdomen.

#### **TABLE OF CONTENTS/OUTLINE**

- Definition: what is visceral and ectopic fat.- Review the pathophysiology of obesity and discuss how to differentiate the adiposity phenotypes on MRI.- Body composition measures on MRI: Visceral adipose tissue, subcutaneous adipose tissue and skeletal muscle. Area or volume? If area, which level? Which muscle groups to include in skeletal muscle quantity assessment.- Protocol: which sequences use to assess body composition parameters and quantify ectopic fat.- Chemical shift-encoded (CSE) MRI with estimation of proton density fat fraction (PDFF): potential biomarker in obesity.- Ectopic fat measures on MRI: Muscle fat: which abdominal muscle group to measure? Pancreas fat: where and how to measure? Liver fat: where and how to measure?

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## Abstract Archives of the RSNA, 2023

GIEE-186

### **Mind The gap! The Tubes and Pipes in Crohn's Disease: Technical Aspects and Diagnostic Findings of CT and MRI-Enterography**

#### **Participants**

Mayra V. Soares, MD, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To review relevant points in the anatomy of the small intestine, in the context of Crohn's Disease, highlighting the main sites of involvement. To review the indications, protocol, and technical aspects of CT and RM-enterography (CT-e and MR-e). To point out differences and similarities, advantages and disadvantages between CT-e and RM-e. To show typical and atypical imaging findings of Crohn's disease and main complications. To distinguish phenotypic patterns of presentation of Crohn's disease in CT-e and RM-e.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Review of the anatomy of the small intestine Review of the typical and atypical imaging findings of Crohn's disease and its phenotypes CT-e and MR-e protocols Main diagnostic findings in Crohn's disease: Segmental mural enhancement mural thickening stenosis ulcerations vasa recta ingurgitation lymph node enlargement Complications related to Crohn's Disease: fistulas inflammatory mass Abscess

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## Abstract Archives of the RSNA, 2023

GIEE-187

### The Mystery of Internal Hernias: What Should the Radiologists Know?

#### Participants

Basem Jaber, MD, Darby, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Reviewing the different types of the internal hernias- Discussing the imaging features of various types of internal hernias- Identifying possible complications of internal hernias- Providing case-based review of common and uncommon pathologies

#### TABLE OF CONTENTS/OUTLINE

Internal hernias are defined as protrusion of small bowel loops through normal apertures and/or defects in the peritoneum or mesentery into a compartment within the abdominal cavity, commonly presenting as an acute intestinal obstruction. The incidence of internal hernias is increasing with the new surgical procedures now being performed. It is crucial for radiologists to be familiar with and understand the different types of internal hernias and the possible complications since they have high mortality rate and they are often challenging to recognize. Key points:- Introduction to peritoneum anatomy- Internal hernia different types- The diagnostic approach for internal hernias- Pearls and pitfalls for recognizing internal hernias complications imaging features

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## Abstract Archives of the RSNA, 2023

GIEE-188

### Just Not GIST: Non-GIST Mesenchymal Neoplasms of the Alimentary Tract

#### Participants

Rashmi Balasubramanya, MD, Philadelphia,, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

There is a heterogeneous group of non-GIST, mesenchymal neoplasms of the gastrointestinal tract that are characterized by distinctive histopathology tumor genetics as well as variable clinico-biological profiles and imaging findings. Characteristic disease distribution: While glomus tumors and plexiform fibromyxomas display distinct predilection for the gastric antrum, smooth muscle tumors of the gut preferentially occur in the esophagus and colorectum. Distinctive genetic markers: Based on MDM2 gene amplifications, esophageal giant fibrovascular polyps are now considered well-differentiated liposarcomas. Other tumors with distinctive cytogenetics include lipomas (HMGA2 gene rearrangements), granular cell tumors (inactivating AP6AP gene mutations), gastroblastomas (MALAT1-GLI1 fusions), plexiform fibromyxomas (GLI activating mutations), malignant neuroectodermal tumors (EWSR1-ATF1 gene fusions), IMTs (ALK gene rearrangements) and SFTs (STAT6 NAB2 gene fusions).

#### TABLE OF CONTENTS/OUTLINE

Introduction, taxonomy, demographics, clinical manifestations, pathological features, Multimodality cross sectional imaging findings on CT, MRI, PET-CT, management, prognosis, conclusion. Entities discussed: Esophageal granular tumor and well- differentiated liposarcoma; distinctive gastric tumors such as synovial sarcoma, IMT, plexiform fibromyxoma, and glomus tumor; smooth muscle tumors, lipomatous/neurogenic tumors, malignant neuroectodermal tumor, Kaposi sarcoma, sclerosing epithelioid fibrosarcoma.

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## Abstract Archives of the RSNA, 2023

GIEE-189

### Not Always What It Seems: Exploring Mimickers of Liver Malignancy

#### Participants

Kumi Ozaki, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

· Review of several mimickers of liver malignancy based on characteristic imaging findings. · Comprehension of key clinical and imaging findings that may help distinguishing mimickers from malignant liver lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of characteristic imaging and clinical features of typical liver malignancy.2. Overview of mimickers of liver malignancy based on each characteristic imaging findings; patterns of enhancement (early staining and prolonged enhancement, early staining and wash-out, gradual enhancement, peripheral enhancement), fat component, lower ADC values, growth rate, cystic lesion with mural nodule, periportal lesion and so on.3. Overview of mimickers of liver malignancy in the patients with chronic liver disease or cirrhosis.4. Overview of mimickers of liver malignancy in the patients with a known malignancy.5. Undistinguishable mimickers from liver malignancy6. Take home points

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## Abstract Archives of the RSNA, 2023

GIEE-19

### Precision Medicine and Early Detection of Pancreatic Cancer

#### Participants

Linda C. Chu, MD, Lutherville, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Patients with pancreatic cancer often present with non-specific clinical symptoms and are diagnosed at advanced disease stage. Recent advances in imaging techniques, molecular analysis, and artificial intelligence can lead to earlier detection of pancreatic cancer, which can significantly improve patient outcomes. The purposes of this exhibits are to review the current guidelines in high-risk screening of pancreatic cancer, review the role of liquid biopsy and pancreatic cyst fluid molecular markers in earlier detection, and the potential role of artificial intelligence in automated detection of pancreatic cancer.

#### TABLE OF CONTENTS/OUTLINE

Current guidelines in high-risk screening of pancreatic cancer. Role of liquid biopsy and pancreatic cyst fluid molecular markers in early detection. Artificial intelligence assisted automated detection of pancreatic cancer.

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## Abstract Archives of the RSNA, 2023

GIEE-190

### CT Imaging for Assessment of Hepatic Steatosis

#### TEACHING POINTS

1. To illustrate a pictorial review of focal and diffuse steatosis in the liver. 2. To explain the principles of quantitative assessment of liver fat using CT. 3. To review the accuracy of fat quantification by using single-energy CT (including quantitative CT) and dual/multienergy CT. 4. To demonstrate application to visual display of quantitative results.

#### TABLE OF CONTENTS/OUTLINE

1. Clinical significance 2. Etiology of diffuse fatty liver diseases 3. Beware of localized fat: neoplastic and non-neoplastic lesions 4. CT techniques for quantification. 4-1. Conventional single-energy CT and quantitative CT 4-2. Dual-energy CT a) CT attenuation value b) Fat fraction c) Electron density d) Virtual non-contrast imaging 4-3. Photon-counting CT 5. Visual tools for pre- and post-therapy assessment 5-1. Fat quantification of each liver lobe/segment 5-2. Fat distribution and its statistics

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## Abstract Archives of the RSNA, 2023

GIEE-191

### Computer-Aided Diagnosis for Hepatic MRI: What is Needed and Expected

#### Participants

Shogo Maeda, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

a. As gadoteric acid-enhanced MRI has combined perfusion and hepatocyte-selective properties, it is widely used to detect and diagnose focal hepatic lesions. b. Gadoteric acid-enhanced hepatobiliary phase (HBP) images are highly sensitive for the detection of hepatic lesions. However, small lesions, especially those near hepatic vessels, may be missed because they and the vessels are low signal-intense on HBP images. Computer-Aided Diagnosis (CAD) may be effective, especially for detecting small lesions on HBP images. c. Because many hepatic lesions, benign or malignant, are low signal-intense on HBP images, a differential diagnosis requires comprehensive evaluation with other sequences. CAD can differentiate between benign and malignant lesions by integrating information from EOB-MRI and sequences such as T2- and diffusion-weighted scans. Therefore, CAD is particularly useful for differential diagnosis in a single case of mixed benign and malignant lesions. d. A diagnosis of hepatic lesions is reached by integrating findings from various modalities and clinical information. A CAD that integrates all information is required.

#### TABLE OF CONTENTS/OUTLINE

a. History and classification of CAD in radiology b. Possibility of CAD for detecting hepatic lesions on MR images c. Possibility of CAD for diagnosis of hepatic lesions on MR images d. Future prospects of CAD for diagnosing hepatic lesions

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## Abstract Archives of the RSNA, 2023

GIEE-192

### Update on Histology, Staging, and Treatment of Intrahepatic Cholangiocarcinoma: The Role of the Radiologist

#### Participants

Wyanne Law, MD, Unionville, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the morphologic and histopathologic classification of intrahepatic cholangiocarcinoma (ICC) 2. Discuss differential diagnosis of ICC, including hepatocellular carcinoma (HCC), metastasis and benign entities 3. Describe American Joint Committee on Cancer (AJCC) 8TH edition staging for ICC and resection criteria 4. Discuss non-surgical options and recognize response/progression disease and complications

#### TABLE OF CONTENTS/OUTLINE

Classification Location: intrahepatic 10% vs perihilar 50- 60% vs distal 20-30% Morphologic: periductal infiltrating, mass forming, intraductal growing-Histopathologic: large duct vs small duct Imaging characteristics of ICC Peripherally enhancing, hypervascular, delayed enhancement Update on staging AJCC 8th edition for ICC TNM Surgical Resection Adequate future liver remnant (FLR) with intact hepatic arterial, portal venous, hepatic venous, and biliary drainage, excluding distant metastases, bilobar tumor and nonregional nodes Chemotherapy Gemcitabine + cisplatin Response: RECIST Immunotherapy TOPAZ-1 trial - Durvalumab -New inhibitors targeting genetic alterations in small duct, Pemigatinib, infigratinib Response: iRECIST-Complications: colitis, hepatitis, pneumonitis, renal failure, myocarditis Hepatic arterial infusion pump Floxuridine-Complications: gastroduodenal artery aneurysm, extravasation from catheter Ablative radiotherapy Complications: Radiation-based liver parenchymal changes (RILD), delayed onset of radiation necrosis Transarterial radioembolization (TARE) Yttrium 90 Complications: Post-radioembolization syndrome, gastroduodenal ulcer, cholecystitis

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## Abstract Archives of the RSNA, 2023

GIEE-193

### Gastrointestinal Ectopic Pancreas: Cross-sectional Imaging Spectrum and Differential Diagnosis

#### TEACHING POINTS

1. Describe the clinical manifestations and the spectrum of cross-sectional imaging findings of the ectopic pancreas (EP) in the gastrointestinal tract. 2. Discuss the diagnosis of the gastrointestinal EP with emphasis to formulate a differential diagnosis for gastrointestinal submucosal tumors.

#### TABLE OF CONTENTS/OUTLINE

1. The definition and overview of clinical manifestations of gastrointestinal ectopic pancreas (EP). 2. The pathologic gross manifestation and histological classification of EP. 3. A list of the common morphological manifestations of EP on cross-sectional images including sites and incidences, location, size, shape, contour, margin, attenuation/intensity signals, growth pattern, enhancement pattern, picking out those specific signs which are essential clues to indicate the diagnosis, such as duct-like structure in the lesion, hyperenhancement of the overlying mucosa, central umbilication, perilesional fat or low attenuation. 4. Describe the uncommon findings of EP with a comprehensive case series, including rare histological types and with secondary complications, including pancreatitis, pseudocyst formation, malignant degeneration, gastrointestinal bleeding, bowel obstruction. 5. Differential diagnosis between EP and other gastrointestinal submucosal tumors, such as gastrointestinal stromal tumors (GISTs), gastroduodenal glomus tumors, neuroendocrine tumor, leiomyomas and schwannomas. 6. Summary 7. Suggesting reading

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## Abstract Archives of the RSNA, 2023

GIEE-2

### Squamoid Cyst of Pancreatic Ducts: Rare Cystic Lesion of Pancreas

#### Participants

Duygu Cengiz, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Develop an awareness of squamoid cyst of pancreatic ducts (SCOP) Learn imaging features of SCOP Compare SCOP to other similar cystic lesions to make differential diagnosis. Discuss relation of SCOP and PDAC

#### TABLE OF CONTENTS/OUTLINE

Cystic lesions of pancreas Rare pancreatic cystic lesion: Squamoid cyst of Pancreatic Ducts (SCOP) Pathologic definition of SCOP Misnomer or not: Is SCOP really related to pancreatic ducts? Imaging features of SCOP Differential diagnosis of SCOP Simple Mucinous Cyst (SMC): Is it possible to differentiate SMC from SCOP? SCOP and PDAC: Is there a relation?

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## Abstract Archives of the RSNA, 2023

GIEE-20

### Distinguishing Inflammatory Conditions from Cancer of the Gastrointestinal Tract: What Radiologists Should Know

#### Participants

Camila Vendrami, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review imaging technique to assess gastrointestinal (GI) inflammatory conditions and cancer
- Review and illustrate the typical imaging appearances that allow differentiation of these inflammatory conditions and cancer
- Review and illustrate potential complications from these entities

#### TABLE OF CONTENTS/OUTLINE

- Introduction: overview of GI inflammatory conditions and tumors
- Imaging techniques: US, CT, MR including enterography
- Gastric inflammation and gastric tumors
  - o Clinical findings, detection and imaging features to differentiate the entities
- Small bowel enteritis and other small bowel pathology and SB cancers (adenocarcinoma, carcinoid, lymphoma, GIST, metastases etc.)
  - o Clinical findings, detection and imaging features to differentiate the entities
- Diverticulitis and colon cancer
  - o Clinical findings, detection and imaging features to differentiate the entities
- Appendicitis and appendiceal cancers [adenocarcinoma, neuroendocrine (carcinoid), lymphoma and colon cancer associated with appendicitis], endometriosis of appendix
  - o Clinical findings, detection and imaging features to differentiate the entities
- Potential complications such as perforation and fistulas
- Conclusion

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## Abstract Archives of the RSNA, 2023

GIEE-21

### **It's Not Just a Question of Size: Unveiling the Secret World of Abdominopelvic Lymph Nodes for a Proper Radiological Assessment**

#### **Participants**

Ana Lopes Potente, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review individual lymph node anatomy, names, and abdominal and pelvic lymph node group locations. Demonstrate through illustrative cases which clues the lymph nodes can reveal to us about diagnostic possibilities.

#### **TABLE OF CONTENTS/OUTLINE**

- Importance of lymph node evaluation. Limitations of size-based evaluation. - Didactic drawings to review anatomy and pathophysiology. - Review of updated literature on normal dimensions of lymph nodes. - Video map to point out nomenclature and location of abdominal and pelvic lymph node chains, such as (but not limited to) retrocrural, retroperitoneal, gastrohepatic ligament, porta hepatis, celiac and superior mesenteric artery, pancreaticoduodenal, perisplenic, mesenteric, and pelvic nodes. - Demonstration of the main imaging techniques for lymph node evaluation. Importance of adequate protocols. Discussion of benefits and limitations of each method. - Case studies to highlight pitfalls and findings that may simulate lymphadenopathy, such as splenosis, accessory spleen, papillary process of the caudate lobe, vascular anomalies, prominent vascular structures like gonadal veins, and scalloped diaphragmatic crus. Tips to avoid misdiagnosis. - Special cases in which lymph node morphology can point to specific diagnoses. - Importance of lymph node features beyond size in diagnosis. - Exposition of rare cases where lymph node enlargement causes vascular and nervous complications. Discussion of diagnosis and management. - Summary of teaching points.

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## Abstract Archives of the RSNA, 2023

GIEE-22

### Spectrum of Heterotopic Ectopic Splenic Conditions

#### Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### TEACHING POINTS

1. To describe the spectrum of heterotopic and ectopic splenic conditions, including the underlying embryologic basis. 2. To demonstrate the role of cross-sectional and imaging and scintigraphy in asymptomatic detection and symptomatic diagnosis of these splenic-related conditions, through a series of clinical examples.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Embryologic development of the spleen o Normal splenic development o Spectrum of abnormal development - Splenic-specific imaging techniques o Nuclear medicine (heat-treated RBC > sulfur colloid scans) o MRI (ferumoxytol) - Heterotopic splenic conditions o Splenules § Pancreatic tail splenules o Splenogonadal fusion § Discontinuous form § Continuous form - Ectopic splenic conditions o Splenosis o Wandering spleen § Incidental asymptomatic detection § Symptomatic torsion o Polysplenia (heterotaxy) § Associated findings- Concluding remarks

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## Abstract Archives of the RSNA, 2023

GIEE-23

### Peritoneal Carcinomatosis: The Role of the Radiologist in Selecting Patients for Curative Treatment

#### Participants

Alicia Espinal Soria, MD, San Sebastian, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To know the different presentations of the peritoneal carcinomatosis in CT. To get familiar with the term Peritoneal Cancer Index and the website used to calculate it "e-Promise". To make a differential diagnosis with the pathologies that may mimic peritoneal implants.

#### TABLE OF CONTENTS/OUTLINE

Intraabdominal malignancies often spread to peritoneal cavity causing peritoneal carcinomatosis. The most common primary neoplasms are colorectal, small bowel, stomach, ovaries and pancreas. Peritoneal carcinomatosis (PC) may present in CT like ascites, peritoneal thickening, peritoneal nodules or masses, "omental cake" pattern or pseudomyxoma peritonei. This presentation forms in CT are also seen in other pathologies such as peritoneal tuberculosis, acute peritonitis, splenosis, peritoneal lymphomatosis, and peritoneal mesothelioma. Histologic analysis must be made to obtain a definitive diagnosis in doubtful cases. Until recently, PC was considered an end-stage disease where supportive care was the only possible treatment. The cytoreductive surgery (CRS) followed by Hypertermic intraperitoneal chemotherapy (HIPEC) is a combined treatment that has given a curative option to properly selected patients. It is important to know the most frequent shapes and locations of peritoneal implants to calculate the Peritoneal Cancer Index (PCI) using CT imaging, which is part of the selection criteria. The website "e-Promise.org" is useful to calculate this Index and help the clinician deciding the most suitable treatment for each patient.

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## Abstract Archives of the RSNA, 2023

GIEE-24

### Comprehensive Review of Imaging in Pancreatic Transplantation: A Panorama of Good and Bad!

#### Participants

Shravya Srinivas Rao, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To learn pancreas transplant- indications, types, surgical procedure- To discuss post-transplant imaging surveillance of pancreas  
- To review the spectrum of post-transplant complications- visceral, vascular, intestinal  
1. Pancreas transplantation procedure- Indications- Types of transplantation (whole organ vs islet cell)- Surgical procedures  
2. Role of imaging in pancreas transplantation- Preoperative imaging- Imaging modalities- Technique and protocol- Post-operative surveillance  
3. Imaging manifestations after pancreas transplantation- Normal appearance- Post-operative complications- Differential diagnosis- Radio-pathologic correlation- Pitfalls and challenges

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## Abstract Archives of the RSNA, 2023

GIEE-25

### Rectum MRI: Beyond the basics

#### Participants

Thiago Jose Pinheiro Lopes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- High-resolution MRI is a cornerstone in the evaluation of the rectum, notably for cancer. In the past years, its use has been expanded far beyond TNM staging, enabling post-neoadjuvant therapy follow-up, patient selection for the "Watch and Wait" approach, predicting response to Total Neoadjuvant Treatment (TNT), and much more. - MRI imaging has enabled less invasive treatment approaches, with improved quality of life for patients and similar outcomes, and radiologists should be aware of these developments. - Our purpose is to review emerging applications of rectal resonance in the radiological routine and bring tips for deepening the anatomy of the rectum.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Delving into the anatomy of the rectum. 3. Recognizing post-CRT changes in rectum cancer. 4. Selecting patients for the "Watch and Wait" approach. 5. Using MRI to predict response to Total Neoadjuvant Treatment (TNT). 6. Identifying mucinous tumors. 7. Recognizing mesorectal fascia involvement. 8. Evaluating sphincter invasion in low rectal cancer. 9. Future directions. 10. Take home messages.

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## Abstract Archives of the RSNA, 2023

GIEE-26

### Quantitative CT for Diffuse Liver Diseases: Steatosis, Iron, and Fibrosis

#### Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### TEACHING POINTS

1. To demonstrate the ability of CT to quantify fat, iron, and fibrosis content within the liver, analogous to MRI approaches. 2. Explain the rationale for opportunistic screening at abdominal CT for detecting unsuspected diffuse liver disease, including steatosis, hemochromatosis, and compensated cirrhosis. 3. Describe a battery of CT-based liver biomarkers that can now be obtained in a fully-automated fashion using AI-based methodology.

#### TABLE OF CONTENTS/OUTLINE

- Overview of diffuse liver diseases  
o Hepatic steatosis and NAFLD  
o Hepatic iron overload and hemochromatosis  
o Hepatic fibrosis and cirrhosis  
- Quantification methods for hepatic fat, iron, and fibrosis content:  
o Liver biopsy  
o Advanced MRI methods  
o CT-based biomarkers  
- Opportunistic CT-based screening for diffuse liver disease  
o Rationale  
o Manual and automated techniques  
o Brief review of evidence to date  
o Pitfalls  
o Prospects for the (near) future  
- Concluding remarks

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## Abstract Archives of the RSNA, 2023

GIEE-27

### Imaging in HIPEC- All You Need To Know!

#### Participants

Shravya Srinivas Rao, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Peritoneal malignancies like pseudomyxoma peritonei, metastatic carcinomatosis from colon adenocarcinoma, mucinous carcinomas of ovary, stomach, pancreas etc., can be treated with cytoreduction surgery and hyperthermic intraperitoneal chemotherapy (HIPEC) or early postoperative intraperitoneal chemotherapy (EPIC). Objectives of this exhibit are:- To discuss imaging manifestations of peritoneal malignancies - To review the technique, principles, and complications of HIPEC therapy- To learn the role of imaging in the assessment of HIPEC patients before and after therapy

#### TABLE OF CONTENTS/OUTLINE

1. HIPEC- technique and principles  
2. Peritoneal tumors- classification and imaging features  
3. Radiological, surgical and pathological correlation  
4. Criteria for CRS and HIPEC- selection of patients for HIPEC  
5. Calculation of Peritoneal Cancer Index: principles and method of estimation  
6. Imaging in response assessment

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## Abstract Archives of the RSNA, 2023

GIEE-28

### Peritoneal Carcinomatosis Versus Primary and Secondary Peritoneal Tumors and Other Traps

#### Participants

Ghina Jardali, MD, Villejuif, France (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review of the imaging features of common and uncommon peritoneal diseases, neoplastic (such as pseudomyxoma peritonei) and non-neoplastic, that mimic peritoneal carcinomatosis. • Emphasis on the CT/MRI findings and the additional imaging clues that may allow the radiologist to appropriately narrow the differential diagnosis and, in some cases, make an imaging-specific diagnosis.

#### TABLE OF CONTENTS/OUTLINE

I. Imaging appearance of peritoneal carcinomatosis II. Imaging clues to the diagnosis of differential diagnosis: a. Secondary peritoneal-based neoplasms i. Pseudomyxoma peritonei b. Primary peritoneal neoplasms i. Malignant peritoneal mesothelioma c. Primary peritoneal mesenchymal tumors i. Gastrointestinal stromal tumor (GIST) with peritoneal sarcomatosis ii. Fibromatosis (Desmoid tumor) d. Non-neoplastic mimics of peritoneal carcinomatosis: i. Mesothelial cysts ii. Cystic lymphangioma iii. Lymphangiomyomatosis iv. Mesenteric fat necrosis / lipophagic granuloma v. Atypical infections: Tuberculosis, Actinomycosis

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## Abstract Archives of the RSNA, 2023

GIEE-29

### **Gastro-Intestinal Devices: from Esophagus to Anus. Imaging Appearance Review of Common and Less Common GI Foreign Bodies**

#### **Participants**

Emre Aslan, MD, Ville Mont-Royal, QC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) Review of imaging appearance of common and less common gastrointestinal (GI) devices.2) Summarize common device-specific complications.3) Review of MRI safety profiles for each GI device.

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction: As minimally invasive procedures become more ubiquitous and technology keeps advancing, new GI devices are being used by interventional radiologists and interventional gastroenterologists.2) Clinical use Radiologists and radiology trainees must stay up to date with new GI devices to recognize and prevent complications whenever possible. Each device's indications, normal imaging appearances, potential complications and MRI safety profiles will be discussed.3) Endoscopically placed devices esophageal, duodenal, rectal stents, AXIOS stent, and Ovesco device.4) Surgically placed devices LINX reflux management system, gastric pacemaker, gastric band, Ray-Tec X-rayable sponge and laparotomy sponge.5) Tubes and balloons Blakemore tube, cecostomy tube, intragastric balloon, and Minnesota tube.6) Other Amplatzer plug and capsule endoscopy device.7) Conclusion Summary of key teaching points.

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## Abstract Archives of the RSNA, 2023

GIEE-3

### The Washout of Hepatocellular Carcinoma at Portal Venous Phase versus Equilibrium Phase: Radiological and Clinicopathological Implication

#### Participants

Kengo Yoshimitsu, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

•To learn that there are two distinct types of hepatocellular carcinoma (HCC) washout to be recognized: one at the portal venous phase (PVP) and the other at the equilibrium phase (EqP). •To learn that these two represents two different phenomena; a dynamic, and a static one, respectively. •To learn that PVP washout is a consequence of rapid hemodynamic change of HCC and background liver (BGL). •To learn that EqP washout represents static condition of contrast medium distribution in the extracellular space of HCC and BGL. •To learn that PVP washout is significantly related to histological grades of HCC, or its status of microvascular invasion. •To learn that EqP washout might be related to immunohistochemical subgroup of HCC.

#### TABLE OF CONTENTS/OUTLINE

1. Basic concept of two types of "WASHOUT" of HCC 2. Washout at PVP: radiological consideration 3. Washout at PVP: clinicopathological implication 4. Washout at EqP: radiological consideration 5. Washout at EqP: clinicopathological implication 6. Washout on dynamic MRI using extracellular contrast medium or gadoxetate 7. Summary

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## Abstract Archives of the RSNA, 2023

GIEE-30

### Focal Liver Lesions: A Case-based Quiz

#### Participants

Laura Cavero Barreras, MD, Ordizia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To highlight the importance of the clinical context of patients with focal liver lesions. - To review the typical and atypical imaging findings of focal liver lesions in multimodality imaging techniques through cases studied in our center. - To know the current guidelines and define a practical approach to the radiologic management of liver lesions. - To identify potential pitfalls and key imaging findings to make the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Focal liver lesions represent a widespread, heterogeneous group of disorders that can be benign or malignant, solitary or multiple. Diagnosis is usually challenging as many lesions may mimic each other. Radiologists must consider the appearance and the enhancement pattern of the nodule on different imaging techniques, such as US, CT, and MRI. Moreover, contrast-enhanced US (CEUS) can help to resolve doubts and establish the diagnosis in cases where other imaging techniques do not provide a definite diagnosis. On the other hand, it is necessary to consider the clinical context of the patient, as this will determine the further management of the lesion. This presentation will take the form of a quiz to discuss the typical and atypical imaging findings and the management of focal liver lesions based on current guidelines.

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## Abstract Archives of the RSNA, 2023

GIEE-31

### Laxative-free Photon-counting CT Colonography for Colorectal Cancer Screening

#### Participants

Yasuji Ryu, MD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The teaching points of this exhibit are to (1) explain the emerging role of laxative-free CT colonography in colorectal cancer (CRC) screening, (2) explain the role of photon-counting CT in addressing the challenges of conventional CT colonography, and (3) explain the role of artificial intelligence (AI) in unlocking the potential of laxative-free photon-counting CT colonography as a CRC screening test.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: the importance of CRC screening; the emerging role and challenges of laxative-free CT colonography. 2. Photon-counting CT: benefits over conventional CT; how photon-counting CT addresses the challenges of laxative-free CT colonography. 3. AI enables an effective laxative-free photon-counting CT colonography examination: computer-aided detection; virtual bowel cleansing; risk assessment; putting it all together. 4. What we know and don't know: outcomes from clinical laxative-free CT colonography trials; initial observations from photon-counting CT colonography studies. 5. Summary.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-33

### Pancreas Transplantation: What Should the Radiologist Know?

#### Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To expose the existing surgical techniques in pancreatic transplantation. To highlight the role of the different imaging tests in graft evaluation. To make a pictorial review of the postoperative complications according to the time after transplantation.

#### TABLE OF CONTENTS/OUTLINE

Pancreatic transplantation is a valid therapeutic option for poorly controlled diabetes mellitus and advanced diabetic nephropathy. Knowledge of the surgical techniques, location of the anastomoses and related complications will assist the radiologist in performing an accurate assessment that leads to adequate management and long-term survival of pancreatic grafts. There are three types of pancreas transplantations regarding the drainage method: systemic venous and bladder exocrine drainage, systemic venous and enteric exocrine drainage, and portal venous and enteric exocrine drainage. Radiological assessment of the pancreas graft is usually multimodal. Ultrasound is the first-line imaging modality for the initial post-surgical evaluation performed within the first 24 hours. CT is preferred if complications are presumed. Postoperative complications include parenchymal, infectious, enteric or vascular disorders, which can be classified according to the time lapse after transplantation in which they occur: immediate (< 24 hours), early (24- 72 hours), intermediate (72 hours-weeks) and late (months). We gathered the most illustrative cases of postoperative complications from recent years at our institution to show the key features of imaging that enable rapid and accurate management.

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## Abstract Archives of the RSNA, 2023

GIEE-34

### Retrospectively Defined Missed Early Signs of Pancreatic Cancer on CT

#### Participants

Satomi Kawamoto, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review cases of missed early pancreatic ductal adenocarcinoma (PDAC) and early changes of PDAC on CT. 2. Small, isoattenuating PDAC without contour deformity can be easily missed. 3. CT findings to suggest early PDAC include pancreatic duct dilatation with or without abrupt duct cutoff, vascular invasion, focal parenchymal atrophy, and focal enhancement.

#### TABLE OF CONTENTS/OUTLINE

1. Background: Delay in diagnosis can contribute to poor outcomes in PDAC, and imaging plays a crucial role in the diagnosis of early PDAC. 2. Review of cases of missed early PDAC and early changes of PDAC before clinical diagnosis on CT. (1) Small, isoattenuating PDAC without contour deformity. (2) Pancreatic duct dilatation is most common secondary finding (3) Abrupt pancreatic duct cut-off (4) Vascular invasion is not a common finding but high likelihood of missing (5) Parenchymal atrophy (6) Focal enhancement. 3. Cognitive errors (1) Underlying pancreatitis (2) Unexpected finding. 4. Discussion of future direction

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## Abstract Archives of the RSNA, 2023

GIEE-35

### Plan to Scan the Pancreas Transplant: A Sweet Review of Anatomy, Imaging Technique, and Complications

#### Participants

Maham Siddique, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: • Pancreas transplant aims to restore normal glycemic control, often in young patients with diabetes and manifesting end-stage renal disease. • Ultrasound is performed to evaluate the pancreas and transplant vessels in the perioperative period. • Ultrasound, CT, and MRI can diagnose transplant-related complications. Common vascular complications include arterial and venous thrombosis and arterial pseudoaneurysm. Transplant pancreatitis has similar complications to inflammation of the native pancreas and can impact the renal transplant. • Radiologists should be familiar with normal pancreas transplant anatomy, vascular and non-vascular complications of pancreas transplants, as early recognition of these entities may improve outcomes.

#### TABLE OF CONTENTS/OUTLINE

Outline: Pancreas transplant background and demographics, Normal pancreas transplant anatomy and surgical technique, Normal transplant evaluation on ultrasound and reporting template, Acute and necrotizing graft pancreatitis, Vascular complications: arterial and venous stenosis and thrombosis, pseudoaneurysm, acute arterial bleeding, Non-vascular complications: Peripancreatic collections, hematoma, post-transplant lymphoproliferative disease.

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## Abstract Archives of the RSNA, 2023

GIEE-36

### Why Oh Y-Grafts: Understanding the Anatomy, Imaging, and Complications of Pancreas Transplantation

#### Participants

Melanie P. Caserta, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pancreas transplant is the treatment for severe Type I diabetes mellitus complicated by end stage renal disease, poorly controlled Type I or II diabetes, and cystic fibrosis. Pancreas transplantation is most commonly performed simultaneously with kidney transplantation (80%) or following kidney transplantation (16%), and least commonly performed alone. Ultrasound is the first line modality for evaluating the allograft and vasculature and to look for complications. Contrast enhanced ultrasound, CT and MRI can be used as problem solving tools to further evaluate complications. After reviewing this case-based exhibit, the learner will: - Understand indications for pancreas transplantation - Describe the surgical anatomy of pancreas transplants - Describe ultrasound technique for evaluating the transplant pancreas - Recognize complications of pancreas transplant - Determine when additional imaging of the pancreas transplant is needed

#### TABLE OF CONTENTS/OUTLINE

Outline: 1. Objectives 2. Background - Pancreas Transplant a. Benefits of pancreas transplantation b. Review of surgical technique 3. Imaging a. Ultrasound - First line imaging i. Ultrasound protocol ii. Normal appearance iii. Complications 1. Vascular 2. Parenchymal 3. Perigraft 4. Bowel b. Problem solving i. Contrast enhanced ultrasound to assess allograft perfusion and vascular complications ii. CT - peripancreatic fluid collections, suspected intestinal obstruction, multiphase evaluation to assess graft and vasculature iii. MRI - Ferumoxytol MRI to assess transplant vasculature 4. Treatment and Intervention a. Medical b. Ultrasound guided c. Endovascular d. Surgical

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## Abstract Archives of the RSNA, 2023

GIEE-37

### Navigating Through the Esophageal Disorders in Chest CT Scans: What Radiologists Should Know

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To know basic anatomy and histology of the esophagus  
To learn the role of CT imaging in the detection and characterization of esophageal pathology.  
To recognize the most important imaging findings of non-malignant and malignant esophageal diseases.

#### TABLE OF CONTENTS/OUTLINE

1. Esophageal anatomy and histology  
2. Benign esophageal disorders  
a). Benign esophageal tumors - Leiomyoma - Fibrovascular polyps - Esophageal schwannomas  
b). Congenital lesions: - Duplication cysts  
c). Esophageal diverticula - Pharyngoesophageal junction: Zenker diverticula - Middle esophagus diverticulum - Epiphrenic diverticulum  
d). Infectious diseases - Candida - HIV - CMV - Herpes simplex virus - Chagas  
e). Inflammatory disorders - Reflux esophagitis and Barrett's esophagus - Eosinophilic esophagitis (EoE) - Radiotherapy-induced esophagitis - Scleroderma - CREST  
f). Traumatic and fistulas - Esophageal impactation - Hematoma - Perforation - Actinic - Esophageal-airway fistula - Esophageal mediastinal fistula  
g). Others - Achalasia - Acute esophageal necrosis (AEN) - Hiatal hernia - Esophageal and para-esophageal varices  
3. Primary malignant esophageal tumors  
a). Squamous carcinoma (SCC)  
b). Adenocarcinoma  
c). Lymphoma  
d). Primary malignant melanoma

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## Abstract Archives of the RSNA, 2023

GIEE-38

### Diffuse and Focal Liver Fat: Pearls and Pitfalls

#### TEACHING POINTS

To review the imaging features of liver fat in different methods. To discuss and illustrate the main causes and consequences of fatty liver disease, as well as its associated conditions. To demonstrate common and uncommon patterns of liver fat distribution and discuss the underlying pathophysiology. To recognize that classic liver lesions can have different patterns of imaging presentation in the setting of steatosis. To present challenging cases and mimic lesions, highlighting the clues that can be helpful for the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Liver fat in different imaging methods (US, CT and MRI). Main findings of several causes of fatty liver disease (alcoholism, metabolic syndrome, chemotherapy, drug toxicity, infection, PCOS). Patterns of liver fat distribution (diffuse, focal, geographic, multinodular, perivascular), including uncommon oncologic and cirrhotic cases. Patterns of presentation of the classic liver lesions in the setting of steatosis (FNH, hemangioma etc). Differential diagnosis between true lesions and pseudolesions.

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## Abstract Archives of the RSNA, 2023

GIEE-39

### Ultrasound Of the Gastrointestinal Tract: Contributions of Ancillary Ultrasound Techniques

#### Participants

Nameerah Wajahat, Calgary, AB (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1.) Greyscale ultrasound evaluation comprises the fundamental basis of diagnostic evaluation of the bowel in inflammatory bowel disease (IBD) (2.) Wall thickness, inflammatory fat and signal on color doppler imaging (CDI) are the markers which increase in proportion to active inflammation. (3.) Ancillary Ultrasound techniques including: endovaginal sonography (EVS), contrast enhanced ultrasound (CEUS) and shear wave elastography (SWE) contribute greatly to final diagnosis and patient outcome. (4.) EVS provides information about anatomy and pathology in the deep pelvis with high resolution. (5.) CEUS allows for subjective and objective information about blood flow at the capillary level, allowing characterization of inflammatory masses as representative of active inflammation (phlegmon) or abscess formation (liquid pus) (6.) SWE measures bowel wall stiffness aiding with characterization of strictures. Soft inflammatory strictures- medical management. Stiff chronic strictures - surgical management

#### TABLE OF CONTENTS/OUTLINE

- Introduction to ultrasound of the bowel with emphasis on greyscale imaging - Ancillary features what are they and what do they do? - Endovaginal Sonography and its role in deep bowel evaluation - CEUS (Contrast Enhanced Ultrasound) and its contribution to activity assessment - SWE (Shear wave elastography) and its contribution to stricture assessment - Change of management with ancillary techniques

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## Abstract Archives of the RSNA, 2023

GIEE-4

### Comprehensive Review of Abdominal Manifestations of Melanoma with Emphasis on Liver Metastasis

#### TEACHING POINTS

The purpose of this exhibit is 1. To review imaging findings of primary and secondary melanoma in the abdomen and pelvis 2. To discuss multimodality imaging of liver metastasis from melanoma 3. To present an imaging atlas of gadoxetic acid-enhanced MRI for liver metastasis and to discuss its potential value 4. To discuss surveillance protocols for intraabdominal metastasis of melanoma

#### TABLE OF CONTENTS/OUTLINE

1. Clinical aspects of melanoma (1) Epidemiology (2) Staging (3) Treatment and prognosis 2. Primary melanoma in the abdomen 3. Metastatic melanoma in the abdomen (1) Liver (2) Pancreaticobiliary system (3) Gastrointestinal tract (4) Other involvement 4. Multimodality imaging of liver metastasis (1) Ultrasound (2) CT (3) MRI i. Lesion detection and characterization ii. Special considerations for gadoxetic acid-enhanced MRI for melanoma iii. MR findings of liver metastasis according to the primary origin of melanoma 5. Surveillance and prognosis (1) Surveillance protocol for metastatic melanoma in the abdomen (2) Prognostic implications of imaging features

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## Abstract Archives of the RSNA, 2023

GIEE-40

### Step-by-step Assessment in Colon Cancer Risk Stratification. Assessment by Virtual Colonography and Dual Energy Support

#### Participants

Omar Gamboa Abundis, MD, Ciudad de Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Colorectal cancer represents the third most diagnosed cancer and corresponds to the second cause of death in the world. The recognized precursor lesion is the adenoma, and the risk of malignant transformation is significantly increased. Virtual colonography is a noninvasive screening method for colon cancer and avoids the unnecessary risk of bleeding or perforation present in colonoscopy. Learn to describe and categorize the findings and pitfalls in lesions found during image processing and viewing.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents: Teaching points. Introduction. What is CRADS. Virtual colonography acquisition protocol. Image processing and anatomical considerations. Description of the results. CRADS categories. CRADS 1 to 4. Extracolonic findings. E0 to E4. Main pitfalls to consider. Conclusions. References. Outline: Colorectal cancer is the third most common cancer and is the second leading cause of cancer death in the world. It is important to carry out a screening test in patients over 45 years of age and even more so in those who present a high risk of suffering from this disease. Virtual colonography provides an excellent alternative with rapid acquisition protocols and high sensitivity and specificity. Useful in highrisk patients during the colonoscopy intervention, also avoiding the possible risk of perforation and bleeding.

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## Abstract Archives of the RSNA, 2023

GIEE-41

### Deep Learning for Electronic Cleansing in Fecal-tagging CT Colonography

#### TEACHING POINTS

This exhibit reviews the historical perspectives of Electronic Cleansing (EC), the major cleansing artifacts and pitfalls in the conventional deterministic EC methods, the recent technical advances of deep-learning based EC (Deep-EC) methods, comparison between Deep-EC and conventional deterministic EC, and the future trend of Deep-EC development fecal-tagging CT Colonography (CTC). The teaching points of this exhibit are: 1. EC requires accurate classification or segmentation of tagging fecal residuals and their mixtures. Conventional deterministic EC methods exhibit various artifacts and pitfalls. 2. State-of-the-art deep-learning models and training techniques provide an effective solution to reduction of EC artifacts and pitfalls. 3. Intracolonic lumen segmentation (ILS), which combines EC and colon segmentation into a single procedure in the CTC workflow, is a promising Deep-EC method in CTC.

#### TABLE OF CONTENTS/OUTLINE

1. Review of deterministic EC methods with discussion of the limitations and clinical challenges. 2. Describe the challenges of building a large-scale CTC dataset for EC. 3. Present recent technical advances of Deep-EC by applying deeper and larger Convolutional Neural Network (CNN) and various model training techniques to reduce EC artifacts. 4. Present a cutting-edge Deep-EC procedure, Intracolonic lumen segmentation, built on the two-stream U-Net (BiS-UNet) model. 5. Compare the image quality of EC and Deep-EC in 3D visualization of cleansed colon in non-cathartic fecal-tagging CTC. 6. Discuss the technique trend and future developments of Deep-EC.

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## Abstract Archives of the RSNA, 2023

GIEE-43

### Peribiliary Cystic Lesions: Uncommon Mimickers of Hepatic and Biliary Cystic Lesions

#### TEACHING POINTS

To describe and demonstrate with radiological cases the common and uncommon peri-biliary entities. To identify the imaging features indicative of pathologies of the peri-biliary space and emphasize the radiological differences with hepatic and biliary lesions. To propose a practical systematization in the evaluation of intrahepatic peri-biliary cystic lesions. To suggest a step-by-step guide for clinical-radiological reasoning.

#### TABLE OF CONTENTS/OUTLINE

Intrahepatic peribiliary cystic lesions are usually benign and result from cystic dilatation of tubule-alveolar glands with acini of serous and mucinous cholangio-cytes with various stages of maturation. The term intrahepatic refers to cystic changes located above the hepatic hilum that have the portal vein, hepatic artery, and portal neurovascular bundle as anatomical landmarks. They are usually multiple, small, thin-walled, serous content, and by definition do not exhibit communication with adjacent bile ducts. They may take on a confluent appearance resembling multiloculated malignancies or even mimic intraductal biliary pathologies. This intrahepatic peri-biliary region is susceptible to several pathologies that include inflammatory, infectious, neoplastic, congenital and acquired nature. The objective of this review is to systematize the evaluation of peribiliary cystic lesions taking into consideration their intrahepatic location and their radiological aspects that may have some peculiar characteristics.

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## Abstract Archives of the RSNA, 2023

GIEE-44

### More Than Atlanta... The Entire Acute Pancreatitis Map. A Comprehensive Review Of Acute Pancreatitis Complications

#### Participants

Lucia Chagas, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the concepts of the Atlanta criteria, both related to the initial diagnosis (edematous interstitial pancreatitis / necrotizing pancreatitis) and their complications (pancreatic pseudocyst / walled-off necrosis). To provide context for other complications of acute pancreatitis, such as thrombosis, pseudoaneurysm, hemorrhage, infection and ductal disconnected syndrome, regarding the associated risk for their development and diagnosis on imaging exams.

#### TABLE OF CONTENTS/OUTLINE

Schematic drawings and computed tomography and magnetic resonance images aimed at understanding imaging findings that precede certain complications, as well as aspects related to their diagnosis. Differential diagnosis approach between edematous interstitial and necrotizing pancreatitis, as well as the complications that may arise from each of them.

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## Abstract Archives of the RSNA, 2023

GIEE-45

### LI-RADS Treatment Response Algorithm v2023: Roadmap for Post Radiation Treatment Response

#### Participants

Aadithya Nalla, Okemos, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for assessing and reporting treatment response after locoregional therapy (LRT) for hepatocellular carcinoma (HCC).2. When compared to other LRTs, radiation-based therapies (transarterial radioembolization (TARE) and stereotactic beam radiation therapy (SBRT)) have distinct post-treatment imaging appearances, including persistence of arterial phase hyperenhancement (APHE), which makes response assessment challenging using the current TRAs which use APHE as a surrogate imaging biomarker for viability. Changes in the LR-TRA v2023 are intended to address this challenge.3. This exhibit highlights the updates in the LR-TRA v2023, including the correct application of the new algorithm after radiation therapy to HCC, with the overall objective of improving diagnostic accuracy of post-treatment imaging assessment.

#### TABLE OF CONTENTS/OUTLINE

1. Summarize the role of the TRA in the context of radiation therapy for HCC.2. Case-based and illustrative review of expected imaging features after radiation-based treatments to HCC and identify pitfalls in response assessment.3. Introduce and highlight key updates of the new component of the LR-TRA v2023 pertaining to its application after radiation-based treatments for response assessment using a case-based review.

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## Abstract Archives of the RSNA, 2023

GIEE-46

### From Guidelines to Radiology Practice: Navigating the 2023 ASCO Guidelines for Advanced Gastroesophageal Cancer

#### Participants

Charit Tippareddy, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss new 2023 ASCO guidelines for advanced gastroesophageal cancer therapies  
2. Radiologic imaging findings related to treatment sequelae  
3. Differentiate treatment related response versus disease progression on radiologic imaging

#### TABLE OF CONTENTS/OUTLINE

1. Pathophysiology, demographics, risk factors of gastroesophageal cancer  
2. New 2023 ASCO Guidelines and their implications for treatment  
3. Imaging modalities used in diagnosis and staging of advanced gastroesophageal cancer  
4. Role of imaging in staging and management of advanced gastroesophageal cancer  
5. Demonstrate patient imaging cases that relate to the following:  
5a. Treatment related effects of immune checkpoint inhibitors  
5b. Treatment related effects of platinum-based chemotherapy  
5c. Treatment related effects of fluoropyrimidines  
5d. Treatment related effects of tyrosine kinase inhibitors  
5e. Post-radiation effects  
5f. Post-esophagectomy complications  
6. Conclusions

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## Abstract Archives of the RSNA, 2023

GIEE-47

### Internalize It!: An Insider's Case-Based Guide to Internal Hernias

#### Participants

Collin Edwards, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Internal hernias occur due to herniation of viscera, most often small bowel, through the mesentery or peritoneum, and considered in the differential for intestinal obstruction. - Internal hernias are classified by different systems based on distribution of bowel loops in the abdomen and pelvis. - Post-operative internal hernias occur after roux-en-Y anastomosis for gastric bypass and liver transplant. - CT with IV and PO contrast is the imaging modality of choice for evaluating internal hernias. - "Sac-like" appearance of dilated small bowel loops on imaging should raise concern for internal hernia. - Radiologists should have a clear understanding of normal peritoneal anatomy, surgical history, and the characteristic location of common and uncommon internal hernias on imaging.

#### TABLE OF CONTENTS/OUTLINE

- Introduction and background - Normal peritoneal anatomy and boundaries - Case-based review, management, and surgical outcome - Paraduodenal hernia - Lesser Sac/Foramen of Winslow hernia - Pericecal hernia - Intersigmoid hernia - Transmesenteric hernia - Pelvic and broad ligament hernia - Post Roux-en-Y hernias: Petersen's, Roux limb mesentery, enteroenterostomy

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## Abstract Archives of the RSNA, 2023

GIEE-48

### Islet Insurgents: A Radio-Pathologic Review of Pancreatic Neuroendocrine Tumors

#### Participants

David Mata, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

**Purpose/Aim:**The goal is to educate the audience in recognizing the multi-modal imaging features of pancreatic neuroendocrine tumors (pNET), with an emphasis on clinical and pathological correlation. We will also elucidate the histopathologic features of pancreatic neuroendocrine neoplasm subtypes.

#### TABLE OF CONTENTS/OUTLINE

**Content organization:**1. Pancreatic Neuroendocrine neoplasm clinical overview. 2. Differentiating syndromic vs nonsyndromic subtypes. 3. Multi-modal radiographic features on Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). 4. Histopathological and gross pathologic characteristics of pNET. 5. Treatment and Prognosis. 6. Summary.

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## Abstract Archives of the RSNA, 2023

GIEE-49

### Have you Ever Seen the Rain? Cross-sectional Imaging of Pancreatic Leak

#### Participants

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recognize the pancreatic anatomy and its relation to other structures. Understand what can cause a pancreatic fistula (PF) and its mechanisms . Comprehend the imaging patterns of PF. Recognize the potential pitfalls of PF.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION: Pancreatic anatomy and relationship with other abdominal structures. Pancreas imaging patterns on Computed Tomography (CT), and Magnetic Resonance Imaging (MRI). Pancreas patterns after surgery (gastroduodenopancreatectomy, and distal pancreatectomy). Epidemiology of PF, and its causes. DIAGNOSIS AND IMAGING FINDINGS: PF - How to identify on CT? How to identify on MRI? How to proceed? Potential pitfalls of PF, don't get caught! SUMMARY AND SYSTEMATIC APPROACH. TAKE HOME MESSAGES.

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## Abstract Archives of the RSNA, 2023

GIEE-5

### Selected Portal Venous Anomalies: An Institutional Multimodality Case-based Review of Portal Varices and Intrahepatic Congenital Shunts

#### Participants

Abtin Jafroodifar, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review portal venous (PV) varices and aneurysms, including congenital, acquired, true and pseudoaneurysms, with review of extrahepatic and intrahepatic classifications. Learn to properly communicate and report PV varices and aneurysms and their complications such as thrombosis, portal hypertension, or compressive syndromes. Discuss congenital intrahepatic portosystemic shunts subtypes. Review PV embryological development as it relates to a radiologist's practice. Explore the diagnostic clues to recognize PV varices, aneurysms, and intrahepatic shunts using multimodality imaging including ultrasound, CT, MR, and cinematic 3D rendering.

#### TABLE OF CONTENTS/OUTLINE

(1) Review normal and variant portal vein anatomy using CT, MR, angiography, and original diagrams. Briefly review portal vein embryological development from the vitelline and umbilical venous systems. (2) Discuss the diagnostic criteria, relevant presentation, and epidemiology of PV varices and aneurysms. Optimal imaging protocols will be outlined. (3) A case-based review of different types of PV varices, including congenital, acquired, and isolated subtypes. Case-based review of intrahepatic portal vein aneurysms and eventual thrombosis. (4) A case-based review of five types of congenital intrahepatic portosystemic shunts classified by Park et al. (*AJR*, 1990). Present pre- and post closure of a congenital intrahepatic shunt case in a patient with bilateral Wilm's tumors. (5) Present a rare case of splenic vein aneurysm with eventual thrombosis and recanalization using cross-sectional imaging; of note, splenic vein aneurysms are so rare that a true prevalence has not been reported. Discuss mesenteric and splenic vein aneurysms.

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## Abstract Archives of the RSNA, 2023

GIEE-50

### Ensuring High-Reliability Anatomic Evaluation for Living Liver Donors Using Multi-Contrast-Agent MRCP

#### Participants

Valerie Khaykin, Ann Arbor, MI (*Presenter*) Nothing to Disclose  
Reve Chahine, MD, Beirut, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Living donor liver transplantation (LDLT) expands access to transplantation but has the challenges of substantial technical complexity and simultaneous risk for both donor and recipient. 2. Precise understanding of the anatomy of the central liver (biliary drainage, hepatic venous drainage, arterial and venous anomalies) and segment 4 is critical to living donor success. 3. Contrast-enhanced MRCP is used to assess anatomy but suffers from suboptimal reliability due to motion artifacts (eg, respiratory motion at MRCP, arterial phase tachypnea with gadoxetate disodium) and technical factors. 4. We implemented a multi-contrast agent MRCP imaging protocol using gadoxetate disodium and gadobenate dimeglumine to enable high-reliability imaging in the arterial phase (gadobenate) and of the bile ducts (non-contrast MRCP + gadoxetate hepatobiliary phase) and prevent the need for repeat or adjunctive imaging (eg, CTA).

#### TABLE OF CONTENTS/OUTLINE

1. Background on LDLT. Highlight key anatomic considerations for assessing eligibility for donation. 3. Targeted review of conventional single-contrast agent MRCP imaging protocols for living liver donor evaluation. a. MRCP with extracellular gadolinium-based contrast material. b. MRCP with gadoxetate disodium. c. Single contrast agent MRCP followed by CTA. 4. Demonstration of successful multi-contrast agent MRCP for assessing living liver donor eligibility. a. Protocol. b. Technical considerations. c. Advantages. d. Pictorial review. e. Limitations.

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## Abstract Archives of the RSNA, 2023

GIEE-51

### **MR Imaging Biomarkers: Can Aggressive Imaging Features of Hepatocellular Carcinoma Predict Early Post-Treatment Recurrence?**

#### **TEACHING POINTS**

1. Hepatocellular carcinoma (HCC) diagnosis and management is almost exclusively imaging based without the need for pathologic confirmation. 2. Certain MR imaging features have shown to be predictive of more aggressive biologic subtypes of HCC, resulting in increased likelihood of early post-treatment recurrence and worse overall survival. 3. In order to optimally treat HCC, it is important to recognize the multifactorial etiology for tumor recurrence and/or progression including a basic understanding of the complex immunologic tumor microenvironment.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review the histopathology of HCC, including the histologic variants using a pictorial representation of the heterogeneity in the histology and biology of HCC. 2. Pictorial review of MR imaging biomarkers predictive of aggressive tumor biology. 3. Review of the hepatic and tumor microenvironment and its role in treatment response after locoregional therapy. 4. Review clinical outcomes after locoregional therapy to HCC by various locoregional modalities with an emphasis on HCC with aggressive pre-treatment imaging features by using a case-based approach. 5. Demonstrate a proposed mechanism to use various MR imaging biomarkers to risk stratify patients with aggressive versus less-aggressive HCC to reduce the chance of early post-treatment progression and improve overall management.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-52

### Solid Pseudopapillary Tumors of the Pancreas: Old Friend, New Meme

#### Participants

David Mata, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit will depict typical image findings of solid pseudopapillary tumors (SPT) of the pancreas, with an emphasis of epidemiological, clinical, and pathological correlation. Illustrated as well are common mimics of SPT, including neuroendocrine and malignant tumors of the pancreas. A review of epidemiology and clinical features of SPT. Identify relevant Ultrasound (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) appearances of typical SPT. Correlate morphologic findings with Positron Emission Tomography (PET), pathologic microscopy, and gross surgical specimens. Provide key features to differentiate SPT from other retroperitoneal tumors.

#### TABLE OF CONTENTS/OUTLINE

SPT are rare epithelial tumors of exocrine pancreas with low malignant potential and overall good prognosis. Mostly found in young adults and Caucasian women, these tumors are often asymptomatic but can present with abdominal pain and a palpable mass. Since there are SPT mimics, it is important to obtain clinical history and know the epidemiology of SPT. Upon diagnosis, SPT are normally large, circumscribed masses comprised of both solid, hemorrhagic, and necrotic components with no associated ductal dilation. It is important to note, smaller presenting SPT (< 3cm) often have image findings of a solid, homogenous appearance. The intralésional appearance depends on the degree of hemorrhage, calcification, tumor necrosis, or cystic degeneration. These tumors are commonly found in the body and tail of the pancreas. To avoid erroneous interpretation or delay in diagnosis, appropriate knowledge of SPT imaging patterns and presentations is required.

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## Abstract Archives of the RSNA, 2023

GIEE-53

### Mimics of Inflammatory Bowel Disease: Not everything is Crohn's or Ulcerative Colitis

#### TEACHING POINTS

1. Inflammatory bowel disease (IBD; Crohn's disease and Ulcerative colitis) represents a group of diseases characterized by chronic inflammation of the gastrointestinal tract. 2. Patients frequently present with nonspecific symptoms such as abdominal pain, weight loss, diarrhea, nausea, vomiting and obstruction. 3. Various infectious and non-infectious diseases can mimic IBD including malabsorption syndromes, autoimmune diseases, drug-induced conditions, diverticulitis, appendicitis, vascular etiologies and malignancy. 4. Imaging is a crucial tool in identifying IBD mimics as it helps clinicians in making accurate diagnoses and implementing appropriate treatment strategies.

#### TABLE OF CONTENTS/OUTLINE

1. Typical imaging characteristics of IBD (Crohn's disease and Ulcerative colitis). 2. Differential diagnoses of infectious causes with common imaging features and corresponding cases. 3. Differential diagnoses of non-infectious causes with common imaging features and corresponding cases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-54

### Unveiling Internal Hernias A Comprehensive Review of CT Imaging Patterns

#### Participants

Patricia Dantas I, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: Review peritoneal cavity anatomy with emphasis on the most common internal hernia sites. Discuss the role of computed tomography (CT) in the diagnosis and management of patients. Illustrate imaging patterns of the main types of internal hernia, highlighting the specific characteristics of congenital, oncologic and bariatric surgery cases. Identify key CT features that help differentiate open-loop from closed-loop obstruction and those that may predict ischemic injury of the small bowel loops. Recognize the main differential diagnoses and pitfalls of internal hernias, addressing diagnostic challenges. Propose an algorithm to aid in the interpretation of CT images in cases of intestinal obstruction.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction: epidemiology, clinical and pathophysiological aspects of bowel obstruction 2) Role of CT in the evaluation of obstructive acute abdomen, including CT protocol recommendations. 3) Review of peritoneal cavity anatomy:- Main peritoneal spaces;- Ligaments;- Normal recesses and foramina. 4) To demonstrate, through a case-based review, the imaging patterns of the following types of internal hernias:- Paraduodenal Through foramen of Winslow- Intersigmoid- Falciform ligament- Pericecal- Supravesical- Transmesenteric / Transomental- Acquired (postoperative/trauma). 5) To discuss and illustrate major complications of internal hernias:- Ischaemia- Perforation- Illustrative key points. 6) Differential diagnosis and pitfalls. 7) Relevant imaging findings that aid surgical decisions. 8) Algorithm for the diagnosis of internal hernias. 9) Conclusions and "take-home messages".

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## Abstract Archives of the RSNA, 2023

GIEE-55

### Preoperative Assessment in Pancreatic Ductal Adenocarcinoma: Understanding the Impact of Staging and Anatomical Variants on Surgical Planning

#### Participants

Davi Romao, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

It is critical to understand the radiologic features of pancreatic ductal adenocarcinoma and how they affect surgical planning. In this pictorial review, we will focus on the assessment of vascular invasion and its impact on surgical planning. We will also review the major anatomic variants associated with the vascular anatomy of the celiac trunk, superior mesenteric artery and its branches.

#### TABLE OF CONTENTS/OUTLINE

1. Review of pancreatic adenocarcinoma staging  
2. Assessment of vascular invasion in pancreatic adenocarcinoma  
2a. Venous involvement  
2b. Artery involvement  
3. Anatomical variants  
3a. Celiac trunk variants  
3b. Superior mesenteric artery variants  
3c. Venous variants  
4. Surgical Technique  
4a. Cephalic pancreaticoduodenectomy  
4b. Distal pancreatectomy  
4c. Types of venous reconstruction  
4d. Celiac axis resection - when is this feasible?

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## Abstract Archives of the RSNA, 2023

GIEE-56

### Learning From Failure: Non-Target Embolization with Yttrium-90 in the Treatment of Hepatic Tumors

#### TEACHING POINTS

1. The role of hepatic trans-arterial radioembolization (TARE) loco-regional therapy is expanding with new applications particularly in earlier stages of disease 2. Optimized TARE workflow involves careful pre-procedural selection, peri-procedural monitoring, and post-procedural evaluation 3. Peri-procedural imaging and dosimetry allows identification of non-target intra- and extra-hepatic dose delivery as well as target dose estimation 4. Identifying potential causes of discordance between Y-90 microsphere delivery and intended target with multi-modality imaging can impact patient outcomes and may be a valuable area of future research

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to transarterial radioembolization (TARE) 2. Indications and approaches to Y90 radioembolization in hepatic tumors 3. Workflow and evaluation of Y90 Treatment (Pre-, peri- and post-procedural) 4. Examples of non-target delivery, complications, and clinical outcome based on peri-therapy scans 5. Potential causes of non-target delivery 6. Future directions of research

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## Abstract Archives of the RSNA, 2023

GIEE-57

### Update on Multi Energy CT Applications for Pancreatic Diseases

#### Participants

Yasunori Nagayama, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Multi-energy CT provides spectral-based imaging such as virtual non-contrast imaging (VNC), virtual monochromatic imaging (VMI), and material density maps, potentially facilitating the optimal lesion assessment and management for patients with pancreatic diseases. The aim of this presentation is to provide the state-of-the-art clinical applications of multi-energy CT technologies for pancreatic imaging by presenting the numerous representative examples.

#### TABLE OF CONTENTS/OUTLINE

I. Principle of multi-energy CT technology II. Multi-energy CT systems III. Post-processed spectral CT imaging IV. Clinical applications of spectral imaging in pancreatic diseases A) Improved lesion delineation 1. Iso-attenuating pancreatic ductal adenocarcinoma (PDAC) 2. Incidental PDAC on routine abdominal CT 3. Staging of PDAC on routine portal-venous phase CT 4. Neuroendocrine tumor (NET) 5. Acute pancreatitis B) Spectral-based lesion characterization 1. Chronic mass forming pancreatitis vs. PDAC 2. NET vs. intrapancreatic accessory spleen 3. Local recurrence of PDAC vs. post-operative perivascular fibrosis 4. Pancreatic cyst C) Prediction of clinical outcome 1. Chemotherapy response for PDAC 2. Risk stratification for post-operative pancreatic fistula (POPF) 3. Prediction of future PDAC development D) Improve patient safety by reducing radiation dose and iodine doses

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## Abstract Archives of the RSNA, 2023

GIEE-58

### Gastrointestinal Oncologic Emergencies: A Radiologists' Guide

#### Participants

Mindy Wang, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Describe the imaging approach for evaluating oncologic emergencies affecting gastrointestinal tract.
- Identify imaging manifestations of gastrointestinal oncologic emergencies.
- Identify potential pitfalls in imaging of gastrointestinal oncologic emergencies.

#### TABLE OF CONTENTS/OUTLINE

- Gastrointestinal oncologic emergencies and imaging approach
- Multimodality imaging features of gastrointestinal oncologic emergencies
  - o Intestinal obstruction
  - o Intestinal ischemia
  - o Intestinal perforation
  - o Intussusception
  - o Inflammatory/infectious changes (including superinfection of tumor necrosis/abscess formation)
  - o Graft versus host disease
  - o Tumor torsion/volvulus
  - o Peritonitis
  - o Lymphatic obstruction
  - o Vascular complications
    - § Hemorrhage (including active extravasation and intramural hematoma)
    - § Thrombosis (microangiopathy, venous and arterial thrombosis or thrombophlebitis)
    - § Arteritis
    - § Aneurysm/pseudoaneurysm
  - o Emergencies related to paraneoplastic syndrome
- Management
- Mimics and potential pitfalls

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## Abstract Archives of the RSNA, 2023

GIEE-59

### Hepatic Artery Infusion Pump: A Multi-institutional Comprehensive Case-based Review

#### Participants

Harit Kapoor, MD, MBBS, Poughkeepsie, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) HAIP is a novel surgically placed intraarterial pharmacotherapeutic option with three salient indications: unresectable burden of colorectal liver metastases (CRLM), adjuvant therapy post CRLM resection and in unresectable intrahepatic cholangiocarcinoma (ICC).2) Post-procedure Tc-MAA SPECT are vital to ensure isolated and maximal bilobar hepatic perfusion for safe and efficacious drug delivery.3) Patient selection is multi-factorial including presence of intra- and extrahepatic disease, anatomy and patency of vasculature, hepatic function, extent of prior chemotherapy treatment, and performance status.4) All HAI devices are MRI conditional however the Medtronic Synchroned II device is set to automatically stall while in the scanner and must be interrogated post-scan to assure the motor has restarted.5) HAIP therapy is associated with unique complications, many of which are delayed and unsuspected. Meticulous interrogation of the catheter tip position and a low threshold for further investigations on follow-up imaging can help decrease complication rates.

#### TABLE OF CONTENTS/OUTLINE

1) Role of HAIP therapy for different clinical indications.2) Technical aspects of HAIP placement and trouble shooting in extrahepatic perfusion3) Expected imaging appearances of HAIP devices in both normal and variant anatomic situations4) Role, interpretation and management implications of Tc-MAA SPECT pump perfusion imaging5) Tabulated overview and Case-based examples of HAIP complications (Pump pocket-related, Catheter-related and Hepatobiliary).6) Summary

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## Abstract Archives of the RSNA, 2023

GIEE-6

### Improving the Gall Stone Detectability by Using the Monochromatic Images with a Fast kVp-Switching Single-Source Spectral Computed Tomography: A Phantom Experiment with Gall Stone Specimen

#### TEACHING POINTS

1. In the conventional polychromatic (kVp) scan mode, gall stones detectability such as the cholesterol, pigment, and rare were lower because the small difference of computed tomography (CT) value (hounsfield unit: HU). 2. Nowadays, with the application of fast kVp switching single source dual energy scan, its spectral mode enables the ability to reconstruct monochromatic images at different energy level. The purpose of this study is to compare the gall stones detectability between the dual energy scan mode and conventional polychromatic scan mode during a phantom study. 3. The monochromatic display method (cine display mode and spectral HU curve) with dual energy scan mode was possible for improving the detection of various gallstones compare with the conventional polychromatic scan mode (kVp).

#### TABLE OF CONTENTS/OUTLINE

CONTENT ORGANIZATION 1: Clinical case (Cholelithiasis) :MRI and CT images 2: Gall stone specimens :dual energy CT scan mode images(keV) and conventional scan mode images (kVp). 3: Spectral HU curve 4: Gall stone specimens (cholesterol): cine display mode 5: Clinical case (Cholelithiasis): performed dual energy CT

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## Abstract Archives of the RSNA, 2023

GIEE-60

### A "Cyst"ematic Approach to Cystic Pancreatic Lesions

#### TEACHING POINTS

The target audience of this educational activity is for all radiologists who read CT or MR imaging of the abdomen.1. Demonstrate multimodality imaging features and patterns of common cystic pancreatic lesions2. Illustrate a systematic approach to distinguishing between pancreatic cystic lesions3. Review case-based clinical management including histopathologic correlation

#### TABLE OF CONTENTS/OUTLINE

Content: A systematic multi-modality imaging review of pancreatic cystic lesions will be included including an explanation for key diagnostic features, differentiation between lesions, histopathologic correlation, and review of management. The case selection includes:1. Mucinous cystic neoplasms2. Serous cystadenomas3. Solid pseudopapillary epithelial neoplasms4. Intraductal papillary mucinous neoplasms5. Cystic neuroendocrine tumors6. Sequela of pancreatitis (pseudocysts and walled off necrosis)

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## Abstract Archives of the RSNA, 2023

GIEE-61

### Exploring the Uncommon: Lesser-Known Abdominal Syndromes and Their Presentation

#### Participants

Priyanka Prajapati, MBBS, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points 1. Illustrate rare abdominal syndromes with clinical and radiological features. Highlight the constellation of associated findings and complications. 3. Emphasize the importance of a multimodality approach when diagnosing rare abdominal syndromes.

#### TABLE OF CONTENTS/OUTLINE

Table of contents 1. Background 2. Normal anatomy relevant to the syndromes 3. Importance of Pathology, Molecular tests, Imaging, Laboratory tests 4. Case based illustrations of: a) TEMPI Syndrome b) Abernethy Syndrome c) DRESS Syndrome d) Li-Fraumeni Syndrome 5. Classical clinical presentation and laboratory findings 6. Pertinent Imaging findings of the syndromes 7. Associated pathologies found 8. Other Rare Abdominal Syndromes

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## Abstract Archives of the RSNA, 2023

GIEE-62

### Imaging Overview of Peritoneal Mesothelioma

#### Participants

Suren Reddy Satti, Preston, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A comprehensive overview of peritoneal mesothelioma with a focus on the histological subtypes, key distinguishing imaging features and understanding the common pitfalls involved in diagnosis.

#### TABLE OF CONTENTS/OUTLINE

The aim is to improve understanding of peritoneal mesothelioma and the subtypes to aid with diagnosis and subsequent management. We present a radiological case-based review of the subtypes of peritoneal mesothelioma with accompanying histological and intra operative findings. Clinical features along with specific imaging findings for each subtype will be shown along with some pitfalls in interpretation. Subtypes of peritoneal mesothelioma: 1. Multicystic mesothelioma 2. Well differentiated papillary mesothelioma 3. Epithelioid mesothelioma 4. Sarcomatoid mesothelioma 5. Biphasic mesothelioma Mimics of mesothelioma - Lymphangioma - IgG4 peritoneal disease - Tuberculosis

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## Abstract Archives of the RSNA, 2023

GIEE-63

### Burn the Cake: The Role of HIPEC in Pseudomyxoma Peritonei

#### Participants

Vitor Bichuette, MD, Uberaba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To review concepts involving epidemiology, imaging findings and surgical techniques used in the treatment of pseudomyxoma peritonei (PP). ? To illustrate the use of peritoneal cancer index (PCI) to assess the peritoneal cavity. ? To review how hyperthermic Intraperitoneal chemotherapy (HIPEC) is performed, the techniques involved, indications and contraindications, and related complications. ? To discuss how radiologists can help surgeons in the management of PP.

#### TABLE OF CONTENTS/OUTLINE

- Introduction - General concepts
  - o The use of CT to assess the PCI
- Pseudomyxoma peritonei:
  - o Definition, clinical presentation, imaging features and treatment.
  - o Imaging aspects of peritoneal pseudomyxoma and peritoneal carcinomatosis: how to differentiate
  - o Surgical treatment
- HIPEC:
  - o A step-by-step explanation of how HIPEC is performed.
  - o Advantages, indications and contraindications.
  - o Most common outcomes and complications.
- Case-Based Review:
  - o Sample cases explaining and demonstrating image findings of PP and how CT can be used before and after the surgery
  - o Assessment of PCI
  - o HIPEC: normal and abnormal findings
- Future Directions: new perspectives in the use of HIPEC to treat peritoneal tumors.
- Conclusion and key takeaways.

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## Abstract Archives of the RSNA, 2023

GIEE-64

### Sonazoid-Enhanced Ultrasonography: What Can We Do in Abdominal Radiology and Intervention?

#### Participants

Jae Woong Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Sonazoid-enhanced ultrasonography (SEUS) is recently introduced contrast-enhanced ultrasonography using Sonazoid (GE Healthcare) offering the vascular phase and the unique post-vascular Kupffer phase for helping diagnose focal liver lesions (FLL). Its role has been primarily focused on differentiating benign and malignant FLLs. However SEUS can be used in diverse clinical settings such as evaluating the hepatic vasculature, and a guiding tool for interventional procedures of the liver. In conclusion, we believe that CEUS can be applied to diverse clinical settings, not only for the diagnostic purposes but also for the interventional procedures as an excellent guiding tool.

#### TABLE OF CONTENTS/OUTLINE

1) Physics of SEUS, 2) Diagnostic roles of SEUS, 3) Application of SEUS in evaluation of hepatic vasculature, 4) Introduction of SEUS during liver biopsy, 5) SEUS as a guidance tool for radiofrequency ablation, 6) Tips and limitations of SEUS.

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## Abstract Archives of the RSNA, 2023

GIEE-65

### Fundamental of Pancreatic Adenocarcinoma Imaging on CT: What a Resident Should Know

#### Participants

Carlos M. Campana SR, MD, CDMX, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the pancreas, its vasculature and lymphatic drainage.- Illustrate the CT features of pancreatic adenocarcinoma. - Understand the staging of the pancreatic adenocarcinoma and the surgical criteria.

#### TABLE OF CONTENTS/OUTLINE

- Introduction.- Anatomic considerations.- Teaching points.- CT features of pancreatic adenocarcinoma.- Case based approach.- Staging and surgical criteria.- Conclusions.

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## Abstract Archives of the RSNA, 2023

GIEE-66

### Fake Liver Lesions: Can You Help Me? An Illustrative Guide to Liver Pseudo-lesions and Tumor Mimickers

#### Participants

Roberta Sasso, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review importance of epidemiology for diagnosis of liver lesions. Illustrate clinical and imaging findings that might help distinguishing benign and malignant liver lesions. Practical tips and imaging features that could help achieve an accurate diagnosis and avoid unnecessary procedures. Highlight potential pitfalls related to different treatments that may mimic liver lesions.

#### TABLE OF CONTENTS/OUTLINE

Introduction - General concepts: epidemiology of liver lesions, including risk factors, incidence, and mortality. Imaging findings on CT and MRI of several liver lesions. Liver lesions: illustrative cases of different benign hepatic lesions and pseudolesions that mimic malignant hepatic lesions. Pitfalls: expected post-treatment changes that might be confused with true lesions. Normal findings after surgery, transplant, ablation, embolization, radiation and immunotherapy are reviewed. Case-Based Review: series of cases demonstrating imaging findings of liver lesions and how different modalities can be used. Conclusion and key takeaways.

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## Abstract Archives of the RSNA, 2023

GIEE-67

### Imaging Review of Pseudomyxoma Peritonei

#### TEACHING POINTS

Comprehensive radiological overview of pseudomyxoma peritonei (PMP), and its patterns of disease spread. Common appearances of appendix mucinous tumours and frequently encountered interpretation pitfalls leading to misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

Diagnosis of PMP is often delayed in the non-specialist setting due to minimal exposure to appendix tumours and a lack of awareness. The aim is to improve the knowledge of pseudomyxoma peritonei and aid in the radiological diagnosis through understanding of its various aetiologies and the common pitfalls in imaging diagnosis. We present a case-based exhibit of PMP with reference to histology and intra-operative findings. To include:

- Common radiologic findings at presentation, predominant patterns of disease spread and complications of PMP with key review areas when reporting.
- Examples of delayed diagnosis from misinterpretation with tips and tricks to aid with accurate diagnosis. The cases include:
  - o Primary appendix tumours, misdiagnosed as an abnormal ovary or fallopian tube.
  - o Krukenberg tumours reported as a primary ovarian tumour.
  - o Diffuse peritoneal disease with a primary appendix tumour (initially not identified).
  - o Complicated appendicitis with an underlying tumour.
- Other origins of pseudomyxoma other than the appendix, such as urachus and mature teratoma of the ovary.
- How to optimize imaging to aid with diagnosis, utilizing positive oral contrast in computed tomography (CT) imaging of pseudomyxoma peritonei, use of MRP re-formats and MRI protocols.

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## Abstract Archives of the RSNA, 2023

GIEE-68

### Role of Radiological Imaging in the Diagnosis and Management of ERCP Complications

#### TEACHING POINTS

- What is Endoscopic Retrograde Cholangiopancreatography (ERCP), and in which situations is it performed?
- What are the complications of ERCP and how often do we encounter them?
- Diagnosis of ERCP complications with the help of imaging methods. Tips for radiologists
- The importance of imaging methods in the early diagnosis of complications
- The role of imaging in management of complications

#### TABLE OF CONTENTS/OUTLINE

Table of Contents

- Terminology and anatomy of the bile ducts and pancreatic duct
- Post-ERCP expected imaging findings
- Complications of ERCP
- Demonstration of pathologies in imaging methods for the diagnosis of complications
- The importance of early diagnosis in case of complications and correlation of imaging finding with clinical symptoms and signs
- Demonstration of possible complications with sample cases
- Follow up imaging findings during the treatment process of patients with complications

Outline

- Endoscopic retrograde cholangiopancreatography (ERCP) is an application that is increasingly used to treat biliopancreatic disorders. This situation leads to a rise in the number of cases with complications.
- It is important to distinguish between expected findings and pathological findings in post ERCP images.
- It is important to evaluate the history and physical examination together with imaging methods for early diagnosis of complications and to decrease morbidity.
- Imaging methods play a guiding role in the classification of complications.

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## Abstract Archives of the RSNA, 2023

GIEE-69

### Multimodality Imaging in the Detection and Characterization of Anatomic Variants, Benign, and Malignant Conditions of the Peri-Ampullary Region

#### Participants

Kelvin Cortis, FRCR, Msida, Malta (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the conventional and variant anatomy of the ampullary and periampullary region. To provide a structured differential of the various conditions that may present at the ampullary and peri-ampullary regions. To describe the imaging features of pathologies at these regions.

#### TABLE OF CONTENTS/OUTLINE

The periampullary region is an anatomically and pathologically complex region. It encompasses the pancreatic head, second part of the duodenum, pancreato-biliary junction, and associated neurovascular structures. All these structures are within a 2cm radius from the major duodenal papilla. Familiarity with this area and its variants will increase diagnostic accuracy and recognition of associated complications, thereby guiding proper management. This pictorial exhibit will display the multimodality imaging findings of developmental, benign, and neoplastic entities that may arise at the ampullary and peri-ampullary regions. Developmental entities include duodenal webs, pancreas divisum, pancreaticobiliary malunion, and annular pancreas. Para-duodenal pancreatitis, papillitis, Lemmel's syndrome, choledocholithiasis, and vascular abnormalities, are benign conditions that might involve the ampullary region. Neoplastic conditions that can involve the periampullary region include ampullary carcinoma, periampullary duodenal carcinoma, pancreatic tumours, distal common bile duct tumours, gastrointestinal stromal tumours, and neuroendocrine tumours. Abdominal radiologists should have a thorough anatomical understanding of the ampullary region in order to formulate a structured differential diagnosis that will lead to timely and precise diagnosis and management.

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## Abstract Archives of the RSNA, 2023

GIEE-7

### Anorectal Fistula - Detection, Classification, and Post Treatment Follow-up

#### Participants

Joseph Owen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Identify and describe anorectal fistula based on the Parks classification system on MR2. Explain the options for treatment of anorectal fistula and associated complications based on their classification3. Recognize and describe the post treatment appearance of anorectal fistula and abscesses on CT and MR

#### TABLE OF CONTENTS/OUTLINE

The predisposing factors for development of anorectal fistula: Crohn's Disease; Prior pelvic radiation; Obstetric injuries; Infection; Foreign body insertio; MalignancyDiagnoses and characterization: MR; Exam under anesthesiaClassification of anorectal fistula with the Parks classification Inter-sphincteric; Trans-sphincteric; Supra-sphincteric; Extra-sphinctericClassification of Anorectal Abscess: Ischiorectal; Inter-sphincteric; Supra-levator; HorseshoeTreatment Abscess- Incision and drainage; Simple fistula - Primary fistulotomy; Complex fistula - Sphincter-sparing staged treatmentPost-treatment imaging appearance and characterization Seton; Endoanal advancement flap; Residual scar tissue; and inflammation; Recurrent fistula; Recurrent abscess

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## Abstract Archives of the RSNA, 2023

GIEE-70

### Advanced Pancreatic Imaging: 10 Tips and Tricks

#### Participants

Mariana Peleja, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pancreatic ductal adenocarcinoma (PDAC) and other pancreatic conditions can be very difficult to diagnose and be a real challenge even to an experienced radiologist. The purpose of this exhibit is to present, through a series of challenging cases, the direct and indirect signs of focal and diffuse pancreatic disease, and how can the radiologist help to establish the correct diagnosis using different imaging methods, such as Ultrasound (US), Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) CT. Some of the presented tips include:- Careful evaluation of main pancreatic duct or biliary tree dilation;- Importance of the T1-weighted images to evaluate the pancreatic parenchyma;- Look for asymmetrical parenchyma atrophy;- Pay attention to abnormalities involving the surrounding vessels;- Search for secondary lesions if uncertain about malignancy (such as liver and lymph nodes).

#### TABLE OF CONTENTS/OUTLINE

- Cases of pancreatic neoplasms and inflammatory conditions, with subtle findings that should raise a suspicion for a pancreatic disease;- Brief Review of pancreatic anatomy with multimodality imaging;- Image assessment of PDAC, with its features spectrum and tricky findings;- Importance of imaging for staging and resectability evaluation;- Other challenging cases in pancreatic cancer imaging, which the radiologist expertise is crucial to the correct management of disease.

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## Abstract Archives of the RSNA, 2023

GIEE-71

### Peritoneal carcinomatosis: A Comprehensive Review of Peritoneal MRI. Primer for Residents

#### TEACHING POINTS

Peritoneal carcinomatosis is a common metastatic manifestation in several malignancies, with a higher incidence in gastrointestinal and gynecological tumors. Imaging techniques are essential in assessing the extent of the disease and guiding treatment decisions. Peritoneal MRI is a noninvasive technique that provides high-quality imaging of the peritoneum with excellent soft tissue contrast and high spatial resolution, with no exposure to ionizing radiation. Specific imaging protocols with DCE and DWI sequences allow a better assessment of peritoneal disease, especially unfavorable sites such as mesenteric and intestinal involvement, with enhanced sensitivity for detecting small lesions. Clinical applications of peritoneal MRI include diagnosis, staging, and monitoring of peritoneal metastases, with a crucial role in guiding therapeutic strategies and prognostic utility in patients undergoing cytoreductive surgery or HIPEC. The "PAUSE" method offers a structured approach to reporting peritoneal involvement, providing a precise description of the location and extent of the disease, serving as a road map for the surgeon and facilitating surgical planning.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Peritoneal metastases and diagnostic challenges. Advantages over CT and PET/CT. Peritoneal MRI: Dedicated protocol. Clinical applications: Diagnosis, staging, and monitoring of peritoneal metastases. Advantages and limitations. The "PAUSE" method: A structured reporting tool. Case examples. Conclusions. References

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## Abstract Archives of the RSNA, 2023

GIEE-72

### Photon-counting CT: Technical Features and Clinical Impact on Abdominal Imaging

#### Participants

Hiroimitsu Onishi, MD, PhD, Suita, Japan (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, General Electric Company

#### TEACHING POINTS

The photon-counting CT system is equipped with a photon-counting detector that can measure the number of photons and the energy of each photon, allowing the acquisition of images with high spatial resolution and virtual monochromatic contrast. One of the major advantages of photon-counting CT in abdominal examinations is that it provides virtual monochromatic images with high image quality and high spatial resolution. The purpose of this presentation is: 1. To illustrate the technical features of photon-counting CT system compared with conventional CT system with energy integrating detector, 2. To introduce the effective use of photon-counting CT for the evaluation of abdominal diseases, and 3. To discuss the clinical impact of photon-counting CT on the diagnosis of abdominal diseases.

#### TABLE OF CONTENTS/OUTLINE

1. Technical overview of photon-counting CT; 2. Scan modes; ultra-high resolution mode, multi-energy mode, and dual source mode; 3. A variety of image reconstruction kernels; 4. Quantum iterative reconstruction algorithm; 5. High spatial resolution; 6. Valuable virtual monochromatic imaging; 7. Possibility of radiation dose reduction; 8. Scanning protocols optimized for the abdominal diseases; 9. Clinical implications for the diagnosis of abdominal diseases; 10. Summary

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## Abstract Archives of the RSNA, 2023

GIEE-73

### Pearls and Pitfalls of Rectal MRI: The Only Stool You Need

#### Participants

Hala Khasawneh, MBBS, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Highlight essential imaging findings in staging. Illustrate essential key points and common pitfalls to serve as a guiding tool for radiologists through an interactive approach. Overview of current treatment options including surgical and nonsurgical approaches, such as "watch and wait" will be discussed.

#### TABLE OF CONTENTS/OUTLINE

Over the past few decades, rectal MRI has created a paradigm shift in the management options of rectal cancer by providing accurate TNM staging and restaging as well as post-treatment assessment. However, a few controversies remain in reporting TNM staging for rectal cancer which radiologists need to be aware of to provide more reproducible and standardized reporting. The benefit of rectal MRI in guiding disease management relies on obtaining high-quality scan for accurate TNM staging, assessment of Circumferential Resection Margin, Extramural Vascular Invasion, anal canal involvement and tumor relation with surrounding pelvic structures. Using an evidence-based approach, we aim to clarify controversial key points in reporting rectal MRI, including staging of T4b tumor, utilizing diffusion weighted imaging in restaging, evaluation of mucinous lesions, differentiating lymph nodes from tumor deposits, and morphological assessment and localization of lateral pelvic lymph nodes in staging and restaging. Rectal MRI is essential for tailoring treatment plans in rectal cancer. Therefore, it is paramount to have standardized and reproducible interpretation of scans to enhance consistency in disease staging.

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## Abstract Archives of the RSNA, 2023

GIEE-74

### The Magic Eye: Advantages of Spectral CT Imaging over Conventional CT in Liver and Pancreatic Pathology

#### Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review the most important spectral CT reconstructions for abdominal imaging and the improvement in material differentiation with this technique. - To show Spectral CT imaging advantages over conventional CT through some cases of liver and pancreatic pathologies.

#### TABLE OF CONTENTS/OUTLINE

Background:Spectral CT is gaining increasing clinical importance with multiple potential applications including abdominal and oncology imaging.We present different cases with liver and pancreatic pathologies where spectral CT images offer multiple advantages over conventional CT, as low-energy virtual monoenergetic images and iodine maps for the detection of hyper- and hypovascularized liver lesions. The purpose of this review is to provide an overview of potential useful abdominal applications of spectral CT focused on liver and pancreatic pathology.Details of content:We present different types of cases (such as characterization of liver and pancreatic lesions, improving vascular contrast for surgical planning or evaluation the response of tumour therapy) and review and analyze the most important spectral CT reconstructions for each case (virtual unenhanced, iodine maps and virtual monochromatic reconstructions).These reconstructions allow better detection and characterizations of findings and reduce the need for correlative or follow-up imaging.Conclusion:Spectral TC imaging offers multiple advantages in the abdominal area. The combination of different types of spectral reconstructions improves better detection and characterization of liver and pancreatic lesions. It also allows precise treatment planning and could be a potential therapy monitoring parameter.

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## Abstract Archives of the RSNA, 2023

GIEE-75

### Going, Going, Gone: Case-Based Review of Sclerosing Hemangiomas

#### Participants

Bryson Jones, BS, Georgetown, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Hepatic hemangiomas are the most common benign neoplasm encounter in the liver and most are discovered incidentally. 2) The appearance of hemangiomas may change over time and may be influenced by senescent changes of the liver or diffuse disease of the surrounding hepatic parenchyma. 3) Hemangiomas undergoing degeneration has been described as sclerosing/sclerosed, hyalinized, or thrombosed and present a diagnostic dilemma for radiologist 4) Understanding the imaging appearance and crucial importance of prior comparative imaging is key to making the diagnosis and avoiding unnecessary additional imaging and invasive procedures.

#### TABLE OF CONTENTS/OUTLINE

I. Briefly review the classic appearance of hepatic hemangiomas, incidence and natural history, as well as illustrative pathological changes that are proposed to occur as hemangiomas sclerose. II. Propose a diagnostic algorithmic approach to a suspected sclerosing/sclerosed hemangioma. III. Provide case-based imaging examples of hemangiomas as they evolve over time, including US, CT, MRI and CEUS. IV. Provide case-based imaging example of pitfalls in attempting to prospectively diagnose sclerosing hemangiomas.

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## Abstract Archives of the RSNA, 2023

GIEE-76

### **Pitfalls of Contrast-enhanced Ultrasound (CEUS) in Liver Lesions: Early Arterial Enhancement Patterns and Washout**

#### **Participants**

Elhamy Heba, MD, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Understand the utility of CEUS in a patient population in which CT and MRI contrast agents are contraindicated. 2. Discuss different enhancement patterns of benign and malignant liver lesions. 3. Explain pitfalls in interpreting washout (most associated with malignancy) including understanding true intravascular nature of microbubbles contrast agent and that additional factors related to technique can lead to early bubble rupture and appearance of false washout in benign lesions. 4. Discuss possible pathophysiology of earlier rupture of the microbubbles in benign subcapsular liver lesions compared to lesions located deeper in the liver. 5. Discuss potential false positive washout scenarios in benign liver lesions on a background of hepatic steatosis due to echogenic liver parenchyma resulting in lesion appearing relatively hypoechoic compared to adjacent liver parenchyma.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview: review of the utility of CEUS and mention the advantages, disadvantages and indications in liver imaging. 2. Understanding the mechanism of CEUS agent (microbubbles), explaining how that might contribute to false washout in different circumstances. 3. Different enhancement pattern of benign and malignant liver lesion with emphasis on washout as an important feature to suggest malignancy of liver lesion. 4. False washout in benign liver lesions as a pitfall of CEUS, case-based approach. 5. True washout in cases of hepatocellular carcinoma, metastases, and cholangiocarcinoma for comparison.

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## Abstract Archives of the RSNA, 2023

GIEE-77

### Imaging Evaluation in Living Liver and Kidney Donors: What to Report

#### Participants

Thamy Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Illustrate the main imaging standards in the pre-transplant evaluation of live liver and kidney donors through conventional radiology images, such as computed tomography (CT) and magnetic resonance imaging (MRI), from the digital archive of our institution.2- Improve the understanding of vascular variants (arterial and venous) and their implications in the pre-renal and liver transplant evaluation of potential living donors using a didactic approach, through illustrations.3- Evaluation of donors' pre-transplant images, understanding the procedure and identification of anatomical variants that may interfere with the surgical technique, in addition to possible pathologies that may prevent a possible transplant.4- Describe and prepare a structured report of the main findings that may contraindicate the candidate for transplants, in addition to assisting in the surgical technique to be performed.

#### TABLE OF CONTENTS/OUTLINE

1 - Review of vascular variants, pathologies and anatomical reconstructions of candidates for pre-transplantation of live liver and kidney donors through illustrative images.2 - Illustration of vascular variants and pathologies supported by the use of illustrative images that may imply or prevent transplantation.3 - Preoperative knowledge of hepatic and renal vascular anatomical variants is mandatory for surgical planning and to help reduce postoperative complications. This information must pertain to the structured report.4 - Summary and messages to take home.

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## Abstract Archives of the RSNA, 2023

GIEE-78

### The Many Faces of FNH: MRI Findings

#### Participants

Enzo Casali SR, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the typical presentation of FNH. Analyze uncommon MRI findings in FNH. Evaluate the importance of liver-specific contrast agents in achieving correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Focal nodular hyperplasia (FNH) is the second most common benign liver tumor after hemangioma. Magnetic Resonance (MRI) is an extremely useful tool for the diagnosis of FNH due to its high sensitivity and specificity. The correct diagnosis of FNH and its distinction from other differential diagnoses is essential because asymptomatic patients with FNH do not require treatment. FNH is classified as classic or nonclassic and MRI findings vary according to this. Lesions typically shows iso or hypointense signal on T1-weighted images, slightly hyper or isointense signal on T2-weighted images, an hyperintense central scar on T2-weighted images, an intense homogeneous enhancement during the arterial phase of gadolinium-enhanced imaging and enhancement of the central scar during later phases. Other more infrequent findings are: increase in size, T1 hyperintensity, the presence of a pseudocapsule, the appearance of multiple FNH all at once and the association with other benign liver lesions. Using liver-specific contrast agents may facilitate the diagnosis in these cases. Recognizing these different MRI patterns allows us to establish a correct diagnosis of FNH, preventing treatment in asymptomatic patients.

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## Abstract Archives of the RSNA, 2023

GIEE-79

### Abbreviated MRI Techniques for HCC Screening

#### Participants

Diana Kadi, MD, Durham, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. US has low sensitivity for HCC, especially in early-stage tumors, cirrhosis and obesity. 2. To improve sensitivity over US for early detection of HCC, while remaining cost-effective, Abbreviated MRI (AMRI) protocols have been developed. 3. This exhibit will review emerging concepts in AMRI-based HCC surveillance, including technical aspects, diagnostic performance, current gaps in knowledge, and future directions.

#### TABLE OF CONTENTS/OUTLINE

1. Current guidelines for HCC surveillance 2. Limitations of US 3. CT and MRI a. Superior reported diagnostic sensitivity, especially for small and early HCC b. Limitations 4. Three general AMRI approaches a. Non-contrast AMRI i. Technique o T1 weighted imaging a. Low sensitivity for early-stage HCC o T2 weighted imaging a. Help differentiate suspicious/benign lesions b. Low sensitivity for small HCC o Diffusion weighted imaging a. Restricted diffusion favors malignancy b. Higher lesion conspicuity ii. Reporting iii. Advantages iv. Disadvantages b. Dynamic AMRI i. Technique o Pre-contrast o Arterial phase a. Assess APHE o Portal venous and delayed phases a. Washout b. Capsule ii. Reporting iii. Advantages iv. Disadvantages 5. Hepatobiliary Phase AMRI a. Technique i. Hepatobiliary phase imaging o High liver to lesion contrast ii. T2 weighted imaging o Excludes some benign lesions iii. DWI o Mixed data regarding benefit of DWI b. Reporting c. Advantages d. Disadvantages 6. Gaps and current needs a. Prospective studies are needed to implement AMRI in guidelines b. Current utilization should be in patients whose US-based HCC surveillance is compromised

**SUMMARY** AMRI is a high-sensitivity alternative to US for surveillance of early-stage HCC in patients at risk for HCC.

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## Abstract Archives of the RSNA, 2023

GIEE-8

### Intrahepatic Cholangiocarcinoma: A Review of Current and Emerging Imaging Techniques and Treatment Options

#### Participants

Julia Saltalamacchia, MD, Portland, OR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Intrahepatic cholangiocarcinoma makes up a small percentage of total CCA cases, but treatment and surgical options differ from extrahepatic cholangiocarcinoma  
2. Improvements in MRCP imaging and PET/MRI serve as complimentary modalities to standard MR and CT imaging for staging, problem solving, and follow up.  
3. Recent developments in systemic and locoregional therapies have expanded treatment options and therapy considerations including radiation therapy, interventional oncology, expanded neoadjuvant therapies, and expanded surgical resectability (including transplantation)

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Intrahepatic cholangiocarcinoma work-up  
a. NCCN guidelines  
3. Imaging considerations  
a. Characteristic findings  
b. Mimics and pitfalls  
c. The emerging role of FDG PET MRI  
4. Treatment options  
a. General principles - locoregional and systemic options  
b. Chemotherapy  
1. Systemic therapy  
2. Targeted  
a. Transarterial chemoembolization  
b. Hepatic arterial infusion pump  
3. Downstaging after neoadjuvant therapy  
c. Radiation  
1. External beam radiation therapy  
2. Y-90 radioembolization (lobar and radiation segmentectomy)  
d. Surgical  
1. Preoperative considerations  
2. Patient selection  
3. Surgical options  
a. Wedge resection  
b. Segmentectomy +/- hepaticojejunostomy (HJ)  
c. Hepatectomy +/- HJ  
d. Transplantation

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## Abstract Archives of the RSNA, 2023

GIEE-80

### Role of Radiology in a Multidisciplinary Approach of Hepatocellular Carcinoma

#### Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review international diagnostic HCC guidelines and LI-RADS with examples- To review the classical imaging appearance and patterns of HCC- To understand imaging features that correlate with favorable versus poor outcome and those associated with post-treatment response and recurrence

#### TABLE OF CONTENTS/OUTLINE

1. Background 2. When to use each imaging modality? 3. Optimal study protocol of the liver 4. What contrast agent to use? Hepatobiliary versus extracellular contrast agent 5. Characterization of hepatocarcinoma nodules 6. How to use LI-RADS? 7. International diagnostic HCC guidelines 8. Mimickers and Overdiagnosis of HCC: Flash-filling hemangioma, focal confluent fibrosis, intrahepatic cholangiocarcinoma, hepatic lymphoma 9. Staging, treatment decision-making, and follow-up of HCC 10. Evaluating beyond the liver: Common sites of extrahepatic metastasis 11. How to select patients with HCC for liver transplantation, resection or locoregional treatment? 12. Advanced disease: Locoregional therapies or systemic therapies

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## Abstract Archives of the RSNA, 2023

GIEE-81

### Pseudomyxoma Peritonei: Concepts, Classification, Imaging Spectrum and HIPEC

#### TEACHING POINTS

To describe and demonstrate the imaging features of pseudomyxoma peritonei in the various diagnostic modalities. To propose a systematization of the evaluation of pseudomyxoma peritonei. Contextualize the role of imaging to predict the extent and quantification of disease that may result in a more aggressive surgical approach combined with or without HIPEC.

#### TABLE OF CONTENTS/OUTLINE

Peritoneal pseudomyxoma (PPM) is a clinical syndrome characterized by the accumulation of mucinous ascites in the peritoneal cavity. The most common cause of peritoneal pseudomyxoma is mucinous neoplasms in the appendix and according to the new consensus statement, PPM is classified based on the histology of the peritoneal disease and not based on the primary neoplasm. Peritoneal pseudomyxoma is classified into: acellular mucin, low-grade mucinous carcinoma peritonei (G1), high-grade mucinous carcinoma peritonei (G2) and high-grade mucinous carcinoma peritonei with signet ring cells (G3). The imaging spectrum of PPM is variable and suggestive findings include mucinous ascites, peritoneal nodules and omental. It is essential to be familiar with this pathology since accurate staging, with details of the sites affected, is essential to define therapy which may include cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (HIPEC). The role of imaging is well documented and each diagnostic modality has its indications and limitations in the staging and follow-up of PPM. This review provides an updated and comprehensive summary of the histologic classification of PPM, imaging findings, and describes the role of the radiologist in the multidisciplinary setting to predict the extent and quantification of disease.

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## Abstract Archives of the RSNA, 2023

GIEE-82

### Peeking Inside the Pancreas: A Radiological Journey through Imaging of Unusual and Rare Pancreatic Tumors

#### Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the imaging approach for evaluating unusual and rare pancreatic tumors. 2. Identify imaging manifestations of unusual and rare pancreatic tumors. 3. Identify potential pitfalls in imaging of unusual and rare pancreatic tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Unusual and rare pancreatic tumors and imaging approach 2. Multimodality imaging features of unusual and rare pancreatic tumors a. Primary malignant tumors: i. Acinar cell adenocarcinoma ii. Pancreatic small cell carcinoma iii. Pancreatic adenosquamous carcinoma iv. Pancreatic lymphoma v. Hepatoid pancreatic adenocarcinoma vi. Pancreatic mucinous carcinoma vii. Pancreatic primary lymphoma viii. Clear cell acinar cell carcinoma ix. Pancreatic carcinosarcoma x. Pancreatic hemangiopericytoma xi. Pancreatic rhabdomyosarcoma b. Primary tumors with malignant potential: i. Solid pseudopapillary tumor ii. Intraductal tubulopapillary neoplasm iii. Teratoma iv. Solid serous cystadenoma c. Secondary Malignant Tumors i. Unusual metastases to pancreas d. Benign Tumors i. Pancreatic lipoma ii. Intraductal papillary neoplasm (IPMN) iii. Lymphoepithelial cysts iv. Focal pancreatitis 3. Mimics and Pitfalls (tumor like conditions; IgG4-RD; biliary tract tumors; duodenal tumors (duodenal dystrophy, gastrointestinal stromal tumor (von Recklinghausen), Brunner's duodenal hamartoma)

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## Abstract Archives of the RSNA, 2023

GIEE-83

### Adding Insult to Injury: Unexpected Gastric Cancer Presentations That Can Make Radiologist's Life Difficult

#### Participants

Dequitier Machado, DC, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To demonstrate the variability in presentations of gastric carcinoma and the dissemination patterns. 2. To understand and learn how to differentiate fibrosis from disease progression and primary tumor involvement. 3. To identify recurrence in the esophagus-gastric junction 4. To illustrate the role of radiology in the differential diagnosis, staging, and surveillance of patients with gastric carcinoma.

#### TABLE OF CONTENTS/OUTLINE

- Gastric normal anatomy and possible secondary implant pathways . Epidemiology of gastric cancer . Variability in presentations in gastric adenocarcinoma.- Rare patterns of tumor recurrence, that we should not miss.

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## Abstract Archives of the RSNA, 2023

GIEE-84

### The Solution is Right at Your Fingertips: Linear Probe and Improvement of US Gallbladder Evaluation

#### Participants

Pilar Navarro Azurmendi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 To analyze the benefits and limitations of linear and curved transducers used in US evaluation of the gallbladder with cine and imaging findings throughout different cases. 2 To review the most advantageous sonographic technique and knobology optimization. 3 To identify potential pitfalls in US evaluation and the technics to prevent them. 4 To assess the available tools to minimize the risk of misinterpretation in biliary pathology imaging.

#### TABLE OF CONTENTS/OUTLINE

1 Types of transducers used for gallbladder evaluation. Characteristics, benefits and limitations. 2 Sonographic technique and knobology optimization through cine videos and images. 3 Anatomy, useful landmarks and choice of sonographic window. 4 Ultrasound artifacts: making use of imaging artifacts to aid in diagnosis. 5 Identify potential pitfalls in gallbladder ultrasound evaluation and how to avoid them. 6 Diagnostic criteria for gallbladder wall pathologies. 7 Test your knowledge: interactive review for integration of clinical cases with imaging findings. 8 Take-home messages.

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## Abstract Archives of the RSNA, 2023

GIEE-85

### Lymphoma: What to Expect from the Unexpected

#### Participants

Fabio Yoshimura, Santana De Parnaiba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lymphoma is a disease that can manifest itself in multiple ways. It is important to know the sites of involvement in its most varied forms and the possible imaging characteristics. This work aims to improve the literature with illustrated teaching cases from our department about suspicious lesions, allowing for early diagnosis and adequate follow-up.

#### TABLE OF CONTENTS/OUTLINE

This work aims to review with illustrated cases and their characteristic images from main abdominal organs affected by Lymphoma:- Liver;- Spleen;- Gastrointestinal tract;- Pancreas;- Kidney;- Peritoneal cavity.

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## Abstract Archives of the RSNA, 2023

GIEE-86

### Uses, Finding, Pitfalls, and Advanced Applications in Gadoteric Acid-Enhanced MR Imaging of the Liver

#### Participants

Elissandra Lima, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To understand the Pharmacokinetics of gadoteric acid- To review clinical applications, pitfalls and of gadoteric acid-enhanced MRI- To discuss advanced and future applications such as multiparametric liver MRI, magnetic resonance cholangiography, and liver function assessment

#### TABLE OF CONTENTS/OUTLINE

1. Background 2. Pharmacokinetics of gadoteric acid 3. Magnetic resonance protocol and technique: abbreviated and multiparametric protocols 4. Optimizing the workflow 5. Clinical applications of gadoteric acid-enhanced MRI: Focal nodular hyperplasia, hepatocellular adenomas, hepatocellular carcinoma, cholangiocellular carcinoma, liver metastases, hepatic fibrosis, biliary imaging 6. Evaluation of treatment response of liver metastases 7. Gadoteric acid-enhanced MRI for staging treatment decision-making, and follow-up of HCC 8. Incidental discovery of focal liver lesions 9. Pitfalls and solutions: arterial phase limitations, hepatobiliary phase limitations, focal nodular hyperplasia, "pseudowashout", uptake in lesions other than FNH. 10. Advanced and future applications

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## Abstract Archives of the RSNA, 2023

GIEE-87

### Bad Connections: Review of Intestinal Fistulae

#### Participants

Allison Forrest, MD, Burlington, VT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Intestinal fistulae in the abdomen and pelvis are common and result in significant morbidity. Fistulae occur between hollow viscous organs and can occur in the setting of surgery, trauma, inflammation, and malignancy. Multiple imaging modalities are used for both initial evaluation and follow up, with selection of technique depending on the anatomy involved. Fluoroscopic evaluation is often helpful in the evaluation as it provides real-time, dynamic evaluation of fistulae and can further delineate complex anatomy in conjunction with cross-sectional imaging. Selection of route of contrast administration and catheter selection for evaluation of enterocutaneous fistulae are particularly important for successful fluoroscopic evaluation. An understanding of the spectrum of fistulae and the tools available to radiologists are critical for accurate characterization of fistulae.

#### TABLE OF CONTENTS/OUTLINE

1. Review the pathophysiology of intestinal fistulae.
2. Provide an overview of indications and protocols for imaging evaluation of fistulae, with emphasis on fluoroscopic evaluation with cross-sectional correlation. Specific tips for evaluation of enterocutaneous, esophageal, small bowel, and colonic fistulae will be discussed.
3. Display case examples of common and uncommon intestinal fistulae, including those due to surgery, malignancy, inflammation, and trauma.
4. Review factors that are commonly implicated in delayed fistulae healing.
5. Brief overview of treatment principles and available therapies.

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## Abstract Archives of the RSNA, 2023

GIEE-88

### Fibro-polycystic Liver Disease: What Radiologists Need to Know

#### Participants

Lautaro Florentin, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fibropolycystic liver disease refers to a group of different liver and biliary anomalies caused by abnormal embryologic development of ductal plates. Congenital hepatic fibrosis, biliary hamartomas, autosomal dominant polycystic disease, Caroli disease, and choledochal cysts are included in this group. Fibropolycystic liver diseases usually do not exist as single entities and can be found in combined forms. Each entity shows characteristic imaging findings, specially at computed tomography (CT) and magnetic resonance (MR). Radiologists should be familiar with this spectrum of lesions to proper guide the management of these patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
What is fibropolycystic liver disease?  
Embryologic development  
Congenital hepatic fibrosis  
What is?  
Imaging findings  
Biliary hamartomas (Von Meyenburg complex)  
What is?  
Imaging findings  
Autosomal dominant polycystic disease  
What is?  
Imaging findings  
Complications  
Caroli Disease  
What is?  
Caroli disease vs. Caroli Syndrom  
Imaging findings  
Choledocal cysts  
Pathogenesis  
controversy. Bilio-pancreatic maljunction association.  
Todani's Classification  
Imaging findings

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## Abstract Archives of the RSNA, 2023

GIEE-89

### New Concepts in Staging and Treatment of Colon Cancer: What the Radiologist Needs to Know

#### Participants

Amit Choudhari, MBBS, FRCR, Mumbai, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand types of colon cancer surgeries, including multivisceral resection
- Comprehend the elements which need to be covered while reporting a clinically relevant colon cancer staging CT report
- Review the questions asked in multidisciplinary tumor boards
- Updates on the recent advances in colon cancer management
- Discuss the advantages of neoadjuvant chemotherapy prior to surgery as per recent literature

#### TABLE OF CONTENTS/OUTLINE

- Pathophysiology of colon cancer
- Types of colon cancer surgeries and nodal resections
- Discuss common and uncommon presentations in colon cancer (extramural vascular invasion, aneurysmal dilatation, vascular involvement, tumor bowel fistula, uncommon pathologies)
- What the surgeon wants to know from the radiologist for planning surgery; e.g., a patient with ascending colon cancer with duodenal involvement can undergo colo-pancreaticoduodenectomy
- dMMR/MSI-H, ctDNA, FoxTROT, Niche-2: What they mean and why do we need to know about them

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## Abstract Archives of the RSNA, 2023

GIEE-9

### Internal Hernia after Roux-en-Y Gastric Bypass: Clues to a Challenging Diagnosis

#### TEACHING POINTS

- Internal hernias are a complication in up to 10% of patients after Roux-en-Y gastric bypass (RYGB).
- Risk factors for internal hernia after RYGB include retrocolic technique, non-closure of mesenteric defects and amount of weight loss after surgery.
- Untreated internal hernias place the patient at risk for bowel ischemia.
- Several signs of varying sensitivity and specificity have been described for internal hernias after RYGB.
- A structured approach should be taken to assess for internal hernias in all patients who have undergone RYGB—especially those who are presenting with abdominal pain.

#### TABLE OF CONTENTS/OUTLINE

- Description of RYGB procedure.
- Three types of internal hernia after RYGB: Transmesocolic, Petersen and jejuno-jejunostomy hernias.
- Incidence of internal hernia after RYGB.
- Risk factors for internal hernia after RYGB.
- Clinical presentation of internal hernias after RYGB.
- Prognosis of untreated internal hernia after RYGB.
- Treatment of internal hernia after RYGB.
- Accuracy of CT in diagnosing internal hernia after RYGB.
- CT findings of internal hernia after RYGB and their sensitivity and specificity in detecting internal hernias. All signs will be accompanied by example images and/or image stacks.
- Vascular Signs: SMV beaking sign, vascular swirl sign and hooking intestine sign.
- Mesenteric Signs: Mesenteric edema, mesenteric lymph nodes and eye of the hurricane sign.
- Bowel signs: Small bowel obstruction, right sided jejunojejunal anastomosis, mushroom sign, small bowel behind SMA, small bowel between transverse colon and stomach and clustered loops of small bowel.
- Structured approach to assessing the presence of internal hernia in patients with RYGB.

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## Abstract Archives of the RSNA, 2023

GIEE-90

### Tips for Differentiation Between Pancreatic Ductal Adenocarcinoma with Bile duct Invasion and Cholangiocarcinoma with Pancreas Invasion

#### Participants

Shintaro Ichikawa, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Both pancreatic ductal adenocarcinoma (PDAC) and cholangiocarcinoma are mostly adenocarcinomas and share common pathological features. Therefore, their imaging findings are similar, and when a mass stretching from the head of the pancreas to the distal common bile duct is found, it may be difficult to distinguish whether it is bile duct invasion from PDAC or pancreatic invasion from cholangiocarcinoma. To differentiate between the two, it may be useful to focus on whether the pancreatic or bile duct lesion is the predominant finding and whether the main pancreatic duct is dilated.

#### TABLE OF CONTENTS/OUTLINE

The following tips for differentiating between PDAC with bile duct invasion and cholangiocarcinoma with pancreatic invasion are discussed along with their key imaging findings:

1. Predominant lesion: Pancreatic lesions of PDAC are larger than those of cholangiocarcinoma. The range of common bile duct lesions in cholangiocarcinomas is greater than that of lesions in PDAC.
2. Double-duct sign: Both the main pancreatic and common bile ducts are often dilated in PDAC, whereas the main pancreatic duct is rarely dilated in cholangiocarcinoma.

The following differential diagnoses are discussed along with their key imaging findings:

1. Ampullary masses (adenoma, adenocarcinoma, and neuroendocrine neoplasms)
2. Pancreatic groove cancer
3. Groove pancreatitis
4. Mass-forming pancreatitis
5. Sclerosing cholangitis

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## Abstract Archives of the RSNA, 2023

GIEE-91

### Complications of Colorectal Cancer Treatment

#### Participants

Kelly Cox, DO, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: Colorectal cancer remains the third most common cancer and is the second leading cause for cancer related deaths in the United States. Colorectal cancer is highly treatable and often curable with early detection. After a quick review of colorectal cancer and its most current treatment algorithms, we will take an in depth look at the complications of treatment including those related to surgery, liver directed therapy, chemotherapy and immune checkpoint inhibitors. As colorectal cancer treatment has rapidly changed in recent years, new and unexpected imaging complications of treatment must be recognized in our daily practice to direct immediate patient care and future colorectal cancer treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Review of colorectal cancer and its most current treatment algorithms 2. Surgical Complications a. Perforation/Anastomotic Leak b. Abscess c. Fistula d. Local recurrence with and without obstruction 3. Liver Directed Therapies a. Intrahepatic artery infusion chemotherapy - biliary strictures b. Radiofrequency ablation i. Thermal injury ii. Injury to adjacent organs c. Radioembolization 4. Chemotherapy Induced Injuries a. Steatohepatitis b. FNH-like lesions 5. Checkpoint Inhibitor complications a. Pseudoprogression b. Pneumonitis c. Diarrhea, enteritis and colitis d. Bowel perforation e. Pancreatitis

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## Abstract Archives of the RSNA, 2023

GIEE-92

### Deep-learning CT Reconstruction in the Abdomen: Principles, Techniques, Current Practice and Future Perspective

#### Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understanding the background and important principles of image reconstruction methods in CT with the advantages and disadvantages of each modality 2. Comprehensive review on the deep learning imaging reconstruction and why it outperforms other modalities 3. To discuss clinical impact of deep-learning CT reconstruction in abdominal imaging 4. Future perspective and implementation

#### TABLE OF CONTENTS/OUTLINE

1. CT image reconstruction and deep learning a. Definition principles of CT image reconstruction b. History and advances of CT image reconstruction until now c. Common quantitative and qualitative parameters for image quality d. Explain the advantages and disadvantages of each reconstruction technique (filtered back projection, iterative reconstruction, full model-based iterative reconstruction, hybrid iterative reconstruction)2. Deep-learning image reconstruction (DLIR) in the abdomen CT a. Understanding the basics of convolutional neural networks (CNNs) b. The role of DLIR in CT image quality improvement and noise reduction c. Factors influencing the performance of deep-learning CT reconstruction3. Where DLIR in CT abdomen now a. DLIR algorithms available b. Current evidence and practice of deep-learning CT reconstruction in the abdomen c. Clinical impact on the diagnosis of abdominal organs diseases4. DLIR limitations and potential future developments

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## Abstract Archives of the RSNA, 2023

GIEE-93

### Radiologic Features of Abdominal Multimodality Imaging Related to Cardiovascular Disorders

#### Participants

Yeju Kang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To classify various cardiovascular disorders causing changes on abdominal multimodality imaging. 2. To comprehensively review the pathophysiology of intra-abdominal changes caused by cardiovascular disorders. 3. To present various radiologic features of abdominal multimodality imaging in patients with cardiovascular disorders.

#### TABLE OF CONTENTS/OUTLINE

1. Cardiac disorders-related changes: Congestive heart failure: hepatic congestion, cardiac cirrhosis/Infective endocarditis: infection due to septic embolism, infarction, mesenteric ischemia/Atrial fibrillation: infarction, mesenteric ischemia/Valvular heart disease: hemosiderin deposition due to mechanical cardiac valve/Cardiac arrest: cardiopulmonary resuscitation-related change 2. Vascular disorders-related changes: Obstruction of the vena cava: liver cirrhosis due to membranous obstruction of inferior vena cava, hepatic neoplasm, third flow due to superior vena cava obstruction/Vasculitis: systemic lupus erythematosus, IgA vasculitis, Behcet disease, etc. 3. Cardiovascular drug-related changes: anticoagulants-related changes, anti-arrhythmic agents-related changes

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GIEE-94

### Signet Ring Cell Adenocarcinomas of the GI Tract: Clinical, Radiological, and Pathological Correlation

#### Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### TEACHING POINTS

1 T1. To describe the key epidemiological, clinical, radiological, and pathological features of signet ring cell adenocarcinomas of the GI tract. 2. To review the specific features of gastric, colorectal, esophageal, appendiceal, and pancreaticobiliary signet ring cancers, with radiologic-pathologic correlation. 3. To illustrate linitis plastica, scirrhous tumors, and the "malignant target sign" associated with these aggressive cancers.

#### TABLE OF CONTENTS/OUTLINE

- Introduction - Signet ring cell adenocarcinomas of the GI tract o Histopathological definition o Epidemiology and prognosis o The malignant target sign - Clinical-Pathological-Radiological correlation o Gastric signet ring cell adenocarcinoma (linitis plastica) o Colorectal signet ring cell adenocarcinoma o Esophageal signet ring cell adenocarcinoma o Appendiceal signet ring cell adenocarcinoma o Pancreaticobiliary signet ring cell adenocarcinoma o Metastatic signet ring cell adenocarcinoma - Concluding remarks

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

GIEE-95

### The Many Forms of Acute Pancreatitis

#### TEACHING POINTS

The morphological expression of acute pancreatitis (AP) is highly variable and in its more complex forms it can be a difficult challenge for the radiologist in training to decipher. Therefore, the main objective of this paper is to present a guide for understanding the morphological classification of AP, related complications and differential diagnoses using the standardized terminology established in the revised Atlanta classification system. Other objectives are: To recognize the general clinical features of AP and the bases of the Atlanta classification system. To understand the current role of the radiologist in the diagnosis and treatment of acute pancreatitis. To emphasize the importance of the implementation of standardized reporting schemas and a well-defined lexicon into the radiology practice to facilitate accurate communication among members of a multidisciplinary team.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Clinical overview: diagnostic criteria, pathogenesis and etiology, disease severity and risk stratification, clinical classification according to the revised Atlanta classification (RAC): phases of evolution and severity. Imaging guidelines: how, when and why to image. General overview of the RAC system. Morphologic classification interstitial edematous pancreatitis (IEP) vs necrotizing pancreatitis (NP). Pancreatic and peripancreatic collections APFC, pseudocyst, ANC and WON. Local complications: Infection, inflammation and mass effect on adjacent organs, biliary obstruction, pancreatic duct stricture, disconnected pancreatic duct, vascular complications (hemorrhage, venous thrombosis, pseudoaneurysm). Other complications. Imaging mimics of AP.

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## Abstract Archives of the RSNA, 2023

GIEE-96

### Pseudomyxoma Peritonei and HIPEC: What Am I Missing?

#### Participants

Matheus Gomes SR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pseudomyxoma peritonei (PMP) is a rare and complex clinical syndrome characterized by the intraperitoneal accumulation of mucinous material, which arises from a variety of neoplasms, mainly from appendiceal mucinous neoplasm. The purpose of this exhibit is • Review the main CT and MRI imaging findings of PMP. • Recognize the most common tumor sites which may cause pseudomyxoma peritonei. • Illustrate through a diagram the pathways of disease spread into peritoneal spaces. • Discuss HIPEC therapy and surgery indications, different outcomes and complications. • Highlight the radiologist role in decision-making in a multidisciplinary team

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Epidemiology, clinical and pathophysiological aspects of pseudomyxoma peritonei- CT and MRI protocol recommendation 2. Current treatment options- To discuss for each of the following treatment modalities indications, contraindications, advantages and limitations (HIPEC, Surgical treatment and Systemic treatment)- To review through illustrative clinical cases the main CT and MRI findings of: Initial assessment of disease • Most common sites of disease • Hints at first evaluation of images • Difficult sites of resection • Potential "blind spots" Evaluation of treatment response • Disease progression • Stable disease / No evidence of disease • Response to treatment 3. "Take-home messages": To improve radiology communication with the multidisciplinary team and ensure prompt diagnosis and proper treatment of PMP, it is essential to understand the major clinical and imaging aspects of the disease and its treatment options.

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## Abstract Archives of the RSNA, 2023

GIEE-97

### Non-cirrhotic Portal Hypertension: Etiologies and Workup

#### Participants

Alba Pugliesi, MD, Ludwigsburg, Germany (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Noncirrhotic portal hypertension (NCPH), defined as elevated portal pressures in absence of advanced hepatic fibrosis, can be seen in association with multiple pre-sinusoidal, sinusoidal, and post-sinusoidal pathologic conditions. 2. Many of the aforementioned etiologies can result in liver dysmorphism (despite the absence of advanced hepatic fibrosis), resulting in incorrect diagnosis of cirrhosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction • Definition and review of mechanisms of portal hypertension Pre-hepatic etiologies of NCPH • Case-based review of pre-hepatic etiologies of NCPH with emphasis on chronic inflow obstruction Intrahepatic etiologies of NCPH • Case-based review of pre-sinusoidal, sinusoidal, and post-sinusoidal etiologies of NCPH. Post-hepatic etiologies of NCPH • Case-based review of post-hepatic etiologies of NCPH with emphasis on outflow obstruction and cardiac etiologies (including Fontan-associated liver disease). Architectural and morphological changes of liver • Review of non-fibrotic pathways of response to injury by hepatocytes, with focus on regenerative nodular hyperplasia Diagnostic Workup, Challenges and Pitfalls • Discussing role of biopsy, hepatic venous wedge pressure, and elastography Conclusion

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## Abstract Archives of the RSNA, 2023

GIEE-98

### Tips and Tricks for CT Optimization of the Abdomen

#### Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The educational exhibit discusses CT dose optimization in abdominal imaging, and how it is important to reduce radiation exposure while maintaining diagnostic accuracy. Strategies for reducing radiation dose and optimizing contrast media administration, managing image artifacts and noise, and incorporating AI-based deep learning image reconstruction (DLIR) can also contribute to dose optimization. Tailoring the imaging protocol based on the clinical indication, patient age, medical history, and comorbidities is crucial for achieving the best diagnostic outcome. Advice from the experts and emphasizing the importance of staff education and collaboration in CT optimization.

#### TABLE OF CONTENTS/OUTLINE

Review the background and understand the basic principles of the CT optimization in abdominal imaging  
Strategies for reducing radiation dose in abdominal CT  
Methods used to optimize the dose in abdominal CT  
Future directions of embedding AI into abdominal imaging  
CT optimization  
Tailoring the imaging protocol to the clinical question and patient presentation  
Factors to be considered when tailoring imaging protocol (the clinical indication, patient age, medical history, and comorbidities)  
Electing the appropriate imaging protocol for achieving the best diagnostic outcome  
Unlocking the Secrets of the CT optimization of the Abdomen: Tips and Tricks from the Pros  
a. Port injections - "How to inject like the pros"  
b. Helical pitch- "Low pitch isn't what it used to be"

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## Abstract Archives of the RSNA, 2023

GIEE-99

### Clinical Application of Artificial Intelligence (AI) in Chronic Liver Diseases Management

#### Participants

Mohamed Eltaher, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the function of artificial intelligence (AI) in tumor segmentation. 2. Review the existing medical uses of liver segmentation. 3. Grasp the advantages and disadvantages of different methods for segmenting liver tissues. 4. Understand the imaging criteria that must be met for a liver segmentation project to be successful. 5. Explore possible future developments in liver segmentation.

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction to artificial intelligence (AI). 2. Overview of different architectures used in deep learning methods. 3. Application of AI in the medical field. a new era of healthcare services. 4. Available Liver segmentation methods and techniques. 5. Advantages and disadvantages of different segmentation methods. 6. Challenges facing manual and automated liver segmentation. 7. Current uses of liver volumetry: a) assessment of response to intervention or surgery in liver malignancy. b) prediction of clinical outcomes in including disease behavior, overall survival. C) virtual surgical planning. d) prediction of future liver remnant volume after hepatectomy surgery. 8. Future directions: a) Vascular sub-segmentation. b) Radiogenomics. c) Fully automated segmental volumetry. d) Automated volumetric RECIST measurements.

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## Abstract Archives of the RSNA, 2023

GUEE

### Genitourinary Imaging Education Exhibits

#### Sub-Events

#### **GUEE-1 Zinner Syndrome: A Radiological Journey Through a Little Known Condition**

##### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To review the embryology and anatomy of the male urogenital system. 2. To describe the radiological findings of typical Zinner syndrome and its variants, through a series of 10 patients from our institution whose images are representative. 3. To perform a differential diagnosis with other pelvis cystic lesions, providing an algorithm that helps us to distinguish them depending on their location and their relationship with adjacent structures, including radiological images belonging to our institution.

##### TABLE OF CONTENTS/OUTLINE

1. Embryology and anatomy of the male urogenital system the role of the mesonephric (Wolffian) duct and the ureteral bud in the formation of the different male urogenital structures. 2. Zinner syndrome: a rare congenital urogenital entity due to an alteration in embryogenesis between 4th and 13th weeks of gestation, characterized by unilateral renal agenesis, cystic dilatation of the ipsilateral seminal vesicle and obstruction of the ejaculatory duct. - Definition. - Pathophysiology. - Clinical manifestations. - Diagnosis: the role of different imaging tests in its diagnosis, specifically pelvic MRI, which is considered the Gold Standard technique due to its excellent soft-tissue resolution. - Treatment. 3. Differential diagnosis with other pelvic cystic lesions (intra- and extraprostatic) according to their location and relationship with neighboring structures. This work is illustrated with representative radiological images of cases belonging to our institution.

#### **GUEE-10 Thingamajigs, Thingamabobs, and Doohickeys: A Comprehensive Imaging Review of Pelvic Medical Devices**

##### Participants

Amanda Gibson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Given the ever-increasing number of imaging examinations performed and the continuous development and refinement of medical devices, radiologists commonly encounter such devices in clinical practice. 2. Pelvic medical devices may be detected incidentally on imaging examinations or imaging may be performed specifically to evaluate for device complication. 3. Knowledge of device indication and function may provide important clues to patient history that might not otherwise be available at the time of image interpretation. 4. Medical device complications are typically related to infection, malposition, and/or suboptimal device function. 5. A comprehensive knowledge of device indication, function, structure, imaging appearance, and associated complications is necessary to provide accurate and timely assessment of pelvic medical devices.

##### TABLE OF CONTENTS/OUTLINE

1. Succinct description of pelvic medical device structure, function, and indications for use in both women and men 2. Illustration of imaging features of pelvic medical devices, including normal findings, imaging artifacts, and device-related complications, across both planar and cross-sectional studies, with emphasis on key findings to report 3. Discussion of MRI safety issues related to pelvic medical devices

#### **GUEE-100 Feel the Burn: Imaging Infections of the Male and Female Reproductive Tract**

##### Participants

Alexander Kuehne, MD, Clear Lake, MN (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Familiarize the radiologist with the spectrum of reproductive tract infections, focusing on some of their more unusual etiologies and presentations.
- Review imaging of male and female reproductive tract infections in case-based format.
- Highlight key imaging features of specific infections, atypical presentations, and common mimics.
- Review imaging characteristics that would help to narrow the differential diagnosis.
- Provide an overview of management and treatment of reproductive tract infections, their sequelae, and complications.

##### TABLE OF CONTENTS/OUTLINE

- Classification of reproductive tract infections: sexually transmitted diseases; endogenous infections; iatrogenic infections.
- Review of infections by anatomic region, particularly unusual infections/presentations: uterus and adnexa; vagina and vulva; prostate and penis; spermatic cord and scrotum; perineum.
- Management of infections, their sequelae, and their complications.

#### **GUEE-101 Imaging of Benign and Malignant Renal Neoplasms Based on the WHO 2022 Classifications: What**

## Radiologists Should Know

Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Describe important reporting elements of renal tumors· Describe classification and approach to renal tumors on the basis of WHO 2022 Classifications· Describe multimodality imaging characteristics of renal tumors· Role of imaging to evaluate renal tumors after local renal therapy and complications

### TABLE OF CONTENTS/OUTLINE

Content: • WHO 2022 renal tumor classification • Reporting elements of renal tumors • Clear cell tumors • Papillary tumors • Oncocytoma • Chromophobe cell renal carcinoma • Mucinous tubular and spindle cell carcinoma • Adult cystic nephroma • Metanephric tumors • Mixed epithelial and stromal renal tumors • Angiomyolipoma • Renomedullary interstitial cell tumor • Mesoblastic nephroma • Collecting duct carcinoma • Eosinophilic solid and cystic renal cell carcinoma • Inflammatory myofibroblastic tumor of the kidney • Renal perivascular epithelioid cell tumor (PEcoma) • Syndromes with renal tumors • Other tumors of the upper tract • Lymphoma • Transitional cell carcinoma • Metastasis • Abscess • Xanthogranulomatous pyelonephritis

### GUEE-102 Imaging of Inferior Vena Cava Wall Invasion in Renal Cell Carcinoma with Tumor Thrombus

Participants

Haiyi Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Locally advanced renal cell carcinoma with inferior vena cava (IVC) tumor thrombus is one of the most challenging diseases in urology. T3c disease is diagnosed when a tumor thrombus invades the IVC wall. The presence or absence of IVC wall invasion has a significant impact on the selection of surgical protocols, which include IVC incision thrombectomy, IVC segmental resection, and IVC resection. Higher morbidity and mortality rates occur when a tumor thrombus invades the IVC wall. Tumor thrombus invading the IVC wall is associated with poor postoperative survival. The purposes of this exhibit are: 1) Discuss the role of IVC wall invasion in the surgical treatment of renal cell carcinoma and tumor thrombus. 2) Clarify significant image findings of IVC wall invasion. 3) Illustrate meaningful information and pitfalls of diagnosing IVC wall invasion in radiology reports.

### TABLE OF CONTENTS/OUTLINE

1) Overview of anatomy and physiology of the inferior vena cava system. 2) Introduction of the mechanism of IVC tumor thrombosis formation in renal cell carcinoma. 3) Describe surgical management of different types of tumor thrombectomy: a. IVC incision thrombectomy; b. IVC segmental resection; c. IVC resection. 4) Imaging methods selection: a. contrast-enhanced ultrasound (CEUS); b. CT; c. MRI. 5) Imaging findings of IVC wall invasion in cases-based imaging. 6) Illustrate key signs and pitfalls in diagnosing IVC wall invasion. 7). Build a scoring system: inferior vena cava wall invasion likelihood scores (IVC WALLS). 8) Consolidate the acquired knowledge: Review preoperative imaging findings of IVC invasion that aid in surgical decisions. 9) Conclusions.

### GUEE-103 Spectrum of Male and Female Urethral and Periurethral Pathologies at Imaging

Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Role of imaging in the evaluation of the urethra.2) Review of relevant male and female urethral anatomy.3) Recognize a variety of urological conditions in males and females at imaging.

### TABLE OF CONTENTS/OUTLINE

Conventional imaging studies such as retrograde urethrography(RUG), voiding cystourethrography(VCUG), and Ultrasonography(US) are limited in the evaluation of the periurethral tissues. MR imaging serves as an important noninvasive imaging modality that can provide anatomic detail of the urethra and periurethral tissue due to excellent tissue contrast and multiplanar capability. 1) Detailed male and female urethral and periurethral anatomy.2) MR technique for urethral evaluation.3) Female urethral pathology including urethral diverticulum and associated pathology, urethral leiomyoma, periurethral/paravaginal cysts, bulking agents, urethral prolapse, periurethral hemangioma, and neoplasms.4) Male urethral pathology including urethral calculi, Peyronie's disease, artificial sphincter, infection, and neoplasms.

### GUEE-104 Radiologic Feature of Complications after Artificial Urinary Sphincter Implantation Following Total Prostatectomy

Participants

Shioto Oda, MD, Kashiwa, Japan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Artificial urinary sphincter (AUS) is an implanted device used for the treatment of urinary incontinence, commonly following prostatectomy. Despite increasing reports of device failure and postoperative complications, comprehensive reports on imaging have yet to be compiled. When complications occur after AUS surgery, entire device replacement may be necessary, which can be burdensome for the patient. However, with precise identification of the malfunctioning part, partial replacement has been possible in some cases. This presentation will exhibit imaging findings of malfunction and postoperative complications after AUS implantation at our hospital, together with anatomical findings, to contribute towards appropriate device management. The purpose of this exhibit is: 1) To provide a comprehensive review of the normal appearance of AUS, along with an analysis of the parts that are commonly associated with complications 2) To exhibit the various complications related to device failure and surgery on a case-by-case basis.

### TABLE OF CONTENTS/OUTLINE

1) Normal Appearance of AUS 2) Malfunction of AUS 2.1) Circuit Leakage 2.2) Pump Malfunction 3) Complications Directly Related to the Procedure 3.1) Urinary Injury During Replacement of AUS 3.2) Hematomas and Infections Occuring in the Subacute Period

## **GUEE-11 Imaging of upper urinary tract neoplasms**

Participants

Kyungmin Kim, BMBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Neoplasms of the upper urinary tract can be investigated with different imaging modalities such as CT, MRI and ultrasound. In certain cases, nuclear medicine studies, such as PET-CT or DMSA can aid with detection of occult bone metastasis or determining the best treatment option. The traditional CT protocol for visualizing renal parenchymal abnormalities is a triple phase study. Alternatively, a split bolus urography protocol also provides good visualization of the renal parenchyma and the collecting systems with a reduced radiation dose. Renal cell carcinoma (RCC) is the most common type of upper urinary tract neoplasm with a wide range of phenotypes from homogeneous solid mass to heterogeneous multi-cystic or necrotic lesions. Differentiating between benign and malignant renal neoplasms can be challenging and histopathological evaluation may be required to confirm the diagnosis. A wide range of conditions ranging from developmental, infectious, granulomatous and vascular causes can mimic upper urinary tract neoplasms.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Imaging modalities for investigation of upper tract neoplasms  
2.1 CT  
2.2 MRI  
2.3 Ultrasound  
2.3.1 Contrast enhanced ultrasound  
2.4 Nuclear medicine  
3. Imaging features of upper tract neoplasms  
3.1 Malignant  
3.1.1 RCC  
3.1.2 TCC  
3.1.3 Lymphoma  
3.1.4 Wilm's tumor  
3.1.5 Miscellaneous  
3.2 Benign  
3.2.1 Oncocytoma  
3.2.2 Angiomyolipoma  
4. Upper urinary tract pseudotumors  
4.1 Developmental  
4.2 Infectious  
4.3 Granulomatous  
4.4 Vascular  
4.5 Miscellaneous  
5. Summary

## **GUEE-12 Not Only Prostate Adenocarcinoma is Present in the Interpretation of Multiparametric Prostate MRI**

### **TEACHING POINTS**

Knowledge of normal anatomic structures and physiological changes that may simulate prostate adenocarcinoma in prostate multiparametric magnetic resonance imaging (mpMRI) Clinical presentation MRI characteristics with pathological correlation can help us to accurately characterize benign and malignant diseases, that can mimic prostate adenocarcinoma in mpMRI resulting in appropriate patient management.

### **TABLE OF CONTENTS/OUTLINE**

Review and identify normal prostatic anatomic structures that can affect mpMRI interpretation because may simulate prostate adenocarcinoma: hypertrophic anterior fibromuscular stroma, asymmetrical and focal thickening of the surgical capsule, congested appearance of periprostatic vascular plexus normal Review the clinical manifestations and mpMRI characteristics with pathological correlation of prostatic and periprostatic benign process: congenital anomalies (Zinner's syndrome), prostatic abscess, infective or inflammatory prostatitis (bacterial, granulomatous, IgG4-related disease), prostatic hemorrhage, ectopic stromal benign prostatic hyperplasia nodule, periprostatic lymph nodes, osteochondroma of the pubic symphysis, neoplasms with unpredictable clinical course (stromal neoplasm of uncertain malignant potential), direct neoplastic invasion of malignant tumors in adjacent organs (diffuse large B-cell lymphoma of the rectum), that can mimic prostate adenocarcinoma in mpMRI

## **GUEE-13 MRI-Based VI-RADS for Bladder Cancer: Enhancing Accuracy and Consistency in Reporting**

Participants

Sina Houshmand, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review imaging findings of bladder cancer with emphasis on the importance of differentiation between muscle-invasive and non-muscle invasive disease and impact of imaging on clinical management.  
2. Review technical aspects of multiparametric MRI for bladder cancer.  
3. A pictorial review and step-by-step tutorial on Vesical Imaging-Reporting and Data System (VI-RADS).

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to bladder cancer  
a. Types and relevant pathology  
b. Diagnosis, staging, treatment  
c. Role of imaging in clinical management  
d. Imaging of bladder cancer  
2. VIRADS  
a. Definitions and categories  
b. MRI scoring  
c. Examples  
3. Technical aspects  
a. Patient preparation  
b. MR protocol  
4. Pitfalls and mimics  
5. Case review

## **GUEE-14 Male Pelvic Floor: Anatomical Particularities and Dysfunctions**

### **TEACHING POINTS**

To review some aspects of normal anatomy that are relevant in the context of male pelvic floor dysfunction. To demonstrate the differences between the male and female pelvic floor by comparing the reference values provided. To identify changes in male pelvic floor structures during micturition and defecation. To review the examination protocols for functional assessment. To systematize the evaluation of male pelvic floor dysfunctions with clinical cases and flowcharts.

### **TABLE OF CONTENTS/OUTLINE**

The male pelvic floor has specific anatomical differences and pathophysiological peculiarities. The most important risk factors for its dysfunction include surgical procedures and radiotherapy. Pelvic floor dysfunctions can be grouped into three major categories (gastrointestinal, urinary, and sexual dysfunctions) and the best modality for this evaluation is dedicated magnetic resonance imaging (MRI). There is a paucity of literature related to imaging evaluation of the male pelvic floor. Typical markers used refer to the pubococcygeal line (PCL), the H line, the M line, and anorectal angle. Specific markers include the puboprostatic angle and the prostatic-urethral angle. Radiologists should recognize these particularities, the potential risk factors leading to these dysfunctions, and which landmarks are used in functional assessment.

## **GUEE-15 No Need to Go Nuts: Simplified Testicular Neoplasms Sonographic Analysis**

Participants

Fabio Yoshimura, Santana De Parnaiba, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**



The purposes of this exhibit are: To review the scrotum and adjacent structures anatomy in ultrasound; To emphasize the importance of adequate sonographic technique evaluation; To review most common testicular neoplasms; To present a metastasis case, a rare entity; To show ultrasound features of these neoplasms.

#### TABLE OF CONTENTS/OUTLINE

1. To review the scrotum anatomy in ultrasound: Testicles; Ductus deferens; Pampiniform plexus; Epididymis; Tunica vaginalis; Tunica albuginea. 2. Examination technique in ultrasound; 3. Illustrated teaching cases from our department showing the main testicular neoplasms: - Seminoma- Non-seminomatous germ cell tumors- Testicular lymphoma- Metastases to testis

#### GUEE-16 Don't Forget the Female Urethra: An Approach for Radiologists

##### TEACHING POINTS

The female urethra can be adequately studied by static or/otr dynamic imaging methods. The spectrum of pathologies is wide, from the complexity of finding direct signs in a urethral diverticulum to the challenge of providing the necessary information for an adequate treatment of solid masses of undetermined origin. In recent years, the use of minimally invasive surgical techniques for the urinary incontinence/pelvic prolapse approach has raised the need to be familiar with the radiological features pre and post treatment for proper patient counseling.

##### TABLE OF CONTENTS/OUTLINE

-Review of the anatomy of the female urethra-Imaging methods-acquisition protocols  
Ultrasound (focused on static technique)  
Magnetic Resonance  
Voiding Cystourethrography  
Retrograde double-balloon positive-pressure urethrography-Pathology of the female urethra  
Malformaciones  
Cystic pathology: diverticulum versus urethral cyst  
Solid pathology  
Benign: abscess; myoma  
Malignant: Primary: urothelial carcinoma, squamous cell carcinoma, adenocarcinoma, Aggressive angiofibroma  
Secondary: contiguous invasion versus metastatic lesions  
Pre-posttreatment imaging in minimally invasive surgical techniques for stress-mixed urinary incontinence (synthetic midurethral slings and bulking agents)-Differential diagnosis of urethral cystic from periurethral cystic pathologies-Conclusions

#### GUEE-17 Predominantly Non-Cystic Multiple Focal Renal Lesions: An Imaging Approach

Participants

Mario G. Santamarina, MD, Vina del Mar, Chile (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To review causes of predominantly non-cystic multiple focal renal lesions. 2. To discuss imaging findings of the different entities. 3. To provide imaging-based clues useful to focus and to guide to the correct diagnosis.

##### TABLE OF CONTENTS/OUTLINE

The presence of multiple focal renal lesions may be an isolated or dominant imaging finding as well as an additional abnormality in the setting of multiorgan involvement. An imaging-based approach may be crucial in the differential diagnosis process as well as in patient management. Knowledge of the imaging appearance of the various causes and integration with other findings may result in a correct diagnosis in most cases as well as in assisting in proper patient work-up and management. Table of Contents: I- Overview; II- Main causes of multiple focal renal lesions 1. Infectious, 2. Inflammatory, 3. Vascular, 4. Related to neoplasm (main hereditary renal cancer syndromes, renal metastases, lymphoproliferative disorders, renal oncocytosis).; III- Summary.

#### GUEE-18 Medical Devices in the Pelvis: The Good, the Bad, and the Ugly

##### TEACHING POINTS

1. Understand that a variety of devices may reside in the pelvis. 2. Recognize the multimodality imaging features of different devices to include expected location and malposition/migration and their potential associated complications. 3. Emphasize the importance of detecting malpositioned/migrated devices to facilitate treatment.

##### TABLE OF CONTENTS/OUTLINE

Medical Devices divided by biological sex where applicable. o Biological Female: § Intrauterine Device • Hormonal (e.g., Mirena) • Non-hormonal (e.g., Copper, Lippes Loop) • Sterilization Device (e.g., Essure) o Biological Male: § Penile Prosthesis o Devices found in both sexes: § Artificial Urinary Sphincter § Suprapubic Catheter and Foley Catheter § Ureteral Stents § Pessary § Peritoneal Dialysis Catheter  
1. The following will be discussed for the devices where applicable: a. Indication b. Types c. Multimodality imaging features of the device in its expected position. d. Multimodality imaging features of the device in an abnormal position. e. Complications from malposition or migration of the device f. Treatment  
2. Highlight the importance of familiarity with the multimodality imaging features of the wide variety of medical devices in the pelvis so that a malpositioned or migrated device can be easily recognized and brought to the attention of the referring physician to facilitate the patient receiving treatment.

#### GUEE-19 Revisiting Voiding Cystourethrography (VCUG) and Retrograde Urethrogram (RUG).

Participants

Gabriela Lauar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Voiding cystourethrography (VCUG) and retrograde urethrogram (RUG) are fluoroscopic classic examinations performed by radiologist even in the present days, despite becoming increasingly scarce, still has its diagnostic value. Iodine contrast and x-ray equipment are required to perform the exam. Indications may vary according to venter, age, and clinical history. The findings can be divided between congenital and acquired at bladder and urethral lesions. VCUG and RUG are complementary tests to urethroscopy, as they can detect pathologies that were not previously visible. Other exams can offer adjunct informations, such as sonography and MRI, but this can provide unique diagnoses or inspire the development of new professionals or new techniques such as urethral resonance.

##### TABLE OF CONTENTS/OUTLINE

This pictorial study aims to review, describe and illustrate the examination and findings of RUG and VCUG in male and female

patients that cannot go unnoticed in our reports. We have selected images of cases from our service that may raise suspicion or confirm the disease. We separate the cases according to anatomy and gender. The pathologies we will explore are divided into bladder, urethra findings, as well as prostate-related.. Quick and correct diagnosis can be crucial for the treatment of our patients.

## **GUEE-2 Dose Reduction Strategies in CTKUB for Urolithiasis**

### **TEACHING POINTS**

1. It is critical for radiologists to understand CTKUB dose reduction strategies and successfully optimize protocols that produce high image quality with minimal dosage. 2. Familiarity with the practical approach in CTKUB will both decrease radiation dose and optimize imaging quality for the specific clinical indication.

### **TABLE OF CONTENTS/OUTLINE**

The purpose of this exhibit is: 1. To discuss the relationship between radiation dose and image quality 2. To assess radiation dose reduction strategy with preserving image quality in CTKUB. Introduction- Radiation exposure and CT- Urolithiasis and CTKUB: Low dose and ultralow dose CT- ALARA principle "As Low As Reasonably Achievable" Optimization for Scans Reconstruction Parameters - CT radiation dose Estimate- CT radiation dose affecting factors- Control Z-Axis: Scan Range - Lower mAs- Lowering kVp- kVp mAs Settings- Automatic Tube Current Modulation (ATCM)- Noise Reduction Technique including deep learning-based image reconstruction Practical Approach: Decreased radiation dose and improved image quality- Dose justification: Risk vs. Benefit - ALARA (As Low As Reasonably Achievable) principle- Optimization for Scans Reconstruction Parameters - Dose Management: Monitoring, Radiation tracking- Educating requesting physicians and CT technicians

## **GUEE-20 Decoding the cCLS Score: A Game-Changer in the Diagnosis and Management of Renal Masses**

Participants

Daniella Braz Parente, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Daniella B. Parente, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review the classification and epidemiology of the most common upper urinary tract neoplasms. Understand the importance of cCLS score in the management of incidental renal lesions. Explore nephrometry as a tool for assessing the surgical complexity of renal masses.

### **TABLE OF CONTENTS/OUTLINE**

I. INTRODUCTION - Overview of upper urinary tract neoplasms and their epidemiology II. IMAGING TECHNIQUE - Overview of imaging modalities for renal mass detection and characterization - Best practices for imaging protocol III. IMAGING INTERPRETATION - Typical imaging features of common renal tumors - Explanation of cCLS score and its significance in the diagnosis of renal masses - Overview of nephrometry score and its role in assessing surgical complexity - Importance of CT and MRI in staging renal masses - Utilization of structured reports IV. QUICK REVIEW OF TREATMENT OPTIONS Overview of different treatment modalities for renal masses Pros and cons of each treatment option V. INTERACTIVE CASE-BASED DIDACTICS - Presentation of illustrative cases demonstrating the utility of cCLS score in diagnosis and management of renal masses

## **GUEE-21 Imaging of Upper Tract Urothelial Neoplasms: Pearls and Pitfalls**

### **TEACHING POINTS**

Review the staging of upper urinary tract urothelial carcinoma (UTUC) which is critical for treatment decisions and surgical planning. Discuss the role of different imaging exams in the diagnosis of UTUC with a focus on CT and MR urogram protocols. Provide an evidence-based approach to critical T-staging. Highlight nuances in staging unique to UTUCs. Identify important pitfalls in the diagnosis of UTUC including benign neoplastic, infectious, and inflammatory etiologies.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: Epidemiology, prevalence, risk factors, Clinical presentation, TNM Staging. Exam protocols Value of multi-phasic exams, CT urogram dose reduction techniques including split bolus and virtual non-contrast, MR urogram. Staging: Tumor location: renal calyx or pelvis, ureter. Multifocality, Evidence based approach to critical T-staging T2 vs T3: ureteral border analysis, Hydronephrosis severity, Evaluation of contralateral urinary tract and bladder, Role of renal function evaluation, Nodal disease and distant metastases, Critical findings for treatment decision making and surgical planning. Pitfalls: Endometriosis, Infection, Malakoplakia. Post-treatment Surveillance imaging: Post-surgical appearance, Local recurrence, Risk of metachronous UTUC in contralateral urinary tract or bladder. Conclusion.

## **GUEE-22 Go with the Flow: Imaging of Urinary Tract Augments, Reconstructions, and Non-Cystectomy Diversions in Adult Patients**

### **TEACHING POINTS**

- A variety of surgical techniques are utilized to augment, reconstruct or reroute the urine stream and these procedures often utilize other segments of the GU or GI tract
- Findings from these procedures may be found on imaging studies during routine practice. Surgical records may not be available for many adult patients, especially for those with remote procedures performed in childhood
- Postsurgical anatomy must be appropriately recognized for accurate diagnoses
- Radiologists should be aware of surgical techniques and potential alterations made to the GU and GI tracts to help recognize expected postoperative anatomy, to facilitate greater diagnostic accuracy of postoperative complications, and avoid potential pitfalls

### **TABLE OF CONTENTS/OUTLINE**

- Review indications for bladder augments, reconstructions and non-cystectomy urinary diversions
- Describe common surgical procedures performed for bladder augmentation, ureteral reconstructions and non-cystectomy diversions, including continent and non-continent diversions- Bladder augments: gastrocystoplasty, ileocystoplasty, sigmoid cystoplasty- Reconstructions: psoas hitch, Boari flap, ileal interposition, uretero-ureterostomy, ureteroneocystectomy- Diversions: ileovesicostomy, appendicovesicostomy, Monti procedure
- Discuss appropriate imaging techniques and radiologic evaluation, including how to recognize the postoperative anatomy and expected findings
- Describe the imaging findings of postoperative complications including leak, fistula, abscess, mucus formation, stones, GU and GI obstruction

## **GUEE-23 Periprostatic Anatomy: An Illustrated Review and Implications for Treatment Planning**

### **TEACHING POINTS**

1. Identify clinically relevant normal anatomy of periprostatic structures with imaging (MRI, CT, and angiography) correlation 2. Recognize periprostatic anatomic variations and implications to treatment planning

### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline 1. Introduction 2. Prostatic pseudocapsule -Discussion of periprostatic fascial anatomy and composition - Implications for prostate cancer (PCa) staging and treatment -Preoperative MRI criteria for the diagnosis of extraprostatic PCa extension 3. Neurovascular Bundle -Normal anatomy with surgical correlation -Imaging identification and implications on prostate biopsy, PCa surgical and image-guided focal treatment planning. 4. Rectoprostatic space and Denonvilliers' Fascia -Discussion of rectoprostatic space and fascial anatomy with surgical correlation -Implication on PCa local dissemination in the pelvis -Hydrogel spacer placement for rectal wall protection during radiation therapy - normal and abnormal gel distribution 5. Membranous Urethra and External Urethral Sphincter -Normal membranous urethra and external urethral sphincter anatomy -Relationship to incontinence prediction post prostatectomy? -Imaging identification of external sphincter and relevance for eligibility and planning of image-guided focal treatment 6. Vascular anatomy -Normal anatomy and common variants -Importance for prostatic embolization procedures in the treatment of benign prostatic hyperplasia

## **GUEE-24 Renal and Upper Urinary Tract Tumors: How to Effectively Report and Impact Surgical Management**

Participants

Monick Nakayama, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Upper urinary tract masses (UTMs) have been increasingly detected by imaging cross-sectional techniques, either as an incidental finding or in the context of a specific investigation, leading to the discovery of renal tumors of smaller dimensions, for whom adequate characterization is mandatory. Correct assignments of malignant and potential benign UTMs are imperative to avoid unnecessary surgical procedures and even biopsies. Nonetheless, the number of benign masses that are surgically approached is still high and prediction of the risk of malignancy is challenging. For UTMs, the lack of well-established scores or specific signs makes imaging evaluation even more difficult but essential for therapeutical definition, and reporting key imaging findings with aggressive lesions is crucial.

### **TABLE OF CONTENTS/OUTLINE**

Introduction Illustrative summary of the anatomy and histology of the kidney and upper urinary tract and histological origin of UTMs Summary of the main image findings in malignant tumors with pathological correlation, including: Tumors of the renal parenchyma Tumors of the collecting system and ureters Lymphoproliferative disorders Metastases Overview of main benign tumors and their essential imaging findings Tricks in upper urinary tract imaging including pseudotumoral lesions How to report the imaging findings for helping in surgical planning Conclusion

## **GUEE-25 Above and Beyond the Imaging Features of Urolithiasis: What the Radiologist Needs to Know**

Participants

Juan Francisco Santoscoy Gutierrez JR, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

a) Review the pathophysiology of kidney stone formation, types of calculi and clinical presentation. b) Discuss the general evaluation of urolithiasis with emphasis on the characteristic imaging features of different urinary calculi and specific imaging findings focusing on the clinically relevant information that can affect management by the urologist. c) Describe the standard of care of nephrolithiasis focusing on the current non-invasive options, minimally invasive options and invasive options performed by the urology surgeon. d) List the anticipated post-treatment follow-up, complications and prognosis of urolithiasis.

### **TABLE OF CONTENTS/OUTLINE**

I. General overview: epidemiology, pathophysiology, clinical presentation II. Evaluation and management: a) General laboratory work and urinary tests b) Imaging and clinically relevant reporting: non-contrast CT, CT urography, dual energy CT, ultrasonography, radiography, MRI III. Treatment: a) Non-invasive options: observation, medical expulsion therapy, oral medication for dissolution b) Minimally invasive options: extracorporeal shockwave lithotripsy, ureteroscopy, percutaneous nephrolithotomy c) Invasive options: laparoscopy and open surgery IV. Post-treatment follow-up, complications and prognosis

## **GUEE-26 Hematuria Beyond Infection, Stones and Cancer: An Imaging and Evaluation Guide of Unusual Cases**

Participants

Eduardo Zukovski, MD, Umuarama, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- It is essential that radiologists know how to investigate hematuria, indications and limitations of each imaging option and recommendations for follow-up;
- All the examination protocols should be adapted to the patient while optimizing radiation dose;
- CT urography performs better than conventional radiography, ultrasound and intravenous urography in the detection of renal parenchymal masses and urinary tract calculi;
- Patients are now categorized into risk categories according to their clinical presentation and risk factors, and the workup is adapted to that category;

### **TABLE OF CONTENTS/OUTLINE**

Hematuria is one of the most common urologic diagnoses, estimate to account for over 20% of urology evaluations; It is defined as the presence of three or more red blood cells per high-powered field in two of three properly collected urinalysis specimens; It can be classified as gross hematuria or microhematuria; The differential diagnosis encompasses a wide range of conditions and the risk of detecting an underlying cancer has been found to be highly dependent on which risk factors are present; More common causes of hematuria include urinary tract infection, urolithiasis, trauma, renal parenchymal disease, and malignancy;

## **GUEE-27 Insights into Renal Cell Carcinoma with Novel Imaging Approaches**

Participants  
Khoschy Schawkat, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

· The updated Bosniak Classification, version 2019, predicts the likelihood of malignancy in cystic renal masses, with improved specificity of the higher risk categories, thereby expanding the number of masses that can be monitored.· In the clear cell likelihood score (ccLS), version 2.0, multiparametric MRI features of small renal masses without macroscopic fat are sequentially analyzed to determine the likelihood of clear cell renal cell carcinoma.· Contrast-enhanced ultrasound and dual energy CT are useful in identification and characterization of solid and cystic renal masses.· Several radiopharmaceuticals may contribute to the characterization of renal masses, such as 99m-technetium sestamibi, radiolabeled girentuximab and 68Ga-prostate-specific membrane antigen.· In the future, RCC may be diagnosed, managed, and treated more effectively using radiomics and artificial intelligence (AI).

#### TABLE OF CONTENTS/OUTLINE

1) New Imaging Algorithms Using Established Imaging Techniques (Bosniak classification, version 2019, and clear cell likelihood score version 2.0). 2) Novel Modalities (Contrast-enhanced ultrasound, dual energy CT, and molecular imaging including Sestamibi, Girentuximab, and PSMA). 3) Radiomic and artificial intelligence.

#### GUEE-28 **Penile MRI: A Multi-institutional Case-based Review of Anatomy, Spectrum of Pathologies and Prosthetic Complications**

Participants  
Harit Kapoor, MD, MBBS, Poughkeepsie, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Penile MRI provides invaluable clinical information in a wide array of pathologies. However, given the infrequent use, contemporary radiology residency and fellowship training provides insufficient exposure to penile MRI.2) After reviewing this presentation, the learner will be able to:a. Understand normal penile anatomy including prosthetic anatomy;b. Describe indications for penile MRI and key aspects for image acquisition;c. Diagnose various penile pathologies based on characteristic imaging findings;d. Understand the basis for differences in management and tenets of surgical planning for various disease entities;e. Describe indications for penile prosthesis implantation and diagnose common implant complications.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of penile MRI technique, indications, and normal anatomy.2) Tabulated summary of various penile diseases with classic MRI appearances.3) Case examples (with differentials, pearls and pitfalls) including but not limited to: (i) Penile trauma (contusion, fractures); (ii) Corrected anomalous genitalia; (iii) Cowper's gland pathology (retention cysts and syringocele); (iv) Penile malignancy (primary staging, post-penectomy recurrence, metastases); (v) Penile implant complications (malpositioning, infection and erosion/extrusion); (vi) Priapism (types, post-treatment imaging); (viii) Periurethral and perineal sepsis.

#### GUEE-29 **Upper Tract Urothelial Neoplasms and Mimics**

Participants  
Satheesh Krishna, MD, Toronto, ON (*Presenter*) Nothing to Disclose  
Murray Di Loreto, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• Review the methods and techniques for the optimal evaluation of the urothelium. • Identify role of imaging in diagnosis and staging of upper tract urothelial cancer. • Identify imaging features with radiology-pathology correlation of lesions involving the urothelium in a quiz-based format.

#### TABLE OF CONTENTS/OUTLINE

• Is there still a role of conventional urography? Which is better - retrograde urography? antegrade urography? intravenous pyelourography? • CT urography - what is the ideal urothelial phase? should arterial phase be included? split-bolus technique vs dedicated delayed phase? • When is MR urography preferred over CT urography- improvements in MR sequences (including compressed sensing, k-space undersampling, parallel imaging and AI). Is Lasix injection needed? Prone vs supine patient positioning? Wide vs narrow FOV how to optimize? Are cine-T2 images useful? T2 based or gadolinium based? Pitfalls, artifacts simulating urothelial disease will be discussed (especially pertaining to MR urography) and solutions will be presented (flow voids on T2? T1\* effects due to concentrated gadolinium). • What is multiparametric MR Urography - what are the various components of multiparametric MR urography, and how does it improve diagnosis? What is the literature evidence for multiparametric MR urography? • How does imaging help in diagnosis and staging of upper tract urothelial neoplasms? What are the key findings impacting management of upper tract urothelial neoplasms? • Approach towards differential diagnosis of these lesions (including common, uncommon and rare mimics) with tips and tricks and imaging pearls as to when to suspect a diagnosis other than UCC, and optimal follow-up/referral strategy.

#### GUEE-3 **Lost Without Bosniak: Overcoming the Challenges of Non-Classifiable Renal Cystic Masses**

Participants  
Jhonata Soares Da Silva, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A comprehensive review of situations where the Bosniak classification for renal cystic masses is not applicable, emphasizing the importance of being aware of these contexts and how to manage cases where the classification is not useful. Challenging Cases: The exhibition will showcase various challenging cases of renal cystic masses where the Bosniak classification may not be applied. These cases will test participants' knowledge and critical thinking.

#### TABLE OF CONTENTS/OUTLINE

Overview of cystic renal lesions in daily practice and the importance of differential diagnoses. Brief mention of the Bosniak

classification system and its limitations. Situations where the Bosniak Classification is not applicable, such as inflammatory/infectious conditions, vascular diseases, calyceal diverticula, polycystic kidney disease, Birt-Hogg-Dubé, Von Hippel-Lindau, Tuberous Sclerosis, pelvic cysts, and cystic metastasis are all conditions that can mimic renal cystic masses and are not included in the Bosniak classification system. In this section, we will review each of these conditions, their presentation, and management. Case-based review of concepts and tips: Practical tips and case-based reviews of concepts to help manage renal cystic masses that cannot be classified by the Bosniak system. Helping assistant doctors for better outcomes: discussion of how to assist and guide assistant doctors in managing challenging cases of renal cystic masses. Key take-home messages: summary of the important points discussed during the presentation, with practical advice on how to incorporate the acquired knowledge into clinical practice.

### **GUEE-30 Imaging and Interventional Management in Different Conditions Underlying Renovascular Hypertension**

Participants

Eric Castane, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review the imaging study of the arterial renal system both in normal and in renal artery stenosis. 2. Describe the vascular radiology management of the renovascular hypertension.

#### **TABLE OF CONTENTS/OUTLINE**

1. Material and methods / Background. 2. Arterial hypertension and renovascular hypertension: definitions and clinical features. 3. Imaging study of the renal arteries: normal, anatomic variants and pathological findings. 3.1. US assessment (evaluation points, technique, signs). 3.2. CT. 3.3. MRI. 3.4. Angiography. 3.5. Algorithmic approach to renal artery stenosis. 4. Interventional radiology management: therapeutic options and post procedure imaging criteria. 5. RAS: etiologies pictorial review (atherosclerosis, fibromuscular dysplasia, vasculitis, others). 6. RAS after renal transplantation (diagnosis and interventions). 7. Conclusions.

### **GUEE-31 Imaging of the Urachus**

Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to: 1. Illustrate normal urachal anatomy on imaging and discuss urachal embryogenesis. 2. Provide case-based review of the imaging features of various urachal non-neoplastic and neoplastic entities.

#### **TABLE OF CONTENTS/OUTLINE**

Embryogenesis: Urachus is an embryonic ductal remnant of the allantois and cloaca extending from the bladder dome to the umbilicus. Imaging modalities: US is usually the imaging modality of choice, especially in the pediatric population. CT and MR carry higher temporal and spatial resolution with added benefit of staging malignancy when present. • Congenital: Patent urachus (urachal fistula); Umbilical-urachal sinus tract; Vesicourachal diverticulum; Urachal cyst • Infections/inflammation: Urachal stone/calcification; abscess. • Urachal neoplasms: Benign Adenoma; Cystadenoma, fibroma. Malignant Mucinous adenocarcinoma; Nonmucinous adenocarcinoma; Urothelial; Squamous; Sarcomatoid; Metastatic. • Non-neoplastic masses: Endometriosis; Hemorrhage. Summary Urachal pathology is often discovered incidentally on imaging and presents with nonspecific urinary symptoms. Early detection of urachal pathology and identification of complications such as infection and malignancy are imperative to prevent significant patient morbidity.

### **GUEE-32 Testicular Cancer: What the Radiologist Needs to Know**

Participants

Ingrid Alonso Ramon, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To review the general characteristics of testicular cancer including the different types and their incidence. To describe the different features of multimodality imaging (ultrasound, CT, PET/CT) including the expected findings depending on histologic type and their utility of each in TNMS. Recognize the importance of diagnosis, treatment and follow-up.

#### **TABLE OF CONTENTS/OUTLINE**

Description of the general characteristics of testicular cancers including (a) embryology (b) incidence (c) detailed pathologic features. d) Clinical presentation To review of multimodality imaging findings including expected findings. To establish the usefulness of the different imaging methods for diagnosis, follow-up, complications and stratification of each one. To Discuss clinical scenarios to establish the best course of action.

### **GUEE-33 Penile Ultrasound: An Updated Pictorial Review for Residents**

Participants

Hugo Velazquez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-To illustrate the anatomical structures of the penis by sonography. -To determine the protocol used at our center. -To show the main indications for penile Doppler ultrasound with and without vasoactive drug. -To list the normal parameters in the Doppler evaluation and their pathological correlation. -To review the main sonographic findings in different conditions.

#### **TABLE OF CONTENTS/OUTLINE**

1. A pictorial review of the anatomy of the penis structures by ultrasound. 2. Penis ultrasound protocol and technical parameters. 3. Indications and use of vasoactive drug. 4. Examples of different conditions with sonographic findings.

### **GUEE-34 Contrast-Enhanced Ultrasound (CEUS): Vascular Applications from the Kidneys to the Bladder**

## TEACHING POINTS

1. CEUS is a very useful imaging modality in patients with poor renal function due to the non-nephrotoxic nature of the ultrasound contrast agents. 2. In the kidneys, CEUS is accurate in characterizing indeterminate lesions, characterizing complex cysts according to the Bosniak criteria, differentiating solid renal tumors from pseudotumors, identifying renal infarction, abscesses, and for the follow-up of non-surgical renal lesions. 3. CEUS is also used in renal transplant patients to look for masses, cysts, and other vascular problems. 4. In the bladder, CEUS is excellent in differentiating bladder cancer from benign pathologies such as a hematoma in patients with hematuria. It also aids in differentiating non-muscle invasive bladder cancers (NMIBC) from muscle-invasive bladder cancers (MIBCs), thereby guiding appropriate management. 5. CEUS can also detect primary tumors of the ureter or tumors extending from the bladder into the ureter by means of enhancement patterns.

## TABLE OF CONTENTS/OUTLINE

1. Overview of vascular applications of CEUS in the urinary system. 2. The technique of performing CEUS. 3. Microbubbles as non-nephrotoxic blood pool contrast agents. 4. Renal applications of CEUS. i. Renal infarction ii. Renal abscess iii. Characterization of cystic renal masses iv. Solid renal tumors vs pseudotumors v. Angiomyolipoma vs renal cell carcinoma 5. Renal transplant applications 6. Bladder application of CEUS. i. Bladder cancer vs Hematoma ii. Staging of bladder cancer iii. NMIBC vs MIBC iv. Ureteral tumor

## GUEE-35 Imaging Findings of Upper Tract Urothelial Carcinoma (UTUC) and Its Mimickers

Participants

Marina Farani, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

To review the characteristic imaging findings of upper tract urothelial carcinoma. To outline the role of imaging in diagnosis and staging of carcinoma of the renal pelvis and the ureter. To discuss different diagnostic imaging modalities in the context of upper tract urothelial carcinomas. To make differential diagnosis of upper urinary tract neoplasms from other lesions, including benign lesions.

## TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology, risk factors, signal and symptoms and pathogenesis about carcinoma of upper urinary tract. Diagnosis: A step-by-step explanation of how to characterize and diagnostic a upper tract urothelial neoplasm. The use of computed tomography and the magnetic resonance to describe the different imaging patterns of tumors (papillary and infiltrating) and to staging urothelial carcinoma of upper urinary tract. Case-Based Review: Sample cases explaining and demonstrating different imaging patterns about upper tract urothelial carcinoma in different imaging modalities. This section will present illustrative cases of carcinoma urothelial infiltrating renal parenchyma, limited at renal pelvis and calyceal infundibulum and distal ureter. This section will present illustrative cases of diagnostic differential/mimickers of urothelial neoplasm, like inflammation, blood clots, endometriosis and renal lymphoma. Conclusion and key takeaways.

## GUEE-36 Bladder Neoplasm: A Practical Guide for Residents

Participants

Vitor Romano, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The purposes of this exhibit are: Provide a practical guide for residents on how to perform a bladder cancer screening. Systematize the evaluation of bladder cancer. Introduce and exemplify the VI-RADS classification. Demonstrate how muscle layer invasion should be evaluated according to the VI-RADS classification.

## TABLE OF CONTENTS/OUTLINE

We will discuss the following topics and focus on the VI-RADS classification. Introduction: Epidemiology; Pathophysiology. Subtypes of bladder cancer. Urothelial carcinoma; Urachal adenocarcinoma. Imaging methods. TNM grading. VI-RADS classification. Imaging acquisition; Analysis; Examples. Evaluation of the metastatic disease. Management and followup.

## GUEE-37 Evaluation of Trauma-Related Kidney Injuries

Participants

Vitor Romano, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The purposes of this exhibit are: Provide a guide on how to assess kidney injuries related to blunt trauma. Indications for radiological evaluation of renal injury. Role of various imaging modalities (computed tomography, excretory urography, angiography, retrograde pyelography, ultrasonography and magnetic resonance imaging). Give a context of the conduct according to the kidney injury.

## TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology; Pathophysiology. Imaging methods. Computed tomography images acquisition protocol. AAST classification for renal trauma. Examples. Overview.

## GUEE-38 Atypical Prostatic Cancer Metastases Recurrence: A Pictorial Review

Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Prostate cancer is one of the most common malignancies in men worldwide. It has a recognizable pattern of metastatic spread, most frequently to regional lymph nodes and bone, as well as a typical recurrence pattern to pelvic lymph nodes, vesicourethral anastomosis, and bed of seminal vesicles and vas deferens. However, there are different patterns of metastases and recurrence

that must be recognized.

#### **TABLE OF CONTENTS/OUTLINE**

Atypical metastatic disease occurs in less than 5% of patients. Atypical lymph node involvement includes the supradiaphragmatic chains, most commonly the retrocaval, hilar, and supraclavicular ones. Extranodal involvement can occur in the lung and pleura, abdominal viscera, breast, orbit, brain/meninges and soft tissues. Interestingly, atypical distant metastases rarely occur in isolation and PET-PSMA usually demonstrates multiple simultaneous lesions. A higher Gleason score has also been reported to be associated with a greater likelihood of atypical metastases. When evaluating for recurrence, the atypical sites that need to be part of the routine imaging evaluation include anterior portions of the urethra, ureteral meatus (associated with poor prognosis), urinary bladder (distant from the anastomotic area), rectum, mesorectum and compromised retroperitoneal lymph nodes with preservation of the pelvic chains. This exhibit aims to review the locations and atypical patterns of manifestation of this neoplasm according to the different diagnostic modalities, focusing on multiparametric magnetic resonance imaging (MRI) and PET-PSMA.

#### **GUEE-39 Clinical Utility of the Vesical Imaging-Reporting and Data System for Histological Variants and Non-Urothelial Bladder Cancer**

##### **TEACHING POINTS**

Histological variants (VUC) and non-urothelial bladder cancer (NUC) are relatively rare bladder cancer subtypes. These subtypes have a high malignant potential, aggressive advanced tumor features, and an increased risk of disease recurrence compared to pure urothelial bladder cancer (PUC). Accurate preoperative muscle invasion assessment and subsequent immediate surgical intervention are warranted in these patients. The usefulness of the Vesical Imaging-Reporting and Data System (VI-RADS) has been established for PUC by several previous studies. However, the validity of VI-RADS for VUC and NUC still has to be established. This exhibit aims to clarify MRI features of VUC and NUC with histological correlation, demonstrate VI-RADS scoring of VUC and NUC, and discuss the feasibility of biparametric MRI for VUC and NUC compared to PUC.

#### **TABLE OF CONTENTS/OUTLINE**

1, VI-RADS and histological classification of bladder cancer, 2, VUC with VI-RADS scoring (squamous differentiation, glandular differentiation, sarcomatoid variant, plasmacytoid variant, micropapillary variant, and nested variant), 3, NUC and other bladder malignant tumors with VI-RADS scoring (squamous cell carcinoma, adenocarcinoma, small cell carcinoma, lymphoma, urachal adenocarcinoma, and bladder metastasis), 4, Risk of underestimation of muscle invasion in VUC and NUC at biparametric MRI and its clinical implications, 5, Summary.

#### **GUEE-4 Use of 3D Printed Models to Guide Surgical Resection of Renal Masses**

Participants

Mujtaba Hameed, BS, BA, Canton, MI (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. 3D modeling and printing has been increasingly utilized in recent years to guide improvements and new applications for medical diagnosis and treatment planning. 2. 3D models provide a unique degree of tactile and visual information, especially anatomopathological information that would be particularly relevant in surgical planning of tumor resection (e.g., renal masses). 3. 3D modeling can improve the characterization and treatment of renal masses at multiple stages, including segmentation, modeling, printing, preoperative planning, patient consent and education, intraoperative reference, and ultimately surgical removal.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction characterizing the background of 3D modeling and printing in medical diagnosis and treatment, as well as review of relevant examples in the literature and within our institutional experience. 2. Description of initial case presentation and pertinent clinical workup. 3. Review of CT images, process of segmentation, and creation of 3D printed models utilizing clinical 3D visualization software. 4. Description of technique used in editing of 3D models via 3D printing software, including model video. 5. Creation of 3D model of the patient's left kidney (with mass demarcated), description of the utility of the modeling process both preoperative and intraoperatively.

#### **GUEE-40 A Practical Guide for Evaluating Renal Masses: Didactic Case-Based Review**

Participants

Fernanda Limonge, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Discuss and illustrate the cystic lesions of the kidney, emphasizing Bosniak v2019 classification. Describe the features of solid renal masses. Review the TNM system for renal cell carcinoma (RCC). Discuss the active surveillance of renal masses as an alternative to immediate treatment. Review the imaging findings in the context of post-treatment.

#### **TABLE OF CONTENTS/OUTLINE**

Cystic lesions- Illustrate the Bosniak classification- Tips on how to interpret a cystic renal mass Didactic approach for evaluating solid renal masses- Ball versus bean patterns- Clear cell likelihood score (ccLS) Describe and review renal masses and histological subtypes- Angiomyolipoma- Oncocytoma- Clear cell RCC- Papillary RCC- Chromophobe RCC- Collecting duct carcinoma- Medullary carcinoma- Urothelial carcinoma- Lymphoma- Metastasis Locoregional risk stratification- Tumor size- Axial location (anterior/posterior; endophytic/exophytic)- Longitudinal location (relationship with the polar lines)- Hilar proximity (vessels/collecting system) Distant disease assessment- Metastatic disease (bone, liver, lung, lymph nodes)- Synchronic urothelial carcinoma Active surveillance Post-treatment complications- Relapse- Hematoma- Urinoma- Arteriovenous complications

#### **GUEE-41 Male Urethral Anatomy Revealed: Navigating Anatomical Variations and Complications**

Participants

Helen Ribeiro De Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The purposes of this exhibit is: Illustrate the main anatomical landmarks of the male urethra according to imaging methods Review

the imaging modalities useful to evaluate the male urethra. Propose a differential diagnosis of lesions according to localization and congenital or acquired, traumatic, infectious, and neoplastic etiologies and highlight the imaging features of each one. To evaluate the postoperative findings and complications.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction- Main anatomical landmarks- Imaging methods- Differential diagnosis and clues to diagnosis- Practical tips and Pitfalls- Normal postoperative findings and complications- Conclusion/Take home message

#### **GUEE-42 Imaging and Management of Renovascular Hypertension: An In-Depth Review**

Participants

Igor Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Understand the pathophysiology of renovascular hypertension (RVH) and its clinical implications. Review the diseases that can lead to RVH, differential diagnosis, and treatment complications. Assess the role of various imaging modalities in diagnosing and assessing the severity of RVH. Discuss the importance of imaging in guiding interventional and surgical management of RVH. Evaluate the current evidence-based guidelines for the management of RVH.

#### **TABLE OF CONTENTS/OUTLINE**

I. Introduction to Renovascular Hypertension A. Pathophysiology of RVH B. Clinical presentation and implications II. Imaging Modalities for RVH A. Duplex ultrasonography B. Computed tomographic angiography (CTA) C. Magnetic resonance angiography (MRA) 1. Protocol and techniques 2. Contrast enhanced vs unenhanced MRA D. Digital subtraction angiography (DSA) E. Selecting of the appropriate imaging modality III. Etiology and Differential Diagnosis of RVH A. Diseases leading to RVH 1. Atherosclerosis 2. Fibromuscular dysplasia 3. Vasculitis 4. Other causes 5. particularities in the pediatric population B. Differential diagnosis and clinical challenges C. Algorithm approach on etiology definition on CTA and MRA IV. Interventional and Surgical Management A. Indications for intervention B. Percutaneous transluminal angioplasty (PTA) with or without stenting C. Surgical revascularization D. Nephrectomy in non-functioning kidneys E. Treatment complications V. Evidence-based Guidelines for RVH Management A. Role of imaging in treatment planning B. Recommendations for follow-up imaging VI. Conclusion A. Importance of imaging in the diagnosis and management of RVH B. Future directions in RVH imaging and management

#### **GUEE-43 Practical Guideline for Adrenal Incidentalomas: A Case-Based Review**

Participants

Iandra Pacheco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Demonstrate a practical guideline with cases to help radiologists with the differential diagnosis of adrenal incidentalomas. Illustrate with didactic cases the European Society of Endocrinology Clinical Practice Guideline in collaboration with the European Network for the Study of Adrenal Tumors and the White Paper of the ACR Incidental Findings Committee. Review the typical image appearance of adrenal incidentalomas.

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION IMAGING PROTOCOL CT and MRI REVIEW INCIDENTALOMAS GUIDELINES White paper of ACR European Society of Endocrinology Clinical Practice DEMONSTRATE DIDACTIC CASES- Adenoma - Myelolipoma - Cyst or hemorrhage - Prior granulomatous infection or hematoma- Indeterminate adrenal incidentalomas (= 1 - < 4 cm with prior imaging) . With cancer history: new or enlarging mass. No cancer history: enlarging indeterminate adrenal masses- Indeterminate adrenal incidentalomas (= 1 - < 4 cm without prior imaging) . No cancer history: 1 - 2 cm 2 - 4 cm. Cancer history- With history of cancer (= 1 - < 4 cm). Without known metastatic disease or prior exam. Central necrosis

#### **GUEE-44 How to Improve Surgical Management in Penile Cancer: An MRI and Pathology Correlation**

Participants

Thiago Caetano, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Describe the protocol and main sequences used in magnetic resonance imaging for optimal imaging of the penis. Comment on the main penile cancer subtypes based on MR imaging features and correlate with the pathological diagnosis. Discuss the importance of MR imaging in the staging of penile cancer, as well as its potential to aid in surgical management.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: Relevant anatomy of the penis Definition and main types of penile cancer Epidemiology and risk factors MR technique and discussion: Describe the main protocol and sequences used in penile cancer MR imaging Staging, imaging features and pathology correlation: Discuss the major changes in the 8th AJCC Cancer Staging Manual Demonstrate imaging features of the main types of penile cancer and correlate with pathology Conclusion: Discuss its usefulness in local staging and locoregional lymph nodal metastasis and comment on future directions

#### **GUEE-45 Space OAR in Prostate Cancer - the What, the How, and Beyond: A Primer for Radiologists**

Participants

Nabih Nakrou, MD, Watertown, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this presentation is to: • Review the role of SpaceOAR hydrogel spacer in prostate cancer treatment and placement techniques. • Discuss imaging findings and mimics on different modalities via variable cases. • Recognize radiologic findings of SpaceOAR complications and malfunction.

#### **TABLE OF CONTENTS/OUTLINE**



We will address the following: • SpaceOAR composition • SpaceOAR placement and anatomy • Indications and roles of SpaceOAR in prostate cancer radiotherapy, including companion cases for treatment and follow-up • Common pitfalls and mimics of hydrogel spacers • Rare SpaceOAR-related complications

#### **GUEE-46 The Female Urethra: A Practical Guide**

Participants

Louise Cavalcanti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Describe embryology and anatomy of the female urethra highlighting the anatomical landmarks for diagnoses and surgical planning. 2. The intention of this pictorial review is to describe the most important imaging methods and their contribution to the diagnosis of the main pathologies. 3. Discuss the main pathologies of the female urethra, through richly illustrated clinical cases, correlating with the symptoms and emphasizing the learning points.

##### **TABLE OF CONTENTS/OUTLINE**

a. Introduction. b. Embryology: Brief description of embryology. c. Anatomy: Important landmarks. d. Imaging methods: Sonography, MRI, Urethrography. e. Pathology: Discuss the most significant pathologies with key points and possible differential diagnoses. f. Cases: Illustrate the most frequent pathologies with clinical cases. g. Take home messages.

#### **GUEE-47 Renal Vascular Hypertension: A Primer for the Radiologist**

##### **TEACHING POINTS**

1. Review the etiology, pathophysiology, classification and diagnosis of renal vascular hypertension 2. Review contemporary ultrasound, CT and MR angiography techniques and findings of renal vascular hypertension 3. Summarize modern treatment recommendations

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Etiology and pathophysiology of renal vascular hypertension 3. Modality selection and protocol optimization 4. Imaging features of renal artery narrowing including a) etiology b) flow dynamics c) renal perfusion d) post-intervention appearance e) complications 5. Summary of treatment recommendations with emphasis on the impact of specific imaging findings on therapy

#### **GUEE-48 Penile Pathology Prep: A Quiz-based Review of Penile Ultrasound for Trainees**

##### **TEACHING POINTS**

By the end of the presentation, the learner will be able to 1. Interpret the imaging and relevant anatomy for penile ultrasound. 2. Understand the role of ultrasound in diagnosis and management of penile pathologies and discern when to use ultrasound as an adjunct or in lieu of other modalities. 3. Describe the ultrasound findings for penile pathologies focusing on emergent and commonly encountered cases. 4. Identify normal and abnormal ultrasound Doppler flow parameters in various conditions that may aid in diagnosis. 5. Raise awareness of the clinical utility of penile ultrasound in certain penile pathologies given the safety profile and wide accessibility of this modality. Target Audience: Trainees.

##### **TABLE OF CONTENTS/OUTLINE**

We present a case-based quiz of various penile pathologies as seen on ultrasound. Each case will be associated with pertinent symptoms and unlabeled ultrasound images. The diagnosis will be revealed, along with description of the imaging findings followed by relevant educational content for each diagnosis such as: defining relevant pathophysiology, explaining key findings/associations, the clinical significance, and the uses/limitations of ultrasound related to that diagnosis. An introductory overview of normal anatomy and Doppler parameters will also be provided. Diagnoses include: 1. Erectile dysfunction - Arteriogenic 2. Erectile dysfunction - Venogenic 3. Priapism - High-flow 4. Priapism - Low-flow 5. Peyronie's disease 6. Mondor's disease 7. Penile fracture 8. Penis infection/abscess 9. Penile mass - Squamous cell carcinoma 10. Penile foreign body

#### **GUEE-49 Now Streaming: Review of Male Urethral Imaging with Focus on MRI**

Participants

Milana Flusberg, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Proper technique and understanding of normal male urethral anatomy on retrograde urethrography aids in interpretation of scans for trauma and strictures. Differential diagnosis of periurethral cysts in men includes utricle, Mullerian duct cyst, Cowper's duct/gland cyst, diverticulum, and collections (urinoma/abscess). MRI is used for local staging of male urethral cancer. Radiologists should be familiar with the appearance of urethral procedures including artificial sphincter and Urolift.

##### **TABLE OF CONTENTS/OUTLINE**

Performance of retrograde urethrography; Normal male urethral anatomy and normal variants; Urethral strictures: inflammatory, post-traumatic, neoplastic; Urethral trauma: mechanisms, grading, associated findings; Peri-urethral cysts and collections: utricle, Mullerian duct cyst, Cowper's duct/gland cyst, diverticulum, urinoma, abscess; Urethral cancer: background, imaging appearance, staging; Post-procedural urethra

#### **GUEE-5 Overview of Tumor Thrombus in Renal Cell Carcinoma**

##### **TEACHING POINTS**

Renal cell carcinoma (RCC) invades into the vasculature in approximately 10% of patients. Tumor thrombus is most commonly associated with clear cell RCC but it can also occur due to other entities, such as papillary RCC. This educational exhibit will: (1) Review the incidence, prognosis, and classification system of tumor thrombus in RCC. (2) Review the imaging features of tumor thrombus. (3) Discuss the role of imaging in guiding surgical treatment of tumor thrombus.

## TABLE OF CONTENTS/OUTLINE

(1) Incidence, clinical presentation, and prognosis of tumor thrombus in RCC. (2) Review the T staging of RCC with tumor thrombus according to the 2010 AJCC clinical staging and Mayo Clinic RCC tumor thrombus level classification system. (3) CT and MRI imaging features of tumor thrombus with case-based pictorial review. (4) Treatment of RCC with tumor thrombus. (5) Potential surgical approach for varying levels of tumor thrombus and post-operative imaging. (6) Summary of teaching points.

### **GUEE-50 Genitourinary Tract Infections and Inflammatory Conditions: Spectrum of Imaging Features, Pitfalls and Mimics**

Participants

Ayman H. Gaballah, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Illustrate the etiology, pathogenesis, and clinical presentation of genitourinary (GU) tract infections 2. Review the appropriate imaging workup and imaging features of GU infections 3. Discuss mimics and pitfalls of GU infections Highlight management options

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomic illustrations 3. Classification of genitourinary tract infections • Urinary tract infections: i. Upper urinary tract (kidney and ureter): 1. Focal/diffuse pyelonephritis 2. Emphysematous pyelitis/pyelonephritis 3. Renal/perinephric abscesses 4. Hydronephrosis and pyonephrosis 5. Xanthogranulomatous pyelonephritis 6. Parasitic infection (hydatid infection) 7. Other infections such as T.B 8. Ureteritis cystica ii. Lower urinary tract (urinary bladder and urethra): 1. Cystitis 2. Emphysematous cystitis 3. Diverticulitis of urinary bladder/urethra 4. Parasitic infection (Schistosomiasis) 5. Fungal infections (actinomycosis, candidiasis) 6. Cystitis cystica 7. Radiation and chemotherapy cystitis 8. iii. Urachal Inflammatory and Infectious Conditions • Genital infections: i. Female genital system: 1. Pelvic inflammatory disease (e.g., cervicitis, endometritis, pyosalpinx, etc.) 2. Tubo-ovarian abscess 3. Pelvic actinomycosis 4. Necrotizing fasciitis 5. Other rare infections ii. Male genital system: 1. Infectious and granulomatous prostatitis 2. Prostatic abscess 3. Epididymo-orchitis and abscess 4. Scrotal wall cellulitis, abscess 5. Fournier gangrene iii. Sexually transmitted infections 4. Predisposing factors and complications of GU infection 5. Imaging features and case presentation 6. Mimics and pitfalls 7. Updates on management options 8. Conclusion

### **GUEE-51 Urologic Prosthetics: An Imaging Review of Short-term and Long-term Complications**

Participants

Mary Woodruff, DO, (*Presenter*) Nothing to Disclose

Mary Woodruff, DO, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Urologic prosthetics are commonly encountered in everyday practice. As with any surgical procedure and implantable device, there are complications, both short-term and longer term. With contribution from the urology team, we have selected a case collection to highlight these complications with both imaging findings and gross anatomic photos. The addition of gross anatomic and surgical photos complement the imaging findings and provide a better understanding of the clinical perspective. In reviewing these cases, the radiologist may better recognize and accurately diagnose complications related to urologic prosthetics.

#### TABLE OF CONTENTS/OUTLINE

A review of the urologic prosthetics and implant components. Normal orthotopic positioning of urologic prosthetics anatomically and in imaging. Selection of cases with imaging and pictorial findings Selected cases include: Urethral cuff erosion of artificial urinary sphincter. Postoperative pelvic/scrotal hematoma. Scrotal abscess. Penile prosthesis scrotal pump erosion. Herniation of prosthesis reservoir into the inguinal canal. Reservoir leak. Fracture of malleable penile prosthesis.

### **GUEE-52 How We Do It: A Diagnostic Approach to Avoid Overtreatment in Management of Centrally Located Renal Masses**

Participants

Layra Leao, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review imaging features of the differential diagnosis of centrally located renal masses.- Illustrate diagnostic clues related to common and uncommon mimickers of upper tract urothelial carcinoma.- Highlight the importance of the tumor board approach in managing challenging cases as a platform for care coordination and a tool to optimize decision-making.

#### TABLE OF CONTENTS/OUTLINE

Imaging diagnostic differentiation of upper tract urothelial carcinomas (UTUC) and other centrally located renal tumors can be challenging; management patterns vary considerably due to the different oncologic behavior of these lesions. Misinterpretation in imaging studies could lead to unnecessary aggressive approaches. Some radiological features can help to predict the histology or pathologic aggressiveness of renal tumors, providing optimal and safe management. The presence of an infiltrative or nodular expansile pattern of growth is the first step in the differentiation of conditions that may simulate UTUC. Benign and malignant mimickers include renal cell carcinomas, metastasis, lymphoma, pseudotumors, and infection. Standardization of imaging protocols and reporting can help to differentiate these entities. The multidisciplinary discussion of challenging cases in the tumor board meetings should be included in the medical practice to identify interpretation mistakes and avoid unnecessary patient damage.

### **GUEE-53 MRI Clear Cell Likelihood Score (cCL): A Great Mechanism to Managing the Indeterminate Renal Masses**

Participants

RODRIGO OKAMURA, GUARULHOS, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 - To understand the different aspects of renal lesions and the importance of classifying those with a higher risk of clear cell carcinoma. 2 - Through practical cases and interactive quizzes, demonstrate how to use the clear cell likelihood score (cCLs). 3 -

Present some cases with limitations of cCLs applicability. 4- Expose some pitfalls and challenging cases.

#### TABLE OF CONTENTS/OUTLINE

1 - Introduction on renal carcinomas subtypes and cCLs score creation.. 2 - Demonstate how to use the cCLs. 3 - Quiz case studies with practical use of cCLs. 4 - Answer each case with the corresponding pathological resulrs. 5 - Challenging cases with limitations of the cCLs algorithm. 6 - Pitfalls that can lead to erroneous diagnosis. 7 - Summary and take home notes.

#### **GUEE-54 Female Lower Genitourinary Tract: Imaging Evaluation of the Most Common Alterations of Interest in Female Urology**

Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? Identify the anatomical landmarks of the female pelvic floor and perineum which can guide the radiologist to the correct diagnosis.? Point out the best imaging method for the diagnosis.? Review imaging features of the most common abnormalities of the female lower genitourinary tract.? List complicating features that may be seen by imaging and some rarer lesions that may be included in the differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Imaging methods Retrograde urethrocytography and computed tomography are limited imaging methods for the evaluation of female lower genitourinary changes. Ultrasound plays a role in more specific indications. However, magnetic resonance imaging is usually the method of choice and provides the best identification of the anatomical structures for the diagnosis. Imaging evaluation common alterations will be characterized especially on MRI, as cystic lesions, including Bartholin's gland cyst and urethral diverticulum, as well as prolapses, such as urethral caruncle. Some complications of the common lesions will be included, in addition to tumors or tumor-like lesions, to provide the radiologist ability to perform differential diagnosis. Conclusion MRI is an ideal imaging method to evaluate female lower genitourinary changes, and it is essential that radiologists know how to detect and characterize these lesions, since, even when benign, they can be quite symptomatic.

#### **GUEE-55 Pitfalls of Renal Transplant Imaging**

Participants

Reece Goiffon, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS1. Discuss the relevant anatomic/imaging considerations, criteria, and imaging techniques for pre-renal donor work-up.2. Become familiar with the normal anatomic features, including location, surgical technique, and relevant hilar anastomoses following renal transplantation as well as the normal grayscale and color/power Doppler imaging features of a renal allograft.3. Review common pitfalls encountered both during pre-renal transplantation work-up and during evaluation of the renal allograft post-transplantation with particular attention to accurate diagnosis of post-transplant complications.4. Highlight the important roles of both computed tomography (CT) and ultrasound (US) in pre- and post-renal transplant evaluation.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINEWe present a comprehensive review of normal pre- and post-renal transplant imaging as well as a review of potential pitfalls in both the pre-transplant imaging work-up and post-transplant allograft evaluation.Pre-renal transplant pitfalls may include:• Incidental arteriopathies (e.g. fibromuscular dysplasia)• Aberrant vascular anatomy• Incidental primary renal neoplasms• Other incidental malignancyPost-renal transplant pitfalls may include:• Postoperative edema at the arterial anastomosis• Renal vein thrombosis with diastolic flow reversal in the transplant renal artery• Postoperative fluid collections (seroma vs hematoma vs urinoma vs lymphocele)• Allograft malignancy

#### **GUEE-56 Imaging of Upper Urinary Tract Neoplasms**

Participants

Miriam Gallego Casals, MD, Sabadell, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Upper urinary tract urothelial carcinoma (UTUC) stands for only 5-10% of all urinary tract tumors and is mainly represented by transitional cell carcinoma (TCC, >95%).TCC usually develops in males around 65 and is related with many chemical compounds and urinary stasis (that is why it is more common in the bladder rather than on the ureter). Haematuria is the most frequent symptom, although non-specific, and urine cytology is usually negative. Commonly multifocal, with a high incidence of early recurrence, requires rigorous urothelial surveillance.CT urography has largely replaced any other imaging techniques, using contrast media to outline the collecting system. As UTUC can be challenging to identify on routine imaging, we use a series of cases to illustrate the most common patterns and signs that help us identify these tumors: a soft tissue density filling defect that enhances lightly is the most typical finding. Other types such as the non-papillary is infiltrative and harder to detect, often invading beyond the mucosa at the time of diagnosis. In the renal pelvis, these tumors do not change renal contours even when large. Instead, small ureteral tumors are more likely to obstruct the kidney and cause renal malfunction.We explain through several cases how to distinguish UTUC from other neoplasms or benign processes, dividing these UTUC mimickers in two groups: - Filling defects pitfalls: clots, calculi, mycetomas, etc- Urothelial thickenings: lymphoma, tuberculosis, schistosomiasis, etc

#### TABLE OF CONTENTS/OUTLINE

Brief description of epidemiologic and pathologic characteristics of the tumors of the upper urinary tract. Discussion of patterns and signs that indicate their presence, and some pitfalls.

#### **GUEE-57 Imaging Assessment for Penile Prosthesis Complications: What the Radiologists Should Know**

Participants

Sofia Bretos Azcona, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the types of penile prostheses and their components and findings on imaging techniques. To review the possible complications associated with penile prostheses and the role of imaging in their assessment and surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. Types of penile prostheses 1.1. Semi-rigid/maleable prostheses. 1.2. Hydraulic prostheses. 1.2.1. Two pieces hydraulic prosthesis 1.2.2. Three pieces hydraulic prosthesis 1.2.3. Low-profile reservoir three pieces hydraulic prosthesis. 2. Radiological evaluation of penile prostheses. 2.1. Radiography 2.2. Ultrasound 2.3. CT scan 2.4. MRI 3. Expected imaging findings on complications related to penile prostheses and the role of imaging in their assessment. 3.1. Immediate surgical complications 3.2. Related to mechanical failure 3.2.1. Autoinflation of cylinders 3.2.2. Leakage 3.2.3. Fractures 3.2.4. Aneurysm of cylinders 3.2.5. Reservoir complications 3.3. Related to malposition of the prostheses components. 3.3.1. Erosion 3.3.2. Migration 3.3.3. Crossover 3.3.4. Buckling 3.3.5. Floppy glans syndrome 3.4. Imaging findings on infected prostheses 3.4.1. Early infection 3.4.2. Late infection 4. Conclusion

#### **GUEE-58 Urothelial-phase CT Urography for Diagnosing Urothelial Tumors: A Paradigm Shift for Investigating Hematuria**

Participants

Nigel Cowan, PhD, FRCR, Cosham, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Urothelial-phase CT urography (25-50 s post contrast administration) is considered a paradigm shift in the development of CT urography for diagnosing urothelial tumors and investigating hematuria. Urothelial tumours are hypervascular and display early hyperenhancement following contrast administration. Familiarity with the signs of urothelial tumours on urothelial-phase CT enables radiologists to make the diagnosis on both GU and non-GU studies. Urothelial-phase compared with excretory-phase CT urography has many advantages. These include shorter examination time, increased patient throughput, no need for complicated patient related manoeuvres to promote full opacification, improved tumour visualisation in cases of hydronephrosis, hydroureter and contrast layering and reduced false positive diagnoses. The diagnostic accuracy of urothelial-phase imaging for urothelial tumors is high. Diagnosis of urothelial tumors using urothelial-phase CT urography makes the excretory-phase redundant.

#### TABLE OF CONTENTS/OUTLINE

A brief 25 year history of CT urography for investigating hematuria. The evolution of CT urography techniques. A comparison of urothelial-phase with excretory-phase CT urography for diagnosing urothelial tumors. Definition description of the techniques. Advantages and disadvantages. An atlas of urothelial tumors showing the signs of urothelial tumours on the urothelial-phase and examples of true positive, false negative and false positive results. Development of a confidence scoring system based on urothelial-phase imaging findings to improve report clarification and direct management: straight to surgery, ureteroscopy +/- biopsy or follow-up. Conclusion References

#### **GUEE-59 New Method for Differentiating Stents from Adjacent Urinary Stone Using Dual Energy Spectral CT with Advanced Post-processing**

#### TEACHING POINTS

1) To illustrate the limitations of conventional CT imaging in differentiating urinary stones and stents. 2) To illustrate novel techniques and approaches using dual energy spectral CT (DEsCT) to differentiate urinary stones from stents. 3) To demonstrate strategies of selecting appropriate image types with advanced post-processing.

#### TABLE OF CONTENTS/OUTLINE

1) Conventional CT and its limitations • Fixed tube voltage of 120kVp with mA modulation and helical scanning mode. • CT value alone lacks the power to differentiate stones and stents. 2) Advanced CT imaging technologies • Dual-energy CT (80/140kVp) with preset dose levels and Adaptive Statistical Iterative Reconstruction-V (ASiR-V). • Different energy levels, material decomposition (MD) images and effective atomic number (Zeff). 3) Optimal strategies using these technologies • Select appropriate MD basis material pairs such as Calcium/Iodine, Fat/ Calcium, Fat/ Iodine, or Iodine/HAP. • Apply Zeff, Calcium/Iodine and CT value at 70 keV to better differentiate urinary stones and stents.

#### **GUEE-6 The Spectrum of Renal Angiomyolipoma with Radiologic Pathologic Correlation**

Participants

Jamie Marko, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Renal angiomyolipoma (AML) is a benign mesenchymal neoplasm composed of an admixture of thick-walled dysmorphic blood vessels, smooth muscle cells and adipose tissue. Angiomyolipomas belong to the perivascular epithelioid cell (PEComa) tumor family. 2. Variants of angiomyolipoma include the classic AML, fat-poor AML, epithelioid AML, and AML with epithelial cysts. Angiomyolipoma may occur sporadically or with tuberous sclerosis. 3. The classic variant, which accounts for more than 90% of cases, is confidently diagnosed at imaging by detecting macroscopic fat. Fat is hyperechoic at ultrasound. It has an attenuation < -20 Hounsfield Units at CT and matches the appearance of subcutaneous fat. Fat is T1 hyperintense with loss of signal with fat suppression at MRI. Small areas of fat are detected with chemical shift imaging. 4. Most angiomyolipomas have a benign clinical course. The most frequent complication is retroperitoneal hemorrhage, most common with tumors > 4 cm. Less commonly, angiomyolipoma may invade the renal vein and inferior vena cava. Epithelioid angiomyolipoma has malignant potential and may recur and metastasize.

#### TABLE OF CONTENTS/OUTLINE

1. Review the gross, histologic, and immunohistochemical pathologic features of renal AML, including the uncommon variants. 2. Describe the multimodality imaging features of renal AML, including the uncommon variants. 3. Describe the pathologic basis of the imaging findings associated with each variant. 4. Illustrate the spectrum of renal AML including its variants. Will include important complications including retroperitoneal hemorrhage and vascular involvement.

#### **GUEE-60 Prostate Imaging for Recurrent Reporting (PI-RR): A User Guide**

Participants

Anup Shetty, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The Prostate imaging for Recurrence Reporting (PI-RR) system was introduced in 2021 to create standards for reporting pelvic MRI after radical prostatectomy or radiation for treatment of prostate cancer. Using a similar nomenclature as PI-RADS v2.1, PI-RR uses established knowledge of MRI features of recurrent prostate cancer and codifies it systematically to be accessible to prostate MR readers of all experience levels. This exhibit is on the RadioGraphics Needs List under Genitourinary Imaging: Pictorial on Guidelines and Reporting Systems. This exhibit will: 1) Discuss the rationale for PI-RR 2) Describe technical standards and reporting guidelines 3) Illustrate the use of PI-RR to assess for recurrent prostate cancer after radical prostatectomy and radiation therapy through a series of instructive cases 4) Describe pitfalls of the current version, including non-applicability for focal therapies 5) Detail areas for future development of PI-RR

#### TABLE OF CONTENTS/OUTLINE

\* Background: Why PI-RR, including the benefits of standardizing post-treatment prostate MRI\* Technical Standards: Requirements, extras (subtraction imaging, 3D volumetric T2 for MPR)\* Reporting: Component scores in the PI-RR system shown in a pictorial format\* Case Examples: Prostatectomy, external beam radiation, brachytherapy\* Pitfalls: Definitions of PI-RR 4/5 for post-prostatectomy based on laterality; susceptibility artifact from brachytherapy seeds and surgical clips; residual prostate tissue after prostatectomy\* Future Development: Focal therapy (cryoablation, HIFU, etc.); Integrating PSMA-PET/CT

#### GUEE-61 Don't Stress, Just Study With Care, Renovascular Hypertension Will Be Conquered, in Your Test

#### TEACHING POINTS

1. Renovascular hypertension (RH) is the most common and potentially reversible cause of secondary hypertension. However, renal artery stenosis is often found as an incidental finding on routine examinations. Thus, knowledge of the clinical aspects of this pathology is necessary to increase the pre-test probability and the different diagnostic imaging modalities provide subsidies for better therapeutic decisions. 2. Revisit the multiple imaging methods used in the diagnosis of RH (Duplex Doppler Ultrasonography, CT Angiography, MRI Angiography and Renography): protocols, advantages, limitations and the main causes of RH as well as its imaging aspects. 3. Knowledge of invasive treatment options (Percutaneous transluminal renal angioplasty and surgery) and their respective technical aspects, indications and procedural complications.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of Renovascular Hypertension (RH) A. Epidemiology B. Physiopathology C. Causes 2. Indications for Testing a Patient for RH: A. Clinical Clues to Enhance the Pre-Test Probability B. Renal Artery Stenosis as an Incidental finding 3. Non Invasive Diagnostic Testing for RH and Expected Findings: A. Duplex Doppler Ultrasonography B. CT Angiography C. MRI Angiography D. Renography E. Contrast-Related Kidney Injury 4. Determining the appropriate time to combine different diagnostic methods 5. Reporting of RH Patient Examination: A. Anatomical Variants B. Most Common Lesion Aspects C. Atherosclerosis D. Fibromuscular Dysplasia E. Complex Lesions 6. Overview of RH Management: A. Percutaneous Transluminal Renal Angioplasty B. Surgery C. Procedural Complications

#### GUEE-62 Prostate MRI Pitfalls and Confounders: A Case-based Approach

Participants

Eduardo Thadeu De Oliveira Correia, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate MRI is widely used for the detection and characterization of prostate cancer. Nonetheless, many conditions can mimic prostate cancer lesions, leading to false positive MRI results. This educational exhibit employs a case-based approach to explore the pitfalls and confounders that arise during the assessment of prostate MRI and guide readers on how to distinguish these benign mimickers from malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

1. A prostate MRI with too many findings a. Case 1: prostate cancer in a MRI done within 4 weeks of prostate biopsy b. Teaching points 2. A must-known confounder a. Case 2: extruded benign prostatic hyperplasia b. Teaching points 3. The importance of clinical history a. Case 3: granulomatous prostatitis b. Teaching points 4. The role of Delayed Contrast Enhancement a. Case 4: prostate abscess b. Teaching points 5. An extremely rare case: know the boundaries! a. Case 5: malakoplakia b. Teaching points 6. Prostate MRI is more than just PI-RADS: check the surroundings! a. Case 6: PI-RADS 5 lesion, ureteral stone and ileo-ileal intussusception b. Teaching points

#### GUEE-63 Factors that Influence Prostate Cancer Visibility on Multiparametric MRI

Participants

Eduardo Thadeu De Oliveira Correia, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Multiparametric MRI (mpMRI) is endorsed by guidelines worldwide as a fundamental tool for the detection and characterization of prostate cancer. Nonetheless, still, 10-20% of patients with clinically significant prostate cancer have a false negative result in mpMRI. In this exhibit, we will review factors that can decrease lesion conspicuity and reduce the detectability of malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

1. What factors can influence Prostate Cancer visibility on mpMRI? a. Histology b. Background Signal Changes c. Image quality 2. Histological determinants of lesion visibility on mpMRI a. Tumor volume b. Gleason/ISUP score c. Epithelium, stroma, and lumen fraction 3. The effect of background signal changes of the peripheral zone on lesion visibility a. Diffusely hypointense peripheral zone on T2WI b. Heterogenous hypointensity in the peripheral zone on T2WI c. Background signal changes in DWI and DCE d. Associated clinical factors and conditions 4. Benign mimickers of prostate cancer on mpMRI a. Prostatitis b. BPH c. Adenosis d. Necrosis e. Focal atrophy 5. Image quality: patient and scanner factors that can decrease lesion conspicuity

## **GUEE-64 Update on Hereditary Renal Mass Syndromes: Genetics, Renal, and Extrarenal Imaging Findings**

Participants

Acacia Yoon, Stanford, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review hereditary renal mass syndromes in the context of the 2022 World Health Organization update, which has a stronger emphasis on genetic alterations. 2. Review extrarenal findings associated with each syndromes. A diagnostic approach will be proposed. 3. Understand the role of the radiologist in diagnosis and management. Genetic testing may not be necessary or even specific for certain syndromes; thus, radiologists may be the first to suggest the diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

1. Hereditary renal mass syndromes with multimodality imaging correlates: genetic mutation, inheritance pattern, diagnostic criteria, renal mass subtype(s), extrarenal findings, and management: Birt-Hogg-Dubé, von Hippel-Lindau, tuberous sclerosis complex, succinate dehydrogenase deficiency, fumarate hydratase deficiency, hereditary papillary renal cell carcinoma, PTEN hamartoma syndrome, BAP1 tumor predisposition syndrome, chromosome 3 translocation. 2. Role of the radiologist in diagnosis and management. 3. Diagnostic approach for the radiologist.

## **GUEE-65 Abnormal Testicular Waveforms: What Do They Mean**

Participants

Yashant Aswani, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To identify typical and atypical waveforms of testicular torsion 2. To understand and describe the difference between partial and complete testicular torsion 3. To describe the features of torsion-detorsion syndrome 4. To understand the mimics of testicular torsion

### **TABLE OF CONTENTS/OUTLINE**

1. Normal testicular blood supply with normal spectral Doppler explained with image and line diagram 2. To illustrate testicular torsion with various examples for clear understanding and interpretation 3. To illustrate examples of partial torsion with various spectral Doppler variations including amplitude of the waveforms, parvus tardus pattern, monophasic waveform and reversal of diastolic flow 4. To illustrate torsion-detorsion with multiple examples. Spermatic knot sign will also be illustrated in detail with images and cine clips 5. To illustrate mimics of testicular torsion such as patients with vasculitis and drug-induced spectral Doppler abnormalities with histopathology correlation

## **GUEE-66 Magnetic Resonance Imaging for Non-Oncologic Penile Pathology: It's Not that Hard**

Participants

Daniel Corominas, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The use of Magnetic Resonance Imaging is widespread for oncological pathology of the penis, but its use is of much importance in non-oncological pathology such as Peyronie's disease, penile fracture, and priapism. Intracavernosal drug injection is an option for the treatment of erectile dysfunction, but it is also important for conducting erection imaging studies, so the radiologist must be aware of its method of administration, possible complications, and how to prevent and treat them. Treatment of non-oncological diseases of the penis using penile prostheses has expanded recently. MRI MRIs the method of choice for evaluating their proper functioning, as it provides high-resolution spatial images and it is key to helping urologists determine the need for replacements and repairs.

### **TABLE OF CONTENTS/OUTLINE**

1) MRI protocol for non-oncological pathology of the penis. 2) Intracavernosal drug injection: a basic guide for radiologists. 3) Penile anatomy on MRI. 4) Non-oncological pathology of the penis. 4.1) Erectile dysfunction 4.2) Peyronie's disease 4.3) Priapism 4.4) Penile fracture 5) Penile prosthesis. 5.1) Indications and types of surgery 5.2) Types of penile prostheses and their components 5.3) Imaging evaluation of the penile prosthesis: importance of MRI 5.4) Evaluation of the penile prosthesis complications. 5.4.1) Cylinders and shafts complications 5.4.2) Glans mobility alterations 5.4.3) Reservoir malposition 5.4.4) Circuit rupture and prosthesis malfunction 6) Conclusions and future directions.

## **GUEE-67 Urethral Pathologies in Male Patients: Evaluation with Magnetic Resonance Urethrography - A Pictorial Essay**

Participants

Kamila Schiavini, MD, SAO LUIS, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

TP1 Magnetic resonance imaging (MRI) is a promising imaging modality for the comprehensive evaluation of urethral pathologies, providing high resolution and multiplanar imaging capabilities without the need for radiation or invasive procedures. TP2 MRI can accurately identify and assess the extent of anterior and posterior urethral strictures, as well as fistulous tracts with adjacent organs, and can aid in the evaluation of postoperative complications. TP3 Urethral strictures can result from traumatic or inflammatory causes and can lead to obstructive uropathy. Posterior urethral injuries commonly result from pelvic trauma, while anterior urethral strictures can result from instrumentation or inflammation. TP4 MRI provides a non-invasive and radiation-free alternative to traditional imaging techniques, such as urethrocytography, which can be limited by poor visualization of urethral strictures and invasiveness. TP5 MRI can also be used to evaluate other pathologies of the male genitourinary tract, including prostate cancer and penile cancer.

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction A. Overview of traditional urethral imaging techniques B. Advantages of MRI for comprehensive evaluation of urethral pathologies II. Methodology A. Patient selection and imaging protocol B. MRI findings in anterior and posterior urethral strictures and

fistulas III. Discussion A. Traumatic and inflammatory causes of urethral strictures B. MRI evaluation of postoperative complications C. Comparison of MRI with traditional urethral imaging techniques IV. Conclusion A. Summary of the advantages of MRI in the evaluation of urethral pathologies B. Potential implications for clinical practice and patient outcomes

#### **GUEE-68 Unveiling the Masked Masqueraders: Navigating Anatomical Variations and Adenocarcinoma Mimickers in Prostate Multiparametric MRI**

Participants

Enis Yilmaz, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Multiparametric MRI (mpMRI) is the imaging modality of choice in assessment of prostate adenocarcinoma (PCa). However, various conditions involving the prostate might resemble PCa due to their imaging characteristics and these patients might undergo unnecessary biopsy procedures. Our aim is to review some of the entities that could be a pitfall for readers and outline their key imaging findings to differentiate them from PCa.

##### **TABLE OF CONTENTS/OUTLINE**

(1) Overview of prostate anatomy and typical imaging characteristics of PCa. (a) Central Zone (b) Anterior fibromuscular stroma (c) Bulbourethral glands (Cowper's glands) (2) Conditions that may mimic PCa and their appearance at mpMRI: (a) Acute and chronic bacterial prostatitis (b) Tuberculous prostatitis (c) Granulomatous prostatitis (d) Prostate abscess (e) Intraprostatic calcification (f) Mucinous neoplasm of prostate (g) Stromal Tumor of Uncertain Malignant Potential of the Prostate (STUMP) (h) Biopsy related hemorrhage (i) Post-focal treatment prostate (j) Exophytic BPH nodule (k) Small cell carcinoma of the prostate (3) Hints that could be helpful in differentiation of PCa and PCa mimickers (4) Summary of findings

#### **GUEE-69 Practical Approach to Primary Retroperitoneal Tumors: Tips for An Imaging Diagnosis**

Participants

Shota Kondo, Hiroshima, Japan (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

a. For a differential imaging diagnosis of primary retroperitoneal tumors, a focus on the principal tumor features, e.g. fat, cystic components, a mucinous matrix, and necrosis is important. b. On images of well-differentiated liposarcomas the fat component predominates. In other histological types of liposarcomas it is not large and it may not be identifiable. c. High signal intensity on T2-weighted MRI scans with delayed contrast enhancement indicates a myxoid stroma that may be, for example, myxoid liposarcoma, schwannoma, or myxofibrosarcoma. d. Retroperitoneal tumors with a predominantly cystic component commonly include benign lesions such as lymphatic malformations, tail gut cysts, and ancient schwannomas. e. Common primary retroperitoneal malignancies such as leiomyosarcoma, undifferentiated pleomorphic sarcoma, and liposarcoma often have a necrotic appearance, suggesting a poor prognosis.

##### **TABLE OF CONTENTS/OUTLINE**

1. Retroperitoneal anatomy 2. Diagnostic algorithm and clinical management of primary retroperitoneal tumors 3. Imaging findings of various primary retroperitoneal tumors 4. Utility of 18F-FDG-PET/CT for diagnosing primary retroperitoneal tumors 5. Tips for avoiding diagnostic pitfalls and for clinical management

#### **GUEE-7 Multiparametric MR Urethrography (MRU): Dynamic Comprehensive Evaluation of the Male Urethra**

Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Describe the optimal technique for a comprehensive MRU protocol including the instillation of sterile urethral jelly, multiparametric sequences, and dynamic maneuvers. Identification of normal urethral anatomy on MRU including evaluation of periurethral compartments in both static and dynamic images. Describe how each component of MRU is crucial for the evaluation of common, uncommon, and rare urethral pathology.

##### **TABLE OF CONTENTS/OUTLINE**

MRU has revolutionized the imaging of the male urethra. Patient preparation: in the supine position and the penis in the anatomic position with an injection of lidocaine gel for urethral distension. Imaging protocol and interpretation high-spatial resolution, small FOV, multiplanar T2WI, to provide the best anatomic overview. T1WI is useful for assessing hemorrhage and vascular thrombosis, while the DCE is useful in evaluating masses and differentiation between fibrosis and inflammation. DWI assists in the depiction of a urethral mass and skips lesions. Dynamic maneuvers, with Valsalva and urination, are also performed to assess the sphincters and pelvic floor. Clinical applications: value of MRU in multiple specific clinical indications will be discussed, including urethral strictures, diverticula, fistulas, trauma, cancer staging, infections/inflammation. Conclusion MRU is an ideal one-stop replacement for traditional fluoroscopic urethrography, with growing data in the literature in recent years.

#### **GUEE-70 Prostate Cancer Strikes Back! A Pictorial Review of Local Recurrence and the PI-RR Score**

Participants

Bernardo Oliveira, MD, MBA, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To understand the main finding of prostate local recurrence on magnetic resonance imaging. To review the new PI-RR score and learn how to apply it. To gain experience in prostate recurrence MR evaluation through clinical cases.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction - First Things First Basic clinical concepts you should know before reading the MR imaging (PSAd, PSA doubling time, and more). Getting familiarized with the normal male pelvis after radical prostatectomy and radiotherapy. A brief review about the new PI-RR score system. Discussion - Prostate Cancer Strikes Back! prostate cancer local recurrence case collection, focusing on

MR imaging.Summary - It's your turn to strike back!Learn tips and tricks to enhance your skills.

## **GUEE-71 The 'New' 2022 World Health Organization (WHO) Classification of Adrenal Cortical Tumors: A Primer for Radiologists**

Participants

Nuray Bakal, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Familiarize audience with 'new' 2022 World Health Organization (WHO) classification of adrenal cortical tumors (ACTs) Describe the pathology, genetics, molecular biology natural history of ACTs. Review imaging spectrum of benign malignant ACTs discuss the role of imaging in the screening, diagnosis, staging, and surveillance Discuss the potential diagnostic management implications of the current classification

### **TABLE OF CONTENTS/OUTLINE**

Introduction The spectrum of adrenal cortical lesions Updates in WHO classification Pathology, Genetics Molecular Biology Genetic Syndromes: Li-Fraumeni, Lynch, MEN1. Imaging Techniques: US, CT, MRI PET-CT Congenital adrenal hyperplasia Adrenocortical nodular disease: Sporadic nodular, Bilateral micronodular, Bilateral macronodular Cortical adenomas: typical/atypical imaging findings Primary aldosteronism: HISTALDO classification imaging findings Cortisol-producing adenomas Cortical carcinoma: imaging spectrum Adrenal Myelolipoma Adrenal rests, adrenal Cysts. Rare tumors: melanoma, adenomatoid tumors sex cord-stromal tumors Role of imaging in screening surveillance of ACTs other lesions Diagnostic Management Implications of 2022 WHO Classification Imaging biomarkers. Conclusion The new 2022 WHO classification of ACTs highlights the importance of molecular genetic features in characterizing classifying ACTs and updated terminology for select pathologies. The pivotal role of CT/MRI/PET-CT imaging features in the diagnosis, treatment surveillance of cortical tumors is discussed. Familiarity of radiologists with new ACTs subtypes associated imaging findings helps to accurately identify and characterize ACTs.

## **GUEE-72 Pictorial Review of the Diagnosis of Muscle-Invasive Bladder Cancer Using Vesical Imaging-Reporting and Data System (VI-RADS)**

Participants

Mitsuru Takeuchi, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The Vesical Imaging-Reporting and Data System (VI-RADS) is a standard MRI imaging and diagnostic method for muscle-invasive bladder cancer that was published in 2018. As a member of the VI-RADS committee, I was involved in the development of the diagnostic criteria. Several studies have demonstrated that VI-RADS has excellent sensitivity and specificity for muscle-invasive bladder cancer. However, reading VI-RADS requires some expertise, and there are various pitfalls. Therefore, this exhibition will first explain the basic MRI reading procedure for bladder cancer. Then, based on my experience of reviewing MRI images of approximately 300 cases of bladder cancer with trainees, we will discuss the causes of misdiagnosis and precautions to prevent misdiagnosis by presenting case images. Furthermore, limitations of the current VI-RADS diagnostic criteria will also be addressed.

### **TABLE OF CONTENTS/OUTLINE**

1) Basic procedure for reading bladder MRI 1-a) Role of multiparametric MRI 1-b) Imaging findings of tumor stalk and thickened submucosa 1-c) Categorizing bladder cancer according to VI-RADS diagnostic criteria 2) Teaching file, misdiagnosed cases by trainee, consideration of the cause and suggestions for improvement 2-a) Problems with the patient's condition or imaging 2-b) Misdiagnosis due to insufficient reading skill 2-c) Misdiagnosed cases caused by the limitation of current VI-RADS diagnostic criteria 2-d) Difficult to diagnose bladder cancer with atypical histology and imaging findings

## **GUEE-73 Visualizing Dynamic Mechanisms of Lower Urinary Tract Symptoms (LUTS): Usefulness of Urodynamic 4D-CT**

### **TEACHING POINTS**

- Providing required items for LUTS surgery
- CT Scanning technique for LUTS
- Benefits of 4D-CT scanning for urination evaluation
- Morphological Evaluation before after surgery

### **TABLE OF CONTENTS/OUTLINE**

A. Morphological and functional evaluations are important. B. Morphological evaluation is required for bladder, urethra, prostate. Scanning is performed in a semi-seated position to reproduce a physiological urination state. 4D-CT uses intermittent scanning to reduce radiation exposure from the beginning to the end of urination. C. "Using 4D-CT can evaluate morphological changes in the bladder, prostate, and urethra and the location and timing of bladder outlet obstruction that occurs at the start of urinary flow, and urodynamic information." D. Analysis of the volume data enables pre and post operative comparisons. Evaluation using CT can show the effectiveness of quantitative evaluation. Outline "4D-CT is particularly effective in judging the applicability of operation and evaluating kinetic and morphological data in cases of prostate problems without morphological changes and dysuria due to a small decrease in uroflow intensity due to insufficient strength of the urethral sphincter muscle." There are cases in which surgery was indicated for patients whose anatomical structure deviated from the ideal. 4D-CT can evaluate morphology and function. So, it is useful for surgical indication and surgical planning.

## **GUEE-74 The Role of Imaging Techniques in Penile Lesions: When and How to Use Them**

Participants

Sandra Baleato Gonzalez, PhD, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To illustrate normal US and MR penile anatomy. 2. To review the spectrum of traumatic and atraumatic lesions involving the penis highlighting the typical and atypical sonographic and MR appearances of pathologic disorders, with special emphasis on distinctive and subtle findings that may clarify the diagnosis. 3. To discuss the value of other imaging techniques (CT, PET-CT, arteriography, urethrography) in penile pathology.



## TABLE OF CONTENTS/OUTLINE

1. Introduction. General features and basic concepts. 2. Anatomy. US and MR anatomy and imaging protocol. 3. Vascular disorders (Mondor disease, partial thrombosis of the corpus cavernosum, high flow and low-flow priapism). 4. Trauma. (Penile fracture, urethral injury, post-traumatic arterial penile fistula, extratunical hematoma and intracavernosal hematoma). 5. Inflammation (Cellulitis, abscess, fistula and gangrenous cavernositis). 6. Benign lesions (Peyronie disease, cavernous hemangioma, median raphe cyst, epidermoid cyst and so on). 7. Malignant lesions (Primary penile cancer and penile metastasis). 8. Summary.

### **GUEE-75 The Perils of Prostate MRI: How to Best Avoid Common Imaging Pitfalls**

Participants

Amanda Gibson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Prostate MR is a robust imaging modality with emerging utilization in screening, tumor characterization, surveillance, risk stratification, and local staging of prostate cancer. 2. The inherent complex anatomy of the prostate gland, coupled with advancements in MRI technology and varied pathologies affecting the prostate, result in several potential pitfalls in MR image interpretation. 3. To ensure accurate interpretation, the radiologist must be familiar with the appearance of normal prostate anatomy, as normal variations can mimic clinically significant cancer, as well as benign entities which could simulate or mask cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review normal anatomy of the prostate on MR with focus on central zone and anterior fibromuscular stroma 2. Illustrate benign prostatic pathologies and ways in which their imaging may mimic prostate cancer - Normal anatomic structures and expected postprocedural sequela that mimic cancer - Noncancerous abnormalities that may mimic cancer - Artifacts which may mimic or mask cancer 3. Describe locoregional invasion of prostate cancer beyond neurovascular bundles and capsular disruption 4. Highlight case-based teaching points with normal and abnormal prostate MRI 5. Provide flowchart guide on different interpretation pathways when reading prostate MRI for both junior and seasoned radiologists

### **GUEE-76 Imaging and Management of Renovascular Hypertension: State-of-the-Art**

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To review the pathophysiology of renovascular hypertension (RHT) 2. To discuss the role of multimodality imaging in the diagnostic pathway of RHT 3. To illustrate the imaging appearances of various causes of RHT 4. To review the role of interventional management of RHT.

#### **TABLE OF CONTENTS/OUTLINE**

1. RENOVASCULAR HYPERTENSION- DEFINITION 2. IMAGING MODALITIES- Ultrasound, doppler; CTA, Photon counting CT; MRA- Contrast and non contrast techniques (3D SSFP, Phase contrast), 4D flow; Catheter angiography; Nuclear medicine; 3. DISCUSSION OF ETIOLOGIES OF RENAL HYPERTENSION WITH MULTIPLE CASE EXAMPLES - Non-stenotic lesions (via renal artery compression and/or changes in renal perfusion) o Renal artery aneurysm o Renal arteriovenous fistula - Stenotic lesions (via renal artery compression/occlusion) o Atherosclerotic disease o Fibromuscular dysplasia o Neurofibromatosis type 1 o Midaortic syndrome o Dissection o Vasculitis (Polyarteritis nodosa ,Takayasu arteritis) o Trauma o Retroperitoneal fibrosis/radiation o Thromboembolism 4. ROLE OF IMAGING IN EXCLUDING OTHER CAUSES OF REFRACTORY HYPERTENSION- Endocrine- pheochromocytoma, hyperaldosteronism, Cushing's, thyroid dysfunction, hyperparathyroidism; Renal parenchymal disease; Mid aortic syndrome, coarctation; 5. IMAGING APPROACH FOR RHT 6. END-ORGAN ASSESSMENT- Kidneys, Heart, brain 7. TREATMENT- Optimal management is individualized to patient clinical context and dependent on etiology of renovascular hypertension; Medical - antihypertensives (i.e. ACE inhibitors/ARBs); Interventional- Angioplasty, stenting; Surgical

### **GUEE-77 Bosniak IV Cystic Masses: A Tough Nut to Crack**

Participants

Ignacio De Garcillan, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To revise Bosniak IV cystic mass v 2019 CT and MRI features.- To review possible pitfalls: interpretative, technical, and mass related.- To illustrate several Bosniak IV cases from our hospital.

#### **TABLE OF CONTENTS/OUTLINE**

In 2019 a new Bosniak classification version was published providing a detailed description of Bosniak IV category features. Its main objective was to increase specificity. Nevertheless, interpretation and classification of septa and nodule in each category remains challenging. In this exhibition we will focus on Bosniak IV cystic masses. Each feature will be revised and discussed to avoid misinterpretation. Potential pitfalls will be reviewed: interpretative quantitative and qualitative features, technical concerns, and mass related issues. Examples of these pitfalls will be exhibited with several recommendations to avoid them: zooming, multiplanar reconstruction, exclusive enhancing septa measuring, subtraction imaging, best quality sequence and examination selection, temporal evolution, employing Bosniak classification when applicable etc. Bosniak IV cystic masses diagnosed at our centre will be illustrated with different imaging techniques. Several clear cell renal carcinomas with cystic transformation, papillary carcinoma, clear cell papillary renal cell tumour, multilocular cystic neoplasm, fumarate hydratase- deficient renal carcinoma and unclassifiable renal carcinoma will be shown.

### **GUEE-78 What Can Go Wrong When Doing Right? Iatrogenic Genitourinary Complications**

#### **TEACHING POINTS**

1. A growing number of systemic, minimally invasive, and surgical treatment modalities for various genitourinary (GU) pathologies may lead to various unique iatrogenic complications. Diagnostic imaging plays an essential role in detection and subsequent management. 2. A multimodality approach to identifying iatrogenic GU complications is key for prompt diagnosis to prevent morbidity.

For example, both multiphase CT urogram and fluoroscopic antegrade nephrostogram can be utilized to confirm ureteral injury.<sup>3</sup> Knowledge of key imaging findings and mimics of complications are important to prevent misdiagnosis and mistreatment as well as to distinguish expected post treatment appearance from complication.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction<sup>1</sup>. Review of treatment modality types for various GU pathologies (both benign and malignant)<sup>2</sup>. Pictorial review of genitourinary anatomy and areas prone for iatrogenic injury• Essential GU anatomical structures• Common postsurgical anatomy• Discussion on the radiosensitivity of the GU systemB. Multimodality approach to identifying GU complications<sup>1</sup>. Decision tree on selecting the most optimal imaging type for common complicationsC. Case-based imaging review of iatrogenic GU complications<sup>1</sup>. Systemic treatment<sup>2</sup>. Minimally invasive interventions<sup>3</sup>. Surgical intervention

#### GUEE-79 Magnetic Resonance Imaging Review and Virtual Biopsy of Common Solid Renal Masses

Participants

Luis Calimano-Ramirez, Jacksonville, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Relevant anatomic review of the renal system. 2. Review multiple cases with magnetic resonance imaging features of neoplastic pathology. 3. Review correlation with pathology result to examine the function of magnetic resonance imaging as means of virtual biopsy toward identifying renal mass characteristics in selected cases.

#### TABLE OF CONTENTS/OUTLINE

1. Neoplastic pathologies: I. Benign etiology: a. Renal leiomyoma b. Renal Angiomyolipoma c. Renal Oncocytoma d. Renal plasmacytoma e. Solitary fibrous tumor. II. Malignant etiology: a. Clear Cell Renal cell Carcinoma b. Papillary Cell Carcinoma c. Medullary Renal Cell Carcinoma d. Collecting Duct Carcinoma e. Urothelial Cell Carcinoma f. Renal Lymphoma.2. Inflammatory etiology: a. Xanthogranulomatous Pyelonephritis.

#### GUEE-8 Imaging of Renal Cancer: The Past, The Present, and The Future

Participants

Alex Chung, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Many benign cystic and solid renal lesions can be reliably distinguished on multiple imaging modalities such as US, contrast-enhanced US (CEUS), CT and MRI, including Bosniak I/II cysts and fat-rich angiomyolipoma (F-AML).-Among indeterminate renal lesions such as clear cell renal cell carcinoma (ccRCC), papillary renal cell carcinoma (pRCC), chromophobe renal cell carcinoma (chrRCC), oncocytoma (Onc) and fat-poor angiomyolipoma (FP-AML), the enhancement characteristics and other parameters can further characterize the renal lesions.-Likert-based CT and MR likelihood scores for renal masses can help stratify the risk of indeterminate renal lesion for active surveillance or surgical management.-Novel imaging parameters and artificial intelligence will further assist in imaging characterization of indeterminate renal lesions.

#### TABLE OF CONTENTS/OUTLINE

-Introduction.-Normal Anatomy and Conventional Imaging Technique.-Imaging Findings/Pathology.-Enhancement characteristics including Mean Enhancement, Absolute Enhancement, Relative Enhancement, Absolute De-enhancement and Relative Washout.-Likelihood scores to aid risk stratification.-Novel imaging parameters and artificial intelligence, including <sup>99m</sup>Tc-sestamibi SPECT, Perfusion, Radiogenomics and Machine/Deep learning.-Biopsy of Renal Masses

#### GUEE-80 Urine the Wrong Place - When Urine Leaves the Urinary Tract. A Review of Urine Leaks and Urinary Tract Fistulas

#### TEACHING POINTS

The presentation of urine leaks and fistulas can be variable; however, a good patient history will usually raise suspicion for these entities. It is important to understand the pathology of urinary leaks and fistulas as well as the expected anatomy, including normal and post-operative, to understand the imaging findings. Familiarity with the principles of CT urogram is crucial in distinguishing blood from urine in trauma and post-operative patients to accurately make a diagnosis. The radiologist plays a vital role in these cases in recommending and troubleshooting follow up imaging as well as in guiding clinicians in their management. Management usually involves urinary diversion, which interventional radiology plays a large role in.

#### TABLE OF CONTENTS/OUTLINE

1) Review of normal male and female urinary tract anatomy and expected post-operative findings 2) Review of urinary tract imaging protocols - CT urogram, cystograms 3) Renal leaks - traumatic, spontaneous 4) Ureteral leaks - traumatic, iatrogenic 5) Bladder leaks - traumatic, iatrogenic, spontaneous 6) Urinary tract fistulas 7) Treatment/management options - IR interventions for urinary diversion

#### GUEE-81 MRI after Focal Therapy for Prostate Cancer: What Radiologists Must Know

#### TEACHING POINTS

-Overview of the currently available focal treatments for prostate cancer: indications, contraindications, and techniques.-Review of potential complications of each procedure: frequency, diagnosis, and management.-Discussion of expected postoperative MRI findings of each procedure: early and late.-Review of imaging findings of recurrent prostate cancer post focal treatment: diagnosis, mimics, and management.-Discussion of potential pitfalls.

#### TABLE OF CONTENTS/OUTLINE

Introduction-Rationale for focal therapy.-Potential benefits.-Criticisms to focal therapy.-Importance for radiologists and urologists.Treatment options-Electroporation (NanoKnife): Technique, Post-op appearance (Early and Late), Complications, Recurrence.-HIFU (FocalOne and TULSA): Technique, Post-op appearance (Early and Late), Complications, Recurrence.-Cryoablation: Technique, Post-op appearance (Early and Late), Complications, Recurrence.-Laser Ablation: Technique, Post-op

appearance (Early and Late), Complications, Recurrence.

## **GUEE-82 Advances in MRI Techniques for Evaluation of Upper Urinary Tract Neoplasms: A Comprehensive Review**

Participants

Mohamed A. El-Ghar, MD, Mansoura, Egypt (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Familiarizing with the different advanced MRI techniques used in the evaluation of renal neoplasms, including diffusion-weighted imaging (DWI), intravoxel incoherent motion (IVIM) MRI, Diffusion Tensor Imaging (DTI), Blood oxygen level dependent (BOLD) MRI and Arterial spin labeling (ASL). 2. Identifying the advantages and limitations of conventional and advanced MRI techniques in the evaluation of renal neoplasms, how they can improve diagnostic accuracy, characterization of the masses and treatment planning. 3. Understanding the role of MRI in the staging renal neoplasms, and if their role for the new techniques. 4. Familiarizing with the current guidelines and recommendations for the use of MRI in the evaluation of renal neoplasms. 5. Identifying potential areas for future research and development in the field of MRI for the evaluation of renal neoplasms, including the use of artificial intelligence and machine learning algorithms to improve diagnostic accuracy and reduce interpretation variability.

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction - Definition and incidence of upper urinary tract neoplasms - Importance of accurate diagnosis and staging - Overview of MRI techniques for evaluation II. Conventional MRI Techniques - T1- and T2-weighted imaging - Contrast-enhanced imaging - Limitations and challenges III. Advanced MRI; DWI MRI, IVIM-MRI, DTI-MRI, BOLD-MRI, ASL, Comparative advantages of advanced techniques • IV. Applications in Upper Urinary Tract Neoplasms • Diagnosis and characterization of renal masses • Differentiation between benign and malignant tumors • Staging of malignant masses • V. Clinical Implications and Future Directions • VI. Conclusion

## **GUEE-83 How to Do a Urethrogram... in Less than 15 Minutes and with No Special Equipment**

### **TEACHING POINTS**

• Urethrograms are nothing to be afraid of; • We have developed a technique that is well-tolerated, can be performed in less than 15 minutes, and requires no specialist equipment; • This exhibit explains how to perform our technique for both males and females; • We also illustrate the important anatomical structures, pitfalls, and complications of this technique.

### **TABLE OF CONTENTS/OUTLINE**

The ideal urethrogram should be quick, well-tolerated, provide high-quality diagnostic images and, if possible, not require any special equipment. At our institution, we have stopped using Knutson's clamps and balloon-occlusion catheters, and now perform approximately 15 studies per week with just 6Fr and 10Fr catheters. The technique we have developed is quick, well-tolerated and provides diagnostic images of the whole (a) anterior and (b) posterior urethra: a) A 10Fr catheter is inserted into anterior urethra. The patient compresses the distal penile shaft while the anterior urethra is imaged in two oblique planes. A release view (with hand suddenly removed) allows the urethra to decompress and distends the submeatal urethra, visualised on fluoroscopy at 3-4 frames/sec; b) The bladder is filled via a catheter or via retrograde instillation (we discuss both methods). The patient voids for a descending study in the oblique plane. We also discuss a rapid '5min urethrogram' in patients without tight strictures, which only requires inserting a catheter once. Adaptions are covered for the following scenarios: i) Tight strictures; ii) Occlusive segments; iii) The female urethra; iv) Percatheter studies. The relevant common pitfalls and uncommon complications of this technique are also discussed.

## **GUEE-84 Evolving Role of Conventional Imaging for Prostate Cancer in the Era of PSMA PET**

Participants

Hiroaki Takahashi, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Prostate-Specific Membrane Antigen (PSMA)-targeted positron emission tomography (PET) imaging is increasingly utilized for evaluating patients with high-risk prostate cancer (PCa) or recurrent PCa. The current National Comprehensive Cancer Network (NCCN) guidelines describe that conventional imaging is not a prerequisite to PSMA-PET for PCa staging. However, we have witnessed growing demand for conventional imaging as a confirmatory test for indeterminate findings on PSMA PET. PSMA-avid lesions other than PCa metastasis may cause false-positive observations, whereas PCa metastases to PSMA avid organs result in false-negative observations. Further, in conjugation with PSMA PET, prostate MRI has better performance in assessing the primary PCa, as well as local recurrence. In this context, PSMA PET does not replace conventional imaging, but does change the way in which conventional imaging is used. This exhibit will discuss the strategic approach of conventional PCa imaging in the era of PSMA PET. The purposes of this exhibit are: 1. To review the evolving role of conventional PCa imaging in the era of PSMA PET. 2. To discuss strategies to address recently recognized PSMA PET imaging pitfalls.

### **TABLE OF CONTENTS/OUTLINE**

1. Fundamental mechanism and imaging interpretation of PSMA PET. 2. Role of conventional PCa imaging: focusing on imaging pitfalls of indeterminate findings on PSMA PET.- Assessment of primary PCa.- Assessment of local recurrence.- Assessment of metastases involving lymph nodes, bones, and solid organs. 3. Summary.

## **GUEE-85 Urinary Bladder Diverticula: Imaging Features and Complications**

Participants

Grace Zhu, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Describe different categories of urinary bladder diverticula with comparison to normal urinary bladder. 2. Discuss urinary bladder diverticula multimodal imaging features. 3. Provide a case-based review of urinary bladder diverticula complications.

### **TABLE OF CONTENTS/OUTLINE**

1. Description of the different types of urinary diverticulaA. Describe histology of normal urinary bladder and diverticulaB. Highlight features of true and false urinary bladder diverticula2. Imaging of urinary bladder diverticulaA. Describe features of uncomplicated urinary bladder diverticulaB. Identify pitfalls that prevent optimal imaging 3C. Provide examples of diverticula mimics3. Case based review of urinary bladder diverticula complicationsA. Urine stasis and urinary bladder diverticula pathologyB. Diverticular stonesC. Diverticula and urinary tract infectionD. Cancer and staging consideration in diverticulaE. Incomplete voiding and obstruction

### **GUEE-86 The Crucial Role of Ultrasound in the Detection of Renal Transplantation Complications**

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To know the essential role of ultrasound in the detection of renal transplant complications. - To describe the systematic to follow when performing an ultrasound of renal transplantation. - To learn the typical ultrasound findings of renal transplant complications. - To be able to recognize those cases in which it will be necessary to complete the study with another tests in order to confirm the suspected diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Doppler ultrasound is one of the control tests routinely performed on all patients 24-48 hours after renal transplantation, as well as subsequently according to their evolution.Thanks to ultrasound, we can assess the state of the renal graft and rule out the existence of associated complications, which may be divided into:1. Vascular complications: - Renal artery stenosis. - Renal artery thrombosis. - Renal vein thrombosis. - Pseudoaneurysm.- Arterio-venous fistula. 2. Urological complications: - Ureteral obstruction. 3. Perirenal collections: - Hematoma. - Urinoma. - Abscess.- Lymphocele. 4. Parenchymal complications: - Acute tubular necrosis. - Acute rejection. - Immunosuppressant toxicity. 5. Other complications: - Lithiasis. - Renal graft infections (early and late). - Chronic rejection.In this paper we will detail the ultrasound findings that characterize these complications, through representative images of cases belonging to our institution. We will also explain those patients in which it was necessary to perform additional studies to confirm the suspected diagnosis.

### **GUEE-87 Penile Ultrasound: A Pictorial Review of the Anatomy and the Most Relevant Pathologies**

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To become familiar with the normal sonographic appearance of the penile structures, as well as to know its arterial and venous vascularization.- To understand the technique of intracavernous injection of vasoactive substances, along with the normal response of vascular structures.- To review the main pathologies affecting the penis and their sonographic findings.

#### **TABLE OF CONTENTS/OUTLINE**

1. Penile anatomy by ultrasound: to recognize the anatomical structures in conjunction with the arterial and venous vascularization.2. Main penile pathologies: - Peyronie disease: its diagnosis is clinical, but ultrasound can confirm its presence, determine the extent of plaques and rule out a possible associated erectile dysfunction. - Erectile dysfunction: through intracavernous injection of vasoactive agents (PGE1) it is assessed whether there is a vascular (arterial or veno-occlusive) cause of erectile dysfunction. - Priapism: to evaluate ischemic, non-ischemic or metastatic causes. - Penile inflammation (e.g. cellulitis, balanitis, cavernositis,...): the main usefulness of ultrasound is to estimate the extension of inflammation and rule out abscess formation. - Trauma: in case of suspected penile rupture, ultrasound is especially helpful in doubtful cases or to locate the fracture line, as well as to assess long-term complications. - Benign entities: including cystic lesions (raphe cysts, epidermoid, dermoid,...), sclerosing lymphangitis, segmental thrombosis of the corpus cavernosum, calciphylaxis,...- Tumors: ultrasound is appropriate to determine the depth of the tumor and its spread to the corpus cavernosum.

### **GUEE-88 Unmuddling the Middle: a Guide to Central Renal Abnormalities**

Participants

Wendy Tu, MD, FRCPC, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Central renal pathologies can originate from all of the complex constituent structures of the kidney: the renal parenchyma, predominantly the medulla; collecting structures; sinus including fat and neural structures; vessels; lymphatics; and extension of retroperitoneal processes. Parenchymal and medullary pathologies can include benign or malignant tumors, from the common renal cell carcinoma to rare primary sarcomas. Both tumorous and nontumorous pathologies can occur in the renal pelvis, such as papillary necrosis or blood clot. Vascular lesions include renal arteriovenous fistula or renal artery aneurysms, which can mimic other pathologies. Retroperitoneal lymphoma, fibrosis, histiocytosis, or lymphangiomatosis can involve the renal sinus. Multimodality imaging with ultrasound, CT, MRI, and angiography is important for differentiation of pathologies. Imaging is crucial to predict partial nephrectomy complexity with use of nephrometry scores.

#### **TABLE OF CONTENTS/OUTLINE**

1) Parenchymal tumors invading the renal sinus such as renal cell carcinoma and mixed epithelial and stromal tumor family tumors 2) Benign and malignant medullary tumors such as hemangioma, primary sarcoma, and medullary carcinoma 3) Sinus and medullary pathologies such as mesenchymal tumors, retroperitoneal fibrosis, and histiocytosis 4) Collecting system processes including urothelial carcinoma, papillary necrosis, calcifications, and clots 5) Vascular anomalies such as arteriovenous malformations, renal artery aneurysm, and renal vein varix

### **GUEE-89 The Body Meets the Adrenal: Adrenal Manifestations of Systemic Disorders**

Participants

Wendy Tu, MD, FRCPC, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To describe imaging manifestations of adrenal gland involvement by common and uncommon systemic disorders. Paired organs of the endocrine system, the adrenal glands have important roles in production of cortical and medullary hormones and catecholamines. The glands can be affected by a variety of neoplastic and non-neoplastic systemic disorders, some with life-threatening consequences such as in cases of adrenal hemorrhage and shock. Radiologists should be familiar with imaging manifestations along with potential associated laboratory abnormalities to ensure correct characterization and diagnosis for guidance on management. It is essential to distinguish adrenal manifestations of systemic disorders from other primary benign and malignant adrenal lesions.

#### TABLE OF CONTENTS/OUTLINE

Entities discussed will include: 1) Hemorrhagic conditions such as stress-related hemorrhage. 2) Hematologic diseases such as lymphoma. 3) Autoimmune conditions leading to adrenalitis such as Ipilimumab-induced adrenalitis. 4) Conditions leading to adrenal hyperplasia such as paraneoplastic syndromes. 5) Hereditary syndromes such as Von Hippel-Lindau disease and Neurofibromatosis. 6) Granulomatous diseases such as tuberculosis. 7) Infiltrative disorders such as amyloidosis. 8) Adrenal hyperenhancement in the setting of systemic hypoperfusion.

#### GUEE-9 Urine Trouble! An Interactive Review of Multiparametric MR Urography It's Pitfalls

##### TEACHING POINTS

1. Review the MR techniques for optimizing multi-parametric MR urography with attention to pitfalls  
2. Identify advantages over CT Urography  
3. Identify imaging features of lesions involving the urothelium in a quiz-based format with radiology-pathology correlation

#### TABLE OF CONTENTS/OUTLINE

1. What is multi-parametric MR Urography and how does it improve diagnosis?  
2. Why would MR Urography be preferred over CT Urography? What are the benefits and limitations?  
3. Improvements in MR sequences (including compressed sensing, k-space under-sampling, parallel imaging, and AI), which allow unprecedented improvement in image quality.  
4. Dilemmas in technique - is Lasix injection needed? Prone versus supine patient positioning? Wide vs narrow FOV? Are cine-T2 images useful?  
5. How to identify and avoid pitfalls and artifacts - flow voids on T2? T1\* effects due to concentrated gadolinium?  
6. How does MR urography help in identification and staging of urothelial neoplasms?  
7. How can MR urography help identify common, uncommon, and rare mimics of urothelial lesions using a rad-path quiz-based format?

#### GUEE-90 2022 WHO Classification of Adrenal Tumors Revisited: Atlas of Diseases with Pathological Insights

Participants

Adriano Basso Dias, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Review the update 2022 WHO Classification of Adrenal Cortical Tumors  
Review the update 2022 WHO Classification of Pheochromocytoma and Paragangliomas  
Identify imaging features with radiologic-pathologic correlation of common and uncommon adrenal lesions

#### TABLE OF CONTENTS/OUTLINE

Are There Any Nomenclature Changes or Any New Diagnostic Categories in the New WHO Classification of Adrenal Cortical Proliferations?  
What are the Radiological and Pathological Correlates of Adrenal Cysts?  
What Should a Radiologist Know about Adrenal Cortical Carcinoma?  
Why Do Radiologists and Pathologists Need to Know Ectopic or Heterotopic Locations for Adrenal Cortical Tissue?  
What are the Highlights in the New WHO 2022 Classification of Pheochromocytoma and Paragangliomas  
Miscellaneous (Including Mesenchymal and Stromal Tumors)

#### GUEE-91 Focal Therapy of Prostate Cancer: A Primer for Radiologists

Participants

Adriano Basso Dias, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Understand the current concepts of prostate focal therapy  
Recognize the most important MRI features to report pre and post focal therapy  
Known the role and limitations of prostate MRI for patient selection for focal therapy  
Be familiar with future directions of imaging techniques in focal therapy

#### TABLE OF CONTENTS/OUTLINE

Introduction - Indications, energy sources and templates available for focal therapy (FT)  
Role of imaging in the pre treatment assessment- MRI for diagnosis, staging and patient selection for FT  
Role of imaging in the post treatment assessment- MRI findings post FT- Types of recurrence- Pitfalls  
Future Perspectives- What imaging modalities are on the horizon for patient selection for focal therapy and treatment guidance

#### GUEE-92 The Extraperitoneal Cavity: Gaining Understanding through Surgical Procedures

Participants

Kiyoko Mukai, Tokyo, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The extraperitoneal cavity has a complex anatomy, and furthermore, there is limited opportunity to understand this invisible anatomy on imaging. In this presentation, we will discuss the anatomy of the extraperitoneal cavity and the importance of preoperative imaging in surgical planning, using the surgical technique for prostatectomy as a guide.

#### TABLE OF CONTENTS/OUTLINE

Learn basic techniques and anatomy in standard surgical procedures  
1. Intra-abdominal observation  
2. Dissection of the retropubic space/Retzius cavity  
3. Lymph node dissection  
4. Incision of the endopelvic fascia  
5. Dissection of the bladder neck  
6. Dissection of the seminal vesicles  
7. Management of the prostate pedicles  
8. Dissection of the posterior aspect of the prostate  
9. Management of the lateral aspect of the prostate  
10. Division of the urethra  
11. Reconstruction (including urethral anastomosis)  
A collection of

casesCase1: Benign prostatic hyperplasiaCase2: Enlargement of the middle lobeCase3: Previous transurethral resection of the prostate (TURP)Case4: T3 prostate cancerCase5: ProstatitisCase6: Vascular anomaly

## **GUEE-93 Insights into Urethra: A Diagnostic Approach and Comprehensive Guide to Multimodal Imaging in Urethral Lesions**

### **TEACHING POINTS**

Urethral lesions can range from common to rarely encountered in clinical practice. Imaging modality plays a key role in evaluating the variety of urethral conditions because of its high objectivity and utility. This exhibit aims to introduce the multimodal imaging spectrum of urethral lesions, from traumatic change to neoplasms, and demonstrate the diagnostic approach to becoming familiar with urethral lesions.

### **TABLE OF CONTENTS/OUTLINE**

Presentation goals:1. To demonstrate the normal anatomy of the male and female urethra.2. To demonstrate the step-by-step diagnostic approach to the urethral lesions3. To demonstrate multimodality imaging findings of various urethral lesionsIllustrative imaging/cases include: (i) Traumatic and post-treatment changes &1;Urethral injury, &1;Urethral foreign body, &1;Iatrogenic changes (&1;Radiation therapy induced urethritis, &1;Changes after transurethral injection therapy, &1;Operative complications)(ii) Intra- or peri-urethral lesions - Intra-urethra &1;Urethral stones, &1;Urethral caruncle, &1;Fibroepithelial polyp, &1;Primary urethral carcinoma, &1;Malignant melanoma, &1;Lymphoma, &1;Sarcoma- Peri-urethra &1;Urethral diverticulum, &1;Periurethral cyst, &1;Peyronie's disease, &1;Leiomyoma, &1;Tumors arising from urethral diverticulum- Both intra- and peri-urethra &1;Urethral cellulitis, &1;Urethral abscess(iii) Non-urethral origin neoplastic lesions &1;Direct invasion from pelvic and genital tumors, &1;Metastatic tumors

## **GUEE-94 Standardized, Vesical Imaging Reporting and Data System (VI-RADS) - Compliant, Acquisition and Interpretation of Multiparametric Magnetic Resonance of the Bladder: A Practical Guide**

Participants

Martina Pecoraro, MD, Roma, Italy (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Bladder multiparametric MRI is the most accurate imaging test for local staging of bladder cancer. 2. The Vesical Imaging Reporting and Data System (VI-RADS) has standardized the acquisition protocol of bladder MRI and created a 5-point scoring system to differentiate muscle invasive from non-muscle invasive bladder cancer.3. The use of VI-RADS for bladder cancer local staging has shown excellent diagnostic performance and inter-reader reproducibility in multiple studies.4. High diagnostic accuracy of bladder MRI and VI-RADS is dependent on proper patient preparation and implementation of the imaging protocol.5. Pitfalls in evaluating bladder MRI can occur and needs to be acknowledged

### **TABLE OF CONTENTS/OUTLINE**

MRI of the bladder with the use of VI-RADS is a powerful diagnostic tool for the local assessment of bladder cancer, but it requires the radiologist to implement a specific acquisition protocol and image interpretation standards to achieve optimal diagnostic accuracy and reproducibility. In this educational exhibit we discuss with a practical approach the technical aspects to follow for the correct acquisition of VI-RADS compliant bladder MRI studies. Furthermore, we provide a practical approach to the assessment, scoring, and reporting of bladder lesions according to the VI-RADS scoring system. Also, we provide details on what is beyond VI-RADS 1.0 concerning Pitfalls and Tips and Tricks: details will cover bladder distension and how to handle with it, pitfalls in staging cancers located at ureteral orifices, at folded bladder walls (e.g anterior bladder wall), at diverticula, and after previous tumor resection. To conclude we will provide insights on training and VI-RADS learning curve.

## **GUEE-95 Everything a Radiologist Needs to Know About the Diagnosis and Treatment of Renal Angiomyolipomas**

Participants

Brendan Ryu, BS, Westbury, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

(1) To review the epidemiology, pathophysiology, and genetic associations of renal AMLs. (2) To highlight the clinical presentation and imaging characteristics of renal AMLs. (3) To discuss the utility and efficacy of the various treatment options for renal AMLs.

### **TABLE OF CONTENTS/OUTLINE**

Introduction and Associations - Overview- Normal Renal Anatomy and Vasculature - Epidemiology and Pathophysiology of Renal AMLs- Association with Tuberous Sclerosis Complex (TSC)Diagnosis- Clinical Presentation- Incidental Secondary to Complications (bleeding, etc.)- Imaging Modalities- Ultrasound/Doppler- Computed Tomography/Angiography- Magnetic Resonance Imaging/Angiography- Direct AngiographyTreatment and Management - Active Surveillance- Criteria for Intervention- Medical Management- mTOR inhibitors- Embolization- Glue- Particles- Coils- Other materials- Ablation- Surgery- Potential Treatment Complications- Bleeding- Non-target embolization- Post-operative collectionPost-Treatment Imaging Appearance

## **GUEE-96 Pre- and Post-treatment Imaging of Upper Urinary Tract Urothelial Cancer (UTUC): National Comprehensive Cancer Network and European Association of Urology UTUC Guidelines in 2023**

Participants

Hirotsugu Nakai, MD, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Upper tract urothelial cancer (UTUC) accounts for 5-10% of UCs. However, 60% of UTUC are invasive at the diagnosis, and multiplicity of disease is common. Therefore, lifelong surveillance is required. Imaging and image-guided biopsy and intervention play an important role in the diagnosis and management of patients with UTUC. CT urography (CTU), MR urography (MRU), and retrograde ureteropyelography with CT or US are used for detection, localization, staging and follow-up of patients with UTUC. FDG PET/CT and chest imaging are useful for staging and re-staging when metastasis is suspected. This is a comprehensive review of the spectrum of clinical and imaging findings of pre- and post-treatment UTUC with illustration of key multimodality imaging findings

in representative cases.

#### TABLE OF CONTENTS/OUTLINE

1) Background of UTUC; epidemiology, risk factors, manifestations, pathology, and staging.2) Review of National Comprehensive Cancer Network (NCCN) and European Association of Urology (EAU) UTUC guidelines, version 2023.3) Technique and utility of imaging modality including CTU, MRU, retrograde ureteropyelography with CT or US, FDG PET/CT, chest CT and radiography, and image guided biopsy and intervention.4) Imaging findings of urothelial cancer of the pelvicaliceal systems and ureters before and after treatment.5) Conditions mimicking UTUC including lymphoma, primary renal neoplasms, metastasis, sarcoma, fibroepithelial polyp, inverted papilloma, ureteritis, amyloidosis, and suburothelial hemorrhage.6) Summary

#### GUEE-97 A Spectrum of LUT Pathologies in Males: A Pictorial Review

Participants

María Salazar Osorio, MD, Ciudad de Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To explain a general review of the male lower urinary tract (LUT) anatomy through diagrams and multimodal images.- To review the most common pathologies and their diagnosis by multiple imaging techniques.- To discuss through real cases common and not-so-common presentations of the pathologies of male LUT.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Anatomy- Imaging techniques- Main indications- Clinical findings and characteristic features of each presentation (congenital anomalies, benign and malignant pathologies of the urethra, bladder, and prostate)- Conclusions

#### GUEE-98 Are We Talking About the Same Thing? How EPE is Scored

Participants

Andre De Freitas Secaf, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate cancer is the second most common cause of cancer-related deaths in men. The first option for treating intermediate and high-risk disease is radiotherapy or radical prostatectomy, however, this choice heavily relies on the presence of extraprostatic extension (EPE). EPE is associated with a higher risk of positive surgical margins, biochemical recurrence, metastatic disease and shorter overall survival. For better surgical planning, the evaluation of EPE using multiparametric magnetic resonance imaging (mpMRI) is essential. There are two major criteria for assessing EPE, through mpMRI, one from National Cancer Institute (NCI) and one from the European Society of Urogenital Radiology (ESUR). The NCI score can be classified as 0- no suspected pathological EPE; 1- curvilinear contact length or capsular irregularity and bulge; 2- curvilinear contact length and capsular irregularity and protuberance; 3- EPE visible on MRI or invasion of adjacent anatomical structures. The ESUR score uses a five-point scale (1 = capsular abutment; 2 = not specified; 3 = capsular irregularity; 4 = neurovascular bundle thickening, bulge, or loss of capsule; 5 = measurable extracapsular disease). We aim to discuss the imaging findings of EPE and how to score them according to the NCI and ESUR criteria, emphasizing their strengths and limitations. These scores should be familiar for any radiologist working in the prostate field, as a more accurate diagnosis of EPE can significantly impact the patient's management and outcomes.

#### TABLE OF CONTENTS/OUTLINE

Introduction; NCI and ESUR scores; Cases of EPE using both scores; Discussion.

#### GUEE-99 Spectrum of Fat Containing Lesions in the Adrenal Gland: Tips, Tricks and Mimics

Participants

Jorge Abreu Gomez, MD, Pickering, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Identify the role of CT and MRI in identification of macroscopic and microscopic fat - including pitfalls, and newer entities including radiomics, histogram analysis, dual-energy decomposition and AI techniques.2. Describe the common, and uncommon adrenal nodules which present with fat, with an algorithmic approach as to how the type (macroscopic vs microscopic), amount (small vs large), distribution (homogeneous vs heterogeneous), helps arrive at the right diagnosis.

#### TABLE OF CONTENTS/OUTLINE

- Adrenal nodules can have microscopic (intravoxel) fat or macroscopic (bulk fat), or both. However, they often mimic each other.- What is the role of CT in detection of microscopic fat? Does an attenuation of <10HU always mean microscopic fat? What are the pitfalls of detecting macroscopic fat with CT - increased noise, small ROI? Can histogram analysis improve CT performance? How can dual energy CT improve fat-detection and fat quantification?- What is the role of MRI in detecting microscopic fat? Is MRI only useful when non-contrast CT attenuation is between 10-30HU? Which is better to depict fat - 2D sequences or 3D sequences? How can flip-angles be optimized to improve detection of fat? How are MRI fat quantification methods applicable to focal adrenal lesions?- Amount of bulk fat in adrenal lesions matters - Masses with >50% of bulk fat are myelolipomas; < 50% - can represent myelolipomas or myelolipomatous degeneration which could occur in either an adrenal adenoma or adrenocortical carcinoma.- How to approach diagnosis of lipid poor adenoma with cross sectional imaging.- What are the different patterns of signal loss on out of phase T1w in the diagnosis of adrenal adenoma, when to suspect malignancy?

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## Abstract Archives of the RSNA, 2023

GUEE-1

### Zinner Syndrome: A Radiological Journey Through a Little Known Condition

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the embryology and anatomy of the male urogenital system. 2. To describe the radiological findings of typical Zinner syndrome and its variants, through a series of 10 patients from our institution whose images are representative. 3. To perform a differential diagnosis with other pelvis cystic lesions, providing an algorithm that helps us to distinguish them depending on their location and their relationship with adjacent structures, including radiological images belonging to our institution.

#### TABLE OF CONTENTS/OUTLINE

1. Embryology and anatomy of the male urogenital system the role of the mesonephric (Wolffian) duct and the ureteral bud in the formation of the different male urogenital structures. 2. Zinner syndrome: a rare congenital urogenital entity due to an alteration in embryogenesis between 4th and 13th weeks of gestation, characterized by unilateral renal agenesis, cystic dilatation of the ipsilateral seminal vesicle and obstruction of the ejaculatory duct. - Definition. - Pathophysiology. - Clinical manifestations. - Diagnosis: the role of different imaging tests in its diagnosis, specifically pelvic MRI, which is considered the Gold Standard technique due to its excellent soft-tissue resolution. - Treatment. 3. Differential diagnosis with other pelvic cystic lesions (intra- and extraprostatic) according to their location and relationship with neighboring structures. This work is illustrated with representative radiological images of cases belonging to our institution.

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## Abstract Archives of the RSNA, 2023

GUEE-10

### Thingamajigs, Thingamabobs, and Doohickeys: A Comprehensive Imaging Review of Pelvic Medical Devices

#### Participants

Amanda Gibson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Given the ever-increasing number of imaging examinations performed and the continuous development and refinement of medical devices, radiologists commonly encounter such devices in clinical practice. 2. Pelvic medical devices may be detected incidentally on imaging examinations or imaging may be performed specifically to evaluate for device complication. 3. Knowledge of device indication and function may provide important clues to patient history that might not otherwise be available at the time of image interpretation. 4. Medical device complications are typically related to infection, malposition, and/or suboptimal device function. 5. A comprehensive knowledge of device indication, function, structure, imaging appearance, and associated complications is necessary to provide accurate and timely assessment of pelvic medical devices.

#### TABLE OF CONTENTS/OUTLINE

1. Succinct description of pelvic medical device structure, function, and indications for use in both women and men 2. Illustration of imaging features of pelvic medical devices, including normal findings, imaging artifacts, and device-related complications, across both planar and cross-sectional studies, with emphasis on key findings to report 3. Discussion of MRI safety issues related to pelvic medical devices

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## Abstract Archives of the RSNA, 2023

GUEE-100

### Feel the Burn: Imaging Infections of the Male and Female Reproductive Tract

#### Participants

Alexander Kuehne, MD, Clear Lake, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Familiarize the radiologist with the spectrum of reproductive tract infections, focusing on some of their more unusual etiologies and presentations.
- Review imaging of male and female reproductive tract infections in case-based format.
- Highlight key imaging features of specific infections, atypical presentations, and common mimics.
- Review imaging characteristics that would help to narrow the differential diagnosis.
- Provide an overview of management and treatment of reproductive tract infections, their sequelae, and complications.

#### TABLE OF CONTENTS/OUTLINE

- Classification of reproductive tract infections: sexually transmitted diseases; endogenous infections; iatrogenic infections.
- Review of infections by anatomic region, particularly unusual infections/presentations: uterus and adnexa; vagina and vulva; prostate and penis; spermatic cord and scrotum; perineum.
- Management of infections, their sequelae, and their complications.

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## Abstract Archives of the RSNA, 2023

GUEE-101

### Imaging of Benign and Malignant Renal Neoplasms Based on the WHO 2022 Classifications: What Radiologists Should Know

#### Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

· Describe important reporting elements of renal tumors· Describe classification and approach to renal tumors on the basis of WHO 2022 Classifications· Describe multimodality imaging characteristics of renal tumors· Role of imaging to evaluate renal tumors after local renal therapy and complications

#### TABLE OF CONTENTS/OUTLINE

Content: • WHO 2022 renal tumor classification • Reporting elements of renal tumors • Clear cell tumors • Papillary tumors • Oncocytoma • Chromophobe cell renal carcinoma • Mucinous tubular and spindle cell carcinoma • Adult cystic nephroma • Metanephric tumors • Mixed epithelial and stromal renal tumors • Angiomyolipoma • Renomedullary interstitial cell tumor • Mesoblastic nephroma • Collecting duct carcinoma • Eosinophilic solid and cystic renal cell carcinoma • Inflammatory myofibroblastic tumor of the kidney • Renal perivascular epitheloid cell tumor (PEcoma) • Syndromes with renal tumors • Other tumors of the upper tract • Lymphoma • Transitional cell carcinoma • Metastasis • Abscess • Xanthogranulomatous pyelonephritis

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## Abstract Archives of the RSNA, 2023

GUEE-102

### Imaging of Inferior Vena Cava Wall Invasion in Renal Cell Carcinoma with Tumor Thrombus

#### Participants

Haiyi Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Locally advanced renal cell carcinoma with inferior vena cava (IVC) tumor thrombus is one of the most challenging diseases in urology. T3c disease is diagnosed when a tumor thrombus invades the IVC wall. The presence or absence of IVC wall invasion has a significant impact on the selection of surgical protocols, which include IVC incision thrombectomy, IVC segmental resection, and IVC resection. Higher morbidity and mortality rates occur when a tumor thrombus invades the IVC wall. Tumor thrombus invading the IVC wall is associated with poor postoperative survival. The purposes of this exhibit are: 1) Discuss the role of IVC wall invasion in the surgical treatment of renal cell carcinoma and tumor thrombus. 2) Clarify significant image findings of IVC wall invasion. 3) Illustrate meaningful information and pitfalls of diagnosing IVC wall invasion in radiology reports.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of anatomy and physiology of the inferior vena cava system. 2) Introduction of the mechanism of IVC tumor thrombosis formation in renal cell carcinoma. 3) Describe surgical management of different types of tumor thrombectomy: a. IVC incision thrombectomy; b. IVC segmental resection; c. IVC resection. 4) Imaging methods selection: a. contrast-enhanced ultrasound (CEUS); b. CT; c. MRI. 5) Imaging findings of IVC wall invasion in case-based imaging. 6) Illustrate key signs and pitfalls in diagnosing IVC wall invasion. 7). Build a scoring system: inferior vena cava wall invasion likelihood scores (IVC WAILS). 8) Consolidate the acquired knowledge: Review preoperative imaging findings of IVC invasion that aid in surgical decisions. 9) Conclusions.

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## Abstract Archives of the RSNA, 2023

GUEE-103

### Spectrum of Male and Female Urethral and Periurethral Pathologies at Imaging

#### Participants

Nikolas Brozovich, MD, Augusta, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Role of imaging in the evaluation of the urethra.2) Review of relevant male and female urethral anatomy.3) Recognize a variety of urological conditions in males and females at imaging.

#### TABLE OF CONTENTS/OUTLINE

Conventional imaging studies such as retrograde urethrography(RUG), voiding cystourethrography(VCUG), and Ultrasonography(US) are limited in the evaluation of the periurethral tissues. MR imaging serves as an important noninvasive imaging modality that can provide anatomic detail of the urethra and periurethral tissue due to excellent tissue contrast and multiplanar capability. 1) Detailed male and female urethral and periurethral anatomy.2) MR technique for urethral evaluation.3) Female urethral pathology including urethral diverticulum and associated pathology, urethral leiomyoma, periurethral/paravaginal cysts, bulking agents, urethral prolapse, periurethral hemangioma, and neoplasms.4) Male urethral pathology including urethral calculi, Peyronie's disease, artificial sphincter, infection, and neoplasms.

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## Abstract Archives of the RSNA, 2023

GUEE-104

### **Radiologic Feature of Complications after Artificial Urinary Sphincter Implantation Following Total Prostatectomy**

#### **Participants**

Shioto Oda, MD, Kashiwa, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Artificial urinary sphincter (AUS) is an implanted device used for the treatment of urinary incontinence, commonly following prostatectomy. Despite increasing reports of device failure and postoperative complications, comprehensive reports on imaging have yet to be compiled. When complications occur after AUS surgery, entire device replacement may be necessary, which can be burdensome for the patient. However, with precise identification of the malfunctioning part, partial replacement has been possible in some cases. This presentation will exhibit imaging findings of malfunction and postoperative complications after AUS implantation at our hospital, together with anatomical findings, to contribute towards appropriate device management. The purpose of this exhibit is: 1) To provide a comprehensive review of the normal appearance of AUS, along with an analysis of the parts that are commonly associated with complications 2) To exhibit the various complications related to device failure and surgery on a case-by-case basis.

#### **TABLE OF CONTENTS/OUTLINE**

1) Normal Appearance of AUS 2) Malfunction of AUS 2.1) Circuit Leakage 2.2) Pump Malfunction 3) Complications Directly Related to the Procedure 3.1) Urinary Injury During Replacement of AUS 3.2) Hematomas and Infections Occurring in the Subacute Period

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## Abstract Archives of the RSNA, 2023

GUEE-11

### Imaging of upper urinary tract neoplasms

#### Participants

Kyungmin Kim, BMBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Neoplasms of the upper urinary tract can be investigated with different imaging modalities such as CT, MRI and ultrasound. In certain cases, nuclear medicine studies, such as PET-CT or DMSA can aid with detection of occult bone metastasis or determining the best treatment option. The traditional CT protocol for visualizing renal parenchymal abnormalities is a triple phase study. Alternatively, a split bolus urography protocol also provides good visualization of the renal parenchyma and the collecting systems with a reduced radiation dose. Renal cell carcinoma (RCC) is the most common type of upper urinary tract neoplasm with a wide range of phenotypes from homogeneous solid mass to heterogeneous multi-cystic or necrotic lesions. Differentiating between benign and malignant renal neoplasms can be challenging and histopathological evaluation may be required to confirm the diagnosis. A wide range of conditions ranging from developmental, infectious, granulomatous and vascular causes can mimic upper urinary tract neoplasms.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Imaging modalities for investigation of upper tract neoplasms  
2.1 CT  
2.2 MRI  
2.3 Ultrasound  
2.3.1 Contrast enhanced ultrasound  
2.4 Nuclear medicine  
3. Imaging features of upper tract neoplasms  
3.1 Malignant  
3.1.1 RCC  
3.1.2 TCC  
3.1.3 Lymphoma  
3.1.4 Wilm's tumor  
3.1.5 Miscellaneous  
3.2 Benign  
3.2.1 Oncocytoma  
3.2.2 Angiomyolipoma  
4. Upper urinary tract pseudotumors  
4.1 Developmental  
4.2 Infectious  
4.3 Granulomatous  
4.4 Vascular  
4.5 Miscellaneous  
5. Summary

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## Abstract Archives of the RSNA, 2023

GUEE-12

### Not Only Prostate Adenocarcinoma is Present in the Interpretation of Multiparametric Prostate MRI

#### TEACHING POINTS

Knowledge of normal anatomic structures and physiological changes that may simulate prostate adenocarcinoma in prostate multiparametric magnetic resonance imaging (mpMRI) Clinical presentation MRI characteristics with pathological correlation can help us to accurately characterize benign and malignant diseases, that can mimic prostate adenocarcinoma in mpMRI resulting in appropriate patient management.

#### TABLE OF CONTENTS/OUTLINE

Review and identify normal prostatic anatomic structures that can affect mpMRI interpretation because may simulate prostate adenocarcinoma: hypertrophic anterior fibromuscular stroma, asymmetrical and focal thickening of the surgical capsule, congested appearance of periprostatic vascular plexus normal Review the clinical manifestations and mpMRI characteristics with pathological correlation of prostatic and periprostatic benign process: congenital anomalies (Zinner's syndrome), prostatic abscess, infective or inflammatory prostatitis (bacterial, granulomatous, IgG4-related disease), prostatic hemorrhage, ectopic stromal benign prostatic hyperplasia nodule, periprostatic lymph nodes, osteochondroma of the pubic symphysis, neoplasms with unpredictable clinical course (stromal neoplasm of uncertain malignant potential), direct neoplastic invasion of malignant tumors in adjacent organs (diffuse large B-cell lymphoma of the rectum), that can mimic prostate adenocarcinoma in mpMRI

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## Abstract Archives of the RSNA, 2023

GUEE-13

### MRI-Based VI-RADS for Bladder Cancer: Enhancing Accuracy and Consistency in Reporting

#### Participants

Sina Houshmand, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review imaging findings of bladder cancer with emphasis on the importance of differentiation between muscle-invasive and non-muscle invasive disease and impact of imaging on clinical management. 2. Review technical aspects of multiparametric MRI for bladder cancer. 3. A pictorial review and step-by-step tutorial on Vesical Imaging-Reporting and Data System (VI-RADS).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to bladder cancer  
a. Types and relevant pathology  
b. Diagnosis, staging, treatment  
c. Role of imaging in clinical management  
d. Imaging of bladder cancer  
2. VIRADS  
a. Definitions and categories  
b. MRI scoring  
c. Examples  
3. Technical aspects  
a. Patient preparation  
b. MR protocol  
4. Pitfalls and mimics  
5. Case review

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## Abstract Archives of the RSNA, 2023

GUEE-14

### Male Pelvic Floor: Anatomical Particularities and Dysfunctions

#### TEACHING POINTS

To review some aspects of normal anatomy that are relevant in the context of male pelvic floor dysfunction. To demonstrate the differences between the male and female pelvic floor by comparing the reference values provided. To identify changes in male pelvic floor structures during micturition and defecation. To review the examination protocols for functional assessment. To systematize the evaluation of male pelvic floor dysfunctions with clinical cases and flowcharts.

#### TABLE OF CONTENTS/OUTLINE

The male pelvic floor has specific anatomical differences and pathophysiological peculiarities. The most important risk factors for its dysfunction include surgical procedures and radiotherapy. Pelvic floor dysfunctions can be grouped into three major categories (gastrointestinal, urinary, and sexual dysfunctions) and the best modality for this evaluation is dedicated magnetic resonance imaging (MRI). There is a paucity of literature related to imaging evaluation of the male pelvic floor. Typical markers used refer to the pubococcygeal line (PCL), the H line, the M line, and anorectal angle. Specific markers include the puboprostatic angle and the prostatic-urethral angle. Radiologists should recognize these particularities, the potential risk factors leading to these dysfunctions, and which landmarks are used in functional assessment.

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## Abstract Archives of the RSNA, 2023

GUEE-15

### No Need to Go Nuts: Simplified Testicular Neoplasms Sonographic Analysis

#### Participants

Fabio Yoshimura, Santana De Parnaiba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: To review the scrotum and adjacent structures anatomy in ultrasound; To emphasize the importance of adequate sonographic technique evaluation; To review most common testicular neoplasms; To present a metastasis case, a rare entity; To show ultrasound features of these neoplasms.

#### TABLE OF CONTENTS/OUTLINE

1. To review the scrotum anatomy in ultrasound: Testicles; Ductus deferens; Pampiniform plexus; Epididymis; Tunica vaginalis; Tunica albuginea. 2. Examination technique in ultrasound; 3. Illustrated teaching cases from our department showing the main testicular neoplasms: - Seminoma- Non-seminomatous germ cell tumors- Testicular lymphoma- Metastases to testis

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## Abstract Archives of the RSNA, 2023

GUEE-16

### Don't Forget the Female Urethra: An Approach for Radiologists

#### TEACHING POINTS

The female urethra can be adequately studied by static or/otr dynamic imaging methods. The spectrum of pathologies is wide, from the complexity of finding direct signs in a urethral diverticulum to the challenge of providing the necessary information for an adequate treatment of solid masses of undetermined origin. In recent years, the use of minimally invasive surgical techniques for the urinary incontinence/pelvic prolapse approach has raised the need to be familiar with the radiological features pre and post treatment for proper patient counseling.

#### TABLE OF CONTENTS/OUTLINE

-Review of the anatomy of the female urethra-Imaging methods-acquisition protocolsUltrasound (focused on static technique)Magnetic ResonanceVoiding CystourethrographyRetrograde double-balloon positive-pressure urethrography-Pathology of the female urethraMalformacionesCystic pathology: diverticulum versus urethral cystSolid pathologyBenign: abscess; myoma Malignant:Primary: urothelial carcinoma, squamous cell carcinoma, adenocarcinoma, Aggressive angiomyxoma Secondary: contiguous invasion versus metastatic lesions Pre-posttreatment imaging in minimally invasive surgical techniques for stress-mixed urinary incontinence (synthetic midurethral slings and bulking agents)-Differential diagnosis of urethral cystic from periurethral cystic pathologies-Conclusions

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## Abstract Archives of the RSNA, 2023

GUEE-17

### Predominantly Non-Cystic Multiple Focal Renal Lesions: An Imaging Approach

#### Participants

Mario G. Santamarina, MD, Vina del Mar, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review causes of predominantly non-cystic multiple focal renal lesions.
2. To discuss imaging findings of the different entities.
3. To provide imaging-based clues useful to focus and to guide to the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

The presence of multiple focal renal lesions may be an isolated or dominant imaging finding as well as an additional abnormality in the setting of multiorgan involvement. An imaging-based approach may be crucial in the differential diagnosis process as well as in patient management. Knowledge of the imaging appearance of the various causes and integration with other findings may result in a correct diagnosis in most cases as well as in assisting in proper patient work-up and management. Table of Contents: I- Overview; II- Main causes of multiple focal renal lesions 1. Infectious, 2. Inflammatory, 3. Vascular, 4. Related to neoplasm (main hereditary renal cancer syndromes, renal metastases, lymphoproliferative disorders, renal oncocytosis).; III- Summary.

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## Abstract Archives of the RSNA, 2023

GUEE-18

### Medical Devices in the Pelvis: The Good, the Bad, and the Ugly

#### TEACHING POINTS

1. Understand that a variety of devices may reside in the pelvis. 2. Recognize the multimodality imaging features of different devices to include expected location and malposition/migration and their potential associated complications. 3. Emphasize the importance of detecting malpositioned/migrated devices to facilitate treatment.

#### TABLE OF CONTENTS/OUTLINE

Medical Devices divided by biological sex where applicable. o Biological Female: § Intrauterine Device • Hormonal (e.g., Mirena) • Non-hormonal (e.g., Copper, Lippes Loop) • Sterilization Device (e.g., Essure) o Biological Male: § Penile Prosthesis o Devices found in both sexes: § Artificial Urinary Sphincter § Suprapubic Catheter and Foley Catheter § Ureteral Stents § Pessary § Peritoneal Dialysis Catheter 1. The following will be discussed for the devices where applicable: a. Indication b. Types c. Multimodality imaging features of the device in its expected position. d. Multimodality imaging features of the device in an abnormal position. e. Complications from malposition or migration of the device f. Treatment 2. Highlight the importance of familiarity with the multimodality imaging features of the wide variety of medical devices in the pelvis so that a malpositioned or migrated device can be easily recognized and brought to the attention of the referring physician to facilitate the patient receiving treatment.

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## Abstract Archives of the RSNA, 2023

GUEE-19

### Revisiting Voiding Cystourethrography (VCUG) and Retrograde Urethrogram (RUG).

#### Participants

Gabriela Lauar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Voiding cystourethrography (VCUG) and retrograde urethrogram (RUG) are fluoroscopic classic examinations performed by radiologist even in the present days, despite becoming increasingly scarce, still has its diagnostic value. Iodine contrast and x-ray equipment are required to perform the exam. Indications may vary according to venter, age, and clinical history. The findings can be divided between congenital and acquired at bladder and urethral lesions. VCUG and RUG are complementary tests to urethroscopy, as they can detect pathologies that were not previously visible. Other exams can offer adjunct informations, such as sonography and MRI, but this can provide unique diagnoses or inspire the development of new professionals or new techniques such as urethral resonance.

#### TABLE OF CONTENTS/OUTLINE

This pictorial study aims to review, describe and illustrate the examination and findings of RUG and VCUG in male and female patients that cannot go unnoticed in our reports. We have selected images of cases from our service that may raise suspicion or confirm the disease. We separate the cases according to anatomy and gender. The pathologies we will explore are divided into bladder, urethra findings, as well as prostate-related.. Quick and correct diagnosis can be crucial for the treatment of our patients.

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## Abstract Archives of the RSNA, 2023

GUEE-2

### Dose Reduction Strategies in CTKUB for Urolithiasis

#### TEACHING POINTS

1. It is critical for radiologists to understand CTKUB dose reduction strategies and successfully optimize protocols that produce high image quality with minimal dosage. 2. Familiarity with the practical approach in CTKUB will both decrease radiation dose and optimize imaging quality for the specific clinical indication.

#### TABLE OF CONTENTS/OUTLINE

The purpose of this exhibit is: 1. To discuss the relationship between radiation dose and image quality 2. To assess radiation dose reduction strategy with preserving image quality in CTKUB. Introduction- Radiation exposure and CT- Urolithiasis and CTKUB: Low dose and ultralow dose CT- ALARA principle "As Low As Reasonably Achievable" Optimization for Scans Reconstruction Parameters - CT radiation dose Estimate- CT radiation dose affecting factors- Control Z-Axis: Scan Range - Lower mAs- Lowering kVp- kVp mAs Settings- Automatic Tube Current Modulation (ATCM)- Noise Reduction Technique including deep learning-based image reconstruction Practical Approach: Decreased radiation dose and improved image quality- Dose justification: Risk vs. Benefit - ALARA (As Low As Reasonably Achievable) principle- Optimization for Scans Reconstruction Parameters - Dose Management: Monitoring, Radiation tracking- Educating requesting physicians and CT technicians

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## Abstract Archives of the RSNA, 2023

GUEE-20

### Decoding the cCLS Score: A Game-Changer in the Diagnosis and Management of Renal Masses

#### Participants

Daniella Braz Parente, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Daniella B. Parente, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the classification and epidemiology of the most common upper urinary tract neoplasms. Understand the importance of cCLS score in the management of incidental renal lesions. Explore nephrometry as a tool for assessing the surgical complexity of renal masses.

#### TABLE OF CONTENTS/OUTLINE

I. INTRODUCTION - Overview of upper urinary tract neoplasms and their epidemiology II. IMAGING TECHNIQUE - Overview of imaging modalities for renal mass detection and characterization - Best practices for imaging protocol III. IMAGING INTERPRETATION - Typical imaging features of common renal tumors - Explanation of cCLS score and its significance in the diagnosis of renal masses - Overview of nephrometry score and its role in assessing surgical complexity - Importance of CT and MRI in staging renal masses - Utilization of structured reports IV. QUICK REVIEW OF TREATMENT OPTIONS Overview of different treatment modalities for renal masses Pros and cons of each treatment option V. INTERACTIVE CASE-BASED DIDACTICS - Presentation of illustrative cases demonstrating the utility of cCLS score in diagnosis and management of renal masses

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## Abstract Archives of the RSNA, 2023

GUEE-21

### Imaging of Upper Tract Urothelial Neoplasms: Pearls and Pitfalls

#### TEACHING POINTS

Review the staging of upper urinary tract urothelial carcinoma (UTUC) which is critical for treatment decisions and surgical planning. Discuss the role of different imaging exams in the diagnosis of UTUC with a focus on CT and MR urogram protocols. Provide an evidence-based approach to critical T-staging. Highlight nuances in staging unique to UTUCs. Identify important pitfalls in the diagnosis of UTUC including benign neoplastic, infectious, and inflammatory etiologies.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology, prevalence, risk factors, Clinical presentation, TNM Staging. Exam protocols Value of multi-phasic exams, CT urogram dose reduction techniques including split bolus and virtual non-contrast, MR urogram. Staging: Tumor location: renal calyx or pelvis, ureter. Multifocality, Evidence based approach to critical T-staging T2 vs T3: ureteral border analysis, Hydronephrosis severity, Evaluation of contralateral urinary tract and bladder, Role of renal function evaluation, Nodal disease and distant metastases, Critical findings for treatment decision making and surgical planning. Pitfalls: Endometriosis, Infection, Malakoplakia. Post-treatment Surveillance imaging: Post-surgical appearance, Local recurrence, Risk of metachronous UTUC in contralateral urinary tract or bladder. Conclusion.

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## Abstract Archives of the RSNA, 2023

GUEE-22

### Go with the Flow: Imaging of Urinary Tract Augments, Reconstructions, and Non-Cystectomy Diversions in Adult Patients

#### TEACHING POINTS

- A variety of surgical techniques are utilized to augment, reconstruct or reroute the urine stream and these procedures often utilize other segments of the GU or GI tract• Findings from these procedures may be found on imaging studies during routine practice. Surgical records may not be available for many adult patients, especially for those with remote procedures performed in childhood• Postsurgical anatomy must be appropriately recognized for accurate diagnoses• Radiologists should be aware of surgical techniques and potential alterations made to the GU and GI tracts to help recognize expected postoperative anatomy, to facilitate greater diagnostic accuracy of postoperative complications, and avoid potential pitfalls

#### TABLE OF CONTENTS/OUTLINE

- Review indications for bladder augments, reconstructions and non-cystectomy urinary diversions• Describe common surgical procedures performed for bladder augmentation, ureteral reconstructions and non-cystectomy diversions, including continent and non-continent diversions- Bladder augments: gastrocystoplasty, ileocystoplasty, sigmoid cystoplasty- Reconstructions: psoas hitch, Boari flap, ileal interposition, uretero-ureterostomy, ureteroneocystectomy- Diversions: ileovesicostomy, appendicovesicostomy, Monti procedure• Discuss appropriate imaging techniques and radiologic evaluation, including how to recognize the postoperative anatomy and expected findings• Describe the imaging findings of postoperative complications including leak, fistula, abscess, mucus formation, stones, GU and GI obstruction

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## Abstract Archives of the RSNA, 2023

GUEE-23

### Periprostatic Anatomy: An Illustrated Review and Implications for Treatment Planning

#### TEACHING POINTS

1. Identify clinically relevant normal anatomy of periprostatic structures with imaging (MRI, CT, and angiography) correlation
2. Recognize periprostatic anatomic variations and implications to treatment planning

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline 1. Introduction 2. Prostatic pseudocapsule -Discussion of periprostatic fascial anatomy and composition - Implications for prostate cancer (PCa) staging and treatment -Preoperative MRI criteria for the diagnosis of extraprostatic PCa extension 3. Neurovascular Bundle -Normal anatomy with surgical correlation -Imaging identification and implications on prostate biopsy, PCa surgical and image-guided focal treatment planning. 4. Rectoprostatic space and Denonvilliers' Fascia -Discussion of rectoprostatic space and fascial anatomy with surgical correlation -Implication on PCa local dissemination in the pelvis -Hydrogel spacer placement for rectal wall protection during radiation therapy - normal and abnormal gel distribution 5. Membranous Urethra and External Urethral Sphincter -Normal membranous urethra and external urethral sphincter anatomy -Relationship to incontinence prediction post prostatectomy? -Imaging identification of external sphincter and relevance for eligibility and planning of image-guided focal treatment 6. Vascular anatomy -Normal anatomy and common variants -Importance for prostatic embolization procedures in the treatment of benign prostatic hyperplasia

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## Abstract Archives of the RSNA, 2023

GUEE-24

### Renal and Upper Urinary Tract Tumors: How to Effectively Report and Impact Surgical Management

#### Participants

Monick Nakayama, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Upper urinary tract masses (UTMs) have been increasingly detected by imaging cross-sectional techniques, either as an incidental finding or in the context of a specific investigation, leading to the discovery of renal tumors of smaller dimensions, for whom adequate characterization is mandatory. Correct assignments of malignant and potential benign UTMs are imperative to avoid unnecessary surgical procedures and even biopsies. Nonetheless, the number of benign masses that are surgically approached is still high and prediction of the risk of malignancy is challenging. For UTMs, the lack of well-established scores or specific signs makes imaging evaluation even more difficult but essential for therapeutical definition, and reporting key imaging findings with aggressive lesions is crucial.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Illustrative summary of the anatomy and histology of the kidney and upper urinary tract and histological origin of UTMs  
Summary of the main image findings in malignant tumors with pathological correlation, including:  
Tumors of the renal parenchyma  
Tumors of the collecting system and ureters  
Lymphoproliferative disorders  
Metastases  
Overview of main benign tumors and their essential imaging findings  
Tricks in upper urinary tract imaging including pseudotumoral lesions  
How to report the imaging findings for helping in surgical planning  
Conclusion

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## Abstract Archives of the RSNA, 2023

GUEE-25

### Above and Beyond the Imaging Features of Urolithiasis: What the Radiologist Needs to Know

#### Participants

Juan Francisco Santoscoy Gutierrez JR, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

a) Review the pathophysiology of kidney stone formation, types of calculi and clinical presentation. b) Discuss the general evaluation of urolithiasis with emphasis on the characteristic imaging features of different urinary calculi and specific imaging findings focusing on the clinically relevant information that can affect management by the urologist. c) Describe the standard of care of nephrolithiasis focusing on the current non-invasive options, minimally invasive options and invasive options performed by the urology surgeon. d) List the anticipated post-treatment follow-up, complications and prognosis of urolithiasis.

#### TABLE OF CONTENTS/OUTLINE

I. General overview: epidemiology, pathophysiology, clinical presentation  
II. Evaluation and management: a) General laboratory work and urinary tests  
b) Imaging and clinically relevant reporting: non-contrast CT, CT urography, dual energy CT, ultrasonography, radiography, MRI  
III. Treatment: a) Non-invasive options: observation, medical expulsion therapy, oral medication for dissolution  
b) Minimally invasive options: extracorporeal shockwave lithotripsy, ureteroscopy, percutaneous nephrolithotomy  
c) Invasive options: laparoscopy and open surgery  
IV. Post-treatment follow-up, complications and prognosis

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## Abstract Archives of the RSNA, 2023

GUEE-26

### Hematuria Beyond Infection, Stones and Cancer: An Imaging and Evaluation Guide of Unusual Cases

#### Participants

Eduardo Zukovski, MD, Umuarama, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- It is essential that radiologists know how to investigate hematuria, indications and limitations of each imaging option and recommendations for follow-up;
- All the examination protocols should be adapted to the patient while optimizing radiation dose;
- CT urography performs better than conventional radiography, ultrasound and intravenous urography in the detection of renal parenchymal masses and urinary tract calculi;
- Patients are now categorized into risk categories according to their clinical presentation and risk factors, and the workup is adapted to that category;

#### TABLE OF CONTENTS/OUTLINE

Hematuria is one of the most common urologic diagnoses, estimate to account for over 20% of urology evaluations; It is defined as the presence of three or more red blood cells per high-powered field in two of three properly collected urinalysis specimens; It can be classified as gross hematuria or microhematuria; The differential diagnosis encompasses a wide range of conditions and the risk of detecting an underlying cancer has been found to be highly dependent on which risk factors are present; More common causes of hematuria include urinary tract infection, urolithiasis, trauma, renal parenchymal disease, and malignancy;

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## Abstract Archives of the RSNA, 2023

GUEE-27

### Insights into Renal Cell Carcinoma with Novel Imaging Approaches

#### Participants

Khoschy Schawkat, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

· The updated Bosniak Classification, version 2019, predicts the likelihood of malignancy in cystic renal masses, with improved specificity of the higher risk categories, thereby expanding the number of masses that can be monitored.· In the clear cell likelihood score (ccLS), version 2.0, multiparametric MRI features of small renal masses without macroscopic fat are sequentially analyzed to determine the likelihood of clear cell renal cell carcinoma.· Contrast-enhanced ultrasound and dual energy CT are useful in identification and characterization of solid and cystic renal masses.· Several radiopharmaceuticals may contribute to the characterization of renal masses, such as 99m-technetium sestamibi, radiolabeled girentuximab and 68Ga-prostate-specific membrane antigen.· In the future, RCC may be diagnosed, managed, and treated more effectively using radiomics and artificial intelligence (AI).

#### TABLE OF CONTENTS/OUTLINE

1) New Imaging Algorithms Using Established Imaging Techniques (Bosniak classification, version 2019, and clear cell likelihood score version 2.0). 2) Novel Modalities (Contrast-enhanced ultrasound, dual energy CT, and molecular imaging including Sestamibi, Girentuximab, and PSMA). 3) Radiomic and artificial intelligence.

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## Abstract Archives of the RSNA, 2023

GUEE-28

### Penile MRI: A Multi-institutional Case-based Review of Anatomy, Spectrum of Pathologies and Prosthetic Complications

#### Participants

Harit Kapoor, MD, MBBS, Poughkeepsie, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Penile MRI provides invaluable clinical information in a wide array of pathologies. However, given the infrequent use, contemporary radiology residency and fellowship training provides insufficient exposure to penile MRI. 2) After reviewing this presentation, the learner will be able to: a. Understand normal penile anatomy including prosthetic anatomy; b. Describe indications for penile MRI and key aspects for image acquisition; c. Diagnose various penile pathologies based on characteristic imaging findings; d. Understand the basis for differences in management and tenets of surgical planning for various disease entities; e. Describe indications for penile prosthesis implantation and diagnose common implant complications.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of penile MRI technique, indications, and normal anatomy. 2) Tabulated summary of various penile diseases with classic MRI appearances. 3) Case examples (with differentials, pearls and pitfalls) including but not limited to: (i) Penile trauma (contusion, fractures); (ii) Corrected anomalous genitalia; (iii) Cowper's gland pathology (retention cysts and syringocele); (iv) Penile malignancy (primary staging, post-penectomy recurrence, metastases); (v) Penile implant complications (malpositioning, infection and erosion/extrusion); (vi) Priapism (types, post-treatment imaging); (viii) Periurethral and perineal sepsis.

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## Abstract Archives of the RSNA, 2023

GUEE-29

### Upper Tract Urothelial Neoplasms and Mimics

#### Participants

Satheesh Krishna, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Murray Di Loreto, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the methods and techniques for the optimal evaluation of the urothelium.
- Identify role of imaging in diagnosis and staging of upper tract urothelial cancer.
- Identify imaging features with radiology-pathology correlation of lesions involving the urothelium in a quiz-based format.

#### TABLE OF CONTENTS/OUTLINE

- Is there still a role of conventional urography? Which is better - retrograde urography? antegrade urography? intravenous pyelourography?
- CT urography - what is the ideal urothelial phase? should arterial phase be included ? split-bolus technique vs dedicated delayed phase?
- When is MR urography preferred over CT urography- improvements in MR sequences (including compressed sensing, k-space undersampling, parallel imaging and AI). Is Lasix injection needed? Prone vs supine patient positioning? Wide vs narrow FOV how to optimize? Are cine-T2 images useful? T2 based or gadolinium based ? Pitfalls, artifacts simulating urothelial disease will be discussed (especially pertaining to MR urography) and solutions will be presented (flow voids on T2? T1\* effects due to concentrated gadolinium).
- What is multiparametric MR Urography - what are the various components of multiparametric MR urography, and how does it improve diagnosis? What is the literature evidence for multiparametric MR urography?
- How does imaging help in diagnosis and staging of upper tract urothelial neoplasms? What are the key findings impacting management of upper tract urothelial neoplasms?
- Approach towards differential diagnosis of these lesions (including common, uncommon and rare mimics) with tips and tricks and imaging pearls as to when to suspect a diagnosis other than UCC, and optimal follow-up/referral strategy.

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## Abstract Archives of the RSNA, 2023

GUEE-3

### Lost Without Bosniak: Overcoming the Challenges of Non-Classifiable Renal Cystic Masses

#### Participants

Jhonata Soares Da Silva, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A comprehensive review of situations where the Bosniak classification for renal cystic masses is not applicable, emphasizing the importance of being aware of these contexts and how to manage cases where the classification is not useful. Challenging Cases: The exhibition will showcase various challenging cases of renal cystic masses where the Bosniak classification may not be applied. These cases will test participants' knowledge and critical thinking.

#### TABLE OF CONTENTS/OUTLINE

Overview of cystic renal lesions in daily practice and the importance of differential diagnoses. Brief mention of the Bosniak classification system and its limitations. Situations where the Bosniak Classification is not applicable, such as inflammatory/infectious conditions, vascular diseases, calyceal diverticula, polycystic kidney disease, Birt-Hogg-Dubé, Von Hippel-Lindau, Tuberous Sclerosis, pelvic cysts, and cystic metastasis are all conditions that can mimic renal cystic masses and are not included in the Bosniak classification system. In this section, we will review each of these conditions, their presentation, and management. Case-based review of concepts and tips: Practical tips and case-based reviews of concepts to help manage renal cystic masses that cannot be classified by the Bosniak system. Helping assistant doctors for better outcomes: discussion of how to assist and guide assistant doctors in managing challenging cases of renal cystic masses. Key take-home messages: summary of the important points discussed during the presentation, with practical advice on how to incorporate the acquired knowledge into clinical practice.

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## Abstract Archives of the RSNA, 2023

GUEE-30

### Imaging and Interventional Management in Different Conditions Underlying Renovascular Hypertension

#### Participants

Eric Castane, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the imaging study of the arterial renal system both in normal and in renal artery stenosis. 2. Describe the vascular radiology management of the renovascular hypertension.

#### TABLE OF CONTENTS/OUTLINE

1. Material and methods / Background. 2. Arterial hypertension and renovascular hypertension: definitions and clinical features. 3. Imaging study of the renal arteries: normal, anatomic variants and pathological findings. 3.1. US assessment (evaluation points, technique, signs). 3.2. CT. 3.3. MRI. 3.4. Angiography. 3.5. Algorithmic approach to renal artery stenosis. 4. Interventional radiology management: therapeutic options and post procedure imaging criteria. 5. RAS: etiologies pictorial review (atherosclerosis, fibromuscular dysplasia, vasculitis, others). 6. RAS after renal transplantation (diagnosis and interventions). 7. Conclusions.

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## Abstract Archives of the RSNA, 2023

GUEE-31

### Imaging of the Urachus

#### Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Illustrate normal urachal anatomy on imaging and discuss urachal embryogenesis. 2. Provide case-based review of the imaging features of various urachal non-neoplastic and neoplastic entities.

#### TABLE OF CONTENTS/OUTLINE

Embryogenesis: Urachus is an embryonic ductal remnant of the allantois and cloaca extending from the bladder dome to the umbilicus. Imaging modalities: US is usually the imaging modality of choice, especially in the pediatric population. CT and MR carry higher temporal and spatial resolution with added benefit of staging malignancy when present. • Congenital: Patent urachus (urachal fistula); Umbilical-urachal sinus tract; Vesicourachal diverticulum; Urachal cyst • Infections/inflammation: Urachal stone/calcification; abscess. • Urachal neoplasms: Benign Adenoma; Cystadenoma, fibroma. Malignant Mucinous adenocarcinoma; Nonmucinous adenocarcinoma; Urothelial; Squamous; Sarcomatoid; Metastatic. • Non-neoplastic masses: Endometriosis; Hemorrhage. Summary Urachal pathology is often discovered incidentally on imaging and presents with nonspecific urinary symptoms. Early detection of urachal pathology and identification of complications such as infection and malignancy are imperative to prevent significant patient morbidity.

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## Abstract Archives of the RSNA, 2023

GUEE-32

### Testicular Cancer: What the Radiologist Needs to Know

#### Participants

Ingrid Alonso Ramon, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the general characteristics of testicular cancer including the different types and their incidence. To describe the different features of multimodality imaging (ultrasound, CT, PET/CT) including the expected findings depending on histologic type and their utility of each in TNMS. Recognize the importance of diagnosis, treatment and follow-up.

#### TABLE OF CONTENTS/OUTLINE

Description of the general characteristics of testicular cancers including (a) embryology (b) incidence (c) detailed pathologic features. d) Clinical presentation To review of multimodality imaging findings including expected findings. To establish the usefulness of the different imaging methods for diagnosis, follow-up, complications and stratification of each one. To Discuss clinical scenarios to establish the best course of action.

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## Abstract Archives of the RSNA, 2023

GUEE-33

### Penile Ultrasound: An Updated Pictorial Review for Residents

#### Participants

Hugo Velazquez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To illustrate the anatomical structures of the penis by sonography. -To determine the protocol used at our center. -To show the main indications for penile Doppler ultrasound with and without vasoactive drug. -To list the normal parameters in the Doppler evaluation and their pathological correlation. -To review the main sonographic findings in different conditions.

#### TABLE OF CONTENTS/OUTLINE

1. A pictorial review of the anatomy of the penis structures by ultrasound. 2. Penis ultrasound protocol and technical parameters. 3. Indications and use of vasoactive drug. 4. Examples of different conditions with sonographic findings.

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## Abstract Archives of the RSNA, 2023

GUEE-34

### Contrast-Enhanced Ultrasound (CEUS): Vascular Applications from the Kidneys to the Bladder

#### TEACHING POINTS

1. CEUS is a very useful imaging modality in patients with poor renal function due to the non-nephrotoxic nature of the ultrasound contrast agents. 2. In the kidneys, CEUS is accurate in characterizing indeterminate lesions, characterizing complex cysts according to the Bosniak criteria, differentiating solid renal tumors from pseudotumors, identifying renal infarction, abscesses, and for the follow-up of non-surgical renal lesions. 3. CEUS is also used in renal transplant patients to look for masses, cysts, and other vascular problems. 4. In the bladder, CEUS is excellent in differentiating bladder cancer from benign pathologies such as a hematoma in patients with hematuria. It also aids in differentiating non-muscle invasive bladder cancers (NMIBC) from muscle-invasive bladder cancers (MIBCs), thereby guiding appropriate management. 5. CEUS can also detect primary tumors of the ureter or tumors extending from the bladder into the ureter by means of enhancement patterns.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of vascular applications of CEUS in the urinary system. 2. The technique of performing CEUS. 3. Microbubbles as non-nephrotoxic blood pool contrast agents. 4. Renal applications of CEUS. i. Renal infarction ii. Renal abscess iii. Characterization of cystic renal masses iv. Solid renal tumors vs pseudotumors v. Angiomyolipoma vs renal cell carcinoma 5. Renal transplant applications 6. Bladder application of CEUS. i. Bladder cancer vs Hematoma ii. Staging of bladder cancer iii. NMIBC vs MIBC iv. Ureteral tumor

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## Abstract Archives of the RSNA, 2023

GUEE-35

### Imaging Findings of Upper Tract Urothelial Carcinoma (UTUC) and Its Mimickers

#### Participants

Marina Farani, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the characteristic imaging findings of upper tract urothelial carcinoma. To outline the role of imaging in diagnosis and staging of carcinoma of the renal pelvis and the ureter. To discuss different diagnostic imaging modalities in the context of upper tract urothelial carcinomas. To make differential diagnosis of upper urinary tract neoplasms from other lesions, including benign lesions.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology, risk factors, signal and symptoms and pathogenesis about carcinoma of upper urinary tract. Diagnosis: A step-by-step explanation of how to characterize and diagnostic a upper tract urothelial neoplasm. The use of computed tomography and the magnetic resonance to describe the different imaging patterns of tumors (papillary and infiltrating) and to staging urothelial carcinoma of upper urinary tract. Case-Based Review: Sample cases explaining and demonstrating different imaging patterns about upper tract urothelial carcinoma in different imaging modalities. This section will present illustrative cases of carcinoma urothelial infiltrating renal parenchyma, limited at renal pelvis and calyceal infundibulum and distal ureter. This section will present illustrative cases of diagnostic differential/mimickers of urothelial neoplasm, like inflammation, blood clots, endometriosis and renal lymphoma. Conclusion and key takeaways.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GUEE-36

### Bladder Neoplasm: A Practical Guide for Residents

#### Participants

Vitor Romano, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Provide a practical guide for residents on how to perform a bladder cancer screening. Systematize the evaluation of bladder cancer. Introduce and exemplify the VI-RADS classification. Demonstrate how muscle layer invasion should be evaluated according to the VI-RADS classification.

#### TABLE OF CONTENTS/OUTLINE

We will discuss the following topics and focus on the VI-RADS classification: Introduction: Epidemiology; Pathophysiology. Subtypes of bladder cancer. Urothelial carcinoma; Urachal adenocarcinoma. Imaging methods. TNM grading. VI-RADS classification. Imaging acquisition; Analysis; Examples. Evaluation of the metastatic disease. Management and followup.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GUEE-37

### Evaluation of Trauma-Related Kidney Injuries

#### Participants

Vitor Romano, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Provide a guide on how to assess kidney injuries related to blunt trauma. Indications for radiological evaluation of renal injury. Role of various imaging modalities (computed tomography, excretory urography, angiography, retrograde pyelography, ultrasonography and magnetic resonance imaging). Give a context of the conduct according to the kidney injury.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology; Pathophysiology. Imaging methods. Computed tomography images acquisition protocol. AAST classification for renal trauma. Examples. Overview.

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## Abstract Archives of the RSNA, 2023

GUEE-38

### Atypical Prostatic Cancer Metastases Recurrence: A Pictorial Review

#### Participants

Murilo Peixoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate cancer is one of the most common malignancies in men worldwide. It has a recognizable pattern of metastatic spread, most frequently to regional lymph nodes and bone, as well as a typical recurrence pattern to pelvic lymph nodes, vesicourethral anastomosis, and bed of seminal vesicles and vas deferens. However, there are different patterns of metastases and recurrence that must be recognized.

#### TABLE OF CONTENTS/OUTLINE

Atypical metastatic disease occurs in less than 5% of patients. Atypical lymph node involvement includes the supradiaphragmatic chains, most commonly the retrocaval, hilar, and supraclavicular ones. Extranodal involvement can occur in the lung and pleura, abdominal viscera, breast, orbit, brain/meninges and soft tissues. Interestingly, atypical distant metastases rarely occur in isolation and PET-PSMA usually demonstrates multiple simultaneous lesions. A higher Gleason score has also been reported to be associated with a greater likelihood of atypical metastases. When evaluating for recurrence, the atypical sites that need to be part of the routine imaging evaluation include anterior portions of the urethra, ureteral meatus (associated with poor prognosis), urinary bladder (distant from the anastomotic area), rectum, mesorectum and compromised retroperitoneal lymph nodes with preservation of the pelvic chains. This exhibit aims to review the locations and atypical patterns of manifestation of this neoplasm according to the different diagnostic modalities, focusing on multiparametric magnetic resonance imaging (MRI) and PET-PSMA.

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## Abstract Archives of the RSNA, 2023

GUEE-39

### **Clinical Utility of the Vesical Imaging-Reporting and Data System for Histological Variants and Non-Urothelial Bladder Cancer**

#### **TEACHING POINTS**

Histological variants (VUC) and non-urothelial bladder cancer (NUC) are relatively rare bladder cancer subtypes. These subtypes have a high malignant potential, aggressive advanced tumor features, and an increased risk of disease recurrence compared to pure urothelial bladder cancer (PUC). Accurate preoperative muscle invasion assessment and subsequent immediate surgical intervention are warranted in these patients. The usefulness of the Vesical Imaging-Reporting and Data System (VI-RADS) has been established for PUC by several previous studies. However, the validity of VI-RADS for VUC and NUC still has to be established. This exhibit aims to clarify MRI features of VUC and NUC with histological correlation, demonstrate VI-RADS scoring of VUC and NUC, and discuss the feasibility of biparametric MRI for VUC and NUC compared to PUC.

#### **TABLE OF CONTENTS/OUTLINE**

1, VI-RADS and histological classification of bladder cancer, 2, VUC with VI-RADS scoring (squamous differentiation, glandular differentiation, sarcomatoid variant, plasmacytoid variant, micropapillary variant, and nested variant), 3, NUC and other bladder malignant tumors with VI-RADS scoring (squamous cell carcinoma, adenocarcinoma, small cell carcinoma, lymphoma, urachal adenocarcinoma, and bladder metastasis), 4, Risk of underestimation of muscle invasion in VUC and NUC at biparametric MRI and its clinical implications, 5, Summary.

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## Abstract Archives of the RSNA, 2023

GUEE-4

### Use of 3D Printed Models to Guide Surgical Resection of Renal Masses

#### Participants

Mujtaba Hameed, BS, BA, Canton, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. 3D modeling and printing has been increasingly utilized in recent years to guide improvements and new applications for medical diagnosis and treatment planning. 2. 3D models provide a unique degree of tactile and visual information, especially anatomopathological information that would be particularly relevant in surgical planning of tumor resection (e.g., renal masses). 3. 3D modeling can improve the characterization and treatment of renal masses at multiple stages, including segmentation, modeling, printing, preoperative planning, patient consent and education, intraoperative reference, and ultimately surgical removal.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction characterizing the background of 3D modeling and printing in medical diagnosis and treatment, as well as review of relevant examples in the literature and within our institutional experience. 2. Description of initial case presentation and pertinent clinical workup. 3. Review of CT images, process of segmentation, and creation of 3D printed models utilizing clinical 3D visualization software. 4. Description of technique used in editing of 3D models via 3D printing software, including model video. 5. Creation of 3D model of the patient's left kidney (with mass demarcated), description of the utility of the modeling process both preoperative and intraoperatively.

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## Abstract Archives of the RSNA, 2023

GUEE-40

### A Practical Guide for Evaluating Renal Masses: Didactic Case-Based Review

#### Participants

Fernanda Limonge, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Discuss and illustrate the cystic lesions of the kidney, emphasizing Bosniak v2019 classification. Describe the features of solid renal masses. Review the TNM system for renal cell carcinoma (RCC). Discuss the active surveillance of renal masses as an alternative to immediate treatment. Review the imaging findings in the context of post-treatment.

#### TABLE OF CONTENTS/OUTLINE

Cystic lesions- Illustrate the Bosniak classification- Tips on how to interpret a cystic renal mass  
Didactic approach for evaluating solid renal masses- Ball versus bean patterns- Clear cell likelihood score (ccLS)  
Describe and review renal masses and histological subtypes- Angiomyolipoma- Oncocytoma- Clear cell RCC- Papillary RCC- Chromophobe RCC- Collecting duct carcinoma- Medullary carcinoma- Urothelial carcinoma- Lymphoma- Metastasis  
Locoregional risk stratification- Tumor size- Axial location (anterior/posterior; endophytic/exophytic)- Longitudinal location (relationship with the polar lines)- Hilar proximity (vessels/collecting system)  
Distant disease assessment- Metastatic disease (bone, liver, lung, lymph nodes)- Synchronous urothelial carcinoma  
Active surveillance  
Post-treatment complications- Relapse- Hematoma- Urinoma- Arteriovenous complications

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## Abstract Archives of the RSNA, 2023

GUEE-41

### Male Urethral Anatomy Revealed: Navigating Anatomical Variations and Complications

#### Participants

Helen Ribeiro De Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit is: Illustrate the main anatomical landmarks of the male urethra according to imaging methods  
Review the imaging modalities useful to evaluate the male urethra  
Propose a differential diagnosis of lesions according to localization and congenital or acquired, traumatic, infectious, and neoplastic etiologies and highlight the imaging features of each one  
To evaluate the postoperative findings and complications

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Main anatomical landmarks- Imaging methods- Differential diagnosis and clues to diagnosis- Practical tips and Pitfalls- Normal postoperative findings and complications- Conclusion/Take home message

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## Abstract Archives of the RSNA, 2023

GUEE-42

### Imaging and Management of Renovascular Hypertension: An In-Depth Review

#### Participants

Igor Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the pathophysiology of renovascular hypertension (RVH) and its clinical implications. Review the diseases that can lead to RVH, differential diagnosis, and treatment complications. Assess the role of various imaging modalities in diagnosing and assessing the severity of RVH. Discuss the importance of imaging in guiding interventional and surgical management of RVH. Evaluate the current evidence-based guidelines for the management of RVH.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction to Renovascular Hypertension A. Pathophysiology of RVH B. Clinical presentation and implications II. Imaging Modalities for RVH A. Duplex ultrasonography B. Computed tomographic angiography (CTA) C. Magnetic resonance angiography (MRA) 1. Protocol and techniques 2. Contrast enhanced vs unenhanced MRA D. Digital subtraction angiography (DSA) E. Selecting of the appropriate imaging modality III. Etiology and Differential Diagnosis of RVH A. Diseases leading to RVH 1. Atherosclerosis 2. Fibromuscular dysplasia 3. Vasculitis 4. Other causes 5. particularities in the pediatric population B. Differential diagnosis and clinical challenges C. Algorithm approach on etiology definition on CTA and MRA IV. Interventional and Surgical Management A. Indications for intervention B. Percutaneous transluminal angioplasty (PTA) with or without stenting C. Surgical revascularization D. Nephrectomy in non-functioning kidneys E. Treatment complications V. Evidence-based Guidelines for RVH Management A. Role of imaging in treatment planning B. Recommendations for follow-up imaging VI. Conclusion A. Importance of imaging in the diagnosis and management of RVH B. Future directions in RVH imaging and management

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## Abstract Archives of the RSNA, 2023

GUEE-43

### Practical Guideline for Adrenal Incidentalomas: A Case-Based Review

#### Participants

Iandra Pacheco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Demonstrate a practical guideline with cases to help radiologists with the differential diagnosis of adrenal incidentalomas. Illustrate with didactic cases the European Society of Endocrinology Clinical Practice Guideline in collaboration with the European Network for the Study of Adrenal Tumors and the White Paper of the ACR Incidental Findings Committee. Review the typical image appearance of adrenal incidentalomas.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION IMAGING PROTOCOL CT and MRI REVIEW INCIDENTALOMAS GUIDELINES White paper of ACR European Society of Endocrinology Clinical Practice DEMONSTRATE DIDACTIC CASES- Adenoma - Myelolipoma - Cyst or hemorrhage - Prior granulomatous infection or hematoma- Indeterminate adrenal incidentalomas (= 1 - < 4 cm with prior imaging) . With cancer history: new or enlarging mass. No cancer history: enlarging indeterminate adrenal masses- Indeterminate adrenal incidentalomas (= 1 - < 4 cm without prior imaging) . No cancer history: 1 - 2 cm 2 - 4 cm. Cancer history- With history of cancer (= 1 - < 4 cm). Without known metastatic disease or prior exam. Central necrosis

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## Abstract Archives of the RSNA, 2023

GUEE-44

### How to Improve Surgical Management in Penile Cancer: An MRI and Pathology Correlation

#### Participants

Thiago Caetano, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the protocol and main sequences used in magnetic resonance imaging for optimal imaging of the penis. Comment on the main penile cancer subtypes based on MR imaging features and correlate with the pathological diagnosis. Discuss the importance of MR imaging in the staging of penile cancer, as well as its potential to aid in surgical management.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Relevant anatomy of the penis  
Definition and main types of penile cancer  
Epidemiology and risk factors  
MR technique and discussion: Describe the main protocol and sequences used in penile cancer MR imaging  
Staging, imaging features and pathology correlation: Discuss the major changes in the 8th AJCC Cancer Staging Manual  
Demonstrate imaging features of the main types of penile cancer and correlate with pathology  
Conclusion: Discuss its usefulness in local staging and locoregional lymph nodal metastasis and comment on future directions

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## Abstract Archives of the RSNA, 2023

GUEE-45

### Space OAR in Prostate Cancer - the What, the How, and Beyond: A Primer for Radiologists

#### Participants

Nabih Nakrou, MD, Watertown, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this presentation is to: • Review the role of SpaceOAR hydrogel spacer in prostate cancer treatment and placement techniques. • Discuss imaging findings and mimics on different modalities via variable cases. • Recognize radiologic findings of SpaceOAR complications and malfunction.

#### TABLE OF CONTENTS/OUTLINE

We will address the following: • SpaceOAR composition • SpaceOAR placement and anatomy • Indications and roles of SpaceOAR in prostate cancer radiotherapy, including companion cases for treatment and follow-up • Common pitfalls and mimics of hydrogel spacers • Rare SpaceOAR-related complications

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## Abstract Archives of the RSNA, 2023

GUEE-46

### The Female Urethra: A Practical Guide

#### Participants

Louise Cavalcanti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe embryology and anatomy of the female urethra highlighting the anatomical landmarks for diagnoses and surgical planning. 2. The intention of this pictorial review is to describe the most important imaging methods and their contribution to the diagnosis of the main pathologies. 3. Discuss the main pathologies of the female urethra, through richly illustrated clinical cases, correlating with the symptoms and emphasizing the learning points.

#### TABLE OF CONTENTS/OUTLINE

a. Introduction. b. Embryology: Brief description of embryology. c. Anatomy: Important landmarks. d. Imaging methods: Sonography, MRI, Urethrography. e. Pathology: Discuss the most significant pathologies with key points and possible differential diagnoses. f. Cases: Illustrate the most frequent pathologies with clinical cases. g. Take home messages.

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## Abstract Archives of the RSNA, 2023

GUEE-47

### Renal Vascular Hypertension: A Primer for the Radiologist

#### TEACHING POINTS

1. Review the etiology, pathophysiology, classification and diagnosis of renal vascular hypertension2. Review contemporary ultrasound, CT and MR angiography techniques and findings of renal vascular hypertension3. Summarize modern treatment recommendations

#### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Etiology and pathophysiology of renal vascular hypertension3. Modality selection and protocol optimization4. Imaging features of renal artery narrowing including a) etiology b) flow dynamics c) renal perfusion d) post-intervention appearance e) complications5. Summary of treatment recommendations with emphasis on the impact of specific imaging findings on therapy

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## Abstract Archives of the RSNA, 2023

GUEE-48

### Penile Pathology Prep: A Quiz-based Review of Penile Ultrasound for Trainees

#### TEACHING POINTS

By the end of the presentation, the learner will be able to

1. Interpret the imaging and relevant anatomy for penile ultrasound.
2. Understand the role of ultrasound in diagnosis and management of penile pathologies and discern when to use ultrasound as an adjunct or in lieu of other modalities.
3. Describe the ultrasound findings for penile pathologies focusing on emergent and commonly encountered cases.
4. Identify normal and abnormal ultrasound Doppler flow parameters in various conditions that may aid in diagnosis.
5. Raise awareness of the clinical utility of penile ultrasound in certain penile pathologies given the safety profile and wide accessibility of this modality.

Target Audience: Trainees.

#### TABLE OF CONTENTS/OUTLINE

We present a case-based quiz of various penile pathologies as seen on ultrasound. Each case will be associated with pertinent symptoms and unlabeled ultrasound images. The diagnosis will be revealed, along with description of the imaging findings followed by relevant educational content for each diagnosis such as: defining relevant pathophysiology, explaining key findings/associations, the clinical significance, and the uses/limitations of ultrasound related to that diagnosis. An introductory overview of normal anatomy and Doppler parameters will also be provided. Diagnoses include:

1. Erectile dysfunction - Arteriogenic
2. Erectile dysfunction - Venogenic
3. Priapism - High-flow
4. Priapism - Low-flow
5. Peyronie's disease
6. Mondor's disease
7. Penile fracture
8. Penis infection/abscess
9. Penile mass - Squamous cell carcinoma
10. Penile foreign body

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## Abstract Archives of the RSNA, 2023

GUEE-49

**Now Streaming: Review of Male Urethral Imaging with Focus on MRI**

### Participants

Milana Flusberg, MD, New York, NY (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Proper technique and understanding of normal male urethral anatomy on retrograde urethrography aids in interpretation of scans for trauma and strictures. Differential diagnosis of periurethral cysts in men includes utricle, Mullerian duct cyst, Cowper's duct/gland cyst, diverticulum, and collections (urinoma/abscess). MRI is used for local staging of male urethral cancer. Radiologists should be familiar with the appearance of urethral procedures including artificial sphincter and Urolift.

### TABLE OF CONTENTS/OUTLINE

Performance of retrograde urethrography; Normal male urethral anatomy and normal variants; Urethral strictures: inflammatory, post-traumatic, neoplastic; Urethral trauma: mechanisms, grading, associated findings; Peri-urethral cysts and collections: utricle, Mullerian duct cyst, Cowper's duct/gland cyst, diverticulum, urinoma, abscess; Urethral cancer: background, imaging appearance, staging; Post-procedural urethra

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## Abstract Archives of the RSNA, 2023

GUEE-5

### Overview of Tumor Thrombus in Renal Cell Carcinoma

#### TEACHING POINTS

Renal cell carcinoma (RCC) invades into the vasculature in approximately 10% of patients. Tumor thrombus is most commonly associated with clear cell RCC but it can also occur due to other entities, such as papillary RCC. This educational exhibit will: (1) Review the incidence, prognosis, and classification system of tumor thrombus in RCC. (2) Review the imaging features of tumor thrombus. (3) Discuss the role of imaging in guiding surgical treatment of tumor thrombus.

#### TABLE OF CONTENTS/OUTLINE

(1) Incidence, clinical presentation, and prognosis of tumor thrombus in RCC. (2) Review the T staging of RCC with tumor thrombus according to the 2010 AJCC clinical staging and Mayo Clinic RCC tumor thrombus level classification system. (3) CT and MRI imaging features of tumor thrombus with case-based pictorial review. (4) Treatment of RCC with tumor thrombus. (5) Potential surgical approach for varying levels of tumor thrombus and post-operative imaging. (6) Summary of teaching points.

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## Abstract Archives of the RSNA, 2023

GUEE-50

### Genitourinary Tract Infections and Inflammatory Conditions: Spectrum of Imaging Features, Pitfalls and Mimics

#### Participants

Ayman H. Gaballah, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Illustrate the etiology, pathogenesis, and clinical presentation of genitourinary (GU) tract infections 2. Review the appropriate imaging workup and imaging features of GU infections 3. Discuss mimics and pitfalls of GU infections Highlight management options

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomic illustrations 3. Classification of genitourinary tract infections • Urinary tract infections: i. Upper urinary tract (kidney and ureter): 1. Focal/diffuse pyelonephritis 2. Emphysematous pyelitis/pyelonephritis 3. Renal/perinephric abscesses 4. Hydronephrosis and pyonephrosis 5. Xanthogranulomatous pyelonephritis 6. Parasitic infection (hydatid infection) 7. Other infections such as T.B 8. Ureteritis cystica ii. Lower urinary tract (urinary bladder and urethra): 1. Cystitis 2. Emphysematous cystitis 3. Diverticulitis of urinary bladder/urethra 4. Parasitic infection (Schistosomiasis) 5. Fungal infections (actinomycosis, candidiasis) 6. Cystitis cystica 7. Radiation and chemotherapy cystitis 8. iii. Urachal Inflammatory and Infectious Conditions • Genital infections: i. Female genital system: 1. Pelvic inflammatory disease (e.g., cervicitis, endometritis, pyosalpinx, etc.) 2. Tubo-ovarian abscess 3. Pelvic actinomycosis 4. Necrotizing fasciitis 5. Other rare infections ii. Male genital system: 1. Infectious and granulomatous prostatitis 2. Prostatic abscess 3. Epididymo-orchitis and abscess 4. Scrotal wall cellulitis, abscess 5. Fournier gangrene iii. Sexually transmitted infections 4. Predisposing factors and complications of GU infection 5. Imaging features and case presentation 6. Mimics and pitfalls 7. Updates on management options 8. Conclusion

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## Abstract Archives of the RSNA, 2023

GUEE-51

### Urologic Prosthetics: An Imaging Review of Short-term and Long-term Complications

#### Participants

Mary Woodruff, DO, (*Presenter*) Nothing to Disclose

Mary Woodruff, DO, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Urologic prosthetics are commonly encountered in everyday practice. As with any surgical procedure and implantable device, there are complications, both short-term and longer term. With contribution from the urology team, we have selected a case collection to highlight these complications with both imaging findings and gross anatomic photos. The addition of gross anatomic and surgical photos complement the imaging findings and provide a better understanding of the clinical perspective. In reviewing these cases, the radiologist may better recognize and accurately diagnose complications related to urologic prosthetics.

#### TABLE OF CONTENTS/OUTLINE

A review of the urologic prosthetics and implant components. Normal orthotopic positioning of urologic prosthetics anatomically and in imaging. Selection of cases with imaging and pictorial findings Selected cases include: Urethral cuff erosion of artificial urinary sphincter. Postoperative pelvic/scrotal hematoma. Scrotal abscess. Penile prosthesis scrotal pump erosion. Herniation of prosthesis reservoir into the inguinal canal. Reservoir leak. Fracture of malleable penile prosthesis.

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## Abstract Archives of the RSNA, 2023

GUEE-52

### How We Do It: A Diagnostic Approach to Avoid Overtreatment in Management of Centrally Located Renal Masses

#### Participants

Layra Leao, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review imaging features of the differential diagnosis of centrally located renal masses.- Illustrate diagnostic clues related to common and uncommon mimickers of upper tract urothelial carcinoma.- Highlight the importance of the tumor board approach in managing challenging cases as a platform for care coordination and a tool to optimize decision-making.

#### TABLE OF CONTENTS/OUTLINE

Imaging diagnostic differentiation of upper tract urothelial carcinomas (UTUC) and other centrally located renal tumors can be challenging; management patterns vary considerably due to the different oncologic behavior of these lesions. Misinterpretation in imaging studies could lead to unnecessary aggressive approaches. Some radiological features can help to predict the histology or pathologic aggressiveness of renal tumors, providing optimal and safe management. The presence of an infiltrative or nodular expansile pattern of growth is the first step in the differentiation of conditions that may simulate UTUC. Benign and malignant mimickers include renal cell carcinomas, metastasis, lymphoma, pseudotumors, and infection. Standardization of imaging protocols and reporting can help to differentiate these entities. The multidisciplinary discussion of challenging cases in the tumor board meetings should be included in the medical practice to identify interpretation mistakes and avoid unnecessary patient damage.

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## Abstract Archives of the RSNA, 2023

GUEE-53

### MRI Clear Cell Likelihood Score (ccL): A Great Mechanism to Managing the Indeterminate Renal Masses

#### Participants

RODRIGO OKAMURA, GUARULHOS, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 - To understand the different aspects of renal lesions and the importance of classifying those with a higher risk of clear cell carcinoma. 2 - Through practical cases and interactive quizzes, demonstrate how to use the clear cell likelihood score (ccLs). 3 - Present some cases with limitations of ccLs applicability. 4- Expose some pitfalls and challenging cases.

#### TABLE OF CONTENTS/OUTLINE

1 - Introduction on renal carcinomas subtypes and ccLs score creation.. 2 - Demonstate how to use the ccLs. 3 - Quiz case studies with practical use of ccLs. 4 - Answer each case with the corresponding pathological resulrs. 5 - Challenging cases with limitations of the ccLs algorithm. 6 - Pitfalls that can lead to erroneous diagnosis. 7 - Summary and take home notes.

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## Abstract Archives of the RSNA, 2023

GUEE-54

### Female Lower Genitourinary Tract: Imaging Evaluation of the Most Common Alterations of Interest in Female Urology

#### Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? Identify the anatomical landmarks of the female pelvic floor and perineum which can guide the radiologist to the correct diagnosis.? Point out the best imaging method for the diagnosis.? Review imaging features of the most common abnormalities of the female lower genitourinary tract.? List complicating features that may be seen by imaging and some rarer lesions that may be included in the differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Imaging methods Retrograde urethrocytography and computed tomography are limited imaging methods for the evaluation of female lower genitourinary changes. Ultrasound plays a role in more specific indications. However, magnetic resonance imaging is usually the method of choice and provides the best identification of the anatomical structures for the diagnosis. Imaging evaluation common alterations will be characterized especially on MRI, as cystic lesions, including Bartholin's gland cyst and urethral diverticulum, as well as prolapses, such as urethral caruncle. Some complications of the common lesions will be included, in addition to tumors or tumor-like lesions, to provide the radiologist ability to perform differential diagnosis. Conclusion MRI is an ideal imaging method to evaluate female lower genitourinary changes, and it is essential that radiologists know how to detect and characterize these lesions, since, even when benign, they can be quite symptomatic.

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## Abstract Archives of the RSNA, 2023

GUEE-55

### Pitfalls of Renal Transplant Imaging

#### Participants

Reece Goiffon, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS1. Discuss the relevant anatomic/imaging considerations, criteria, and imaging techniques for pre-renal donor work-up.2. Become familiar with the normal anatomic features, including location, surgical technique, and relevant hilar anastomoses following renal transplantation as well as the normal grayscale and color/power Doppler imaging features of a renal allograft.3. Review common pitfalls encountered both during pre-renal transplantation work-up and during evaluation of the renal allograft post-transplantation with particular attention to accurate diagnosis of post-transplant complications.4. Highlight the important roles of both computed tomography (CT) and ultrasound (US) in pre- and post-renal transplant evaluation.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINEWe present a comprehensive review of normal pre- and post-renal transplant imaging as well as a review of potential pitfalls in both the pre-transplant imaging work-up and post-transplant allograft evaluation.Pre-renal transplant pitfalls may include:• Incidental arteriopathies (e.g. fibromuscular dysplasia)• Aberrant vascular anatomy• Incidental primary renal neoplasms• Other incidental malignancyPost-renal transplant pitfalls may include:• Postoperative edema at the arterial anastomosis• Renal vein thrombosis with diastolic flow reversal in the transplant renal artery• Postoperative fluid collections (seroma vs hematoma vs urinoma vs lymphocele)• Allograft malignancy

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## Abstract Archives of the RSNA, 2023

GUEE-56

### Imaging of Upper Urinary Tract Neoplasms

#### Participants

Miriam Gallego Casals, MD, Sabadell, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Upper urinary tract urothelial carcinoma (UTUC) stands for only 5-10% of all urinary tract tumors and is mainly represented by transitional cell carcinoma (TCC, >95%). TCC usually develops in males around 65 and is related with many chemical compounds and urinary stasis (that is why it is more common in the bladder rather than on the ureter). Haematuria is the most frequent symptom, although non-specific, and urine cytology is usually negative. Commonly multifocal, with a high incidence of early recurrence, requires rigorous urothelial surveillance. CT urography has largely replaced any other imaging techniques, using contrast media to outline the collecting system. As UTUC can be challenging to identify on routine imaging, we use a series of cases to illustrate the most common patterns and signs that help us identify these tumors: a soft tissue density filling defect that enhances lightly is the most typical finding. Other types such as the non-papillary is infiltrative and harder to detect, often invading beyond the mucosa at the time of diagnosis. In the renal pelvis, these tumors do not change renal contours even when large. Instead, small ureteral tumors are more likely to obstruct the kidney and cause renal malfunction. We explain through several cases how to distinguish UTUC from other neoplasms or benign processes, dividing these UTUC mimickers in two groups: - Filling defects pitfalls: clots, calculi, mycetomas, etc- Urothelial thickenings: lymphoma, tuberculosis, schistosomiasis, etc

#### TABLE OF CONTENTS/OUTLINE

Brief description of epidemiologic and pathologic characteristics of the tumors of the upper urinary tract. Discussion of patterns and signs that indicate their presence, and some pitfalls.

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## Abstract Archives of the RSNA, 2023

GUEE-57

### Imaging Assessment for Penile Prostheses Complications: What the Radiologists Should Know

#### Participants

Sofia Bretos Azcona, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the types of penile prostheses and their components and findings on imaging techniques. To review the possible complications associated with penile prostheses and the role of imaging in their assessment and surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. Types of penile prostheses 1.1. Semi-rigid/maleable prostheses. 1.2. Hydraulic prostheses. 1.2.1. Two pieces hydraulic prosthesis 1.2.2. Three pieces hydraulic prosthesis 1.2.3. Low-profile reservoir three pieces hydraulic prosthesis. 2. Radiological evaluation of penile prostheses. 2.1. Radiography 2.2. Ultrasound 2.3. CT scan 2.4. MRI 3. Expected imaging findings on complications related to penile prostheses and the role of imaging in their assessment. 3.1. Immediate surgical complications 3.2. Related to mechanical failure 3.2.1. Autoinflation of cylinders 3.2.2. Leakage 3.2.3. Fractures 3.2.4. Aneurysm of cylinders 3.2.5. Reservoir complications 3.3. Related to malposition of the prostheses components. 3.3.1. Erosion 3.3.2. Migration 3.3.3. Crossover 3.3.4. Buckling 3.3.5. Floppy glans syndrome 3.4. Imaging findings on infected prostheses 3.4.1. Early infection 3.4.2. Late infection 4. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GUEE-58

### **Urothelial-phase CT Urography for Diagnosing Urothelial Tumors: A Paradigm Shift for Investigating Hematuria**

#### **Participants**

Nigel Cowan, PhD, FRCR, Cosham, United Kingdom (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Urothelial-phase CT urography (25-50 s post contrast administration) is considered a paradigm shift in the development of CT urography for diagnosing urothelial tumors and investigating hematuria. Urothelial tumours are hypervascular and display early hyperenhancement following contrast administration. Familiarity with the signs of urothelial tumours on urothelial-phase CT enables radiologists to make the diagnosis on both GU and non-GU studies. Urothelial-phase compared with excretory-phase CT urography has many advantages. These include shorter examination time, increased patient throughput, no need for complicated patient related manoeuvres to promote full opacification, improved tumour visualisation in cases of hydronephrosis, hydroureter and contrast layering and reduced false positive diagnoses. The diagnostic accuracy of urothelial-phase imaging for urothelial tumors is high. Diagnosis of urothelial tumors using urothelial-phase CT urography makes the excretory-phase redundant.

#### **TABLE OF CONTENTS/OUTLINE**

A brief 25 year history of CT urography for investigating hematuria. The evolution of CT urography techniques. A comparison of urothelial-phase with excretory-phase CT urography for diagnosing urothelial tumors. Definition description of the techniques. Advantages and disadvantages. An atlas of urothelial tumors showing the signs of urothelial tumours on the urothelial-phase and examples of true positive, false negative and false positive results. Development of a confidence scoring system based on urothelial-phase imaging findings to improve report clarification and direct management: straight to surgery, ureteroscopy +/- biopsy or follow-up. Conclusion References

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## Abstract Archives of the RSNA, 2023

GUEE-59

### New Method for Differentiating Stents from Adjacent Urinary Stone Using Dual Energy Spectral CT with Advanced Post-processing

#### TEACHING POINTS

1) To illustrate the limitations of conventional CT imaging in differentiating urinary stones and stents. 2) To illustrate novel techniques and approaches using dual energy spectral CT (DEsCT) to differentiate urinary stones from stents. 3) To demonstrate strategies of selecting appropriate image types with advanced post-processing.

#### TABLE OF CONTENTS/OUTLINE

1) Conventional CT and its limitations • Fixed tube voltage of 120kVp with mA modulation and helical scanning mode. • CT value alone lacks the power to differentiate stones and stents. 2) Advanced CT imaging technologies • Dual-energy CT (80/140kVp) with preset dose levels and Adaptive Statistical Iterative Reconstruction-V (ASiR-V). • Different energy levels, material decomposition (MD) images and effective atomic number (Zeff). 3) Optimal strategies using these technologies • Select appropriate MD basis material pairs such as Calcium/Iodine, Fat/ Calcium, Fat/ Iodine, or Iodine/HAP. • Apply Zeff, Calcium/Iodine and CT value at 70 keV to better differentiate urinary stones and stents.

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## Abstract Archives of the RSNA, 2023

GUEE-6

### The Spectrum of Renal Angiomyolipoma with Radiologic Pathologic Correlation

#### Participants

Jamie Marko, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Renal angiomyolipoma (AML) is a benign mesenchymal neoplasm composed of an admixture of thick-walled dysmorphic blood vessels, smooth muscle cells and adipose tissue. Angiomyolipomas belong to the perivascular epithelioid cell (PEComa) tumor family. 2. Variants of angiomyolipoma include the classic AML, fat-poor AML, epithelioid AML, and AML with epithelial cysts. Angiomyolipoma may occur sporadically or with tuberous sclerosis. 3. The classic variant, which accounts for more than 90% of cases, is confidently diagnosed at imaging by detecting macroscopic fat. Fat is hyperechoic at ultrasound. It has an attenuation  $< -20$  Hounsfield Units at CT and matches the appearance of subcutaneous fat. Fat is T1 hyperintense with loss of signal with fat suppression at MRI. Small areas of fat are detected with chemical shift imaging. 4. Most angiomyolipomas have a benign clinical course. The most frequent complication is retroperitoneal hemorrhage, most common with tumors  $> 4$  cm. Less commonly, angiomyolipoma may invade the renal vein and inferior vena cava. Epithelioid angiomyolipoma has malignant potential and may recur and metastasize.

#### TABLE OF CONTENTS/OUTLINE

1. Review the gross, histologic, and immunohistochemical pathologic features of renal AML, including the uncommon variants. 2. Describe the multimodality imaging features of renal AML, including the uncommon variants. 3. Describe the pathologic basis of the imaging findings associated with each variant. 4. Illustrate the spectrum of renal AML including its variants. Will include important complications including retroperitoneal hemorrhage and vascular involvement.

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## Abstract Archives of the RSNA, 2023

GUEE-60

### Prostate Imaging for Recurrent Reporting (PI-RR): A User Guide

#### Participants

Anup Shetty, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The Prostate imaging for Recurrence Reporting (PI-RR) system was introduced in 2021 to create standards for reporting pelvic MRI after radical prostatectomy or radiation for treatment of prostate cancer. Using a similar nomenclature as PI-RADS v2.1, PI-RR uses established knowledge of MRI features of recurrent prostate cancer and codifies it systematically to be accessible to prostate MR readers of all experience levels. This exhibit is on the RadioGraphics Needs List under Genitourinary Imaging: Pictorial on Guidelines and Reporting Systems. This exhibit will: 1) Discuss the rationale for PI-RR 2) Describe technical standards and reporting guidelines 3) Illustrate the use of PI-RR to assess for recurrent prostate cancer after radical prostatectomy and radiation therapy through a series of instructive cases 4) Describe pitfalls of the current version, including non-applicability for focal therapies 5) Detail areas for future development of PI-RR

#### TABLE OF CONTENTS/OUTLINE

\* Background: Why PI-RR, including the benefits of standardizing post-treatment prostate MRI\* Technical Standards: Requirements, extras (subtraction imaging, 3D volumetric T2 for MPR)\* Reporting: Component scores in the PI-RR system shown in a pictorial format\* Case Examples: Prostatectomy, external beam radiation, brachytherapy\* Pitfalls: Definitions of PI-RR 4/5 for post-prostatectomy based on laterality; susceptibility artifact from brachytherapy seeds and surgical clips; residual prostate tissue after prostatectomy\* Future Development: Focal therapy (cryoablation, HIFU, etc.); Integrating PSMA-PET/CT

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## Abstract Archives of the RSNA, 2023

GUEE-61

**Don't Stress, Just Study With Care, Renovascular Hypertension Will Be Conquered, in Your Test**

### TEACHING POINTS

1. Renovascular hypertension (RH) is the most common and potentially reversible cause of secondary hypertension. However, renal artery stenosis is often found as an incidental finding on routine examinations. Thus, knowledge of the clinical aspects of this pathology is necessary to increase the pre-test probability and the different diagnostic imaging modalities provide subsidies for better therapeutic decisions. 2. Revisit the multiple imaging methods used in the diagnosis of RH (Duplex Doppler Ultrasonography, CT Angiography, MRI Angiography and Renography): protocols, advantages, limitations and the main causes of RH as well as its imaging aspects. 3. Knowledge of invasive treatment options (Percutaneous transluminal renal angioplasty and surgery) and their respective technical aspects, indications and procedural complications.

### TABLE OF CONTENTS/OUTLINE

1. Overview of Renovascular Hypertension (RH) A. Epidemiology B. Physiopathology C. Causes 2. Indications for Testing a Patient for RH: A. Clinical Clues to Enhance the Pre-Test Probability B. Renal Artery Stenosis as an Incidental finding 3. Non Invasive Diagnostic Testing for RH and Expected Findings: A. Duplex Doppler Ultrasonography B. CT Angiography C. MRI Angiography D. Renography E. Contrast-Related Kidney Injury 4. Determining the appropriate time to combine different diagnostic methods 5. Reporting of RH Patient Examination: A. Anatomical Variants B. Most Common Lesion Aspects C. Atherosclerosis D. Fibromuscular Dysplasia E. Complex Lesions 6. Overview of RH Management: A. Percutaneous Transluminal Renal Angioplasty B. Surgery C. Procedural Complications

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## Abstract Archives of the RSNA, 2023

GUEE-62

### Prostate MRI Pitfalls and Confounders: A Case-based Approach

#### Participants

Eduardo Thadeu De Oliveira Correia, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate MRI is widely used for the detection and characterization of prostate cancer. Nonetheless, many conditions can mimic prostate cancer lesions, leading to false positive MRI results. This educational exhibit employs a case-based approach to explore the pitfalls and confounders that arise during the assessment of prostate MRI and guide readers on how to distinguish these benign mimickers from malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

1. A prostate MRI with too many findings a. Case 1: prostate cancer in a MRI done within 4 weeks of prostate biopsy b. Teaching points 2. A must-known confounder a. Case 2: extruded benign prostatic hyperplasia b. Teaching points 3. The importance of clinical history a. Case 3: granulomatous prostatitis b. Teaching points 4. The role of Delayed Contrast Enhancement a. Case 4: prostate abscess b. Teaching points 5. An extremely rare case: know the boundaries! a. Case 5: malakoplakia b. Teaching points 6. Prostate MRI is more than just PI-RADS: check the surroundings! a. Case 6: PI-RADS 5 lesion, ureteral stone and ileo-ileal intussusception b. Teaching points

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## Abstract Archives of the RSNA, 2023

GUEE-63

### Factors that Influence Prostate Cancer Visibility on Multiparametric MRI

#### Participants

Eduardo Thadeu De Oliveira Correia, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Multiparametric MRI (mpMRI) is endorsed by guidelines worldwide as a fundamental tool for the detection and characterization of prostate cancer. Nonetheless, still, 10-20% of patients with clinically significant prostate cancer have a false negative result in mpMRI. In this exhibit, we will review factors that can decrease lesion conspicuity and reduce the detectability of malignant lesions.

#### TABLE OF CONTENTS/OUTLINE

1. What factors can influence Prostate Cancer visibility on mpMRI? a. Histology b. Background Signal Changes c. Image quality 2. Histological determinants of lesion visibility on mpMRI a. Tumor volume b. Gleason/ISUP score c. Epithelium, stroma, and lumen fraction 3. The effect of background signal changes of the peripheral zone on lesion visibility a. Diffusely hypointense peripheral zone on T2WI b. Heterogenous hypointensity in the peripheral zone on T2WI c. Background signal changes in DWI and DCE d. Associated clinical factors and conditions 4. Benign mimickers of prostate cancer on mpMRI a. Prostatitis b. BPH c. Adenosis d. Necrosis e. Focal atrophy 5. Image quality: patient and scanner factors that can decrease lesion conspicuity

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## Abstract Archives of the RSNA, 2023

GUEE-64

### Update on Hereditary Renal Mass Syndromes: Genetics, Renal, and Extrarenal Imaging Findings

#### Participants

Acacia Yoon, Stanford, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review hereditary renal mass syndromes in the context of the 2022 World Health Organization update, which has a stronger emphasis on genetic alterations. 2. Review extrarenal findings associated with each syndromes. A diagnostic approach will be proposed. 3. Understand the role of the radiologist in diagnosis and management. Genetic testing may not be necessary or even specific for certain syndromes; thus, radiologists may be the first to suggest the diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Hereditary renal mass syndromes with multimodality imaging correlates: genetic mutation, inheritance pattern, diagnostic criteria, renal mass subtype(s), extrarenal findings, and management: Birt-Hogg-Dubé, von Hippel-Lindau, tuberous sclerosis complex, succinate dehydrogenase deficiency, fumarate hydratase deficiency, hereditary papillary renal cell carcinoma, PTEN hamartoma syndrome, BAP1 tumor predisposition syndrome, chromosome 3 translocation. 2. Role of the radiologist in diagnosis and management. 3. Diagnostic approach for the radiologist.

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## Abstract Archives of the RSNA, 2023

GUEE-65

### Abnormal Testicular Waveforms: What Do They Mean

#### Participants

Yashant Aswani, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To identify typical and atypical waveforms of testicular torsion 2. To understand and describe the difference between partial and complete testicular torsion 3. To describe the features of torsion-detorsion syndrome 4. To understand the mimics of testicular torsion

#### TABLE OF CONTENTS/OUTLINE

1. Normal testicular blood supply with normal spectral Doppler explained with image and line diagram 2. To illustrate testicular torsion with various examples for clear understanding and interpretation 3. To illustrate examples of partial torsion with various spectral Doppler variations including amplitude of the waveforms, parvus tardus pattern, monophasic waveform and reversal of diastolic flow 4. To illustrate torsion-detorsion with multiple examples. Spermatic knot sign will also be illustrated in detail with images and cine clips 5. To illustrate mimics of testicular torsion such as patients with vasculitis and drug-induced spectral Doppler abnormalities with histopathology correlation

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## Abstract Archives of the RSNA, 2023

GUEE-66

### Magnetic Resonance Imaging for Non-Oncologic Penile Pathology: It's Not that Hard

#### Participants

Daniel Corominas, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The use of Magnetic Resonance Imaging is widespread for oncological pathology of the penis, but its use is of much importance in non-oncological pathology such as Peyronie's disease, penile fracture, and priapism. Intracavernosal drug injection is an option for the treatment of erectile dysfunction, but it is also important for conducting erection imaging studies, so the radiologist must be aware of its method of administration, possible complications, and how to prevent and treat them. Treatment of non-oncological diseases of the penis using penile prostheses has expanded recently. MRI is the method of choice for evaluating their proper functioning, as it provides high-resolution spatial images and it is key to helping urologists determine the need for replacements and repairs.

#### TABLE OF CONTENTS/OUTLINE

1) MRI protocol for non-oncological pathology of the penis. 2) Intracavernosal drug injection: a basic guide for radiologists. 3) Penile anatomy on MRI. 4) Non-oncological pathology of the penis. 4.1) Erectile dysfunction. 4.2) Peyronie's disease. 4.3) Priapism. 4.4) Penile fracture. 5) Penile prosthesis. 5.1) Indications and types of surgery. 5.2) Types of penile prostheses and their components. 5.3) Imaging evaluation of the penile prosthesis: importance of MRI. 5.4) Evaluation of the penile prosthesis complications. 5.4.1) Cylinders and shafts complications. 5.4.2) Glans mobility alterations. 5.4.3) Reservoir malposition. 5.4.4) Circuit rupture and prosthesis malfunction. 6) Conclusions and future directions.

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## Abstract Archives of the RSNA, 2023

GUEE-67

### Urethral Pathologies in Male Patients: Evaluation with Magnetic Resonance Urethrography - A Pictorial Essay

#### Participants

Kamila Schiavini, MD, SAO LUIS, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TP1 Magnetic resonance imaging (MRI) is a promising imaging modality for the comprehensive evaluation of urethral pathologies, providing high resolution and multiplanar imaging capabilities without the need for radiation or invasive procedures. TP2 MRI can accurately identify and assess the extent of anterior and posterior urethral strictures, as well as fistulous tracts with adjacent organs, and can aid in the evaluation of postoperative complications. TP3 Urethral strictures can result from traumatic or inflammatory causes and can lead to obstructive uropathy. Posterior urethral injuries commonly result from pelvic trauma, while anterior urethral strictures can result from instrumentation or inflammation. TP4 MRI provides a non-invasive and radiation-free alternative to traditional imaging techniques, such as urethrocytography, which can be limited by poor visualization of urethral strictures and invasiveness. TP5 MRI can also be used to evaluate other pathologies of the male genitourinary tract, including prostate cancer and penile cancer.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of traditional urethral imaging techniques B. Advantages of MRI for comprehensive evaluation of urethral pathologies II. Methodology A. Patient selection and imaging protocol B. MRI findings in anterior and posterior urethral strictures and fistulas III. Discussion A. Traumatic and inflammatory causes of urethral strictures B. MRI evaluation of postoperative complications C. Comparison of MRI with traditional urethral imaging techniques IV. Conclusion A. Summary of the advantages of MRI in the evaluation of urethral pathologies B. Potential implications for clinical practice and patient outcomes

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## Abstract Archives of the RSNA, 2023

GUEE-68

### Unveiling the Masked Masqueraders: Navigating Anatomical Variations and Adenocarcinoma Mimickers in Prostate Multiparametric MRI

#### Participants

Enis Yilmaz, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Multiparametric MRI (mpMRI) is the imaging modality of choice in assessment of prostate adenocarcinoma (PCa). However, various conditions involving the prostate might resemble PCa due to their imaging characteristics and these patients might undergo unnecessary biopsy procedures. Our aim is to review some of the entities that could be a pitfall for readers and outline their key imaging findings to differentiate them from PCa.

#### TABLE OF CONTENTS/OUTLINE

(1) Overview of prostate anatomy and typical imaging characteristics of PCa. (a) Central Zone (b) Anterior fibromuscular stroma (c) Bulbourethral glands (Cowper's glands) (2) Conditions that may mimic PCa and their appearance at mpMRI: (a) Acute and chronic bacterial prostatitis (b) Tuberculous prostatitis (c) Granulomatous prostatitis (d) Prostate abscess (e) Intraprostatic calcification (f) Mucinous neoplasm of prostate (g) Stromal Tumor of Uncertain Malignant Potential of the Prostate (STUMP) (h) Biopsy related hemorrhage (i) Post-focal treatment prostate (j) Exophytic BPH nodule (k) Small cell carcinoma of the prostate (3) Hints that could be helpful in differentiation of PCa and PCa mimickers (4) Summary of findings

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## Abstract Archives of the RSNA, 2023

GUEE-69

### Practical Approach to Primary Retroperitoneal Tumors: Tips for An Imaging Diagnosis

#### Participants

Shota Kondo, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

a. For a differential imaging diagnosis of primary retroperitoneal tumors, a focus on the principal tumor features, e.g. fat, cystic components, a mucinous matrix, and necrosis is important. b. On images of well-differentiated liposarcomas the fat component predominates. In other histological types of liposarcomas it is not large and it may not be identifiable. c. High signal intensity on T2-weighted MRI scans with delayed contrast enhancement indicates a myxoid stroma that may be, for example, myxoid liposarcoma, schwannoma, or myxofibrosarcoma. d. Retroperitoneal tumors with a predominantly cystic component commonly include benign lesions such as lymphatic malformations, tail gut cysts, and ancient schwannomas. e. Common primary retroperitoneal malignancies such as leiomyosarcoma, undifferentiated pleomorphic sarcoma, and liposarcoma often have a necrotic appearance, suggesting a poor prognosis.

#### TABLE OF CONTENTS/OUTLINE

1. Retroperitoneal anatomy 2. Diagnostic algorithm and clinical management of primary retroperitoneal tumors 3. Imaging findings of various primary retroperitoneal tumors 4. Utility of 18F-FDG-PET/CT for diagnosing primary retroperitoneal tumors 5. Tips for avoiding diagnostic pitfalls and for clinical management

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## Abstract Archives of the RSNA, 2023

GUEE-7

### Multiparametric MR Urethrography (MRU): Dynamic Comprehensive Evaluation of the Male Urethra

#### Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the optimal technique for a comprehensive MRU protocol including the instillation of sterile urethral jelly, multiparametric sequences, and dynamic maneuvers. Identification of normal urethral anatomy on MRU including evaluation of periurethral compartments in both static and dynamic images. Describe how each component of MRU is crucial for the evaluation of common, uncommon, and rare urethral pathology.

#### TABLE OF CONTENTS/OUTLINE

MRU has revolutionized the imaging of the male urethra. Patient preparation: in the supine position and the penis in the anatomic position with an injection of lidocaine gel for urethral distension. Imaging protocol and interpretation high-spatial resolution, small FOV, multiplanar T2WI, to provide the best anatomic overview. T1WI is useful for assessing hemorrhage and vascular thrombosis, while the DCE is useful in evaluating masses and differentiation between fibrosis and inflammation. DWI assists in the depiction of a urethral mass and skips lesions. Dynamic maneuvers, with Valsalva and urination, are also performed to assess the sphincters and pelvic floor. Clinical applications: value of MRU in multiple specific clinical indications will be discussed, including urethral strictures, diverticula, fistulas, trauma, cancer staging, infections/inflammation. Conclusion MRU is an ideal one-stop replacement for traditional fluoroscopic urethrography, with growing data in the literature in recent years.

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## Abstract Archives of the RSNA, 2023

GUEE-70

### Prostate Cancer Strikes Back! A Pictorial Review of Local Recurrence and the PI-RR Score

#### Participants

Bernardo Oliveira, MD, MBA, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the main finding of prostate local recurrence on magnetic resonance imaging. To review the new PI-RR score and learn how to apply it. To gain experience in prostate recurrence MR evaluation through clinical cases.

#### TABLE OF CONTENTS/OUTLINE

Introduction - First Things First Basic clinical concepts you should know before reading the MR imaging (PSAd, PSA doubling time, and more). Getting familiarized with the normal male pelvis after radical prostatectomy and radiotherapy. A brief review about the new PI-RR score system. Discussion - Prostate Cancer Strikes Back A prostate cancer local recurrence case collection, focusing on MR imaging. Summary - It's your turn to strike back! Learn tips and tricks to enhance your skills.

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## Abstract Archives of the RSNA, 2023

GUEE-71

### The 'New' 2022 World Health Organization (WHO) Classification of Adrenal Cortical Tumors: A Primer for Radiologists

#### Participants

Nuray Bakal, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize audience with 'new' 2022 World Health Organization (WHO) classification of adrenal cortical tumors (ACTs) Describe the pathology, genetics, molecular biology natural history of ACTs. Review imaging spectrum of benign malignant ACTs discuss the role of imaging in the screening, diagnosis, staging, and surveillance Discuss the potential diagnostic management implications of the current classification

#### TABLE OF CONTENTS/OUTLINE

Introduction The spectrum of adrenal cortical lesions Updates in WHO classification Pathology, Genetics Molecular Biology Genetic Syndromes: Li-Fraumeni, Lynch, MEN1. Imaging Techniques: US, CT, MRI PET-CT Congenital adrenal hyperplasia Adrenocortical nodular disease: Sporadic nodular, Bilateral micronodular, Bilateral macronodular Cortical adenomas: typical/atypical imaging findings Primary aldosteronism: HISTALDO classification imaging findings Cortisol-producing adenomas Cortical carcinoma: imaging spectrum Adrenal Myelolipoma Adrenal rests, adrenal Cysts. Rare tumors: melanoma, adenomatoid tumors sex cord-stromal tumors Role of imaging in screening surveillance of ACTs other lesions Diagnostic Management Implications of 2022 WHO Classification Imaging biomarkers. Conclusion The new 2022 WHO classification of ACTs highlights the importance of molecular genetic features in characterizing classifying ACTs and updated terminology for select pathologies. The pivotal role of CT/MRI/PET-CT imaging features in the diagnosis, treatment surveillance of cortical tumors is discussed. Familiarity of radiologists with new ACTs subtypes associated imaging findings helps to accurately identify and characterize ACTs.

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## Abstract Archives of the RSNA, 2023

GUEE-72

### **Pictorial Review of the Diagnosis of Muscle-Invasive Bladder Cancer Using Vesical Imaging-Reporting and Data System (VI-RADS)**

#### **Participants**

Mitsuru Takeuchi, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The Vesical Imaging-Reporting and Data System (VI-RADS) is a standard MRI imaging and diagnostic method for muscle-invasive bladder cancer that was published in 2018. As a member of the VI-RADS committee, I was involved in the development of the diagnostic criteria. Several studies have demonstrated that VI-RADS has excellent sensitivity and specificity for muscle-invasive bladder cancer. However, reading VI-RADS requires some expertise, and there are various pitfalls. Therefore, this exhibition will first explain the basic MRI reading procedure for bladder cancer. Then, based on my experience of reviewing MRI images of approximately 300 cases of bladder cancer with trainees, we will discuss the causes of misdiagnosis and precautions to prevent misdiagnosis by presenting case images. Furthermore, limitations of the current VI-RADS diagnostic criteria will also be addressed.

#### **TABLE OF CONTENTS/OUTLINE**

1) Basic procedure for reading bladder MRI 1-a) Role of multiparametric MRI 1-b) Imaging findings of tumor stalk and thickened submucosa 1-c) Categorizing bladder cancer according to VI-RADS diagnostic criteria 2) Teaching file, misdiagnosed cases by trainee, consideration of the cause and suggestions for improvement 2-a) Problems with the patient's condition or imaging 2-b) Misdiagnosis due to insufficient reading skill 2-c) Misdiagnosed cases caused by the limitation of current VI-RADS diagnostic criteria 2-d) Difficult to diagnose bladder cancer with atypical histology and imaging findings

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## Abstract Archives of the RSNA, 2023

GUEE-73

### Visualizing Dynamic Mechanisms of Lower Urinary Tract Symptoms (LUTS): Usefulness of Urodynamic 4D-CT

#### TEACHING POINTS

- Providing required items for LUTS surgery • CT Scanning technique for LUTS • Benefits of 4D-CT scanning for urination evaluation
- Morphological Evaluation before after surgery

#### TABLE OF CONTENTS/OUTLINE

A. Morphological and functional evaluations are important. B. Morphological evaluation is required for bladder, urethra, prostate. Scanning is performed in a semi-seated position to reproduce a physiological urination state. 4D-CT uses intermittent scanning to reduce radiation exposure from the beginning to the end of urination. C. "Using 4D-CT can evaluate morphological changes in the bladder, prostate, and urethra and the location and timing of bladder outlet obstruction that occurs at the start of urinary flow, and urodynamic information." D. Analysis of the volume data enables pre and post operative comparisons. Evaluation using CT can show the effectiveness of quantitative evaluation. Outline "4D-CT is particularly effective in judging the applicability of operation and evaluating kinetic and morphological data in cases of prostate problems without morphological changes and dysuria due to a small decrease in uroflow intensity due to insufficient strength of the urethral sphincter muscle." There are cases in which surgery was indicated for patients whose anatomical structure deviated from the ideal. 4D-CT can evaluate morphology and function. So, it is useful for surgical indication and surgical planning.

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## Abstract Archives of the RSNA, 2023

GUEE-74

### The Role of Imaging Techniques in Penile Lesions: When and How to Use Them

#### Participants

Sandra Baleato Gonzalez, PhD, Santiago de Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To illustrate normal US and MR penile anatomy. 2. To review the spectrum of traumatic and atraumatic lesions involving the penis highlighting the typical and atypical sonographic and MR appearances of pathologic disorders, with special emphasis on distinctive and subtle findings that may clarify the diagnosis. 3. To discuss the value of other imaging techniques (CT, PET-CT, arteriography, urethrography) in penile pathology.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. General features and basic concepts. 2. Anatomy. US and MR anatomy and imaging protocol. 3. Vascular disorders (Mondor disease, partial thrombosis of the corpus cavernosum, high flow and low-flow priapism). 4. Trauma. (Penile fracture, urethral injury, post-traumatic arterial penile fistula, extratunical hematoma and intracavernosal hematoma). 5. Inflammation (Cellulitis, abscess, fistula and gangrenous cavernositis). 6. Benign lesions (Peyronie disease, cavernous hemangioma, median raphe cyst, epidermoid cyst and so on). 7. Malignant lesions (Primary penile cancer and penile metastasis). 8. Summary.

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## Abstract Archives of the RSNA, 2023

GUEE-75

### The Perils of Prostate MRI: How to Best Avoid Common Imaging Pitfalls

#### Participants

Amanda Gibson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Prostate MR is a robust imaging modality with emerging utilization in screening, tumor characterization, surveillance, risk stratification, and local staging of prostate cancer. 2. The inherent complex anatomy of the prostate gland, coupled with advancements in MRI technology and varied pathologies affecting the prostate, result in several potential pitfalls in MR image interpretation. 3. To ensure accurate interpretation, the radiologist must be familiar with the appearance of normal prostate anatomy, as normal variations can mimic clinically significant cancer, as well as benign entities which could simulate or mask cancer.

#### TABLE OF CONTENTS/OUTLINE

1. Review normal anatomy of the prostate on MR with focus on central zone and anterior fibromuscular stroma 2. Illustrate benign prostatic pathologies and ways in which their imaging may mimic prostate cancer - Normal anatomic structures and expected postprocedural sequela that mimic cancer - Noncancerous abnormalities that may mimic cancer - Artifacts which may mimic or mask cancer 3. Describe locoregional invasion of prostate cancer beyond neurovascular bundles and capsular disruption 4. Highlight case-based teaching points with normal and abnormal prostate MRI 5. Provide flowchart guide on different interpretation pathways when reading prostate MRI for both junior and seasoned radiologists

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## Abstract Archives of the RSNA, 2023

GUEE-76

### Imaging and Management of Renovascular Hypertension: State-of-the-Art

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the pathophysiology of renovascular hypertension (RHT) 2. To discuss the role of multimodality imaging in the diagnostic pathway of RHT 3. To illustrate the imaging appearances of various causes of RHT 4. To review the role of interventional management of RHT.

#### TABLE OF CONTENTS/OUTLINE

1. RENOVASCULAR HYPERTENSION- DEFINITION 2 .IMAGING MODALITIES- Ultrasound, doppler; CTA, Photon counting CT; MRA- Contrast and non contrast techniques (3D SSFP, Phase contrast), 4D flow; Catheter angiography; Nuclear medicine; 3. DISCUSSION OF ETIOLOGIES OF RENAL HYPERTENSION WITH MULTIPLE CASE EXAMPLES - Non-stenotic lesions (via renal artery compression and/or changes in renal perfusion) o Renal artery aneurysm o Renal arteriovenous fistula - Stenotic lesions (via renal artery compression/occlusion) o Atherosclerotic disease o Fibromuscular dysplasia o Neurofibromatosis type 1 o Midaortic syndrome o Dissection o Vasculitis (Polyarteritis nodosa ,Takayasu arteritis) o Trauma o Retroperitoneal fibrosis/radiation o Thromboembolism 4. ROLE OF IMAGING IN EXCLUDING OTHER CAUSES OF REFRACTORY HYPERTENSION- Endocrine- pheochromocytoma, hyperaldosteronism, Cushing's, thyroid dysfunction, hyperparathyroidism; Renal parenchymal disease; Mid aortic syndrome, coarctation; 5. IMAGING APPROACH FOR RHT 6. END-ORGAN ASSESSMENT- Kidneys, Heart, brain 7. TREATMENT- Optimal management is individualized to patient clinical context and dependent on etiology of renovascular hypertension; Medical - antihypertensives (i.e. ACE inhibitors/ARBs); Interventional- Angioplasty, stenting; Surgical

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## Abstract Archives of the RSNA, 2023

GUEE-77

### Bosniak IV Cystic Masses: A Tough Nut to Crack

#### Participants

Ignacio De Garcillan, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To revise Bosniak IV cystic mass v 2019 CT and MRI features.- To review possible pitfalls: interpretative, technical, and mass related.- To illustrate several Bosniak IV cases from our hospital.

#### TABLE OF CONTENTS/OUTLINE

In 2019 a new Bosniak classification version was published providing a detailed description of Bosniak IV category features. Its main objective was to increase specificity. Nevertheless, interpretation and classification of septa and nodule in each category remains challenging. In this exhibition we will focus on Bosniak IV cystic masses. Each feature will be revised and discussed to avoid misinterpretation. Potential pitfalls will be reviewed: interpretative quantitative and qualitative features, technical concerns, and mass related issues. Examples of these pitfalls will be exhibited with several recommendations to avoid them: zooming, multiplanar reconstruction, exclusive enhancing septa measuring, subtraction imaging, best quality sequence and examination selection, temporal evolution, employing Bosniak classification when applicable etc. Bosniak IV cystic masses diagnosed at our centre will be illustrated with different imaging techniques. Several clear cell renal carcinomas with cystic transformation, papillary carcinoma, clear cell papillary renal cell tumour, multilocular cystic neoplasm, fumarate hydratase- deficient renal carcinoma and unclassifiable renal carcinoma will be shown.

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## Abstract Archives of the RSNA, 2023

GUEE-78

### What Can Go Wrong When Doing Right? Iatrogenic Genitourinary Complications

#### TEACHING POINTS

1. A growing number of systemic, minimally invasive, and surgical treatment modalities for various genitourinary (GU) pathologies may lead to various unique iatrogenic complications. Diagnostic imaging plays an essential role in detection and subsequent management. 2. A multimodality approach to identifying iatrogenic GU complications is key for prompt diagnosis to prevent morbidity. For example, both multiphasic CT urogram and fluoroscopic antegrade nephrostogram can be utilized to confirm ureteral injury. 3. Knowledge of key imaging findings and mimics of complications are important to prevent misdiagnosis and mistreatment as well as to distinguish expected post treatment appearance from complication.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction  
1. Review of treatment modality types for various GU pathologies (both benign and malignant)  
2. Pictorial review of genitourinary anatomy and areas prone for iatrogenic injury  
• Essential GU anatomical structures  
• Common postsurgical anatomy  
• Discussion on the radiosensitivity of the GU system  
B. Multimodality approach to identifying GU complications  
1. Decision tree on selecting the most optimal imaging type for common complications  
C. Case-based imaging review of iatrogenic GU complications  
1. Systemic treatment  
2. Minimally invasive interventions  
3. Surgical intervention

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## Abstract Archives of the RSNA, 2023

GUEE-79

### Magnetic Resonance Imaging Review and Virtual Biopsy of Common Solid Renal Masses

#### Participants

Luis Calimano-Ramirez, Jacksonville, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Relevant anatomic review of the renal system. 2. Review multiple cases with magnetic resonance imaging features of neoplastic pathology. 3. Review correlation with pathology result to examine the function of magnetic resonance imaging as means of virtual biopsy toward identifying renal mass characteristics in selected cases.

#### TABLE OF CONTENTS/OUTLINE

1. Neoplastic pathologies: I. Benign etiology: a. Renal leiomyoma b. Renal Angiomyolipoma c. Renal Oncocytoma d. Renal plamacytoma e. Solitary fibrous tumor. II. Malignant etiology: a. Clear Cell Renal cell Carcinoma b. Papillary Cell Carcinoma c. Medullary Renal Cell Carcinoma d. Collecting Duct Carcinoma e. Urothelial Cell Carcinoma f. Renal Lymphoma.2. Inflammatory etiology: a. Xanthogranulomatous Pyelonephritis.

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## Abstract Archives of the RSNA, 2023

GUEE-8

### Imaging of Renal Cancer: The Past, The Present, and The Future

#### Participants

Alex Chung, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Many benign cystic and solid renal lesions can be reliably distinguished on multiple imaging modalities such as US, contrast-enhanced US (CEUS), CT and MRI, including Bosniak I/II cysts and fat-rich angiomyolipoma (F-AML).-Among indeterminate renal lesions such as clear cell renal cell carcinoma (ccRCC), papillary renal cell carcinoma (pRCC), chromophobe renal cell carcinoma (chrRCC), oncocytoma (Onc) and fat-poor angiomyolipoma (FP-AML), the enhancement characteristics and other parameters can further characterize the renal lesions.-Likert-based CT and MR likelihood scores for renal masses can help stratify the risk of indeterminate renal lesion for active surveillance or surgical management.-Novel imaging parameters and artificial intelligence will further assist in imaging characterization of indeterminate renal lesions.

#### TABLE OF CONTENTS/OUTLINE

-Introduction.-Normal Anatomy and Conventional Imaging Technique.-Imaging Findings/Pathology.-Enhancement characteristics including Mean Enhancement, Absolute Enhancement, Relative Enhancement, Absolute De-enhancement and Relative Washout.-Likelihood scores to aid risk stratification.-Novel imaging parameters and artificial intelligence, including 99mTc-sestamibi SPECT, Perfusion, Radiogenomics and Machine/Deep learning.-Biopsy of Renal Masses

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## Abstract Archives of the RSNA, 2023

GUEE-80

### Urine the Wrong Place - When Urine Leaves the Urinary Tract. A Review of Urine Leaks and Urinary Tract Fistulas

#### TEACHING POINTS

The presentation of urine leaks and fistulas can be variable; however, a good patient history will usually raise suspicion for these entities. It is important to understand the pathology of urinary leaks and fistulas as well as the expected anatomy, including normal and post-operative, to understand the imaging findings. Familiarity with the principles of CT urogram is crucial in distinguishing blood from urine in trauma and post-operative patients to accurately make a diagnosis. The radiologist plays a vital role in these cases in recommending and troubleshooting follow up imaging as well as in guiding clinicians in their management. Management usually involves urinary diversion, which interventional radiology plays a large role in.

#### TABLE OF CONTENTS/OUTLINE

1) Review of normal male and female urinary tract anatomy and expected post-operative findings 2) Review of urinary tract imaging protocols - CT urogram, cystograms 3) Renal leaks - traumatic, spontaneous 4) Ureteral leaks - traumatic, iatrogenic 5) Bladder leaks - traumatic, iatrogenic, spontaneous 6) Urinary tract fistulas 7) Treatment/management options - IR interventions for urinary diversion

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## Abstract Archives of the RSNA, 2023

GUEE-81

### MRI after Focal Therapy for Prostate Cancer: What Radiologists Must Know

#### TEACHING POINTS

-Overview of the currently available focal treatments for prostate cancer: indications, contraindications, and techniques.-Review of potential complications of each procedure: frequency, diagnosis, and management.-Discussion of expected postoperative MRI findings of each procedure: early and late.-Review of imaging findings of recurrent prostate cancer post focal treatment: diagnosis, mimics, and management.-Discussion of potential pitfalls.

#### TABLE OF CONTENTS/OUTLINE

Introduction-Rationale for focal therapy.-Potential benefits.-Criticisms to focal therapy.-Importance for radiologists and urologists.Treatment options-Electroporation (NanoKnife): Technique, Post-op appearance (Early and Late), Complications, Recurrence.-HIFU (FocalOne and TULSA): Technique, Post-op appearance (Early and Late), Complications, Recurrence.-Cryoablation: Technique, Post-op appearance (Early and Late), Complications, Recurrence.-Laser Ablation: Technique, Post-op appearance (Early and Late), Complications, Recurrence.

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## Abstract Archives of the RSNA, 2023

GUEE-82

### Advances in MRI Techniques for Evaluation of Upper Urinary Tract Neoplasms: A Comprehensive Review

#### Participants

Mohamed A. El-Ghar, MD, Mansoura, Egypt (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Familiarizing with the different advanced MRI techniques used in the evaluation of renal neoplasms, including diffusion-weighted imaging (DWI), intravoxel incoherent motion (IVIM) MRI, Diffusion Tensor Imaging (DTI), Blood oxygen level dependent (BOLD) MRI and Arterial spin labeling (ASL). 2. Identifying the advantages and limitations of conventional and advanced MRI techniques in the evaluation of renal neoplasms, how they can improve diagnostic accuracy, characterization of the masses and treatment planning. 3. Understanding the role of MRI in the staging renal neoplasms, and if their role for the new techniques. 4. Familiarizing with the current guidelines and recommendations for the use of MRI in the evaluation of renal neoplasms. 5. Identifying potential areas for future research and development in the field of MRI for the evaluation of renal neoplasms, including the use of artificial intelligence and machine learning algorithms to improve diagnostic accuracy and reduce interpretation variability.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction - Definition and incidence of upper urinary tract neoplasms - Importance of accurate diagnosis and staging - Overview of MRI techniques for evaluation II. Conventional MRI Techniques -T1- and T2-weighted imaging -Contrast-enhanced imaging -Limitations and challenges III. Advanced MRI; DWI MRI, IVIM-MRI,DTI-MRI, BOLD-MRI, ASL, Comparative advantages of advanced techniques • IV. Applications in Upper Urinary Tract Neoplasms • Diagnosis and characterization of renal masses • Differentiation between benign and malignant tumors • Staging of malignant masses • V. Clinical Implications and Future Directions • VI. Conclusion

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## Abstract Archives of the RSNA, 2023

GUEE-83

### How to Do a Urethrogram... in Less than 15 Minutes and with No Special Equipment

#### TEACHING POINTS

- Urethrograms are nothing to be afraid of;
- We have developed a technique that is well-tolerated, can be performed in less than 15 minutes, and requires no specialist equipment;
- This exhibit explains how to perform our technique for both males and females;
- We also illustrate the important anatomical structures, pitfalls, and complications of this technique.

#### TABLE OF CONTENTS/OUTLINE

The ideal urethrogram should be quick, well-tolerated, provide high-quality diagnostic images and, if possible, not require any special equipment. At our institution, we have stopped using Knutson's clamps and balloon-occlusion catheters, and now perform approximately 15 studies per week with just 6Fr and 10Fr catheters. The technique we have developed is quick, well-tolerated and provides diagnostic images of the whole (a) anterior and (b) posterior urethra: a) A 10Fr catheter is inserted into anterior urethra. The patient compresses the distal penile shaft while the anterior urethra is imaged in two oblique planes. A release view (with hand suddenly removed) allows the urethra to decompress and distends the submeatal urethra, visualised on fluoroscopy at 3-4 frames/sec; b) The bladder is filled via a catheter or via retrograde instillation (we discuss both methods). The patient voids for a descending study in the oblique plane. We also discuss a rapid '5min urethrogram' in patients without tight strictures, which only requires inserting a catheter once. Adaptions are covered for the following scenarios: i) Tight strictures; ii) Occlusive segments; iii) The female urethra; iv) Pericatheter studies. The relevant common pitfalls and uncommon complications of this technique are also discussed.

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## Abstract Archives of the RSNA, 2023

GUEE-84

### Evolving Role of Conventional Imaging for Prostate Cancer in the Era of PSMA PET

#### Participants

Hiroaki Takahashi, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate-Specific Membrane Antigen (PSMA)-targeted positron emission tomography (PET) imaging is increasingly utilized for evaluating patients with high-risk prostate cancer (PCa) or recurrent PCa. The current National Comprehensive Cancer Network (NCCN) guidelines describe that conventional imaging is not a prerequisite to PSMA-PET for PCa staging. However, we have witnessed growing demand for conventional imaging as a confirmatory test for indeterminate findings on PSMA PET. PSMA-avid lesions other than PCa metastasis may cause false-positive observations, whereas PCa metastases to PSMA avid organs result in false-negative observations. Further, in conjugation with PSMA PET, prostate MRI has better performance in assessing the primary PCa, as well as local recurrence. In this context, PSMA PET does not replace conventional imaging, but does change the way in which conventional imaging is used. This exhibit will discuss the strategic approach of conventional PCa imaging in the era of PSMA PET. The purposes of this exhibit are: 1. To review the evolving role of conventional PCa imaging in the era of PSMA PET. 2. To discuss strategies to address recently recognized PSMA PET imaging pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Fundamental mechanism and imaging interpretation of PSMA PET. 2. Role of conventional PCa imaging: focusing on imaging pitfalls of indeterminate findings on PSMA PET.- Assessment of primary PCa.- Assessment of local recurrence.- Assessment of metastases involving lymph nodes, bones, and solid organs. 3. Summary.

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## Abstract Archives of the RSNA, 2023

GUEE-85

### Urinary Bladder Diverticula: Imaging Features and Complications

#### Participants

Grace Zhu, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe different categories of urinary bladder diverticula with comparison to normal urinary bladder.  
2. Discuss urinary bladder diverticula multimodal imaging features  
3. Provide a case-based review of urinary bladder diverticula complications

#### TABLE OF CONTENTS/OUTLINE

1. Description of the different types of urinary diverticula  
A. Describe histology of normal urinary bladder and diverticula  
B. Highlight features of true and false urinary bladder diverticula  
2. Imaging of urinary bladder diverticula  
A. Describe features of uncomplicated urinary bladder diverticula  
B. Identify pitfalls that prevent optimal imaging  
3. Provide examples of diverticula mimics  
3. Case based review of urinary bladder diverticula complications  
A. Urine stasis and urinary bladder diverticula pathology  
B. Diverticular stones  
C. Diverticula and urinary tract infection  
D. Cancer and staging consideration in diverticula  
E. Incomplete voiding and obstruction

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## Abstract Archives of the RSNA, 2023

GUEE-86

### The Crucial Role of Ultrasound in the Detection of Renal Transplantation Complications

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To know the essential role of ultrasound in the detection of renal transplant complications.
- To describe the systematic to follow when performing an ultrasound of renal transplantation.
- To learn the typical ultrasound findings of renal transplant complications.
- To be able to recognize those cases in which it will be necessary to complete the study with another tests in order to confirm the suspected diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Doppler ultrasound is one of the control tests routinely performed on all patients 24-48 hours after renal transplantation, as well as subsequently according to their evolution. Thanks to ultrasound, we can assess the state of the renal graft and rule out the existence of associated complications, which may be divided into: 1. Vascular complications: - Renal artery stenosis. - Renal artery thrombosis. - Renal vein thrombosis. - Pseudoaneurysm. - Arterio-venous fistula. 2. Urological complications: - Ureteral obstruction. 3. Perirenal collections: - Hematoma. - Urinoma. - Abscess. - Lymphocele. 4. Parenchymal complications: - Acute tubular necrosis. - Acute rejection. - Immunosuppressant toxicity. 5. Other complications: - Lithiasis. - Renal graft infections (early and late). - Chronic rejection. In this paper we will detail the ultrasound findings that characterize these complications, through representative images of cases belonging to our institution. We will also explain those patients in which it was necessary to perform additional studies to confirm the suspected diagnosis.

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## Abstract Archives of the RSNA, 2023

GUEE-87

### Penile Ultrasound: A Pictorial Review of the Anatomy and the Most Relevant Pathologies

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To become familiar with the normal sonographic appearance of the penile structures, as well as to know its arterial and venous vascularization.- To understand the technique of intracavernous injection of vasoactive substances, along with the normal response of vascular structures.- To review the main pathologies affecting the penis and their sonographic findings.

#### TABLE OF CONTENTS/OUTLINE

1. Penile anatomy by ultrasound: to recognize the anatomical structures in conjunction with the arterial and venous vascularization.2. Main penile pathologies: - Peyronie disease: its diagnosis is clinical, but ultrasound can confirm its presence, determine the extent of plaques and rule out a possible associated erectile dysfunction. - Erectile dysfunction: through intracavernous injection of vasoactive agents (PGE1) it is assessed whether there is a vascular (arterial or veno-occlusive) cause of erectile dysfunction. - Priapism: to evaluate ischemic, non-ischemic or metastatic causes. - Penile inflammation (e.g. cellulitis, balanitis, cavernositis,...): the main usefulness of ultrasound is to estimate the extension of inflammation and rule out abscess formation. - Trauma: in case of suspected penile rupture, ultrasound is especially helpful in doubtful cases or to locate the fracture line, as well as to assess long-term complications. - Benign entities: including cystic lesions (raphe cysts, epidermoid, dermoid,...), sclerosing lymphangitis, segmental thrombosis of the corpus cavernosum, calciphylaxis,...- Tumors: ultrasound is appropriate to determine the depth of the tumor and its spread to the corpus cavernosum.

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## Abstract Archives of the RSNA, 2023

GUEE-88

### Unmuddling the Middle: a Guide to Central Renal Abnormalities

#### Participants

Wendy Tu, MD, FRCPC, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Central renal pathologies can originate from all of the complex constituent structures of the kidney: the renal parenchyma, predominantly the medulla; collecting structures; sinus including fat and neural structures; vessels; lymphatics; and extension of retroperitoneal processes. Parenchymal and medullary pathologies can include benign or malignant tumors, from the common renal cell carcinoma to rare primary sarcomas. Both tumorous and nontumorous pathologies can occur in the renal pelvis, such as papillary necrosis or blood clot. Vascular lesions include renal arteriovenous fistula or renal artery aneurysms, which can mimic other pathologies. Retroperitoneal lymphoma, fibrosis, histiocytosis, or lymphangiomatosis can involve the renal sinus. Multimodality imaging with ultrasound, CT, MRI, and angiography is important for differentiation of pathologies. Imaging is crucial to predict partial nephrectomy complexity with use of nephrometry scores.

#### TABLE OF CONTENTS/OUTLINE

1) Parenchymal tumors invading the renal sinus such as renal cell carcinoma and mixed epithelial and stromal tumor family tumors 2) Benign and malignant medullary tumors such as hemangioma, primary sarcoma, and medullary carcinoma 3) Sinus and medullary pathologies such as mesenchymal tumors, retroperitoneal fibrosis, and histiocytosis 4) Collecting system processes including urothelial carcinoma, papillary necrosis, calcifications, and clots 5) Vascular anomalies such as arteriovenous malformations, renal artery aneurysm, and renal vein varix

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## Abstract Archives of the RSNA, 2023

GUEE-89

### The Body Meets the Adrenal: Adrenal Manifestations of Systemic Disorders

#### Participants

Wendy Tu, MD, FRCPC, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe imaging manifestations of adrenal gland involvement by common and uncommon systemic disorders. Paired organs of the endocrine system, the adrenal glands have important roles in production of cortical and medullary hormones and catecholamines. The glands can be affected by a variety of neoplastic and non-neoplastic systemic disorders, some with life-threatening consequences such as in cases of adrenal hemorrhage and shock. Radiologists should be familiar with imaging manifestations along with potential associated laboratory abnormalities to ensure correct characterization and diagnosis for guidance on management. It is essential to distinguish adrenal manifestations of systemic disorders from other primary benign and malignant adrenal lesions.

#### TABLE OF CONTENTS/OUTLINE

Entities discussed will include: 1) Hemorrhagic conditions such as stress-related hemorrhage. 2) Hematologic diseases such as lymphoma. 3) Autoimmune conditions leading to adrenalitis such as Ipilimumab-induced adrenalitis. 4) Conditions leading to adrenal hyperplasia such as paraneoplastic syndromes. 5) Hereditary syndromes such as Von Hippel-Lindau disease and Neurofibromatosis. 6) Granulomatous diseases such as tuberculosis. 7) Infiltrative disorders such as amyloidosis. 8) Adrenal hyperenhancement in the setting of systemic hypoperfusion.

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## Abstract Archives of the RSNA, 2023

GUEE-9

### Urine Trouble! An Interactive Review of Multiparametric MR Urography It's Pitfalls

#### TEACHING POINTS

1. Review the MR techniques for optimizing multi-parametric MR urography with attention to pitfalls  
2. Identify advantages over CT Urography  
3. Identify imaging features of lesions involving the urothelium in a quiz-based format with radiology-pathology correlation

#### TABLE OF CONTENTS/OUTLINE

1. What is multi-parametric MR Urography and how does it improve diagnosis?  
2. Why would MR Urography be preferred over CT Urography? What are the benefits and limitations?  
3. Improvements in MR sequences (including compressed sensing, k-space under-sampling, parallel imaging, and AI), which allow unprecedented improvement in image quality.  
4. Dilemmas in technique - is Lasix injection needed? Prone versus supine patient positioning? Wide vs narrow FOV? Are cine-T2 images useful?  
5. How to identify and avoid pitfalls and artifacts - flow voids on T2? T1\* effects due to concentrated gadolinium?  
6. How does MR urography help in identification and staging of urothelial neoplasms?  
7. How can MR urography help identify common, uncommon, and rare mimics of urothelial lesions using a rad-path quiz-based format?

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## Abstract Archives of the RSNA, 2023

GUEE-90

### 2022 WHO Classification of Adrenal Tumors Revisited: Atlas of Diseases with Pathological Insights

#### Participants

Adriano Basso Dias, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the update 2022 WHO Classification of Adrenal Cortical Tumors  
Review the update 2022 WHO Classification of Pheochromocytoma and Paragangliomas  
Identify imaging features with radiologic-pathologic correlation of common and uncommon adrenal lesions

#### TABLE OF CONTENTS/OUTLINE

Are There Any Nomenclature Changes or Any New Diagnostic Categories in the New WHO Classification of Adrenal Cortical Proliferations?  
What are the Radiological and Pathological Correlates of Adrenal Cysts?  
What Should a Radiologist Know about Adrenal Cortical Carcinoma?  
Why Do Radiologists and Pathologists Need to Know Ectopic or Heterotopic Locations for Adrenal Cortical Tissue?  
What are the Highlights in the New WHO 2022 Classification of Pheochromocytoma and Paragangliomas  
Miscellaneous (Including Mesenchymal and Stromal Tumors)

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## Abstract Archives of the RSNA, 2023

GUEE-91

### Focal Therapy of Prostate Cancer: A Primer for Radiologists

#### Participants

Adriano Basso Dias, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the current concepts of prostate focal therapy  
Recognize the most important MRI features to report pre and post focal therapy  
Know the role and limitations of prostate MRI for patient selection for focal therapy  
Be familiar with future directions of imaging techniques in focal therapy

#### TABLE OF CONTENTS/OUTLINE

Introduction - Indications, energy sources and templates available for focal therapy (FT)  
Role of imaging in the pre treatment assessment- MRI for diagnosis, staging and patient selection for FT  
Role of imaging in the post treatment assessment- MRI findings post FT- Types of recurrence- Pitfalls  
Future Perspectives- What imaging modalities are on the horizon for patient selection for focal therapy and treatment guidance

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## Abstract Archives of the RSNA, 2023

GUEE-92

### The Extraperitoneal Cavity: Gaining Understanding through Surgical Procedures

#### Participants

Kiyoko Mukai, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The extraperitoneal cavity has a complex anatomy, and furthermore, there is limited opportunity to understand this invisible anatomy on imaging. In this presentation, we will discuss the anatomy of the extraperitoneal cavity and the importance of preoperative imaging in surgical planning, using the surgical technique for prostatectomy as a guide.

#### TABLE OF CONTENTS/OUTLINE

Learn basic techniques and anatomy in standard surgical procedures

1. Intra-abdominal observation
2. Dissection of the retroperitoneal space/Retzius cavity
3. Lymph node dissection
4. Incision of the endopelvic fascia
5. Dissection of the bladder neck
6. Dissection of the seminal vesicles
7. Management of the prostate pedicles
8. Dissection of the posterior aspect of the prostate
9. Management of the lateral aspect of the prostate
10. Division of the urethra
11. Reconstruction (including urethral anastomosis)

A collection of cases

- Case1: Benign prostatic hyperplasia
- Case2: Enlargement of the middle lobe
- Case3: Previous transurethral resection of the prostate (TURP)
- Case4: T3 prostate cancer
- Case5: Prostatitis
- Case6: Vascular anomaly

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## Abstract Archives of the RSNA, 2023

GUEE-93

### Insights into Urethra: A Diagnostic Approach and Comprehensive Guide to Multimodal Imaging in Urethral Lesions

#### TEACHING POINTS

Urethral lesions can range from common to rarely encountered in clinical practice. Imaging modality plays a key role in evaluating the variety of urethral conditions because of its high objectivity and utility. This exhibit aims to introduce the multimodal imaging spectrum of urethral lesions, from traumatic change to neoplasms, and demonstrate the diagnostic approach to becoming familiar with urethral lesions.

#### TABLE OF CONTENTS/OUTLINE

Presentation goals: 1. To demonstrate the normal anatomy of the male and female urethra. 2. To demonstrate the step-by-step diagnostic approach to the urethral lesions. 3. To demonstrate multimodality imaging findings of various urethral lesions. Illustrative imaging/cases include: (i) Traumatic and post-treatment changes & Urethral injury, & Urethral foreign body, & Iatrogenic changes (& Radiation therapy induced urethritis, & Changes after transurethral injection therapy, & Operative complications) (ii) Intra- or peri-urethral lesions - Intra-urethra & Urethral stones, & Urethral caruncle, & Fibroepithelial polyp, & Primary urethral carcinoma, & Malignant melanoma, & Lymphoma, & Sarcoma- Peri-urethra & Urethral diverticulum, & Periurethral cyst, & Peyronie's disease, & Leiomyoma, & Tumors arising from urethral diverticulum- Both intra- and peri-urethra & Urethral cellulitis, & Urethral abscess (iii) Non-urethral origin neoplastic lesions & Direct invasion from pelvic and genital tumors, & Metastatic tumors

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## Abstract Archives of the RSNA, 2023

GUEE-94

### **Standardized, Vesical Imaging Reporting and Data System (VI-RADS) - Compliant, Acquisition and Interpretation of Multiparametric Magnetic Resonance of the Bladder: A Practical Guide**

#### **Participants**

Martina Pecoraro, MD, Roma, Italy (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Bladder multiparametric MRI is the most accurate imaging test for local staging of bladder cancer. 2. The Vesical Imaging Reporting and Data System (VI-RADS) has standardized the acquisition protocol of bladder MRI and created a 5-point scoring system to differentiate muscle invasive from non-muscle invasive bladder cancer. 3. The use of VI-RADS for bladder cancer local staging has shown excellent diagnostic performance and inter-reader reproducibility in multiple studies. 4. High diagnostic accuracy of bladder MRI and VI-RADS is dependent on proper patient preparation and implementation of the imaging protocol. 5. Pitfalls in evaluating bladder MRI can occur and needs to be acknowledged

#### **TABLE OF CONTENTS/OUTLINE**

MRI of the bladder with the use of VI-RADS is a powerful diagnostic tool for the local assessment of bladder cancer, but it requires the radiologist to implement a specific acquisition protocol and image interpretation standards to achieve optimal diagnostic accuracy and reproducibility. In this educational exhibit we discuss with a practical approach the technical aspects to follow for the correct acquisition of VI-RADS compliant bladder MRI studies. Furthermore, we provide a practical approach to the assessment, scoring, and reporting of bladder lesions according to the VI-RADS scoring system. Also, we provide details on what is beyond VI-RADS 1.0 concerning Pitfalls and Tips and Tricks: details will cover bladder distension and how to handle with it, pitfalls in staging cancers located at ureteral orifices, at folded bladder walls (e.g anterior bladder wall), at diverticula, and after previous tumor resection. To conclude we will provide insights on training and VI-RADS learning curve.

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## Abstract Archives of the RSNA, 2023

GUEE-95

### Everything a Radiologist Needs to Know About the Diagnosis and Treatment of Renal Angiomyolipomas

#### Participants

Brendan Ryu, BS, Westbury, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) To review the epidemiology, pathophysiology, and genetic associations of renal AMLs. (2) To highlight the clinical presentation and imaging characteristics of renal AMLs. (3) To discuss the utility and efficacy of the various treatment options for renal AMLs.

#### TABLE OF CONTENTS/OUTLINE

Introduction and Associations - Overview- Normal Renal Anatomy and Vasculature - Epidemiology and Pathophysiology of Renal AMLs- Association with Tuberous Sclerosis Complex (TSC)Diagnosis- Clinical Presentation- Incidental Secondary to Complications (bleeding, etc.)- Imaging Modalities- Ultrasound/Doppler- Computed Tomography/Angiography- Magnetic Resonance Imaging/Angiography- Direct AngiographyTreatment and Management - Active Surveillance- Criteria for Intervention- Medical Management- mTOR inhibitors- Embolization- Glue- Particles- Coils- Other materials- Ablation- Surgery- Potential Treatment Complications- Bleeding- Non-target embolization- Post-operative collectionPost-Treatment Imaging Appearance

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GUEE-96

### Pre- and Post-treatment Imaging of Upper Urinary Tract Urothelial Cancer (UTUC): National Comprehensive Cancer Network and European Association of Urology UTUC Guidelines in 2023

#### Participants

Hirotsugu Nakai, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Upper tract urothelial cancer (UTUC) accounts for 5-10% of UCs. However, 60% of UTUC are invasive at the diagnosis, and multiplicity of disease is common. Therefore, lifelong surveillance is required. Imaging and image-guided biopsy and intervention play an important role in the diagnosis and management of patients with UTUC. CT urography (CTU), MR urography (MRU), and retrograde ureteropyelography with CT or US are used for detection, localization, staging and follow-up of patients with UTUC. FDG PET/CT and chest imaging are useful for staging and re-staging when metastasis is suspected. This is a comprehensive review of the spectrum of clinical and imaging findings of pre- and post-treatment UTUC with illustration of key multimodality imaging findings in representative cases.

#### TABLE OF CONTENTS/OUTLINE

1) Background of UTUC; epidemiology, risk factors, manifestations, pathology, and staging.2) Review of National Comprehensive Cancer Network (NCCN) and European Association of Urology (EAU) UTUC guidelines, version 2023.3) Technique and utility of imaging modality including CTU, MRU, retrograde ureteropyelography with CT or US, FDG PET/CT, chest CT and radiography, and image guided biopsy and intervention.4) Imaging findings of urothelial cancer of the pelvicaliceal systems and ureters before and after treatment.5) Conditions mimicking UTUC including lymphoma, primary renal neoplasms, metastasis, sarcoma, fibroepithelial polyp, inverted papilloma, ureteritis, amyloidosis, and suburothelial hemorrhage.6) Summary

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

GUEE-97

### A Spectrum of LUT Pathologies in Males: A Pictorial Review

#### Participants

María Salazar Osorio, MD, Ciudad de Mexico, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To explain a general review of the male lower urinary tract (LUT) anatomy through diagrams and multimodal images.- To review the most common pathologies and their diagnosis by multiple imaging techniques.- To discuss through real cases common and not-so-common presentations of the pathologies of male LUT.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Anatomy- Imaging techniques- Main indications- Clinical findings and characteristic features of each presentation (congenital anomalies, benign and malignant pathologies of the urethra, bladder, and prostate)- Conclusions

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## Abstract Archives of the RSNA, 2023

GUEE-98

### Are We Talking About the Same Thing? How EPE is Scored

#### Participants

Andre De Freitas Secaf, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prostate cancer is the second most common cause of cancer-related deaths in men. The first option for treating intermediate and high-risk disease is radiotherapy or radical prostatectomy, however, this choice heavily relies on the presence of extraprostatic extension (EPE). EPE is associated with a higher risk of positive surgical margins, biochemical recurrence, metastatic disease and shorter overall survival. For better surgical planning, the evaluation of EPE using multiparametric magnetic resonance imaging (mpMRI) is essential. There are two major criteria for assessing EPE, through mpMRI, one from National Cancer Institute (NCI) and one from the European Society of Urogenital Radiology (ESUR). The NCI score can be classified as 0- no suspected pathological EPE; 1- curvilinear contact length or capsular irregularity and bulge; 2- curvilinear contact length and capsular irregularity and protuberance; 3- EPE visible on MRI or invasion of adjacent anatomical structures. The ESUR score uses a five-point scale (1 = capsular abutment; 2 = not specified; 3 = capsular irregularity; 4 = neurovascular bundle thickening, bulge, or loss of capsule; 5 = measurable extracapsular disease). We aim to discuss the imaging findings of EPE and how to score them according to the NCI and ESUR criteria, emphasizing their strengths and limitations. These scores should be familiar for any radiologist working in the prostate field, as a more accurate diagnosis of EPE can significantly impact the patient's management and outcomes.

#### TABLE OF CONTENTS/OUTLINE

Introduction; NCI and ESUR scores; Cases of EPE using both scores; Discussion.

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## Abstract Archives of the RSNA, 2023

GUEE-99

### Spectrum of Fat Containing Lesions in the Adrenal Gland: Tips, Tricks and Mimics

#### Participants

Jorge Abreu Gomez, MD, Pickering, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Identify the role of CT and MRI in identification of macroscopic and microscopic fat - including pitfalls, and newer entities including radiomics, histogram analysis, dual-energy decomposition and AI techniques. 2. Describe the common, and uncommon adrenal nodules which present with fat, with an algorithmic approach as to how the type (macroscopic vs microscopic), amount (small vs large), distribution (homogeneous vs heterogeneous), helps arrive at the right diagnosis.

#### TABLE OF CONTENTS/OUTLINE

- Adrenal nodules can have microscopic (intravoxel) fat or macroscopic (bulk fat), or both. However, they often mimic each other.- What is the role of CT in detection of microscopic fat? Does an attenuation of <10HU always mean microscopic fat? What are the pitfalls of detecting macroscopic fat with CT - increased noise, small ROI? Can histogram analysis improve CT performance? How can dual energy CT improve fat-detection and fat quantification?- What is the role of MRI in detecting microscopic fat? Is MRI only useful when non-contrast CT attenuation is between 10-30HU? Which is better to depict fat - 2D sequences or 3D sequences? How can flip-angles be optimized to improve detection of fat? How are MRI fat quantification methods applicable to focal adrenal lesions?- Amount of bulk fat in adrenal lesions matters - Masses with >50% of bulk fat are myelolipomas; < 50% - can represent myelolipomas or myelolipomatous degeneration which could occur in either an adrenal adenoma or adrenocortical carcinoma.- How to approach diagnosis of lipid poor adenoma with cross sectional imaging.- What are the different patterns of signal loss on out of phase T1w in the diagnosis of adrenal adenoma, when to suspect malignancy?

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## Abstract Archives of the RSNA, 2023

HNEE

### Head & Neck Imaging Education Exhibits

#### Sub-Events

#### **HNEE-1 Don't Lose Your Nerve: Pictorial Review of Cranial Nerve Denervation in the Head and Neck**

Participants

Rachel Saks, MD, Rego Park, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the pathophysiology of denervation and the subsequent imaging changes that occur within the muscle over time.2. Review the anatomy of the cranial nerves with motor function, particularly focussing on the muscles innervated by each nerve and their appearances with acute and chronic denervation.3. Review potential imaging pitfalls due to denervation changes, such as misinterpretation of contralateral FDG uptake in the setting of vocal cord palsy.

#### TABLE OF CONTENTS/OUTLINE

1. Pathophysiology of denervation2. Imaging findings in acute, subacute and late denervation3. Cranial nerve anatomy and appearances of denervation of the muscles innervated by the specific nerve- Oculomotor nerve- Trochlear nerve- Abducens nerve- Trigeminal nerve- Facial nerve- Glossopharyngeal nerve- Vagus nerve- Spinal Accessory nerve- Hypoglossal nerve4. Imaging pitfalls

#### **HNEE-10 Don't Get Trapped: Diagnostic Errors in Emergency Head and Neck Radiology**

Participants

Thiago Jose Pinheiro Lopes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- An incidence of 3-4% of errors in the radiological routine is estimated. In the emergency room, the accuracy of the diagnosis becomes even more relevant, considering the need to take more immediate measures depending on the imaging findings. - Errors in diagnostic radiology can occur for a variety of reasons. Recognizing the cognitive views that favor their occurrence is important to prevent them. - Our objective is to present a series of head and neck radiological cases, unraveling the causes of errors and then providing strategies to be followed to minimize them during radiological interpretation.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Types of errors in diagnostic radiology (Renfrew Classification). 3. Series of misdiagnosis real cases in emergency room head and neck radiology, including: a) Case discussion: anatomy review, possible complications related to an error in image interpretation. b) Identification of the error causes. c) Tips on how to avoid them. 4. Challenges, pearls and pitfalls when interpreting a head and neck radiological exam. 5. Take home messages.

#### **HNEE-11 Basic Principles of Nasal Imaging**

Participants

Mina Al-Ani, MBBCh, Elmsford, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Nasal masses can originate in the nasal cavity or adjacent structures. Utilizing a systematic approach for evaluating nasal imaging plays a crucial role in establishing a differential diagnosis, treatment, and surgical planning. After a review of nasal anatomy using illustrations and cross-sectional images, we discuss the fundamental principles of nasal imaging and their application in the analysis of a broad spectrum of nasal abnormalities. Imaging features and clinical findings of these lesions are discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction emphasizing the role of imaging in diagnosing nasal lesions.2. Illustration of nasal anatomy.3. Principles of nasal imaging used in the evaluation of a wide range of nasal lesions, including but not limited to:a. Congenital lesions (e.g., encephalocele, supernumerary tooth, and nasolabial cyst)b. Benign masses (e.g., schwannoma, paraganglioma, and inverted papilloma)c. Malignant masses (e.g., squamous cell carcinoma, esthesioneuroblastoma, and nasal metastasis)d. Infectious and inflammatory lesions (e.g., fungal sinusitis, granulomatosis with polyangiitis, and rhinoscleroma)e. Pseudomasses (e.g., pneumosinus dilatans, septal hematoma, and rhinolith).4. Conclusion.

#### **HNEE-12 Orthognathic Imaging: Pre- and Post-Surgical Considerations for Craniofacial Reconstruction**

Participants

Jeffers Nguyen, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The interpretation of orthognathic imaging studies is a growing part of both general and subspecialty neuroradiology practice.



These studies are performed to evaluate a wide range of conditions, including congenital anomalies, traumatic injuries, neoplastic growth, and iatrogenic complications. They are necessary for successful craniofacial reconstruction. Surgical planning and post-surgical follow-up studies are used to evaluate for appropriate jaw alignment and bite and to assess for complications. These topics may not be covered in depth by educational materials at the residency and fellowship levels. We hope to provide an accessible, illustrative review at graded levels of orthognathic imaging for the trainee, general radiologist, and neuroradiologist. Finally, we will also briefly touch on principles related to imaging for an increasingly prevalent procedure, facial feminization surgery, and we will share cases related to our institution experience.

#### **TABLE OF CONTENTS/OUTLINE**

1) Etiologies of Maxillofacial Deformities; 2) Important Orthognathic Terms and Concepts; 3) Orthognathic Surgical Procedures and their Indications; 4) Pre- and Post-Surgical Orthognathic Imaging Considerations; 5) Overview of Facial Feminization Surgery (FFS); 6) Utility of Orthognathic and FFS Presurgical Planning Macros and Reporting Checklists

#### **HNEE-13 Hypervascular Neck Lesions: From the Most Common to Uncommon Pathology**

Participants

Hugo Velazquez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-To describe the anatomy of the neck spaces and its contents. -To determine the protocols used in suspected neck lesions by CTA and MRA. -To list the most common and uncommon neck lesions with a hypervascular pattern enhancement. -To illustrate clinical scenarios of these lesions.

#### **TABLE OF CONTENTS/OUTLINE**

1. A pictorial review of the anatomy of the neck spaces and its contents. 2. CTA and MRA protocols for the approach of neck lesions. 3. Key points of the most common vascular neck lesions. 4. Examples of uncommon vascular lesions of the neck to keep in mind.

#### **HNEE-14 Breaking the Ultrasound Barrier: Review of Sonographic Imaging of the Neck**

Participants

Anu Kamalasanan, FRCR, MBBS, East Renfrewshire, United Kingdom (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) Tongue pathology can be assessed, characterized and staged with USS. 2) Thyroglossal duct pathology are better assessed with USS as avascular cystic structure in infrahyoid midline anterior to the pre epiglottic space and cranially extending deep to the hyoid towards the midline posterior tongue which move dynamically with deglutition and protrusion of tongue. 3) Tonsils are seen as predominantly hypoechoic regions of alternating hyper and hypoechoic striations in the oropharynx, at the level of and deep to submandibular gland. 4) Pre epiglottic and paraglottic fat spaces are visualized as homogeneously hyperechoic avascular fat filled spaces with pathology presenting as hypoechoic mass. 5) Thyroid cartilage involvement presents with dehiscence of the hyperechoic cortex and infiltration of medulla and extra laryngeal tissues.

#### **TABLE OF CONTENTS/OUTLINE**

1) Illustrate with examples the normal sonographic appearance and contents of surgical triangles of the neck. 2) Illustrate with examples the sonographic cervical lymph nodal stations, normal and pathological sonographic appearance of lymph nodes. 3) Illustrate with example the normal sonographic appearance of the soft tissues of the neck, including sonographic appearance of tongue, oropharynx, supraglottis and larynx. 4) Illustrate with examples the pathological sonographic appearance of the soft tissues of the neck, including pathology of tongue, oropharynx, supraglottis and larynx.

#### **HNEE-15 Imaging of Nasal, Paranasal, and Skull Base Lesions: A Comprehensive Review**

Participants

Kota Yokoyama, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The World Health Organization's (WHO) Classification of Head and Neck Tumors, Fifth Edition, is now available in 2022. This book is essential for radiologists to consider differential diagnosis and to obtain clinical information. On the other hand, the classification is based on the origin of the lesion and the genes, which makes it inconvenient as a guide for specific anatomical sites. For example, bone and soft tissue tumors, hematologic tumors, melanotic tumors, minor salivary gland tumors, germ cell tumors, and neuroendocrine tumors which can occur anywhere in the head and neck region, are classified in their own category, creating unexpected pitfalls when considering the differential diagnosis of nasal, paranasal, and skull base lesions. In addition, since the book is not intended for radiologists only, it does not cover a wide range of useful diagnostic imaging findings. Focusing on the radiologist, this exhibition will provide a comprehensive review of CT, MRI, and nuclear medicine imaging findings of lesions that can occur in the nasal, paranasal, and skull base.

#### **TABLE OF CONTENTS/OUTLINE**

1. Anatomy of nasal, paranasal, skull base 2. Sinonasal tract (nasal, paranasal, skull base) origin tumors 3. Other origin tumors involving the sinonasal tract 4. Inflammation involving the sinonasal tract 5. Infections involving the sinonasal tract

#### **HNEE-16 Clinical-radiologic Correlation of Acute Disorders of the Afferent Visual Pathway**

Participants

Kyle Robey, MD, Brookline, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The afferent visual pathway includes structures that perceive and process visual information, as well as the intervening nerves and white matter tracts. Acute processes affecting the globes, optic nerves, optic tracts, optic radiations, and occipital cortices may result in sudden onset of vision loss. Given the relatively large anatomical area over which the afferent visual pathway is

distributed, the insults which can occur are diverse in etiology. A broad differential should initially be considered, which can be focused by relevant history. Moreover, though the entire afferent visual pathway should be scrutinized in the setting of an acute visual deficit, an ocular examination and visual field campimetry may further localize the affected anatomical structure. Therefore, familiarity with the clinical presentation and neuro-ophthalmological exam can guide the radiologist in evaluating and interpreting CT and MR images.

#### TABLE OF CONTENTS/OUTLINE

1) Review of the anatomy of the afferent visual pathway 2) Analyze and understand the main elements of a basic eye exam and correlate the findings with the affected anatomical area 3) Review common and uncommon conditions of acute vision loss which span the afferent visual pathway

#### HNEE-17 **Open Your Eyes! What Every Radiologist Should Know About Orbit Vascular Lesions**

Participants

Marcella N. Brandao, MD, MEd, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand well the anatomy of the orbit and dominate the normal in the image; Distinguish the pathologies that affect the extraconal, intraconal and both compartments; Recognize and review the particularities of the main diseases in the illustrative cases, both in Computed Tomography and Magnetic Resonance;

#### TABLE OF CONTENTS/OUTLINE

Every radiologist needs to be attentive to the details involving vascular lesions of the orbit. These diseases are infrequent, some extremely rare, but they cannot go unnoticed in differential imaging diagnoses. In addition, the natural history, growth pattern and histological composition of each lesion must be taken into account for the correct diagnosis. It is essential to recognize and keep in mind the diagnosis of: capillary hemangioma; venous lymphatic malformation; arteriovenous fistula; venous cavernous malformation; cavernous carotid fistula; ophthalmic artery aneurysm. Each image finding in the different modalities will be exemplified in detail through figures, descriptions and tables. Furthermore, the present study will make you a more complete radiologist, as it will explain the anatomy of the orbit relating it to each lesion in a direct, simple and intuitive way, making your diagnosis accurate and fast. In addition to serving as a guide for quick reference on the topic.

#### HNEE-18 **Multimodality Imaging of Salivary Glands**

#### TEACHING POINTS

1. To discuss the anatomy of major salivary glands 2. To review salivary gland pathology categories and associated epidemiology 3. To describe ultrasound, CT/MRI features of common pathologies with pathologic correlation 4. To introduce newly described entities in salivary gland pathology 5. To highlight the utility of percutaneous biopsy, with technical considerations

#### TABLE OF CONTENTS/OUTLINE

1. Normal anatomy a. Parotid b. Submandibular c. Sublingual 2. Common salivary gland pathologies a. Sialolithiasis b. Sjogren syndrome c. Infectious/Inflammatory conditions d. Cysts e. Neoplasms (with hints based on patient demographics and risk factors) i. Benign 1. Pleomorphic adenoma 2. Warthin's Tumor 3. Cystadenolymphoma 4. Other- Hemangioma, Oncocytoma, Basal Cell Adenoma ii. Malignant 1. Mucoepidermoid carcinoma 2. Adenocystic carcinoma 3. Squamous cell carcinoma 4. Adenocarcinoma 5. Acinic cell carcinoma 6. Lymphoma iii. Metastases 3. Newly described salivary gland pathology a. Sclerosing polycystic adenoma b. Mucinous/secretory variant of myoepithelioma c. Mammary analog secretory carcinoma d. Cribriform adenocarcinoma e. IgG4-related disease 4. Pitfalls 5. Percutaneous biopsy a. Approach and anatomical considerations b. FNA versus Core c. US vs CT guidance d. Complications 6. Summary/conclusion

#### HNEE-19 **Pediatric Head and Neck: On Call Resource**

Participants

Alexandra Foust, DO, North Royalton, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The spectrum of acute non-traumatic disease in the pediatric head and neck differs from that in adults. 2. Consider foreign body ingestion or aspiration in young child with sudden-onset respiratory distress or paroxysmal cough. 3. Meningitis, empyema, and venous sinus thrombosis are important complications of pediatric sinusitis or otomastoiditis cases.

#### TABLE OF CONTENTS/OUTLINE

The vast array of acute non-traumatic pathologies encountered in the pediatric head and neck can be an intimidating subject for residents on busy call rotations with limited time to look up information. Although there is some overlap with adult diseases, many entities are more common in the pediatric population and, thus, it is important for radiologists caring for children to be well-versed in this topic. This multi-institutional, multimodality exhibit will be structured as an on-call resource for trainees, organized by anatomic location and highlighting key points, pearls, pitfalls, and mimics of many acute non-traumatic pathologies in the pediatric head and neck: Selected Examples: 1. Orbit: peri-orbital and orbital cellulitis, dacryocystitis, optic neuritis, proptosis 2. Sinonasal: complicated sinusitis 3. Ear: labyrinthitis, otomastoiditis, petrous apicitis 4. Oral/airway: epiglottitis, laryngotracheobronchitis, tonsillitis and peritonsillar abscess, Ludwig angina 5. Neck/spine: Grisel syndrome, retropharyngeal abscess, lymphadenitis, sialadenitis, torticollis, infection of congenital cysts, osteomyelitis 6. Variable: foreign body insertion (oral/nasal), angioedema 7. Vascular: Lemierre syndrome, vasculitis, nontraumatic dissection, and complicated vascular malformations

#### HNEE-2 **Proton Beam Therapy for Skull Base Chordoma and Chondrosarcoma: A Guide for the Radiologist**

#### TEACHING POINTS

- High-quality CT and MRI are critical for optimising surgical and radiotherapy decision-making and treatment in skull base chordoma and chondrosarcoma
- A detailed radiology report at the time of proton planning is essential for assessment of baseline and postoperative tumor sites, including distance to critical structures, with a required gap of =3mm from brainstem and =5mm from the optic apparatus
- Radiologists should be aware of surgical approaches to skull base tumors
- Radiologists should understand imaging appearances following multilayer endoscopic skull base repair and be aware of their evolution over time

## TABLE OF CONTENTS/OUTLINE

Skull base chordoma and chondrosarcoma are rare, locally aggressive tumors. Treatment consists of maximal surgical resection and postoperative adjuvant therapy. Proton beam therapy enables dose escalation to tumor while limiting exposure dose to critical neurologic structures (brainstem, optic apparatus). High-quality pre-operative CT and MRI are critical for proton planning. MRI should include T2, T2 fat saturation, T1, volume FLAIR, FIESTA and postcontrast T1 fat saturation, with at least one volume sequence. Preoperative CTA BrainLab with bone reconstructions enables assessment of bone erosion, vascular relations and anatomical assessment for endoscopic-approach surgery. Intraoperative MRI should be considered to confirm clearance from dose-limiting structures. Post-operative MRI is optimally performed at <48 hours to enable optimal distinction between post-operative changes relating to multilayer skull base repair and tumor residuum.

### HNEE-20 Congenital and Infantile Masses of the Head and Neck

Participants

Alexandra Foust, DO, North Royalton, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A rapidly growing mass lacking high vessel density (Doppler US), internal flow-voids (MRI), and arterial-phase enhancement (MRI) should raise concern for lesions other than hemangioma. 2. It is important to describe the relationship of fetal head and neck masses to the airway so that appropriate delivery plans (EXIT procedure) can be made.

#### TABLE OF CONTENTS/OUTLINE

The spectrum of congenital and infantile head and neck soft tissue masses is broad, including developmental structural deformities/deficiencies, ectopic tissues, and benign and malignant neoplasms. It is important for radiologists to be aware of the imaging features of these lesions so that timely and appropriate management can be pursued. This multi-institutional, multimodality exhibit highlights pearls and pitfalls from fetal and post-natal cases encountered during clinical practice to illustrate the imaging appearance of numerous common and rare infantile masses in the head and neck using an anatomic approach. Selected Examples: 1. Skull/scalp: Cephalohematoma and other collections 2. Nasal: nasal glial heterotopia, cephalocele 3. Orbital: dacryocystocele, orbital varix 4. Oral/airway: epulis, epignathus, nasopalatine duct cyst, vallecular cyst, hairy polyp, sialoblastoma 5. Ear: cholesteatoma 6. Neck: thyroglossal duct cyst, ectopic thyroid or thymus, fibromatosis coli 7. Variable: dermoid/epidermoid, branchial apparatus anomaly, vascular anomalies, neuroblastoma, rhabdomyosarcoma, infantile fibrosarcoma, melanotic ectodermal tumor of infancy.

### HNEE-21 Post-operative Imaging in Oncologic Skull Base Surgery Reconstructions

#### TEACHING POINTS

? There is a broad spectrum of surgical techniques in resection of skull base tumors. ? Recognizing normal aspects of post-surgical grafts is important to differentiate from recurrent disease in skull base surgery. ? Radiologist plays an important role in preoperative and post-surgical management of this lesions.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and normal variants Skull base surgery is a complex procedure that involves accessing and operating on the delicate structures and the anatomical complex area at the base of the skull. It is challenging even for experienced surgeons and radiologists. It forms the floor of the cranial cavity and separates the brain from other facial and neck structures. It is divided into three regions: the anterior skull base, the middle skull base, and the posterior skull base. Each of these regions has its own unique anatomy and challenges when it comes to surgery. For a successful surgery, knowledge of the normal variants of the anatomy is crucial to avoid iatrogenic lesions during surgery. Some important normal variants include the pneumatization of the anterior clinoid process, sphenothmoidal (Onodi) cells, and postsellar pneumatization from the sphenoid sinus. These variants are associated with a greater risk for carotid and optic nerve injuries as well as cerebrospinal fluid (CSF) rhinorrhea. Neurosurgical options in accessing the skull base ? Frontotemporal ? Subfrontal ? Transpetrosal ? Lateral ? Endoscopic endonasal Common Neoplasms ? Pituitary adenoma ? Schwannoma ? Meningioma ? Olfactory neuroblastoma ? Skull base invasion from head and neck tumor Normal imaging characteristics of post-surgical grafts When to suspect a recurrent tumor?

### HNEE-22 Complications of Paranasal Sinus Mucoceles: A Pictorial Review

Participants

Joseph Carbone, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: 1. Review mucocele CT and MR imaging characteristics and their variance, as well as potential locations to be aware of with a highlight on important adjacent structures. 2. Describe complications of mucoceles with CT and MR correlates with a focus on findings requiring urgent management. 3. Provide radiologists with a framework for reporting when discussing mucoceles, adjacent structures, and their pertinent negatives as it relates to mucocele complications.

#### TABLE OF CONTENTS/OUTLINE

Mucoceles are slow-growing lesions that result from obstruction of the facial paranasal sinuses. While they are most often benign, they can sometimes lead to urgent or severe pathology in nearby structures. The severity of clinical presentation varies depending on the sinus involved, ranging from asymptomatic to intracranial extension resulting in blindness. Further, radiologists should be aware for their potential for aggressive behavior and have an understanding for relevant reportable findings when describing mucoceles pertaining to mass effect and the location of adjacent structures, superimposed infection, and intracranial extension. This educational exhibit aims to review varying imaging characteristics of mucoceles and their potential locations using CT and MRI correlates. A pictorial review of mucoceles and their severe complications will be used to highlight key reportable imaging findings for radiologists when describing mucoceles and their involvement with adjacent structures.

### HNEE-23 Imaging of the Skull and Facial Bones for Pediatric and Adult Patients

Participants

Minako Azuma, MD, PhD, Miyazaki, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. In pediatric and adult patients, a wide variety of abnormalities are found in the skull and facial bones, including tumors, inflammations, congenital disease, and so on. Additionally, there are also secondary changes in bone associated with some diseases. 2. It is necessary for radiologists to know radiological findings of the skull and facial bone disorders. 3. Radiologists also have to know normal variations that have no pathological significance.

## TABLE OF CONTENTS/OUTLINE

1. Anatomy and normal development of the skull and facial bones 2. Techniques for the imaging of the skull and facial bones (1) CT (2) MRI (3) CT like bone imaging in MRI 3. Normal variants of the skull and facial bones (1) Shape and thickness (2) Bone marrow (3) Pneumatization 4. Disorders of the skull and facial bones (1) Abnormality associated with suture (craniosynostosis) (2) Tumors and allied diseases a) Benign: Chordoma, osteoma, meningioma, and so on b) Malignant: chondrosarcoma, rhabdomyosarcoma, metastasis c) Allied diseases: Epidermoid cyst, hemangioma, Langerhans Cell Histiocytosis, and so on (3) Systematic disease a) Hematologic disorders: leukemia, multiple myeloma, anemias b) Metabolic and endocrine disorders (4) Metabolic and endocrine disorders: primary hyperparathyroidism (5) Inflammation and infection: osteomyelitis (5) Secondary changes in bone: Hyperostosis, blistering 3. Take home points 4. References

## HNEE-24 Sonographic Evaluation of Major Salivary Glands: A Pictorial Review

Participants

Rachita Khot, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

## TEACHING POINTS

High-resolution ultrasound imaging plays a key role in evaluating focal versus diffuse salivary gland diseases and differentiating benign versus malignant lesions. This exhibit will discuss approaches to diagnosis and 1. Review the typical and uncommon sonographic appearances of pathologies involving the salivary glands 2. Discuss the OMERACT Ultrasound Scoring System in primary Sjögren's Syndrome 3. Discuss the next step in the management of the pathologies

## TABLE OF CONTENTS/OUTLINE

1. Illustration of major salivary gland and surrounding structures 2. Ultrasound imaging techniques, sonographic landmarks, and normal anatomy 3. Approach to diagnosis 4. OMERACT Ultrasound Scoring System in Sjögren's Syndrome • Background • Grey-scale scoring with imaging examples: Grade 0, normal parenchyma; Grade 1, mild inhomogeneity without anechoic or hypoechoic areas and hyperechogenic bands; Grade 2, moderate inhomogeneity with focal anechoic or hypoechoic areas; Grade 3, severe inhomogeneity with diffuse anechoic or hypoechoic areas occupying the entire gland 5. Pathologies of the major salivary glands • Congenital: Lymphoepithelial cysts, Epidermoid cyst • Sialadenitis: Acute and chronic; Abscess • Sialolithiasis: Obstructing and non-obstructing stones in the duct • Sialectasis • Neoplasms: Hemangioma, Lymphangioma, Lipoma, Adenomas (Pleomorphic, Basal cell, Warthin's), Carcinoma (Adenoid cystic carcinoma (Ca), Mucoepidermoid Ca, Acinar cell Ca, Squamous cell Ca), Lymphoma, Metastasis • Others: Intraglandular lymph nodes, Trauma, AV fistula 6. Management and follow-up • Role of CT and MRI in the further workup • Role of biopsy 7. Conclusion

## HNEE-25 Decoding Cystic and Cyst-Like Lesions in the Head and Neck: A Comprehensive Imaging Guide

Participants

Maria Lucia Brun, MD, OTTAWA, ON (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- To identify the relevant imaging features of cystic and cyst-like lesions of the head and neck. - To describe the differential diagnosis of cystic and cyst-like lesions of the head and neck, based on imaging and anatomical location. - To learn the importance of incorporating relevant/pertinent clinical information in narrowing the differential diagnoses. - To recognize the course and potential complications associated with cystic and cyst-like lesions. - To suggest appropriate follow-up and recommend effective diagnostic workup.

## TABLE OF CONTENTS/OUTLINE

1. Introduction/Background 2. Role of Diagnostic Imaging- Ultrasound- CT - MRI 3. Approach based on location Once the cystic nature is confirmed? evaluate differential diagnosis according to location: - Anterior neck - Midline lesions: Parapharyngeal/pharyngeal cysts, Ranula, Thyroid cysts, Parathyroid cysts, thyroglossal duct cyst, thymic cyst, dermoid/epidermoid cyst. - Lateral - Paramedian lesions: Branchial cleft cysts, Lymphatic malformations, suppurative/caseating adenopathy (infectious/inflammatory), cystic adenopathy (thyroid cancer and HPV-related SCC). - Specific spaces: Salivary glands; entities which may present as a cyst in the salivary glands: Lymphoepithelial cysts, Epidermal inclusion cysts, Warthin tumor, Mucocele, etc. 4. Others- Not location-dependent: Lymphocele, Seroma, Abscesses. 5. Conclusion

## HNEE-26 Chew It All Up! Everything You Need to Know About Teeth

Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The high prevalence of craniofacial trauma, sinus infection disease, and maxillo-mandibular procedures, among other conditions, frequently requires the interpretation of dental images in daily practice. Teeth can be the source or the extension of a pathologic process and therefore must not be overlooked by radiologists. Radiologists can use their knowledge of the main dental imaging findings in emergency radiology to add great value to image interpretation. In this study we will describe the anatomy of the structures surrounding the teeth. Identify the main dental alterations in the emergency or outpatient setting. Train the radiologist to look accurately at lesions, mainly inflammatory ones related to dental disorders.

## TABLE OF CONTENTS/OUTLINE

General and dental anatomy. Inflammatory conditions related to teeth as pericoronitis, periodontal disease, periapical abscess, dental sinusitis, facial cellulitis and abscess, orbital cellulitis, Ludwig's angina, dental trauma, complications of dental procedures like dental implants and extraction. Most common tumor and tumor-like lesions related to teeth. Take home messages.

## **HNEE-27 The Jugular Foramen: Approach to Tumoral and Non-tumoral Pathologies**

Participants

Yasovineeth Bhogadi, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Review the anatomy of the Jugular foramen- Understand the clinical presentations of various pathologies- Differential diagnosis to tumoral disease and approach- Non-tumoral disease entities

### **TABLE OF CONTENTS/OUTLINE**

- Review the anatomy of the Jugular foramen- Differential diagnosis of masses- Approach to tumoral masses- Non-tumoral disease entities

## **HNEE-28 Use Homemade Rice Bags to Improve the Image Quality of 3.0TMR Cervical Spine Enhancement Scans**

### **TEACHING POINTS**

1. Magnetic resonance cervical spine enhancement scan fat suppression current problems 2. To propose a method to improve image quality using rice bags

### **TABLE OF CONTENTS/OUTLINE**

1. Magnetic resonance cervical spine enhancement scan fat suppression current problems • Contrast-enhanced scans of the cervical spine are mainly performed using the T1WI adipose inhibition sequence to better visualize the lesions • But in the actual examination, due to the irregular geometry of the neck, the local magnetic field is uneven, and the fat suppression is often uneven, which affects the image quality and the display of lesions 2. A method to improve image quality using rice bags is proposed. • Rice bags are simple to make and low cost • Place a rice bag under the patient's neck and a rice bag above the neck without causing discomfort • Comparing conventional MRI scans with neck-filled rice bag scans, we found that the use of rice bags can eliminate artifacts, improve lipid uniformity, and improve image quality

## **HNEE-29 Parry-Romberg Syndrome and En Coup De Sabre: A Pictorial Review**

### **TEACHING POINTS**

(1) Parry-Romberg Syndrome [PRS] and En Coup De Sabre [ECDS] are defined by acquired progressive hemifacial atrophy. (2) Patients may present with headache, facial pain/paresthesia, or epilepsy. (3) Atrophy can affect unilateral periorbital, midface bones and soft tissues. (4) Atrophic tissue does not demonstrate signal change or enhancement as might be seen with denervation. (5) Intracranial manifestations may also be present, although facial involvement does not predict intracranial lesion severity.

### **TABLE OF CONTENTS/OUTLINE**

(1) Review definition, clinical symptomatology, expected course, and hypothesized etiologies of Parry-Romberg Syndrome (PRS) and linear scleroderma/En Coup De Sabre (ECDS), disease processes characterized by progressive hemifacial atrophy. (2) Review imaging findings of facial soft tissue atrophy and intracranial abnormalities in PRS and ECDS, as derived from a review of 40 PRS patients at a single institution, including brain, neck and face CTs and MRs. (3) Atrophy in PRS and ECDS predominantly affects periorbital, midface and scalp soft tissues, typically without MR signal intensity change, distinguishing it from denervation atrophy. (4) Clinical severity of facial soft tissue atrophy does not predict intracranial lesion severity.

## **HNEE-3 Revisiting Distant Metastasis in Head and Neck Cancer**

Participants

Naoko Saito, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Distant metastasis (DM) in head and neck cancer (HNC) is relatively uncommon. When DM occurs, the prognosis is considered miserable, with median overall survival of under one year. Although little attention has been focused on the treatment of DM, recent reports on oligometastasis have changed the therapeutic approach to DM. For patients with oligometastasis, aggressive local treatment of metastatic sites may achieve prolonged survival. This educational exhibit reviews the epidemiology, imaging findings, and risk factors of DM of HNC and summarizes the current knowledge of the oligometastasis of HNC. The teaching points are: 1. To understand the mechanisms and patterns of DM of HNC. 2. To learn the characteristic imaging findings of DM based on the site and histopathology. 3. To learn the current knowledge about the characteristics and the therapy of oligometastasis in HNC.

### **TABLE OF CONTENTS/OUTLINE**

1. The definition of DM: the pathophysiology (hematogenous, lymphatic spread), the timing (synchronous, metachronous), the spectrum of metastasis (polymetastasis, oligometastasis, oligorecurrence, oligoprogression) 2. The site-based approach of DM (lung, bone, liver, brain, skin, etc.): pathophysiology, incidence, imaging findings 3. The cancer-based approach of DM: histopathology (SCC, EBV/HPV associated SCC, thyroid cancer, salivary gland cancer, neuroendocrine tumor, melanoma, etc.): incidence, imaging findings 4. Summary of the risk factors for DM: literature review 5. Therapy: current concepts

## **HNEE-30 Nasolacrimal System Pathologies: What a Radiologist Needs to Know**

### **TEACHING POINTS**

•While reading a CT, deliberate consideration should be given to the density of the contents within the nasolacrimal duct and for the evaluation of wall thinning. •The extent of soft tissue disease is evaluated using magnetic resonance imaging (MRI), and contrast-enhanced MR is particularly helpful in distinguishing soft tissue from fluid. •Nasolacrimal duct may act as a conduit for the transmission of pathologies from the orbit to the sinonasal cavity and vice-versa. •Primary nasolacrimal malignancies are rare and often have delayed diagnosis due to presentation mimicking benign aetiology.

### **TABLE OF CONTENTS/OUTLINE**

?Describe normal Nasolacrimal duct anatomy with images. ?Illustrate with images the Nasolacrimal duct pathologies. ?Discuss management pathway.

### **HNEE-31 Hyoid Bone: Anatomy, Embriology, Developmental Malformations and Symptomatic Cases**

Participants

Beatriz Prado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

This panel aims to: Review the structure and function, embriology, anatomy and physiologic variants of the hyoid bone. Discuss and describe through illustrative cases the imaging patterns of the main pathologies involving the hyoid bone.

#### **TABLE OF CONTENTS/OUTLINE**

Review of the hyoid bone structure and function  
Review of the hyoid bone anatomy, including suprahyoid and infrahyoid muscles, relation to blood vessels and nerves.  
Physiologic variants  
Clinical cases involving the hyoid bone:- Hyoid bone insertion tendinitis (hyoid bone syndrome)- Calcified stylohyoid ligament and Eagle syndrome- Traumatic lesions, including body and greater horn luxation and hyoid fracture- Triticeal cartilage ankylosis in the hyoid- Thyroid lamina ankylosis in the hyoid- Ectopic thyroid gland adjacent to the hyoid bone- Vascular compression- Sistrunk procedure- Ectopic thyroid gland adjacent to the hyoid bone  
Final remarks

### **HNEE-32 How to Find CHD7 Disorder: Beyond CHARGE Syndrome**

#### **TEACHING POINTS**

CHARGE syndrome is named after an acronym for the characteristic signs (coloboma, heart defect, atresia choanae, retarded growth and development, genital hypoplasia, ear anomalies/deafness). CHD7 is the causative gene for CHARGE syndrome. Recently, CHD7 mutations have been detected in cases that do not show typical signs of CHARGE syndrome, and the concept of CHD7 disorder has been proposed to include the broader spectrum of CHD7 mutations. Even in such atypical cases, the characteristic imaging findings of CHARGE syndrome are detected. The purpose of this educational exhibit is to: 1. Present the disease concept of CHARGE syndrome. 2. Detail the characteristic imaging findings of CHARGE syndrome. 3. Outline the broader spectrum of CHD7 disorders and provide cases in which imaging findings help identify CHD7 mutations, even in atypical CHARGE syndrome

#### **TABLE OF CONTENTS/OUTLINE**

1. CHARGE syndrome a. Concept b. Clinical presentation c. Causative gene -CHD7- 2. Imaging findings a. Key finding -semicircular canal hypoplasia- b. Additional findings of the face and skull base 1) Auditory system and temporal bone 2) Eye, palate, and olfactory system 3) Clivus c. Others 3. CHD7 disorder a. Concept b. Cases that the imaging findings implicate CHD7 mutations 1) Severe combined immunodeficiency 2) Mild phenotype 3) Kallmann syndrome

### **HNEE-33 A Particular Pain in the Neck: Taking a Radiology's Journey from Imaging to Immunohistochemistry**

Participants

Karla Anabel Borgna, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Reviewing the variability of head and neck tumor entities and their mode of presentation, excluding squamous Cell Carcinoma. Identifying radiological signs, anatomical relationships and learning how to report them. Correlating the radiological features of head and neck tumors (non-squamous cell carcinoma) with immunohistochemistry and histological findings. Emphasize the role of the radiologist as a key contributor to the orientation of the tumor's etiology.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction  
Case-based approach with radiologic correlation  
Imaging findings with histologic and immunohistochemical correlation  
Take-home message  
References

### **HNEE-34 3N: Not Common Nose, Nasal Cavity and Nasopharynx Tumors**

#### **TEACHING POINTS**

Sinonasal neoplasms are rare, accounting for only 3 % of head and neck malignancies, among the most frequent tumors reported are adenocarcinoma, squamous cell carcinoma, undifferentiated carcinoma, olfactory neuroblastoma, sinonasal lymphoma, and sinonasal mucosa melanoma. The complex anatomy and histology of this region make evaluation a challenge for the clinician. Fortunately, in these kinds of tumors, Computed tomography and magnetic resonance imaging, plays an important role in surgical and therapeutic planning, especially in the involvement of those small parts such as involvement of the anterior and middle cranial fossae, pterygopalatine fossa, pterygomaxillary fissure, foramen rotundum, vidian canal, inferior orbital fissure, orbital apex, and perineural involvement, therefore some distinguishing features can help narrow the differential diagnosis and assess the true extent of the disease.

#### **TABLE OF CONTENTS/OUTLINE**

Epidermoid carcinoma, Carcinoid tumor, Peripheral nerve sheath tumor, Rhabdomyosarcoma, Sinonasal undifferentiated carcinoma, Ewing sarcoma, Sinonasal Melanoma, Lymphoma, Esthesioneuroblastoma and sinonasal juvenile angiofibroma

### **HNEE-35 Sinonasal Tumors: What the Tumor Board Wants to Know**

Participants

Alexander Moeller, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. There is a long differential diagnosis for tumors occurring within the sinonasal cavity with overlapping imaging features. 2. Pathology is critical in diagnosis and determining treatment. 3. Most primary tumors are staged based on the TNM classification. TNM tumor staging is predominantly based on tumor location and tumor extension, which differs between lesions that arise from the maxillary sinus and those that occur within the ethmoid/nasal cavity. 4. Esthesioneuroblastomas are staged based on the Kadish

classification system.5. Sinonasal tumors are primarily treated with surgical resection.6. Chemotherapy and radiation may be administered prior to surgery for larger lesions, following surgery for residual or recurrent disease or in place of surgery for a palliative approach.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review the differential diagnosis of sinonasal tumors based on the updated WHO classification system. 2. Discuss pathology of sinonasal tumors, incorporating molecular features. 3. Discuss the TNM staging of sinonasal tumors for lesions arising from the maxillary sinus and ethmoid/nasal cavity.4. Review staging of esthesioneuroblastoma.5. Treatment strategies of Sinonasal tumors: Indications for surgery, chemotherapy and radiation using a multidisciplinary approach.6. Review imaging features of lesions that will affect treatment decisions: what the surgeon wants to know, what the medical oncologist wants to know and what the radiation oncologist wants to know.

#### **HNEE-36 Face to Face: Reviewing Facial Malformations**

Participants

Danielly Santos SR, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

This pictorial essay aims to review and synthesize the main facial malformations. The purposes of this submission are: - To review the developmental anatomy and normal embryogenesis of facial structures; - To discuss imaging features of facial malformations related to nasal cavity, frontonasal region, nasolacrimal apparatus, labiopalatine complex and craniofacial syndromes; - To present a compendium of cases involving facial malformations to exemplify;

#### **TABLE OF CONTENTS/OUTLINE**

There are a wide variety of congenital face abnormalities that originate during transformation of the first pair of pharyngeal arches into adult structures. Computed tomography and magnetic resonance imaging are important components in the comprehensive evaluation of these lesions. A detailed understanding of face embryogenesis and developmental anatomy is important in directing appropriate patient management. Familiarity with the characteristic imaging features of these anomalies along with knowledge of midface embryogenesis and normal developmental anatomy is essential to prevent misinterpretation of anatomic variations that may simulate disease.

#### **HNEE-37 Scars and Lumps Shrinking the Tunnel: Radiological Evaluation of Laryngotracheal Stenosis**

#### **TEACHING POINTS**

At the end of this exhibit, the attendees would be able to:1. Identify laryngotracheal stenosis etiologies.2. Describe the clinical and radiological classifications of laryngotracheal stenosis3. Recognize the key imaging findings encountered in the different entities of laryngotracheal stenosis

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction.2) Anatomical Review: Imaging of the Larynx and Trachea3) Diagnostic and Radiological Approach to Laryngotracheal Stenosis.4) Laryngotracheal Stenosis Measurement.5) Laryngotracheal Stenosis: Key Imaging and Clinical Findings through Case Presentationa) Laryngotracheal Trauma/Iatrogenicb) Laryngotracheal Compressionc) Infiltrative Lesionsd) Laryngotracheal Inflammation/infectione) Laryngotracheal Autoimmune Lesions6)Conclusion

#### **HNEE-38 A Nod to the Nodes In Children: A Practical Clinical Approach to Pediatric Cervical Lymphadenopathy**

Participants

Elizabeth Snyder, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Cervical adenopathy is a common clinical scenario in children.- A wide variety of entities can present with cervical adenopathy; importantly, the spectrum of pathology and imaging appearance differs in many cases from that seen in adults.- While US is typically the first line imaging modality, CT, MRI and NM studies may all have a role in the workup of cervical adenopathy, with different strengths and limitations.- Radiologists must know when and with which modality to image.- This multi-institutional collaboration highlights imaging appearances of both common and uncommon disorders affecting cervical nodes in children in order to aid radiologists in their clinical practice. Pearls, pitfalls, and mimics will be included.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introductiona. Anatomy of cervical lymph nodes (levels, etc.)b. Normal imaging appearance2. Imaging approacha. Modality selection and benefits/limitations of US, CT, MRI, NM studiesb. Systematic approach diagram highlighting helpful features (e.g., cystic, hyperenhancing, calcified, etc.)3. Infectious lymphadenopathya. Imaging appearance b. Complications: necrosis, abscessc. Specific infectious processes: e.g., bacterial, TB, MAI, cat scratch disease4. Neoplasm a. Lymphomab. Metastasis: e.g., thyroid cancer, NPC, SCC5. Histiocytosis. LCHb. Rosai-Dorfman disease6. Lymphoproliferative disorders: e.g., Castleman, HLH7. Unusual entities: Kawasaki, Kikuchi, MIS-C, HIV8. Mimics (lymphatic malformations, branchial cleft cysts, parotid neoplasms, etc.)9. DDx of common imaging findings: calcifications, cystic nodes10. Summary and conclusion

#### **HNEE-39 Don't Miss the Forest for the Trees: Parathyroid Ultrasound - Anatomy, Technique, Pearls and Pitfalls**

Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review key aspects of the clinical, laboratorial, and imaging assessment of patients with primary hyperparathyroidism. Illustrate the role of ultrasound (US) for preoperative evaluation of parathyroid glands, including their localization, normal and pathological findings, with multimodality imaging correlations. Summarize in a practical approach the most important pearls and pitfalls for the accurate US assessment of parathyroid glands, highlighting the use of high-frequency transducers.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction  
Anatomy of the parathyroid and adjacent structures  
Primary Hyperparathyroidism: pathophysiology and clinical aspects  
Parathyroid preoperative evaluation  
Laboratorial workup for hyperparathyroidism  
Multimodality imaging for surgical planning: US, computed tomography, magnetic resonance, and scintigraphy  
Ultrasound of the parathyroid glands  
Positioning, technique, transducers  
Typical and atypical imaging findings (B-mode, Doppler and elastography)  
US guided fine-needle aspiration (radiologic-pathologic correlations)  
Case-based review with multimodality imaging  
Pearls: novel approaches for improvement (high-frequency transducers and other strategies)  
Pitfalls: lesions of the esophagus, lymph nodes, soft tissues, and thyroid  
Take home messages

#### **HNEE-4      Look out! Conditions that Cause Proptosis**

Participants

Erica Naves, MD, Nova Lima, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Teaching Points The purposes of this exhibit are to review the anatomy of the orbit, including the orbital content and bone structures that delimit it. Also, to demonstrate that, due to its osseous limitations, the orbit is limited to expand if any expansive process is within its limits. Therefore, several types of expansive processes manifest with proptosis. The exhibit demonstrates through illustrative cases the different scenarios that manifest with proptosis, in the context of metabolic disorder, trauma, infection, inflammatory process, vascular lesions, primary neoplasms, metastasis, among others.

##### **TABLE OF CONTENTS/OUTLINE**

Table of Contents / Outline The exhibit initiates with annotated images of the anatomy of the orbit, including the bone limits and contents, to demonstrate the normal appearance on computed tomography and magnetic resonance imaging. The next slides include the diagnostic criteria of proptosis, and exemplifying annotated images. The majority of the presentation include illustrative cases presenting with proptosis divided by metabolic, trauma, infection, inflammatory, vascular and neoplastic sections. Cases of thyroid-associated orbitopathy, bone fracture, orbital muscle lesion, subperiosteal abscess, idiopathic orbital inflammation, IgG4-related disease, granulomatosis with polyangiitis, carotid-cavernous fistula, venous malformation, lymphangioma, optic nerve glioma, optic nerve meningioma, orbital lymphoma, rhabdomyosarcoma, sphenoid wing meningioma, metastatic melanoma, extramedullary plasmacytoma and bone metastasis are displayed. The presentation closure contains take-home messages.

#### **HNEE-40      Save Your Own Neck: A Neck Muscles Guide for Daily Practice - Anatomy, Variations, and Pathologies**

Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The purposes of this exhibit are:- Review and illustrate the anatomy and innervation of head and neck muscles, and its correlation with the cervical spaces, emphasizing the importance of understanding for the delimitation of lesions found in daily routine exams.- Describe the anatomical variations of the cervical muscles and the possible pitfalls they can cause, simulating diseases.- Determine the great injuries, separating them by their etiology, and propose an algorithm for their evaluation in cases of technical limitation.

##### **TABLE OF CONTENTS/OUTLINE**

- Cervical muscles:1) Division by compartments- masticatory.- pharynx (circular and longitudinal) and larynx.- front of the neck (suprahyoid and infrahyoid).- prevertebral (prevertebral and scalene).- paraspinal (suboccipital, extrinsic back, and intrinsic back (superficial, intermediate, and deep layer)).2) injuries:- congenital (agenesis, torticollis, and syndromes)- infectious/inflammatory (phlegmon, abscess, tropical myositis, necrotizing fasciitis)- trauma or surgery (denervation, myositis ossificans)- vascular anomalies.- tumors (benign, malignant, and metastasis).- Diagnostic Algorithm- Final remarks

#### **HNEE-41      Practical Approach to Orbital Lesions by Anatomical Compartments**

##### **TEACHING POINTS**

The purposes of this exhibit are:- Classify the different pathologies in each of the orbital compartments.- Present the essential imaging features of the main orbital lesions.- Highlight the importance of knowing the location of pathologies in the orbital compartments to facilitate the diagnosis and narrow the differential diagnoses.

##### **TABLE OF CONTENTS/OUTLINE**

? Introduction : ? Review of the anatomy of the orbital compartments ? Compartment of the optic nerve/sheath complex : ? ? Ischemic optic neuritis ? Optic nerve glioma (NF1) ? Optic nerve glioma (sporadic) ? Optic nerve meningioma ? Conal/muscular compartment : ? Graves orbitopathy ? Left sixth cranial nerve palsy ? Orbital pseudotumor ? Myositis by IgG4 ? Intraconal compartment : ? Colobomatous malformation ? Venolymphatic vascular malformation ? Cavernous hemangioma ? Extraconal compartment : ? Dermoid cyst ? Subperiosteal abscess ? Preseptal cellulitis ? Nasolacrimal apparatus : ? Non-Hodgkin lymphoma of the lacrimal glands ? Infected dacryocystocele

#### **HNEE-42      Unilateral Sinusitis: What Radiologists Should be Aware of**

Participants

Janani Asogan Vaishnavi, MD, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Rhinorrhoea and foul smelling discharge are the common clinical presentations in inflammatory / infective disease while epistaxis and/or mass effect in the cheek / palate / orbit are the common presenting features in malignancy.2. Odontogenic sinusitis is one of the most common causes of unilateral sinus opacification followed by fungal ball and antrochoanal polyp. Inverted papilloma is the most common benign pathology, while squamous cell carcinoma is the most common malignant pathology.3. Incidence of neoplastic disease is much higher in the presence of unilateral sinus opacification, with rise in incidence with increasing age.4. Site of origin of inverted papilloma is often seen as focal area of hyperostosis on CT. This can be useful identifying recurrence and malignant transformation which are frequent with inadequate excision.5. Aggressive bone destruction, especially erosion of the posterolateral wall of the maxillary sinus and extra-sinus extension is often seen in malignancy.

##### **TABLE OF CONTENTS/OUTLINE**



1. Radiological anatomy of paranasal sinuses including drainage pathways  
2. Explain various causes of unilateral sinus opacification  
3. Illustrate with images, the key radiological and pathognomonic findings to be looked for in unilateral sinus opacification  
4. Provide a pictorial review of unilateral sinus opacification encountered in our centre  
5. Briefly describe how to approach a case of unilateral sinus opacification

#### **HNEE-43 What is this Bump on the Face, Radiology? Medial Canthal Swelling, Differential Diagnosis of Angular Vein Thrombosis Radiologists Should Know**

Participants

Nahyun Jo, MD, Galveston, TX (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The face is the first body part a physician sees when they meet a patient; it is often diagnosed and followed clinically. With the advances in imaging and increase in utilization, radiologic evaluation of facial masses is becoming more common. In certain cases, radiology plays a crucial role. Facial vein thrombosis presents as a focal facial mass-like lesion due to engorged veins. This is well-known in the traditional anatomy literature related to the "danger triangle" of the face. While thrombophlebitis is a more common etiology, more recently, facial/angular vein thrombosis secondary to periorbital cosmetic botulinum toxin injections has been reported by ophthalmologists and plastic surgeons. Due to its proximity to the sinuses, sinus-related diseases such as dacryocystocele or nasolacrimal duct obstruction often mimic angular vein pathologies. Vascular malformations such as an ophthalmic artery arteriovenous fistula, carotid-cavernous fistula, or lymphovenous malformation may also present as periorbital mass or proptosis. Other etiologies of soft tissue masses, such as skin tumors or benign masses, should also be considered.

##### **TABLE OF CONTENTS/OUTLINE**

We discuss the basic anatomical structures in the face that radiology trainees should know. Then we further discuss the imaging findings of facial masses ranging from the most common lipoma to uncommon lymphovascular malformations. Each of the common and unique cases is presented for each pathology with teaching points. - Introduction to facial anatomy- Infection-Trauma-Venous thrombosis-Vascular malformations-Sinus related-Benign cluster of tissues-Tumor-Foreign body and cosmetic injections

#### **HNEE-44 Node More Tears: Unraveling the Etiologies and Imaging of Lymph Nodes Diseases**

##### **TEACHING POINTS**

To understand patterns of lymphadenopathy in imaging methods.  
To illustrate the most common imaging findings of lymph nodes diseases and the useful hallmarks that help in differential diagnosis.  
To learn about advanced imaging methods and how they can help in the evaluation of lymphadenopathy.

##### **TABLE OF CONTENTS/OUTLINE**

Anatomy of lymph node  
Patterns of lymph nodes diseases - Hypervascular - Cystic or necrotic - Calcified  
Main imaging characteristics and differential diagnosis of the different etiologies.- Inflammatory / Infectious (Viral, Bacterial, Fungal and others).  
- Lymphomas - Castleman Disease - Neoplastic Metastasis ( Eg. Squamous cell carcinoma; Kaposi sarcoma)- Lymphadenopathy associated with systemic syndromes (eg. Kikuchi-Fujimoto Disease, Kimura, systemic lupus erythematosus)  
Take-home messages and tips and tricks to differential diagnosis.

#### **HNEE-45 Advanced Neck Ultrasound: Pearls and Pitfalls Using High-Frequency Transducers**

Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Review key findings in neck ultrasound using high-frequency transducers (24-33MHz). Illustrate clinical situations where the use of high-frequency transducers was decisive for the characterization of imaging findings in neck region, including skin, thyroid, parathyroid, salivary glands and lymph nodes lesions. Provide tips and tricks in a practical approach to a successful clinical practice integration.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction  
US transducer types: an overview  
Applications: a case-based review  
Skin US: benign and malignant lesions  
Thyroid US: focal and diffuse disease  
Parathyroid US: normal and abnormal findings  
Lymph node US: beyond metastatic disease  
Salivary gland US: pearls and pitfalls  
Other challenging applications  
Practical approach: tips and tricks for clinical practice integration  
Future perspectives: ultra-high frequency US  
Take home messages

#### **HNEE-46 To Infinity And Beyond: A Primer Review Of The Uncommon Disorders Of The Temporomandibular Joint Besides Internal Derangement**

##### **TEACHING POINTS**

- Review the normal anatomy of the temporomandibular joint and its relationship to adjacent structures- To illustrate a variety of rare cases in order to avoid misinterpretations and pitfalls;

##### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION:RELEVANT IMAGING ANATOMY:TEMPOROMANDIBULAR LESIONS AND ALTERATIONS: Clinical cases illustrating the spectrum of uncommon TMJ findings in CT and MRI.Condylar pathologies;Coronoid process pathologies;Extension of TMJ pathological processes to adjacent structures;Inflammations non-infectious;Infectious Other pathologies.TAKE-HOME MESSAGESREFERENCES

#### **HNEE-47 The Tongue Has People Talking**

Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Show the anatomy of the tongue through schematic illustrations and its correlation with radiological images, indicating anatomical reference points. Determine the role of each imaging technique in the analysis of the pathology of the tongue. Review the most frequent pathology of the tongue, mainly tumors outlining the radiological findings with therapeutic implications.

#### TABLE OF CONTENTS/OUTLINE

Background Embryology and Anatomy of the tongue Imaging technique Imaging findings- Oncological tongue Radiological findings with therapeutic implications- Congenital anomalies- Inflamed tongues- Lingual denervation. The tongue is the central part of the oral cavity and the oropharynx. It is the organ of taste, plays an essential role in the formation of the alimentary bolus and in swallowing and forms part of the phonatory system. Given the importance the role of the tongue plays in the patient's quality of life, the radiologist of the head and neck should be familiar with its anatomy, the optimum imaging techniques for its evaluation, as well as its spectrum of pathologies. In this way the radiological description will reflect reliably and with anatomical detail the extent of a lesion, particularly in the area of oncology, and it will be possible to select the most appropriate treatment for each patient so as to preserve function to the maximum extent possible. The radiological evaluation will also be of special significance during the surveillance period following treatment, so the radiologist should be familiar with the main therapeutic strategies and be accustomed to the image of the treated patient as well as the most appropriate techniques for detecting tumor recurrence.

#### HNEE-48 Look on the Bright Sign: Shedding Light on Mysteries of Optic Neuropathy

Participants

Alice Abreu Mota, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Optic neuropathy: It may be the only manifestation of Behçet's disease in the central nervous system. Diffusion restriction may be seen in trauma and ischemia. In induced cocaine cases, it is often unilateral, due to compression or ischemia. Methanol intoxication findings included bilateral optic nerve enhancement, putamen and caudate necrosis. Leber's hereditary optic neuropathy may show increased T2 signal in the optic nerves, chiasm, and tracts. Neuritis can also simulate a tumor. The short-segment enhancement at the optic nerve-globe junction is seen on cat scratch disease. Granulomatosis with polyangiitis (GPA) is often hypointense on T2. Direct granulomatous infiltration is one of the triggers of sarcoidosis. MOG-IgG+ exhibit long-length, bilateral, and anterior optic nerve involvement. Unilateral and short-segment involvement is seen in Multiple Sclerosis. In Neuromyelitis Optica (NMO) the impairment is bilateral on posterior optic nerves and chiasm.

#### TABLE OF CONTENTS/OUTLINE

Toxic Metanol Cocaine Medicine Granulomatosis Sarcoidosis; GPA; Tolosa Hunt; IgG4 Related Disease; Cat scratch disease; Tuberculosis. Non-demyelinating Vogt-Koyanagi-Harada; Behçet's Disease. Demyelinating Multiple Sclerosis; NMO; MOG-IgG+. Others Ischemic; Trauma; Tumor.

#### HNEE-49 Cavernous Sinus Imaging: Anatomy, Pathology and Warning Signs for Daily Practice

Participants

Ana Sanchez, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the anatomy and study protocol of the cavernous sinus. Provide warning signs to quickly recognize cavernous sinus involvement and assess patient treatment. Discuss clinical cases of our Department and relevant imaging findings.

#### TABLE OF CONTENTS/OUTLINE

Anatomy Study protocol Warning Signs: Enlargement of superior ophthalmic vein/s. Morphological change. Finding Density/ Signal — Flow void. Clinical exam — multiple cranial nerve deficit. Red bulging eye. Restricted diffusion. Clinical cases: Neoplasms: meningioma, hemangioma, macroadenoma, chordoma. Inflammatory: Tolosa Hunt Syndrome. Vascular: aneurysm, carotid-cavernous fistula. Miscellaneous: intracavernous arachnoid cyst, air/fat in the cavernous sinus. References

#### HNEE-5 Facial Retaining Ligaments: Can We See It

Participants

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A thorough investigation of the layers and structures of facial anatomy is crucial when performing facial surgery and aesthetic procedures. The retaining ligaments of the face represent additional information of this anatomy and are essential in understanding principles of facial aging and rejuvenation. They are located in constant anatomic locations where they separate facial spaces and compartments. Their main significance relates to their anatomical understanding in fillers procedures and in surgical release in order to achieve the desired aesthetic outcome. Furthermore, they have a sentinel role in their anatomic relationship to facial nerve branches. Descriptions of the retaining ligaments are variable in the literature; due to different interpretations of anatomy, several classifications, locations, and nomenclature systems have been proposed, but there is no description of imaging findings. This study will review and clarify the anatomy and imaging aspects of the retaining ligaments of the face using High frequency ultrasound (HFUS/24-33MHz). The purpose of this exhibit is: (1) To illustrate the anatomy of the facial retaining ligaments with fresh-frozen specimen correlation; (2) To describe the correct examination technique; (3) To highlight the importance of HFUS in facial ligaments and nerves characterization; (4) To show the dynamic evaluation and characterization of facial ligaments with HFUS; (5) To describe the most important related facial ageing changes and aesthetic importance

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION; 2. ANATOMY; 3. FACIAL AGEING PROCESS; 3. HFUS EVALUATION TECHNIQUE; 4. UNDERSTANDING AESTHETIC PROCEDURES; 5. CONCLUSION

#### HNEE-50 Understanding Neck Dissection and Bringing the Radiologist Closer to the Surgeon

Participants

Marcos Pinheiro II, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Teaching Point 1: Understand the different types of neck dissection. There are different types of neck dissection, ranging from a selective neck dissection to a radical neck dissection. It is important for radiologists to understand the extent of surgery and the structures that are removed in each type of neck dissection to accurately recognize them and properly interpret postoperative imaging studies. Teaching Point 2: Be aware of potential complications. Neck dissection can be associated with various complications, including bleeding, infection, and injury to important structures such as the spinal accessory nerve. Radiologists must be familiar with these potential complications and be able to identify them on imaging studies.

## TABLE OF CONTENTS/OUTLINE

1. Anatomy of cervical lymph node levels and surgical techniques involved in neck dissection. 2. Role of imaging in the preoperative planning (evaluation of the primary tumor and cervical nodal status, therefore helping the surgeon decide the most appropriate type of neck dissection, if needed). 3. Recognize expected imaging findings in postoperative neck dissection, as well as potential complications, including hematoma, abscess, and injury to neurovascular structures.

## HNEE-51 Paranasal Sinuses Computed Tomography: Read It Like an Expert

### TEACHING POINTS

Learn the acquisition protocols and become familiar with the anatomy and anatomical variations of the paranasal sinuses to guide the endoscopic sinus surgeon

### TABLE OF CONTENTS/OUTLINE

Nose and paranasal sinuses anatomy is highly variable and some anatomic variants can result in complications in FESS. The nasal septum is made up of an anterior cartilaginous component and a posterior bony component including the vomer and the perpendicular plate of the ethmoid. Septum anatomic variations include septal deviation that can cause a middle turbinate displacement and interfere with surgical access to the middle meatus; septal pneumatization may narrow the sphenoidal recess and impede access to the sphenoid ostium. The middle turbinate is the site of different variations, including concha bullosa (pneumatization of the inferior bulbous portion of the middle turbinate, or "cell of Grunwald" if pneumatization is limited to the vertical lamella above the level of the ostiomeatal complex), that can obstruct the ethmoidal infundibulum, and paradoxical middle turbinate, when the turbinate shows a paradoxical lateral convexity, which can impede surgical access to the ostiomeatal complex and contribute to recurrent rhinosinusitis. Haller cells are ethmoid cells extending into the orbital floor, with variable sizes that can narrow the ostia of the maxillary sinus or ethmoid infundibulum. Onodi cells are posterior ethmoid cells extending to the sphenoid sinus, placed medially to the optic nerve. These cells can also surround the optic nerve and are linked with increased risk of nerve damage during sinus surgery.

## HNEE-52 Approach to Jaw Lesions

Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

CT and MR can characterize jaw lesion location, composition, margins, and extent. Jaw lesions are classified into odontogenic vs. non-odontogenic, and simple/complex lytic or sclerotic. Key etiologies include developmental, inflammatory, traumatic, and neoplastic. Patient age, symptoms, and systemic findings help narrow the differential. For suspected neoplasms, biopsy helps confirm the diagnosis. The range of potential approaches includes watchful waiting, sclerotherapy, ablation, curettage, subtotal resection, and radical excision. Genetic testing is important when certain histologies and syndromes are suspected.

### TABLE OF CONTENTS/OUTLINE

1. Dentistry 101 Jaw/tooth development Anatomy eruption Imaging modalities 2. Classification Odontogenic, non-odontogenic Developmental, inflammatory, traumatic, neoplastic 3. Simple Cystic Radicular Dentigerous Buccal bifurcation Lateral periodontal Fissural Stafne Simple 4. Complex Cystic Aneurysmal bone cyst / Giant cell granuloma Langerhans cell histiocytosis Ameloblastoma Odontogenic myxoma Odontogenic fibroma Mixed odontogenic tumors 5. Sclerotic/Mixed Tori Odontomas Fibro-osseous lesions Cemento-osseous dysplasia Cementoblastoma Osteomyelitis: acute, chronic (Garré), nonbacterial (CRMO, SAPHO) Osteonecrosis 6. Syndromic Odontogenic keratocyst (Gorlin) Brown tumors (hyperparathyroidism) Gardner syndrome Cherubism Desmoplastic fibroma (TS, fibromatoses) Gorham disease

## HNEE-53 Advanced MRI of the Head and Neck

Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

Advanced MRI techniques utilized in the head neck include anatomic, diffusion, perfusion, vascular, elastography, functional, and metabolic. Understanding of fundamental physical principles enables optimal utilization interpretation. Informed clinical use improves patient diagnosis management. Clinical applications exist for congenital, neoplastic, vascular, metabolic, and traumatic etiologies.

### TABLE OF CONTENTS/OUTLINE

1. High-resolution: T2, T1, 7 Tesla Cranial nerve lesions Midface anomalies Meningoceles Inner ear anomalies Orbital malformations, tumors 2. Phase-contrast: 2D, 3D CSF flow Angiography 3. Diffusion: non-echo-planar, intravoxel incoherent motion, diffusion tensor imaging Skull base tumor, infection Pott's puffy tumor Cord/nerve fibers 4. Perfusion: arterial spin labeling, dynamic susceptibility contrast, dynamic contrast-enhanced Vascular tumors Vascular malformations Skull base tumors Pituitary lesions Face transplant 5. Vascular: time-of-flight, phase-contrast, time-resolved, ferumoxytol, vessel wall imaging PHACES association Vasculopathies 6. Ultrashort- and zero-echo-time imaging Malformations Trauma Tumors Postoperative 7. Elastography Pituitary adenoma Vestibular schwannoma 8. Spectroscopy 9. PET/MR Epilepsy HN tumors 10. Chemical exchange saturation transfer 11. Anatomic modeling

## HNEE-54 Zero Echo-Time MRI of the Head and Neck

## Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

- Cortical bone MRI utilizes short-TE techniques such as gradient, ultrashort, and zero echo-time.
- Short-T2 tissues appear dark, hence the term "black-bone" MRI.
- Use cases include plagiocephaly, craniosynostosis, calvarial lesions, sinonasal disease, head neck tumors, jaw lesions, trauma, surgical navigation, and postoperative evaluation.
- Postprocessing advances using point reconstructions and deep learning facilitate synthetic ("bright-bone") CT generation, 3D visualization, and surgical planning.

### TABLE OF CONTENTS/OUTLINE

1. Technique

- Gradient, ultrashort, zero echo-time
- Workflow sequence options
- Interpretation and pitfalls

2. Clinical Cases

- Plagiocephaly
- Simple craniosynostosis: metopic, sagittal, coronal
- Genetic syndromes: Apert, Saethre-Chotzen, achondroplasia
- Skull: ecchordosis physaliphora, dermoid cysts, LCH, fibrous dysplasia
- Sinonasal: midnasal stenosis, pneumosinus dilatans, sinusitis
- Tumors: orbitotemporal NF1, rhabdomyosarcoma, chordoma
- Jaw lesions: ameloblastoma, desmoplastic fibroma
- Trauma: abusive head trauma, TBI, leptomeningeal cyst, cephalohematoma
- Surgical planning: arachnoid cyst, hydrocephalus
- Shunt evaluation: tumor, craniosynostosis, overshunting
- Postoperative evaluation: craniotomy, cranioplasty, ZMC, orbital blowout, cephalocele

3. Postprocessing

- Point processing
- Deep learning: models, loss functions, generalizability
- Diagnostic use
- Surgical planning

## HNEE-55 Fetal Head and Neck Imaging

### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

Fetal HN anomalies can be classified into congenital, genetic, vascular, neoplastic, traumatic, and endocrine etiologies. Major diagnoses include micrognathia, facial clefts, craniosynostosis, meningocele, vascular malformations, teratoma, and airway obstruction. US and MRI have complementary roles for prenatal screening and detailed workup. Each technique has specific clinical indications and technical limitations. Fetal MRI protocols should include 3-plane ssFSE with optional balanced SSFP, diffusion, and T1. The radiology report should address brain, face, neck, and airway, along with secondary complications and multisystem associations. Several qualitative features and quantitative metrics can be applied. For at-risk patients, serial imaging can improve diagnostic yield and interventional planning. Postnatal imaging is important for confirmation of prenatal findings.

### TABLE OF CONTENTS/OUTLINE

1. Craniofacial Malformations Oro/craniofacial clefts Micrognathia, Pierre-Robin Beckwith-Wiedemann Orbital telorism, malformations Craniosynostosis Cephaloceles, meningoceles Acrania-exencephaly-anencephaly Amniotic band syndrome

2. Genetic Syndromes Apert Pfeiffer Frontonasal dysplasia DiGeorge Fraser

3. Cervicofacial Masses Vascular anomalies Hemangioma Lymphatic malformation Vein of Galen malformation Arteriovenous malformation Teratoma Goiter

4. Upper Airway Congenital high airway obstruction syndrome Laryngeal stenosis/atresia Tracheal stenosis/atresia Tracheo-esophageal fistula (VACTERL)

## HNEE-56 Pediatric Cutaneous Lesions: Below the Surface

### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

Pediatric skin lesions are often harbingers of more extensive or systemic disease. Unique cutaneous stigmata are seen in vascular anomalies and phakomatoses. Radiologic imaging is needed to characterize deep or multisystem involvement. Understanding of genetics helps to explain disease pathogenesis and develop targeted therapies.

### TABLE OF CONTENTS/OUTLINE

1. Background Genetic advances Ras and mTOR pathways Targeted therapies Critical point for intervention

2. Vascular Anomalies Malformations Low-flow Lymphatic (syndrome: GLA) Venous (syndromes: VMCM, BRBNS, KTW) Capillary (syndromes: M-CM, CLAPO) High-flow AVM AVF Syndromes: HHT, CM-AVM, PWS, CAMS Tumors Benign Congenital hemangioma Infantile hemangioma Syndromes: hemangiomatosis, PHACES Borderline Juvenile nasopharyngeal angiofibroma Kaposiform hemangioendothelioma Malignant

3. Phakomatoses Dysplastic NF1 NF2 NF3 Tuberous sclerosis Gorlin Cowden Proteus Encephalocraniocutaneous lipomatosis Vascular Von Hippel-Lindau Sturge-Weber Ataxia-telangiectasia Pigmentary Neurocutaneous melanosis Pigmentary mosaicism

## HNEE-57 Pediatric Orbital Lesions

### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### TEACHING POINTS

Pediatric orbital lesions can be classified into congenital, CSF, traumatic, vascular, endocrine, inflammatory, and neoplastic. Radiologic evaluation evaluates intraorbital compartments and extraorbital structures. Correlate imaging findings with ophthalmologic exam and imaging.

### TABLE OF CONTENTS/OUTLINE

1. Background Orbital anatomy development Ophthalmology: fundoscopy, US, OCT Radiology: CT, MR, XA

2. Congenital Small eye: anophthalmia, microphthalmia, phthisis bulbi Big eye: buphthalmos, staphylomas, colobomas Germ layer derivatives Syndromes: NF1, NF2, Aicardi, CHARGE, morning glory, Walker-Warburg Cranial dysinnervation

3. CSF Papilledema vs. pseudopapilledema Cephalocele Exorbitism

4. Trauma Anterior segment Posterior segment Globe rupture Fractures

5. Vascular anomalies Low-flow malformations

Varix Venous Lymphatic Sturge-Weber Coats disease High-flow malformations Carotid-cavernous fistula Wyburn-Mason Vascular tumors Hemangiomas PHACES Von Hippel-Lindau 6. Endocrine Pediatric Graves 7. Inflammation Pott's puffy tumor Aspergillosis COVID-19 Demyelination MS NMO ADEM Histiocytosis LCH JXG Granulomatosis IgG4 CRION 8. Neoplasia Intraocular Retinoblastoma Medulloepithelioma Periorbital Adenoid cystic carcinoma Hidradenocarcinoma Benign Solitary fibrous tumor Pituitary macroadenoma Small round cell Rhabdomyosarcoma Neuroblastoma Leukemia Desmoplastic sarcoma Bone lesions Osteoma Fibrous dysplasia Sickle cell infarcts

## **HNEE-58 Head Neck Vascular Anomalies and Syndromes**

Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### **TEACHING POINTS**

The ISSVA classification divides vascular anomalies into vascular malformations (vasculogenesis) and vascular tumors (angiogenesis). Radiology plays an important role in diagnosis and treatment of HN vascular anomalies. Major imaging approaches include US, CT, and MR. Each modality has specific clinical indications and limitations. Imaging findings should be correlated with dermatologic examination and other clinical information. There is an emerging focus on genetic causality and targeted therapies.

### **TABLE OF CONTENTS/OUTLINE**

1. ISSVA Classification Vascular neoplasms: benign, borderline, malignant Vascular malformations: simple, combined, syndromic Genetics and targeted therapies 2. Imaging Modalities USXRCTMRXA 3. Malformations Low-flow Capillary, venous, lymphatic Syndromes: Sturge-Weber, blue rubber bleb nevus, megalencephaly-capillary malformation, CLAPO, Gorham-Stout, generalized lymphatic anomaly High-flow Arteriovenous malformation, arteriovenous fistula Syndromes: cerebral arteriovenous metamerism syndrome, hereditary hemorrhagic telangiectasia, CM-AVM 4. Tumors Congenital hemangioma RICH, NICH, PICH Infantile hemangioma Hemangiomas, PHACES Kaposiform hemangioendothelioma / Tufted angioma Epithelioid hemangioendothelioma Kaposi sarcoma Angiosarcoma 5. Overgrowth Facial infiltrating lipomatosis Epidermal nevus Megalencephaly-capillary malformation: MCAP, MPPH Proteus Cowden

## **HNEE-59 Approach to Pediatric Face and Neck Masses**

Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

### **TEACHING POINTS**

Evaluation of pediatric face neck masses includes clinical history, physical exam, lab values, and radiology. Diagnostic imaging can be performed with US, CT, or MR to characterize lesion location, composition, and extent. Diagnostic categories include congenital, vascular, inflammatory, and neoplastic.

### **TABLE OF CONTENTS/OUTLINE**

1. Congenital Midface Dermal sinus Glial heterotopia Encephalocele Branchial clefts Types 1-4 Branchial pouches Thymus Parathyroid Thyroid 2. Vascular Vascular malformations Low-flow syndromes Lymphatic (generalized lymphatic anomaly) Venous (blue rubber bleb nevus) Capillary (megalencephaly-capillary malformation) High-flow syndromes HHT CM-AVM CAMS Vascular tumors Congenital hemangioma Infantile hemangioma: hemangiomas, PHACES Borderline tumors Juvenile nasopharyngeal angiofibroma Kaposiform hemangioendothelioma 3. Inflammatory Tonsillar vs. peritonsillar abscess Retropharyngeal edema vs. abscess Pott's puffy tumor Salivary glands Sialadenitis Pneumoparotitis Mucocele / Ranula Autoimmune 4. Neoplastic Lipomatous lesions Congenital infiltrating lipomatosis Lipoblastoma Teratoma Fibrous lesions Fibromatosis colli Myofibromatosis Leiomyoma Desmoplastic fibroma (tuberous sclerosis) Desmoid fibromatosis (Gardner) Sarcoma Rhabdomyosarcoma Ewing Fibrosarcoma Synovial sarcoma Neuroblastoma Primary Secondary Nerve sheath tumors NF1 NF2 NF3 Neuroendocrine tumors Glomus (SDH, NF1, VHL, MEN) Thyroid Thyroiditis Thyroid CA

## **HNEE-6 Differentiating Malignant Parotid Tumors From Pleomorphic Adenomas and Warthin's Tumors: The Benefits of Tumor Blood Flow and Apparent Diffusion Coefficient Histogram Analysis**

### **TEACHING POINTS**

It is occasionally difficult to differentiate malignant parotid tumors (MTs) from two major benign tumors such as pleomorphic adenomas (PAs) and Warthin's tumors (WTs). Here, we review how to diagnose parotid tumors by the use of apparent diffusion coefficient (ADC) and tumor blood flow (TBF) obtained by pseudocontinuous arterial spin labeling (pCASL), comparing conventional methods such as tumor-to-parotid gland signal intensity ratios with histogram analysis for the following reasons: 1. to understand principle of pCASL; 2. to review conventional methods to evaluate parotid tumors by TBF and ADC; and 3. to understand the benefits of TBF and ADC histogram analysis for differentiating MTs from PAs and WTs.

### **TABLE OF CONTENTS/OUTLINE**

1. Essential knowledge of parotid tumors such as incidence rate, and major tumor types 2. Principle of pCASL 3. Conventional methods for differentiating MTs from PAs and WTs 1. TBF and ADC histogram analysis for differentiating MTs from PAs and WTs 2. Conclusion: The combination of TBF and ADC evaluated by histogram analysis may enhance the diagnostic performance for differentiating parotid MTs from PAs and WTs.

## **HNEE-60 Opportunistic Assessment for Parathyroid Adenomas: How We Do It and Why**

Participants

Karol Cardenas, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

There are well-documented shortcomings in the diagnosis and treatment of primary hyperparathyroidism (PHPT). These gaps have prompted calls for innovative changes to how health systems approach this disease. One proposed change is for radiologists to assess for enlarged parathyroid glands on routine imaging studies with the goal of identifying individuals with undiagnosed PHPT.

This exhibit will 1) review relevant PHPT background, 2) summarize existing evidence related to opportunistic parathyroid assessment, and 3) share a practical, step-by-step approach to opportunistically screening for parathyroid adenomas (i.e., "how we do it") with illustrative case examples.

#### **TABLE OF CONTENTS/OUTLINE**

1. Opportunistic Screening - definition; potential benefits and risks  
2. PHPT Background - epidemiology, pathophysiology, diagnosis, treatment, accepted imaging role  
3. Existing Gaps - failure to diagnose, failure to treat, morbidity of untreated disease  
4. Opportunistic Assessment for Parathyroid Adenomas - anatomy, size criteria, imaging characteristics, review of the evidence, relevant aspects of Fifth International Workshop clinical guidelines, how we do it (search pattern, imaging evaluation, reporting)  
5. Illustrative Examples - opportunistically identifying parathyroid adenomas on CT, MR, US; differentiating from mimics (exophytic thyroid tissue, thyroid nodule, lymph node)  
6. Proposed Best Practices Decision Tree for "Should I Recommend Biochemical Testing for Possible PHPT?"  
7. Summary and Conclusion

#### **HNEE-61 Hmm...Is That Normal? Pediatric Skull Base Variants With A Focus on the Temporal Bone**

Participants

Asha Sarma, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-Radiologists must recognize many normal skull base variants that may be mistaken for disease in pediatric patients.  
-Differentiating normal variants from disease may be especially challenging in the temporal bone, given complex anatomy and frequently incomplete ossification.  
-This multi-institutional exhibit will provide a detailed case-based review of pediatric skull base variants including relevant companion cases, pearls, pitfalls, and mimics.  
-After viewing this exhibit, radiologists will have practical tools for differentiating normal skull base variants from disease and strategies for troubleshooting difficult cases.  
-This exhibit aims to: 1) describe relevant anatomy, embryology, and post-natal development of the skull base and temporal bones, 2) identify CT and MRI findings of common and uncommon developmental findings and variants, 3) contrast these variants with similar-appearing disease states, and 4) explain strategies for troubleshooting difficult cases.

#### **TABLE OF CONTENTS/OUTLINE**

1) Normal anterior skull base ossification and variants (e.g., skull base synchondroses, craniopharyngeal canal)  
2) Normal temporal bone development and variants (e.g., cochlear cleft, incomplete ossification of the semicircular canals)  
3) Variant middle ear findings (e.g., ossicular pneumatization, suspensory ligament calcification)  
4) Vascular variants (e.g., emissary venous channels mimicking fracture, aplastic petrous carotid canal)  
5) Skull base pneumatization variants  
6) Other salient findings (e.g., skull base sutures, foramen tympanicum)

#### **HNEE-62 Pictorial Overview of Temporomandibular Joint Pathologies**

Participants

Wen Wang, MD, Orlando, FL (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review the anatomy of TMJ. Provide illustrative cases and clinical scenarios depicting common and rare pathologies involving TMJ.

#### **TABLE OF CONTENTS/OUTLINE**

1. Relevant anatomic review of the temporomandibular joint.  
2. Check list/Search pattern for TMJ pathologies.  
3. Congenital anomalies: i. Congenital hypoplasia ii. Ankylosis of TMJ.  
4. Infectious pathology: i. Septic arthritis of TMJ ii. Post-operative infection  
5. Degenerative disease: i. Osteoarthritis of TMJ ii. TMJ disc dislocation and subluxation.  
6. Neoplastic disease: i. Osteochondromatosis of TMJ ii. Ameloblastoma iii. Metastatic disease.  
7 Other pathologies: osteonecrosis.

#### **HNEE-63 Practical Tips for Hypopharyngeal Carcinoma Staging**

Participants

Carlos Alberto Coelho Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The hypopharynx represents the lowest portion of the pharynx and can be affected by neoplastic and non-neoplastic diseases. Squamous cell carcinoma is the most common neoplasm in this region and can affect one of its three main subsites: pyriform sinuses, posterior wall and post-cricoid region. Imaging evaluation is essential in the staging of these patients, along with clinical and endoscopic examination. The objective of this presentation is to help the radiologist in the evaluation of neoplastic lesions of the hypopharynx, with images and tips for the evaluation of primary lesions and lymph node enlargement, contributing to the TNM classification.

#### **TABLE OF CONTENTS/OUTLINE**

Discussion of imaging tips in staging the hypopharynx neoplasms by showing clinical cases with MRI and CT images. We start this presentation by detailing the anatomical limits of the hypopharynx. We will detail the three main subsites of hypopharyngeal neoplasms: pyriform sinuses, posterior wall and postcricoid region. We highlight the main points of the TNM classification and, through cases, we demonstrate the main anatomical landmarks, how to measure the lesions, besides tumor extension pathways. Lymph node aspects will also be discussed, such as dimensions, dissemination routes, extranodal extension and necrosis. The conclusion of this presentation shows that hypopharyngeal neoplasms are part of the daily clinical routine of general and head and neck radiologists. Therefore, the anatomy of the pharynx must be well known, as well as the main subsites of the hypopharynx. We also show that it is not necessary to memorize the TNM staging, but the radiologist must know how to evaluate its most important points and landmarks.

#### **HNEE-64 Orbital Trauma: A Pictorial Review**

Participants

Junaid Kalair, BS, Richardson, TX (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Discuss the role of imaging in evaluation of orbital trauma  
2. Recognized normal orbital anatomy on CT and MRI  
3. Describe the spectrum of orbital trauma injuries seen on imaging  
4. Recognize mimics of orbital injuries

#### TABLE OF CONTENTS/OUTLINE

Roles of radiographs, ultrasound, CT, and MRI in orbital trauma imaging  
Normal bony and soft tissue anatomy of the orbit on CT MRI including orbital compartments  
Pictorial Review of orbital injuries including: Extra-conal injuries Preseptal vs. post-septal hemorrhage Intra-conal vs. Extra-conal hemorrhage Traumatic exophthalmos vs. enophthalmos Ocular muscle injury/entrapment Foreign bodies Globe injuries Anterior segment Aqueous humor hemorrhage Uveal Prolapse Lens Dislocation Ejection Posterior segment Vitreous humor hemorrhage Subretinal hemorrhage Subchoroidal hemorrhage Open globe Imaging findings Foreign bodies Orbital trauma mimics  
Iatrogenic intraocular gas  
Medical implants

#### HNEE-65 Internal Cacophony of Heartbeats: Rhythmic Whooshing and Buzzing in the Ear - Maddening Patient and Physician

##### TEACHING POINTS

1. Review common and uncommon etiologies of pulsatile tinnitus including vascular, structural and neoplasms.  
2. Multimodality imaging assessment and diagnostic workup.  
3. Current concepts in management and review of treatment options.

#### TABLE OF CONTENTS/OUTLINE

1. Background introduction of pulsatile tinnitus  
2. Review of common and uncommon etiologies of pulsatile tinnitus  
a. Vascular:  
i. Venous: Idiopathic intracranial hypertension, jugular bulb diverticulum, and emissary veins  
ii. Arterial: arteriovenous fistula and malformations, aberrant carotid artery, fibromuscular dysplasia and carotid dissections  
b. Structural:  
i. Skull base dehiscence, internal jugular vein compression  
ii. Conductive hearing loss, e.g. otosclerosis  
c. Tumor: Paraganglioma, meningioma, low flow vascular malformations (Hemangiomas)  
3. Diagnostic Imaging QR codes with scrollable imaging data sets will be provided, with practical clues for making the diagnosis, and will include high-resolution flat panel CT.  
a. Idiopathic intracranial hypertension CTV, MRV, and DSA.  
b. High riding jugular bulb and diverticulum CTV and DSA, and vascular Eagle syndrome.  
c. Dural arteriovenous fistula CTA, MRA, and DSA Including high resolution 14 second magnified flat-panel computed tomography  
d. Aberrant carotid artery CTA and DSA  
e. Paraganglioma MRI, MRA, and DSA  
f. Meningioma MRIg. Sigmoid sinus wall dehiscence and emissary veins CTA including treatment DSA.  
h. Otosclerosis CT  
4. Review of treatment options  
a. Transverse sinus stenosis stenting.  
b. Arteriovenous fistula embolization.  
c. Jugular vein decompression.  
d. Bony dehiscence resurfacing.  
5. Diagnostic algorithm summary

#### HNEE-66 Imaging Evaluation of Hearing Loss: Understanding Audiograms to Refine Interpretation

##### TEACHING POINTS

1) Prior to imaging, patients with hearing loss undergo audiometric assessment, which categorizes hearing loss as conductive, sensorineural, or mixed.  
2) CT is the first-line imaging modality for patients with conductive hearing loss (CHL), and an understanding of prior audiometric testing results can benefit the radiologist's temporal bone CT interpretation.  
3) Pure-tone hearing test results may be the most relevant component of the audiogram report for radiologists and are often viewable in the electronic medical record at the time of CT interpretation.  
4) Recognizing specific CHL patterns in audiograms can increase confidence and accuracy of CT interpretations.  
5) The presence or absence of the acoustic reflex informs likelihood of a third window phenomenon.

#### TABLE OF CONTENTS/OUTLINE

I. Evaluation of the patient with hearing loss  
a. Clinical assessment  
b. Audiometric evaluation  
c. Role of imaging  
i. Indications for CT  
ii. Indications for MRI  
II. Review of audiometric testing  
a. Pure-tone hearing test  
i. Basic interpretation  
ii. Patterns of conductive hearing loss  
b. Acoustic reflex  
i. Principles  
ii. Acoustic reflex testing  
III. Illustrative Cases  
a. Pattern 1: Low frequency CHL closing in at higher frequencies  
b. Pattern 2: Flat CHL  
c. Pattern 3: The Carhart notch  
d. Absent acoustic reflex

#### HNEE-67 Ultrasound Assessment of Parathyroid Disease: The Latest and Greatest

##### TEACHING POINTS

- Provide an overview of the anatomy, function, and embryology of the parathyroid gland.
- Emphasize the indications, limitations, and benefits of ultrasound in evaluating the parathyroid gland.
- Compare different imaging techniques for the parathyroid gland.
- Discuss the ultrasound protocol for evaluating the parathyroid gland.
- Become familiar with descriptive terms for normal parathyroid gland anatomy.
- Review the most common pathologies and provide case studies to illustrate the practical application of theoretical concepts.
- Analyze differential diagnoses, tips, and tricks.
- Discuss updates in ultrasound evaluation for parathyroid gland pathology.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of the parathyroid gland  
1.1 Anatomy  
1.2 Function  
1.3. Embryology  
2. Ultrasound evaluation of the parathyroid gland  
2.1 Indications  
2.2 Limitations  
2.3 Benefits  
3. Comparison of imaging techniques for the parathyroid gland: ultrasound, 4DCT, and SPECT.  
4. Ultrasound and CEUS protocol for evaluating the parathyroid gland.  
5. Descriptive terms for normal parathyroid gland anatomy  
6. Common pathologies in the parathyroid gland: parathyroid adenoma, parathyroid hyperplasia, parathyroid carcinoma, atypical parathyroid adenoma/atypical parathyroid tumor.  
7. Differential diagnoses: thyroid nodules and cervical adenopathies, tips and tricks for improving radiology reports.  
8. Updates in ultrasound evaluation for parathyroid gland pathology: elastography and CEUS.  
9. Conclusion.

#### HNEE-68 Molecular Markers of Head and Neck Tumors

Participants

Amit K. Agarwal, MD, MBBS, Jacksonville, FL (*Presenter*) Stockholder, Gilead Sciences, Inc

##### TEACHING POINTS

1. To understand the basics of neuropathology and genetics  
2. Review the molecular markers genetics of head and neck tumors  
3. Discuss reclassified and newly recognized head and neck tumors

#### TABLE OF CONTENTS/OUTLINE

1. Neuropathology for the Neuroradiologist  
a. Basic histopathology (H E stains)  
b. Immunohistochemistry (immunocytology)  
c. Genetic

analysis (FISH, PCR, Next-generation sequencing,) d. Liquid biopsy<sup>2</sup>. Markers for squamous cell carcinomas (SCCa) of the head and neck. HPV (p16+ tumors) b. EBV positive tumors c. Circulating-tumor DNA (ct-DNA) for tumor surveillance<sup>3</sup>. Molecular markers for non-SCCa tumors of head and neck a. Muscle differentiation (actin, desmin) b. Neural differentiation (S100, GFAP) c. Vascular differentiation (CD markers) d. Epithelial differentiation (cytokeratin, EMA)<sup>4</sup>. Reclassified and newly recognized tumors a. SDH deficient paragangliomas b. EBV-related smooth muscle tumors c. Mammary analogue secretory carcinoma (MASC) 5. Therapeutic advances in head and neck oncology (focus on immunotherapy) 6. Summary/conclusion

## **HNEE-69 A Practical Guide for Radiologists: Localizing and Diagnosing Pathologies in the Carotid and Parapharyngeal Spaces**

### **TEACHING POINTS**

- Provides a comprehensive overview of the radiologic anatomy of the carotid and parapharyngeal space (PPS)
- Describes a practical approach for localizing the pathologies affecting the carotid and PPS.
- Reviews common and rare pathologies in the carotid and PPS using case-based examples, highlighting distinctive clinical and imaging features that can aid in the best differential diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

Table of Contents 1. Terminology of the Carotid and PPS 2. Anatomy and Contents of the Carotid and PPS 3. Practical approach to Diagnosing Pathologies in the Carotid and PPS 4. Displacement Pattern of PPS Fat for Localizing Masses. 5. Case-Based Review of Primary and Secondary Pathologies in the PPS 6. Case-Based Review of Primary and Secondary Pathologies in the Carotid Space Outline • Knowledge of anatomy is essential for localizing a lesion in the Carotid or PPS. • Displacement patterns of PPS fat can aid in identifying the space of origin. • Understanding the contents and common/rare lesions of these spaces is the first step in generating a differential diagnosis. • Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best differential diagnosis.

## **HNEE-7 Hypervascular Head and Neck Tumors: Image Aspects**

### **TEACHING POINTS**

Hypervascular tumors, by definition, are arterialized and present intense and early contrast enhancement. They comprise a wide variety of pathologies, which can be didactically divided into five major groups: neuroendocrine tumors, vascular tumors, primary lymphadenopathy, metastatic lymphadenopathy and other hypervascular tumors.

### **TABLE OF CONTENTS/OUTLINE**

In this presentation we are going to review hypervascular head and neck tumors and characterize their imaging features on computed tomography (CT) and magnetic resonance imaging (MRI), focusing on features that aid in the differential diagnosis through flowcharts. Images will be presented comparing the different locations of the paragangliomas and the various patterns of growth of the Juvenile nasopharyngeal angiofibroma. Metastatic and primary lymphadenopathy will be differentiated through tables.

## **HNEE-70 Update in Imaging of Parotid Lesions and Treatment-related Findings**

### **TEACHING POINTS**

Parotid gland tumors are a rare entity among the neoplasms of the head and neck. In adults, most encountered lesions are benign, being only 10% of parotid tumors malignant. Radiological assessment of these lesions includes ultrasound (US), computed tomography (CT), and morphological and functional magnetic resonance imaging (MRI). The definition of the nature of the lesion is essential for the election of treatment methods. Benign neoplasms may be destined for follow-up or managed surgically by gland-sparing techniques with facial nerve preservation. On the contrary, malignant lesions are treated frequently with total gland resection and sacrifice of the facial nerve with corresponding posterior morbidity. The exhibit aims to present the gamut of parotid neoplasms according to their imaging characteristics in the initial study and to stress the importance of radiological support in the follow-up. Treatment options including different surgical approaches and the correlation between applied technique and imaging will be provided.

### **TABLE OF CONTENTS/OUTLINE**

1. Parotid anatomy. 2. Imaging modalities: US, CT, morphological, and functional MRI. Applications. 3. Primary and secondary parotid lesions. 4. Different types of surgical approaches. 5. Follow-up findings.

## **HNEE-71 Bone Metabolic Disorders in Pediatric Patients: Key Clues for Early Detection in Dental Imaging**

Participants

Jo-Eun Kim, DDS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Bone metabolic disorder refers to a disease caused by a variety of causes that break the balance between bone-forming and bone-removing activities. Bone metabolic disorders can affect pediatric patients and impact their oral health. Dental imaging, such as panoramic radiographs and cone-beam computed tomography (CBCT), can provide key clues for early detection of these disorders. - Generalized loss of follicular cortex or lamina dura of tooth - Generalized widening or obliteration of pulp chamber - Generalized sclerotic or osteopenic change of trabecular bone Understanding the imaging features of bone metabolic disorders is essential for dental practitioners to identify and refer patients for appropriate medical care. Especially, it is important to distinguish it from hematopoietic malignancy (such as leukemia, or lymphoma), which can appear similar and requires urgent treatment. Collaboration between dental and medical professionals is crucial for the management and treatment of bone metabolic disorders in pediatric patients.

### **TABLE OF CONTENTS/OUTLINE**

1. Meaning of dental imaging in pediatrics 2. Schematic explanation of bone mineral metabolic disorder 3. Bone metabolic disorders which impact on teeth and jaw bone structures (summary table) 4. Example of panoramic radiographs of the pediatric patients affected by metabolic disorder 5. Differential diagnosis from hematopoietic malignancy of pediatric patients (Importance of detecting changes on dental radiography)



## **HNEE-72    Participants    **Something In Your Teeth! Dental Panoramic Radiology for Radiologists****

Logan Ryals, BS, Jackson, MS (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review normal dental anatomy and imaging features, highlighting digital panoramic radiography (Panorex) cross-sectional imaging correlates. Discuss the differential diagnosis of oral maxillofacial/dental pathology on Panorex and cross-sectional imaging. Recognize the importance of systematic dental imaging interpretation in the diagnosis of oral and maxillofacial diseases.

### **TABLE OF CONTENTS/OUTLINE**

The oral cavity is the intersection of dentistry and medicine. However, the relationship of oral and systemic conditions is not fully appreciated. Modalities used in dental radiology include periapical and bitewing radiography, digital panoramic radiography, and cone-beam computed tomography. Panoramic radiography is most widely encountered by radiologists, but few receive formal training, and many are uncomfortable interpreting these studies despite frequent expectations to do so. Early detection of intraoral pathologies by radiologists may improve patient care and alert clinicians to the need for dental consultation. Familiarity with the anatomy and pathology of the oral and maxillofacial region will improve radiologists' diagnostic confidence and allow for the synthesis of a timely and detailed differential diagnosis. We will review dental imaging protocols, normal dental anatomy, and common findings of oral and maxillofacial pathology. A wide range of pathology will be discussed, emphasizing their appearances on panoramic radiographs with cross-sectional imaging correlates. Pathologies to be discussed include infectious and inflammatory lesions, periodontal diseases, cystic, benign and malignant masses, sinus pathology, and bone and temporomandibular joint disorders.

## **HNEE-73    **Unlocking the Temporomandibular Joint: CT, MRI and Arthroscopic Correlation****

Participants

Silvia Cayon Somacarrera, MD, Torrelavega, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To illustrate the spectrum of findings in temporomandibular joint derangement on MR and its correlation with arthroscopic findings when available To highlight the role of CT in temporomandibular joint derangement To show the different surgical therapeutic approaches of temporomandibular pathology

### **TABLE OF CONTENTS/OUTLINE**

The most important anatomic structure of the temporomandibular joint is the articular meniscus, therefore it is the main element to be evaluated. We must study its morphology along with its location relative to the condyle in both closed- and open-mouth positions. However, we must bear in mind that meniscus aberrant displacement is also frequently seen in asymptomatic volunteers so that other findings such as joint effusion, retrodiskal layer rupture, lateral pterygoid muscle attachments thickening, degenerative changes, osteochondromatosis and ankylosis, may be required to help guide the diagnosis. It is important for the radiologists to detect early MR imaging signs of temporomandibular dysfunction, thereby avoiding its evolution to osteoarthritis. Nevertheless, it is important to know that the therapeutic approach is made by assessing both the clinical situation of the patient and the imaging. We have selected a wide variety of temporomandibular joint derangement cases in order to show the different imaging findings as well as the arthroscopic correlation when available. We also include a description of the different treatment approaches carried out in our institution.

## **HNEE-74    **Lesions in the Optic Tracts: Clinical-radiological Manifestations****

Participants

Maria Rocha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Review the basic anatomy of the visual pathway and correlation with clinical manifestations.- Present the most frequent lesions in each region of the optic tract and review the main differential diagnoses.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Anatomy review 3. Correlation the anatomy with clinical manifestations 4. Most frequent lesion in each topography

## **HNEE-75    **Temporal Bone Anatomy on Photon Counting CT: Beyond the Obvious****

Participants

Shehbaz Ansari, MD, MBBS, Chicago, IL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Describe the concept and design of photon counting CT scanners and understand its advantages over conventional CT scanners with energy integrating detectors. 2. Illustrate temporal bone anatomy with emphasis on structures that were previously not reliably or less vividly identifiable. 3. Develop a system-based approach to temporal bone radiological anatomy.

### **TABLE OF CONTENTS/OUTLINE**

The imaging anatomy of the temporal bone has seen little progress in the last decade owing to the limited progress in the detector technology. Conventional detectors suffer from the inverse relation between radiation dose and image noise along with a limit to image resolution. Photon counting detectors (PCDs) have improved contrast to noise ratio with twice the resolution at nearly half the radiation dose. The basic physics of these detectors and their potential uses will be first discussed. To highlight the advantages of PCDs, we depict temporal bone anatomy including small structures not previously identifiable on imaging. Historically, advances in imaging to clarify anatomy has led to a deeper understanding of and elucidation of new pathologies associated with these structures. We also put forward a system-based approach to the anatomy of this region along with the conventional section-based anatomy. This system-based approach, aided by diagrammatic illustrations, will aid in understanding the complex anatomy of minute neural structures and communications around the ear, the delicate ossicular support system, neural and vascular supply of the labyrinth, and minor adjacent fissures among others.

## **HNEE-76 Feast Your Eyes on US of the Eye: A Guide to Ophthalmic Sonography**

Participants

Pedro Daza, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The eye needs a gel pillow. Acquired planes must evaluate anterior and posterior chambers. The optic nerve must be acquired on its own, using Doppler. Extraocular structures are important. Dynamic images are strong points of the sonography.

### **TABLE OF CONTENTS/OUTLINE**

Anatomy and radiological anatomy of eye. Technique and recommendations. Pathology with case review. Conclusions.

## **HNEE-77 Imaging of Post-dental Treatment: What Radiologists Need to Know in Common and Advanced Dental Procedures**

### **TEACHING POINTS**

With recent advancements in dentistry, various new treatment methods have been clinically introduced, and many new materials are being used for treatments. Post-dental treatment CT and MR images reveal a variety of hard tissue and soft tissue changes and used dental materials which often associate image artifacts. Therefore, familiarity with post-treatment changes and dental materials is crucial to avoid misinterpretation as true pathologies, identify complications and evaluate for recurrent disease. The purpose of this exhibit is 1) to review common and uncommon dental treatments with an emphasis on recently introduced treatment and procedures, 2) to review expected and unexpected post-dental treatment changes and dental materials on CT and MR images, and 3) to discuss imaging approach to identify complications and disease recurrence or progression.

### **TABLE OF CONTENTS/OUTLINE**

1) Review of common and uncommon dental treatments, with an emphasis on recently introduced treatments and dental materials  
2) Review of expected and unexpected post-dental treatment changes and dental materials on CT and MR images  
3) Discussion on imaging approach to identify complications and disease recurrence or progression

## **HNEE-78 PET/MRI In Head and Neck Cancer: Ready For Primetime?**

Participants

Craig Foote, MD, BSc, Baltimore, MD (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

PET/MR is a relatively new modality poised to provide considerable, novel clinical value in the field of head and neck oncology by combining the functional evaluation of FDG PET with the exquisite soft tissue resolution of MR imaging. Patients with head and neck cancers already requiring MRI for TNM staging may stand to benefit the most from the use of PET/MR, which offers the ability to simultaneously acquire the optimal regional and distant metastatic evaluation offered by PET in addition to MR, as opposed to separately by MR and PET/CT. This educational exhibit will provide an overview of PET/MR and its current role in head and neck cancer, as well as discuss barriers to its widespread acceptance and predictions for the future.

### **TABLE OF CONTENTS/OUTLINE**

1) Overview of PET/MR a) Evolution of PET/MR b) Advancements in hardware c) Physics d) Coregistration  
2) Advantages of PET/MR a) Comparison to PET/CT i) Radiation dose reduction, longer acquisition times, improved radiation planning, etc. ii) Lung nodule detection compared to PET CT b) MRI for more accurate T staging  
c) Application of NIRADS (Neck imaging reporting and data system) in PET/MR  
3) Examples of PET/MR in head and neck cancer a) Evaluation of post-treatment change versus recurrence b) Head and neck cancer of unknown primary c) Orbital malignancy d) Perineural Spread  
4) Barriers to use a) Costs b) Lack of trial data showing distinct advantages  
5) Recent developments/future predictions a) Multi-parametric imaging b) Innovative radiotracers

## **HNEE-79 Laryngeal Carcinoma Evaluation with Dual Energy CT (DECT)**

Participants

Paloma Puyalto, PhD, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Dual-energy CT (DECT) can be used in laryngeal carcinoma (LC) evaluation. Based on the decomposition of different materials, DECT can distinguish tissues with similar Hounsfield Unit attenuations assessed in simple energy CT (SECT). The size, the identification of the margins of LC, and the evaluation of adjacent structures invasion, which could change the LC staging, is not always easy due to the small size occupied by the complex laryngeal structures in the visceral compartment and their similar attenuation values. A more accurate diagnosis can be made with DECT. The main objectives of this exhibit are: 1. To describe DECT image acquisition protocols and post-processing techniques related to the evaluation of LC. 2. To illustrate DECT findings in LC by TNM staging and its SECT correspondence. 3. To expose the differential diagnosis and potential pitfalls of LC in DECT and how to try to avoid them.

### **TABLE OF CONTENTS/OUTLINE**

1. Overview review of LC. 2. Diagnostic clinical and imaging strategies to evaluate LC. 3. DECT protocol for LC evaluation and post-processing techniques related to imaging of LC such as virtual monochromatic and material decomposition images. 4. Case-based cancer image examples with DECT and SECT correspondence for each TNM stage. 5. LC pitfalls and differential diagnosis of LC in DECT images.

## **HNEE-8 Ultrasound of Ocular Globe: Revealing What Lies Below**

Participants

Ingrid Caridade, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Ultrasound (US) of the eye has become increasingly popular in clinical practice as a complementary tool to ophthalmoscopy as it is

Ultrasound (US) of the eye has become increasingly popular in clinical practice as a complementary tool to ophthalmoscopy, as it is a dependable and secure diagnostic technique for assessing and monitoring various ophthalmic conditions, including inflammation, tumors, and traumatic injuries, as well as measure the optic nerve and detect intracranial hypertension. The method is accessible, non-invasive, and relatively low-cost, with few contraindications. The eye's superficial location and structure make the US an ideal examination option, particularly in emergency situations. It is typically recommended when it is challenging to examine the fundus of the eye due to conditions that cause opacity of the ocular globe. In pediatrics, US can be performed without sedation or radiation, making it an especially valuable tool. Radiologists should be familiar with the basic anatomy of the eye, as well as the examination technique and ultrasonographic findings of the entities that frequently affect the ocular globe. In this presentation, we show a literature review and case analysis performed using high-frequency linear transducers with B-mode ultrasonography and color Doppler. Subsequently, the findings are compared to imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI).

#### **TABLE OF CONTENTS/OUTLINE**

Review the normal eye anatomy. Demonstrate the US examination technique. Discuss some pathologies of the eye and its main ultrasonographic image features.

#### **HNEE-80 Delayed Gadolinium-enhanced MRI in Ménière's Disease: Imaging Findings and Clinical Application**

##### **TEACHING POINTS**

The purpose of this exhibit is to summarise current MRI techniques for hydrops imaging; to describe current diagnostic MRI criteria for Ménière's disease; and to discuss clinical application of hydrops imaging

#### **TABLE OF CONTENTS/OUTLINE**

Anatomy of inner ear structures; delayed gadolinium-enhanced inner ear MRI; MRI assessment; review of imaging findings; clinical utility

#### **HNEE-81 Mimics of Ménière's disease on delayed gadolinium-enhanced MRI**

##### **TEACHING POINTS**

The purpose of this exhibit is (1) to review imaging features of several peripheral vertigo-associated diseases on delayed gadolinium-enhanced MRI and (2) to describe the current role of MRI in differentiating Ménière's disease from other vertigo-associated diseases.

#### **TABLE OF CONTENTS/OUTLINE**

Anatomy of inner ear structures; delayed gadolinium-enhanced inner ear MRI; review of imaging findings in Ménière's disease, intralabyrinthine fistula, perilymphatic fistula, labyrinthitis, sudden sensorineural hearing loss, vestibular neuritis, vestibular migraine, vestibular schwannoma; summary of MRI findings and differentiating features.

#### **HNEE-82 Imaging Considerations for Transoral Robotic Surgery (TORS) Planning**

Participants

Niedja Santos Goncalves Tsuno, Brasilia, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- To learn the radiological imaging findings that represent indications and contraindications for Transoral Robotic Surgery (TORS), focusing on Head and Neck oncology. - To identify expected postsurgical status of tumors resected by TORS.

#### **TABLE OF CONTENTS/OUTLINE**

1. Simplify the anatomy of the oropharynx, hypopharynx, and larynx, with emphasis on the tonsillar regions, base of the tongue, supraglottis, hypopharynx (pyriform sinus), and also the pre-styloid parapharyngeal and retropharyngeal spaces. 2. Summarize classical TORS ideal indications for treatment of head and neck neoplasms, focusing on the role of CT and MR imaging to determine the size of the tumor, its location and relationship with adjacent structures. 3. Summarize and exemplify the major general contraindications for TORS related to the primary tumor (internal carotid artery entrapment, invasion of the prevertebral space, massive extension into the masticatory space, bone involvement) and those not related to the primary tumor (unresectable cervical nodal disease, metastases and high surgical-anesthetic risk), in addition to reviewing site-specific contraindications. 4. Conclusion.

#### **HNEE-83 What, Where and When of Imaging in Spontaneous Skull Base CSF Fistulas**

Participants

Sanchita Gupta, MBBS, MD, New Delhi, India (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1) Understand the anatomical basis and pathophysiology of spontaneously developing CSF fistulas 2) Approach to imaging in patients with skull base fistula 3) Identify the imaging appearance of lesions, and features to differentiate these from potential mimics 4) To extract clinically relevant imaging information which translates into improved decision-making and ease during the surgical procedure

#### **TABLE OF CONTENTS/OUTLINE**

1) What is a Spontaneous Skull base CSF fistula? 2) Pathophysiology of a CSF leak 3) Anatomical considerations - Common sites - Cribriform plate - Sphenoid bone - Perisellar and Lateral recess - Temporal bone - Tegmen tympani and mastoid 4) History and Clinical Presentation 5) Imaging modalities for assessment - Indications and Technique - High-resolution Computed Tomography (HRCT) - Magnetic resonance Cisternography - Contrast-enhanced CT Cisternography - Gadolinium-enhanced MR Cisternography 6) Imaging features of spontaneous skull base CSF fistula 7) Associated features of Idiopathic Intracranial Hypertension 8) Structured reporting format for the pre-surgical evaluation of skull base CSF fistula - What the Surgeon Wants to Know.

## **HNEE-84 The External Carotid Artery: The Forgotten Carotid Branch. Tips and Tricks for the Evaluation in Different Imaging Techniques.**

Participants

Maria Galante I, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-To review the pathway, anatomical relationships and areas supplied by the external carotid artery.-To describe the anatomy of the artery and the relationship with other structures in the different techniques, including CTA, MRA, US and DSA.-To give some tips to achieve an accurate evaluation of the artery and its main pathologies, especially while performing a diagnostic US.- To offer a US protocol for the assesment of these artery.The external carotid artery is one of the main vascular structures of the head and neck region, not only because it irrigates this area, but also because some of its branches anastomose with the internal carotid and posterior cerebral arteries, becoming an important source of collateral supply. Besides, it is well known that the number of interventional and surgical procedures has massively increased . So, being the territory supplied by this artery so extensive and sometimes tricky, it could get affected whenever any of these procedures are performed, or in the case of tumors of the head and neck region, and traumatic injuries. In this exhibit we will analyze the anatomical pathway, territory, and relations of this artery.

### **TABLE OF CONTENTS/OUTLINE**

1) General Anatomical Description2) The external carotid artery in Imaging Techiques: US, CTA, MRI , DSA3) Tips and Tricks for the evaluation in US technique: Protocol4) Superior thyroid artery5) Ascending pharyngeal artery6) Lingual artery7) Facial artery8) Occipital artery9) Posterior auricular artery10) Maxillary artery11) Superficial temporal artery

## **HNEE-85 Algorithmic Approach to Head and Neck Emergency Neuroradiology**

### **TEACHING POINTS**

1. Discuss common neuroradiology examinations of the head and neck region from the emergency department.2. Outline key anatomic structures and common emergent diagnoses of the head and neck.3. Provide algorithmic approaches for interpreting neuroradiology examinations of the neck soft tissues, skull base, face, and orbits.4. Display image rich case examples of head and neck neuroradiology emergent diagnoses which outline key features for high quality reports.

### **TABLE OF CONTENTS/OUTLINE**

1) Neuroradiology examinations of the head and neck commonly ordered in the emergency department i) CT: neck soft tissues, maxillofacial, temporal bone, orbits, cervical spine, CTA ii) MRI: neck soft tissues, face, orbits, IAC, cervical spine, MRA iii) Radiographs: Neck soft tissue, cervical spine, face, mandible 2) Neck soft tissue Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Ludwig's Angina, Tracheal Fractures etc. 3) Skull base Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Ossicular dislocation, Bezold abscess etc. 4) Face Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Le Fort Fractures, Fungal sinusitis etc. 5) Orbit Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Globe rupture, Retrobulbar hemorrhage etc.

## **HNEE-86 Breathe Easier: A Guide for Imaging Obstructive Sleep Apnea (OSA)**

### **TEACHING POINTS**

Obstructive Sleep Apnea (OSA) is a common condition characterized by repetitive episodes of partial or complete upper airway obstruction during sleep, leading to disrupted breathing and decreased oxygen levels.Imaging techniques, such as computed tomography (CT) can provide valuable information for the diagnosis of OSA and surgical planning.CT is particularly useful for assessing the upper airway anatomy and identifying anatomical factors contributing to airway obstruction.A standardized approach for evaluating CT, including measurements of relevant landmarks is useful for communicating the findings to the referring surgeon.

### **TABLE OF CONTENTS/OUTLINE**

I. IntroductionDefinition and epidemiology of OSAScanning ProtocolIII. Imaging Techniques for OSAComputed Tomography (CT)Magnetic Resonance Imaging (MRI)III. Role of Imaging in OSA Diagnosis and ManagementUpper Airway AnatomyAssessmentSoft Tissue Structure EvaluationFunctional Changes DetectionComplications IdentificationTreatment GuidanceAnatomical Measurements on CTImplantable Neurostimulator to Treat Obstructive Sleep ApneaIV. ConclusionSummary of key pointsFuture directions and challenges in OSA imaging research

## **HNEE-87 Dacryocystography using Computed Tomography: What a Radiologist Needs to Know**

### **TEACHING POINTS**

Computed Tomography Dacryocystography (CT DCG) is a valuable technique to evaluate the nasolacrimal drainage system in epiphora. It allows unequivocal demonstration of the level and causes of obstruction that include inflammatory, traumatic (fractures and iatrogenic), developmental stenosis of the bony lacrimal canal, and an occasional lacrimal sac tumor, etc. It also provides useful information about the degree of obstruction, whether obstruction is anatomical or functional, insight into reasons for failed dacryocystorhinostomy, and other useful findings like sac size, diverticuli, fistulae, etc. The technique, therefore, provides a one-stop shop for all necessary information for the diagnosis, treatment planning, and follow-up in epiphora.

### **TABLE OF CONTENTS/OUTLINE**

1)Indications 2)Technique 3)Interpretation 4)Etiologies with illustrative cases 5)Ancillary findings aided and detected by CT 5)Limitations 6)Conclusions

## **HNEE-88 Liptology or the Science Behind Beautiful Lips**

### **TEACHING POINTS**

- To describe the anatomy of lips and perioral region- What ultrasound technique is used to depict anatomy and tips to perform the exam- To assess any anatomical variants or physiological changes that affect the lips ?- To describe optimal prognostic tools during the ultrasound exam that might prevent any adverse event and also to define some common complications.

## TABLE OF CONTENTS/OUTLINE

The main focus is to describe the anatomy of simple but yet complicated organ that recently has been exposed to much attention. The other important part is to learn what anatomical variations are common and what pathological or physiological changes could be defined using Ultrasound. Due to the fact that there is unabated trend of aesthetic procedures in which complications are becoming more and more prominent, the radiologist must become familiar of them. Together we will identify what might be the ingredients of beautiful lips and their aging changes. The last but not least we will describe what the overfilled syndrome looks like and how it might affect the oral and perioral region.

### HNEE-89 Diagnostic Imaging of Enophthalmos: A Practical Approach

#### TEACHING POINTS

- Describe measures used to evaluate the normal globe position in cross-sectional imaging. - Discuss the main imaging features of entities that lead to enophthalmos and its mimics. - Demonstrate the utility of CT and MRI in the differential diagnosis of patients with enophthalmos.

## TABLE OF CONTENTS/OUTLINE

Enophthalmos, defined as inward displacement of a normal-sized globe within the orbit, can occur unilaterally or bilaterally and is relatively common. If the displacement is minimal, the diagnosis may not always be based on physical examination and these patients may be initially misdiagnosed as having contralateral exophthalmos. Various etiologies cause enophthalmos and trauma is the leading cause. CT and MRI are the imaging techniques of choice for evaluating enophthalmos, and each have distinct advantages. While CT is useful for the detailed assessment of bone structures, MRI is better suited for analyzing orbital soft tissues. Our purpose is to present an overview of the imaging characteristics of entities that can cause enophthalmos based on various mechanisms, including structural abnormalities, fat atrophy, retraction, mixed, uni- vs. bilateral, and pseudoenophthalmos.

### HNEE-9 US of the Neck Beyond the Thyroid: Parathyroids, Salivary Glands, Adenopathy, Trachea

Participants

Matheus Marcelino Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: - Make a multimodality-based didactic review to elucidate multiple cervical conditions at neck ultrasound; - Propose a didactic categorization of these conditions: .Gastrointestinal malformations. Congenital malformations. Infectious causes. Oncology causes. Post operative conditions - Correlate those findings with other exams; - Illustrate those conditions based on cases from our radiology group.

## TABLE OF CONTENTS/OUTLINE

We will elucidate multiple cervical conditions at neck ultrasound and focus on their imaging features using a multimodality approach in this exhibit. Gastrointestinal malformations Zenker diverticulum Congenital malformations Cystic Thyroglossal duct cyst Branched cyst Lymphangioma Ranula Solid Teratoma Glioma Vascular Hemangioma Arteriovenous malformation Infectious causes Sialadenitis Parotitis Abscess Lymph node abscess Carotidynia Oncology Lymphoma Parotid Submandibular gland Oropharynx Post operative conditions

### HNEE-90 A Practical Guide to Reporting an Oropharyngeal Videofluoroscopic Swallow Study: Anatomical Landmarks, Tips, and Tricks

Participants

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe oropharyngeal region anatomy and mechanism of swallowing. - To review the study protocols of oropharyngeal videofluoroscopic swallow study (VFSS) in the evaluation of different clinical conditions and endoscopic findings. - To illustrate the most important anatomic landmarks and signs to evaluate in different phases of a swallowing videofluoroscopy. - To analyze steps in interpretation of an VFSS, report structure and essential points in reporting.

## TABLE OF CONTENTS/OUTLINE

Oropharyngeal videofluoroscopic swallow study is the technique of choice in the diagnosis of oropharyngeal dysphagia causes. The study protocol should be tailored according to the specific clinical symptoms and endoscopic findings in each patient. Reporting an VFSS requires knowledge of the most important anatomic landmarks and a detailed report structure including findings in the different phases of deglutition. We present: - Normal anatomy of the oropharynx and mechanism of swallowing. - Study protocol: Contrast agent preparation. Swallowing protocol: bolus volumes (small or large) consistency (liquid to semisolid). Patient positioning. Image requirements. Recording. - Study evaluation. Anatomical landmarks. Deglutition phases. Implications for treatment. Meal consistency. Different manoeuvres improving swallowing. - Report: Systematic analysis of imaging findings. Motility disorders: Bolus transport from oral cavity, Laryngeal vestibular penetration, Pharynx residue, Transglottic aspiration; Intrinsic causes: cricopharyngeal bar (prominent cricopharyngeal muscle), diverticulum, web. Extrinsic compression: osteophytes, thyroid gland. Surgery (laryngectomy).

### HNEE-91 Head and Neck: It's Not a Tumor

Participants

Brian Yep, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe imaging features of head and neck lesions that should raise the concern for oncologic processes. 2. Provide non-neoplastic differential considerations for head and neck lesions.

## TABLE OF CONTENTS/OUTLINE

One of the major questions that arise when encountering a head and neck lesion is to discern if it is a neoplastic or non-neoplastic

process. This educational exhibit will first highlight imaging features that should raise the concern for an aggressive neoplastic head and neck process. Then, through a case-based style, non-oncologic mimics will be presented to provide alternative benign differential diagnostic considerations including infectious, inflammatory, and variant congenital/developmental etiologies. Finally, one can put this knowledge to the test through a series of quiz questions.

## **HNEE-92 Imaging of Facial Pain and Numbness: Trigeminal Neuralgia and Neuropathy**

### **TEACHING POINTS**

1. Review the normal anatomy of the trigeminal nerve, its branches and structures normally present along its anatomic course. A combination of 2D and 3D rendered images will be used, as well as CT/MRI imaging examples. 2. Discuss the pathophysiology of classic and secondary causes of trigeminal neuralgia. 3. Present a case-based review illustrating different examples of classic and secondary trigeminal neuralgia on CT/MRI images. 4. Provide a step-by-step search pattern for trigeminal pain

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Normal trigeminal nerve and skull base anatomy III. Classification of common sources of trigeminal pain. Imaging review, pathophysiology, symptoms, and management will be reviewed. Cases will include but are not limited to: a. Trigeminal Neuralgia: neurovascular compression, demyelination, tumoral compression. b. Trigeminal Perineural Tumor Spread c. Post-Herpetic Neuralgia d. Post-Traumatic Trigeminal Neuropathy e. Trigeminal Trophic Syndrome: iatrogenic, brainstem infarction f. Anesthesia Dolorosa g. Trigeminal Tic Syndrome IV. Differential Diagnosis for non-trigeminal sources of facial pain: optic neuritis, nervus intermedius neuralgia, glossopharyngeal neuralgia. V. Simplified search pattern for trigeminal pain VI. Conclusion

## **HNEE-93 Dysphagia: A Pictorial Review of Common and Uncommon Causes**

Participants

Selima Siala, MD, Carrboro, NC (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Illustrate a large spectrum of diseases causing dysphagia. Highlight key imaging findings of common diseases of the pharynx and esophagus.

### **TABLE OF CONTENTS/OUTLINE**

Dysphagia is a broad term used to describe a subjective sensation of difficulty when swallowing. Causes of dysphagia can be divided into structural and functional. Structural dysphagia includes lesions that compromise the esophageal lumen typically leading to difficulty swallowing solid food prior to liquids. Examples of structural dysphagia include congenital anomalies (esophageal web and vascular entities), acquired (Zenker's diverticulum, Longus coli tendonitis, goiter, and aortic dissection), neoplasms, inflammation (esophagitis, felinization of the esophagus, Barrett's esophagus, and scleroderma), infection (abscess and Candidiasis), iatrogenic (surgically induced) and foreign bodies. Functional dysphagia is caused by conditions that interfere with normal peristalsis including diffuse esophageal spasm and achalasia. Hence the swallowing of both solid foods and liquid is compromised at the same time. Dysphagia can also be classified based on location as oropharyngeal or substernal. Oropharyngeal dysphagia is defined as a sensation of blockage in the throat, while substernal dysphagia presents as a sensation of blockage between the thoracic inlet and the xiphoid process. The evaluation of dysphagia heavily relies on imaging, particularly fluoroscopy studies including modified barium swallow and esophagography as well as CT. Fluoroscopy studies provide an evaluation of both anatomic structure and function of the pharynx and esophagus while CT provides better anatomic evaluation outside of the lumen.

## **HNEE-94 Decoding the Language of Neoplastic Cells: Molecular Markers as Prognostic and Diagnostic Tools for Oral Squamous Cell Carcinoma**

Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To illustrate the most recent genetic alterations described in Oral Squamous Cell Carcinoma (OSCC) and correlate with the pathology, imaging, and prognosis. To show that molecular analysis can provide information on tumor biological behavior. To demonstrate the importance of incorporating molecular analysis of OSCC.

### **TABLE OF CONTENTS/OUTLINE**

1. Revision of the anatomy of the oral cavity. 2. Epidemiology, pathology, and demographics of OSCC. 3. Recent advances in molecular biology. 4. Specific genetic mutations, amplifications, or deletions associated with tumor progression, recurrence, and response to therapy. 5. Identification of human papillomavirus (HPV) leading to improved prognosis and targeted therapy. 6. Imaging strategies to depict the correct diagnosis based on the genetic profile. 7. Targeted therapies or immunotherapies. 8. Flowchart of the changes and last updates based on the neoplastic molecular profile. 9. Take-home messages.

## **HNEE-95 Lessons About Cholesteatomas. Keratinize Radiological Knowledge**

Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Teaching points To demonstrate the features of cross-sectional imaging cholesteatomas, indications and limitations of HRCT and MRI. To illustrate the main complications of cholesteatomas and post-operative assessment.

### **TABLE OF CONTENTS/OUTLINE**

Table of contents / Outline Background. Imaging protocol. Basic anatomy: middle and inner ear. Features of external and middle ear cholesteatomas. The role of CT and MRI in the diagnosis of cholesteatoma. Extra auricular cholesteatoma. Complications of cholesteatoma. Assessment of recurrence and postoperative findings through CT and MRI. Take home messages.

## **HNEE-96 What a Pain in the... Imaging Findings of the Painful Ear**

Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Teaching points To detect the imaging features of the painful ear. To identify the main CT features of incipient and coalescent acute mastoiditis as a basis for recommending conservative or surgical management. To detect intracranial complications of acute inflammatory diseases.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline Background. Basic anatomy of the external, middle and inner ear. HRCT and MRI imaging protocol. The role of CT and MRI in the diagnosis of mastoiditis. Necrotizing external otitis. Local complications: Myringosclerosis / tympanosclerosis, Ossicular fixation and erosion, Labyrinthine fistula, Labyrinthitis, Periosteal / Bezold's abscess. Extensive complications: Dural sinus thrombosis, Meningitis, Subdural effusion, Brain abscess, Petrous apicitis.

#### **HNEE-97 Nose Job: A Work in Progress... Aesthetic Procedures of the Nose - Pre and Postoperative**

#### **TEACHING POINTS**

1. Review the structural anatomy of the nasal region 2. Detail the nasal functional anatomy for a successful rhinoplasty surgery. 3. Guide the radiologist to detail anatomical changes relevant to the surgical procedure 4. To evaluate the computed tomography (CT) imaging as a tool for developing approaches or strategies for leading aesthetic nasal surgical procedures. 5. To evaluate the postoperative CT images as a tool for evaluating changes, sequels and complications after the aesthetic surgical procedure.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Nasal anatomy b. Nasal functional anatomy c. Nasal deformities d. Clinical application of CT to aesthetic procedures of the nose 2. Preoperative CT image a. What should be evaluated: bony pyramid, cartilaginous pyramid, nasal valves, nasal deformities 3. Postoperative CT image a. Surgical techniques and imaging findings: rhinoplasty, septoplasty, rhinectomy, maxillary antrostomy and uncinectomy, nasal turbinate surgery, ethmoidectomy, nasal prosthesis b. Complications c. Sequels 4. Take-home messages

#### **HNEE-98 Precision Imaging of Diplopia: MRI Protocol and Various Diseases**

#### **TEACHING POINTS**

Diplopia is a relatively common neuro-ophthalmological symptom and has a variety of causes. Here, a high-resolution MRI protocol specialized for diplopia is introduced, and various imaging findings related to diplopia are presented.

#### **TABLE OF CONTENTS/OUTLINE**

Diplopia MRI should be designed to include the entire pathway of cranial nerve (CN) III, IV, and VI, and the orbit. In general, 3D heavily T2-weighted images or 3D proton-density weighted images are often used for evaluation of the cisternal segment of CNs. However, the cisternal segment of CN4 is so small that high resolution 3D true fast imaging with steady-state free precession (Trufi) is required: a slice thickness of 0.3mm, and a scan range acquired above and below of the junction of inferior colliculus and superior medullary velum in the brainstem (figure 1). For the cavernous segment of CNs, contrast-enhanced 3D T1 Volumetric interpolated breath-hold examination (VIBE) image with fat-suppression allow us to identify normal CNs located therein (figure 2). The anatomical classification of etiologies associated with diplopia can be divided into brainstem lesions (figure 3), cistern (figure 4), cavernous (figure 5), and orbital regions. Causes that can cause diplopia include congenital diseases, vascular lesion, tumor, inflammation, infection, and trauma, etc.

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## Abstract Archives of the RSNA, 2023

HNEE-1

### Don't Lose Your Nerve: Pictorial Review of Cranial Nerve Denervation in the Head and Neck

#### Participants

Rachel Saks, MD, Rego Park, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the pathophysiology of denervation and the subsequent imaging changes that occur within the muscle over time.2. Review the anatomy of the cranial nerves with motor function, particularly focussing on the muscles innervated by each nerve and their appearances with acute and chronic denervation.3. Review potential imaging pitfalls due to denervation changes, such as misinterpretation of contralateral FDG uptake in the setting of vocal cord palsy.

#### TABLE OF CONTENTS/OUTLINE

1. Pathophysiology of denervation2. Imaging findings in acute, subacute and late denervation3. Cranial nerve anatomy and appearances of denervation of the muscles innervated by the specific nerve- Oculomotor nerve- Trochlear nerve- Abducens nerve- Trigeminal nerve- Facial nerve- Glossopharyngeal nerve- Vagus nerve- Spinal Accessory nerve- Hypoglossal nerve4. Imaging pitfalls

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## Abstract Archives of the RSNA, 2023

HNEE-10

### Don't Get Trapped: Diagnostic Errors in Emergency Head and Neck Radiology

#### Participants

Thiago Jose Pinheiro Lopes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- An incidence of 3-4% of errors in the radiological routine is estimated. In the emergency room, the accuracy of the diagnosis becomes even more relevant, considering the need to take more immediate measures depending on the imaging findings. - Errors in diagnostic radiology can occur for a variety of reasons. Recognizing the cognitive views that favor their occurrence is important to prevent them. - Our objective is to present a series of head and neck radiological cases, unraveling the causes of errors and then providing strategies to be followed to minimize them during radiological interpretation.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Types of errors in diagnostic radiology (Renfrew Classification). 3. Series of misdiagnosis real cases in emergency room head and neck radiology, including: a) Case discussion: anatomy review, possible complications related to an error in image interpretation. b) Identification of the error causes. c) Tips on how to avoid them. 4. Challenges, pearls and pitfalls when interpreting a head and neck radiological exam. 5. Take home messages.

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## Abstract Archives of the RSNA, 2023

HNEE-11

### Basic Principles of Nasal Imaging

#### Participants

Mina Al-Ani, MBCh, Elmsford, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Nasal masses can originate in the nasal cavity or adjacent structures. Utilizing a systematic approach for evaluating nasal imaging plays a crucial role in establishing a differential diagnosis, treatment, and surgical planning. After a review of nasal anatomy using illustrations and cross-sectional images, we discuss the fundamental principles of nasal imaging and their application in the analysis of a broad spectrum of nasal abnormalities. Imaging features and clinical findings of these lesions are discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction emphasizing the role of imaging in diagnosing nasal lesions. 2. Illustration of nasal anatomy. 3. Principles of nasal imaging used in the evaluation of a wide range of nasal lesions, including but not limited to: a. Congenital lesions (e.g., encephalocele, supernumerary tooth, and nasolabial cyst) b. Benign masses (e.g., schwannoma, paraganglioma, and inverted papilloma) c. Malignant masses (e.g., squamous cell carcinoma, esthesioneuroblastoma, and nasal metastasis) d. Infectious and inflammatory lesions (e.g., fungal sinusitis, granulomatosis with polyangiitis, and rhinoscleroma) e. Pseudomasses (e.g., pneumosinus dilatans, septal hematoma, and rhinolith). 4. Conclusion.

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## Abstract Archives of the RSNA, 2023

HNEE-12

### Orthognathic Imaging: Pre- and Post-Surgical Considerations for Craniofacial Reconstruction

#### Participants

Jeffers Nguyen, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The interpretation of orthognathic imaging studies is a growing part of both general and subspecialty neuroradiology practice. These studies are performed to evaluate a wide range of conditions, including congenital anomalies, traumatic injuries, neoplastic growth, and iatrogenic complications. They are necessary for successful craniofacial reconstruction. Surgical planning and post-surgical follow-up studies are used to evaluate for appropriate jaw alignment and bite and to assess for complications. These topics may not be covered in depth by educational materials at the residency and fellowship levels. We hope to provide an accessible, illustrative review at graded levels of orthognathic imaging for the trainee, general radiologist, and neuroradiologist. Finally, we will also briefly touch on principles related to imaging for an increasingly prevalent procedure, facial feminization surgery, and we will share cases related to our institution experience.

#### TABLE OF CONTENTS/OUTLINE

1) Etiologies of Maxillofacial Deformities; 2) Important Orthognathic Terms and Concepts; 3) Orthognathic Surgical Procedures and their Indications; 4) Pre- and Post-Surgical Orthognathic Imaging Considerations; 5) Overview of Facial Feminization Surgery (FFS); 6) Utility of Orthognathic and FFS Presurgical Planning Macros and Reporting Checklists

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## Abstract Archives of the RSNA, 2023

HNEE-13

### Hypervascular Neck Lesions: From the Most Common to Uncommon Pathology

#### Participants

Hugo Velazquez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To describe the anatomy of the neck spaces and its contents. -To determine the protocols used in suspected neck lesions by CTA and MRA. -To list the most common and uncommon neck lesions with a hypervascular pattern enhancement. -To illustrate clinical scenarios of these lesions.

#### TABLE OF CONTENTS/OUTLINE

1. A pictorial review of the anatomy of the neck spaces and its contents. 2. CTA and MRA protocols for the approach of neck lesions. 3. Key points of the most common vascular neck lesions. 4. Examples of uncommon vascular lesions of the neck to keep in mind.

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## Abstract Archives of the RSNA, 2023

HNEE-14

### Breaking the Ultrasound Barrier: Review of Sonographic Imaging of the Neck

#### Participants

Anu Kamalasanan, FRCR, MBBS, East Renfrewshire, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Tongue pathology can be assessed, characterized and staged with USS. 2) Thyroglossal duct pathology are better assessed with USS as avascular cystic structure in infrahyoid midline anterior to the pre epiglottic space and cranially extending deep to the hyoid towards the midline posterior tongue which move dynamically with deglutition and protrusion of tongue. 3) Tonsils are seen as predominantly hypoechoic regions of alternating hyper and hypoechoic striations in the oropharynx, at the level of and deep to submandibular gland. 4) Pre epiglottic and paraglottic fat spaces are visualized as homogeneously hyperechoic avascular fat filled spaces with pathology presenting as hypoechoic mass. 5) Thyroid cartilage involvement presents with dehiscence of the hyperechoic cortex and infiltration of medulla and extra laryngeal tissues.

#### TABLE OF CONTENTS/OUTLINE

1) Illustrate with examples the normal sonographic appearance and contents of surgical triangles of the neck. 2) Illustrate with examples the sonographic cervical lymph nodal stations, normal and pathological sonographic appearance of lymph nodes. 3) Illustrate with example the normal sonographic appearance of the soft tissues of the neck, including sonographic appearance of tongue, oropharynx, supraglottis and larynx. 4) Illustrate with examples the pathological sonographic appearance of the soft tissues of the neck, including pathology of tongue, oropharynx, supraglottis and larynx.

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## Abstract Archives of the RSNA, 2023

HNEE-15

### Imaging of Nasal, Paranasal, and Skull Base Lesions: A Comprehensive Review

#### Participants

Kota Yokoyama, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The World Health Organization's (WHO) Classification of Head and Neck Tumors, Fifth Edition, is now available in 2022. This book is essential for radiologists to consider differential diagnosis and to obtain clinical information. On the other hand, the classification is based on the origin of the lesion and the genes, which makes it inconvenient as a guide for specific anatomical sites. For example, bone and soft tissue tumors, hematologic tumors, melanotic tumors, minor salivary gland tumors, germ cell tumors, and neuroendocrine tumors which can occur anywhere in the head and neck region, are classified in their own category, creating unexpected pitfalls when considering the differential diagnosis of nasal, paranasal, and skull base lesions. In addition, since the book is not intended for radiologists only, it does not cover a wide range of useful diagnostic imaging findings. Focusing on the radiologist, this exhibition will provide a comprehensive review of CT, MRI, and nuclear medicine imaging findings of lesions that can occur in the nasal, paranasal, and skull base.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of nasal, paranasal, skull base
2. Sinonasal tract (nasal, paranasal, skull base) origin tumors
3. Other origin tumors involving the sinonasal tract
4. Inflammation involving the sinonasal tract
5. Infections involving the sinonasal tract

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## Abstract Archives of the RSNA, 2023

HNEE-16

### Clinical-radiologic Correlation of Acute Disorders of the Afferent Visual Pathway

#### Participants

Kyle Robey, MD, Brookline, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The afferent visual pathway includes structures that perceive and process visual information, as well as the intervening nerves and white matter tracts. Acute processes affecting the globes, optic nerves, optic tracts, optic radiations, and occipital cortices may result in sudden onset of vision loss. Given the relatively large anatomical area over which the afferent visual pathway is distributed, the insults which can occur are diverse in etiology. A broad differential should initially be considered, which can be focused by relevant history. Moreover, though the entire afferent visual pathway should be scrutinized in the setting of an acute visual deficit, an ocular examination and visual field campimetry may further localize the affected anatomical structure. Therefore, familiarity with the clinical presentation and neuro-ophthalmological exam can guide the radiologist in evaluating and interpreting CT and MR images.

#### TABLE OF CONTENTS/OUTLINE

1) Review of the anatomy of the afferent visual pathway 2) Analyze and understand the main elements of a basic eye exam and correlate the findings with the affected anatomical area 3) Review common and uncommon conditions of acute vision loss which span the afferent visual pathway

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## Abstract Archives of the RSNA, 2023

HNEE-17

### Open Your Eyes! What Every Radiologist Should Know About Orbit Vascular Lesions

#### Participants

Marcella N. Brandao, MD, MEd, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand well the anatomy of the orbit and dominate the normal in the image; Distinguish the pathologies that affect the extraconal, intraconal and both compartments; Recognize and review the particularities of the main diseases in the illustrative cases, both in Computed Tomography and Magnetic Resonance;

#### TABLE OF CONTENTS/OUTLINE

Every radiologist needs to be attentive to the details involving vascular lesions of the orbit. These diseases are infrequent, some extremely rare, but they cannot go unnoticed in differential imaging diagnoses. In addition, the natural history, growth pattern and histological composition of each lesion must be taken into account for the correct diagnosis. It is essential to recognize and keep in mind the diagnosis of: capillary hemangioma; venous lymphatic malformation; arteriovenous fistula; venous cavernous malformation; cavernous carotid fistula; ophthalmic artery aneurysm. Each image finding in the different modalities will be exemplified in detail through figures, descriptions and tables. Furthermore, the present study will make you a more complete radiologist, as it will explain the anatomy of the orbit relating it to each lesion in a direct, simple and intuitive way, making your diagnosis accurate and fast. In addition to serving as a guide for quick reference on the topic.

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## Abstract Archives of the RSNA, 2023

HNEE-18

### Multimodality Imaging of Salivary Glands

#### TEACHING POINTS

1. To discuss the anatomy of major salivary glands 2. To review salivary gland pathology categories and associated epidemiology 3. To describe ultrasound, CT/MRI features of common pathologies with pathologic correlation 4. To introduce newly described entities in salivary gland pathology 5. To highlight the utility of percutaneous biopsy, with technical considerations

#### TABLE OF CONTENTS/OUTLINE

1. Normal anatomy a. Parotid b. Submandibular c. Sublingual 2. Common salivary gland pathologies a. Sialolithiasis b. Sjogren syndrome c. Infectious/Inflammatory conditions d. Cysts e. Neoplasms (with hints based on patient demographics and risk factors)  
i. Benign 1. Pleomorphic adenoma 2. Warthin's Tumor 3. Cystadenolymphoma 4. Other- Hemangioma, Oncocytoma, Basal Cell Adenoma ii. Malignant 1. Mucoepidermoid carcinoma 2. Adenocystic carcinoma 3. Squamous cell carcinoma 4. Adenocarcinoma 5. Acinic cell carcinoma 6. Lymphoma iii. Metastases 3. Newly described salivary gland pathology a. Sclerosing polycystic adenoma b. Mucinous/secretory variant of myoepithelioma c. Mammary analog secretory carcinoma d. Cribriform adenocarcinoma e. IgG4-related disease 4. Pitfalls 5. Percutaneous biopsy a. Approach and anatomical considerations b. FNA versus Core c. US vs CT guidance d. Complications 6. Summary/conclusion

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## Abstract Archives of the RSNA, 2023

HNEE-19

### Pediatric Head and Neck: On Call Resource

#### Participants

Alexandra Foust, DO, North Royalton, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The spectrum of acute non-traumatic disease in the pediatric head and neck differs from that in adults. 2. Consider foreign body ingestion or aspiration in young child with sudden-onset respiratory distress or paroxysmal cough. 3. Meningitis, empyema, and venous sinus thrombosis are important complications of pediatric sinusitis or otomastoiditis cases.

#### TABLE OF CONTENTS/OUTLINE

The vast array of acute non-traumatic pathologies encountered in the pediatric head and neck can be an intimidating subject for residents on busy call rotations with limited time to look up information. Although there is some overlap with adult diseases, many entities are more common in the pediatric population and, thus, it is important for radiologists caring for children to be well-versed in this topic. This multi-institutional, multimodality exhibit will be structured as an on-call resource for trainees, organized by anatomic location and highlighting key points, pearls, pitfalls, and mimics of many acute non-traumatic pathologies in the pediatric head and neck: Selected Examples: 1. Orbit: peri-orbital and orbital cellulitis, dacryocystitis, optic neuritis, proptosis 2. Sinonasal: complicated sinusitis 3. Ear: labyrinthitis, otomastoiditis, petrous apicitis 4. Oral/airway: epiglottitis, laryngotracheobronchitis, tonsillitis and peritonsillar abscess, Ludwig angina 5. Neck/spine: Grisel syndrome, retropharyngeal abscess, lymphadenitis, sialadenitis, torticollis, infection of congenital cysts, osteomyelitis 6. Variable: foreign body insertion (oral/nasal), angioedema 7. Vascular: Lemierre syndrome, vasculitis, nontraumatic dissection, and complicated vascular malformations

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## Abstract Archives of the RSNA, 2023

HNEE-2

### Proton Beam Therapy for Skull Base Chordoma and Chondrosarcoma: A Guide for the Radiologist

#### TEACHING POINTS

- High-quality CT and MRI are critical for optimising surgical and radiotherapy decision-making and treatment in skull base chordoma and chondrosarcoma
- A detailed radiology report at the time of proton planning is essential for assessment of baseline and postoperative tumor sites, including distance to critical structures, with a required gap of =3mm from brainstem and =5mm from the optic apparatus
- Radiologists should be aware of surgical approaches to skull base tumors
- Radiologists should understand imaging appearances following multilayer endoscopic skull base repair and be aware of their evolution over time

#### TABLE OF CONTENTS/OUTLINE

Skull base chordoma and chondrosarcoma are rare, locally aggressive tumors. Treatment consists of maximal surgical resection and postoperative adjuvant therapy. Proton beam therapy enables dose escalation to tumor while limiting exposure dose to critical neurologic structures (brainstem, optic apparatus). High-quality pre-operative CT and MRI are critical for proton planning. MRI should include T2, T2 fat saturation, T1, volume FLAIR, FIESTA and postcontrast T1 fat saturation, with at least one volume sequence. Preoperative CTA BrainLab with bone reconstructions enables assessment of bone erosion, vascular relations and anatomical assessment for endoscopic-approach surgery. Intraoperative MRI should be considered to confirm clearance from dose-limiting structures. Post-operative MRI is optimally performed at <48 hours to enable optimal distinction between post-operative changes relating to multilayer skull base repair and tumor residuum.

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## Abstract Archives of the RSNA, 2023

HNEE-20

### Congenital and Infantile Masses of the Head and Neck

#### Participants

Alexandra Foust, DO, North Royalton, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A rapidly growing mass lacking high vessel density (Doppler US), internal flow-voids (MRI), and arterial-phase enhancement (MRI) should raise concern for lesions other than hemangioma. 2. It is important to describe the relationship of fetal head and neck masses to the airway so that appropriate delivery plans (EXIT procedure) can be made.

#### TABLE OF CONTENTS/OUTLINE

The spectrum of congenital and infantile head and neck soft tissue masses is broad, including developmental structural deformities/deficiencies, ectopic tissues, and benign and malignant neoplasms. It is important for radiologists to be aware of the imaging features of these lesions so that timely and appropriate management can be pursued. This multi-institutional, multimodality exhibit highlights pearls and pitfalls from fetal and post-natal cases encountered during clinical practice to illustrate the imaging appearance of numerous common and rare infantile masses in the head and neck using an anatomic approach. Selected Examples: 1. Skull/scalp: Cephalohematoma and other collections 2. Nasal: nasal glial heterotopia, cephalocele 3. Orbital: dacryocystocele, orbital varix 4. Oral/airway: epulis, epignathus, nasopalatine duct cyst, vallecular cyst, hairy polyp, sialoblastoma 5. Ear: cholesteatoma 6. Neck: thyroglossal duct cyst, ectopic thyroid or thymus, fibromatosis coli 7. Variable: dermoid/epidermoid, branchial apparatus anomaly, vascular anomalies, neuroblastoma, rhabdomyosarcoma, infantile fibrosarcoma, melanotic ectodermal tumor of infancy.

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## Abstract Archives of the RSNA, 2023

HNEE-21

### Post-operative Imaging in Oncologic Skull Base Surgery Reconstructions

#### TEACHING POINTS

? There is a broad spectrum of surgical techniques in resection of skull base tumors. ? Recognizing normal aspects of post-surgical grafts is important to differentiate from recurrent disease in skull base surgery. ? Radiologist plays an important role in preoperative and post-surgical management of this lesions.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and normal variants Skull base surgery is a complex procedure that involves accessing and operating on the delicate structures and the anatomical complex area at the base of the skull. It is challenging even for experienced surgeons and radiologists. It forms the floor of the cranial cavity and separates the brain from other facial and neck structures. It is divided into three regions: the anterior skull base, the middle skull base, and the posterior skull base. Each of these regions has its own unique anatomy and challenges when it comes to surgery. For a successful surgery, knowledge of the normal variants of the anatomy is crucial to avoid iatrogenic lesions during surgery. Some important normal variants include the pneumatization of the anterior clinoid process, sphenoidal (Onodi) cells, and postsellar pneumatization from the sphenoid sinus. These variants are associated with a greater risk for carotid and optic nerve injuries as well as cerebrospinal fluid (CSF) rhinorrhea. Neurosurgical options in accessing the skull base ? Frontotemporal ? Subfrontal ? Transpetrosal ? Lateral ? Endoscopic endonasal Common Neoplasms ? Pituitary adenoma ? Schwannoma ? Meningioma ? Olfactory neuroblastoma ? Skull base invasion from head and neck tumor Normal imaging characteristics of post-surgical grafts When to suspect a recurrent tumor?

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## Abstract Archives of the RSNA, 2023

HNEE-22

### Complications of Paranasal Sinus Mucoceles: A Pictorial Review

#### Participants

Joseph Carbone, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: 1. Review mucocele CT and MR imaging characteristics and their variance, as well as potential locations to be aware of with a highlight on important adjacent structures. 2. Describe complications of mucoceles with CT and MR correlates with a focus on findings requiring urgent management. 3. Provide radiologists with a framework for reporting when discussing mucoceles, adjacent structures, and their pertinent negatives as it relates to mucocele complications.

#### TABLE OF CONTENTS/OUTLINE

Mucoceles are slow-growing lesions that result from obstruction of the facial paranasal sinuses. While they are most often benign, they can sometimes lead to urgent or severe pathology in nearby structures. The severity of clinical presentation varies depending on the sinus involved, ranging from asymptomatic to intracranial extension resulting in blindness. Further, radiologists should be aware for their potential for aggressive behavior and have an understanding for relevant reportable findings when describing mucoceles pertaining to mass effect and the location of adjacent structures, superimposed infection, and intracranial extension. This educational exhibit aims to review varying imaging characteristics of mucoceles and their potential locations using CT and MRI correlates. A pictorial review of mucoceles and their severe complications will be used to highlight key reportable imaging findings for radiologists when describing mucoceles and their involvement with adjacent structures.

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## Abstract Archives of the RSNA, 2023

HNEE-23

### Imaging of the Skull and Facial Bones for Pediatric and Adult Patients

#### Participants

Minako Azuma, MD, PhD, Miyazaki, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. In pediatric and adult patients, a wide variety of abnormalities are found in the skull and facial bones, including tumors, inflammations, congenital disease, and so on. Additionally, there are also secondary changes in bone associated with some diseases. 2. It is necessary for radiologists to know radiological findings of the skull and facial bone disorders. 3. Radiologists also have to know normal variations that have no pathological significance.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy and normal development of the skull and facial bones 2. Techniques for the imaging of the skull and facial bones (1) CT (2) MRI (3) CT like bone imaging in MRI 3. Normal variants of the skull and facial bones (1) Shape and thickness (2) Bone marrow (3) Pneumatization 4. Disorders of the skull and facial bones (1) Abnormality associated with suture (craniosynostosis) (2) Tumors and allied diseases a) Benign: Chordoma, osteoma, meningioma, and so on b) Malignant: chondrosarcoma, rhabdomyosarcoma, metastasis c) Allied diseases: Epidermoid cyst, hemangioma, Langerhans Cell Histiocytosis, and so on (3) Systematic disease a) Hematologic disorders: leukemia, multiple myeloma, anemias b) Metabolic and endocrine disorders (4) Metabolic and endocrine disorders: primary hyperparathyroidism (5) Inflammation and infection: osteomyelitis (5) Secondary changes in bone: Hyperostosis, blistering 3. Take home points 4. References

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## Abstract Archives of the RSNA, 2023

HNEE-24

### Sonographic Evaluation of Major Salivary Glands: A Pictorial Review

#### Participants

Rachita Khot, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

High-resolution ultrasound imaging plays a key role in evaluating focal versus diffuse salivary gland diseases and differentiating benign versus malignant lesions. This exhibit will discuss approaches to diagnosis and 1. Review the typical and uncommon sonographic appearances of pathologies involving the salivary glands2. Discuss the OMERACT Ultrasound Scoring System in primary Sjögren's Syndrome3. Discuss the next step in the management of the pathologies

#### TABLE OF CONTENTS/OUTLINE

1. Illustration of major salivary gland and surrounding structures2. Ultrasound imaging techniques, sonographic landmarks, and normal anatomy 3. Approach to diagnosis4. OMERACT Ultrasound Scoring System in Sjögren's Syndrome • Background • Grey-scale scoring with imaging examples: Grade 0, normal parenchyma; Grade 1, mild inhomogeneity without anechoic or hypoechoic areas and hyperechogenic bands; Grade 2, moderate inhomogeneity with focal anechoic or hypoechoic areas; Grade 3, severe inhomogeneity with diffuse anechoic or hypoechoic areas occupying the entire gland 5. Pathologies of the major salivary glands • Congenital: Lymphoepithelial cysts, Epidermoid cyst • Sialadenitis: Acute and chronic; Abscess • Sialolithiasis: Obstructing and non-obstructing stones in the duct • Sialectasis • Neoplasms: Hemangioma, Lymphangioma, Lipoma, Adenomas (Pleomorphic, Basal cell, Warthin's), Carcinoma (Adenoid cystic carcinoma (Ca), Mucoepidermoid Ca, Acinar cell Ca, Squamous cell Ca), Lymphoma, Metastasis • Others: Intraglandular lymph nodes, Trauma, AV fistula6. Management and follow-up • Role of CT and MRI in the further workup • Role of biopsy7. Conclusion

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## Abstract Archives of the RSNA, 2023

HNEE-25

### Decoding Cystic and Cyst-Like Lesions in the Head and Neck: A Comprehensive Imaging Guide

#### Participants

Maria Lucia Brun, MD, OTTAWA, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To identify the relevant imaging features of cystic and cyst-like lesions of the head and neck. - To describe the differential diagnosis of cystic and cyst-like lesions of the head and neck, based on imaging and anatomical location.- To learn the importance of incorporating relevant/pertinent clinical information in narrowing the differential diagnoses. - To recognize the course and potential complications associated with cystic and cyst-like lesions.- To suggest appropriate follow-up and recommend effective diagnostic workup.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction/Background2. Role of Diagnostic Imaging- Ultrasound- CT - MRI3. Approach based on locationOnce the cystic nature is confirm ? evaluate differential diagnosis according to location:- Anterior neck - Midline lesions: Parapharyngeal/pharyngeal cysts, Ranula, Thyroid cysts, Parathyroid cysts, thyroglossal duct cyst, thymic cyst, dermoid/epidermoid cyst.- Lateral - Paramedian lesions: Branchial cleft cysts, Lymphatic malformations, suppurative/caseating adenopathy (infectious/inflammatory), cystic adenopathy (thyroid cancer and HPV-related SCC).- Specific spaces: Salivary glands; entities which may present as a cyst in the salivary glands: Lymphoepithelial cysts, Epidermal inclusion cysts, Warthin tumor, Mucocele, etc.4. Others- Not location-dependent: Lymphocele, Seroma, Abscesses.5. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

HNEE-26

### Chew It All Up! Everything You Need to Know About Teeth

#### Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The high prevalence of craniofacial trauma, sinus infection disease, and maxillomandibular procedures, among other conditions, frequently requires the interpretation of dental images in daily practice. Teeth can be the source or the extension of a pathologic process and therefore must not be overlooked by radiologists. Radiologists can use their knowledge of the main dental imaging findings in emergency radiology to add great value to image interpretation. In this study we will describe the anatomy of the structures surrounding the teeth. Identify the main dental alterations in the emergency or outpatient setting. Train the radiologist to look accurately at lesions, mainly inflammatory ones related to dental disorders.

#### TABLE OF CONTENTS/OUTLINE

General and dental anatomy. Inflammatory conditions related to teeth as pericoronitis, periodontal disease, periapical abscess, dental sinusitis, facial cellulitis and abscess, orbital cellulitis, Ludwig's angina, dental trauma, complications of dental procedures like dental implants and extraction. Most common tumor and tumor-like lesions related to teeth. Take home messages.

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## Abstract Archives of the RSNA, 2023

HNEE-27

### The Jugular Foramen: Approach to Tumoral and Non-tumoral Pathologies

#### Participants

Yasovineeth Bhogadi, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the Jugular foramen- Understand the clinical presentations of various pathologies- Differential diagnosis to tumoral disease and approach- Non-tumoral disease entities

#### TABLE OF CONTENTS/OUTLINE

- Review the anatomy of the Jugular foramen- Differential diagnosis of masses- Approach to tumoral masses- Non-tumoral disease entities

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

HNEE-28

### Use Homemade Rice Bags to Improve the Image Quality of 3.0TMR Cervical Spine Enhancement Scans

#### TEACHING POINTS

1. Magnetic resonance cervical spine enhancement scan fat suppression current problems 2. To propose a method to improve image quality using rice bags

#### TABLE OF CONTENTS/OUTLINE

1. Magnetic resonance cervical spine enhancement scan fat suppression current problems • Contrast-enhanced scans of the cervical spine are mainly performed using the T1WI adipose inhibition sequence to better visualize the lesions • But in the actual examination, due to the irregular geometry of the neck, the local magnetic field is uneven, and the fat suppression is often uneven, which affects the image quality and the display of lesions 2. A method to improve image quality using rice bags is proposed. • Rice bags are simple to make and low cost • Place a rice bag under the patient's neck and a rice bag above the neck without causing discomfort • Comparing conventional MRI scans with neck-filled rice bag scans, we found that the use of rice bags can eliminate artifacts, improve lipid uniformity, and improve image quality

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## Abstract Archives of the RSNA, 2023

HNEE-29

### Parry-Romberg Syndrome and En Coup De Sabre: A Pictorial Review

#### TEACHING POINTS

(1) Parry-Romberg Syndrome [PRS] and En Coup De Sabre [ECDS] are defined by acquired progressive hemifacial atrophy. (2) Patients may present with headache, facial pain/paresthesia, or epilepsy. (3) Atrophy can affect unilateral periorbital, midface bones and soft tissues. (4) Atrophic tissue does not demonstrate signal change or enhancement as might be seen with denervation. (5) Intracranial manifestations may also be present, although facial involvement does not predict intracranial lesion severity.

#### TABLE OF CONTENTS/OUTLINE

(1) Review definition, clinical symptomatology, expected course, and hypothesized etiologies of Parry-Romberg Syndrome (PRS) and linear scleroderma/En Coup De Sabre (ECDS), disease processes characterized by progressive hemifacial atrophy. (2) Review imaging findings of facial soft tissue atrophy and intracranial abnormalities in PRS and ECDS, as derived from a review of 40 PRS patients at a single institution, including brain, neck and face CTs and MRs. (3) Atrophy in PRS and ECDS predominantly affects periorbital, midface and scalp soft tissues, typically without MR signal intensity change, distinguishing it from denervation atrophy. (4) Clinical severity of facial soft tissue atrophy does not predict intracranial lesion severity.

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## Abstract Archives of the RSNA, 2023

HNEE-3

### Revisiting Distant Metastasis in Head and Neck Cancer

#### Participants

Naoko Saito, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Distant metastasis (DM) in head and neck cancer (HNC) is relatively uncommon. When DM occurs, the prognosis is considered miserable, with median overall survival of under one year. Although little attention has been focused on the treatment of DM, recent reports on oligometastasis have changed the therapeutic approach to DM. For patients with oligometastasis, aggressive local treatment of metastatic sites may achieve prolonged survival. This educational exhibit reviews the epidemiology, imaging findings, and risk factors of DM of HNC and summarizes the current knowledge of the oligometastasis of HNC. The teaching points are: 1. To understand the mechanisms and patterns of DM of HNC. 2. To learn the characteristic imaging findings of DM based on the site and histopathology. 3. To learn the current knowledge about the characteristics and the therapy of oligometastasis in HNC.

#### TABLE OF CONTENTS/OUTLINE

1. The definition of DM: the pathophysiology (hematogenous, lymphatic spread), the timing (synchronous, metachronous), the spectrum of metastasis (polymetastasis, oligometastasis, oligorecurrence, oligoprogression) 2. The site-based approach of DM (lung, bone, liver, brain, skin, etc.): pathophysiology, incidence, imaging findings 3. The cancer-based approach of DM: histopathology (SCC, EBV/HPV associated SCC, thyroid cancer, salivary gland cancer, neuroendocrine tumor, melanoma, etc.): incidence, imaging findings 4. Summary of the risk factors for DM: literature review 5. Therapy: current concepts

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## Abstract Archives of the RSNA, 2023

HNEE-30

### Nasolacrimal System Pathologies: What a Radiologist Needs to Know

#### TEACHING POINTS

- While reading a CT, deliberate consideration should be given to the density of the contents within the nasolacrimal duct and for the evaluation of wall thinning.
- The extent of soft tissue disease is evaluated using magnetic resonance imaging (MRI), and contrast-enhanced MR is particularly helpful in distinguishing soft tissue from fluid.
- Nasolacrimal duct may act as a conduit for the transmission of pathologies from the orbit to the sinonasal cavity and vice-versa.
- Primary nasolacrimal malignancies are rare and often have delayed diagnosis due to presentation mimicking benign aetiology.

#### TABLE OF CONTENTS/OUTLINE

?Describe normal Nasolacrimal duct anatomy with images. ?Illustrate with images the Nasolacrimal duct pathologies. ?Discuss management pathway.

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## Abstract Archives of the RSNA, 2023

HNEE-31

### Hyoid Bone: Anatomy, Embriology, Developmental Malformations and Symptomatic Cases

#### Participants

Beatriz Prado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This panel aims to: Review the structure and function, embriology, anatomy and physiologic variants of the hyoid bone. Discuss and describe through illustrative cases the imaging patterns of the main pathologies involving the hyoid bone.

#### TABLE OF CONTENTS/OUTLINE

Review of the hyoid bone structure and function  
Review of the hyoid bone anatomy, including suprahyoid and infrahyoid muscles, relation to blood vessels and nerves.  
Physiologic variants  
Clinical cases involving the hyoid bone:  
-Hyoid bone insertion tendinitis (hyoid bone syndrome)  
-Calcified stylohyoid ligament and Eagle syndrome  
-Traumatic lesions, including body and greater horn luxation and hyoid fracture  
-Triticeal cartilage ankylosis in the hyoid  
-Thyroid lamina ankylosis in the hyoid  
-Ectopic thyroid gland adjacent to the hyoid bone  
-Vascular compression  
-Sistrunk procedure  
-Ectopic thyroid gland adjacent to the hyoid bone  
Final remarks

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## Abstract Archives of the RSNA, 2023

HNEE-32

### How to Find CHD7 Disorder: Beyond CHARGE Syndrome

#### TEACHING POINTS

CHARGE syndrome is named after an acronym for the characteristic signs (coloboma, heart defect, atresia choanae, retarded growth and development, genital hypoplasia, ear anomalies/deafness). CHD7 is the causative gene for CHARGE syndrome. Recently, CHD7 mutations have been detected in cases that do not show typical signs of CHARGE syndrome, and the concept of CHD7 disorder has been proposed to include the broader spectrum of CHD7 mutations. Even in such atypical cases, the characteristic imaging findings of CHARGE syndrome are detected. The purpose of this educational exhibit is to: 1. Present the disease concept of CHARGE syndrome<sup>2</sup>. Detail the characteristic imaging findings of CHARGE syndrome<sup>3</sup>. Outline the broader spectrum of CHD7 disorders and provide cases in which imaging findings help identify CHD7 mutations, even in atypical CHARGE syndrome

#### TABLE OF CONTENTS/OUTLINE

1. CHARGE syndrome a. Concept b. Clinical presentation c. Causative gene -CHD7- 2. Imaging findings a. Key finding -semicircular canal hypoplasia- b. Additional findings of the face and skull base 1) Auditory system and temporal bone 2) Eye, palate, and olfactory system 3) Clivus c. Others 3. CHD7 disorder a. Concept b. Cases that the imaging findings implicate CHD7 mutations 1) Severe combined immunodeficiency 2) Mild phenotype 3) Kallmann syndrome

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## Abstract Archives of the RSNA, 2023

HNEE-33

### A Particular Pain in the Neck: Taking a Radiology's Journey from Imaging to Immunohistochemistry

#### Participants

Karla Anabel Borgna, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Reviewing the variability of head and neck tumor entities and their mode of presentation, excluding squamous Cell Carcinoma. Identifying radiological signs, anatomical relationships and learning how to report them. Correlating the radiological features of head and neck tumors (non-squamous cell carcinoma) with immunohistochemistry and histological findings. Emphasize the role of the radiologist as a key contributor to the orientation of the tumor's etiology.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Case-based approach with radiologic correlation  
Imaging findings with histologic and immunohistochemical correlation  
Take-home message  
References

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## Abstract Archives of the RSNA, 2023

HNEE-34

### 3N: Not Common Nose, Nasal Cavity and Nasopharynx Tumors

#### TEACHING POINTS

Sinonasal neoplasms are rare, accounting for only 3 % of head and neck malignancies, among the most frequent tumors reported are adenocarcinoma, squamous cell carcinoma, undifferentiated carcinoma, olfactory neuroblastoma, sinonasal lymphoma, and sinonasal mucosa melanoma. The complex anatomy and histology of this region make evaluation a challenge for the clinician. Fortunately, in these kinds of tumors, Computed tomography and magnetic resonance imaging, plays an important role in surgical and therapeutic planning, especially in the involvement of those small parts such as involvement of the anterior and middle cranial fossae, pterygopalatine fossa, pterygomaxillary fissure, foramen rotundum, vidian canal, inferior orbital fissure, orbital apex, and perineural involvement, therefore some distinguishing features can help narrow the differential diagnosis and assess the true extent of the disease.

#### TABLE OF CONTENTS/OUTLINE

Epidermoid carcinoma, Carcinoid tumor, Peripheral nerve sheath tumor, Rhabdomyosarcoma, Sinonasal undifferentiated carcinoma, Ewing sarcoma, Sinonasal Melanoma, Lymphoma, Esthesioneuroblastoma andsinonasal juvenile angiofibroma

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## Abstract Archives of the RSNA, 2023

HNEE-35

### Sinonasal Tumors: What the Tumor Board Wants to Know

#### Participants

Alexander Moeller, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. There is a long differential diagnosis for tumors occurring within the sinonasal cavity with overlapping imaging features. 2. Pathology is critical in diagnosis and determining treatment. 3. Most primary tumors are staged based on the TNM classification. TNM tumor staging is predominantly based on tumor location and tumor extension, which differs between lesions that arise from the maxillary sinus and those that occur within the ethmoid/nasal cavity. 4. Esthesioneuroblastomas are staged based on the Kadish classification system. 5. Sinonasal tumors are primarily treated with surgical resection. 6. Chemotherapy and radiation may be administered prior to surgery for larger lesions, following surgery for residual or recurrent disease or in place of surgery for a palliative approach.

#### TABLE OF CONTENTS/OUTLINE

1. Review the differential diagnosis of sinonasal tumors based on the updated WHO classification system. 2. Discuss pathology of sinonasal tumors, incorporating molecular features. 3. Discuss the TNM staging of sinonasal tumors for lesions arising from the maxillary sinus and ethmoid/nasal cavity. 4. Review staging of esthesioneuroblastoma. 5. Treatment strategies of Sinonasal tumors: Indications for surgery, chemotherapy and radiation using a multidisciplinary approach. 6. Review imaging features of lesions that will affect treatment decisions: what the surgeon wants to know, what the medical oncologist wants to know and what the radiation oncologist wants to know.

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## Abstract Archives of the RSNA, 2023

HNEE-36

### Face to Face: Reviewing Facial Malformations

#### Participants

Danielly Santos SR, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This pictorial essay aims to review and synthesize the main facial malformations. The purposes of this submission are: - To review the developmental anatomy and normal embryogenesis of facial structures; - To discuss imaging features of facial malformations related to nasal cavity, frontonasal region, nasolacrimal apparatus, labiopalatine complex and craniofacial syndromes; - To present a compendium of cases involving facial malformations to exemplify;

#### TABLE OF CONTENTS/OUTLINE

There are a wide variety of congenital face abnormalities that originate during transformation of the first pair of pharyngeal arches into adult structures. Computed tomography and magnetic resonance imaging are important components in the comprehensive evaluation of these lesions. A detailed understanding of face embryogenesis and developmental anatomy is important in directing appropriate patient management. Familiarity with the characteristic imaging features of these anomalies along with knowledge of midface embryogenesis and normal developmental anatomy is essential to prevent misinterpretation of anatomic variations that may simulate disease.

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## Abstract Archives of the RSNA, 2023

HNEE-37

### Scars and Lumps Shrinking the Tunnel: Radiological Evaluation of Laryngotracheal Stenosis

#### TEACHING POINTS

At the end of this exhibit, the attendees would be able to: 1. Identify laryngotracheal stenosis etiologies. 2. Describe the clinical and radiological classifications of laryngotracheal stenosis. 3. Recognize the key imaging findings encountered in the different entities of laryngotracheal stenosis.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction. 2) Anatomical Review: Imaging of the Larynx and Trachea. 3) Diagnostic and Radiological Approach to Laryngotracheal Stenosis. 4) Laryngotracheal Stenosis Measurement. 5) Laryngotracheal Stenosis: Key Imaging and Clinical Findings through Case Presentation. a) Laryngotracheal Trauma/Iatrogenic. b) Laryngotracheal Compression. c) Infiltrative Lesions. d) Laryngotracheal Inflammation/infection. e) Laryngotracheal Autoimmune Lesions. 6) Conclusion.

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## Abstract Archives of the RSNA, 2023

HNEE-38

### A Nod to the Nodes In Children: A Practical Clinical Approach to Pediatric Cervical Lymphadenopathy

#### Participants

Elizabeth Snyder, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Cervical adenopathy is a common clinical scenario in children.- A wide variety of entities can present with cervical adenopathy; importantly, the spectrum of pathology and imaging appearance differs in many cases from that seen in adults.- While US is typically the first line imaging modality, CT, MRI and NM studies may all have a role in the workup of cervical adenopathy, with different strengths and limitations.- Radiologists must know when and with which modality to image.- This multi-institutional collaboration highlights imaging appearances of both common and uncommon disorders affecting cervical nodes in children in order to aid radiologists in their clinical practice. Pearls, pitfalls, and mimics will be included.

#### TABLE OF CONTENTS/OUTLINE

1. Introductiona. Anatomy of cervical lymph nodes (levels, etc.)b. Normal imaging appearance2. Imaging approacha. Modality selection and benefits/limitations of US, CT, MRI, NM studiesb. Systematic approach diagram highlighting helpful features (e.g., cystic, hyperenhancing, calcified, etc.)3. Infectious lymphadenopathy a. Imaging appearance b. Complications: necrosis, abscessc. Specific infectious processes: e.g., bacterial, TB, MAI, cat scratch disease4. Neoplasm a. Lymphomab. Metastasis: e.g., thyroid cancer, NPC, SCC5. Histiocytosis a. LCHb. Rosai-Dorfman disease6. Lymphoproliferative disorders: e.g., Castleman, HLH7. Unusual entities: Kawasaki, Kikuchi, MIS-C, HIV8. Mimics (lymphatic malformations, branchial cleft cysts, parotid neoplasms, etc.)9. DDX of common imaging findings: calcifications, cystic nodes10. Summary and conclusion

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## Abstract Archives of the RSNA, 2023

HNEE-39

### Don't Miss the Forest for the Trees: Parathyroid Ultrasound - Anatomy, Technique, Pearls and Pitfalls

#### Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review key aspects of the clinical, laboratorial, and imaging assessment of patients with primary hyperparathyroidism. Illustrate the role of ultrasound (US) for preoperative evaluation of parathyroid glands, including their localization, normal and pathological findings, with multimodality imaging correlations. Summarize in a practical approach the most important pearls and pitfalls for the accurate US assessment of parathyroid glands, highlighting the use of high-frequency transducers.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Anatomy of the parathyroid and adjacent structures  
Primary Hyperparathyroidism: pathophysiology and clinical aspects  
Parathyroid preoperative evaluation  
Laboratorial workup for hyperparathyroidism  
Multimodality imaging for surgical planning: US, computed tomography, magnetic resonance, and scintigraphy  
Ultrasound of the parathyroid glands  
Positioning, technique, transducers  
Typical and atypical imaging findings (B-mode, Doppler and elastography)  
US guided fine-needle aspiration (radiologic-pathologic correlations)  
Case-based review with multimodality imaging  
Pearls: novel approaches for improvement (high-frequency transducers and other strategies)  
Pitfalls: lesions of the esophagus, lymph nodes, soft tissues, and thyroid  
Take home messages

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## Abstract Archives of the RSNA, 2023

HNEE-4

### Look out! Conditions that Cause Proptosis

#### Participants

Erica Naves, MD, Nova Lima, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points The purposes of this exhibit are to review the anatomy of the orbit, including the orbital content and bone structures that delimit it. Also, to demonstrate that, due to its osseous limitations, the orbit is limited to expand if any expansive process is within its limits. Therefore, several types of expansive processes manifest with proptosis. The exhibit demonstrates through illustrative cases the different scenarios that manifest with proptosis, in the context of metabolic disorder, trauma, infection, inflammatory process, vascular lesions, primary neoplasms, metastasis, among others.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents / Outline The exhibit initiates with annotated images of the anatomy of the orbit, including the bone limits and contents, to demonstrate the normal appearance on computed tomography and magnetic resonance imaging. The next slides include the diagnostic criteria of proptosis, and exemplifying annotated images. The majority of the presentation include illustrative cases presenting with proptosis divided by metabolic, trauma, infection, inflammatory, vascular and neoplastic sections. Cases of thyroid-associated orbitopathy, bone fracture, orbital muscle lesion, subperiosteal abscess, idiopathic orbital inflammation, IgG4-related disease, granulomatosis with polyangiitis, carotid-cavernous fistula, venous malformation, lymphangioma, optic nerve glioma, optic nerve meningioma, orbital lymphoma, rhabdomyosarcoma, sphenoid wing meningioma, metastatic melanoma, extramedullary plasmacytoma and bone metastasis are displayed. The presentation closure contains take-home messages.

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## Abstract Archives of the RSNA, 2023

HNEE-40

### Save Your Own Neck: A Neck Muscles Guide for Daily Practice - Anatomy, Variations, and Pathologies

#### Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are:- Review and illustrate the anatomy and innervation of head and neck muscles, and its correlation with the cervical spaces, emphasizing the importance of understanding for the delimitation of lesions found in daily routine exams.- Describe the anatomical variations of the cervical muscles and the possible pitfalls they can cause, simulating diseases.- Determine the great injuries, separating them by their etiology, and propose an algorithm for their evaluation in cases of technical limitation.

#### TABLE OF CONTENTS/OUTLINE

- Cervical muscles:1) Division by compartments- masticatory.- pharynx (circular and longitudinal) and larynx.- front of the neck (suprahyoid and infrahyoid).- prevertebral (prevertebral and scalene).- paraspinal (suboccipital, extrinsic back, and intrinsic back (superficial, intermediate, and deep layer)).2) injuries:- congenital (agenesis, torticollis, and syndromes)- infectious/inflammatory (phlegmon, abscess, tropical myositis, necrotizing fasciitis)- trauma or surgery (denervation, myositis ossificans)- vascular anomalies.- tumors (benign, malignant, and metastasis).- Diagnostic Algorithm- Final remarks

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## Abstract Archives of the RSNA, 2023

HNEE-41

### Practical Approach to Orbital Lesions by Anatomical Compartments

#### TEACHING POINTS

The purposes of this exhibit are:- Classify the different pathologies in each of the orbital compartments.- Present the essential imaging features of the main orbital lesions.- Highlight the importance of knowing the location of pathologies in the orbital compartments to facilitate the diagnosis and narrow the differential diagnoses.

#### TABLE OF CONTENTS/OUTLINE

? Introduction : ? Review of the anatomy of the orbital compartments ? Compartment of the optic nerve/sheath complex :? ? Ischemic optic neuritis ? Optic nerve glioma (NF1) ? Optic nerve glioma (sporadic) ? Optic nerve meningioma ? Conal/muscular compartment : ? Graves orbitopathy ? Left sixth cranial nerve palsy ? Orbital pseudotumor ? Myositis by IgG4 ? Intraconal compartment : ? Colobomatous malformation ? Venolymphatic vascular malformation ? Cavernous hemangioma ? Extraconal compartment :? Dermoid cyst ? Subperiosteal abscess ? Preseptal cellulitis ? Nasolacrimal apparatus : ? Non-Hodgkin lymphoma of the lacrimal glands ? Infected dacryocystocele

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## Abstract Archives of the RSNA, 2023

HNEE-42

### Unilateral Sinusitis: What Radiologists Should be Aware of

#### Participants

Janani Asogan Vaishnavi, MD, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Rhinorrhoea and foul smelling discharge are the common clinical presentations in inflammatory / infective disease while epistaxis and/or mass effect in the cheek / palate / orbit are the common presenting features in malignancy. 2. Odontogenic sinusitis is one of the most common causes of unilateral sinus opacification followed by fungal ball and antrochoanal polyp. Inverted papilloma is the most common benign pathology, while squamous cell carcinoma is the most common malignant pathology. 3. Incidence of neoplastic disease is much higher in the presence of unilateral sinus opacification, with rise in incidence with increasing age. 4. Site of origin of inverted papilloma is often seen as focal area of hyperostosis on CT. This can be useful identifying recurrence and malignant transformation which are frequent with inadequate excision. 5. Aggressive bone destruction, especially erosion of the posterolateral wall of the maxillary sinus and extra-sinus extension is often seen in malignancy.

#### TABLE OF CONTENTS/OUTLINE

1. Radiological anatomy of paranasal sinuses including drainage pathways 2. Explain various causes of unilateral sinus opacification 3. Illustrate with images, the key radiological and pathognomonic findings to be looked for in unilateral sinus opacification 4. Provide a pictorial review of unilateral sinus opacification encountered in our centre 5. Briefly describe how to approach a case of unilateral sinus opacification

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## Abstract Archives of the RSNA, 2023

HNEE-43

### What is this Bump on the Face, Radiology? Medial Canthal Swelling, Differential Diagnosis of Angular Vein Thrombosis Radiologists Should Know

#### Participants

Nahyun Jo, MD, Galveston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The face is the first body part a physician sees when they meet a patient; it is often diagnosed and followed clinically. With the advances in imaging and increase in utilization, radiologic evaluation of facial masses is becoming more common. In certain cases, radiology plays a crucial role. Facial vein thrombosis presents as a focal facial mass-like lesion due to engorged veins. This is well-known in the traditional anatomy literature related to the "danger triangle" of the face. While thrombophlebitis is a more common etiology, more recently, facial/angular vein thrombosis secondary to periorbital cosmetic botulinum toxin injections has been reported by ophthalmologists and plastic surgeons. Due to its proximity to the sinuses, sinus-related diseases such as dacryocystocele or nasolacrimal duct obstruction often mimic angular vein pathologies. Vascular malformations such as an ophthalmic artery arteriovenous fistula, carotid-cavernous fistula, or lymphovenous malformation may also present as periorbital mass or proptosis. Other etiologies of soft tissue masses, such as skin tumors or benign masses, should also be considered.

#### TABLE OF CONTENTS/OUTLINE

We discuss the basic anatomical structures in the face that radiology trainees should know. Then we further discuss the imaging findings of facial masses ranging from the most common lipoma to uncommon lymphovascular malformations. Each of the common and unique cases is presented for each pathology with teaching points. - Introduction to facial anatomy-Infection-Trauma-Venous thrombosis-Vascular malformations-Sinus related-Benign cluster of tissues-Tumor-Foreign body and cosmetic injections

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## Abstract Archives of the RSNA, 2023

HNEE-44

### Node More Tears: Unraveling the Etiologies and Imaging of Lymph Nodes Diseases

#### TEACHING POINTS

To understand patterns of lymphadenopathy in imaging methods. To illustrate the most common imaging findings of lymph nodes diseases and the useful hallmarks that help in differential diagnosis. To learn about advanced imaging methods and how they can help in the evaluation of lymphadenopathy.

#### TABLE OF CONTENTS/OUTLINE

Anatomy of lymph node  
Patterns of lymph nodes diseases - Hypervascular - Cystic or necrotic - Calcified  
Main imaging characteristics and differential diagnosis of the different etiologies.- Inflammatory / Infectious (Viral, Bacterian, Fungal and others).  
- Lymphomas - Castleman Disease - Neoplastic Metastasis ( Eg. Squamous cell carcinoma; Kaposi sarcoma)- Lymphadenopathy associated with systemic syndromes (eg. Kikuchi-Fujimoto Disease, Kimura, systemic lupus erythematosus)  
Take-home messages and tips and tricks to differential diagnosis.

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## Abstract Archives of the RSNA, 2023

HNEE-45

### Advanced Neck Ultrasound: Pearls and Pitfalls Using High-Frequency Transducers

#### Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review key findings in neck ultrasound using high-frequency transducers (24-33MHz). Illustrate clinical situations where the use of high-frequency transducers was decisive for the characterization of imaging findings in neck region, including skin, thyroid, parathyroid, salivary glands and lymph nodes lesions. Provide tips and tricks in a practical approach to a successful clinical practice integration.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
US transducer types: an overview  
Applications: a case-based review  
Skin US: benign and malignant lesions  
Thyroid US: focal and diffuse disease  
Parathyroid US: normal and abnormal findings  
Lymph node US: beyond metastatic disease  
Salivary gland US: pearls and pitfalls  
Other challenging applications  
Practical approach: tips and tricks for clinical practice integration  
Future perspectives: ultra-high frequency US  
Take home messages

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## Abstract Archives of the RSNA, 2023

HNEE-46

### **To Infinity And Beyond: A Primer Review Of The Uncommon Disorders Of The Temporomandibular Joint Besides Internal Derangement**

#### **TEACHING POINTS**

- Review the normal anatomy of the temporomandibular joint and its relationship to adjacent structures- To illustrate a variety of rare cases in order to avoid misinterpretations and pitfalls;

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION:RELEVANT IMAGING ANATOMY:TEMPOROMANDIBULAR LESIONS AND ALTERATIONS: Clinical cases illustrating the spectrum of uncommon TMJ findings in CT and MRI.Condylar pathologies;Coronoid process pathologies;Extension of TMJ pathological processes to adjacent structures;Inflammations non-infectious;Infectious Other pathologies.TAKE-HOME MESSAGESREFERENCES

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## Abstract Archives of the RSNA, 2023

HNEE-47

### The Tongue Has People Talking

#### Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Show the anatomy of the tongue through schematic illustrations and its correlation with radiological images, indicating anatomical reference points. Determine the role of each imaging technique in the analysis of the pathology of the tongue. Review the most frequent pathology of the tongue, mainly tumors outlining the radiological findings with therapeutic implications.

#### TABLE OF CONTENTS/OUTLINE

Background Embryology and Anatomy of the tongue Imaging technique Imaging findings- Oncological tongue Radiological findings with therapeutic implications- Congenital anomalies- Inflamed tongues- Lingual denervation. The tongue is the central part of the oral cavity and the oropharynx. It is the organ of taste, plays an essential role in the formation of the alimentary bolus and in swallowing and forms part of the phonatory system. Given the importance the role of the tongue plays in the patient's quality of life, the radiologist of the head and neck should be familiar with its anatomy, the optimum imaging techniques for its evaluation, as well as its spectrum of pathologies. In this way the radiological description will reflect reliably and with anatomical detail the extent of a lesion, particularly in the area of oncology, and it will be possible to select the most appropriate treatment for each patient so as to preserve function to the maximum extent possible. The radiological evaluation will also be of special significance during the surveillance period following treatment, so the radiologist should be familiar with the main therapeutic strategies and be accustomed to the image of the treated patient as well as the most appropriate techniques for detecting tumor recurrence.

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## Abstract Archives of the RSNA, 2023

HNEE-48

### Look on the Bright Sign: Shedding Light on Mysteries of Optic Neuropathy

#### Participants

Alice Abreu Mota, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Optic neuropathy: It may be the only manifestation of Behçet's disease in the central nervous system. Diffusion restriction may be seen in trauma and ischemia. In induced cocaine cases, it is often unilateral, due to compression or ischemia. Methanol intoxication findings included bilateral optic nerve enhancement, putamen and caudate necrosis. Leber's hereditary optic neuropathy may show increased T2 signal in the optic nerves, chiasm, and tracts. Neuritis can also simulate a tumor. The short-segment enhancement at the optic nerve-globe junction is seen on cat scratch disease. Granulomatosis with polyangiitis (GPA) is often hypointense on T2. Direct granulomatous infiltration is one of the triggers of sarcoidosis. MOG-IgG+ exhibit long-length, bilateral, and anterior optic nerve involvement. Unilateral and short-segment involvement is seen in Multiple Sclerosis. In Neuromyelitis Optica (NMO) the impairment is bilateral on posterior optic nerves and chiasm.

#### TABLE OF CONTENTS/OUTLINE

Toxic Metanol Cocaine Medicine Granulomatosis Sarcoidosis; GPA; Tolosa Hunt; IgG4 Related Disease; Cat scratch disease; Tuberculosis. Non-demyelinating Vogt-Koyanagi-Harada; Behçet's Disease. Demyelinating Multiple Sclerosis; NMO; MOG-IgG+. Others Ischemic; Trauma; Tumor.

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## Abstract Archives of the RSNA, 2023

HNEE-49

### Cavernous Sinus Imaging: Anatomy, Pathology and Warning Signs for Daily Practice

#### Participants

Ana Sanchez, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the anatomy and study protocol of the cavernous sinus. Provide warning signs to quickly recognize cavernous sinus involvement and assess patient treatment. Discuss clinical cases of our Department and relevant imaging findings.

#### TABLE OF CONTENTS/OUTLINE

Anatomy Study protocol Warning Signs: Enlargement of superior ophthalmic vein/s. Morphological change. Finding Density/ Signal — Flow void. Clinical exam — multiple cranial nerve deficit. Red bulging eye. Restricted diffusion. Clinical cases: Neoplasms: meningioma, hemangioma, macroadenoma, chordoma. Inflammatory: Tolosa Hunt Syndrome. Vascular: aneurysm, carotid-cavernous fistula. Miscellaneous: intracavernous arachnoid cyst, air/fat in the cavernous sinus. References

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## Abstract Archives of the RSNA, 2023

HNEE-5

### Facial Retaining Ligaments: Can We See It

#### Participants

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A thorough investigation of the layers and structures of facial anatomy is crucial when performing facial surgery and aesthetic procedures. The retaining ligaments of the face represent additional information of this anatomy and are essential in understanding principles of facial aging and rejuvenation. They are located in constant anatomic locations where they separate facial spaces and compartments. Their main significance relates to their anatomical understanding in fillers procedures and in surgical release in order to achieve the desired aesthetic outcome. Furthermore, they have a sentinel role in their anatomic relationship to facial nerve branches. Descriptions of the retaining ligaments are variable in the literature; due to different interpretations of anatomy, several classifications, locations, and nomenclature systems have been proposed, but there is no description of imaging findings. This study will review and clarify the anatomy and imaging aspects of the retaining ligaments of the face using High frequency ultrasound (HFUS/24-33MHz). The purpose of this exhibit is: (1)To illustrate the anatomy of the facial retaining ligaments with fresh-frozen specimen correlation; (2)To describe the correct examination technique; (3)To highlight the importance of HFUS in facial ligaments and nerves characterization; (4)To show the dynamic evaluation and characterization of facial ligaments with HFUS; (5)To describe the most important related facial ageing changes and aesthetic importance

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION; 2. ANATOMY; 3. FACIAL AGEING PROCESS; 3. HFUS EVALUATION TECHNIQUE; 4. UNDERSTANDING AESTHETIC PROCEDURES; 5. CONCLUSION

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## Abstract Archives of the RSNA, 2023

HNEE-50

### Understanding Neck Dissection and Bringing the Radiologist Closer to the Surgeon

#### Participants

Marcos Pinheiro II, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Point 1: Understand the different types of neck dissection. There are different types of neck dissection, ranging from a selective neck dissection to a radical neck dissection. It is important for radiologists to understand the extent of surgery and the structures that are removed in each type of neck dissection to accurately recognize them and properly interpret postoperative imaging studies. Teaching Point 2: Be aware of potential complications. Neck dissection can be associated with various complications, including bleeding, infection, and injury to important structures such as the spinal accessory nerve. Radiologists must be familiar with these potential complications and be able to identify them on imaging studies.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of cervical lymph node levels and surgical techniques involved in neck dissection.
2. Role of imaging in the preoperative planning (evaluation of the primary tumor and cervical nodal status, therefore helping the surgeon decide the most appropriate type of neck dissection, if needed).
3. Recognize expected imaging findings in postoperative neck dissection, as well as potential complications, including hematoma, abscess, and injury to neurovascular structures.

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## Abstract Archives of the RSNA, 2023

HNEE-51

### Paranasal Sinuses Computed Tomography: Read It Like an Expert

#### TEACHING POINTS

Learn the acquisition protocols and become familiar with the anatomy and anatomical variations of the paranasal sinuses to guide the endoscopic sinus surgeon

#### TABLE OF CONTENTS/OUTLINE

Nose and paranasal sinuses anatomy is highly variable and some anatomic variants can result in complications in FESS. The nasal septum is made up of an anterior cartilaginous component and a posterior bony component including the vomer and the perpendicular plate of the ethmoid. Septum anatomic variations include septal deviation that can cause a middle turbinate displacement and interfere with surgical access to the middle meatus; septal pneumatization may narrow the sphenoethmoidal recess and impede access to the sphenoid ostium. The middle turbinate is the site of different variations, including concha bullosa (pneumatization of the inferior bulbous portion of the middle turbinate, or "cell of Grunwald" if pneumatization is limited to the vertical lamella above the level of the ostiomeatal complex), that can obstruct the ethmoidal infundibulum, and paradoxical middle turbinate, when the turbinate shows a paradoxical lateral convexity, which can impede surgical access to the ostiomeatal complex and contribute to recurrent rhinosinusitis. Haller cells are ethmoid cells extending into the orbital floor, with variable sizes that can narrow the ostia of the maxillary sinus or ethmoid infundibulum. Onodi cells are posterior ethmoid cells extending to the sphenoid sinus, placed medially to the optic nerve. These cells can also surround the optic nerve places the nerve and are linked with increased risk of nerve damage during sinus surgery.

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## Abstract Archives of the RSNA, 2023

HNEE-52

### Approach to Jaw Lesions

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

CT and MR can characterize jaw lesion location, composition, margins, and extent. Jaw lesions are classified into odontogenic vs. non-odontogenic, and simple/complex lytic or sclerotic. Key etiologies include developmental, inflammatory, traumatic, and neoplastic. Patient age, symptoms, and systemic findings help narrow the differential. For suspected neoplasms, biopsy helps confirm the diagnosis. The range of potential approaches includes watchful waiting, sclerotherapy, ablation, curettage, subtotal resection, and radical excision. Genetic testing is important when certain histologies and syndromes are suspected.

#### TABLE OF CONTENTS/OUTLINE

1. Dentistry 101 Jaw/tooth development Anatomy eruption Imaging modalities 2. Classification Odontogenic, non-odontogenic Developmental, inflammatory, traumatic, neoplastic 3. Simple Cystic Radicular Dentigerous Buccal bifurcation Lateral periodontal Fissural Stafne Simple 4. Complex Cystic Aneurysmal bone cyst / Giant cell granuloma Langerhans cell histiocytosis Ameloblastoma Odontogenic myxoma Odontogenic fibroma Mixed odontogenic tumors 5. Sclerotic/Mixed Tori Odontomas Fibro-osseous lesions Cemento-osseous dysplasia Cementoblastoma Osteomyelitis: acute, chronic (Garre), nonbacterial (CRMO, SAPHO) Osteonecrosis 6. Syndromic Odontogenic keratocyst (Gorlin) Brown tumors (hyperparathyroidism) Gardner syndrome Cherubism Desmoplastic fibroma (TS, fibromatoses) Gorham disease

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## Abstract Archives of the RSNA, 2023

HNEE-53

### Advanced MRI of the Head and Neck

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

Advanced MRI techniques utilized in the head neck include anatomic, diffusion, perfusion, vascular, elastography, functional, and metabolic. Understanding of fundamental physical principles enables optimal utilization interpretation. Informed clinical use improves patient diagnosis management. Clinical applications exist for congenital, neoplastic, vascular, metabolic, and traumatic etiologies.

#### TABLE OF CONTENTS/OUTLINE

1. High-resolution: T2, T1, 7 Tesla Cranial nerve lesions Midface anomalies Meningoceles Inner ear anomalies Orbital malformations, tumors  
2. Phase-contrast: 2D, 3D CSF flow Angiography  
3. Diffusion: non-echo-planar, intravoxel incoherent motion, diffusion tensor imaging Skull base tumor, infection Pott's puffy tumor Cord/nerve fibers  
4. Perfusion: arterial spin labeling, dynamic susceptibility contrast, dynamic contrast-enhanced Vascular tumors Vascular malformations Skull base tumors Pituitary lesions Face transplant  
5. Vascular: time-of-flight, phase-contrast, time-resolved, ferumoxytol, vessel wall imaging PHACES association Vasculopathies  
6. Ultrashort- and zero-echo-time imaging Malformations Trauma Tumors Postoperative  
7. Elastography Pituitary adenoma Vestibular schwannoma  
8. Spectroscopy  
9. PET/MR Epilepsy HN tumors  
10. Chemical exchange saturation transfer  
11. Anatomic modeling

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## Abstract Archives of the RSNA, 2023

HNEE-54

### Zero Echo-Time MRI of the Head and Neck

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

- Cortical bone MRI utilizes short-TE techniques such as gradient, ultrashort, and zero echo-time.
- Short-T2 tissues appear dark, hence the term "black-bone" MRI.
- Use cases include plagiocephaly, craniosynostosis, calvarial lesions, sinonasal disease, head neck tumors, jaw lesions, trauma, surgical navigation, and postoperative evaluation.
- Postprocessing advances using point reconstructions and deep learning facilitate synthetic ("bright-bone") CT generation, 3D visualization, and surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. Technique• Gradient, ultrashort, zero echo-time• Workflow sequence options• Interpretation and pitfalls2. Clinical Cases• Plagiocephaly• Simple craniosynostosis: metopic, sagittal, coronal• Genetic syndromes: Apert, Saethre-Chotzen, achondroplasia• Skull: ecchordosis physaliphora, dermoid cysts, LCH, fibrous dysplasia• Sinonasal: midnasal stenosis, pneumosinus dilatans, sinusitis• Tumors: orbitotemporal NF1, rhabdomyosarcoma, chordoma• Jaw lesions: ameloblastoma, desmoplastic fibroma• Trauma: abusive head trauma, TBI, leptomeningeal cyst, cephalohematoma• Surgical planning: arachnoid cyst, hydrocephalus• Shunt evaluation: tumor, craniosynostosis, overshunting• Postoperative evaluation: craniotomy, cranioplasty, ZMC, orbital blowout, cephalocele3. Postprocessing• Point processing• Deep learning: models, loss functions, generalizability• Diagnostic use• Surgical planning

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## Abstract Archives of the RSNA, 2023

HNEE-55

### Fetal Head and Neck Imaging

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

Fetal HN anomalies can be classified into congenital, genetic, vascular, neoplastic, traumatic, and endocrine etiologies. Major diagnoses include micrognathia, facial clefts, craniosynostosis, meningocele, vascular malformations, teratoma, and airway obstruction. US and MRI have complementary roles for prenatal screening and detailed workup. Each technique has specific clinical indications and technical limitations. Fetal MRI protocols should include 3-plane ssFSE with optional balanced SSFP, diffusion, and T1. The radiology report should address brain, face, neck, and airway, along with secondary complications and multisystem associations. Several qualitative features and quantitative metrics can be applied. For at-risk patients, serial imaging can improve diagnostic yield and interventional planning. Postnatal imaging is important for confirmation of prenatal findings.

#### TABLE OF CONTENTS/OUTLINE

1. Craniofacial Malformations Oro/craniofacial clefts Micrognathia, Pierre-Robin Beckwith-Wiedemann Orbital telorism, malformations Craniosynostosis Cephaloceles, meningoceles Acrania-exencephaly-anencephaly Amniotic band syndrome 2. Genetic Syndromes Apert Pfeiffer Frontonasal dysplasia DiGeorge Fraser 3. Cervicofacial Masses Vascular anomalies Hemangioma Lymphatic malformation Vein of Galen malformation Arteriovenous malformation Teratoma Goiter 4. Upper Airway Congenital high airway obstruction syndrome Laryngeal stenosis/atresia Tracheal stenosis/atresia Tracheo-esophageal fistula (VACTERL)

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## Abstract Archives of the RSNA, 2023

HNEE-56

### Pediatric Cutaneous Lesions: Below the Surface

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

Pediatric skin lesions are often harbingers of more extensive or systemic disease. Unique cutaneous stigmata are seen in vascular anomalies and phakomatoses. Radiologic imaging is needed to characterize deep or multisystem involvement. Understanding of genetics helps to explain disease pathogenesis and develop targeted therapies.

#### TABLE OF CONTENTS/OUTLINE

1. Background Genetic advances Ras and mTOR pathways Targeted therapies Critical point for intervention  
2. Vascular Anomalies Malformations Low-flow Lymphatic (syndrome: GLA) Venous (syndromes: VMCM, BRBNS, KTW) Capillary (syndromes: M-CM, CLAPO) High-flow AVM AVF Syndromes: HHT, CM-AVM, PWS, CAMS Tumors Benign Congenital hemangioma Infantile hemangioma Syndromes: hemangiomatosis, PHACES Borderline Juvenile nasopharyngeal angiofibroma Kaposiform hemangioendothelioma Malignant  
3. Phakomatoses Dysplastic NF1 NF2 NF3 Tuberous sclerosis Gorlin Cowden Proteus Encephalocraniocutaneous lipomatosis Vascular Von Hippel-Lindau Sturge-Weber Ataxia-telangiectasia Pigmentary Neurocutaneous melanosis Pigmentary mosaicism

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## Abstract Archives of the RSNA, 2023

HNEE-57

### Pediatric Orbital Lesions

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

Pediatric orbital lesions can be classified into congenital, CSF, traumatic, vascular, endocrine, inflammatory, and neoplastic. Radiologic evaluation evaluates intraorbital compartments and extraorbital structures. Correlate imaging findings with ophthalmologic exam and imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Background Orbital anatomy development Ophthalmology: fundoscopy, US, OCT Radiology: CT, MR, XA 2. Congenital Small eye: anophthalmia, microphthalmia, phthisis bulbi Big eye: buphthalmos, staphylomas, colobomas Germ layer derivatives Syndromes: NF1, NF2, Aicardi, CHARGE, morning glory, Walker-Warburg Cranial dysinnervation 3. CSF Papilledema vs. pseudopapilledema Cephalocele Exorbitism 4. Trauma Anterior segment Posterior segment Globe rupture Fractures 5. Vascular anomalies Low-flow malformations Varix Venous Lymphatic Sturge-Weber Coats disease High-flow malformations Carotid-cavernous fistula Wyburn-Mason Vascular tumors Hemangiomas PHACES Von Hippel-Lindau 6. Endocrine Pediatric Graves 7. Inflammation Pott's puffy tumor Aspergillosis COVID-19 Demyelination MS NMO ADEM Histiocytosis LCH JXG Granulomatosis IgG4 CRION 8. Neoplasia Intraocular Retinoblastoma Medulloepithelioma Periorbital Adenoid cystic carcinoma Hidradenocarcinoma Benign Solitary fibrous tumor Pituitary macroadenoma Small round cell Rhabdomyosarcoma Neuroblastoma Leukemia Desmoplastic sarcoma Bone lesions Osteoma Fibrous dysplasia Sickle cell infarcts

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## Abstract Archives of the RSNA, 2023

HNEE-58

### Head Neck Vascular Anomalies and Syndromes

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

The ISSVA classification divides vascular anomalies into vascular malformations (vasculogenesis) and vascular tumors (angiogenesis). Radiology plays an important role in diagnosis and treatment of HN vascular anomalies. Major imaging approaches include US, CT, and MR. Each modality has specific clinical indications and limitations. Imaging findings should be correlated with dermatologic examination and other clinical information. There is an emerging focus on genetic causality and targeted therapies.

#### TABLE OF CONTENTS/OUTLINE

1. ISSVA Classification Vascular neoplasms: benign, borderline, malignant Vascular malformations: simple, combined, syndromic Genetics and targeted therapies 2. Imaging Modalities USXRCTMRXA 3. Malformations Low-flow Capillary, venous, lymphatic Syndromes: Sturge-Weber, blue rubber bleb nevus, megalencephaly-capillary malformation, CLAPO, Gorham-Stout, generalized lymphatic anomaly High-flow Arteriovenous malformation, arteriovenous fistula Syndromes: cerebral arteriovenous metamerism syndrome, hereditary hemorrhagic telangiectasia, CM-AVM 4. Tumors Congenital hemangioma RICH, NICH, PICH Infantile hemangioma Hemangiomatosis, PHACES Kaposiform hemangioendothelioma / Tufted angioma Epithelioid hemangioendothelioma Kaposi sarcoma Angiosarcoma 5. Overgrowth Facial infiltrating lipomatosis Epidermal nevus Megalencephaly-capillary malformation: MCAP, MPPH Proteus Cowden

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## Abstract Archives of the RSNA, 2023

HNEE-59

### Approach to Pediatric Face and Neck Masses

#### Participants

Mai-Lan Ho, MD, Dublin, OH (*Presenter*) Research Grant, Siemens AG; Research Grant, Cardinal Health, Inc; Research Grant, Italfarmaco SpA

#### TEACHING POINTS

Evaluation of pediatric face neck masses includes clinical history, physical exam, lab values, and radiology. Diagnostic imaging can be performed with US, CT, or MR to characterize lesion location, composition, and extent. Diagnostic categories include congenital, vascular, inflammatory, and neoplastic.

#### TABLE OF CONTENTS/OUTLINE

1. Congenital Midface Dermal sinus Glial heterotopia Encephalocele Branchial clefts Types 1-4 Branchial pouches Thymus Parathyroid Thyroid 2. Vascular Vascular malformations Low-flow syndromes Lymphatic (generalize lymphatic anomaly) Venous (blue rubber bleb nevus) Capillary (megalencephaly-capillary malformation) High-flow syndromes HHT CM-AVM CAMS Vascular tumors Congenital hemangioma Infantile hemangioma: hemangiomatosis, PHACES Borderline tumors Juvenile nasopharyngeal angiofibroma Kaposiform hemangioendothelioma 3. Inflammatory Tonsillar vs. peritonsillar abscess Retropharyngeal edema vs. abscess Pott's puffy tumor Salivary glands Sialosis Sialadenitis Pneumoparotitis Mucocele / Ranula Autoimmune 4. Neoplastic Lipomatous lesions Congenital infiltrating lipomatosis Lipoblastoma Teratoma Fibrous lesions Fibromatosis colli Myofibromatosis Leiomyoma Desmoplastic fibroma (tuberous sclerosis) Desmoid fibromatosis (Gardner) Sarcoma Rhabdomyosarcoma Ewing Fibrosarcoma Synovial sarcoma Neuroblastoma Primary Secondary Nerve sheath tumors NF1 NF2 NF3 Neuroendocrine tumors Glomus (SDH, NF1, VHL, MEN) Thyroid Thyroiditis Thyroid CA

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## Abstract Archives of the RSNA, 2023

HNEE-6

### **Differentiating Malignant Parotid Tumors From Pleomorphic Adenomas and Warthin's Tumors: The Benefits of Tumor Blood Flow and Apparent Diffusion Coefficient Histogram Analysis**

#### **TEACHING POINTS**

It is occasionally difficult to differentiate malignant parotid tumors (MTs) from two major benign tumors such as pleomorphic adenomas (PAs) and Warthin's tumors (WTs). Here, we review how to diagnose parotid tumors by the use of apparent diffusion coefficient (ADC) and tumor blood flow (TBF) obtained by pseudocontinuous arterial spin labeling (pCASL), comparing conventional methods such as tumor-to-parotid gland signal intensity ratios with histogram analysis for the following reasons: 1. to understand principle of pCASL; 2. to review conventional methods to evaluate parotid tumors by TBF and ADC; and 3. to understand the benefits of TBF and ADC histogram analysis for differentiating MTs from PAs and WTs.

#### **TABLE OF CONTENTS/OUTLINE**

1. Essential knowledge of parotid tumors such as incidence rate, and major tumor types 2. Principle of pCASL 3. Conventional methods for differentiating MTs from PAs and WTs 1. TBF and ADC histogram analysis for differentiating MTs from PAs and WTs 2. Conclusion: The combination of TBF and ADC evaluated by histogram analysis may enhance the diagnostic performance for differentiating parotid MTs from PAs and WTs.

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## Abstract Archives of the RSNA, 2023

HNEE-60

### Opportunistic Assessment for Parathyroid Adenomas: How We Do It and Why

#### Participants

Karol Cardenas, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

There are well-documented shortcomings in the diagnosis and treatment of primary hyperparathyroidism (PHPT). These gaps have prompted calls for innovative changes to how health systems approach this disease. One proposed change is for radiologists to assess for enlarged parathyroid glands on routine imaging studies with the goal of identifying individuals with undiagnosed PHPT. This exhibit will 1) review relevant PHPT background, 2) summarize existing evidence related to opportunistic parathyroid assessment, and 3) share a practical, step-by-step approach to opportunistically screening for parathyroid adenomas (i.e., "how we do it") with illustrative case examples.

#### TABLE OF CONTENTS/OUTLINE

1. Opportunistic Screening - definition; potential benefits and risks
2. PHPT Background - epidemiology, pathophysiology, diagnosis, treatment, accepted imaging role
3. Existing Gaps - failure to diagnose, failure to treat, morbidity of untreated disease
4. Opportunistic Assessment for Parathyroid Adenomas - anatomy, size criteria, imaging characteristics, review of the evidence, relevant aspects of Fifth International Workshop clinical guidelines, how we do it (search pattern, imaging evaluation, reporting)
5. Illustrative Examples - opportunistically identifying parathyroid adenomas on CT, MR, US; differentiating from mimics (exophytic thyroid tissue, thyroid nodule, lymph node)
6. Proposed Best Practices Decision Tree for "Should I Recommend Biochemical Testing for Possible PHPT?"
7. Summary and Conclusion

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## Abstract Archives of the RSNA, 2023

HNEE-61

### Hmm...Is That Normal? Pediatric Skull Base Variants With A Focus on the Temporal Bone

#### Participants

Asha Sarma, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Radiologists must recognize many normal skull base variants that may be mistaken for disease in pediatric patients.-Differentiating normal variants from disease may be especially challenging in the temporal bone, given complex anatomy and frequently incomplete ossification.-This multi-institutional exhibit will provide a detailed case-based review of pediatric skull base variants including relevant companion cases, pearls, pitfalls, and mimics.-After viewing this exhibit, radiologists will have practical tools for differentiating normal skull base variants from disease and strategies for troubleshooting difficult cases.-This exhibit aims to: 1) describe relevant anatomy, embryology, and post-natal development of the skull base and temporal bones, 2) identify CT and MRI findings of common and uncommon developmental findings and variants, 3) contrast these variants with similar-appearing disease states, and 4) explain strategies for troubleshooting difficult cases.

#### TABLE OF CONTENTS/OUTLINE

1) Normal anterior skull base ossification and variants (e.g., skull base synchondroses, craniopharyngeal canal) 2) Normal temporal bone development and variants (e.g., cochlear cleft, incomplete ossification of the semicircular canals) 3) Variant middle ear findings (e.g., ossicular pneumatization, suspensory ligament calcification) 4) Vascular variants (e.g., emissary venous channels mimicking fracture, aplastic petrous carotid canal); 5) Skull base pneumatization variants; 6) Other salient findings (e.g., skull base sutures, foramen tympanicum)

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## Abstract Archives of the RSNA, 2023

HNEE-62

### Pictorial Overview of Temporomandibular Joint Pathologies

#### Participants

Wen Wang, MD, Orlando, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the anatomy of TMJ. Provide illustrative cases and clinical scenarios depicting common and rare pathologies involving TMJ.

#### TABLE OF CONTENTS/OUTLINE

1. Relevant anatomic review of the temporomandibular joint. 2. Check list/Search pattern for TMJ pathologies. 3. Congenital anomalies: i. Congenital hypoplasia ii. Ankylosis of TMJ. 4. Infectious pathology: i. Septic arthritis of TMJ ii. Post-operative infection 5. Degenerative disease: i. Osteoarthritis of TMJ ii. TMJ disc dislocation and subluxation. 6. Neoplastic disease: i. Osteochondromatosis of TMJ ii. Ameloblastoma iii. Metastatic disease. 7 Other pathologies: osteonecrosis.

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## Abstract Archives of the RSNA, 2023

HNEE-63

### Practical Tips for Hypopharyngeal Carcinoma Staging

#### Participants

Carlos Alberto Coelho Neto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The hypopharynx represents the lowest portion of the pharynx and can be affected by neoplastic and non-neoplastic diseases. Squamous cell carcinoma is the most common neoplasm in this region and can affect one of its three main subsites: pyriform sinuses, posterior wall and post-cricoid region. Imaging evaluation is essential in the staging of these patients, along with clinical and endoscopic examination. The objective of this presentation is to help the radiologist in the evaluation of neoplastic lesions of the hypopharynx, with images and tips for the evaluation of primary lesions and lymph node enlargement, contributing to the TNM classification.

#### TABLE OF CONTENTS/OUTLINE

Discussion of imaging tips in staging the hypopharynx neoplasms by showing clinical cases with MRI and CT images. We start this presentation by detailing the anatomical limits of the hypopharynx. We will detail the three main subsites of hypopharyngeal neoplasms: pyriform sinuses, posterior wall and postcricoid region. We highlight the main points of the TNM classification and, through cases, we demonstrate the main anatomical landmarks, how to measure the lesions, besides tumor extension pathways. Lymph node aspects will also be discussed, such as dimensions, dissemination routes, extranodal extension and necrosis. The conclusion of this presentation shows that hypopharyngeal neoplasms are part of the daily clinical routine of general and head and neck radiologists. Therefore, the anatomy of the pharynx must be well known, as well as the main subsites of the hypopharynx. We also show that it is not necessary to memorize the TNM staging, but the radiologist must know how to evaluate its most important points and landmarks.

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## Abstract Archives of the RSNA, 2023

HNEE-64

### Orbital Trauma: A Pictorial Review

#### Participants

Junaid Kalair, BS, Richardson, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss the role of imaging in evaluation of orbital trauma
2. Recognized normal orbital anatomy on CT and MRI
3. Describe the spectrum of orbital trauma injuries seen on imaging
4. Recognize mimics of orbital injuries

#### TABLE OF CONTENTS/OUTLINE

Roles of radiographs, ultrasound, CT, and MRI in orbital trauma imaging  
Normal bony and soft tissue anatomy of the orbit on CT MRI including orbital compartments  
Pictorial Review of orbital injuries including: Extra-globe injuries  
Preseptal vs. post-septal hemorrhage  
Intra-conal vs. Extra-conal hemorrhage  
Traumatic exophthalmos vs. enophthalmos  
Ocular muscle injury/entrapment  
Foreign bodies  
Globe injuries  
Anterior segment  
Aqueous humor hemorrhage  
Uveal Prolapse  
Lens Dislocation  
Ejection  
Posterior segment  
Vitreous humor hemorrhage  
Subretinal hemorrhage  
Subchoroidal hemorrhage  
Open globe  
Imaging findings  
Foreign bodies  
Orbital trauma mimics  
Iatrogenic intraocular gas  
Medical implants

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## Abstract Archives of the RSNA, 2023

HNEE-65

### Internal Cacophony of Heartbeats: Rhythmic Whooshing and Buzzing in the Ear - Maddening Patient and Physician

#### TEACHING POINTS

1. Review common and uncommon etiologies of pulsatile tinnitus including vascular, structural and neoplasms. 2. Multimodality imaging assessment and diagnostic workup. 3. Current concepts in management and review of treatment options.

#### TABLE OF CONTENTS/OUTLINE

1. Background introduction of pulsatile tinnitus 2. Review of common and uncommon etiologies of pulsatile tinnitus a. Vascular: i. Venous: Idiopathic intracranial hypertension, jugular bulb diverticulum, and emissary veins ii. Arterial: arteriovenous fistula and malformations, aberrant carotid artery, fibromuscular dysplasia and carotid dissections b. Structural: i. Skull base dehiscence, internal jugular vein compression ii. Conductive hearing loss, e.g. otosclerosis c. Tumor: Paraganglioma, meningioma, low flow vascular malformations (Hemangiomas) 3. Diagnostic Imaging QR codes with scrollable imaging data sets will be provided, with practical clues for making the diagnosis, and will include high-resolution flat panel CT. a. Idiopathic intracranial hypertension CTV, MRV, and DSA. b. High riding jugular bulb and diverticulum CTV and DSA, and vascular Eagle syndrome. c. Dural arteriovenous fistula CTA, MRA, and DSA including high resolution 14 second magnified flat-panel computed tomography d. Aberrant carotid artery CTA and DSA e. Paraganglioma MRI, MRA, and DSA f. Meningioma MRI g. Sigmoid sinus wall dehiscence and emissary veins CTA including treatment DSA. h. Otosclerosis CT 4. Review of treatment options a. Transverse sinus stenosis stenting. b. Arteriovenous fistula embolization. c. Jugular vein decompression. d. Bony dehiscence resurfacing. 5. Diagnostic algorithm summary

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## Abstract Archives of the RSNA, 2023

HNEE-66

### Imaging Evaluation of Hearing Loss: Understanding Audiograms to Refine Interpretation

#### TEACHING POINTS

1) Prior to imaging, patients with hearing loss undergo audiometric assessment, which categorizes hearing loss as conductive, sensorineural, or mixed. 2) CT is the first-line imaging modality for patients with conductive hearing loss (CHL), and an understanding of prior audiometric testing results can benefit the radiologist's temporal bone CT interpretation. 3) Pure-tone hearing test results may be the most relevant component of the audiogram report for radiologists and are often viewable in the electronic medical record at the time of CT interpretation. 4) Recognizing specific CHL patterns in audiograms can increase confidence and accuracy of CT interpretations. 5) The presence or absence of the acoustic reflex informs likelihood of a third window phenomenon.

#### TABLE OF CONTENTS/OUTLINE

I. Evaluation of the patient with hearing lossa. Clinical assessmentb. Audiometric evaluationc. Role of imagingi. Indications for CTii. Indications for MRII. Review of audiometric testinga. Pure-tone hearing testi. Basic interpretationii. Patterns of conductive hearing lossb. Acoustic reflexi. Principlesii. Acoustic reflex testingIII. Illustrative Casesa. Pattern 1: Low frequency CHL closing in at higher frequenciesb. Pattern 2: Flat CHLc. Pattern 3: The Carhart notchd. Absent acoustic reflex

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

HNEE-67

### Ultrasound Assessment of Parathyroid Disease: The Latest and Greatest

#### TEACHING POINTS

- Provide an overview of the anatomy, function, and embryology of the parathyroid gland.
- Emphasize the indications, limitations, and benefits of ultrasound in evaluating the parathyroid gland.
- Compare different imaging techniques for the parathyroid gland.
- Discuss the ultrasound protocol for evaluating the parathyroid gland.
- Become familiar with descriptive terms for normal parathyroid gland anatomy.
- Review the most common pathologies and provide case studies to illustrate the practical application of theoretical concepts.
- Analyze differential diagnoses, tips, and tricks.
- Discuss updates in ultrasound evaluation for parathyroid gland pathology.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of the parathyroid gland 1.1 Anatomy 1.2 Function 1.3. Embryology 2. Ultrasound evaluation of the parathyroid gland 2.1 Indications 2.2 Limitations 2.3 Benefits 3. Comparison of imaging techniques for the parathyroid gland: ultrasound, 4DCT, and SPECT. 4. Ultrasound and CEUS protocol for evaluating the parathyroid gland. 5. Descriptive terms for normal parathyroid gland anatomy 6. Common pathologies in the parathyroid gland: parathyroid adenoma, parathyroid hyperplasia, parathyroid carcinoma, atypical parathyroid adenoma/atypical parathyroid tumor. 7. Differential diagnoses: thyroid nodules and cervical adenopathies, tips and tricks for improving radiology reports. 8. Updates in ultrasound evaluation for parathyroid gland pathology: elastography and CEUS. 9. Conclusion.

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## Abstract Archives of the RSNA, 2023

HNEE-68

### Molecular Markers of Head and Neck Tumors

#### Participants

Amit K. Agarwal, MD, MBBS, Jacksonville, FL (*Presenter*) Stockholder, Gilead Sciences, Inc

#### TEACHING POINTS

1. To understand the basics of neuropathology and genetics  
2. Review the molecular markers genetics of head and neck tumors  
3. Discuss reclassified and newly recognized head and neck tumors

#### TABLE OF CONTENTS/OUTLINE

1. Neuropathology for the Neuroradiologist  
a. Basic histopathology (H E stains)  
b. Immunohistochemistry (immunocytology)  
c. Genetic analysis (FISH, PCR, Next-generation sequencing,) d. Liquid biopsy  
2. Markers for squamous cell carcinomas (SCCa) of the head and neck  
a. HPV (p16+ tumors) b. EBV positive tumors c. Circulating-tumor DNA (ct-DNA) for tumor surveillance  
3. Molecular markers for non-SCCa tumors of head and neck  
a. Muscle differentiation (actin, desmin) b. Neural differentiation (S100, GFAP) c. Vascular differentiation (CD markers) d. Epithelial differentiation (cytokeratin, EMA)  
4. Reclassified and newly recognized tumors  
a. SDH deficient paragangliomas b. EBV-related smooth muscle tumors c. Mammary analogue secretory carcinoma (MASC)  
5. Therapeutic advances in head and neck oncology (focus on immunotherapy)  
6. Summary/conclusion

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## Abstract Archives of the RSNA, 2023

HNEE-69

### **A Practical Guide for Radiologists: Localizing and Diagnosing Pathologies in the Carotid and Parapharyngeal Spaces**

#### **TEACHING POINTS**

- Provides a comprehensive overview of the radiologic anatomy of the carotid and parapharyngeal space (PPS)
- Describes a practical approach for localizing the pathologies affecting the carotid and PPS.
- Reviews common and rare pathologies in the carotid and PPS using case-based examples, highlighting distinctive clinical and imaging features that can aid in the best differential diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents 1. Terminology of the Carotid and PPS 2. Anatomy and Contents of the Carotid and PPS 3. Practical approach to Diagnosing Pathologies in the Carotid and PPS 4. Displacement Pattern of PPS Fat for Localizing Masses. 5. Case-Based Review of Primary and Secondary Pathologies in the PPS 6. Case-Based Review of Primary and Secondary Pathologies in the Carotid Space Outline

- Knowledge of anatomy is essential for localizing a lesion in the Carotid or PPS.
- Displacement patterns of PPS fat can aid in identifying the space of origin.
- Understanding the contents and common/rare lesions of these spaces is the first step in generating a differential diagnosis.
- Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best differential diagnosis.

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## Abstract Archives of the RSNA, 2023

HNEE-7

### Hypervascular Head and Neck Tumors: Image Aspects

#### TEACHING POINTS

Hypervascular tumors, by definition, are arterialized and present intense and early contrast enhancement. They comprise a wide variety of pathologies, which can be didactically divided into five major groups: neuroendocrine tumors, vascular tumors, primary lymphadenopathy, metastatic lymphadenopathy and other hypervascular tumors.

#### TABLE OF CONTENTS/OUTLINE

In this presentation we are going to review hypervascular head and neck tumors and characterize their imaging features on computed tomography (CT) and magnetic resonance imaging (MRI), focusing on features that aid in the differential diagnosis through flowcharts. Images will be presented comparing the different locations of the paragangliomas and the various patterns of growth of the Juvenile nasopharyngeal angiofibroma. Metastatic and primary lymphadenopathy will be differentiated through tables.

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## Abstract Archives of the RSNA, 2023

HNEE-70

### Update in Imaging of Parotid Lesions and Treatment-related Findings

#### TEACHING POINTS

Parotid gland tumors are a rare entity among the neoplasms of the head and neck. In adults, most encountered lesions are benign, being only 10% of parotid tumors malignant. Radiological assessment of these lesions includes ultrasound (US), computed tomography (CT), and morphological and functional magnetic resonance imaging (MRI). The definition of the nature of the lesion is essential for the election of treatment methods. Benign neoplasms may be destined for follow-up or managed surgically by gland-sparing techniques with facial nerve preservation. On the contrary, malignant lesions are treated frequently with total gland resection and sacrifice of the facial nerve with corresponding posterior morbidity. The exhibit aims to present the gamut of parotid neoplasms according to their imaging characteristics in the initial study and to stress the importance of radiological support in the follow-up. Treatment options including different surgical approaches and the correlation between applied technique and imaging will be provided.

#### TABLE OF CONTENTS/OUTLINE

1. Parotid anatomy. 2. Imaging modalities: US, CT, morphological, and functional MRI. Applications. 3. Primary and secondary parotid lesions. 4. Different types of surgical approaches. 5. Follow-up findings.

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## Abstract Archives of the RSNA, 2023

HNEE-71

### Bone Metabolic Disorders in Pediatric Patients: Key Clues for Early Detection in Dental Imaging

#### Participants

Jo-Eun Kim, DDS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Bone metabolic disorder refers to a disease caused by a variety of causes that break the balance between bone-forming and bone-removing activities. Bone metabolic disorders can affect pediatric patients and impact their oral health. Dental imaging, such as panoramic radiographs and cone-beam computed tomography (CBCT), can provide key clues for early detection of these disorders.

- Generalized loss of follicular cortex or lamina dura of tooth
- Generalized widening or obliteration of pulp chamber
- Generalized sclerotic or osteopenic change of trabecular bone

Understanding the imaging features of bone metabolic disorders is essential for dental practitioners to identify and refer patients for appropriate medical care. Especially, it is important to distinguish it from hematopoietic malignancy (such as leukemia, or lymphoma), which can appear similar and requires urgent treatment. Collaboration between dental and medical professionals is crucial for the management and treatment of bone metabolic disorders in pediatric patients.

#### TABLE OF CONTENTS/OUTLINE

1. Meaning of dental imaging in pediatrics
2. Schematic explanation of bone mineral metabolic disorder
3. Bone metabolic disorders which impact on teeth and jaw bone structures (summary table)
4. Example of panoramic radiographs of the pediatric patients affected by metabolic disorder
5. Differential diagnosis from hematopoietic malignancy of pediatric patients (Importance of detecting changes on dental radiography)

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## Abstract Archives of the RSNA, 2023

HNEE-72

### There's Something In Your Teeth! Dental Panoramic Radiology for Radiologists

#### Participants

Logan Ryals, BS, Jackson, MS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review normal dental anatomy and imaging features, highlighting digital panoramic radiography (Panorex) cross-sectional imaging correlates. Discuss the differential diagnosis of oral maxillofacial/dental pathology on Panorex and cross-sectional imaging. Recognize the importance of systematic dental imaging interpretation in the diagnosis of oral and maxillofacial diseases.

#### TABLE OF CONTENTS/OUTLINE

The oral cavity is the intersection of dentistry and medicine. However, the relationship of oral and systemic conditions is not fully appreciated. Modalities used in dental radiology include periapical and bitewing radiography, digital panoramic radiography, and cone-beam computed tomography. Panoramic radiography is most widely encountered by radiologists, but few receive formal training, and many are uncomfortable interpreting these studies despite frequent expectations to do so. Early detection of intraoral pathologies by radiologists may improve patient care and alert clinicians to the need for dental consultation. Familiarity with the anatomy and pathology of the oral and maxillofacial region will improve radiologists' diagnostic confidence and allow for the synthesis of a timely and detailed differential diagnosis. We will review dental imaging protocols, normal dental anatomy, and common findings of oral and maxillofacial pathology. A wide range of pathology will be discussed, emphasizing their appearances on panoramic radiographs with cross-sectional imaging correlates. Pathologies to be discussed include infectious and inflammatory lesions, periodontal diseases, cystic, benign and malignant masses, sinus pathology, and bone and temporomandibular joint disorders.

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## Abstract Archives of the RSNA, 2023

HNEE-73

### Unlocking the Temporomandibular Joint: CT, MRI and Arthroscopic Correlation

#### Participants

Silvia Cayon Somacarrera, MD, Torrelavega, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the spectrum of findings in temporomandibular joint derangement on MR and its correlation with arthroscopic findings when available To highlight the role of CT in temporomandibular joint derangement To show the different surgical therapeutic approaches of temporomandibular pathology

#### TABLE OF CONTENTS/OUTLINE

The most important anatomic structure of the temporomandibular joint is the articular meniscus, therefore it is the main element to be evaluated. We must study its morphology along with its location relative to the condyle in both closed- and open-mouth positions. However, we must bear in mind that meniscus aberrant displacement is also frequently seen in asymptomatic volunteers so that other findings such as joint effusion, retrodiskal layer rupture, lateral pterygoid muscle attachments thickening, degenerative changes, osteochondromatosis and ankylosis, may be required to help guide the diagnosis. It is important for the radiologists to detect early MR imaging signs of temporomandibular dysfunction, thereby avoiding its evolution to osteoarthritis. Nevertheless, it is important to know that the therapeutic approach is made by assessing both the clinical situation of the patient and the imaging. We have selected a wide variety of temporomandibular joint derangement cases in order to show the different imaging findings as well as the arthroscopic correlation when available. We also include a description of the different treatment approaches carried out in our institution.

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## Abstract Archives of the RSNA, 2023

HNEE-74

### Lesions in the Optic Tracts: Clinical-radiological Manifestations

#### Participants

Maria Rocha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the basic anatomy of the visual pathway and correlation with clinical manifestations.- Present the most frequent lesions in each region of the optic tract and review the main differential diagnoses.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomy review 3. Correlation the anatomy with clinical manifestations4. Most frequent lesion in each topography

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## Abstract Archives of the RSNA, 2023

HNEE-75

### Temporal Bone Anatomy on Photon Counting CT: Beyond the Obvious

#### Participants

Shehbaz Ansari, MD, MBBS, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the concept and design of photon counting CT scanners and understand its advantages over conventional CT scanners with energy integrating detectors. 2. Illustrate temporal bone anatomy with emphasis on structures that were previously not reliably or less vividly identifiable. 3. Develop a system-based approach to temporal bone radiological anatomy.

#### TABLE OF CONTENTS/OUTLINE

The imaging anatomy of the temporal bone has seen little progress in the last decade owing to the limited progress in the detector technology. Conventional detectors suffer from the inverse relation between radiation dose and image noise along with a limit to image resolution. Photon counting detectors (PCDs) have improved contrast to noise ratio with twice the resolution at nearly half the radiation dose. The basic physics of these detectors and their potential uses will be first discussed. To highlight the advantages of PCDs, we depict temporal bone anatomy including small structures not previously identifiable on imaging. Historically, advances in imaging to clarify anatomy has led to a deeper understanding of and elucidation of new pathologies associated with these structures. We also put forward a system-based approach to the anatomy of this region along with the conventional section-based anatomy. This system-based approach, aided by diagrammatic illustrations, will aid in understanding the complex anatomy of minute neural structures and communications around the ear, the delicate ossicular support system, neural and vascular supply of the labyrinth, and minor adjacent fissures among others.

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## Abstract Archives of the RSNA, 2023

HNEE-76

### Feast Your Eyes on US of the Eye: A Guide to Ophthalmic Sonography

#### Participants

Pedro Daza, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The eye needs a gel pillow. Acquired planes must evaluate anterior and posterior chambers. The optic nerve must be acquired on its own, using Doppler. Extraocular structures are important. Dynamic images are strong points of the sonography.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and radiological anatomy of eye. Technique and recommendations. Pathology with case review. Conclusions.

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## Abstract Archives of the RSNA, 2023

HNEE-77

### Imaging of Post-dental Treatment: What Radiologists Need to Know in Common and Advanced Dental Procedures

#### TEACHING POINTS

With recent advancements in dentistry, various new treatment methods have been clinically introduced, and many new materials are being used for treatments. Post-dental treatment CT and MR images reveal a variety of hard tissue and soft tissue changes and used dental materials which often associate image artifacts. Therefore, familiarity with post-treatment changes and dental materials is crucial to avoid misinterpretation as true pathologies, identify complications and evaluate for recurrent disease. The purpose of this exhibit is 1) to review common and uncommon dental treatments with an emphasis on recently introduced treatment and procedures, 2) to review expected and unexpected post-dental treatment changes and dental materials on CT and MR images, and 3) to discuss imaging approach to identify complications and disease recurrence or progression.

#### TABLE OF CONTENTS/OUTLINE

- 1) Review of common and uncommon dental treatments, with an emphasis on recently introduced treatments and dental materials
- 2) Review of expected and unexpected post-dental treatment changes and dental materials on CT and MR images
- 3) Discussion on imaging approach to identify complications and disease recurrence or progression

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## Abstract Archives of the RSNA, 2023

HNEE-78

### PET/MRI In Head and Neck Cancer: Ready For Primetime?

#### Participants

Craig Foote, MD, BSc, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

PET/MR is a relatively new modality poised to provide considerable, novel clinical value in the field of head and neck oncology by combining the functional evaluation of FDG PET with the exquisite soft tissue resolution of MR imaging. Patients with head and neck cancers already requiring MRI for TNM staging may stand to benefit the most from the use of PET/MR, which offers the ability to simultaneously acquire the optimal regional and distant metastatic evaluation offered by PET in addition to MR, as opposed to separately by MR and PET/CT. This educational exhibit will provide an overview of PET/MR and its current role in head and neck cancer, as well as discuss barriers to its widespread acceptance and predictions for the future.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of PET/MR a) Evolution of PET/MR b) Advancements in hardware c) Physics d) Coregistration  
2) Advantages of PET/MR a) Comparison to PET/CT i) Radiation dose reduction, longer acquisition times, improved radiation planning, etc. ii) Lung nodule detection compared to PET/CT b) MRI for more accurate T staging c) Application of NIRADS (Neck imaging reporting and data system) in PET/MR  
3) Examples of PET/MR in head and neck cancer a) Evaluation of post-treatment change versus recurrence b) Head and neck cancer of unknown primary c) Orbital malignancy d) Perineural Spread  
4) Barriers to use a) Costs b) Lack of trial data showing distinct advantages  
5) Recent developments/future predictions a) Multi-parametric imaging b) Innovative radiotracers

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## Abstract Archives of the RSNA, 2023

HNEE-79

### Laryngeal Carcinoma Evaluation with Dual Energy CT (DECT)

#### Participants

Paloma Puyalto, PhD, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Dual-energy CT (DECT) can be used in laryngeal carcinoma (LC) evaluation. Based on the decomposition of different materials, DECT can distinguish tissues with similar Hounsfield Unit attenuations assessed in simple energy CT (SECT). The size, the identification of the margins of LC, and the evaluation of adjacent structures invasion, which could change the LC staging, is not always easy due to the small size occupied by the complex laryngeal structures in the visceral compartment and their similar attenuation values. A more accurate diagnosis can be made with DECT. The main objectives of this exhibit are: 1. To describe DECT image acquisition protocols and post-processing techniques related to the evaluation of LC. 2. To illustrate DECT findings in LC by TNM staging and its SECT correspondence. 3. To expose the differential diagnosis and potential pitfalls of LC in DECT and how to try to avoid them.

#### TABLE OF CONTENTS/OUTLINE

1. Overview review of LC. 2. Diagnostic clinical and imaging strategies to evaluate LC. 3. DECT protocol for LC evaluation and post-processing techniques related to imaging of LC such as virtual monochromatic and material decomposition images. 4. Case-based cancer image examples with DECT and SECT correspondence for each TNM stage. 5. LC pitfalls and differential diagnosis of LC in DECT images.

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## Abstract Archives of the RSNA, 2023

HNEE-8

### Ultrasound of Ocular Globe: Revealing What Lies Below

#### Participants

Ingrid Caridade, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ultrasound (US) of the eye has become increasingly popular in clinical practice as a complementary tool to ophthalmoscopy, as it is a dependable and secure diagnostic technique for assessing and monitoring various ophthalmic conditions, including inflammation, tumors, and traumatic injuries, as well as measure the optic nerve and detect intracranial hypertension. The method is accessible, non-invasive, and relatively low-cost, with few contraindications. The eye's superficial location and structure make the US an ideal examination option, particularly in emergency situations. It is typically recommended when it is challenging to examine the fundus of the eye due to conditions that cause opacity of the ocular globe. In pediatrics, US can be performed without sedation or radiation, making it an especially valuable tool. Radiologists should be familiar with the basic anatomy of the eye, as well as the examination technique and ultrasonographic findings of the entities that frequently affect the ocular globe. In this presentation, we show a literature review and case analysis performed using high-frequency linear transducers with B-mode ultrasonography and color Doppler. Subsequently, the findings are compared to imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI).

#### TABLE OF CONTENTS/OUTLINE

Review the normal eye anatomy. Demonstrate the US examination technique. Discuss some pathologies of the eye and its main ultrasonographic image features.

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## **Abstract Archives of the RSNA, 2023**

HNEE-80

### **Delayed Gadolinium-enhanced MRI in Ménière's Disease: Imaging Findings and Clinical Application**

#### **TEACHING POINTS**

The purpose of this exhibit is to summarise current MRI techniques for hydrops imaging; to describe current diagnostic MRI criteria for Ménière's disease; and to discuss clinical application of hydrops imaging

#### **TABLE OF CONTENTS/OUTLINE**

Anatomy of inner ear structures; delayed gadolinium-enhanced inner ear MRI; MRI assessment; review of imaging findings; clinical utility

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## Abstract Archives of the RSNA, 2023

HNEE-81

### Mimics of Ménière's disease on delayed gadolinium-enhanced MRI

#### TEACHING POINTS

The purpose of this exhibit is (1) to review imaging features of several peripheral vertigo-associated diseases on delayed gadolinium-enhanced MRI and (2) to describe the current role of MRI in differentiating Ménière's disease from other vertigo-associated diseases.

#### TABLE OF CONTENTS/OUTLINE

Anatomy of inner ear structures; delayed gadolinium-enhanced inner ear MRI; review of imaging findings in Ménière's disease, intralabyrinthine fistula, perilymphatic fistula, labyrinthitis, sudden sensorineural hearing loss, vestibular neuritis, vestibular migraine, vestibular schwannoma; summary of MRI findings and differentiating features.

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## Abstract Archives of the RSNA, 2023

HNEE-82

### Imaging Considerations for Transoral Robotic Surgery (TORS) Planning

#### Participants

Niedja Santos Goncalves Tsuno, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To learn the radiological imaging findings that represent indications and contraindications for Transoral Robotic Surgery (TORS), focusing on Head and Neck oncology. - To identify expected postsurgical status of tumors resected by TORS.

#### TABLE OF CONTENTS/OUTLINE

1. Simplify the anatomy of the oropharynx, hypopharynx, and larynx, with emphasis on the tonsillar regions, base of the tongue, supraglottis, hypopharynx (pyriform sinus), and also the pre-styloid parapharyngeal and retropharyngeal spaces. 2. Summarize classical TORS ideal indications for treatment of head and neck neoplasms, focusing on the role of CT and MR imaging to determine the size of the tumor, its location and relationship with adjacent structures. 3. Summarize and exemplify the major general contraindications for TORS related to the primary tumor (internal carotid artery entrapment, invasion of the prevertebral space, massive extension into the masticatory space, bone involvement) and those not related to the primary tumor (unresectable cervical nodal disease, metastases and high surgical-anesthetic risk), in addition to reviewing site-specific contraindications. 4. Conclusion.

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## Abstract Archives of the RSNA, 2023

HNEE-83

### What, Where and When of Imaging in Spontaneous Skull Base CSF Fistulas

#### Participants

Sanchita Gupta, MBBS, MD, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Understand the anatomical basis and pathophysiology of spontaneously developing CSF fistulas  
2) Approach to imaging in patients with skull base fistula  
3) Identify the imaging appearance of lesions, and features to differentiate these from potential mimics  
4) To extract clinically relevant imaging information which translates into improved decision-making and ease during the surgical procedure

#### TABLE OF CONTENTS/OUTLINE

1) What is a Spontaneous Skull base CSF fistula?  
2) Pathophysiology of a CSF leak  
3) Anatomical considerations - Common sites - Cribriform plate - Sphenoid bone - Perisellar and Lateral recess - Temporal bone - Tegmen tympani and mastoideum  
4) History and Clinical Presentation  
5) Imaging modalities for assessment - Indications and Technique - High-resolution Computed Tomography (HRCT) - Magnetic resonance Cisternography - Contrast-enhanced CT Cisternography - Gadolinium-enhanced MR Cisternography  
6) Imaging features of spontaneous skull base CSF fistula  
7) Associated features of Idiopathic Intracranial Hypertension  
8) Structured reporting format for the pre-surgical evaluation of skull base CSF fistula - What the Surgeon Wants to Know.

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## Abstract Archives of the RSNA, 2023

HNEE-84

### **The External Carotid Artery: The Forgotten Carotid Branch. Tips and Tricks for the Evaluation in Different Imaging Techniques.**

#### **Participants**

Maria Galante I, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-To review the pathway, anatomical relationships and areas supplied by the external carotid artery.-To describe the anatomy of the artery and the relationship with other structures in the different techniques, including CTA, MRA, US and DSA.-To give some tips to achieve an accurate evaluation of the artery and its main pathologies, especially while performing a diagnostic US.- To offer a US protocol for the assesment of these artery.The external carotid artery is one of the main vascular structures of the head and neck region, not only because it irrigates this area, but also because some of its branches anastomose with the internal carotid and posterior cerebral arteries, becoming an important source of collateral supply. Besides, it is well known that the number of interventional and surgical procedures has massively increased . So, being the territory supplied by this artery so extensive and sometimes tricky, it could get affected whenever any of these procedures are performed, or in the case of tumors of the head and neck region, and traumatic injuries. In this exhibit we will analyze the anatomical pathway, territory, and relations of this artery.

#### **TABLE OF CONTENTS/OUTLINE**

1) General Anatomical Description2) The external carotid artery in Imaging Techiques: US, CTA, MRI , DSA3) Tips and Tricks for the evaluation in US technique: Protocol4) Superior thyroid artery5) Ascending pharyngeal artery6) Lingual artery7) Facial artery8) Occipital artery9) Posterior auricular artery10) Maxillary artery11) Superficial temporal artery

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## Abstract Archives of the RSNA, 2023

HNEE-85

### Algorithmic Approach to Head and Neck Emergency Neuroradiology

#### TEACHING POINTS

1. Discuss common neuroradiology examinations of the head and neck region from the emergency department. 2. Outline key anatomic structures and common emergent diagnoses of the head and neck. 3. Provide algorithmic approaches for interpreting neuroradiology examinations of the neck soft tissues, skull base, face, and orbits. 4. Display image rich case examples of head and neck neuroradiology emergent diagnoses which outline key features for high quality reports.

#### TABLE OF CONTENTS/OUTLINE

1) Neuroradiology examinations of the head and neck commonly ordered in the emergency department i) CT: neck soft tissues, maxillofacial, temporal bone, orbits, cervical spine, CTA ii) MRI: neck soft tissues, face, orbits, IAC, cervical spine, MRA iii) Radiographs: Neck soft tissue, cervical spine, face, mandible 2) Neck soft tissue Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Ludwig's Angina, Tracheal Fractures etc. 3) Skull base Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Ossicular dislocation, Bezold abscess etc. 4) Face Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Le Fort Fractures, Fungal sinusitis etc. 5) Orbit Algorithm i) Structured diagnostic strategy (1) Key anatomy and diagnoses ii) Case examples (1) Globe rupture, Retrobulbar hemorrhage etc.

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## Abstract Archives of the RSNA, 2023

HNEE-86

### Breathe Easier: A Guide for Imaging Obstructive Sleep Apnea (OSA)

#### TEACHING POINTS

Obstructive Sleep Apnea (OSA) is a common condition characterized by repetitive episodes of partial or complete upper airway obstruction during sleep, leading to disrupted breathing and decreased oxygen levels. Imaging techniques, such as computed tomography (CT) can provide valuable information for the diagnosis of OSA and surgical planning. CT is particularly useful for assessing the upper airway anatomy and identifying anatomical factors contributing to airway obstruction. A standardized approach for evaluating CT, including measurements of relevant landmarks is useful for communicating the findings to the referring surgeon.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction  
Definition and epidemiology of OSA  
Scanning Protocol  
II. Imaging Techniques for OSA  
Computed Tomography (CT)  
Magnetic Resonance Imaging (MRI)  
III. Role of Imaging in OSA Diagnosis and Management  
Upper Airway Anatomy  
Assessment  
Soft Tissue Structure Evaluation  
Functional Changes  
Detection  
Complications Identification  
Treatment Guidance  
Anatomical Measurements on CT  
Implantable Neurostimulator to Treat Obstructive Sleep Apnea  
IV. Conclusion  
Summary of key points  
Future directions and challenges in OSA imaging research

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## Abstract Archives of the RSNA, 2023

HNEE-87

### Dacryocystography using Computed Tomography: What a Radiologist Needs to Know

#### TEACHING POINTS

Computed Tomography Dacryocystography (CT DCG) is a valuable technique to evaluate the nasolacrimal drainage system in epiphora. It allows unequivocal demonstration of the level and causes of obstruction that include inflammatory, traumatic (fractures and iatrogenic), developmental stenosis of the bony lacrimal canal, and an occasional lacrimal sac tumor, etc. It also provides useful information about the degree of obstruction, whether obstruction is anatomical or functional, insight into reasons for failed dacryocystorhinostomy, and other useful findings like sac size, diverticuli, fistulae, etc. The technique, therefore, provides a one-stop shop for all necessary information for the diagnosis, treatment planning, and follow-up in epiphora.

#### TABLE OF CONTENTS/OUTLINE

1)Indications 2)Technique 3)Interpretation 4)Etiologies with illustrative cases 5)Ancillary findings aided and detected by CT  
5)Limitations 6)Conclusions

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## Abstract Archives of the RSNA, 2023

HNEE-88

### Liptology or the Science Behind Beautiful Lips

#### TEACHING POINTS

- To describe the anatomy of lips and perioral region- What ultrasound technique is used to depict anatomy and tips to perform the exam- To assess any anatomical variants or physiological changes that affect the lips ?- To describe optimal prognostic tools during the ultrasound exam that might prevent any adverse event and also to define some common complications.

#### TABLE OF CONTENTS/OUTLINE

The main focus is to describe the anatomy of simple but yet complicate organ that recently has been exposed to much attention. The other important part is to learn what anatomical variations are common and what pathological or physiological changes could be defined using Ultrasound. Due to the fact that there is unabated trend of aesthetic procedures in which complications are becoming more and more prominent, the radiologist must become familiar of them. Together we will identify what might be the ingredients of beautiful lips and their aging changes. The last but not least we will describe what the overfilled syndrome looks like and how it might affect the oral and perioral region.

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## Abstract Archives of the RSNA, 2023

HNEE-89

### Diagnostic Imaging of Enophthalmos: A Practical Approach

#### TEACHING POINTS

- Describe measures used to evaluate the normal globe position in cross-sectional imaging.- Discuss the main imaging features of entities that lead to enophthalmos and its mimics.- Demonstrate the utility of CT and MRI in the differential diagnosis of patients with enophthalmos.

#### TABLE OF CONTENTS/OUTLINE

Enophthalmos, defined as inward displacement of a normal-sized globe within the orbit, can occur unilaterally or bilaterally and is relatively common. If the displacement is minimal, the diagnosis may not always be based on physical examination and these patients may be initially misdiagnosed as having contralateral exophthalmos. Various etiologies cause enophthalmos and trauma is the leading cause. CT and MRI are the imaging techniques of choice for evaluating enophthalmos, and each have distinct advantages. While CT is useful for the detailed assessment of bone structures, MRI is better suited for analyzing orbital soft tissues. Our purpose is to present an overview of the imaging characteristics of entities that can cause enophthalmos based on various mechanisms, including structural abnormalities, fat atrophy, retraction, mixed, uni- vs. bilateral, and pseudoenophthalmos.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

HNEE-9

### US of the Neck Beyond the Thyroid: Parathyroids, Salivary Glands, Adenopathy, Trachea

#### Participants

Matheus Marcelino Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are:-Make a multimodality-based didactic review to elucidate multiples cervical conditions at neck ultrasound;-Propose a didactic categorization of these conditions: .Gastrointestinal malformations.Congenit malformations.Infectious causes.Oncology causes.Post operative conditions-Correlate those findings with other exams;-Illustrate those conditions based on cases from our radiology group.

#### TABLE OF CONTENTS/OUTLINE

We will elucidate multiples cervical conditions at neck ultrasound and focus on their imaging features using a multimodality approach in this exhibit.Gastrointestinal malformations Zenker diverticulumCongenit malformationsCysticThyroglossal duct cyst Branquial cyst Lymphangioma Ranula Solid TeratomaGlioma Vascular Hemangioma Arteriovenous malfomation Infectious causesSialadenitisParotitisAbcessLymph node abscessCarotidyniaOncologyLinfomaParotid Submandibular gland Oropharynx Post operative conditions

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

HNEE-90

### **A Practical Guide to Reporting an Oropharyngeal Videofluoroscopic Swallow Study: Anatomical Landmarks, Tips, and Tricks**

#### **Participants**

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-To describe oropharyngeal region anatomy and mechanism of swallowing. -To review the study protocols of oropharyngeal videofluoroscopic swallow study (VFSS) in the evaluation of different clinical conditions and endoscopic findings. -To illustrate the most important anatomic landmarks and signs to evaluate in different phases of a swallowing videofluoroscopy. - To analyze steps in interpretation of an VFSS, report structure and essential points in reporting.

#### **TABLE OF CONTENTS/OUTLINE**

Oropharyngeal videofluoroscopic swallow study is the technique of choice in the diagnosis of oropharyngeal dysphagia causes. The study protocol should be tailored according to the specific clinical symptoms and endoscopic findings in each patient. Reporting an VFSS requires knowledge of the most important anatomic landmarks and a detailed report structure including findings in the different phases of deglutition. We present: -Normal anatomy of the oropharynx and mechanism of swallowing. - Study protocol: Contrast agent preparation. Swallowing protocol: bolus volumes (small or large) consistency (liquid to semisolid). Patient positioning. Image requirements. Recording. -Study evaluation. Anatomical landmarks. Deglutition phases. Implications for treatment. Meal consistency. Different manoeuvres improving swallowing. -Report: Systematic analysis of imaging findings. Motility disorders: Bolus transport from oral cavity, Laryngeal vestibular penetration, Pharynx residue, Transglottic aspiration; Intrinsic causes: cricopharyngeal bar (prominent cricopharyngeal muscle), diverticulum, web. Extrinsic compression: osteophytes, thyroid gland. Surgery (laryngectomy).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

HNEE-91

### Head and Neck: It's Not a Tumor

#### Participants

Brian Yep, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe imaging features of head and neck lesions that should raise the concern for oncologic processes. 2. Provide non-neoplastic differential considerations for head and neck lesions.

#### TABLE OF CONTENTS/OUTLINE

One of the major questions that arise when encountering a head and neck lesion is to discern if it is a neoplastic or non-neoplastic process. This educational exhibit will first highlight imaging features that should raise the concern for an aggressive neoplastic head and neck process. Then, through a case-based style, non-oncologic mimics will be presented to provide alternative benign differential diagnostic considerations including infectious, inflammatory, and variant congenital/developmental etiologies. Finally, one can put this knowledge to the test through a series of quiz questions.

Printed on: 04/12/24

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## Abstract Archives of the RSNA, 2023

HNEE-93

### Dysphagia: A Pictorial Review of Common and Uncommon Causes

#### Participants

Selima Siala, MD, Carrboro, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Illustrate a large spectrum of diseases causing dysphagia. Highlight key imaging findings of common diseases of the pharynx and esophagus.

#### TABLE OF CONTENTS/OUTLINE

Dysphagia is a broad term used to describe a subjective sensation of difficulty when swallowing. Causes of dysphagia can be divided into structural and functional. Structural dysphagia includes lesions that compromise the esophageal lumen typically leading to difficulty swallowing solid food prior to liquids. Examples of structural dysphagia include congenital anomalies (esophageal web and vascular entities), acquired (Zenker's diverticulum, Longus coli tendonitis, goiter, and aortic dissection), neoplasms, inflammation (esophagitis, felonization of the esophagus, Barrett's esophagus, and scleroderma), infection (abscess and Candidiasis), iatrogenic (surgically induced) and foreign bodies. Functional dysphagia is caused by conditions that interfere with normal peristalsis including diffuse esophageal spasm and achalasia. Hence the swallowing of both solid foods and liquid is compromised at the same time. Dysphagia can also be classified based on location as oropharyngeal or substernal. Oropharyngeal dysphagia is defined as a sensation of blockage in the throat, while substernal dysphagia presents as a sensation of blockage between the thoracic inlet and the xiphoid process. The evaluation of dysphagia heavily relies on imaging, particularly fluoroscopy studies including modified barium swallow and esophagography as well as CT. Fluoroscopy studies provide an evaluation of both anatomic structure and function of the pharynx and esophagus while CT provides better anatomic evaluation outside of the lumen.

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## Abstract Archives of the RSNA, 2023

HNEE-94

### Decoding the Language of Neoplastic Cells: Molecular Markers as Prognostic and Diagnostic Tools for Oral Squamous Cell Carcinoma

#### Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the most recent genetic alterations described in Oral Squamous Cell Carcinoma (OSCC) and correlate with the pathology, imaging, and prognosis. To show that molecular analysis can provide information on tumor biological behavior. To demonstrate the importance of incorporating molecular analysis of OSCC.

#### TABLE OF CONTENTS/OUTLINE

1. Revision of the anatomy of the oral cavity. 2. Epidemiology, pathology, and demographics of OSCC. 3. Recent advances in molecular biology. 4. Specific genetic mutations, amplifications, or deletions associated with tumor progression, recurrence, and response to therapy. 5. Identification of human papillomavirus (HPV) leading to improved prognosis and targeted therapy. 6. Imaging strategies to depict the correct diagnosis based on the genetic profile. 7. Targeted therapies or immunotherapies. 8. Flowchart of the changes and last updates based on the neoplastic molecular profile. 9. Take-home messages.

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## Abstract Archives of the RSNA, 2023

HNEE-95

### Lessons About Cholesteatomas. Keratinize Radiological Knowledge

#### Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching points To demonstrate the features of cross-sectional imaging cholesteatomas, indications and limitations of HRCT and MRI. To illustrate the main complications of cholesteatomas and post-operative assessment.

#### TABLE OF CONTENTS/OUTLINE

Table of contents / OutlineBackground. Imaging protocol. Basic anatomy: middle and inner ear. Features of external and middle ear cholesteatomas. The role of CT and MRI in the diagnosis of cholesteatoma. Extra auricular cholesteatoma. Complications of cholesteatoma. Assessment of recurrence and postoperative findings through CT and MRI. Take home messages.

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## Abstract Archives of the RSNA, 2023

HNEE-96

### What a Pain in the... Imaging Findings of the Painful Ear

#### Participants

Bruna Gherardi, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching points To detect the imaging features of the painful ear. To identify the main CT features of incipient and coalescent acute mastoiditis as a basis for recommending conservative or surgical management. To detect intracranial complications of acute inflammatory diseases.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/OutlineBackground. Basic anatomy of the external, middle and inner ear. HRCT and MRI imaging protocol. The role of CT and MRI in the diagnosis of mastoiditis. Necrotizing external otitis.Local complications: Myringosclerosis / tympanosclerosis, Ossicular fixation and erosion, Labyrinthine fistula, Labyrinthitis, Periosteal / Bezold's abscess.Extensive complications: Dural sinus thrombosis, Meningitis, Subdural effusion, Brain abscess, Petrous apicitis.

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## Abstract Archives of the RSNA, 2023

HNEE-97

### Nose Job: A Work in Progress... Aesthetic Procedures of the Nose - Pre and Postoperative

#### TEACHING POINTS

1. Review the structural anatomy of the nasal region  
2. Detail the nasal functional anatomy for a successful rhinoplasty surgery.  
3. Guide the radiologist to detail anatomical changes relevant to the surgical procedure  
4. To evaluate the computed tomography (CT) imaging as a tool for developing approaches or strategies for leading aesthetic nasal surgical procedures.  
5. To evaluate the postoperative CT images as a tool for evaluating changes, sequels and complications after the aesthetic surgical procedure.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
a. Nasal anatomy  
b. Nasal functional anatomy  
c. Nasal deformities  
d. Clinical application of CT to aesthetic procedures of the nose  
2. Preoperative CT image  
a. What should be evaluated: bony pyramid, cartilaginous pyramid, nasal valves, nasal deformities  
3. Postoperative CT image  
a. Surgical techniques and imaging findings: rhinoplasty, septoplasty, rhinectomy, maxillary antrostomy and uncinectomy, nasal turbinate surgery, ethmoidectomy, nasal prosthesis  
b. Complications  
c. Sequels  
4. Take-home messages

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## Abstract Archives of the RSNA, 2023

HNEE-98

### Precision Imaging of Diplopia: MRI Protocol and Various Diseases

#### TEACHING POINTS

Diplopia is a relatively common neuro-ophthalmological symptom and has a variety of causes. Here, a high-resolution MRI protocol specialized for diplopia is introduced, and various imaging findings related to diplopia are presented.

#### TABLE OF CONTENTS/OUTLINE

Diplopia MRI should be designed to include the entire pathway of cranial nerve(CN) III, IV, and VI, and the orbit. In general, 3D heavily T2-weighted images or 3D proton-density weighted images are often used for evaluation of the cisternal segment of CNs. However, the cisternal segment of CN4 is so small that high resolution 3D true fast imaging with steady-state free precession (Trufi) is required: a slice thickness of 0.3mm, and a scan range acquired above and below of the junction of inferior colliculus and superior medullary velum in the brainstem (figure 1). For the cavernous segment of CNs, contrast-enhanced 3D T1 Volumetric interpolated breath-hold examination (VIBE) image with fat-suppression allow us to identify normal CNs located therein (figure 2). The anatomical classification of etiologies associated with diplopia can be divided into brainstem lesions (figure 3), cistern (figure 4), cavernous (figure 5), and orbital regions. Causes that can cause diplopia include congenital diseases, vascular lesion, tumor, inflammation, infection, and trauma, etc.

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## Abstract Archives of the RSNA, 2023

INEE

### Imaging Informatics Education Exhibits

#### Sub-Events

#### **INEE-1      What Will Happen to AI Technology in Radiology? Systematic Review of Natural Language Processing for Radiological Image Processing**

##### TEACHING POINTS

In recent years, the application of artificial intelligence (AI) technology in the medical field has been advancing rapidly. In radiology, AI technology is expected to improve the accuracy of physician diagnosis through image analysis and automated diagnosis. Specifically, these include automated diagnostic technologies using deep learning and the prediction of patient health status. Many of the technologies that use AI include systems that use Natural Language Processing (NLP). Improvements in NLP models have made it possible to handle not only text data but also image data, and many applications in the medical field have been reported. The purpose of this exhibit is to show the application of NLP model in radiology and our work applying the Vision Transformer to atrial fibrillation types classification. The major teaching points of this exhibit are 1.AI technology in radiology is expected to improve the accuracy of physician diagnosis through image analysis and automated diagnosis. 2.NLP enables the processing and extraction of large amounts of natural language generated in the medical field. 3.How can NLP be used for medical imaging?

##### TABLE OF CONTENTS/OUTLINE

1. AI Technology in Radiology 2. What is NLP? -Familiar Applications of NLP Models -Typical models used for NLP -Examples of Image Applications of NLP Models 3. Introduction to this study -Atrial Fibrillation Types Classification Using the Vision Transformer

#### **INEE-10      Establishing a Radiology Research Laboratory, from A-Z**

Participants

Hussain Al Yousif, MD, Hershey, PA (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Quantitative image analysis for clinical trials is poorly managed using standard clinical workflows. Radiology Research laboratories standardize the workflows for trials that use imaging endpoints. Radiology Research laboratories can provide more value to support institutional research objectives beyond image interpretation and should be set up to serve as central point of contact for all clinical researchers and medical imaging.

##### TABLE OF CONTENTS/OUTLINE

Defining the problem - addressing the needValue of radiologists and medical imaging personnel at the various stages of clinical research:• Research protocol development• Feasibility assessments• Access to radiologists and technical resourcesPartnering for success - working with your customers and end users to know what service are needed:• Image review with quality quantitative image assessment• Image transfer• Protocol review• Feasibility assessments• Trial budget developmentTake advantage of existing institutional core lab infrastructure:• List of provided services accessible via website.• Billing for services• OperationsIdentify the key components and personnel required for functioning of the lab:• Hardware and software• PersonnelDeveloping a budget and list of provided services.Research lab operational workflow in context of clinical operationsAnnual reviews, with budget and performance adjustments.

#### **INEE-11      Lung Cancer Screening and AI: Challenges and Opportunities**

Participants

Leonardo Rosolen Iunes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To discuss the potential role of artificial intelligence (AI) in lung cancer screening (LCS), highlighting: - AI applications in LCS: machine learning versus deep learning strategies - AI limitations in LCS: data collection, reproducibility, generalizability, validation - Responsible AI: fairness, accountability, and transparency - Addressing gender and racial bias in LCS programs - Future perspectives: combining the strengths of radiologists and AI for best LCS practices

##### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Ongoing challenges in implementation of LCS b. AI in healthcare: basic concepts 2. AI and lung cancer: an overview a. Screening b. Radiomics and Radiogenomics c. Decision making and prognosis prediction 3. AI in LCS: potential applications a. Early detection b. Nodule classification c. Radiography versus Computed tomography d. Retrospective versus Prospective Studies 4. Limitations and Challenges: AI in the real world a. Bias in underserved and underrepresented populations 5. Responsible AI: transparency and regulation 6. Future perspectives 7. Take home messages

#### **INEE-12      AI-Driven Tools and Techniques in Radiology Education: Empowering the Next Generation of Radiologists**

Participants

Matteo Mancino, MD, Roma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The integration of AI into radiology education is crucial, as state-of-art AI applications such as deep learning and machine learning are transforming decision making and patient care. Radiology trainees must be well-versed in AI technologies to effectively leverage their potential in delivering value-based clinical practice. The aim of this poster is to provide an overview of AI's role in radiology trainee education, addressing challenges, state-of-art resources and future directions.

#### TABLE OF CONTENTS/OUTLINE

1. Curriculum development Building an AI curriculum including ethics, data quality, privacy, and AI's impact on clinical workflows. 2. Interdisciplinary learning: Encouraging trainees to collaborate with other medical specialties to understand AI's broader implications in healthcare. 3. Collaboration Encouraging cooperation between radiology departments, AI experts, and industry partners to develop tailored educational content and resources. 4. Assessments: Leveraging AI for performance assessment in radiology board examinations and multidisciplinary meetings to enhance clinical decision-making skills. 5. AI-augmented education Using AI to provide learning experiences, such as personalized case selection. 6. Barriers and challenges: Addressing barriers to AI education, and developing strategies to overcome these challenges. 7. Future directions: Exploring innovative ways to integrate AI into radiology education, such as AI-driven simulations, virtual reality, and gamification.

#### INEE-13 **Generative AI Predicts the Survival of Patients with Progressive Fibrosing Interstitial Lung Disease**

Participants

Masaki Okamoto, Boston, MA (*Presenter*) Stockholder, TOKYO analytica

#### TEACHING POINTS

Progressive fibrosing interstitial lung disease (PF-ILD) is a group of diseases characterized by increasing self-sustaining fibrosis, progressive decline in lung function, and high mortality. Due to the highly variable rates of decline and poor prognosis of PF-ILD, accurate, individualized mortality prediction is crucial for therapeutic decision-making and management of the patients. However, PF-ILD does not have any formal prognosis-based staging system, and none of the developed existing prognostic biomarkers have been considered accurate enough for establishing such a system. The teaching points of this exhibit are to (1) review currently available clinical prognostic biomarkers for PF-ILD, (2) review an emerging generative AI-based biomarker for imaging-based prediction of survival in PF-ILD, and (3) review the comparative performance between the clinical and generative-AI-based prognostic biomarkers in the prediction of the survival in PF-ILD.

#### TABLE OF CONTENTS/OUTLINE

(1) Unmet need for accurate prognostic biomarkers for PF-ILD. (2) Clinically established prognostic biomarkers for PF-ILD (gender, age, and physiology (GAP) index; composite physiologic index (CPI); visual high-resolution CT pattern). (3) Radiomic biomarkers (traditional radiomics; hyper-curvature features) for survival analysis. (4) Emerging generative AI-based imaging biomarker (gen2surv). (5) Comparative performance of biomarkers in terms of survival prediction and Kaplan-Meier survival curves. (6) Clinical case studies.

#### INEE-14 **AI as a Medical Device: Demystifying FDA Regulation for AI Tools in Clinical Radiology Practice**

Participants

Anjali Patel, Ocala, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the FDA's role in regulating AI radiology tools categorized as software as a medical device. Gain a fundamental understanding of FDA regulations, crucial for algorithm developers and end users to ensure appropriate and optimal use. Distinguish between FDA clearance and different classifications for radiological software as a medical device. Appreciate the importance of various classifications concerning algorithm development, validation rigor, and intended use. Assess the real-world implications of device classifications on the adoption of AI tools in clinical radiology practice. Explore ongoing debates and potential future developments in FDA regulation of AI radiology tools.

#### TABLE OF CONTENTS/OUTLINE

Introduction Overview of FDA classifications for AI medical software Class I devices Class II devices Class III devices Discerning intended use and its influence on device classification Motivations behind seeking lower category classifications and potential pitfalls in clinical practice Different category FDA classifications and impact on AI tool adoption and usability in clinical practice Controversial aspects and future optimization of FDA regulation in AI radiology tools Conclusions

#### INEE-15 **Streamlining Emergency and General Radiology Reporting Through Customized Macros for Incidental Findings: A Primer and Online Repository**

Participants

Jeffers Nguyen, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Modern radiologic practice demands higher volume study interpretation, which may be facilitated by improvements in dictation workflow. There is a large variety of incidental findings that may be made during the course of general, multi-modality, or emergency radiologic practice whose accepted follow-up recommendations may be difficult to recall for general radiologists, or those practicing outside of a subspecialty area. Furthermore, existing solutions to streamline the reporting of incidental findings are cumbersome and require too many clicks or keystrokes to rapidly implement. We present customized, pick list type macros that allow easy selection of up-to-date recommendations for the most common incidental findings that may be encountered in routine practice. We demonstrate how these may be used and provide an online repository from which they may be downloaded and imported for personal use.

#### TABLE OF CONTENTS/OUTLINE

1) A brief review of incidental findings; 2) How to create, export, and import pick list macros (PowerScribe); 3) How to use pick list macros (video demonstration); 4) Demonstrating the value of pick list macros for incidentally detected lesions, including adnexal

masses, pituitary lesions, pulmonary nodules, liver lesions, pancreatic cystic lesions, renal masses, and more;5) URL for online repository of macro resources

## **INEE-16 The OpenAI Ecosystem and Potential Applications in Radiology**

Participants

Reza Sirous, MD, MPH, Washington DC, DC (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Explaining Large Language models (LLM) and Large multimodal models (LMM) 2) Explaining about OpenAI ecosystem and its extensive list of AI-powered tools 3) Explaining potential applications of OpenAI tools in Radiology 4) Explaining other LLMs competing with OpenAI tools and their potential applications in Radiology

### **TABLE OF CONTENTS/OUTLINE**

1) LLM vs. LMM: a) Background, evolution, examples, and comparison of LLM vs. LMM b) Discussing and comparing major LLM platforms (including ChatGPT, LaMDA, MT-NLG, BLOOM, Galactica, PaLM, LLaMA, etc.) 2) OpenAI ecosystem: Introducing the below tools, their general applications, strengths, weaknesses, opportunities, and threats: a) ChatGPT b) Playground c) Plugins d) Application Programming Interface (API) e) Whisper f) Dall.E g) Codex h) ImageGPT i) CLIP j) Alignment k) Microscope l) Gym m) Baselines 3) Discussing potential applications of each OpenAI tool in Radiology, strengths, weaknesses, opportunities, and threats: a) Clinical Applications (for radiologists, referring physicians, patients, etc.) b) Research Publications (for journals/reviewers, authors, etc.) c) Education Admission Process (for radiology trainees, faculty, etc.) d) Public Health Health Policy (for policy makers, screening campaigns, etc.) 4) Introducing alternatives to the OpenAI tools, pros, and cons: a) Chatbots (alternatives to ChatGPT), including Google Bard, Baidu ERNIE Bot, etc. b) Text-to-Image convertors (alternatives to DALL.E) including Midjourney, Stable Diffusion, Google Parti c) Speech-to-text convertors (alternatives to Whisper) including Kaldi, Nuance, Microsoft Azure Speech, Google Cloud Speech-to-text, Amazon Transcribe, Deepgram 5) Conclusion

## **INEE-17 Improving Workstation Ergonomics and Productivity with Input Devices: Saving Time and Your Wrists**

Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Discuss the biomechanics and ergonomic factors affecting radiology input devices.- Review common repetitive stress injuries experienced by radiologists caused by input device use.- Systematic product review with pros and cons of popular computer mice, dictation devices and non-traditional input devices (named below) in terms of ergonomics, effectiveness and programmability.- Tutorial on how to customize commonly available input devices with recommended profiles.

### **TABLE OF CONTENTS/OUTLINE**

Radiologist's productivity and wellness are influenced by tools used to interact with clinical images. Software and hardware can augment efficiency but also have the potential to lead to burnout via poor ergonomics. We review the relevant biomechanics and anatomy involved in using computer mice and dictaphones with review of primary literature and of common repetitive stress injuries experienced by radiologists. We offer alternatives to commonly used input devices (mouse, keyboard, handheld dictaphone) used to review clinical images. We share the factors important in choosing a device (e.g. on-board memory) and the results of a systematic review of devices that could augment radiologists' productivity and improve ergonomics including: A) Pointing Devices:- Gaming mice- Ergonomic mice- Trackballs/Trackpads B) Dictation Devices:- Traditional Nuance PowerMic-style- Wearable headsets- Table-top microphones (e.g. podcasting microphone) C) Non-traditional input devices for example:- Elgato stream deck- Contour ShuttlePro- Contour Roller Mouse Finally, we provide tested templates for the above programmable devices to get a new user started with improving their ergonomics and efficiency in the reading room.

## **INEE-18 Transforming Radiology with Large Language Models: Opportunities and Challenges**

### **TEACHING POINTS**

Personalizing Imaging Examinations LLMs can guide patients through imaging procedures based on medical history, including preparation and potential risks. Improving Clinical Documentation LLMs can flag discrepancies and provide decision support, improving accuracy and reducing errors in medical records. Streamlining Insurance Prior Authorization LLMs can assist clinicians in submitting complete prior authorization requests and automating insurance review, reducing manual review time. Increasing Patient Engagement LLMs can convert complex medical information into easily understandable language and provide personalized education, increasing patient engagement. Decreasing Barriers to Access to Healthcare: LLMs can facilitate remote consultations, appointment scheduling, and educational resources, overcoming barriers to healthcare access. Security and Privacy Considerations The use of LLMs in healthcare raises privacy and cybersecurity concerns that must be addressed to protect patient data and comply with laws and regulations.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to Large Language Models (LLMs) 2. The Current State of LLMs 3. Compliance and Security 4. Aid in Patient Care 4.1. Personalizing Information for Imaging Examinations 4.2. Decreasing Barriers to Access to Healthcare 4.3. Personalizing Imaging Examinations Resources 4.3. Increasing Patient Engagement 5. Aid in Radiology Workflow 5.1. Automating Routine Tasks (such as appointment scheduling and reminder notifications) 5.2. Facilitating Insurance Prior Authorization 5.3. Improving Clinical Documentation 5.4. Easier EMR Transfer from Different Facility 6. Future Directions 7. Conclusions

## **INEE-19 Unlocking a New Era in Radiology: Leveraging GPT for Accurate Diagnosis of Diseases**

Participants

Matheus Fritzen, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Understanding the role of ChatGPT in radiologic diagnosis through real-world cases; Evaluating the impact of ChatGPT on hypothesis formulation and diagnostic accuracy; Analyzing ChatGPT's role in providing diagnostic tips and guidance; Assessing the potential of

ChatGPT for improved clinical decision-making

## TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:  
I. Introduction to ChatGPT in Radiologic Diagnosis  
A. Overview of ChatGPT's capabilities  
B. The potential for AI-assisted diagnosis  
II. Case Studies: ChatGPT in Diagnostic Process  
A. Real-world examples of ChatGPT-enhanced diagnoses  
B. Hypothesis formulation and diagnostic accuracy improvements  
III. ChatGPT's Role in Providing Diagnostic Tips and Guidance  
A. Case examples illustrating diagnostic assistance  
B. The impact of ChatGPT on radiologists' decision-making process  
IV. Assessing ChatGPT's Potential for Clinical Decision Support  
A. Evaluation of case study outcomes  
B. Implications for radiology practice  
V. Conclusion  
A. The real-world impact of ChatGPT on radiologic diagnosis  
B. Future advancements and integration in radiology practice  
This abstract presents a series of case studies that demonstrate the practical applications of ChatGPT in radiologic diagnosis, hypothesis formulation, and clinical decision support. The guide provides an in-depth analysis of how ChatGPT can be utilized to enhance diagnostic accuracy, offer diagnostic tips and guidance, and improve clinical decision-making in real-world scenarios. By showcasing the tangible benefits of ChatGPT through these case studies, the presentation aims to highlight the potential of AI-assisted diagnosis in revolutionizing radiology practice.

## INEE-2 Anatomy of an Ontology

### TEACHING POINTS

1. Understand the distinction between a taxonomy and an ontology.  
2. Comprehend the need for ontologies in medical reporting and electronic records to support interoperability.  
3. Survey the strengths and weaknesses of existing medical ontologies applicable to radiology reporting.  
4. Learn about an effort to create an ontology that has evolved from the concept of the now antiquated American College of Radiology's Index of Radiological Diagnoses.

### TABLE OF CONTENTS/OUTLINE

1. Define what is a taxonomy and what is an ontology. 1a. Illustrate the concepts of CUI, AUI, TUI, and SUI.  
2. Demonstrate why an ontology is important for use in radiology reporting. 2a. Illustrate how an ontology is essential for natural language processing and the creation of mineable, structured data.  
3. Provide an overview of the major medical ontologies applicable to radiology reporting, including SNOMED, RadLex, ICD-10, FMA, MedDRA, and others. 3a. Show where there are deficiencies in the major ontologies, including knowledge gaps pertinent to diagnostic radiology reporting.  
4. Review the original concept of the American College of Radiology's Index of Radiological Diagnoses and how it was used to create teaching files before the existence of desktop computers.  
5. Illustrate how a new ontology is being constructed inspired by the Index of Radiological Diagnoses but in a more pragmatic fashion to accommodate interactive multimedia reporting. 5a. Show cross-mappings between this new ontology and existing ontologies. 5b. Demonstrate the importance of incorporating synoptic phrase for use in radiology reporting.

## INEE-20 Using a Workflow Engine to Improve Data Retrieval and Curation in Multi-modal Research Studies

Participants

Ali Ganjizadeh, MD, Rochester, MN (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Introduction to workflow concepts and their importance in research studies  
2. Overview of the technologies used in the retrieval system: MongoDB, FastAPI, Camunda and NextJS  
3. Understanding the retrieval system architecture  
3a. A modular data retrieval browser-based program to collect multiple data types from multiple data sources  
3b. Setting up a browser-based user interface to create and execute tasks for each subject to retrieve its data from servers  
4. Handling errors and failures in retrieving data using the workflow engine  
5. Additional steps in the workflow system, such as de-identification and data storage  
6. Conclusion and impact of the workflow system on research studies

### TABLE OF CONTENTS/OUTLINE

1. Introduction  
1a. Overview of workflow systems  
1b. Importance of workflow-based systems in research studies  
2. Technologies Used  
2a. MongoDB  
2b. FastAPI  
2c. NextJS  
2d. Tailwind CSS  
2e. Camunda  
3. Workflow System Architecture  
3a. Overview of the system architecture  
3b. Explanation of the workflow engine  
4. Modular Data Retrieval Program  
4a. Setting up the program to collect multiple data types from multiple sources  
4b. Creating tasks for each subject to retrieve data  
5. Browser-Based User Interface  
5a. Designing a user interface to execute tasks for data retrieval  
5b. Graphical user interface for selecting patients to include in the study  
6. Handling Errors and Failures  
6a. How the workflow engine handles errors and failures in data retrieval  
7. Conclusion and Impact  
7a. Significance of the workflow system in research studies  
7b. Lessons learned from the development and implementation of the system

## INEE-21 Use of Chat GPT in Radiology Research

Participants

Andrew Benza, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

Andrew Benza, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Highlight unique and generalizable prompts to leverage large language models in research.  
- Discuss the art of prompt engineering and key phrases to improve outputs.  
- Demonstrate the variety of functionalities of ChatGPT and Bing AI Search and how it pertains to research.  
- Discuss the future of research with AI as a supplemental tool.

### TABLE OF CONTENTS/OUTLINE

1. History of AI.  
2. New AI systems and their functionalities.  
3. Prompt engineering and key phrases to leverage ChatGPT.  
4. Illustrate how ChatGPT can be used throughout the entire research process for example during the following stages:  
a. Formulate the idea  
b. Write an IRB proposal  
c. Design a research study  
d. Analyze data  
e. Interpret results  
f. Prepare publication  
5. The future of AI and what it means for research/education.

## INEE-22 Beyond Writing and Reporting: Opportunities and Challenges of GPT-based Models in Radiology

Participants

Jose Maluf, MD, (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To learn definitions and basic concepts of generative AI, natural language processing (NLP) and large language models (LLM) applied to healthcare; - To understand the potential impact of generative pre-trained transformer (GPT)-based models in the radiology practice; - To be familiar with some potential applications of GPT-based models in radiology, including image manipulation, report generation, educational support, clinical decision support, and data analysis; - To emphasize the challenges and limitations before implementation of these models in clinical practice, with focus on ethical and regulatory issues.

#### TABLE OF CONTENTS/OUTLINE

Introduction: AI in healthcare Generative AI, NLP and LLM: Definitions and Basic Concepts Applications in Radiology Image manipulation and improving Medical writing and reporting Clinical decision support Health insurance and advocacy issues Education Other emerging applications Limitations and Challenges Hallucinations and other common mistakes Privacy, security and other risks on clinical implementation Ethical issues: Transparency, bias and discrimination Regulation Future perspectives: what is next? Take home messages

#### INEE-23 Artificial Intelligence: Missed steps and a double edge sword

Participants

Anisa Chowdhary, MD, Milford, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Radiologists should be vigilant and careful as AI can certainly make incorrect diagnosis or miss the diagnosis in certain case scenarios.
- Radiologists should use AI as a secondary adjunct. AI can underperform in specific subset of patients where a radiologist approach is crucial to avoid any diagnostic error.
- AI will continue to serve as a secondary adjunct rather than an alternative to a radiologist.
- AI can certainly help improve work flow and patient care by looking at flagged cases to do a quick triage of which cases to dictate first.

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- Overview
- Missed diagnosis and missed cases by Artificial intelligence
- Teaching points

#### INEE-24 How Federated Learning Improves Pancreatic Segmentation Using Three Distributed Training

Participants

Chen Shen, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn Federated Learning, a method for learning from several remote datasets without centralized processing.
2. To learn a new robust aggregation method for Federated Learning
3. To learn the effectiveness of using Federated Learning for pancreatic segmentation.

#### TABLE OF CONTENTS/OUTLINE

Why Federated Learning is useful in healthcare applications?- Distinct from natural images, collecting data from various resources may lead to multiple technical, legal, and privacy issues.- Can produce a model with features from several dispersed sources without requiring the training data to be centralized.Demonstrate the pancreatic segmentation process using Federated Learning.- How does Federated Learning work?- How does the server use FedAvg, a standard aggregation method, to aggregate models from multiple clients?- Introduce a dynamic weight aggregation method to aggregate the model updates properly.A comparison of the pancreatic segmentation performance.- Introduce the datasets and the segmentation models.- Compares the performance of Federated Learning over standalone training on three pancreas datasets.- Compares the effectiveness of dynamic weight aggregation with the original FedAvg algorithm.

1. Qualitative evaluation results.
2. Quantitative segmentation accuracy to show the Federated Learning and our proposed aggregation method improve the segmentation performance on pancreas.

#### INEE-25 Achieving Trustworthy Artificial Intelligence in Clinical Applications: A Comprehensive Review of Key Concepts and Solutions in Medical Imaging

Participants

Pouria Rouzrokh, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In this exhibit, radiologists will learn to:1) Understand why predictive power doesn't ensure AI models' clinical trustworthiness; 2) name and describe methods to explain AI models, quantify their uncertainty, and detect outlier data for their predictions; 3) analyze the clinical trustworthiness of AI models introduced in scientific studies or commercial products.

#### TABLE OF CONTENTS/OUTLINE

Problem Statement: Is predictive power (e.g., accuracy) all we need?; A review of scenarios where AI fails in clinical deployment.The Triangle of Trustworthiness: Model explainability; Uncertainty quantification; Out-of-distribution detection.Model Explainability: Can we explain the black box of AI models?; A review of interpretation maps (e.g., saliency maps, occlusion sensitivity, integrated maps, etc.) and their use cases; A review of SHAP values and their use cases; Limitations of model explainability.Uncertainty Quantification (UQ): What is vs. what is not model uncertainty?; Where do we expect AI to be uncertain?; UQ methods (Bayesian methods, evidential deep learning methods, posthoc calibration methods); Pros and cons of UQ Methods.Outlier Detection: Out-of-distribution vs. out-of-domain data: what's the difference?; How can outlier data harm your model?; Potential sources of outlier data (covariate drift, dataset drift, concept drift); a review of outlier detection methods (threshold-based, classifier-based, generative AI-based, distance-based, Nearest-neighbor-based); Pros and cons of outlier detection methods.How to shift gears toward trustworthy AI in radiology? Recommendations for AI developers, scientific journals/reviewers, and end-user organizations/radiologists.

#### INEE-26 From Pixels to Diagnosis: Unleashing the Power of Generative AI in Radiology

Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand basic concepts of image-based neural networks in radiology. Understand how generative AI models architecture and how they are built and trained on radiological images. Most notable applications of Generative AI in radiology. Impact of Generative AI on radiology practice.

#### TABLE OF CONTENTS/OUTLINE

1- Understand basic concepts of deep learning and image-based neural networks. a) What is deep learning? b) How neural networks train and Backpropagation c) The significance of convolutional neural networks d) Dissection of a basic convolutional neural network architecture  
2- Understand how generative AI models architecture and how they are built and trained on radiological images. a) generator models architectures b) How are generative models trained to create radiology images? c) Emphasis on CycleGan models d) What are diffusion models and their potential in imaging?  
3- Provide examples of current and possible applications of generative AI in abdominal radiology a) Synthesizing CT images from MRI b) Image segmentation c) Image reconstruction from image space  
4- Impact of Generative AI on radiology practice with different applications of generative models in abdominal imaging ( image synthesis from noise, CT synthesis from MRI, image reconstruction, segmentation)

#### INEE-27 3D Printing in Pectus Excavatum Surgical Planning

Participants

Mikel Garcia, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Pectus excavatum is the most common deformity of the chest wall, characterized by a concave depression of the sternum. - While diagnosis can often be made without imaging, chest radiographs and CT scans can be useful in cases where the diagnosis is uncertain or to assess the severity of the deformity. Haller's index is commonly used in this evaluation. - The Nuss procedure is a minimally invasive technique used to treat pectus excavatum. It involves inserting a metal bar behind the sternum to correct the deformity, with the bar typically being shaped during the operation based on the patient's chest. - By utilizing 3D printing of the patient's chest CT, the bar can be shaped prior to the surgery, which can help decrease the duration of the operation.

#### TABLE OF CONTENTS/OUTLINE

- Imaging of pectus excavatum- Nuss procedure- 3D reconstruction and segmentation- 3D printing- Presurgical planning using a 3D printed model

#### INEE-28 Promoting Equitable AI in Radiology: Harnessing Open Source Tools for Bias and Fairness Estimation

Participants

Vasanth Venugopal, MD, New Delhi, India (*Presenter*) Officer, CARPL.AI Inc

#### TEACHING POINTS

1. Identifying and addressing biases in AI radiology applications is crucial for promoting equitable healthcare and accurate patient outcomes.  
2. Open-source tools such as AI Fairness 360, Fairlearn, What-If Tool, and Scikit offer tailored techniques for bias estimation and fairness assessment in radiology.  
3. Implementing bias mitigation strategies in AI radiology applications can help reduce disparities in diagnoses and treatment recommendations  
4. Collaborative efforts within the radiology and AI research community are essential for developing robust, up-to-date tools and methodologies  
5. Integrating multiple tools enables comprehensive evaluations across diverse radiological scenarios and patient demographics.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction - Importance of assessing bias and fairness in AI radiology applications  
A. Equitable patient outcomes  
B. Open source tools for evaluation  
II. Variety of Open Source Tools  
A. Comprehensive fairness evaluation  
B. Identification of potential biases  
III. Available Packages for Bias Estimation  
Scikit-fairness/scikit-lego  
IBM Fairness 360  
Aequitas  
Google What-if tool  
PyMetrics audit-ai  
Microsoft Fairlearn  
IV. Comparison and integration of tools  
V. Assessing Fairness Across Multiple Dimensions  
A. Demographic attributes  
B. Clinical attributes  
C. Mitigating disparities in AI radiology systems  
V. Collaboration and Regular Updates  
A. Engaging with the research community  
B. Addressing evolving fairness challenges  
C. Ensuring up-to-date tools and methodologies  
VI. Conclusion - The critical role of open source tools for bias and fairness estimation in radiology AI

#### INEE-29 Effective Program Management for an Artificial Intelligence Team: Optimizing Performance and Productivity

#### TEACHING POINTS

1. Provide insight on how to effectively build, recruit and manage multidisciplinary teams whose collective goal is to deliver AI solutions to the radiology practice.  
2. Share lessons learned from the challenges encountered when trying to optimize an AI program management structure.

#### TABLE OF CONTENTS/OUTLINE

1. Purpose  
a. Provide requirements for creating an effective program management structure that optimizes team performance and productivity.  
2. Building a Radiology AI Team  
a. Master FTE Plan  
b. Job Descriptions  
c. Roles and Responsibilities  
d. Org Chart  
e. Governance  
f. Recruitment  
g. Training Education  
3. Program/Project Management  
a. Organization  
b. Methodology  
i. Hybrid  
c. Electronic Tools  
i. Monday.com  
ii. Azure Dev Ops  
iii. Microsoft Teams  
iv. OneNote  
v. SharePoint  
d. Quality Management System (QMS)  
Compliance  
e. Meeting Structure  
f. Communication  
4. Lessons Learned  
a. Challenges  
b. Successes  
5. Conclusion  
a. Building and managing a multidisciplinary team of individuals whose goal is to deliver AI solutions to the radiology practice in a safe and efficient manner requires careful consideration to the overall program management structure and associated tool sets.  
PDF Upload  
\*See attached ppt

#### INEE-3 Generative AI (Gen AI) Based Electronic Cleansing: Unlocking the Potential of Photon-counting CT Colonography

Participants

Rie Tachibana, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Electronic cleansing (EC) plays a crucial role in enhancing the sensitivity of polyp detection during virtual endoscopic fly-through reading in CT colonography (CTC) by subtracting orally tagged residual materials from the images. This exhibit aims to (1) provide insights into recent advances in generative AI (GenAI) based EC for CTC; (2) explore the benefits and potential applications of photon-counting CTC; and (3) present clinical outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Review the history and recent developments in GenAI-based EC for CTC, including the emergence of photon-counting CT technology. 2. How GenAI-based EC works: (2.1) Explain the basic ideas of GenAI; (2.2) Discuss how self-supervised GenAI-based EC differs from traditional EC; (2.3) Explain diffusion-based EC. 3. Photon-counting CT colonography: (3.1) Provide overview of photon-counting CT; (3.2) Discuss advantages and potential applications in CTC; (3.3) Explain Gen AI-based EC for photon-counting CTC. 4. Case studies: (4.1) Compare the image quality and outcomes of various GenAI-based EC techniques in clinical conventional and photon-counting CTC cases; (4.2) Review potential diagnostic challenges.

#### INEE-30 Take the Right Path: Overview of Artificial Intelligence Guidelines

Participants

Carlos Felipe Reyna, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Present the different kinds of guidelines. Describe guidelines for development, application and implementation, and the evaluation of Artificial Intelligence (AI), created to direct and conduct research in a standardized way, avoiding process errors. To evaluate which of these guidelines is more useful for a specific interest.

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Describe and compare such guides in terms of: purpose and format. Which contexts they fit using flowcharts and schematic images.

#### INEE-31 Federated Learning - Game Changing AI Concept to Train AI without Sending Patient Data Out from Hospitals

#### TEACHING POINTS

(1) To understand the concept of federated learning to address data security and privacy concerns. (2) To learn the application and advantages of federated learning for liver tumor segmentation in hepatic CT. (3) To study the process of the development and performance of federated learning with a patch-wise massive-training artificial neural network (MTANN) model for liver tumor segmentation.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction to Federated Learning - Challenges in acquiring extensive training datasets for a deep learning model from multiple hospitals - Role of federated learning in collaborative learning without sharing data - Issues of federated learning: 1) small local training data, 2) high computational demands, and 3) heavy network loads B. Federated Learning for Tumor Segmentation in Medical Imaging - Overview of federated learning models and their applications to tumor segmentation in medical imaging - Federated learning coupled with MTANN models for addressing the above three issues of the current federated learning C. Clinical Relevance and Performance of Federated Learning for Tumor Segmentation - Ensuring data privacy while achieving accurate tumor segmentation - Performance of federated learning for tumor segmentation - Comparisons with the current-state-of-the-art model and "gold-standard" centralized training model

#### INEE-32 Use of Generative AI for Non-interpretative Tasks in Radiology

Participants

Vinit Balyan, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To provide an overview of the current state-of-the-art in generative artificial intelligence (AI) and its applications for non-interpretative tasks in radiology. 2. To showcase examples of how generative AI is being used in radiology today. 3. To highlight the challenges associated with using generative AI in radiology. 4. To touch upon the potential future developments in the field of generative AI and their potential impact on radiology.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Generative AI Key concepts and applications 2. Specific ways in which generative AI can be used in non-interpretative tasks in radiology, including: a. Reporting; checking grammar and syntax, generating summary, making reports more readable for non-specialists/patients b. Communication of important findings c. Managing work scheduled. Writing emails 3. Real-world examples of how generative AI has been used to enhance the accuracy and speed of radiological diagnoses 4. Challenges associated with using generative AI in radiology, including Data privacy and security concerns, Ethical considerations, The need for human oversight 5. Potential future developments in the field of generative AI and their potential impact on radiology Conclusion: Overall, the exhibit aims to educate and inform visitors about the latest advances in generative AI and its potential applications in radiology. By providing real-world examples and highlighting the challenges associated with using generative AI in radiology, the exhibit offers an opportunity for visitors to learn about cutting-edge technology that could help improve the efficiency of radiologists, ultimately benefiting patients and medical professionals alike.

#### INEE-33 R Programming Language Basics for Radiologists

#### TEACHING POINTS

1. Learn how to install R 2. Know how to import and process data 3. Run common statistical tests 4. Explore and understand large datasets better

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The R programming language serves as an invaluable resource for managing and analyzing large datasets effectively and efficiently.



As a free and open-source software, R presents a cost-effective solution for performing common statistical tests, crafting visualizations, and even implementing machine learning algorithms. Exhibit Outline: Software installation: -Installing the R programming language-Setting up an Integrated Development Environment (IDE) -Installing essential packagesData import and processing: -File handling and manipulation-Data cleaning and preprocessing -Data transformation and aggregationCommon statistical tests in radiology: Sample code and examples for:- Descriptive statistics -T-test -Analysis of Variance (ANOVA) - Pearson's correlation coefficient -Spearman's rank correlation coefficient -Chi-square test -Logistic regression and more.Large dataset analysis:-Data visualization techniques- Exploratory data analysis (EDA)-Machine learning and predictive modeling-Text mining and natural language processing (NLP)

### **INEE-34 Leveraging Medical Image Annotation with Practical Annotation Quality Check Tools**

Participants

Henrique Lee, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Prepare the data for an artificial intelligence (AI) models often involves intensive annotation work to ensure accurate ground truth. However, radiologists who participate in AI projects may lack practical training in annotation, leading to doubts that increase the variability of annotations. To address this, we developed an automated tool that evaluates bounding box and segmentation annotations and provides feedback to the annotator. The tool uses .json files for bounding box annotations and NifTY files for segmentation annotations, both exported from 3D Slicer. Python scripts compare the locations and categories of findings in the bounding box annotations, as well as the distance and similarity of binary masks in the segmentation annotations with those generated by experts. Results are presented in an HTML report. In a pilot study, we used 5 chest radiographs and 2 head CT scans from publicly available datasets (Montgomery and CQ-500) previously annotated by experts. The availability of reports in an introductory AI course for medical radiologists allowed instructors to monitor participants' progress and identify areas for further emphasis.

#### **TABLE OF CONTENTS/OUTLINE**

Our workflow resulted improved the overall quality of instruction, enhancing the professionalism of the annotations. Annotation tools can increase student engagement and productivity, with teacher supervision facilitating consensus-building and optimizing the laborious task of annotation. Our solution can be applied to various 2D and 3D images studied by radiologists. User-friendly applications that facilitate the teaching of high-quality image annotation are crucial for fostering the development and validation of novel AI models.

### **INEE-35 Automatic Detection of Contrast Enhancement in T1-weighted Brain MRI Images Using Artificial Intelligence**

#### **TEACHING POINTS**

The purposes of this exhibit are: . Development and validation of a tool for post-contrast enhancement detection in T1-weighted MRI images. . Implementation of this tool in the clinical routine of the radiology and diagnostic imaging service of Clinical Hospital of Ribeirao Preto.

#### **TABLE OF CONTENTS/OUTLINE**

The use of magnetic resonance imaging (MRI) in medical practice is extensive and encompasses the diagnosis of multiple conditions such as neoplasms, infections, inflammatory diseases, among others. In these contexts, the analysis of post-contrast enhancement is essential. The detection and quantification of enhancement in T1-weighted cerebral MRI images is a challenging task due to the complexity of the images and the variability in the appearance of contrast enhancement. Artificial intelligence (AI) techniques have the potential to improve the efficiency and accuracy of this process, but the development and evaluation of AI-based approaches for this purpose is a laborious task.

### **INEE-36 A Practical Primer on the Radiomics Quality Score: How to Interpret the Results of Radiomics Studies**

Participants

Mohammad Mirza-aghazadeh-Attari, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Radiomics quality scores are used to assess the quality of radiomics studies and are based on a set of criteria related to study design, image acquisition, segmentation, feature extraction, and statistical analysis. The purpose of a radiomics quality score is to provide a standardized method for evaluating the quality of radiomics studies and to aid in the interpretation and comparison of study results. Interpreting a radiomics quality score involves understanding the specific criteria used to evaluate the study and the scoring system employed. Typically, a higher score indicates a higher quality study that is more likely to produce reliable and reproducible results. It is important to note that a radiomics quality score is just one factor to consider when evaluating the results of a radiomics study. Other factors such as sample size, patient demographics, and clinical relevance of the results should also be taken into account. Ultimately, the interpretation of radiomics study results should be made in the context of the specific clinical question being addressed and in consultation with a radiologist or other medical expert. Here we present a step by step approach to understanding and applying the RQS.

#### **TABLE OF CONTENTS/OUTLINE**

1- Radiomics Quality Score: A short introduction on its History 2- Methodologic considerations covered in RQS: - 2.1 Extraction of features -2.2 Development of predictive models and classifiers - 2.3 Performance evaluation of models - 2.4 Utility considerations 3- Reporting RQS results 4-Applications of RQS in clinical practice and research 5-Prospectives to enhancing RQS: RQS V2 6- useful tools

### **INEE-37 From Models to Masks, Barriers to Roadblocks, Posters to Presentations: Experience in Forming Cross Institutional Collaborations for Artificial Intelligence Research**

Participants

Nader Refai, MD,BS, Dearborn, MI (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review of key collaborations necessary for AI related research. 2. Review of potential roadblocks and barriers during project creation and execution. 3. Infrastructure considerations needed for a successful project.

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-Review of key collaborations which facilitate AI research--Domain Experts---Subspecialty radiologist involvement---Trainee involvement (resident/medical student)--AI Expertise---Programmers, data scientists--IT support--Graduate Students-Potential Roadblocks and Barriers--IRB and Data use agreements--DICOM de-identification at scale--De-identified DICOM storage--Image transfer between institutions--EHR data extraction at scale-Infrastructure considerations needed for a successful project.--Image or Data labeling---Example of open-source solutions for DICOM labeling/masking--GPU processing for model creation and testing--Project Management--Conclusion/Summary

#### INEE-38 Imaging Feature as a Function: A Novel Radiomics Framework

Participants

Nicolo Gennaro, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiomic features exhibit functional correlation with tumor size. Large datasets of pre-treatment scans of liver metastasis can uncover the functional association between tumor size and heterogeneity, providing potential insights into tumor growth and treatment. Harmonization allows to remove scanner-associated effects while preserving cancer-specific functional dependence. Texture features show functional size-dependence that allow to generate delta-radiomics data by utilizing post-treatment imaging data only.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Size measurement is a critical task for radiology and represents the pillar of response assessment to antitumor therapies. Size-dependence of radiomic features: We illustrate why radiomics features are affected by tumor size and how radiomic features might not be comparable even within ROIs of the same tumor but manually delineated by different operators. Harmonization in radiomics: The importance of feature harmonization to remove scanner-related biases and preserve size-dependence. Response Assessment: How size-dependence of texture features can be exploited to obtain delta-radiomics without baseline imaging.

#### INEE-39 The Comprehensive Open Federated Ecosystem (COFE): Enabling Impactful Healthcare Studies

Participants

Sarthak Pati, MSc, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

There is a growing body of literature offering evidence of the potential impact that artificial intelligence (AI) methods can have on healthcare. To ensure robustness evaluate generalizability of AI methods, ample diverse multi-site patient datasets are desired. However, there are various factors that hinder access to such data in the current paradigm of multi-site collaborations, which include the tedious bureaucratic processes, data ownership concerns, legal considerations reflected in patient privacy regulations. To tackle these issues, we introduce the community-driven Comprehensive Open Federated Ecosystem (COFE), which includes multiple open-source software tools to make distributed healthcare AI more accessible by leveraging zero/low code principles to get models to learn across data silos using Federated Learning (FL), to evaluate their performance on diverse datasets that they were not used to train with using Federated Evaluation (FE). The goals of the exhibit are to: broaden the understanding of the general community regarding FL FE, showcase how a user can leverage FL to train a model across various sites, present results of the first real-world federation across 71 collaborating sites, focusing on brain tumors, discuss privacy data protection concerns how COFE hopes to solve it, showcase how a user can leverage FE to generate generalizable statistics for AI methods.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will present a community-driven open-source ecosystem to train evaluate AI models across multiple clinical sites in a data-private paradigm. Specific principles to protect data privacy will be described, along with common pitfalls to avoid when performing FL-based studies.

#### INEE-4 Data Curation in Minutes not Days: Efficient Large Scale Dataset Preparation for Machine Learning Applications in Kaapana

#### TEACHING POINTS

In the era of rapidly growing medical imaging datasets and federated learning, efficient management and processing of medical images is crucial. Current medical image viewers, however, lack the capability for large-scale dataset curation. To address this, we introduce a data curation tool integrated into the Kaapana open-source framework, designed to streamline organization, management, and processing of extensive medical imaging datasets. Radiologists can easily filter for metadata, annotate and structure datasets, visualize dataset distributions, and quickly inspect individual studies. State-of-the-art machine learning algorithms, such as body part regression, nnUNet, and TotalSegmentator, can be applied to automatically annotate studies based on algorithm outcomes, which can accelerate the curation workflow by allowing filtering for specific organs, bone structures and body parts. This tool fosters collaboration between multidisciplinary teams, with machine learning researchers creating algorithms to support radiologists, who in turn annotate and curate the data. In conclusion, the proposed tool offers an intuitive interface for radiologists to efficiently curate datasets for use in machine learning algorithms.

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1. Introduction 2. Data Curation Tool 2.1. Features 2.2. Metadata Annotation 2.3. Structuring Visualization 3. ML Algorithm Integrations 4. Conclusion Future Directions

#### INEE-40 Beyond the Hype: The Power of GANs in Restoring MRI Texture

Participants

Kensuke Umehara, PhD, Chiba, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Generative adversarial networks (GANs) are one of the deep learning-based image generation models that have been widely used in medical imaging research, such as modality conversion and data augmentation. However, their application in diagnostic imaging is still met with resistance due to the perception that "GANs easily generate fake images." On the other hand, it is not widely known that with proper model selection and training, GANs can be a useful tool for generating high-quality images from low-quality ones. The teaching points of this exhibit are to 1) provide an overview of GANs using supervised learning, 2) showcase the application of one of the representative supervised GANs, super-resolution GAN, to MRI images, achieving high-quality imaging while enabling short-time imaging, and 3) demonstrate the high-accuracy restoration of the texture of MRI images by applying super-resolution GAN.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Super-resolution GAN for Accelerating MRI 3. Radiomics Analysis 4. Clinical Showcases

#### INEE-41 Accelerating Machine Learning for Medical Imaging by Integrating AIM and AI Federated Learning into Clinical Workflow

Participants

Pattanasak Mongkolwat, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The incorporation of Annotation and Image Markup (AIM) and AI Federated Learning (FL) framework into an imaging workflow can expedite the creation of deep neural network models without compromising the confidentiality and sharing of imaging data. Furthermore, this integration can standardize the creation of annotations for supervised or semi-supervised deep learning approaches in annotated images. 2. Integrating an AIM image annotation tool into clinical workflows can speed up the process of creating annotated images based on an AIM template. The user wants to make simple and constrained annotations. The annotation results can be stored as an AIM XML document, JSON object, or DICOM SR PS3.21 object. Combining the AIM information with corresponding image can facilitate the development and training of multimodal deep learning models. 3. The proposed software tools in this framework simplify the setup and usage of FL and enable the creation of standardized annotations, allowing radiologists and AI researchers to focus on data quality and deep learning model development.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of AIM, AI Federated Learning, and Multimodal Deep Learning 2. Imaging Workflow Architecture and Tools: modified ePAD, Fuji Synapse (example integration), DICOM anonymizer, Mini-PACS, AIM database, AI image inference, cohort creator, image and AIM staging location, Cohort worklist, DICOM reader, AIM transform, FL Web Admin Management, web-based AIM template builder. 3. Framework and Software Tool Requirements 4. Installation and Configuration Guide for Participating Institutions 5. Preparing Your DL Model and Data for AI Training 6. Live and Video Demonstration of the Installed Environments

#### INEE-42 AI-assisted Decision Making for Prostate Cancer Diagnosis

#### TEACHING POINTS

The interpretation of prostate multiparametric MRI is challenging. Up to 30% of clinically significant cancers (PCa) are missed even by expert, and there is large inter-reader variation. Artificial intelligence (AI) shows promise in diagnosing PCa using MR images. To leverage the power of AI, it is crucial to determine if AI can assist radiologists in the diagnostic process and if radiology trainees can learn from AI-generated insights. We trained a state-of-the-art AI model (nnUnet) on a large-scale MRI dataset for PCa diagnosis. We have developed a web-based system for interactive and learning resources, incorporating the AI. This system assists radiologists in PCa diagnosis by providing AI-generated predictions (lesion maps). With this information at their disposal, radiologists make their own predictions and annotations using our web application. We will compare the diagnostic performance of human-only, AI-only, and human+AI. We will also examine the interaction between radiologists and AI to inform better teaching processes. Ultimately, we hope the tool will improve radiologists diagnostic performance and patient outcomes by leveraging the power of AI.

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Preliminary teaching results on simple AI assisted reader tasks. An AI model (nnUnet) trained on PI-CAI dataset: mpMRI images - T2W, DWI/ADC, DCE for human-only reader performance (we random sampled 80 cases for testing purposes). AI-assisted decision making: AI predicted lesion maps. Annotation tool: radiologists annotate prostate cancer with AI assistance at their disposal. Assessment: the performance of human-only, AI-only, and human+AI will be analyzed to generate insights to improve the task performance and teaching.

#### INEE-43 Harnessing AI for Improved Workflow in Radiology: Beyond Image Analysis

Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

AI can be employed in numerous aspects of the radiology exam's electronic roundtrip, extending beyond image interpretation. This technology holds the potential to increase efficiency, reduce unnecessary scans, improve image quality and patient safety, and expedite the interpretation process. AI assisted reporting has tremendous potential to enhance practice and efficiency. By leveraging AI in these areas, healthcare professionals can save time and resources while enhancing the overall quality of patient care.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) AI Applications Prior to Image Acquisition • Scan Ordering Optimization • Pre-exam Screening • Protocols • Scheduling 3) AI Applications During Image Acquisition • Patient Positioning • Contrast and Radiation Dosimetry • Scan Time Reduction • Image Reconstruction and Postprocessing 4) AI Applications Following Image Acquisition • Worklist Prioritization • Urgent Finding Notification • Hanging Protocol Optimization • Assisted Reporting a) Next generation reporting b) AI-generated preliminary reporting 5) Other Applications • Resident Education • Quality Assurance and Patient Safety • Billing and Compliance 6) Conclusion

## **INEE-44      Designing and Implementing a DICOM Collector for Analytics, Quality Improvement, and Regulatory Compliance**

Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Understand the magnitude of DICOM data and architecture necessary to handle such large volumes, 2) Describe the utility that can be derived from DICOM data through additional applications, 3) Understand the pitfalls of naively scraping data without expert input

### **TABLE OF CONTENTS/OUTLINE**

1) What are you collecting and why?, 2) How much data are we talking about?, 3) what kind of architecture do you need?, 4) You collected it, now what do you do with it? (applications), 5) Why is a team necessary for what database - seems like a summer project for a graduate computer science student?, 6) Does use justify the effort expended?

## **INEE-45      NCI Imaging Data Commons: Towards Transparency and Reproducibility in Imaging AI**

Participants

Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

NCI Imaging Data Commons (IDC) is a cloud-based repository of publicly available cancer imaging data co-located with analysis and exploration tools and resources. IDC, part of the NCI Cancer Research Data Commons (CRDC), provides secure access to a large, comprehensive, and expanding collection of cancer research data. IDC uses a combination of commercially available (Google Cloud Platform (GCP), Amazon Web Services (AWS)) and open source components. The IDC portal (<https://imaging.datacommons.cancer.gov>) and SQL interface enable exploration and visualization of data and cohort building. As of Spring 2023, IDC hosts over 40 TB of radiology and digital pathology image data encoded using the DICOM standard, and available in both GCP and AWS. While the IDC is intended for cloud-based data processing, data can be freely downloaded for on-premise analysis. Cloud-based workflows enable reproducible analysis and results. We will present the scope and status of IDC (e.g., new datasets and features), learning resources (e.g., interactive notebooks with reproducible AI workflows applied to the data within IDC), use cases (including those demonstrating large scale time- and cost-efficient analysis workflows) and plans for future development, along with live interactive demonstrations.

### **TABLE OF CONTENTS/OUTLINE**

Overview of CRDC and IDC; Data curation and the role of The Cancer Imaging Archive; Portal; Viewer; Organization of data; Integration of tools; Use case development; Documentation and user support resources; Large scale computing using CRDC Cloud Resources; IDC cloud credit program; Status update and plans for future development.

## **INEE-46      Image-to-text and Text-to-image Models: A Primer for Radiologists**

Participants

An Ni Wu, MD, Gatineau, QC (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review key concepts of neural network models connecting text and images; 2. Discuss potential applications of image-to-text and text-to-image models in medical imaging; 3. Illustrate key components involved in zero-shot prediction models; 4. Understand the overall design and architectures of text-to-image models; 5. Discuss future directions applicable in radiology.

### **TABLE OF CONTENTS/OUTLINE**

1. Trend: groundbreaking emergence of neural network models connecting text and images. 2. Relevance for radiology: a discipline connecting text reports with medical images. 3. Illustration of key components involved in zero-shot prediction models: text vectorization, image vectorization, vector-space, attribute predictions, image attribute mapping, text classifier, and zero-shot prediction. 4. Illustration of recent models connecting image to text (i.e., CLIP) and text to images (i.e., DALL-E, Stable Diffusion, Imagen). 5. Architecture of CLIP and key messages: convolutional neural networks for text and image encoding, dataset classifier creation, zero-shot prediction model, transfer learning, natural language supervision, generalization, efficiency, flexibility, and limitations. 6. Applications of text-to-image models in radiology: image classification, automated caption generation, synthetic image generation. 7. Future directions: new applications in radiology and technical innovations.

## **INEE-47      Rapid Clinical Deployment of AI Applications for Radiology Using Mercure - An Open Source DICOM Orchestration Platform**

Participants

James O'Callaghan, PhD, MEng, New York, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The aim of this presentation is to inform the audience of available open-source software that can be used to rapidly integrate Radiology Artificial Intelligence (AI) applications into their clinical infrastructure. We will outline the need for software tools to address practical challenges in translating medical imaging research techniques into real world settings. This will be followed by a description of DICOM orchestrators and how they can help to bridge this gap by handling interactions and requirements of clinical environments. Mercure - an open-source and freely available DICOM orchestrator, will be used to demonstrate how attendees can easily integrate AI applications into their clinical workflow using an intuitive web-based user interface. MONAI (Medical Open Network for Artificial Intelligence) is a popular open-source framework for medical imaging AI. In the concluding section, we will give guidance on how MONAI can be used with Mercure to deploy AI applications for Radiology in a rapid and standardized manner.

### **TABLE OF CONTENTS/OUTLINE**

1. The increasing demand for Artificial Intelligence in Radiology 2. Challenges in clinical translation of AI 3. Integration of AI applications into clinical environments using Mercure 4. Standardization and rapid deployment of AI applications

## **INEE-48 AI Adoption in Clinical Practice: A Practical Guide for the Practicing Radiologist**

Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- There is an increasing number of commercial AI algorithms. However, the actual value and useability of these algorithms requires more than evaluation of diagnostic performance metrics alone.
- We will review and provide practical suggestions for radiologists to use when evaluating AI software for their clinical practice.
- We will discuss important practical barriers that should be considered in order to properly assess useability and seamless integration into radiological practice.
- We will discuss pitfalls and opportunities for the use of AI to enhance clinical practice, including efficiency.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Discuss basic diagnostic metrics, relevance, and why diagnostic performance alone will not ensure impactful adoption 3. Importance of seamless workflow integration and avoiding pitfalls a. Time to image processing and transfer to viewer b. Pitfalls for algorithms requiring expert-viewer interactions c. AI data transfer and reporting module 4. Importance of seamless workflow integration: Opportunities a. Review increasing number of report augmentation and semi-automated reporting tools providing opportunities for reporting efficiency b. Future areas of efficiency improvement 5. Algorithm testing and deployment challenges and opportunities 6. Non-interpretive AI applications 7. Conclusions

## **INEE-49 Prompting Language Models 101: A Primer for Radiologists**

Participants

Bardia Khosravi, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Large language model (LLMs) inception was four years ago; however, the advent of ChatGPT provides a unique user experience, showcasing the power of LLMs. Although the chat interface is exceedingly helpful, some nuances exist in creating a correctly structured prompt for a better answer, with less back and forth. This exhibit will cover three main points: 1. Introduction to Language Models 2. The Importance of Prompting 3. Popular Prompting Strategies

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to Language Models: This section covers large language model basics. What makes them a significant breakthrough in the natural language processing domain? We will focus on some of the applications of LLMs in radiology, specifically in report structuring. 2. The Importance of Prompting: The chat interface of LLMs, like ChatGPT, can cover many personal use cases. On the contrary, this interface may not be helpful for automated information extraction. Additionally, using open source LLMs (as an alternative to ChatGPT, which requires sending data outside of the institution), requires proper prompting to guide the LLM to output the desired results with only one question asked. 3. Popular Prompting Strategies: This section will cover three main prompting strategies: (a) zero-shot prompting, (b) few-shot prompting, (c) chain-of-thought prompting. We use the example of abstracting cervical vertebral fractures from radiology reports. We will provide examples of the model's output based on each prompt to give a better understanding of the importance of prompt engineering.

## **INEE-5 Explainable Artificial Intelligence (XAI) in Computer Vision Explained for the Radiologist**

Participants

Adarsh Ghosh, MD, MBBS, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Computer vision applications use deep neural networks composed of multiple convolutional layers. The radiological images pass through these layers, and the complex interrelationships are incomprehensible. The resultant algorithm's black-box nature impairs understanding of its decision. 2. Deep learning algorithms address both mundane and critical medical problems. The black-box nature of deep learning algorithms is more problematic in high-stakes situations, such as decisions resulting in patient surgery or intervention. 3. Several approaches are available to develop explainable AI models. Each approach has specific limitations, advantages, and applicability.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: Models with high accuracy may be less transparent: The story of Clever Hans Explainable AI (XAI): What is explainable AI and how is it classified. Importance of XAI in radiology XAI methods: The methods available to explain an algorithm's output and their limitations. Visual Explanations (saliency maps) Back propagation-based approach Perturbation-based approach Text explanations Example-based explanations The limitations of XAI: Additional computing costs. Interpreting interpretable AI

## **INEE-50 Further Possibilities of Deep Learning in the Ultrasound Field**

### **TEACHING POINTS**

In recent years, deep learning technology has become a necessity in the medical field. These technologies have been widely used in mammography, CT, and MRI in clinical applications. In the ultrasound field, a wide range of techniques using deep learning, such as noise reduction and automated detection, have been reported. However, it is clear that deep learning is still in its developing stage compared to other modalities. Why is this? The purpose of this exhibition is to describe the current situation, challenges, and future possibilities of deep learning applications in the ultrasound field. As an example of research using deep learning, we will go into deep learning in the ultrasound field from our research on carotid plaque region extraction and composition differentiation using ultrasound images. The major teaching points of this exhibit are: 1. Introduction of research on deep learning in the ultrasound field 2. Current situation and challenges of deep learning in the ultrasound field 3. Future possibilities with deep learning

### **TABLE OF CONTENTS/OUTLINE**

1. Current situation of AI application to the ultrasound field -Noise Reduction -Segmentation -Classification 2. Introduction of our study 3. Potential AI applications in the ultrasound field

## **INEE-51 How Nationwide Medical Image Database and AI-based Image and Finding-text Analysis Work for**

## **Nation-wide Disease Spread Surveillance: Three years of experience on CT Image-based COVID-19 Monitoring**

### Participants

Kensaku Mori, PhD, Nagoya, Japan (*Presenter*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation

### TEACHING POINTS

- To understand how nation-wide medical image database works for nationwide disease surveillance using AI-based medical image and finding-text analysis- To understand how national medical image database collects medical images from participating hospitals- To understand how AI analyzes national medical image database on a cloud computing platform- To understand what kind of data are stored on national medical image database- To understand how COVID-19 infection spread monitoring are performed on national medical image database

### TABLE OF CONTENTS/OUTLINE

National medical image database- National Institute of Informatics, Japan, hosts the National Medical Image Database (NII-MID).- Participating hospitals automate daily image transfers to NII-MID.- AI-image and findings-text analyses are performed on incoming medical images.- Daily analysis utilizes AI-based methods.COVID-19 surveillance using CT images- AI -based (Convolutional Neural Network) analysis of CT images following RSNA COVID-19 CT scan classification guideline for images sent to NII-MID.- Automated data selection of CT images for analysis from NII-MID, using findings-texts.- COVID-19-related word analysis from findings-texts.- Calculation of daily COVID-19 suspicious image rates from data transfers.- Three years of experience monitoring COVID-19 cases through NII-MID.- Demonstrating the relationship between COVID-19 suspicious CT image rates and the daily number of COVID-19 related deaths.Future outlook- Expanding the functionality of NII-MID as a nationwide disease monitoring tool.- Broadening the scope of AI-based analysis targets.- Preparing for the prediction of the next unknown pandemic.

### **INEE-52 Advanced and Versatile AI System for 3D Medical Image Super-resolution**

### Participants

Tong Zheng, Nagoya, Japan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Gain an understanding of the concept of super-resolution (SR) and the differences between SR in RGB color images and medical images. 2. Identify the main challenges involved in performing SR on medical images. 3. Learn about a specialized AI system designed to overcome these challenges in medical image SR. 4. Explore the exceptional performance of our SR AI on two medical image datasets and its potential in aiding radiologists' diagnoses.

### TABLE OF CONTENTS/OUTLINE

1. AI-based super-resolution (SR): fundamental concepts -SR is a technique that enhances the resolution of an image. -In medical imaging, SR can help radiologists observe precise anatomical structures in low-resolution (LR) images. 2. Challenges of medical image SR -AI for RGB image SR is typically trained using LR-high-resolution (HR) image pairs. - It is difficult to use AI for medical images' SR: LR and HR medical images are often acquired from different devices or scanning conditions. 3. Our specialized AI for medical image SR -We use a real-time registration network to minimize coordinate differences between LR and HR images. -We use a pre-trained generative model to minimize differences in intensity and scanning devices. 4. Two original medical image datasets to validate our SR AI -Dataset-A: micro CT (HR) - clinical CT (LR) dataset. LR-HR images differ in intensity, coordinate, and scanning device. -Dataset-B: Brain MRI dataset. LR-HR images differ in coordinate. 5. Radiologists' diagnostic process is aided by our SR AI - Our AI successfully performed SR on both medical image datasets, making it easier for radiologists to observe precise anatomical structures and make diagnosis. -Statistical analysis showed that our AI outperformed other recent AIs.

### **INEE-53 Preparing for the (Un)Expected: Preventing Ransomware Attacks Before They Happen**

### TEACHING POINTS

Cyberattacks continue to be one of the toughest problems and biggest threats to have hit the healthcare industry in recent years. When hackers gain entry into a hospital's computer network, not only are the hospital operations, financials and data in jeopardy, but there is a direct threat to patient care and safety. As reported by SOPHOS, 34% of hospitals were hit by ransomware in the last year alone. With many hospitals expanding their digital landscape to include cloud computing, telemedicine and remote work, the vulnerability of being a target of an attack remains a risk. Sky Lakes Medical Center fell victim to a ransomware attack in October 2020. In this session, the director of information systems will discuss how his team was able to successfully recover 650 servers and 150 applications in just four weeks' time. He will share best practices of lessons learned and outline the necessary infrastructure and technology systems to have in place so other organizations can prevent disaster before it happens and ultimately help to reduce the number of ransomware attacks in healthcare.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Ransomware numbers within healthcare 3. Top vulnerabilities within healthcare organizations 4. Necessary informatics, infrastructure, and technologies to have in place 5. Key priorities and step by step on how to recover if it does happen to you 6. Conclusion

### **INEE-54 Collaborative Development of a PACS-Integrated Quality Control Dashboard : A Single Institutional Experience**

### Participants

Vijaya Kosaraju, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Designing and implementing a Technologist Quality assessment (Tech QA) dashboard that is integrated with PACS (2) Determine the appropriate QA metrics over a period of time to set up the baseline and target areas for improvement (3) Design a way to deploy the right interventions and measure the resulting response (4) Analyze the intervention response to measure improvement over baseline as a way to improve patient care and radiologist satisfaction.

## TABLE OF CONTENTS/OUTLINE

(1) Introduction to Tech QA (2) How we did it over time (3) Developing the current PACS integrated QA system (4) Challenges associated with implementation and deployment a) Challenges in the backend b) Challenges to educate radiologists and technologists c) Make an efficient path for review of the QAs d) Design a closed feedback loop for efficient processing (5) Initial results of the Tech QA process (6) Interventions deployed as a result of baseline metrics (7) Analyzing the results of the interventions (8) Conclusion (9) Future goals

### INEE-55 Programmatically Generating Radiology Report Fields to Facilitate Structured Reporting Utilizing RadElements.org

Participants

Andrew Gomella, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-A significant barrier to adoption of structured reporting and use of standardized data elements is the need for each element/concept to be manually created within individual institution's production reporting software-The ability to programmatically create complex report fields and templates helps reduce the barrier to entry-With a relatively short python script the entirety of the RSNA/ACR RadElement.org common data element library can be converted to Powerscribe macros, which can be dragged-and-dropped into reports or batch loaded into the dictation system for department wide use

## TABLE OF CONTENTS/OUTLINE

1. Motivation for creating a programmatic interface for generating radiology report fields and reports2. Reverse engineering the structure of a standard radiology report file (from Powerscribe)3. Approach to generating the report fields and templates in python utilizing XML (Extensible Markup Language) and raw text functions4. Generating autotext snippets for use in reports from RSNA's radelement.org5. Demo of drag and drop functionality adding rad elements or rad element sets to a report template

### INEE-56 How Graph Neural Network Works for Automated Nomenclature of Abdominal Blood Vessels

Participants

Kensaku Mori, PhD, Nagoya, Japan (*Presenter*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation

#### TEACHING POINTS

- To understand what is graph convolutional network (GCN)- To understand how GCN is applied for vasculature nomenclature- To understand automated nomenclature performance by GCN- To understand anatomical annotation for 3D blood vessel regions by GCN-based automated nomenclature

## TABLE OF CONTENTS/OUTLINE

Introduction- The importance of automated vasculature nomenclature as a key function in future CAD systems.- Enhancing CT image reading workflow with automated vasculature nomenclature.- Overview of abdominal vasculature systems and their anatomical names.Spectral based graph convolution and graph convolutional network- Review of the theoretical aspects of Graph Convolutional Networks (GCN).-Review of spectral-based graph convolution operations in GCN and their computer implementation.How to apply GCN for automated nomenclature of abdominal blood vessels- Extracting blood vessel tree structures from CT images.- Feature extraction from tree structure.- GCN training methodology.- Automated nomenclature using GCN.Experiments- Configuration of training data.- Annotation of training data.- Evaluating nomenclature performance.- Automated annotation of 3D-rendered blood vessels based on automated nomenclature.- Performance changes for different convolutional areas.Discussion- Limitations of GNN-based automated nomenclature for blood vessels.- Enhancing radiological and surgical readings of CT images with automated nomenclature.- The effectiveness of automated nomenclature in constructing symbolic logic-based CAD systems.

### INEE-6 Designing a Radiomics study: Hurdles and Pitfalls

Participants

Adarsh Ghosh, MD,MBBS, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiomic studies are complex, requiring a unique trial design, data preparation, informatics tools, and infrastructure.2. Radiomic studies are often designed to be hypothesis-generating rather than to answer a hypothesis. This difference in study design requires researchers to identify key comparative data such as patient outcome or histologic diagnosis before the study begins.3. Because radiomics is still a nascent field of imaging research, there are unique challenges and potential pitfalls at every step of the research process.

## TABLE OF CONTENTS/OUTLINE

Radiomics 101 Tools needed to perform a radiomics study Steps of a radiomics study Asking the right questions: -- Is there clinical value? -- Finding the right comparative measure Data curation: the curse and blessing of electronic medical records Imaging data: - - Not all data is created equally: Data Preparation -- Managing multi-institutional data Image segmentation: -- So many circles, so much time -- Managing multiple series Feature extraction: IBSI and open source -- Pyradiomics and more Data modelling: Feature selection and dimensional reduction Data analysis and validation: Finding signal in the noise Common errors in study design and strategies to avoid them: -- Overfitting -- Data leakage -- Data peeking Significance does not equal importance

### INEE-7 Fight for Fairness in AI for Medical Imaging

#### TEACHING POINTS

1. To highlight the critical importance of fairness in AI for medical imaging, emphasizing the negative impacts of biased algorithms on patient outcomes.2. To provide an overview of various evaluation metrics that can be used to assess fairness in AI models, including equality of opportunity and demographic parity, with a particular focus on their application in medical imaging.3. To introduce debiasing methods such as pre-processing techniques and adversarial training, and discuss their effectiveness in

addressing bias in AI models for medical imaging.4. To encourage ongoing discussion and action to promote fairness and equity in healthcare AI and identify future challenges in this rapidly evolving field.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction1.1. Importance of fairness and bias in AI for medical imaging1.2. Brief review of previous studies addressing fairness issues2. Definitions of fairness and bias2.1. Explanation of fairness and bias2.2. Types of bias3. Methods to mitigate bias3.1. Pre-processing techniques (e.g., data cleaning, re-sampling, feature selection)3.2. In-processing techniques (e.g., pruning, contrastive learning, adversarial training)3.3. Post-processing techniques (e.g., calibration)4. Evaluation metrics for fairness4.1. Explanation of evaluation metrics used to assess fairness: demographic parity, equalized odds, and equality of opportunity4.2. Advantages and limitations of each metric5. Challenges5.1. Lack of diversity and representation in healthcare data5.2. Technical limitations of current debiasing methods5.3. Action to promote fairness and equity in AI for healthcare

#### INEE-8 Approaches to Writing and Implementing Custom Software as a Trainee at a Large Academic Health Center

Participants

Andrew Gomella, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Coding is an increasingly popular and important skill, with more non-career programmers picking up coding skills.- Recently released large language models have decreased the entry barrier for coding by demonstrating the possibility of generating complex software from natural language prompts.- Writing, implementing, and testing code in a health system presents unique barriers and challenges, but it is possible even as a trainee.- Significant variation in practice/hospital IT infrastructure, security policies, and the suite of radiology/EHR combinations unfortunately limits cross-institutional development of software.- The software approach, including whether to use a specific language, how to distribute to colleagues, and attention to IT security, depends on the specific problem at hand and can range from surprisingly trivial to prohibitively complex.

#### TABLE OF CONTENTS/OUTLINE

- Motivation- A general approach to tackling software ideas, from feasibility to production- Is there an API(Application Programming Interface)? and what can be done if there isn't?- Institutional variation in IT and software suites, and why it matters- Security considerations- Low code solutions: Example of a program that can be completely run within our hospital infrastructure without any installation or 'writing' code.- Scripting solutions: Example of AutoHotKey scripts including a few line solutions, to dynamically modify open radiology report text.- Python: Swiss army knife, with limitless possibilities and vast online community- Browser plugins: Example of a Chrome plugin used to add features to intranet web pages.- PACS and EHR plugins

#### INEE-9 Maximizing Generative AI's Potential in Radiology: Fine-Tuning and Prompt Engineering

Participants

Theodore Kim, Washington, DC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- ChatGPT and other generative AI tools have the potential to play significant roles in education, research and clinical practice for diagnostic radiology- One way to maximize their use and potential is by focusing on improving the quality of its output through the processes of fine-tuning and prompt engineering- Fine-tuning is the process of training a pre-trained model on a smaller, task-specific datasets to improve its performance on that task. For example, training a model with specific terminology and recommendations associated with updated Fleischner criteria to guide management of pulmonary nodules on a model already trained on a larger dataset of radiologic imaging- Prompt engineering focuses on designing and refining input queries to obtain the most accurate and relevant desired output. These methods can include using radiology-specific terminology, providing necessary medical context, crafting precise prompts with specific constraints, and using iterative processes to identify and develop the most effective prompt structures.

#### TABLE OF CONTENTS/OUTLINE

1. Principles of Fine Tuning2. Commonly used Algorithms for Fine Tuning3. Fine Tuning in ChatGPT4. Principles of Prompt Engineering5. Prompt Engineering in ChatGPT

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## Abstract Archives of the RSNA, 2023

INEE-1

### What Will Happen to AI Technology in Radiology? Systematic Review of Natural Language Processing for Radiological Image Processing

#### TEACHING POINTS

In recent years, the application of artificial intelligence (AI) technology in the medical field has been advancing rapidly. In radiology, AI technology is expected to improve the accuracy of physician diagnosis through image analysis and automated diagnosis. Specifically, these include automated diagnostic technologies using deep learning and the prediction of patient health status. Many of the technologies that use AI include systems that use Natural Language Processing (NLP). Improvements in NLP models have made it possible to handle not only text data but also image data, and many applications in the medical field have been reported. The purpose of this exhibit is to show the application of NLP model in radiology and our work applying the Vision Transformer to atrial fibrillation types classification. The major teaching points of this exhibit are 1.AI technology in radiology is expected to improve the accuracy of physician diagnosis through image analysis and automated diagnosis. 2.NLP enables the processing and extraction of large amounts of natural language generated in the medical field. 3.How can NLP be used for medical imaging?

#### TABLE OF CONTENTS/OUTLINE

1. AI Technology in Radiology 2. What is NLP? -Familiar Applications of NLP Models -Typical models used for NLP -Examples of Image Applications of NLP Models 3. Introduction to this study -Atrial Fibrillation Types Classification Using the Vision Transformer

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## Abstract Archives of the RSNA, 2023

INEE-10

### Establishing a Radiology Research Laboratory, from A-Z

#### Participants

Hussain Al Yousif, MD, Hershey, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Quantitative image analysis for clinical trials is poorly managed using standard clinical workflows. Radiology Research laboratories standardize the workflows for trials that use imaging endpoints. Radiology Research laboratories can provide more value to support institutional research objectives beyond image interpretation and should be set up to serve as central point of contact for all clinical researchers and medical imaging.

#### TABLE OF CONTENTS/OUTLINE

Defining the problem - addressing the needValue of radiologists and medical imaging personnel at the various stages of clinical research:

- Research protocol development
- Feasibility assessments
- Access to radiologists and technical resources

Partnering for success - working with your customers and end users to know what service are needed:

- Image review with quality quantitative image assessment
- Image transfer
- Protocol review
- Feasibility assessments
- Trial budget development

Take advantage of existing institutional core lab infrastructure:

- List of provided services accessible via website.
- Billing for services
- Operations

Identify the key components and personnel required for functioning of the lab:

- Hardware and software
- Personnel

Developing a budget and list of provided services. Research lab operational workflow in context of clinical operations Annual reviews, with budget and performance adjustments.

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## Abstract Archives of the RSNA, 2023

INEE-11

### Lung Cancer Screening and AI: Challenges and Opportunities

#### Participants

Leonardo Rosolen Iunes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To discuss the potential role of artificial intelligence (AI) in lung cancer screening (LCS), highlighting: - AI applications in LCS: machine learning versus deep learning strategies - AI limitations in LCS: data collection, reproducibility, generalizability, validation - Responsible AI: fairness, accountability, and transparency - Addressing gender and racial bias in LCS programs - Future perspectives: combining the strengths of radiologists and AI for best LCS practices

#### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Ongoing challenges in implementation of LCS b. AI in healthcare: basic concepts 2. AI and lung cancer: an overview a. Screening b. Radiomics and Radiogenomics c. Decision making and prognosis prediction 3. AI in LCS: potential applications a. Early detection b. Nodule classification c. Radiography versus Computed tomography d. Retrospective versus Prospective Studies 4. Limitations and Challenges: AI in the real world a. Bias in underserved and underrepresented populations 5. Responsible AI: transparency and regulation 6. Future perspectives 7. Take home messages

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## Abstract Archives of the RSNA, 2023

INEE-12

### AI-Driven Tools and Techniques in Radiology Education: Empowering the Next Generation of Radiologists

#### Participants

Matteo Mancino, MD, Roma, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The integration of AI into radiology education is crucial, as state-of-art AI applications such as deep learning and machine learning are transforming decision making and patient care. Radiology trainees must be well-versed in AI technologies to effectively leverage their potential in delivering value-based clinical practice. The aim of this poster is to provide an overview of AI's role in radiology trainee education, addressing challenges, state-of-art resources and future directions.

#### TABLE OF CONTENTS/OUTLINE

1. Curriculum development Building an AI curriculum including ethics, data quality, privacy, and AI's impact on clinical workflows. 2. Interdisciplinary learning: Encouraging trainees to collaborate with other medical specialties to understand AI's broader implications in healthcare. 3. Collaboration Encouraging cooperation between radiology departments, AI experts, and industry partners to develop tailored educational content and resources. 4. Assessments: Leveraging AI for performance assessment in radiology board examinations and multidisciplinary meetings to enhance clinical decision-making skills. 5. AI-augmented education Using AI to provide learning experiences, such as personalized case selection. 6. Barriers and challenges: Addressing barriers to AI education, and developing strategies to overcome these challenges. 7. Future directions: Exploring innovative ways to integrate AI into radiology education, such as AI-driven simulations, virtual reality, and gamification.

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## Abstract Archives of the RSNA, 2023

INEE-13

### Generative AI Predicts the Survival of Patients with Progressive Fibrosing Interstitial Lung Disease

#### Participants

Masaki Okamoto, Boston, MA (*Presenter*) Stockholder, TOKYO analytica

#### TEACHING POINTS

Progressive fibrosing interstitial lung disease (PF-ILD) is a group of diseases characterized by increasing self-sustaining fibrosis, progressive decline in lung function, and high mortality. Due to the highly variable rates of decline and poor prognosis of PF-ILD, accurate, individualized mortality prediction is crucial for therapeutic decision-making and management of the patients. However, PF-ILD does not have any formal prognosis-based staging system, and none of the developed existing prognostic biomarkers have been considered accurate enough for establishing such a system. The teaching points of this exhibit are to (1) review currently available clinical prognostic biomarkers for PF-ILD, (2) review an emerging generative AI-based biomarker for imaging-based prediction of survival in PF-ILD, and (3) review the comparative performance between the clinical and generative-AI-based prognostic biomarkers in the prediction of the survival in PF-ILD.

#### TABLE OF CONTENTS/OUTLINE

(1) Unmet need for accurate prognostic biomarkers for PF-ILD. (2) Clinically established prognostic biomarkers for PF-ILD (gender, age, and physiology (GAP) index; composite physiologic index (CPI); visual high-resolution CT pattern). (3) Radiomic biomarkers (traditional radiomics; hyper-curvature features) for survival analysis. (4) Emerging generative AI-based imaging biomarker (gen2surv). (5) Comparative performance of biomarkers in terms of survival prediction and Kaplan-Meier survival curves. (6) Clinical case studies.

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## Abstract Archives of the RSNA, 2023

INEE-14

### AI as a Medical Device: Demystifying FDA Regulation for AI Tools in Clinical Radiology Practice

#### Participants

Anjali Patel, Ocala, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the FDA's role in regulating AI radiology tools categorized as software as a medical device. Gain a fundamental understanding of FDA regulations, crucial for algorithm developers and end users to ensure appropriate and optimal use. Distinguish between FDA clearance and different classifications for radiological software as a medical device. Appreciate the importance of various classifications concerning algorithm development, validation rigor, and intended use. Assess the real-world implications of device classifications on the adoption of AI tools in clinical radiology practice. Explore ongoing debates and potential future developments in FDA regulation of AI radiology tools.

#### TABLE OF CONTENTS/OUTLINE

Introduction Overview of FDA classifications for AI medical software Class I devices Class II devices Class III devices Discerning intended use and its influence on device classification Motivations behind seeking lower category classifications and potential pitfalls in clinical practice Different category FDA classifications and impact on AI tool adoption and usability in clinical practice Controversial aspects and future optimization of FDA regulation in AI radiology tools Conclusions

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## Abstract Archives of the RSNA, 2023

INEE-15

### Streamlining Emergency and General Radiology Reporting Through Customized Macros for Incidental Findings: A Primer and Online Repository

#### Participants

Jeffers Nguyen, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Modern radiologic practice demands higher volume study interpretation, which may be facilitated by improvements in dictation workflow. There is a large variety of incidental findings that may be made during the course of general, multi-modality, or emergency radiologic practice whose accepted follow-up recommendations may be difficult to recall for general radiologists, or those practicing outside of a subspecialty area. Furthermore, existing solutions to streamline the reporting of incidental findings are cumbersome and require too many clicks or keystrokes to rapidly implement. We present customized, pick list type macros that allow easy selection of up-to-date recommendations for the most common incidental findings that may be encountered in routine practice. We demonstrate how these may be used and provide an online repository from which they may be downloaded and imported for personal use.

#### TABLE OF CONTENTS/OUTLINE

1) A brief review of incidental findings; 2) How to create, export, and import pick list macros (PowerScribe); 3) How to use pick list macros (video demonstration); 4) Demonstrating the value of pick list macros for incidentally detected lesions, including adnexal masses, pituitary lesions, pulmonary nodules, liver lesions, pancreatic cystic lesions, renal masses, and more; 5) URL for online repository of macro resources

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## Abstract Archives of the RSNA, 2023

INEE-16

### The OpenAI Ecosystem and Potential Applications in Radiology

#### Participants

Reza Sirous, MD, MPH, Washington DC, DC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Explaining Large Language models (LLM) and Large multimodal models (LMM) 2) Explaining about OpenAI ecosystem and its extensive list of AI-powered tools 3) Explaining potential applications of OpenAI tools in Radiology 4) Explaining other LLMs competing with OpenAI tools and their potential applications in Radiology

#### TABLE OF CONTENTS/OUTLINE

1) LLM vs. LMM: a) Background, evolution, examples, and comparison of LLM vs. LMM b) Discussing and comparing major LLM platforms (including ChatGPT, LaMDA, MT-NLG, BLOOM, Galactica, PaLM, LLaMA, etc.) 2) OpenAI ecosystem: Introducing the below tools, their general applications, strengths, weaknesses, opportunities, and threats: a) ChatGPT b) Playground c) Plugins d) Application Programming Interface (API) e) Whisper f) Dall.E g) Codex h) ImageGPT i) CLIP j) Alignment k) Microscope l) Gym m) Baselines 3) Discussing potential applications of each OpenAI tool in Radiology, strengths, weaknesses, opportunities, and threats: a) Clinical Applications (for radiologists, referring physicians, patients, etc.) b) Research Publications (for journals/reviewers, authors, etc.) c) Education Admission Process (for radiology trainees, faculty, etc.) d) Public Health Health Policy (for policy makers, screening campaigns, etc.) 4) Introducing alternatives to the OpenAI tools, pros, and cons: a) Chatbots (alternatives to ChatGPT), including Google Bard, Baidu ERNIE Bot, etc. b) Text-to-Image convertors (alternatives to DALL.E) including Midjourney, Stable Diffusion, Google Parti c) Speech-to-text convertors (alternatives to Whisper) including Kaldi, Nuance, Microsoft Azure Speech, Google Cloud Speech-to-text, Amazon Transcribe, Deepgram 5) Conclusion

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## Abstract Archives of the RSNA, 2023

INEE-17

### Improving Workstation Ergonomics and Productivity with Input Devices: Saving Time and Your Wrists

#### Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Discuss the biomechanics and ergonomic factors affecting radiology input devices.- Review common repetitive stress injuries experienced by radiologists caused by input device use.- Systematic product review with pros and cons of popular computer mice, dictation devices and non-traditional input devices (named below) in terms of ergonomics, effectiveness and programmability.- Tutorial on how to customize commonly available input devices with recommended profiles.

#### TABLE OF CONTENTS/OUTLINE

Radiologist's productivity and wellness are influenced by tools used to interact with clinical images. Software and hardware can augment efficiency but also have the potential to lead to burnout via poor ergonomics. We review the relevant biomechanics and anatomy involved in using computer mice and dictaphones with review of primary literature and of common repetitive stress injuries experienced by radiologists. We offer alternatives to commonly used input devices (mouse, keyboard, handheld dictaphone) used to review clinical images. We share the factors important in choosing a device (e.g. on-board memory) and the results of a systematic review of devices that could augment radiologists' productivity and improve ergonomics including: A) Pointing Devices:- Gaming mice- Ergonomic mice- Trackballs/Trackpads B) Dictation Devices:- Traditional Nuance PowerMic-style- Wearable headsets- Table-top microphones (e.g. podcasting microphone) C) Non-traditional input devices for example:- Elgato stream deck- Contour ShuttlePro- Contour Roller Mouse Finally, we provide tested templates for the above programmable devices to get a new user started with improving their ergonomics and efficiency in the reading room.

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## Abstract Archives of the RSNA, 2023

INEE-18

### Transforming Radiology with Large Language Models: Opportunities and Challenges

#### TEACHING POINTS

Personalizing Imaging Examinations LLMs can guide patients through imaging procedures based on medical history, including preparation and potential risks. Improving Clinical Documentation LLMs can flag discrepancies and provide decision support, improving accuracy and reducing errors in medical records. Streamlining Insurance Prior Authorization LLMs can assist clinicians in submitting complete prior authorization requests and automating insurance review, reducing manual review time. Increasing Patient Engagement LLMs can convert complex medical information into easily understandable language and provide personalized education, increasing patient engagement. Decreasing Barriers to Access to Healthcare: LLMs can facilitate remote consultations, appointment scheduling, and educational resources, overcoming barriers to healthcare access. Security and Privacy Considerations The use of LLMs in healthcare raises privacy and cybersecurity concerns that must be addressed to protect patient data and comply with laws and regulations.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Large Language Models (LLMs) 2. The Current State of LLMs 3. Compliance and Security 4. Aid in Patient Care 4.1. Personalizing Information for Imaging Examinations 4.2. Decreasing Barriers to Access to Healthcare 4.3. Personalizing Imaging Examinations Resources 4.3. Increasing Patient Engagement 5. Aid in Radiology Workflow 5.1. Automating Routine Tasks (such as appointment scheduling and reminder notifications) 5.2. Facilitating Insurance Prior Authorization 5.3. Improving Clinical Documentation 5.4. Easier EMR Transfer from Different Facility 6. Future Directions 7. Conclusions

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## Abstract Archives of the RSNA, 2023

INEE-19

### Unlocking a New Era in Radiology: Leveraging GPT for Accurate Diagnosis of Diseases

#### Participants

Matheus Fritzen, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understanding the role of ChatGPT in radiologic diagnosis through real-world cases; Evaluating the impact of ChatGPT on hypothesis formulation and diagnostic accuracy; Analyzing ChatGPT's role in providing diagnostic tips and guidance; Assessing the potential of ChatGPT for improved clinical decision-making

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:  
I. Introduction to ChatGPT in Radiologic Diagnosis  
A. Overview of ChatGPT's capabilities  
B. The potential for AI-assisted diagnosis  
II. Case Studies: ChatGPT in Diagnostic Process  
A. Real-world examples of ChatGPT-enhanced diagnoses  
B. Hypothesis formulation and diagnostic accuracy improvements  
III. ChatGPT's Role in Providing Diagnostic Tips and Guidance  
A. Case examples illustrating diagnostic assistance  
B. The impact of ChatGPT on radiologists' decision-making process  
IV. Assessing ChatGPT's Potential for Clinical Decision Support  
A. Evaluation of case study outcomes  
B. Implications for radiology practice  
V. Conclusion  
A. The real-world impact of ChatGPT on radiologic diagnosis  
B. Future advancements and integration in radiology practice  
This abstract presents a series of case studies that demonstrate the practical applications of ChatGPT in radiologic diagnosis, hypothesis formulation, and clinical decision support. The guide provides an in-depth analysis of how ChatGPT can be utilized to enhance diagnostic accuracy, offer diagnostic tips and guidance, and improve clinical decision-making in real-world scenarios. By showcasing the tangible benefits of ChatGPT through these case studies, the presentation aims to highlight the potential of AI-assisted diagnosis in revolutionizing radiology practice.

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## Abstract Archives of the RSNA, 2023

INEE-2

### Anatomy of an Ontology

#### TEACHING POINTS

1. Understand the distinction between a taxonomy and an ontology. 2. Comprehend the need for ontologies in medical reporting and electronic records to support interoperability. 3. Survey the strengths and weaknesses of existing medical ontologies applicable to radiology reporting. 4. Learn about an effort to create an ontology that has evolved from the concept of the now antiquated American College of Radiology's Index of Radiological Diagnoses.

#### TABLE OF CONTENTS/OUTLINE

1. Define what is a taxonomy and what is an ontology. 1a. Illustrate the concepts of CUI, AUI, TUI, and SUI. 2. Demonstrate why an ontology is important for use in radiology reporting. 2a. Illustrate how an ontology is essential for natural language processing and the creation of mineable, structured data. 3. Provide an overview of the major medical ontologies applicable to radiology reporting, including SNOMED, RadLex, ICD-10, FMA, MedDRA, and others. 3a. Show where there are deficiencies in the major ontologies, including knowledge gaps pertinent to diagnostic radiology reporting. 4. Review the original concept of the American College of Radiology's Index of Radiological Diagnoses and how it was used to create teaching files before the existence of desktop computers. 5. Illustrate how a new ontology is being constructed inspired by the Index of Radiological Diagnoses but in a more pragmatic fashion to accommodate interactive multimedia reporting. 5a. Show cross-mappings between this new ontology and existing ontologies. 5b. Demonstrate the importance of incorporating synoptic phrase for use in radiology reporting.

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## Abstract Archives of the RSNA, 2023

INEE-20

### Using a Workflow Engine to Improve Data Retrieval and Curation in Multi-modal Research Studies

#### Participants

Ali Ganjizadeh, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Introduction to workflow concepts and their importance in research studies  
2. Overview of the technologies used in the retrieval system: MongoDB, FastAPI, Camunda and NextJS  
3. Understanding the retrieval system architecture  
3a. A modular data retrieval browser-based program to collect multiple data types from multiple data sources  
3b. Setting up a browser-based user interface to create and execute tasks for each subject to retrieve its data from servers  
4. Handling errors and failures in retrieving data using the workflow engine  
5. Additional steps in the workflow system, such as de-identification and data storage  
6. Conclusion and impact of the workflow system on research studies

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
1a. Overview of workflow systems  
1b. Importance of workflow-based systems in research studies  
2. Technologies Used  
2a. MongoDB  
2b. FastAPI  
2c. NextJS  
2d. Tailwind CSS  
2e. Camunda  
3. Workflow System Architecture  
3a. Overview of the system architecture  
3b. Explanation of the workflow engine  
4. Modular Data Retrieval Program  
4a. Setting up the program to collect multiple data types from multiple sources  
4b. Creating tasks for each subject to retrieve data  
5. Browser-Based User Interface  
5a. Designing a user interface to execute tasks for data retrieval  
5b. Graphical user interface for selecting patients to include in the study  
6. Handling Errors and Failures  
6a. How the workflow engine handles errors and failures in data retrieval  
7. Conclusion and Impact  
7a. Significance of the workflow system in research studies  
7b. Lessons learned from the development and implementation of the system

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## Abstract Archives of the RSNA, 2023

INEE-21

### Use of Chat GPT in Radiology Research

#### Participants

Andrew Benza, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

Andrew Benza, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Highlight unique and generalizable prompts to leverage large language models in research.- Discuss the art of prompt engineering and key phrases to improve outputs.- Demonstrate the variety of functionalities of ChatGPT and Bing AI Search and how it pertains to research.-Discuss the future of research with AI as a supplemental tool.

#### TABLE OF CONTENTS/OUTLINE

1. History of AI.2. New AI systems and their functionalities.3. Prompt engineering and key phrases to leverage ChatGPT.4. Illustrate how ChatGPT can be used throughout the entire research process for example during the following stages: a. Formulate the idea. b. Write an IRB proposal. c. Design a research study. d. Analyze data. e. Interpret results. f. Prepare publication.5. The future of AI and what it means for research/education.

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## Abstract Archives of the RSNA, 2023

INEE-22

### Beyond Writing and Reporting: Opportunities and Challenges of GPT-based Models in Radiology

#### Participants

Jose Maluf, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To learn definitions and basic concepts of generative AI, natural language processing (NLP) and large language models (LLM) applied to healthcare; - To understand the potential impact of generative pre-trained transformer (GPT)-based models in the radiology practice; - To be familiar with some potential applications of GPT-based models in radiology, including image manipulation, report generation, educational support, clinical decision support, and data analysis; - To emphasize the challenges and limitations before implementation of these models in clinical practice, with focus on ethical and regulatory issues.

#### TABLE OF CONTENTS/OUTLINE

Introduction: AI in healthcare Generative AI, NLP and LLM: Definitions and Basic Concepts Applications in Radiology Image manipulation and improving Medical writing and reporting Clinical decision support Health insurance and advocacy issues Education Other emerging applications Limitations and Challenges Hallucinations and other common mistakes Privacy, security and other risks on clinical implementation Ethical issues: Transparency, bias and discrimination Regulation Future perspectives: what is next? Take home messages

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## Abstract Archives of the RSNA, 2023

INEE-23

### Artificial Intelligence: Missed steps and a double edge sword

#### Participants

Anisa Chowdhary, MD, Milford, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Radiologists should be vigilant and careful as AI can certainly make incorrect diagnosis or miss the diagnosis in certain case scenarios.
- Radiologists should use AI as a secondary adjunct. AI can underperform in specific subset of patients where a radiologist approach is crucial to avoid any diagnostic error.
- AI will continue to serve as a secondary adjunct rather than an alternative to a radiologist.
- AI can certainly help improve work flow and patient care by looking at flagged cases to do a quick triage of which cases to dictate first.

#### TABLE OF CONTENTS/OUTLINE

- Introduction
- Overview
- Missed diagnosis and missed cases by Artificial intelligence
- Teaching points

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## Abstract Archives of the RSNA, 2023

INEE-24

### How Federated Learning Improves Pancreatic Segmentation Using Three Distributed Training

#### Participants

Chen Shen, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn Federated Learning, a method for learning from several remote datasets without centralized processing.2. To learn a new robust aggregation method for Federated Learning3. To learn the effectiveness of using Federated Learning for pancreatic segmentation.

#### TABLE OF CONTENTS/OUTLINE

Why Federated Learning is useful in healthcare applications?- Distinct from natural images, collecting data from various resources may lead to multiple technical, legal, and privacy issues.- Can produce a model with features from several dispersed sources without requiring the training data to be centralized.Demonstrate the pancreatic segmentation process using Federated Learning.- How does Federated Learning work?- How does the server use FedAvg, a standard aggregation method, to aggregate models from multiple clients?- Introduce a dynamic weight aggregation method to aggregate the model updates properly.A comparison of the pancreatic segmentation performance.- Introduce the datasets and the segmentation models.- Compares the performance of Federated Learning over standalone training on three pancreas datasets.- Compares the effectiveness of dynamic weight aggregation with the original FedAvg algorithm.1. Qualitative evaluation results.2. Quantitative segmentation accuracy to show the Federated Learning and our proposed aggregation method improve the segmentation performance on pancreas.

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## Abstract Archives of the RSNA, 2023

INEE-25

### Achieving Trustworthy Artificial Intelligence in Clinical Applications: A Comprehensive Review of Key Concepts and Solutions in Medical Imaging

#### Participants

Pouria Rouzrokh, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In this exhibit, radiologists will learn to: 1) Understand why predictive power doesn't ensure AI models' clinical trustworthiness; 2) name and describe methods to explain AI models, quantify their uncertainty, and detect outlier data for their predictions; 3) analyze the clinical trustworthiness of AI models introduced in scientific studies or commercial products.

#### TABLE OF CONTENTS/OUTLINE

Problem Statement: Is predictive power (e.g., accuracy) all we need?; A review of scenarios where AI fails in clinical deployment. The Triangle of Trustworthiness: Model explainability; Uncertainty quantification; Out-of-distribution detection. Model Explainability: Can we explain the black box of AI models?; A review of interpretation maps (e.g., saliency maps, occlusion sensitivity, integrated maps, etc.) and their use cases; A review of SHAP values and their use cases; Limitations of model explainability. Uncertainty Quantification (UQ): What is vs. what is not model uncertainty?; Where do we expect AI to be uncertain?; UQ methods (Bayesian methods, evidential deep learning methods, posthoc calibration methods); Pros and cons of UQ Methods. Outlier Detection: Out-of-distribution vs. out-of-domain data: what's the difference?; How can outlier data harm your model?; Potential sources of outlier data (covariate drift, dataset drift, concept drift); a review of outlier detection methods (threshold-based, classifier-based, generative AI-based, distance-based, Nearest-neighbor-based); Pros and cons of outlier detection methods. How to shift gears toward trustworthy AI in radiology? Recommendations for AI developers, scientific journals/reviewers, and end-user organizations/radiologists.

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## Abstract Archives of the RSNA, 2023

INEE-26

### From Pixels to Diagnosis: Unleashing the Power of Generative AI in Radiology

#### Participants

Mostafa Shehata, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand basic concepts of image-based neural networks in radiology. Understand how generative AI models architecture and how they are built and trained on radiological images. Most notable applications of Generative AI in radiology. Impact of Generative AI on radiology practice.

#### TABLE OF CONTENTS/OUTLINE

1- Understand basic concepts of deep learning and image-based neural networks. a) What is deep learning? b) How neural networks train and Backpropagation c) The significance of convolutional neural networks d) Dissection of a basic convolutional neural network architecture  
2- Understand how generative AI models architecture and how they are built and trained on radiological images. a) generator models architectures b) How are generative models trained to create radiology images? c) Emphasis on CycleGan models d) What are diffusion models and their potential in imaging?  
3- Provide examples of current and possible applications of generative AI in abdominal radiology a) Synthesizing CT images from MRI b) Image segmentation c) Image reconstruction from image space  
4- Impact of Generative AI on radiology practice with different applications of generative models in abdominal imaging ( image synthesis from noise, CT synthesis from MRI, image reconstruction, segmentation)

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## Abstract Archives of the RSNA, 2023

INEE-27

### 3D Printing in Pectus Excavatum Surgical Planning

#### Participants

Mikel Garcia, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Pectus excavatum is the most common deformity of the chest wall, characterized by a concave depression of the sternum.-While diagnosis can often be made without imaging, chest radiographs and CT scans can be useful in cases where the diagnosis is uncertain or to assess the severity of the deformity. Haller's index is commonly used in this evaluation. - The Nuss procedure is a minimally invasive technique used to treat pectus excavatum. It involves inserting a metal bar behind the sternum to correct the deformity, with the bar typically being shaped during the operation based on the patient's chest.- By utilizing 3D printing of the patient's chest CT, the bar can be shaped prior to the surgery, which can help decrease the duration of the operation.

#### TABLE OF CONTENTS/OUTLINE

- Imaging of pectus excavatum- Nuss procedure- 3D reconstruction and segmentation- 3D printing- Presurgical planning using a 3D printed model

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## Abstract Archives of the RSNA, 2023

INEE-28

### Promoting Equitable AI in Radiology: Harnessing Open Source Tools for Bias and Fairness Estimation

#### Participants

Vasanth Venugopal, MD, New Delhi, India (*Presenter*) Officer, CARPL.AI Inc

#### TEACHING POINTS

1. Identifying and addressing biases in AI radiology applications is crucial for promoting equitable healthcare and accurate patient outcomes. 2. Open-source tools such as AI Fairness 360, Fairlearn, What-If Tool, and Scikit offer tailored techniques for bias estimation and fairness assessment in radiology. 3. Implementing bias mitigation strategies in AI radiology applications can help reduce disparities in diagnoses and treatment recommendations. 4. Collaborative efforts within the radiology and AI research community are essential for developing robust, up-to-date tools and methodologies. 5. Integrating multiple tools enables comprehensive evaluations across diverse radiological scenarios and patient demographics.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction - Importance of assessing bias and fairness in AI radiology applications  
A. Equitable patient outcomes  
B. Open source tools for evaluation  
II. Variety of Open Source Tools  
A. Comprehensive fairness evaluation  
B. Identification of potential biases  
III. Available Packages for Bias Estimation  
Scikit-fairness/scikit-lego  
IBM Fairness 360  
Aequitas  
Google What-if tool  
PyMetrics  
audit-ai  
Microsoft Fairlearn  
IV. Comparison and integration of tools  
IV. Assessing Fairness Across Multiple Dimensions  
A. Demographic attributes  
B. Clinical attributes  
C. Mitigating disparities in AI radiology systems  
V. Collaboration and Regular Updates  
A. Engaging with the research community  
B. Addressing evolving fairness challenges  
C. Ensuring up-to-date tools and methodologies  
VI. Conclusion - The critical role of open source tools for bias and fairness estimation in radiology AI

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## Abstract Archives of the RSNA, 2023

INEE-29

### Effective Program Management for an Artificial Intelligence Team: Optimizing Performance and Productivity

#### TEACHING POINTS

1. Provide insight on how to effectively build, recruit and manage multidisciplinary teams whose collective goal is to deliver AI solutions to the radiology practice. 2. Share lessons learned from the challenges encountered when trying to optimize an AI program management structure.

#### TABLE OF CONTENTS/OUTLINE

1. Purpose a. Provide requirements for creating an effective program management structure that optimizes team performance and productivity. 2. Building a Radiology AI Team a. Master FTE Plan b. Job Descriptions c. Roles and Responsibilities d. Org Chart e. Governance f. Recruitment g. Training Education 3. Program/Project Management a. Organization b. Methodology i. Hybrid c. Electronic Tools i. Monday.com ii. Azure Dev Ops iii. Microsoft Teams iv. OneNote v. SharePoint d. Quality Management System (QMS) Compliance e. Meeting Structure f. Communication 4. Lessons Learned a. Challenges b. Successes 5. Conclusion a. Building and managing a multidisciplinary team of individuals whose goal is to deliver AI solutions to the radiology practice in a safe and efficient manner requires careful consideration to the overall program management structure and associated tool sets. PDF Upload

\*See attached ppt

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## Abstract Archives of the RSNA, 2023

INEE-3

### Generative AI (Gen AI) Based Electronic Cleansing: Unlocking the Potential of Photon-counting CT Colonography

#### Participants

Rie Tachibana, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Electronic cleansing (EC) plays a crucial role in enhancing the sensitivity of polyp detection during virtual endoscopic fly-through reading in CT colonography (CTC) by subtracting orally tagged residual materials from the images. This exhibit aims to (1) provide insights into recent advances in generative AI (GenAI) based EC for CTC; (2) explore the benefits and potential applications of photon-counting CTC; and (3) present clinical outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Review the history and recent developments in GenAI-based EC for CTC, including the emergence of photon-counting CT technology. 2. How GenAI-based EC works: (2.1) Explain the basic ideas of GenAI; (2.2) Discuss how self-supervised GenAI-based EC differs from traditional EC; (2.3) Explain diffusion-based EC. 3. Photon-counting CT colonography: (3.1) Provide overview of photon-counting CT; (3.2) Discuss advantages and potential applications in CTC; (3.3) Explain Gen AI-based EC for photon-counting CTC. 4. Case studies: (4.1) Compare the image quality and outcomes of various GenAI-based EC techniques in clinical conventional and photon-counting CTC cases; (4.2) Review potential diagnostic challenges.

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## Abstract Archives of the RSNA, 2023

INEE-30

### Take the Right Path: Overview of Artificial Intelligence Guidelines

#### Participants

Carlos Felipe Reyna, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Present the different kinds of guidelines. Describe guidelines for development, application and implementation, and the evaluation of Artificial Intelligence (AI), created to direct and conduct research in a standardized way, avoiding process errors. To evaluate which of these guidelines is more useful for a specific interest.

#### TABLE OF CONTENTS/OUTLINE

Describe and compare such guides in terms of: purpose and format. Which contexts they fit using flowcharts and schematic images.

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## Abstract Archives of the RSNA, 2023

INEE-31

### Federated Learning - Game Changing AI Concept to Train AI without Sending Patient Data Out from Hospitals

#### TEACHING POINTS

(1) To understand the concept of federated learning to address data security and privacy concerns. (2) To learn the application and advantages of federated learning for liver tumor segmentation in hepatic CT. (3) To study the process of the development and performance of federated learning with a patch-wise massive-training artificial neural network (MTANN) model for liver tumor segmentation.

#### TABLE OF CONTENTS/OUTLINE

A. Introduction to Federated Learning - Challenges in acquiring extensive training datasets for a deep learning model from multiple hospitals - Role of federated learning in collaborative learning without sharing data - Issues of federated learning: 1) small local training data, 2) high computational demands, and 3) heavy network loads B. Federated Learning for Tumor Segmentation in Medical Imaging - Overview of federated learning models and their applications to tumor segmentation in medical imaging - Federated learning coupled with MTANN models for addressing the above three issues of the current federated learning C. Clinical Relevance and Performance of Federated Learning for Tumor Segmentation - Ensuring data privacy while achieving accurate tumor segmentation - Performance of federated learning for tumor segmentation - Comparisons with the current-state-of-the art model and "gold-standard" centralized training model

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## Abstract Archives of the RSNA, 2023

INEE-32

### Use of Generative AI for Non-interpretative Tasks in Radiology

#### Participants

Vinit Baliyan, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To provide an overview of the current state-of-the-art in generative artificial intelligence (AI) and its applications for non-interpretative tasks in radiology. 2. To showcase examples of how generative AI is being used in radiology today. 3. To highlight the challenges associated with using generative AI in radiology. 4. To touch upon the potential future developments in the field of generative AI and their potential impact on radiology.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Generative AI Key concepts and applications 2. Specific ways in which generative AI can be used used in for non-interpretative tasks in radiology, including: a. Reporting; checking grammar and syntax, generating summary, making reports more readable for non-specialists/patients b. Communication of important findings c. Managing work scheduled. Writing emails 3. Real-world examples of how generative AI has been used to enhance the accuracy and speed of radiological diagnoses 4. Challenges associated with using generative AI in radiology, including Data privacy and security concerns, Ethical considerations, The need for human oversight 5. Potential future developments in the field of generative AI and their potential impact on radiology Conclusion: Overall, the exhibit aims to educate and inform visitors about the latest advances in generative AI and its potential applications in radiology. By providing real-world examples and highlighting the challenges associated with using generative AI in radiology, the exhibit offers an opportunity for visitors to learn about cutting-edge technology that could help improve the efficiency of radiologists, ultimately benefiting patients and medical professionals alike.

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## Abstract Archives of the RSNA, 2023

INEE-33

### R Programming Language Basics for Radiologists

#### TEACHING POINTS

1. Learn how to install R 2. Know how to import and process data 3. Run common statistical tests 4. Explore and understand large datasets better

#### TABLE OF CONTENTS/OUTLINE

The R programming language serves as an invaluable resource for managing and analyzing large datasets effectively and efficiently. As a free and open-source software, R presents a cost-effective solution for performing common statistical tests, crafting visualizations, and even implementing machine learning algorithms. Exhibit Outline: Software installation: -Installing the R programming language-Setting up an Integrated Development Environment (IDE) -Installing essential packagesData import and processing: -File handling and manipulation-Data cleaning and preprocessing -Data transformation and aggregationCommon statistical tests in radiology: Sample code and examples for:- Descriptive statistics -T-test -Analysis of Variance (ANOVA) - Pearson's correlation coefficient -Spearman's rank correlation coefficient -Chi-square test -Logistic regression and more.Large dataset analysis:-Data visualization techniques- Exploratory data analysis (EDA)-Machine learning and predictive modeling-Text mining and natural language processing (NLP)

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## Abstract Archives of the RSNA, 2023

INEE-34

### Leveraging Medical Image Annotation with Practical Annotation Quality Check Tools

#### Participants

Henrique Lee, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Prepare the data for an artificial intelligence (AI) models often involves intensive annotation work to ensure accurate ground truth. However, radiologists who participate in AI projects may lack practical training in annotation, leading to doubts that increase the variability of annotations. To address this, we developed an automated tool that evaluates bounding box and segmentation annotations and provides feedback to the annotator. The tool uses .json files for bounding box annotations and NifTY files for segmentation annotations, both exported from 3D Slicer. Python scripts compare the locations and categories of findings in the bounding box annotations, as well as the distance and similarity of binary masks in the segmentation annotations with those generated by experts. Results are presented in an HTML report. In a pilot study, we used 5 chest radiographs and 2 head CT scans from publicly available datasets (Montgomery and CQ-500) previously annotated by experts. The availability of reports in an introductory AI course for medical radiologists allowed instructors to monitor participants' progress and identify areas for further emphasis.

#### TABLE OF CONTENTS/OUTLINE

Our workflow resulted improved the overall quality of instruction, enhancing the professionalism of the annotations. Annotation tools can increase student engagement and productivity, with teacher supervision facilitating consensus-building and optimizing the laborious task of annotation. Our solution can be applied to various 2D and 3D images studied by radiologists. User-friendly applications that facilitate the teaching of high-quality image annotation are crucial for fostering the development and validation of novel AI models.

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## Abstract Archives of the RSNA, 2023

INEE-35

### Automatic Detection of Contrast Enhancement in T1-weighted Brain MRI Images Using Artificial Intelligence

#### TEACHING POINTS

The purposes of this exhibit are: . Development and validation of a tool for post-contrast enhancement detection in T1-weighted MRI images.. Implementation of this tool in the clinical routine of the radiology and diagnostic imaging service of Clinical Hospital of Ribeirao Preto.

#### TABLE OF CONTENTS/OUTLINE

The use of magnetic resonance imaging (MRI) in medical practice is extensive and encompasses the diagnosis of multiple conditions such as neoplasms, infections, inflammatory diseases, among others. In these contexts, the analysis of post-contrast enhancement is essential. The detection and quantification of enhancement in T1-weighted cerebral MRI images is a challenging task due to the complexity of the images and the variability in the appearance of contrast enhancement. Artificial intelligence (AI) techniques have the potential to improve the efficiency and accuracy of this process, but the development and evaluation of AI-based approaches for this purpose is a laborious task.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

INEE-36

### A Practical Primer on the Radiomics Quality Score: How to Interpret the Results of Radiomics Studies

#### Participants

Mohammad Mirza-aghazadeh-Attari, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiomics quality scores are used to assess the quality of radiomics studies and are based on a set of criteria related to study design, image acquisition, segmentation, feature extraction, and statistical analysis. The purpose of a radiomics quality score is to provide a standardized method for evaluating the quality of radiomics studies and to aid in the interpretation and comparison of study results. Interpreting a radiomics quality score involves understanding the specific criteria used to evaluate the study and the scoring system employed. Typically, a higher score indicates a higher quality study that is more likely to produce reliable and reproducible results. It is important to note that a radiomics quality score is just one factor to consider when evaluating the results of a radiomics study. Other factors such as sample size, patient demographics, and clinical relevance of the results should also be taken into account. Ultimately, the interpretation of radiomics study results should be made in the context of the specific clinical question being addressed and in consultation with a radiologist or other medical expert. Here we present a step by step approach to understanding and applying the RQS.

#### TABLE OF CONTENTS/OUTLINE

1- Radiomics Quality Score: A short introduction on its History 2- Methodologic considerations covered in RQS: - 2.1 Extraction of features -2.2 Development of predictive models and classifiers - 2.3 Performance evaluation of models - 2.4 Utility considerations 3- Reporting RQS results 4-Applications of RQS in clinical practice and research 5-Prospectives to enhancing RQS: RQS V2 6- useful tools

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

INEE-37

### **From Models to Masks, Barriers to Roadblocks, Posters to Presentations: Experience in Forming Cross Institutional Collaborations for Artificial Intelligence Research**

#### **Participants**

Nader Refai, MD,BS, Dearborn, MI (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review of key collaborations necessary for AI related research.2. Review of potential roadblocks and barriers during project creation and execution.3. Infrastructure considerations needed for a successful project.

#### **TABLE OF CONTENTS/OUTLINE**

-Review of key collaborations which facilitate AI research--Domain Experts---Subspeciality radiologist involvement---Trainee involvement (resident/medical student)--AI Expertise---Programmers, data scientists--IT support--Graduate Students-Potential Roadblocks and Barriers--IRB and Data use agreements--DICOM de-identification at scale--De-identified DICOM storage--Image transfer between institutions--EHR data extraction at scale-Infrastructure considerations needed for a successful project.--Image or Data labeling---Example of open-source solutions for DICOM labeling/masking--GPU processing for model creation and testing--Project Management-Conclusion/Summary

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## Abstract Archives of the RSNA, 2023

INEE-38

### Imaging Feature as a Function: A Novel Radiomics Framework

#### Participants

Nicolo Gennaro, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiomic features exhibit functional correlation with tumor size. Large datasets of pre-treatment scans of liver metastasis can uncover the functional association between tumor size and heterogeneity, providing potential insights into tumor growth and treatment. Harmonization allows to remove scanner-associated effects while preserving cancer-specific functional dependence. Texture features show functional size-dependence that allow to generate delta-radiomics data by utilizing post-treatment imaging data only.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Size measurement is a critical task for radiology and represents the pillar of response assessment to antitumor therapies. Size-dependence of radiomic features: We illustrate why radiomics features are affected by tumor size and how radiomic features might not be comparable even within ROIs of the same tumor but manually delineated by different operators. Harmonization in radiomics: The importance of feature harmonization to remove scanner-related biases and preserve size-dependence. Response Assessment: How size-dependence of texture features can be exploited to obtain delta-radiomics without baseline imaging.

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## Abstract Archives of the RSNA, 2023

INEE-39

### The Comprehensive Open Federated Ecosystem (COFE): Enabling Impactful Healthcare Studies

#### Participants

Sarthak Pati, MSc, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

There is a growing body of literature offering evidence of the potential impact that artificial intelligence (AI) methods can have on healthcare. To ensure robustness evaluate generalizability of AI methods, ample diverse multi-site patient datasets are desired. However, there are various factors that hinder access to such data in the current paradigm of multi-site collaborations, which include the tedious bureaucratic processes, data ownership concerns, legal considerations reflected in patient privacy regulations. To tackle these issues, we introduce the community-driven Comprehensive Open Federated Ecosystem (COFE), which includes multiple open-source software tools to make distributed healthcare AI more accessible by leveraging zero/low code principles to get models to learn across data silos using Federated Learning (FL), to evaluate their performance on diverse datasets that they were not used to train with using Federated Evaluation (FE). The goals of the exhibit are to: broaden the understanding of the general community regarding FL FE, showcase how a user can leverage FL to train a model across various sites, present results of the first real-world federation across 71 collaborating sites, focusing on brain tumors, discuss privacy data protection concerns how COFE hopes to solve it, showcase how a user can leverage FE to generate generalizable statistics for AI methods.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will present a community-driven open-source ecosystem to train evaluate AI models across multiple clinical sites in a data-private paradigm. Specific principles to protect data privacy will be described, along with common pitfalls to avoid when performing FL-based studies.

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## Abstract Archives of the RSNA, 2023

INEE-4

### **Data Curation in Minutes not Days: Efficient Large Scale Dataset Preparation for Machine Learning Applications in Kaapana**

#### **TEACHING POINTS**

In the era of rapidly growing medical imaging datasets and federated learning, efficient management and processing of medical images is crucial. Current medical image viewers, however, lack the capability for large-scale dataset curation. To address this, we introduce a data curation tool integrated into the Kaapana open-source framework, designed to streamline organization, management, and processing of extensive medical imaging datasets. Radiologists can easily filter for metadata, annotate and structure datasets, visualize dataset distributions, and quickly inspect individual studies. State-of-the-art machine learning algorithms, such as body part regression, nnUNet, and TotalSegmentator, can be applied to automatically annotate studies based on algorithm outcomes, which can accelerate the curation workflow by allowing filtering for specific organs, bone structures and body parts. This tool fosters collaboration between multidisciplinary teams, with machine learning researchers creating algorithms to support radiologists, who in turn annotate and curate the data. In conclusion, the proposed tool offers an intuitive interface for radiologists to efficiently curate datasets for use in machine learning algorithms.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Data Curation Tool 2.1. Features 2.2. Metadata Annotation 2.3. Structuring Visualization 3. ML Algorithm Integrations 4. Conclusion Future Directions

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## Abstract Archives of the RSNA, 2023

INEE-40

### Beyond the Hype: The Power of GANs in Restoring MRI Texture

#### Participants

Kensuke Umehara, PhD, Chiba, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Generative adversarial networks (GANs) are one of the deep learning-based image generation models that have been widely used in medical imaging research, such as modality conversion and data augmentation. However, their application in diagnostic imaging is still met with resistance due to the perception that "GANs easily generate fake images." On the other hand, it is not widely known that with proper model selection and training, GANs can be a useful tool for generating high-quality images from low-quality ones. The teaching points of this exhibit are to 1) provide an overview of GANs using supervised learning, 2) showcase the application of one of the representative supervised GANs, super-resolution GAN, to MRI images, achieving high-quality imaging while enabling short-time imaging, and 3) demonstrate the high-accuracy restoration of the texture of MRI images by applying super-resolution GAN.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Super-resolution GAN for Accelerating MRI 3. Radiomics Analysis 4. Clinical Showcases

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## Abstract Archives of the RSNA, 2023

INEE-41

### Accelerating Machine Learning for Medical Imaging by Integrating AIM and AI Federated Learning into Clinical Workflow

#### Participants

Pattanasak Mongkolwat, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The incorporation of Annotation and Image Markup (AIM) and AI Federated Learning (FL) framework into an imaging workflow can expedite the creation of deep neural network models without compromising the confidentiality and sharing of imaging data. Furthermore, this integration can standardize the creation of annotations for supervised or semi-supervised deep learning approaches in annotated images. 2. Integrating an AIM image annotation tool into clinical workflows can speed up the process of creating annotated images based on an AIM template. The user wants to make simple and constrained annotations. The annotation results can be stored as an AIM XML document, JSON object, or DICOM SR PS3.21 object. Combining the AIM information with corresponding image can facilitate the development and training of multimodal deep learning models. 3. The proposed software tools in this framework simplify the setup and usage of FL and enable the creation of standardized annotations, allowing radiologists and AI researchers to focus on data quality and deep learning model development.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of AIM, AI Federated Learning, and Multimodal Deep Learning 2. Imaging Workflow Architecture and Tools: modified ePAD, Fuji Synapse (example integration), DICOM anonymizer, Mini-PACS, AIM database, AI image inference, cohort creator, image and AIM staging location, Cohort worklist, DICOM reader, AIM transform, FL Web Admin Management, web-based AIM template builder. 3. Framework and Software Tool Requirements 4. Installation and Configuration Guide for Participating Institutions 5. Preparing Your DL Model and Data for AI Training 6. Live and Video Demonstration of the Installed Environments

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## Abstract Archives of the RSNA, 2023

INEE-42

### AI-assisted Decision Making for Prostate Cancer Diagnosis

#### TEACHING POINTS

The interpretation of prostate multiparametric MRI is challenging. Up to 30% of clinically significant cancers (PCa) are missed even by expert, and there is large inter-reader variation. Artificial intelligence (AI) shows promise in diagnosing PCa using MR images. To leverage the power of AI, it is crucial to determine if AI can assist radiologists in the diagnostic process and if radiology trainees can learn from AI-generated insights. We trained a state-of-the-art AI model (nnUnet) on a large-scale MRI dataset for PCa diagnosis. We have developed a web-based system for interactive and learning resources, incorporating the AI. This system assists radiologists in PCa diagnosis by providing AI-generated predictions (lesion maps). With this information at their disposal, radiologists make their own predictions and annotations using our web application. We will compare the diagnostic performance of human-only, AI-only, and human+AI. We will also examine the interaction between radiologists and AI to inform better teaching processes. Ultimately, we hope the tool will improve radiologists diagnostic performance and patient outcomes by leveraging the power of AI.

#### TABLE OF CONTENTS/OUTLINE

Preliminary teaching results on simple AI assisted reader tasks. An AI model (nnUnet) trained on PI-CAI dataset: mpMRI images - T2W, DWI/ADC, DCE for human-only reader performance (we random sampled 80 cases for testing purposes). AI-assisted decision making: AI predicted lesion maps. Annotation tool: radiologists annotate prostate cancer with AI assistance at their disposal. Assessment: the performance of human-only, AI-only, and human+AI will be analyzed to generate insights to improve the task performance and teaching.

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## Abstract Archives of the RSNA, 2023

INEE-43

### Harnessing AI for Improved Workflow in Radiology: Beyond Image Analysis

#### Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

AI can be employed in numerous aspects of the radiology exam's electronic roundtrip, extending beyond image interpretation. This technology holds the potential to increase efficiency, reduce unnecessary scans, improve image quality and patient safety, and expedite the interpretation process. AI assisted reporting has tremendous potential to enhance practice and efficiency. By leveraging AI in these areas, healthcare professionals can save time and resources while enhancing the overall quality of patient care.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction  
2) AI Applications Prior to Image Acquisition • Scan Ordering Optimization • Pre-exam Screening • Protocoling • Scheduling  
3) AI Applications During Image Acquisition • Patient Positioning • Contrast and Radiation Dosimetry • Scan Time Reduction • Image Reconstruction and Postprocessing  
4) AI Applications Following Image Acquisition • Worklist Prioritization • Urgent Finding Notification • Hanging Protocol Optimization • Assisted Reporting  
a) Next generation reporting  
b) AI-generated preliminary reporting  
5) Other Applications • Resident Education • Quality Assurance and Patient Safety • Billing and Compliance  
6) Conclusion

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## Abstract Archives of the RSNA, 2023

INEE-44

### Designing and Implementing a DICOM Collector for Analytics, Quality Improvement, and Regulatory Compliance

#### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Understand the magnitude of DICOM data and architecture necessary to handle such large volumes, 2) Describe the utility that can be derived from DICOM data through additional applications, 3) Understand the pitfalls of naively scraping data without expert input

#### TABLE OF CONTENTS/OUTLINE

1) What are you collecting and why?, 2) How much data are we talking about?, 3) what kind of architecture do you need?, 4) You collected it, now what do you do with it? (applications), 5) Why is a team necessary for what database - seems like a summer project for a graduate computer science student?, 6) Does use justify the effort expended?

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## Abstract Archives of the RSNA, 2023

INEE-45

### NCI Imaging Data Commons: Towards Transparency and Reproducibility in Imaging AI

#### Participants

Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

NCI Imaging Data Commons (IDC) is a cloud-based repository of publicly available cancer imaging data co-located with analysis and exploration tools and resources. IDC, part of the NCI Cancer Research Data Commons (CRDC), provides secure access to a large, comprehensive, and expanding collection of cancer research data. IDC uses a combination of commercially available (Google Cloud Platform (GCP), Amazon Web Services (AWS)) and open source components. The IDC portal (<https://imaging.datacommons.cancer.gov>) and SQL interface enable exploration and visualization of data and cohort building. As of Spring 2023, IDC hosts over 40 TB of radiology and digital pathology image data encoded using the DICOM standard, and available in both GCP and AWS. While the IDC is intended for cloud-based data processing, data can be freely downloaded for on-premise analysis. Cloud-based workflows enable reproducible analysis and results. We will present the scope and status of IDC (e.g., new datasets and features), learning resources (e.g., interactive notebooks with reproducible AI workflows applied to the data within IDC), use cases (including those demonstrating large scale time- and cost-efficient analysis workflows) and plans for future development, along with live interactive demonstrations.

#### TABLE OF CONTENTS/OUTLINE

Overview of CRDC and IDC; Data curation and the role of The Cancer Imaging Archive; Portal; Viewer; Organization of data; Integration of tools; Use case development; Documentation and user support resources; Large scale computing using CRDC Cloud Resources; IDC cloud credit program; Status update and plans for future development.

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## Abstract Archives of the RSNA, 2023

INEE-46

### Image-to-text and Text-to-image Models: A Primer for Radiologists

#### Participants

An Ni Wu, MD, Gatineau, QC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review key concepts of neural network models connecting text and images; 2. Discuss potential applications of image-to-text and text-to-image models in medical imaging; 3. Illustrate key components involved in zero-shot prediction models; 4. Understand the overall design and architectures of text-to-image models; 5. Discuss future directions applicable in radiology.

#### TABLE OF CONTENTS/OUTLINE

1. Trend: groundbreaking emergence of neural network models connecting text and images. 2. Relevance for radiology: a discipline connecting text reports with medical images. 3. Illustration of key components involved in zero-shot prediction models: text vectorization, image vectorization, vector-space, attribute predictions, image attribute mapping, text classifier, and zero-shot prediction. 4. Illustration of recent models connecting image to text (i.e., CLIP) and text to images (i.e., DALL-E, Stable Diffusion, Imagen). 5. Architecture of CLIP and key messages: convolutional neural networks for text and image encoding, dataset classifier creation, zero-shot prediction model, transfer learning, natural language supervision, generalization, efficiency, flexibility, and limitations. 6. Applications of text-to-image models in radiology: image classification, automated caption generation, synthetic image generation. 7. Future directions: new applications in radiology and technical innovations.

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## Abstract Archives of the RSNA, 2023

INEE-47

### Rapid Clinical Deployment of AI Applications for Radiology Using Mercure - An Open Source DICOM Orchestration Platform

#### Participants

James O'Callaghan, PhD, MEng, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this presentation is to inform the audience of available open-source software that can be used to rapidly integrate Radiology Artificial Intelligence (AI) applications into their clinical infrastructure. We will outline the need for software tools to address practical challenges in translating medical imaging research techniques into real world settings. This will be followed by a description of DICOM orchestrators and how they can help to bridge this gap by handling interactions and requirements of clinical environments. Mercure - an open-source and freely available DICOM orchestrator, will be used to demonstrate how attendees can easily integrate AI applications into their clinical workflow using an intuitive web-based user interface. MONAI (Medical Open Network for Artificial Intelligence) is a popular open-source framework for medical imaging AI. In the concluding section, we will give guidance on how MONAI can be used with Mercure to deploy AI applications for Radiology in a rapid and standardized manner.

#### TABLE OF CONTENTS/OUTLINE

1. The increasing demand for Artificial Intelligence in Radiology 2. Challenges in clinical translation of AI 3. Integration of AI applications into clinical environments using Mercure 4. Standardization and rapid deployment of AI applications

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## Abstract Archives of the RSNA, 2023

INEE-48

### AI Adoption in Clinical Practice: A Practical Guide for the Practicing Radiologist

#### Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- There is an increasing number of commercial AI algorithms. However, the actual value and useability of these algorithms requires more than evaluation of diagnostic performance metrics alone.
- We will review and provide practical suggestions for radiologists to use when evaluating AI software for their clinical practice.
- We will discuss important practical barriers that should be considered in order to properly assess useability and seamless integration into radiological practice.
- We will discuss pitfalls and opportunities for the use of AI to enhance clinical practice, including efficiency.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Discuss basic diagnostic metrics, relevance, and why diagnostic performance alone will not ensure impactful adoption 3. Importance of seamless workflow integration and avoiding pitfalls a. Time to image processing and transfer to viewer b. Pitfalls for algorithms requiring expert-viewer interactions c. AI data transfer and reporting module 4. Importance of seamless workflow integration: Opportunities a. Review increasing number of report augmentation and semi-automated reporting tools providing opportunities for reporting efficiency b. Future areas of efficiency improvement 5. Algorithm testing and deployment challenges and opportunities 6. Non-interpretive AI applications 7. Conclusions

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## Abstract Archives of the RSNA, 2023

INEE-49

### Prompting Language Models 101: A Primer for Radiologists

#### Participants

Bardia Khosravi, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Large language model (LLMs) inception was four years ago; however, the advent of ChatGPT provides a unique user experience, showcasing the power of LLMs. Although the chat interface is exceedingly helpful, some nuances exist in creating a correctly structured prompt for a better answer, with less back and forth. This exhibit will cover three main points: 1. Introduction to Language Models 2. The Importance of Prompting 3. Popular Prompting Strategies

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Language Models: This section covers large language model basics. What makes them a significant breakthrough in the natural language processing domain? We will focus on some of the applications of LLMs in radiology, specifically in report structuring. 2. The Importance of Prompting: The chat interface of LLMs, like ChatGPT, can cover many personal use cases. On the contrary, this interface may not be helpful for automated information extraction. Additionally, using open source LLMs (as an alternative to ChatGPT, which requires sending data outside of the institution), requires proper prompting to guide the LLM to output the desired results with only one question asked. 3. Popular Prompting Strategies: This section will cover three main prompting strategies: (a) zero-shot prompting, (b) few-shot prompting, (c) chain-of-thought prompting. We use the example of abstracting cervical vertebral fractures from radiology reports. We will provide examples of the model's output based on each prompt to give a better understanding of the importance of prompt engineering.

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## Abstract Archives of the RSNA, 2023

INEE-5

### Explainable Artificial Intelligence (XAI) in Computer Vision Explained for the Radiologist

#### Participants

Adarsh Ghosh, MD,MBBS, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Computer vision applications use deep neural networks composed of multiple convolutional layers. The radiological images pass through these layers, and the complex interrelationships are incomprehensible. The resultant algorithm's black-box nature impairs understanding of its decision. 2. Deep learning algorithms address both mundane and critical medical problems. The black-box nature of deep learning algorithms is more problematic in high-stakes situations, such as decisions resulting in patient surgery or intervention. 3. Several approaches are available to develop explainable AI models. Each approach has specific limitations, advantages, and applicability.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Models with high accuracy may be less transparent: The story of Clever Hans Explainable AI (XAI): What is explainable AI and how is it classified. Importance of XAI in radiology XAI methods: The methods available to explain an algorithm's output and their limitations. Visual Explanations (saliency maps) Back propagation-based approach Perturbation-based approach Text explanations Example-based explanations The limitations of XAI: Additional computing costs. Interpreting interpretable AI

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## Abstract Archives of the RSNA, 2023

INEE-50

### Further Possibilities of Deep Learning in the Ultrasound Field

#### TEACHING POINTS

In recent years, deep learning technology has become a necessity in the medical field. These technologies have been widely used in mammography, CT, and MRI in clinical applications. In the ultrasound field, a wide range of techniques using deep learning, such as noise reduction and automated detection, have been reported. However, it is clear that deep learning is still in its developing stage compared to other modalities. Why is this? The purpose of this exhibition is to describe the current situation, challenges, and future possibilities of deep learning applications in the ultrasound field. As an example of research using deep learning, we will go into deep learning in the ultrasound field from our research on carotid plaque region extraction and composition differentiation using ultrasound images. The major teaching points of this exhibit are: 1. Introduction of research on deep learning in the ultrasound field 2. Current situation and challenges of deep learning in the ultrasound field 3. Future possibilities with deep learning

#### TABLE OF CONTENTS/OUTLINE

1. Current situation of AI application to the ultrasound field -Noise Reduction -Segmentation -Classification 2. Introduction of our study 3. Potential AI applications in the ultrasound field

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## Abstract Archives of the RSNA, 2023

INEE-51

### How Nationwide Medical Image Database and AI-based Image and Finding-text Analysis Work for Nationwide Disease Spread Surveillance: Three years of experience on CT Image-based COVID-19 Monitoring

#### Participants

Kensaku Mori, PhD, Nagoya, Japan (*Presenter*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation

#### TEACHING POINTS

- To understand how nation-wide medical image database works for nationwide disease surveillance using AI-based medical image and finding-text analysis- To understand how national medical image database collects medical images from participating hospitals- To understand how AI analyzes national medical image database on a cloud computing platform- To understand what kind of data are stored on national medical image database- To understand how COVID-19 infection spread monitoring are performed on national medical image database

#### TABLE OF CONTENTS/OUTLINE

National medical image database- National Institute of Informatics, Japan, hosts the National Medical Image Database (NII-MID).- Participating hospitals automate daily image transfers to NII-MID.- AI-image and findings-text analyses are performed on incoming medical images.- Daily analysis utilizes AI-based methods.COVID-19 surveillance using CT images- AI -based (Convolutional Neural Network) analysis of CT images following RSNA COVID-19 CT scan classification guideline for images sent to NII-MID.- Automated data selection of CT images for analysis from NII-MID, using findings-texts.- COVID-19-related word analysis from findings-texts.- Calculation of daily COVID-19 suspicious image rates from data transfers.- Three years of experience monitoring COVID-19 cases through NII-MID.- Demonstrating the relationship between COVID-19 suspicious CT image rates and the daily number of COVID-19 related deaths.Future outlook- Expanding the functionality of NII-MID as a nationwide disease monitoring tool.- Broadening the scope of AI-based analysis targets.- Preparing for the prediction of the next unknown pandemic.

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## Abstract Archives of the RSNA, 2023

INEE-52

### Advanced and Versatile AI System for 3D Medical Image Super-resolution

#### Participants

Tong Zheng, Nagoya, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Gain an understanding of the concept of super-resolution (SR) and the differences between SR in RGB color images and medical images. 2. Identify the main challenges involved in performing SR on medical images. 3. Learn about a specialized AI system designed to overcome these challenges in medical image SR. 4. Explore the exceptional performance of our SR AI on two medical image datasets and its potential in aiding radiologists' diagnoses.

#### TABLE OF CONTENTS/OUTLINE

1. AI-based super-resolution (SR): fundamental concepts -SR is a technique that enhances the resolution of an image. -In medical imaging, SR can help radiologists observe precise anatomical structures in low-resolution (LR) images. 2. Challenges of medical image SR -AI for RGB image SR is typically trained using LR-high-resolution (HR) image pairs. - It is difficult to use AI for medical images' SR: LR and HR medical images are often acquired from different devices or scanning conditions. 3. Our specialized AI for medical image SR -We use a real-time registration network to minimize coordinate differences between LR and HR images. -We use a pre-trained generative model to minimize differences in intensity and scanning devices. 4. Two original medical image datasets to validate our SR AI -Dataset-A: micro CT (HR) - clinical CT (LR) dataset. LR-HR images differ in intensity, coordinate, and scanning device. -Dataset-B: Brain MRI dataset. LR-HR images differ in coordinate. 5. Radiologists' diagnostic process is aided by our SR AI - Our AI successfully performed SR on both medical image datasets, making it easier for radiologists to observe precise anatomical structures and make diagnosis. -Statistical analysis showed that our AI outperformed other recent AIs.

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## Abstract Archives of the RSNA, 2023

INEE-53

### Preparing for the (Un)Expected: Preventing Ransomware Attacks Before They Happen

#### TEACHING POINTS

Cyberattacks continue to be one of the toughest problems and biggest threats to have hit the healthcare industry in recent years. When hackers gain entry into a hospital's computer network, not only are the hospital operations, financials and data in jeopardy, but there is a direct threat to patient care and safety. As reported by SOPHOS, 34% of hospitals were hit by ransomware in the last year alone. With many hospitals expanding their digital landscape to include cloud computing, telemedicine and remote work, the vulnerability of being a target of an attack remains a risk. Sky Lakes Medical Center fell victim to a ransomware attack in October 2020. In this session, the director of information systems will discuss how his team was able to successfully recover 650 servers and 150 applications in just four weeks' time. He will share best practices of lessons learned and outline the necessary infrastructure and technology systems to have in place so other organizations can prevent disaster before it happens and ultimately help to reduce the number of ransomware attacks in healthcare.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Ransomware numbers within healthcare 3. Top vulnerabilities within healthcare organizations 4. Necessary informatics, infrastructure, and technologies to have in place 5. Key priorities and step by step on how to recover if it does happen to you 6. Conclusion

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## Abstract Archives of the RSNA, 2023

INEE-54

### Collaborative Development of a PACS-Integrated Quality Control Dashboard : A Single Institutional Experience

#### Participants

Vijaya Kosaraju, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Designing and implementing a Technologist Quality assessment (Tech QA) dashboard that is integrated with PACS (2) Determine the appropriate QA metrics over a period of time to set up the baseline and target areas for improvement (3) Design a way to deploy the right interventions and measure the resulting response (4) Analyze the intervention response to measure improvement over baseline as a way to improve patient care and radiologist satisfaction.

#### TABLE OF CONTENTS/OUTLINE

(1) Introduction to Tech QA (2) How we did it over time (3) Developing the current PACS integrated QA system (4) Challenges associated with implementation and deployment a) Challenges in the backend b) Challenges to educate radiologists and technologists c) Make an efficient path for review of the QAs d) Design a closed feedback loop for efficient processing (5) Initial results of the Tech QA process (6) Interventions deployed as a result of baseline metrics (7) Analyzing the results of the interventions (8) Conclusion (9) Future goals

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## Abstract Archives of the RSNA, 2023

INEE-55

### Programmatically Generating Radiology Report Fields to Facilitate Structured Reporting Utilizing RadElements.org

#### Participants

Andrew Gomella, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-A significant barrier to adoption of structured reporting and use of standardized data elements is the need for each element/concept to be manually created within individual institution's production reporting software-The ability to programmatically create complex report fields and templates helps reduce the barrier to entry-With a relatively short python script the entirety of the RSNA/ACR RadElement.org common data element library can be converted to Powerscribe macros, which can be dragged-and-dropped into reports or batch loaded into the dictation system for department wide use

#### TABLE OF CONTENTS/OUTLINE

1. Motivation for creating a programmatic interface for generating radiology report fields and reports
2. Reverse engineering the structure of a standard radiology report file (from Powerscribe)
3. Approach to generating the report fields and templates in python utilizing XML (Extensible Markup Language) and raw text functions
4. Generating autotext snippets for use in reports from RSNA's radelement.org
5. Demo of drag and drop functionality adding rad elements or rad element sets to a report template

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## Abstract Archives of the RSNA, 2023

INEE-56

### How Graph Neural Network Works for Automated Nomenclature of Abdominal Blood Vessels

#### Participants

Kensaku Mori, PhD, Nagoya, Japan (*Presenter*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation

#### TEACHING POINTS

- To understand what is graph convolutional network (GCN)- To understand how GCN is applied for vasculature nomenclature- To understand automated nomenclature performance by GCN- To understand anatomical annotation for 3D blood vessel regions by GCN-based automated nomenclature

#### TABLE OF CONTENTS/OUTLINE

Introduction- The importance of automated vasculature nomenclature as a key function in future CAD systems.- Enhancing CT image reading workflow with automated vasculature nomenclature.- Overview of abdominal vasculature systems and their anatomical names.Spectral based graph convolution and graph convolutional network- Review of the theoretical aspects of Graph Convolutional Networks (GCN).-Review of spectral-based graph convolution operations in GCN and their computer implementation.How to apply GCN for automated nomenclature of abdominal blood vessels- Extracting blood vessel tree structures from CT images.- Feature extraction from tree structure.- GCN training methodology.- Automated nomenclature using GCN.Experiments- Configuration of training data.- Annotation of training data.- Evaluating nomenclature performance.- Automated annotation of 3D-rendered blood vessels based on automated nomenclature.- Performance changes for different convolutional areas.Discussion- Limitations of GNN-based automated nomenclature for blood vessels.- Enhancing radiological and surgical readings of CT images with automated nomenclature.- The effectiveness of automated nomenclature in constructing symbolic logic-based CAD systems.

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## Abstract Archives of the RSNA, 2023

INEE-6

### Designing a Radiomics study: Hurdles and Pitfalls

#### Participants

Adarsh Ghosh, MD,MBBS, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiomic studies are complex, requiring a unique trial design, data preparation, informatics tools, and infrastructure. 2. Radiomic studies are often designed to be hypothesis-generating rather than to answer a hypothesis. This difference in study design requires researchers to identify key comparative data such as patient outcome or histologic diagnosis before the study begins. 3. Because radiomics is still a nascent field of imaging research, there are unique challenges and potential pitfalls at every step of the research process.

#### TABLE OF CONTENTS/OUTLINE

Radiomics 101 Tools needed to perform a radiomics study Steps of a radiomics study Asking the right questions: -- Is there clinical value? -- Finding the right comparative measure Data curation: the curse and blessing of electronic medical records Imaging data: - - Not all data is created equally: Data Preparation -- Managing multi-institutional data Image segmentation: -- So many circles, so much time -- Managing multiple series Feature extraction: IBSI and open source -- Pyradiomics and more Data modelling: Feature selection and dimensional reduction Data analysis and validation: Finding signal in the noise Common errors in study design and strategies to avoid them: -- Overfitting -- Data leakage -- Data peeking Significance does not equal importance

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

INEE-7

### Fight for Fairness in AI for Medical Imaging

#### TEACHING POINTS

1. To highlight the critical importance of fairness in AI for medical imaging, emphasizing the negative impacts of biased algorithms on patient outcomes. 2. To provide an overview of various evaluation metrics that can be used to assess fairness in AI models, including equality of opportunity and demographic parity, with a particular focus on their application in medical imaging. 3. To introduce debiasing methods such as pre-processing techniques and adversarial training, and discuss their effectiveness in addressing bias in AI models for medical imaging. 4. To encourage ongoing discussion and action to promote fairness and equity in healthcare AI and identify future challenges in this rapidly evolving field.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
1.1. Importance of fairness and bias in AI for medical imaging  
1.2. Brief review of previous studies addressing fairness issues  
2. Definitions of fairness and bias  
2.1. Explanation of fairness and bias  
2.2. Types of bias  
3. Methods to mitigate bias  
3.1. Pre-processing techniques (e.g., data cleaning, re-sampling, feature selection)  
3.2. In-processing techniques (e.g., pruning, contrastive learning, adversarial training)  
3.3. Post-processing techniques (e.g., calibration)  
4. Evaluation metrics for fairness  
4.1. Explanation of evaluation metrics used to assess fairness: demographic parity, equalized odds, and equality of opportunity  
4.2. Advantages and limitations of each metric  
5. Challenges  
5.1. Lack of diversity and representation in healthcare data  
5.2. Technical limitations of current debiasing methods  
5.3. Action to promote fairness and equity in AI for healthcare

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## Abstract Archives of the RSNA, 2023

INEE-8

### Approaches to Writing and Implementing Custom Software as a Trainee at a Large Academic Health Center

#### Participants

Andrew Gomella, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Coding is an increasingly popular and important skill, with more non-career programmers picking up coding skills.- Recently released large language models have decreased the entry barrier for coding by demonstrating the possibility of generating complex software from natural language prompts.- Writing, implementing, and testing code in a health system presents unique barriers and challenges, but it is possible even as a trainee.- Significant variation in practice/hospital IT infrastructure, security policies, and the suite of radiology/EHR combinations unfortunately limits cross-institutional development of software.- The software approach, including whether to use a specific language, how to distribute to colleagues, and attention to IT security, depends on the specific problem at hand and can range from surprisingly trivial to prohibitively complex.

#### TABLE OF CONTENTS/OUTLINE

- Motivation- A general approach to tackling software ideas, from feasibility to production- Is there an API(Application Programming Interface)? and what can be done if there isn't?- Institutional variation in IT and software suites, and why it matters- Security considerations- Low code solutions: Example of a program that can be completely run within our hospital infrastructure without any installation or 'writing' code.- Scripting solutions: Example of AutoHotKey scripts including a few line solutions, to dynamically modify open radiology report text.- Python: Swiss army knife, with limitless possibilities and vast online community- Browser plugins: Example of a Chrome plugin used to add features to intranet web pages.- PACS and EHR plugins

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## Abstract Archives of the RSNA, 2023

INEE-9

### Maximizing Generative AI's Potential in Radiology: Fine-Tuning and Prompt Engineering

#### Participants

Theodore Kim, Washington, DC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- ChatGPT and other generative AI tools have the potential to play significant roles in education, research and clinical practice for diagnostic radiology- One way to maximize their use and potential is by focusing on improving the quality of its output through the processes of fine-tuning and prompt engineering- Fine-tuning is the process of training a pre-trained model on a smaller, task-specific datasets to improve its performance on that task. For example, training a model with specific terminology and recommendations associated with updated Fleischner criteria to guide management of pulmonary nodules on a model already trained on a larger dataset of radiologic imaging- Prompt engineering focuses on designing and refining input queries to obtain the most accurate and relevant desired output. These methods can include using radiology-specific terminology, providing necessary medical context, crafting precise prompts with specific constraints, and using iterative processes to identify and develop the most effective prompt structures.

#### TABLE OF CONTENTS/OUTLINE

1. Principles of Fine Tuning  
2. Commonly used Algorithms for Fine Tuning  
3. Fine Tuning in ChatGPT  
4. Principles of Prompt Engineering  
5. Prompt Engineering in ChatGPT

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

IREE

### Interventional Radiology Education Exhibits

#### Sub-Events

#### **IREE-1 Pre-operative Osseous Tumor Embolization: A Review of Presentation, Benefits, and Technical Details**

##### Participants

Ashini Patel, MBA, BS, Davie, FL (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Preoperative tumor embolization is a safe and effective adjunctive to tumor resection that has benefits including decreased estimated blood loss, and less complications. 2. There are only few contraindications to pre-operative embolizations, and most patients that undergo the procedure will benefit for later tumor resection. 3. Importance of tumor feeding arteries. 4. It is valuable to consider all patients with suspected hypervascular osseous for preoperative tumor angiography and embolization.

##### TABLE OF CONTENTS/OUTLINE

1. A review on osseous tumors, their typical management and how preoperative embolization can improve outcomes. 2. Selection of patients that would benefit from this procedure before tumor resection. 3. Review of example cases outlining the technical details of the embolization procedure, to include devices used and the importance of tumor feeding arteries. 4. Analyze the efficacy and safety of pre-operative embolization and its value in decreased estimated blood loss and transfusion need, and complications. Compare this data to surgical resection without embolization.

#### **IREE-10 To Sclerose or Decompress? Comparing BRTO and TIPS for Gastric Variceal Management**

##### TEACHING POINTS

Objectives\* Understand gastric variceal (GV) anatomy\* Identify indications and contraindications for BRTO and TIPS\* List conventional and alternative procedure steps\* Recognize common and rare intra- and post-procedural complications

##### TABLE OF CONTENTS/OUTLINE

Outline: 1. Introduction (epidemiology, mortality) 2. Anatomy: \* Location (GOV and IGV classification) \* Afferent/efferent anatomy (Kiyosue classification) \* Uphill/downhill drainage patterns 3. Indications: \* Variceal bleeding (active or prophylaxis) \* BRTO: HCC, refractory HE, preserving liver function \* TIPS: Portal HTN with  $\geq 12$  mmHg 4. Contraindications: \* BRTO: Portal/splenic vein thrombosis, refractory ascites, uncontrolled EV, absent gastroduodenal shunt, severe portal HTN \* TIPS: HE, Child-Pugh C, CHF, pulmonary HTN, cystic liver disease 5. Procedural Steps: \* BRTO (including both conventional approaches as well as modified approaches, including CARTO and PARTO) \* TIPS (including CO<sub>2</sub> venography, portography, various vascular approaches, and embolization) 6. Complications: BRTO: \* Intra-procedural: sclerosant extravasation, balloon rupture, premature balloon deflation \* Post-procedural: ARF, hemolysis, cardiogenic shock, pulmonary edema, DIC, PE, portal/splenic/renal vein thrombosis, adrenal infarct TIPS: \* Intra-procedural: Liver capsule/parenchyma/biliary injury, PV rupture, arrhythmias \* Post-procedural: HE, hepatic failure, TIPS migration/dysfunction, infection

#### **IREE-11 Microwave Ablation of the Liver Lesions in Critical Locations: Are there No-No Zones**

##### Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Thermal ablation is the mainstay of treatment for small hepatic tumors (<2 cm). Thermal ablation may not be preferred in these patients if the tumors are in high-risk locations, however. These high-risk locations include, but are not limited to, tumors adjacent to the main portal vein, the inferior vena cava, the gall bladder, the diaphragm, and the heart. 2. By discussing the literature and showing cases of successful microwave ablation of tumors in high-risk locations, we show that MWA can be a safe and effective.

##### TABLE OF CONTENTS/OUTLINE

1. The major differences between radiofrequency ablation and microwave ablation as it pertains to the management of malignancy. 2. Cases of microwave ablation of tumors in high-risk locations and a discussion of the current literature on the safety and efficacy of such procedures. 3. The cases display the ablation of tumors adjacent to the main portal vein, the inferior vena cava, the gall bladder, the diaphragm, and the heart. 4. Technical maneuvers will be described to increase safety and efficacy for the difficult lesions.

#### **IREE-12 Ablation vs Free Life. Colorectal Cancer with Lung Metastases: Evaluation of Local Recurrence and Chemotherapy-free Interval in Patients Treated with Ablative Therapy**

##### Participants

Pedro L. Lino, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

To discuss percutaneous ablation and its role as a safe and effective treatment option for colorectal cancer lung metastases, and the benefits of its minimally invasive nature. To determine patient selection characteristics, preprocedural planning, and tactics involved in a safe and successful outcome, particularly in challenging cases. To examine the impact of ablation (RFA and MWA) on overall survival and chemotherapy-free interval in patients with lung metastases from colorectal cancer.

## TABLE OF CONTENTS/OUTLINE

1.Introduction and epidemiology 2.Procedure applied anatomy 3.RFA treatment techniques a.Patient positioning; b.Tactical pneumothorax; c.Leverage; d.Hydrodissection. 4.Acute complications 5.Evaluation of disease progression

### **IREE-13 Thermal Protection: Heightened Safety for Minimally Invasive Percutaneous Thermal Ablation of Musculoskeletal Tumors**

Participants

Anderanik Tomasian, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Over the past two decades, minimally invasive percutaneous image-guided thermal ablations have been progressively incorporated in the management paradigm of patients with musculoskeletal tumors and endorsed by the National Comprehensive Cancer Network and American College of Radiology. The high clinical success rates and durability of therapeutic effects of such interventions to achieve local tumor control, pain palliation, and cure have been documented in the recent literature. Therefore, safety of musculoskeletal thermal ablations is critical and must be ensured by radiologists in care of patients with bone tumors for improved patient outcomes. To enhance safety and minimize undesired thermal injury to surrounding vital tissues as a result of non-target ablation, several thermal protection strategies have been successfully implemented in clinical practice.

## TABLE OF CONTENTS/OUTLINE

• General considerations • Neuroanatomic considerations • Tissues at risk (Spinal cord, spinal and peripheral nerves, torso organs, articular cartilage, subchondral bone plate/physis, skin) • Thermal protection techniques (Indications and Choice of technique) • Passive thermal protection (Patient Biofeedback and Clinical Assessment, Temperature Monitoring strategies, Neurophysiological Monitoring with somatosensory and motor-evoked potentials, Electrostimulation) Active thermal protection (Thermal Insulation strategies, Thermal Modification techniques) • Thermal Injuries/Complications and their management

### **IREE-14 The Rise of Robotics in Interventional Radiology**

## TEACHING POINTS

• The use of robotics in interventional radiology is an emerging trend following medical technology and engineering developments in recent years. • Robotic-assisted interventional radiology is beginning to play a key role in cardiac and neurovascular interventions and expanding rapidly. • Endovascular robotic systems can help facilitate precise and stable catheter navigation while reducing radiation exposure during procedures.

## TABLE OF CONTENTS/OUTLINE

1. Overview of the history and timeline of robotics in interventional radiology. 2. Introduction and summary of robotic systems and their advantages and disadvantages. 3. Key studies demonstrating the role of robotics for endovascular interventions. 4. Telerobotics in interventional radiology and its roles and limitations. 5. Future prospects for robotic-assisted interventional radiology.

### **IREE-15 How to Perform a Correct Access for Minimally Invasive Lumbar Spine Procedures**

Participants

Natalia Parra, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Fluoroscopy guided interventions in lumbar spine involve a variety of minimally invasive procedures for improving pain management. Three of the main approaches typically used to get access to the targeted structure are transforaminal, interlaminar and transpedicular. The aim of the proposed exhibit is to provide radiology residents and fellows with a quick guide to better understand the basics of these techniques and thus be able to perform a safer and more effective access. At the outset, the exhibit will list the different types of procedures enabled by the abovementioned approaches. Following, it will provide a pictorial review of the anatomical keys in preprocedural imaging studies. Finally, the exhibit will explain how to perform the approaches step-by-step, from the positioning of the angiograph and the anatomical references to the needle insertion, and will conclude by describing how to check its correct positioning.

## TABLE OF CONTENTS/OUTLINE

1. Types of procedures and related approaches. 2. Imaging studies: what to look at and how to do it. 3. Angiograph positioning and anatomical references. 4. How to perform and correct the approaches in real time. 5. How to check the positioning of the needle.

### **IREE-16 Percutaneous Cryoablation: A Comprehensive Review of Whole-body Application**

## TEACHING POINTS

1) Percutaneous cryoablation is a minimally invasive procedure that is safe and effective in treating various solid benign and malignant lesions throughout the human body. 2) Imaging and tissue diagnosis is necessary before ablation to ensure that cryoablation is the most appropriate modality of treatment. 3) Percutaneous cryoablation can be performed with ultrasound, fluoroscopy, computed tomography, or magnetic resonance imaging guidance. Knowing the risks and benefits of each modality is important for choosing the best modality for individual patient lesions. 4) Cryoshock is a feared clinical syndrome after cryoablation for which early diagnosis and management is crucial. 5) Abscopal effect is a unique effect of cryoablation based on immune-mediated post-ablation antigen presentation.

## TABLE OF CONTENTS/OUTLINE

1) Mechanism of action and physics of cryoablation leading to induction of cellular apoptosis and the understanding of ablation

1) Mechanism of action and physics of cryoablation leading to induction of cellular apoptosis and the understanding of ablation artifacts. 2) Indications and contraindications, diagnostic workup, and imaging diagnosis for lesions amenable to cryoablation. 3) Procedural protocols for the management of lung/kidney solid tumors, metastasis, bone and soft tissue solid/cystic lesions, nerve pain, and vascular malformations. 4) Adverse effects of cryoablation including cryoshock and the mitigation of these effects. 5) Abscopal effect and future directions for the use of cryoablation to prevent lesion recurrence and treat metastatic disease.

### **IREE-17 The Need for Virtual Fluoroscopic Imaging in Bronchial Artery Embolization: The Best for Radiation Exposure Dose Reduction**

Participants

Yoshihiro Tanaka, BA, Ibaraki, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

In this study, we investigated the relationship between supporting images of a new concept and exposure reduction in bronchial artery embolization <BAE>. This is research on exposure reduction aimed at shortening the procedure time by creating a support image similar to the IR image using CT volume data, in contrast to the existing exposure protection and exposure reduction mechanisms of IR equipment.

#### **TABLE OF CONTENTS/OUTLINE**

A virtual fluoroscopic image <VFI> is a Ray-summation image that is similar to a fluoroscopic image, and blood vessel running and the lesioned part are superimposed and displayed (Fig.1). Thereby it possible to use information intuitively alongside fluoroscopic images, and to avoid unnecessary mapping imaging for bronchial artery identification and time waste due to blind catheterization under fluoroscopy, aiming at rapid vascular selection and hemostasis (Fig.2,3). Also, a workstation can be easily installed and implemented, and the CT volume data obtained in advance is used so that there is no need to purchase new and expensive IR equipment. As a result, the number of angiographies required for dissection can be minimized, which not only reduces the amount of contrast agent and exposure, but also reduces complications by shortening the procedure time (Table 1,2).

### **IREE-18 2022 Barcelona Clinic Liver Cancer Update for the Interventional Radiologist**

#### **TEACHING POINTS**

1) Understand the updates to the 2022 Barcelona Clinic Liver Cancer (BCLC) guidelines for managing patients with hepatocellular carcinoma (HCC) 2) Review supporting evidence for transarterial chemoembolization (TACE) and percutaneous ablation 3) Highlight recent evidence surrounding transarterial radioembolization (TARE) that warranted its inclusion in the new guidelines 4) Discuss the new systemic agents included in the 2022 BCLC guidelines and their supporting evidence

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction, including epidemiology of HCC and interventional radiology (IR) management options in the previous BCLC guidelines 2) BCLC framework for classifying HCC 3) Review of existing literature on TACE and percutaneous ablation for patients with HCC 4) Overview of updates in the 2022 BCLC guidelines for IRs: Sub-division of Intermediate Stage (Stage B) patients, extending the existing liver transplant criterion to include more patients and include systemic options for other patients at this stage 5) Overview of updates in the 2022 BCLC guidelines for IRs: Inclusion of TARE for the first time in the guidelines, with a review of new, high impact studies leading to the inclusion of TARE 6) Overview of updates in the 2022 BCLC guidelines for IRs: New systemic agents for patients with advanced stage disease, including a review of high impact studies leading to the addition of the new systemic agents in the guidelines 7) Discussion of combination therapies for HCC such as TACE + systemic therapy, TARE + systemic therapy, TACE + percutaneous ablation, and percutaneous ablation combined with adjuvant systemic therapy 8) Conclusion and summary

### **IREE-19 Imaging and Interventional Management of Lymphatic System Disorders**

Participants

Eric Castane, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review the lymphatic system disorders. 2. Describe the radiologic management of the lymphatic system disorders.

#### **TABLE OF CONTENTS/OUTLINE**

1. Material and Methods / Background Lymphatic. 2. Anatomy and Physiology. 3. Disorders of the Lymphatic System. 3.1. Classification. 3.2. Diagnosis. 4. Imaging of the Lymphatic System. 4.1. Ultrasound. 4.2. Magnetic Resonance. 4.3. Nodal Lymphangiography. 4.4. Imaging in Lymphatic Disorders. 5. Interventional Management of Lymphatic Disorders. 5.1. Chylothorax. 5.2. Chyle Ascites. 5.3. Peripheral Lymphatic Leak. 5.4. Lymphatic Plastic Bronchitis. 6. Post Procedure 6.1. Complications. 6.2. Post Procedure Imaging. 7. Conclusions.

### **IREE-2 Shoot Your Shot: Techniques and Pitfalls of Pelvic Collection Drainage**

Participants

Kateryna Burlak, MBBS, Melbourne, Australia (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Most pelvic collections can be drained safely and effectively through a percutaneous image-guided approach. Collections in locations that are difficult to access pose a unique challenge and invite consideration of alternative approaches. We aim to discuss the techniques and pitfalls of these approaches, to encourage drainage of collections initially considered difficult or inaccessible and to raise awareness about potential complications. Teaching points of this exhibit include the following: 1 - To review the methods and anatomy of potential approaches involved in drainage of pelvic collections (including transperineal, transgluteal, transrectal and transvaginal approaches) 2- To demonstrate general techniques used (Trocar vs Seldinger techniques) 3- To discuss potential complications which can occur in drainage of pelvic collections and how to avoid them

#### **TABLE OF CONTENTS/OUTLINE**

1. Methods and anatomy of potential approaches: Lateral abdominal wall, Anterior abdominal wall, Transgluteal, Transperineal,

Transrectal, Transvaginal 2. General techniques used 3. Examples of potential pitfalls and complications 4. Summary and teaching points

## **IREE-20 Next Step for Colorectal Liver Metastasis Ablation: Computed Tomography During Hepatic Arteriography Guidance in Percutaneous Thermal Ablation**

Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) This study aims to show the feasibility and accuracy of using computed tomography during hepatic arteriography (CTHA) as a percutaneous ablation guidance tool for colorectal liver metastasis (CLM) patients. 2) CTHA is performed via a transarterial catheter inserted into the hepatic artery for arterial assessment. It involves dual-phase contrast medium acquisition with specific rates and acquisition delays during a breath hold on expiration. 3) CTHA improves CLM visibility due to high contrast resolution and absence of portal venous system contrast-media deposition. CLMs appear hypoattenuating with a necrotic center and ill-defined enhancing rim visible on the arterial phase. 4) In contrast to its high sensitivity, CTHA specificity for detecting small tumors is often limited by the presence of pseudolesions. Moreover, limitations include potential complications related to sheath and catheter placement, physician's costs and time, and arterial anatomy variants. 5) CTHA enables precise oncologic intervention planning, combined therapies, and intraprocedural treatment response monitoring. Further research is needed to fully evaluate its clinical utility for guiding CLM ablation.

### **TABLE OF CONTENTS/OUTLINE**

1) 'Let's Put a Ring on It' - CLM imaging presentation on CTHA; 2) Setting the Target - Image-guiding techniques in percutaneous liver tumor ablation and CTHA protocol; 3) Tips or tricks - Pseudolesions or CLMs? 4) Thinking Outside the Box - Future Perspectives

## **IREE-21 Minimally Invasive Thoracic Tumor Treatment and Palliation**

### **TEACHING POINTS**

Percutaneous ablation is an established safe treatment for primary and metastatic lung tumors. Adjunct intra-procedural maneuvers, such as creation of artificial pleural effusions or pneumothoraces, can permit treatment of tumors adjacent to critical structures. Emerging approaches such as arterial chemoembolization are altering the landscape of intervention for thoracic malignancies. Minimally invasive procedures such as percutaneous tumor localization, thoracic tumor embolization, and image-guided brachytherapy seed implantation can enable multidisciplinary treatment. Palliative interventions, ranging from embolization to shunt implantation, can provide palliation for thoracic oncology patients.

### **TABLE OF CONTENTS/OUTLINE**

Tumor treatment Percutaneous ablation Radiofrequency ablation Cryoablation Microwave ablation Technical considerations during ablation Chemoembolization of lung tumors Interdisciplinary procedures Tumor localization prior to surgical resection Preoperative embolization of central thoracic tumors Image guided brachytherapy seed implantation Palliation Glue embolization of bronchopleural fistulas Bronchial artery embolization for hemoptysis Recurrent pleural effusion management Tunneled indwelling pleural catheters Denver pleurovenous shunt

## **IREE-22 The Effects of Artificial Intelligence and ChatGPT on Interventional Radiology**

### **TEACHING POINTS**

\*Artificial intelligence (AI) learns from data, and processes it to perform tasks requiring human intelligence\*AI can help create customized treatment plans for patients\*Fluoroscopy systems with AI reduce radiation exposure to make procedures safer\*Pre-operative and intraoperative images integrated by AI, provide more accurate guidance for image-guided procedures\*AI can create virtual angiography, which can be used for education and planning purposes\*ChatGPT can assist radiologists in creating educational and research materials more efficiently

### **TABLE OF CONTENTS/OUTLINE**

Artificial intelligence (AI) refers to computational models that use algorithms to process data, learn from it using the output to perform tasks traditionally associated with human intelligence. AI models utilize patient diagnostic images and clinical findings to anticipate procedural outcomes. This enables interventional radiologists to customize treatment plans for each patient beforehand. AI has enabled fluoroscopy systems to substantially decrease radiation exposure to patients and staff. This is evidenced by a significant reduction in median dose area product from 5,708 mGy·cm<sup>2</sup> to 2,178 mGy·cm<sup>2</sup> (P < 0.001). AI can integrate pre-operative 3D with intraoperative 2D images, improving guidance for biopsies and image-guided procedures. This added augmented-reality element enhances the accuracy and safety of interventional procedures. AI employs preoperative imaging to create virtual angiography, which acts as an educational and real-time planning aid for both trainees and seasoned interventionalists. With the advent of chatGPT radiologists can harness AI to aid in the composition of educational and research material.

## **IREE-23 Intercostal Neurolysis: A Primer**

Participants

Omar Al-Daoud, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review relevant anatomy of the intercostal nerves. Describe indications for neurolysis. Describe risks of intercostal neurolysis. Highlight tips and tricks for risk mitigation.

### **TABLE OF CONTENTS/OUTLINE**

Goals and Objectives, Case Presentation, Intercostal Nerve Anatomy, Indications for Intercostal Nerve Block and Neurolysis, Risks of Intercostal Neurolysis, Mitigating Risks, Nerve Block Cocktail, Additional Case Presentations, Learning Points

## **IREE-24      Gastrointestinal Tract Tumors: Imaging and Interventional Management of Bleeding**

Participants

Forrest Linch, MD, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Learn mesenteric angiographic anatomy with special attention to anatomical variations and the blood supply to specific portions of the GI tract, which may affect treatment approach. 2. Learn common primary and metastatic etiologies of gastrointestinal tract bleeding requiring intravascular intervention. 3. Understand diagnostic imaging findings and interventional radiologic techniques for managing gastrointestinal tract bleeding

### **TABLE OF CONTENTS/OUTLINE**

1. Mesenteric angiography: A) Standard technique and anatomy, B) Normal variant anatomy, C) Blood supply to specific portions of the GI tract; 2. Angiography of gastrointestinal tract malignancies: A) Common pathologies by location, B) Angiographic finding of tumors; 3. Diagnostic imaging of gastrointestinal tract malignancies: A) Modality selection (CT, MRI, NM), B) Expected findings and treatment implications; 4. Intravascular management of bleeding gastrointestinal tract malignancies: A) Indications, contraindications, B) Pre-procedure planning - i) Clinical evaluation, ii) Role of cross-sectional imaging and endoscopy, iii) Anatomic/vascular considerations (arterial supply, collaterals, variants), C) Technique - i) Particle versus coil embolization, ii) Coil embolization for protection of non-target structures, D) Outcomes and complications;

## **IREE-25      Advancing Frontiers in Lung Malignancy Treatment: Unraveling the Potential of Interventional Radiology in the Ablation of Lung Malignancies**

Participants

Izzet Altun, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Interventional radiology has evolved as a promising modality for the ablation of lung malignancies. Various techniques such as Radiofrequency Ablation (RFA), Microwave Ablation (MWA), and Cryoablation are extensively utilized, each with unique benefits and limitations. The choice of technique is determined by factors such as lesion size, location, and patient condition. These image-guided percutaneous ablation techniques are particularly advantageous for patients unsuitable for surgery or stereotactic radiation therapy. Future directions point towards refining these techniques, improving patient selection criteria, and integrating these modalities with novel systemic and loco-regional therapies for comprehensive patient care.

### **TABLE OF CONTENTS/OUTLINE**

The report provides an overview of image guided ablation of lung malignancies. The goal is to present mechanism, advantages, and limitations of RFA, MWA, cryoablation and other less common techniques such as laser ablation. Discussion on patient selection, pre and post-procedural evaluation for lung ablation will be presented. Outline: 1- Introduction to IR in lung ablation, highlighting the scope of RFA, MWA, and cryoablation. 2- Detailed exploration of ablative techniques, focusing on mechanisms, optimal application, and potential drawbacks. 3- Examination of patient selection criteria, pre and post-procedural evaluation, and contraindications. 4- Analysis of the anesthesia management, CT protocols, and periprocedural considerations for lung ablation. 5- Discussion on the current state of research and future directions, emphasizing the potential for improved techniques and integrative treatment approaches. 6- Conclusion

## **IREE-26      Creating Transvenous Intrahepatic Portosystemic Shunts (TIPS) with the Aid of Ultrasound (US): Tips for US**

### **TEACHING POINTS**

Learning Objectives Review standard steps for conventional TIPS creation. Provide steps and tips for using intracardiac echography (ICE) catheters and transabdominal ultrasound for aiding in TIPS creation. Discuss advantages and disadvantages of the various equipment used for TIPS creation and when to consider each.

### **TABLE OF CONTENTS/OUTLINE**

Content/Outline Introduction Review steps for performing TIPS creation using fluoroscopic guidance Review cross sectional imaging to aid in procedure planning Demonstrate indirect portography and limitations. Demonstrate each of the key steps for creating a TIPS. Review ICE catheter setup Jugular vs Femoral approach Tips for orienting user to key anatomy and needle directing Tips to improve efficiency Review Transabdominal US set up Tips for orienting user to key anatomy and needle directing Tips to improve efficiency Discuss advantages and disadvantages each approach Unique cases best managed by each guidance modality Prevention of complications by each guidance modality Cost accessibility of each guidance modality While TIPS procedures are most commonly done using conventional fluoroscopy guidance, ultrasound may be used in conjunction with benefit. This presentation reviews guidance modalities for TIPS creation focusing on key imaging and circumstances favorable and unfavorable to each guidance modality.

## **IREE-27      The ABCs of CT-guided Lung Biopsy: Tips and Tricks for Optimal Outcomes**

Participants

Miriana Mariussi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purpose of this exhibit is to: • Review the indications for the percutaneous CT-Guided lung biopsy • Comprehend the pre-procedural imaging analysis and planning • Assess the principles of the percutaneous biopsy techniques and co-axial techniques • Knowledge the common complications after the procedures and their management • Highlight the recommendations to avoid pneumothorax and other complications • Recognize common CT image findings observed in the post-procedural follow-up

### **TABLE OF CONTENTS/OUTLINE**

Percutaneous biopsy of lung lesions is increasing due to the rise of cancer incidence and the growing need for molecular and immunohistologic analyses. The size of the lesion, the size of the biopsy needle and the chosen technique have a direct impact on

the success of the procedure. A case based pictorial essay allows for a comprehensive assessment of: • Indications and patient selection for percutaneous CT-Guided lung biopsy • Establishing a concise pre-procedural imaging analysis and planning • Percutaneous technique and co-axial techniques • Needle positioning, trajectory and lesion sampling • Recognizing expected complications after the procedure • Strategies and tips for achieving a successful outcome • Reducing the risk of pneumothorax and other complications • Highlighting important post-procedural management steps • Understanding biopsy results and follow up

### **IREE-28 CT Guided Trans-osseous Biopsy, a Road Less Traveled: A review of Indications, Technical Aspects and Literature Summary**

#### **TEACHING POINTS**

CT guided transosseous biopsy is an alternative technique for lesions blocked by vital structures or apparently directly inaccessible. Coaxial technique is essential in transosseous biopsy, as it allows taking various samples through a secure access diminishing the number of skin punctures and risks of tumor seeding. The success of these procedures depends on the knowledge of regional anatomy, a correct planning and experience of the operator.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: Usually when performing an image guided percutaneous biopsy, the access is selected using the shortest path, avoiding vessels, nerves, or organs. Sometimes, this is not possible and more aggressive procedures, such as surgery, are required. A transosseous access can be used as an alternative approach to tackle this setback and sample deep and challenging targets. Furthermore, CT guided transosseous biopsies can be performed in order to reduce complication risks. Approaches: -Trans-sternal: lesions in anterior mediastinum. -Trans-rib: for pleural-based lung lesions or immediately deep to a rib -Trans-scapular: for apical lung lesions abutting superior margin of major fissure. -Trans-vertebral: for lesions anterior to the vertebral body, aortic lymph nodes. -Trans-iliac, pubic or sacral for internal iliac lymph nodes, other deep pelvic nodes in patients with pelvic malignancy or presacral lesions. Technical considerations. Complications. Take home messages

### **IREE-29 Multiple Cavitory Lung Lesions on CT: Biopsy Approach, Accuracy and Safety**

Participants

Juan Wang, Beijing, China (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Understand the different biopsy approaches available for multiple cavitory lung lesions on CT, including transthoracic needle biopsy, bronchoscopy, and surgical biopsy, and their relative advantages and disadvantages. 2. Learn how to assess the accuracy of biopsy results, including sensitivity, specificity, and positive predictive value. 3. Become familiar with the potential complications associated with each biopsy approach, such as pneumothorax, bleeding, and infection, and how to manage them. 4. Appreciate the role of image guidance in improving the accuracy and safety of biopsy procedures for multiple cavitory lung lesions on CT. 5. Understand the importance of multidisciplinary collaboration among radiologists, pulmonologists, and thoracic surgeons in developing a biopsy strategy.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction: This section will provide an overview of multiple cavitory lung lesions and the importance of accurate diagnosis and treatment. 2. Biopsy approaches: This section will discuss the different biopsy approaches for multiple cavitory lung lesions, including CT-guided biopsy, bronchoscopy, and surgical biopsy. 3. Accuracy of biopsy: This section will focus on the accuracy of biopsy for multiple cavitory lung lesions. It will discuss factors that can affect the accuracy of biopsy, such as lesion size, location, and underlying pathology. 4. Safety of biopsy: This section will review the safety of biopsy for multiple cavitory lung lesions. It will discuss potential complications associated with each biopsy approach, such as bleeding, pneumothorax, and infection. 5. Conclusion: This section will summarize the key takeaways from the education exhibit.

### **IREE-3 Sticky Situations: Expanding the Role of Glue in Trauma**

#### **TEACHING POINTS**

Discuss the properties of liquid embolic (glue); Characterize ideal uses for glue in traumatic injuries; Use cases to review diagnostic trauma CT findings, angiographic correlates and post glue embolization appearances; Review potential complications and pitfalls of glue embolization.

#### **TABLE OF CONTENTS/OUTLINE**

Outline: Introduction; Review of traumatic injuries and ideal cases for liquid embolics; Properties of glue (N-butyl cyanoacrylate), how to prepare, mixtures and delivery techniques; CT findings before and after glue embolization and how to differentiate from evolving injuries; Case presentations: Pseudoaneurysms (Spleen, Liver, Renal, Pelvis, Extremity), Active Extravasation (Spleen, Liver, Pelvis), and Traumatic AV Fistulas; Complications of glue embolization (non-target embolization, portal vein embolization, pulmonary emboli, skin injury) and how to prevent them. Conclusion: Glue is a versatile embolic which can be safely deployed in traumatic intervention. As glue becomes more frequently used, an understanding of expected post embolization changes is necessary to minimize erroneous reporting.

### **IREE-30 Thoracic Vent for Management of Pneumothorax: Review of Technique and Comparison to Conventional Thoracostomy**

Participants

Latika Baranga, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Incidence of pneumothorax in patients undergoing transthoracic needle biopsy reported varying from 9-54%. Current treatment options include observation/conservative, simple aspiration, thoracostomy tube placement, ambulatory management with Thoracic vent placement or thoracostomy tube with or without Heimlich valve. Here we describe Thoracic vent device as an alternative to chest tube for iatrogenic pneumothorax. It is a simple one-piece device made of polyurethane catheter connected to a plastic chamber containing a one-way valve and comes with an adhesive tape to secure it. It does not require suture or additional securing devices nor additional tubing or bag/container attachments enabling early mobilization and outpatient monitoring. It's simple design without attachment makes it easier and safer to manage as an outpatient compared to thoracostomy with or without

a Heimlich valve.

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction discussing epidemiology, and treatment options for management of pneumothorax including technique such as thoracostomy tube with Heimlich valve and Thoracic vent. 2. Description of Thoracic vent device components, mechanism of action, placement technique. 3. and 4. Case describing steps of CT guided Thoracic vent placement, and follow up imaging. Appearance of the device on chest radiograph is demonstrated to assist in recognition of the device by diagnostic radiologist. 5. Comparison of Thoracic vent with conventional thoracostomy with and without Heimlich valve.

#### **IRRE-31 Look Before You Leap: Anatomical and Technical Considerations of Image-guided C2 Dorsal Root Ganglion Ablation and C1-C2 Lateral Joint Injections**

Participants

Bahram Mohajer, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

i. Discuss the cervicogenic headache as the primary indication of Image-guided C2 dorsal root ganglion (DRG) ablation and C1-C2 lateral joint injections. ii. Review the general anatomy of C2 DRG and C1-C2 lateral articulation and notable anatomical structures. iii. Illustrate CT-guided C2 DRG ablation technique and considerations. iv. Illustrate Computed Tomography and Fluoroscopic-guided C1-C2 lateral articulation injection techniques and considerations.

#### TABLE OF CONTENTS/OUTLINE

i. Cervicogenic headache (1. Presentation 2. Prevalence and efficacy of intra-articular injections). 3. General anatomy of the C2 DRG and C1-C2 lateral articulation. 4. Degenerative arthritis of C1-C2 lateral articulation presentation on STIR MRI (a) and CT (b). ii. Important anatomical proximities of C2 DRG and lateral atlanto-axial joints (1. Vertebral artery 2. Thecal sac 3. C2 ventral ramus). iii. CT-guided C2 DRG ablation procedure, technique, and considerations (1. Patient positioning, 2. Trajectory selection, 3. Needle insertion, contrast administration, and ablation). iv. CT-guided intra-articular injection, technique, and considerations (1. Patient positioning, 2. Trajectory selection, 3. Needle insertion, contrast administration, and injection). v. Fluoroscopy-guided procedure, technique, and considerations (1. Trajectory selection, 2. Needle insertion, contrast administration, and injection).

#### **IRRE-32 Utility Of Spectral CT During Percutaneous Thermal Ablation**

Participants

Ahmad Parvinian, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to demonstrate the utility of spectral CT for interventional ablation procedures. Recently, an interventional suite was developed which combined a dual-layer detector spectral CT scanner on rails with an image guided-therapy system (Spectral Angio CT, Philips Healthcare). In this exhibit, case examples will highlight use cases for spectral CT in procedure planning, probe placement, iceball visualization, and post-ablation assessment. Teaching points include: (1) technical background on spectral CT, (2) clinical background on minimally invasive ablations, and (3) overcoming interventional challenges with spectral CT.

#### TABLE OF CONTENTS/OUTLINE

1. Title page: Utility Of Spectral CT During Percutaneous Thermal Ablation. 2. Teaching points: Technical background, clinical background, and overcoming interventional challenges. 3. Interventional ablations clinical background: Procedure planning, probe placement, treatment monitoring, and post-ablation assessment. 4. Background on spectral CT for interventions: Dual-layer spectral detector technology, visualization modes for spectral imaging, and spectral CT on rails for interventions. 5. Case examples: (A.) Procedure planning with low MonoE for lesion visualization. (B.) Probe placement with high MonoE to reduce needle artifact. (C.) Treatment monitoring with z-effective and low MonoE. (D.) Bone ablations with bone removal. (E.) Post-ablation assessment with low MonoE to reduce contrast dose. 6. Conclusions

#### **IRRE-33 Transperineal Ultrasound-Guided Prostate Biopsy: Why and How**

Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Review different prostatic biopsies approaches, emphasizing the transperineal technique and its peculiarities. Illustrate with cases different applications of the technique (systematic biopsy, cognitive guidance and MR imaging fusion). Identifying the radiological features of common postprocedural complications

#### TABLE OF CONTENTS/OUTLINE

Prostate cancer: epidemiology and imaging findings; Indications and patient selection for prostate biopsy; Different biopsy approaches and its characteristics; Technique steps; Illustrative cases of different applications of the transperineal prostate biopsy technique; Understanding and managing common complications post-procedure; Recognizing common image findings observed after the procedure; Interpreting biopsy outcomes and ensuring proper follow-up.

#### **IRRE-34 Too Hot to Handle? Non-worrisome Extrahepatic Localization of 99mTc MAA and Yttrium-90 During Planning and Radioembolization Procedures**

Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. In the work-up of patients for Y-90 radioembolization of hepatic tumors, it is often revealed that 99mTc-macroaggregated albumin (MAA) has accumulated in extrahepatic organs and blood vessels. While substantial Y-90 localization in some extrahepatic sites, such as the lungs, is an absolute contraindication for treatment, other sites do not have strict guidelines. 2. We show the

safe, complication-free administration of Y-90 to five patients with off-target uptake in each the following locations: a persistent falciform artery, the gall bladder, a portal vein tumor thrombus, a perihepatic lymph node, and the spleen.<sup>3</sup> The literature is consistent with the conclusion that uptake of Y-90 in the falciform artery, the gall bladder, and a tumor thromboses is generally safe and should not be an absolute contraindication to therapy. It has yet to be elucidated whether this is the case for uptake in the spleen and lymph nodes.<sup>4</sup> Off-target Y-90 uptake in the spleen may actually be beneficial and help treat/prevent post-radioembolization hypersplenism and thrombocytopenia.

#### TABLE OF CONTENTS/OUTLINE

1. Cases of safe and successful Y-90 therapy to patients with extrahepatic uptake in the extrahepatic following locations<sup>2</sup>. Along with each case, the current literature regarding the safety of treatment of patients with these off-target uptakes is discussed.

#### IREE-35 Contrast Enhanced CT Lymphangiography For Various Lymphatic Disorders

Participants

Yura Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Despite the physiologic and clinical significance of the lymphatic system, lymphatic imaging remains difficult and in the developmental stages. In recent years, MR lymphangiography has enabled the depiction of lymphatic structure, but its widespread use is limited by its inherent limitations: high cost, limited accessibility, contraindications to MR, inability to position change, and inability of bedside needle insertion in MR suite is still obstacles. CT, which is not restricted by these constraints, may be a solution for more accessible lymphatic imaging. We have utilized contrast enhanced CT lymphangiography for characterization of various thoracoabdominal lymphatic diseases and pre-interventional planning. Herein, we introduce our practice of CT lymphangiography.<sup>1</sup> Learn the protocol and technical aspect of contrast-enhanced CT lymphangiography<sup>2</sup>. Describe normal lymphatics anatomy with contrast-enhanced CT lymphangiography<sup>3</sup>. Learn the characteristics of various thoracoabdominal lymphatic diseases with CT lymphangiography

#### TABLE OF CONTENTS/OUTLINE

1. Protocol<sup>1</sup> Procedure: Inguinal LN cannulation under US guidance<sup>2</sup> CT technique for imaging the central lymphatics<sup>2</sup>. Technical aspect of CT lymphangiography<sup>1</sup> Acquisition time and CT dose<sup>2</sup> Comparison with MR lymphangiography<sup>3</sup>. Normal anatomy of the central lymphatics<sup>4</sup>. Various lymphatic disorders<sup>1</sup> Iatrogenic thoracic duct injury with chylothorax<sup>2</sup> Lymphatic anomaly

#### IREE-36 Artificial Intelligence in Interventional Radiology: A Primer for Residents

#### TEACHING POINTS

Artificial Intelligence (AI) has already demonstrated an ability to significantly improve efficiency in diagnostic radiology. There are however, unique challenges which need to be addressed to completely realise the potential of AI in Interventional Radiology (IR). Apart from key issues including data storage, lack of interoperability and non-standard practices, there are significant concerns about legal accountability and potential risks in interventions that prevent AI from being used independently or clinically without the oversight of an expert radiologist. Research and innovation involving AI in IR is limited to few higher centres, thus preventing adequate exposure of AI to Interventional Radiology residents, compared to their Diagnostic Radiology (DR) counterparts. Our Educational Exhibit aims to introduce IR residents and fellows to the vast possibilities of incorporating AI into their regular clinical practice (ranging from decision support and triaging of patients to prognostication and outcome prediction) and also introduce them to various open-source software and modules which can assist them in their day-to-day IR practice.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 1A. AI in Medical Imaging 1B. Types of Data in DR and IR 2. Unique Challenges in IR 3. Opportunities of AI Implementation 3A. Pre-Procedural Support 3B. Peri-Procedural Support 3C. Post-Procedural Support 4. Established AI algorithms in Interventions 5. Open-Source software and modules 6. Opportunities for AI innovation in IR 7. Can AI Replace Us? 8. The way ahead for an AI-assisted Interventional Radiology practice

#### IREE-37 Portosystemic Shunts: A Comprehensive Review

Participants

John Walker, MD, PhD, San Antonio, TX (*Presenter*) Speaker, Shionogi & Co, Ltd; Consultant, Shionogi & Co, Ltd

#### TEACHING POINTS

1. To review the development of the portal system and teach normal and variant anatomy.<sup>2</sup> To become familiar with cross sectional and angiographic appearances of both common and uncommon portosystemic shunts.<sup>3</sup> To understand the clinical relevance of portosystemic shunts form congenital to acquired.<sup>4</sup> To demonstrate minimally invasive treatment options for portosystemic shunts.

#### TABLE OF CONTENTS/OUTLINE

1. Review the development of normal portal venous anatomy and subsequently congenital variant anatomy. In addition, understand shared territories with systemic veins that may allow shunts to form 2. Use cross sectional and angiographic images to teach the anatomy of portosystemic shunts to include congenital intra-hepatic and extrahepatic (Abernethy) shunts, as well as common acquired gastroesophageal, splenorenal, paraumbilical shunts and less common acquired mesenteric to retroperitoneal territories and consider surgically altered sites allowing for unique shunts 3. Discuss clinical implications of untreated portosystemic shunt and 4. Explore indications and techniques for treating shunts by type and location, to include discussion on expected sequelae of treating and potential complications.

#### IREE-38 Training of Interventional Radiology Procedures Using Virtual Reality: Current Status and Potential Metaverse

Participants

Yukiko Honda, MD, Kure, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS



The COVID-19 pandemic made it difficult to train learners on procedures that involve direct patient contact, such as interventional radiology (IR). For this reason, we developed training materials for learners on endovascular procedures of the abdominal pelvis in IR using virtual reality (VR). Advantages of VR-based IR education include the ability to conduct training at any time, repeated training exercises, no invasiveness to the patients, and no risk of infection to both the patient and the learner. Even after the pandemic, to further develop the good points of VR education, many educators are attempting to apply metaverse to the education of their specialty. Although metaverse education is considered useful in IR education, it is not widely used at present. This educational exhibit will provide a brief overview of simulators available for purchase, benefits of metaverse education, and our VR-based training software, and discuss its advantages, current issues, and future prospects.

#### TABLE OF CONTENTS/OUTLINE

1. Features of the currently commercially available VR simulators of endovascular procedures. 2. Benefits of metaverse education. 3. What is needed to spread metaverse education. a. Three components: hardware, software, and contents, b. High-speed networks, c. Computing technologies: edge computing, and cloud computing, d. Modeling and rendering technologies: Unity or Blender, e. Interaction technologies: Sensors, or real-time tracking, f. Authentication technologies: blockchain, g. Wearable device: head-mounted displays or smart glasses, h. Concerning the learner: learning logging, and analysis. 4. Review of reports on the cases of metaverse education. 5. Future challenges and our approach.

#### IREE-39 **Interventional Radiology Role in Treating Primary Pancreatic Cancer: Current Treatments and Future Prospects**

Participants

Fereshteh Khorshidi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review primary pancreatic cancer epidemiology, current therapies and prognosis- Review interventional radiology role in diagnosis of pancreatic cancer and palliative care- Review percutaneous and transarterial image-guided treatment options for unresectable primary pancreatic cancer offered by interventional radiology.- Importance of having a multidisciplinary approach and individually tailored treatment plan.

#### TABLE OF CONTENTS/OUTLINE

Primary pancreatic cancer- Prevalence- Significance- Clinical stages- Survival rate- Current therapies for resectable tumors Minimally invasive treatments of unresectable pancreatic cancer, their advantages, effectiveness and complications Treatments- Transarterial therapieso Regional intra-arterial chemotherapy with double-balloon catheter (RenovoCath)• Mechanism of action• Safety and efficacy• Ongoing Trials- Percutaneous ablative therapies:o Non-thermal ablation: Irreversible electroporation• Mechanism of action• Safety and efficacy• Ongoing Trials Synergetic effect of ablative therapies and immunotherapy; a future prospective Cases?. A few cases of ablation?

#### IREE-4 **Superior Vena Cava Syndrome Imaging and Management**

#### TEACHING POINTS

1. Review central venous anatomy and highlight potential collateral pathways. 2. Review the historical and current superior vena cava (SVC) syndrome etiologies. 3. Review the pathophysiology of SVC syndrome. 4. Present SVC syndrome classification systems. 5. Discuss SVC syndrome treatment and management. 6. Detail indications, benefits, and complications of endovascular treatment of SVC syndrome.

#### TABLE OF CONTENTS/OUTLINE

I. History and evolution of SVC syndrome etiologies. II. Central venous anatomy. III. Pathophysiology and symptoms of SVC syndrome. IV. SVC syndrome classification systems. V. SVC syndrome treatment algorithm. VI. Endovascular therapy cases. VII. Endovascular therapy techniques. VIII. SVC syndrome endovascular complications. IX. Projected future of SVC syndrome therapy.

#### IREE-40 **Thermoprotective Techniques in Musculoskeletal Ablation**

Participants

Ahmad Parvinian, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to provide a case-based review of thermoprotective techniques used during percutaneous thermal ablation of musculoskeletal tumors. The exhibit will demonstrate the basic principles of musculoskeletal ablations performed using ultrasound, CT, fluoroscopic, and MRI guidance, depict the various active and passive thermoprotective techniques that are critical to safe and effective ablation, and provide a framework for recognizing and addressing complications. Teaching points include: (1) clinical background and principles of musculoskeletal ablation, (2) active thermoprotective techniques, (3) passive thermoprotective techniques, (4) complication management.

#### TABLE OF CONTENTS/OUTLINE

1. Title page 2. Teaching points 3. Musculoskeletal ablation background 4. Preprocedural Considerations 5. Passive thermoprotection- Ablation zone monitoring- Temperature monitoring- Neurophysiologic monitoring 6. Active thermoprotection- Hydrodisplacement- Pneumodisplacement- Balloon interposition- Probe traction- Internal warming- External warming 7. Complication recognition and management 8. Conclusions

#### IREE-41 **Thyroid Nodule Fine Needle Aspiration: What the Pathologist Wants You to Know**

#### TEACHING POINTS

- Fine needle aspiration (FNA) is an optimal diagnostic tool for thyroid nodules because it is cost-effective, safe, and accurate .
- The Bethesda guidelines for thyroid FNA consider that the unsatisfactory rate on cytopathology is of about 10% , however different studies have shown that the unsatisfactory rate can range from 0.4% up to 40% .
- Some of the reasons why FNA results may be inaccurate include: 1. Sampling error: the sample may not accurately represent the entire nodule. 2. Inadequate sample size: the sample taken during FNA may be too small to yield accurate results. 3. Technical error: The accuracy of FNA results can be affected

by technical errors, such as improper handling or processing of the tissue sample.4. Nodule size: multiple studies have shown that the diagnostic accuracy of FNA is limited in large thyroid nodules. • The technique of the specimen collection and evaluation and the preparation of the slide can play a decisive role in the diagnostic accuracy therefore it's important for the radiologist to recognize the correct technique. • The "classic" technique uses three slides and generates two slides for interpretation. A slide to be deposited in fixative, a slide to be air dried, and a spreader slide. • The two-slide technique has been called the "butterfly" or "book-end" technique. It has the advantage of simplicity and better reproducibility. It produces a relatively uniform and rounded imprint of FNA material for evaluation on two mirror image slides.

#### TABLE OF CONTENTS/OUTLINE

1. Patient selection2. Equipment needed for thyroid biopsy3. Patient preparation4. Needle based sample collection techniques5. Sample preparation6. Pathologist recommendations in order to reduce inconclusive results

#### IREE-42 Nutcracker Syndrome: Diagnosis and the Role of Minimally Invasive Interventions

Participants

Alina Hasanain, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Nutcracker phenomenon is an anatomic condition characterized by extrinsic compression of the left renal vein, causing entrapment, and subsequent diminished outflow to the inferior vena cava.2. Nutcracker syndrome refers to Nutcracker phenomenon with clinically apparent sequelae, which include hematuria, abdominal pain, and gonadal varices among a variety of other symptoms, the severity of which can depend on the severity of the anatomic findings.3. The role of interventions, especially minimally invasive interventions such as endovascular treatment, has become more prominent in the treatment of severe Nutcracker syndrome. This exhibit will outline diagnostic methods and management options for Nutcracker syndrome with a focus on endovascular approaches.

#### TABLE OF CONTENTS/OUTLINE

1. Review the pathophysiology of Nutcracker syndrome with anatomic causes and variations2. Discuss diagnostic methods doppler ultrasound, CT, MRI and angiography, venography and intravascular ultrasound.a. Imaging criteria and classificationb. Examples of cases from a single institution3. Discuss management options including conservative management and surgical options with an emphasis on endovascular approaches (stenting, coil embolization of varices).a. Advantages over open or laparoscopic interventionsb. Complications and pitfallsc. Future directions

#### IREE-43 Managing Hemoptysis from Diagnosis to the Angio Suite: A How-to Guide for the Radiologist

#### TEACHING POINTS

Hemoptysis is the airway bleeding, ranging from blood-tinged mucus to gross hemorrhage: when massive -almost defined as a >300mL/24h bleeding- it is a life-threatening and challenging condition. Angiography with embolization is the front-line therapy for emergent cases of hemoptysis. The aim of this study is to give a concise guide to the diagnostic and interventional management of hemoptysis in the angiography suite.

#### TABLE OF CONTENTS/OUTLINE

Hemoptysis generally arises from the bronchial arteries (BAs,~90%) and encompasses infectious, inflammatory and malignant causes, being tuberculosis the most common worldwide. After airway securing, underlying conditions and laterality must be assessed: CT angiogram -eventually along with bronchoscopy- is a useful tool to review and report origin (orthotopic/ectopic), course and morphology of BAs or to identify nonbronchial systemic/pulmonary bleeding source. On conventional bronchial arteriograms, selective catheterization of BAs origins is mandatory, while the anterior spinal artery and its medullary branches must be identified in order to avoid iatrogenic transverse myelitis or paralysis, the major complications. Hypertrophied vessels, parenchymal hyperemia, blushing or pseudoaneurysm suggest bleed source. For BAs, embolic particles (350-700microm) are usually preferred, while coils and plugs preclude reintervention if hemoptysis recurs and are thus limited to bronchial aneurysms and pulmonary arteries embolization. Recurrence rates range from 10 to 58% and increase over time and in certain diseases (e.g. cystic fibrosis).

#### IREE-44 Abernethy Malformations: Making Sense of Congenital Portosystemic Shunts

#### TEACHING POINTS

Abernethy malformation, or congenital portosystemic shunt, is a rare abnormality of the portal venous system. The portal vein either fails to form or forms abnormally, resulting in an anomalous shunt that diverts blood from the portal vein to the systemic circulation without passing through the liver. The clinical manifestations of Abernethy malformation can vary depending on the severity and location of the shunt, and may include encephalopathy, portal hypertension, and liver failure. Abernethy malformation can be detected via ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI). Patients with Abernethy malformation are at risk for liver lesions, thus particular attention must be paid to the liver parenchyma. The orientation and size of the shunt can be confirmed via catheter-directed angiography and balloon occlusion. Treatment options for Abernethy malformation include interventional or surgical shunt closure, liver transplantation, or conservative medical management of symptoms. The choice of treatment depends on the severity of the malformation and the patient's clinical condition.

#### TABLE OF CONTENTS/OUTLINE

(1) Introduction: Overview of Abernethy malformation(2) Clinical presentation: Signs and symptoms(3) Imaging: Detection, associated findings, characterization, and confirmation(4) Treatment: To close or not to close?

#### IREE-45 Sharp Recanalization for Central Venous Occlusive Disease: Advanced Techniques and Evidence-Based Outcomes

Participants

John Domini, Columbus, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Define the role of and indications for sharp endovascular recanalization in the management of central venous occlusive disease

(CVOD). Examine relevant clinical and vascular anatomy relevant to CVOD. Describe the conventional interventional methods of central venous recanalization. Discuss pertinent procedural techniques, devices, technical challenges, and special considerations of sharp central venous recanalization. Review risks, evidence-based outcomes, complications, and post-procedural care.

#### TABLE OF CONTENTS/OUTLINE

A review of indications and rationale for patient selection will be discussed. Central venous anatomy with marked implications on technical approaches will be examined. Procedural details will review the conventional methods and highlight indications for sharp recanalization and advanced techniques. Technical aspects including equipment choices, procedural techniques, practical pearls and potential pitfalls will be discussed, guided by a case-based review. Interpretation of clinical results, evidence-based outcomes will also be reviewed with a focus on complications, risks and post-procedural care.

#### IREE-46 Vasculitis: Clinical Evaluation, Imaging, and Treatment

Participants

Kausthubh Hegde, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the definition and types of Vasculitis. 2. Discuss the signs, symptoms, and clinical evaluation of the most common types of Vasculitis. 3. Diagnosis with an emphasis on the role of imaging in diagnosing Vasculitis. 4. Case-based examples of IR treatment options and follow-up care.

#### TABLE OF CONTENTS/OUTLINE

1. Vasculitis: definition and pathophysiology of the disease. 2. Classification of vasculitis - Lie classification of vasculitis (1994) - 2012 revised International Chapel Hill Consensus Conference nomenclature of vasculitides 3. Review of the signs and symptoms of different types of vasculitis. 4. Role of diagnostic imaging modalities in the evaluation of vasculitis (with case-based examples). 5. Indications and contraindications for endovascular treatment of vasculitis (with case-based examples). 6. Complications and follow-up care after IR procedures.

#### IREE-47 Embolization of Extracranial Arteriovenous Malformations: Strategies of Interventional Approaches According to the Yakes Classification

#### TEACHING POINTS

Learn imaging findings associated with arteriovenous malformations (AVM) and present the Yakes classification Present briefly the main genetic mutations associated pathways and potential drug therapies Understand interventional management of AVM according to the Yakes classification Discuss embolization strategies according to the Yakes classification and AVM territory Discuss outcomes, follow-up and complications Propose a therapeutic algorithm based on the Yakes classification, clinical staging and genotyping

#### TABLE OF CONTENTS/OUTLINE

Overview and classification of AVM according to the Yakes classification Clinical and imaging evaluation before procedure Presentation of the Shobinger classification and discussion of the relative roles of Doppler ultrasound, CT, MRI, DSA Embolization techniques Presentation of liquid and mechanical embolizing agents and their use according to the approach (endovascular transarterial approach, direct puncture, retrograde venous approach). The safe use of ethanol and bleomycin will be also discussed Treatment techniques according to AVM territory and Yakes classification Discuss specific considerations for head and neck, limbs, thoracic, abdominal and pelvic AVMs Yakes Type I (transarterial, transvenous, coils, plug) Yakes Type II (transarterial, direct puncture, retrograde venous, liquid agent) Yakes IIIa (transvenous, coils, plug liquid agents) Yakes IIIb (transarterial, direct puncture, retrograde venous, liquid agent, coils) Yakes IV (direct puncture ethanol, interstitial infiltration bleomycin) Follow-up and outcomes evaluation Clinical and imaging criteria to assess therapeutic response Conclusion Therapeutic algorithm proposed

#### IREE-48 Fluid Solutions for Complex Cases: A Comprehensive Guide to Sclerosant and Liquid Embolic Agents for Radiologists

Participants

Keith Ameyaw, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Liquid embolic and sclerosant agents are vital tools in interventional procedures capable of achieving targeted vessel occlusion, space occupation or tissue fibrosis. 2. Understanding the mechanism of action of these agents is essential for optimal use, procedural technique, and informing operator preference. 3. Different agents have unique advantages and complications. Selecting the appropriate agent is critical for optimizing patient outcomes. 4. Radiologists must be intimately familiar with the unique post-procedural imaging characteristics of liquid embolics/sclerosants. These imaging findings play a crucial role in assessing both the success of the procedure and informing follow-up care.

#### TABLE OF CONTENTS/OUTLINE

1. Mechanism of action of sclerosant and liquid embolic agents. 2. Indications for use in several disease entities, including: intracranial and extracranial vascular malformations, lymphatic malformations, tumors, cysts, benign prostatic hyperplasia, venous insufficiency, arterial hemorrhage, portal hypertensive variceal hemorrhage, aortic graft endoleak, lymphatic leak/chylothorax, lymphoceles, post-operative seroma, and gonadal vein embolization. 3. Technique and procedural considerations. 4. Advantages and associated complications of different agents. 5. Imaging findings with descriptions of associated artifacts necessary for appropriately assessing procedural success and informing follow-up care.

#### IREE-49 Benefits of Hybrid CT/Angiography Utilization for Microsphere Trans-arterial Radioembolization with Yttrium-90

#### TEACHING POINTS

Hybrid angiography/CT (Angio-CT) employs both traditional CT imaging with concurrent fluoroscopic angiography in the same procedure room. Although introduced prior to cone-beam CT, Angio-CT has been under-utilized due to cost and availability. The resurgence of Angio-CT has proven to be a very useful tool in interventional oncology; however, its application in microsphere

trans-arterial radioembolization is not well documented through the literature. Angio-CT shows unique advantages in the image resolution regardless of patient preparation, catheter directed contrast imaging in the planned treatment field to precisely calculate more accurate dosimetry in routine and multifocal lesions, to more accurately characterize lesions and any potential changes in lesions with higher sensitivity and specificity, and to more accurately detect anatomic variants and/or accessory tumor feeding vessels. Lastly, early data suggests Angio-CT systems utilization could improve survival in patients with HCC when performing trans-arterial therapy, likely due to more accurate and precise pre-treatment and intraprocedural imaging.

#### TABLE OF CONTENTS/OUTLINE

1. What is Angio/CT? 2. Practical points and precision of dosimetry with Angio/CT 3. Unique Advantages in image quality and predicting success 4. Optimal Utility of Each Modality 5. The Unknowns and the Research Potential 6. Case Examples a. Improved detection and characterization b. Anatomic variants potentially unnoticed with cone-beam c. Improving dosimetry accuracy 7. Quantifiable benefit in outcome?

#### IREE-5 Advances in Percutaneous Jejunostomy: Novel Techniques and Their Clinical Implications

##### TEACHING POINTS

Percutaneous radiologic jejunostomy (PRJ) is a minimally invasive procedure for patients requiring enteral feeding and access for biliary interventions, especially in patients who have altered anatomy, such as after gastric resection, gastric bypass surgery, Whipple procedure, or liver transplant. After reviewing this exhibit learners should be able to: 1. Recognize common indications for PRJ 2. Understand novel techniques to aid in successful PRJ access 3. Recognize and address complications related to PRJ

#### TABLE OF CONTENTS/OUTLINE

This exhibit will: 1. Review imaging and anatomical considerations for jejunal access 2. Discuss common indications, contraindications and patient selection for PRJ 3. Introduce procedural advancements in PRJ through a case-based approach- Traditional techniques in PRJ- Modified coaxial technique for T fastener deployment through a sheath- Utilizing cone beam CT to ensure proper T fastener placement- Using an orogastric magnetic balloon and ultrasound guidance to assist in complicated cases where traditional methods fail 4. Address pitfalls and potential complications of PRJ Summary Clinical Implications: As the number of liver transplants, cholecystectomies and gastric surgeries increase every year, there may be more demand for jejunal access to manage potential complications of these procedures. PRJ can allow for enteral nutrition and access for repeated biliary interventions.

#### IREE-50 A Review of Superior Vena Cava Interventions

Participants

Jorge Lopera, MD, San Antonio, TX (*Presenter*) Shareholder, Tecnostent SA; Consultant, Merit Medical Systems, Inc; Research Grant, AngioDynamics, Inc

##### TEACHING POINTS

To review the clinical presentation and treatment options for SVC syndrome. To understand the role of different endovascular techniques to treat stenoses, occlusions and thrombosis of the SVC. To illustrate the challenges when treating SVC stenoses in patients with existing central lines. To discuss the different recanalization techniques to treat complex chronic occlusions of the SVC. To review the different complications with SVC interventions and how to treat them.

#### TABLE OF CONTENTS/OUTLINE

1. Clinical presentations and imaging of central venous and SVC stenoses and occlusions. 2. Review of treatment options in malignant SVC syndrome. 3. Treatment options in SVC syndrome - special situations: a. SVC syndrome with existing ports and dialysis lines. b. SVC syndrome with thrombus c. Endovascular stenting : single or kissing stents. Covered or bare stents. d. Recanalization techniques for complex chronic occlusions. 4. Complications .

#### IREE-51 Percutaneously Induced Neuroregeneration for Treatment of Chronic Neuropathic Pain

##### TEACHING POINTS

1) Review the pathophysiology of neuropathic pain and the Sunderland classification of nerve injury. 2) Explain how percutaneous cryoneurolysis can induce regeneration of damaged peripheral nerves causing chronic pain. 3) Demonstrate the ability of percutaneous cryoneurolysis to provide long term relief and neuroregeneration for the treatment of chronic neuropathic pain. 4) Discuss current indications and potential new applications of cryoneurolysis.

#### TABLE OF CONTENTS/OUTLINE

1) Incidence and causes of neuropathic pain. 2) Pathophysiology of nerve injury and chronic peripheral nerve pain. 3) Mechanism of cryoneurolysis and neuroregeneration. 4) Current indications and patient selection. 5) Techniques for cryoneurolysis, including approaches and duration/temperature of ablation. 6) Post-procedure follow-up and outcomes. 7) Case examples of cryoneurolysis for pain relief and neuroregeneration. 8) The pre-operative use of cryoneurolysis to reduce pain caused by other interventions including ablation, embolization, and post-mastectomy pain. 9) Exploring new applications of cryoneurolysis.

#### IREE-52 Super Selective Radioembolization for Hepatocellular Carcinoma: Radiation Segmentectomy and Beyond

##### TEACHING POINTS

Radioembolization has emerged as an effective treatment option for hepatocellular carcinoma that cannot be surgically removed. The procedure involves the preferential deposition of radioactive microspheres into the hypervascular tumor through a siphoning effect, typically achieved by injecting the microspheres at the lobar artery level. However, to improve tumor response and minimize potential complications, superselective radioembolization is recommended. The purpose of this exhibit is : (1) To review the rationale behind radiation segmentectomy. (2) To learn when superselective radioembolization is necessary, (3) to offer technical tips for performing superselective radioembolization.

#### TABLE OF CONTENTS/OUTLINE

1) Radiation segmentectomy : rationale and evidence 2) Dosimetry : Practical guide for dosimetry of superselective radioembolization 3) When superselective radioembolization is needed A. small single tumor : radiation segmentectomy B. Large

single tumor saddling on both lobes C. Small remnant liver D. Hepatic artery branching at acute angle E. Extrahepatic collateral artery supplying the tumor 4) Technical consideration of superselective radioembolization A. Protection of distal normal liver by using balloon microcatheter and detachable coil B. Combination treatment of lobar and segmental artery C. Combination treatment of 1st and 2nd week dosing of glass microsphere 5) Follow-up imaging after superselective radioembolization A. Early loss of arterial enhancement of the tumor B. Focal radiation necrosis mimicking new hypovascular tumor

### **IREE-53 TESLA: The Future in Treatment for Malignant Perihilar Obstruction**

#### **TEACHING POINTS**

In malignant bile duct obstructions the most common treatment in the Netherlands is endoscopic drainage (ERCP) with placing plastic tubes, combined with biliary drainage. Cholangitis due to ERCP occurs often, in 40-60% of the patients, probably caused by colonization of bowel bacteria and infection of undrained segments. Patients often need multiple re-interventions. The 90days mortality after diagnosis is 35%. In the TESLA trial the hypothesis is that primary percutaneous stenting, without placing a biliary drain and without stenting the ampulla of Vater, provides less infectious complications and less reinterventions compared to endoscopic drainage. Ensuring a decrease in morbidity and mortality and improving the quality of life.

#### **TABLE OF CONTENTS/OUTLINE**

Compare primary percutaneous stenting above the ampulla versus endoscopic drainage for palliative treatment of malignant hilar biliary obstruction in the TESLA study. Primary providing a lower complication rate and furthermore lowering the absolute and relative bilirubin levels, decreasing the number of reinterventions and providing a better quality of life. This abstract provides an overview of the TESLA trial, an education of the interventional procedure and materials and provides the first promising data retrieved from the TESLA trial.

### **IREE-54 Advancing Interventional Procedures With Mixed Reality**

#### **TEACHING POINTS**

Introduction: The presentation focuses on Microsoft's HoloLens2 for visualization on an angiography biplane system. The HoloLens2 device is a mixed reality device that uses depth, light, and infrared cameras to track its environment and anchor multiple virtual displays to view ultrasound and fluoroscopy in real-time during image-guided interventions. Teaching Points: • Overview of the HoloLens2 device and its functionalities as they relate to interventional procedures • Demonstrate improvements in customization, decrease visual field discrepancies, and reduce ergonomic challenges associated with the current angiography systems • Evaluation of the image quality, latency, customization capabilities, and overall user experience • Demonstrate functionality like voice, gaze, and gesture controls in the live angiography environment • Case examples of the HoloLens2 integration in image-guided interventions on secondary personnel and primary phantom work

#### **TABLE OF CONTENTS/OUTLINE**

Outline: The presentation will cover the various teaching points related to HoloLens2 integration into an angiography suite. Attendees will learn how the device facilitates the clinician seeing what they want and where they want. The presentation will conclude with a summary of the promising role the HoloLens2 provides in advancing the clinician experience in interventional radiology and answer the question of why integrating this emerging technology will be beneficial in the clinical environment.

### **IREE-55 Percutaneous Cryoneurolysis for Complex Pain: Indications, Technique, and Expectations**

#### **TEACHING POINTS**

1. Review the epidemiology of complex pain syndromes and current need for analgesic adjuncts in pain management 2. Discuss the mechanisms of how percutaneous cryoneurolysis affects pain 3. Review the uses and techniques of various procedures including intercostal, ilioinguinal, intercostobrachial, and pudendal nerve cryoneurolysis 4. Demonstrate successful approaches to complex pain including pathologies involving the rib, hip, arm, and groin 5. Discuss common complications after percutaneous cryoneurolysis, including their diagnosis and management

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction, including epidemiology of complex pain syndromes 2. Mechanism and physiology behind cryoneurolysis effect on pain 3. Indication, technique, and successful case of intercostal nerve cryoneurolysis 4. Indication, technique, and successful case of ilioinguinal nerve cryoneurolysis 5. Indication, technique, and successful case of intercostobrachial nerve cryoneurolysis 6. Indication, technique, and successful case of pudendal nerve cryoneurolysis 7. Recognition and management of common complications 8. Conclusion and summary

### **IREE-56 Ectopic Varices: Anatomic and Hemodynamic Features and Endovascular Techniques**

#### **TEACHING POINTS**

Ectopic varices arise in the hepatopetal or hepatofugal collateral vessels outside the gastro-esophageal region account for up to 5% of variceal bleeding. Various endovascular techniques can be effectively applied based upon their anatomic and hemodynamic features. Duodenal varices (DVs) are the most common type and arise in either hepatopetal collaterals or hepatofugal collaterals. DVs with hepatopetal collaterals are treated by portal vein (PV) stenting and those with hepatofugal collateral are treated by antegrade and/or retrograde obliteration techniques with or without TIPS. Rectal varices (RVs) are common complication in portal hypertension and arise in hepatofugal collaterals from the superior rectal vein to the bilateral internal iliac veins. Antegrade obliteration is often required to eradication of RVs because of their complicated drainage system. TIPS is effective to prevent recurrent bleeding. (Peri)stomal varices (SVs) can develop after ileostomy. SVs are supplied by the ileal veins and drains into the epigastric veins. They are often associated with portal hypertension but also with local hemodynamic abnormality. SVs with refractory bleeding have been treated by direct puncture embolization, antegrade obliteration and TIPS. Choledochal (-jejunal) varices arise in hepatopetal collaterals with extrahepatic PV occlusion often associated with choledocojejunostomy. They are treated by PV stenting with additional endovascular techniques.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline 1. Basics of ectopic varices and various endovascular techniques 2. Duodenal varices 3. Rectal varices 4. Stomal varices 5. Choledochal (-jejunal) varices 6. Miscellaneous/ infrequent varices

## **IREE-57 Thermoablation of Pulmonary Metastasis: A Standard for a Secure Approach**

Participants

Barbara Nunes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To illustrate noble structures in the pulmonary ablation areas under risk, which should be minded during the procedure.- To discuss patient selection, positioning, rationale of safe routes for the probe, and safety maneuvers in order to avoid and protect the above structures.- To assess the criterias of an adequate ablation zone and its expected course.- To illustrate the most important complications involved in the thermoablation of pulmonary metastasis.

### **TABLE OF CONTENTS/OUTLINE**

- Anatomy- Thermoablation mechanics- Patient positioning rationale and safe routes on pulmonary nodules ablation- Protective maneuvers- Defining an adequate ablation zone- Expected course of an adequate ablation zone- Most important acute complications

## **IREE-58 Buffalo Lung: A Human Complication after Lung Biopsy**

Participants

Nicole Law, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Buffalo lung is a rare occurrence of bilateral pneumothoracies due to an abnormal physical communication between the two pleural spaces.2. Iatrogenic buffalo lung can occur following intrathoracic procedures such as median sternotomy, laparoscopic surgery and heart-lung transplantation, putting these patients at higher risk for bilateral pneumothoracies during a lung biopsy procedure.3. Presentation of buffalo chest can be worse than that of unilateral pneumothorax, including severe and sudden onset of dyspnea and pleuritic chest pain, tachycardia, hypotension, and even cardiac arrest or death.4. Quick action should be taken in these patients to place bilateral chest tubes in order to re-expand the collapsed lungs. For this reason, it is important for IR physicians to be aware of the risk of buffalo lung in lung biopsy patients.

### **TABLE OF CONTENTS/OUTLINE**

Introduction.Patient case example.Picture examples.Discussion of buffalo lung and its' presentations.Patient risk factors.Treatment and case outcome.

## **IREE-59 Anatomic Variants of the Hepatic Arteries and Technical Considerations for Y90 Radioembolization**

Participants

Taylor Loon, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Review hepatic arterial variants that a radiologist should be able to recognize using the MICHEL classification. 2) Identify and familiarize the most common hepatic arterial variants encountered in pre-treatment mapping for Yttrium-90 radioembolization based on imaging findings. 3) Highlight the possible complications of Y90 microsphere diffusion into replaced right and left hepatic arteries and technical considerations when encountering variants.

### **TABLE OF CONTENTS/OUTLINE**

1) Review standard hepatic artery anatomy and the relevant imaging findings trainees should know to quickly evaluate using CT and digital subtraction angiography. 2)Introduce the MICHEL classification and subclassify based on right, left and common hepatic arterial origins. Present digitally drawn visual diagrams demonstrating each MICHEL classification. 3) Present cases from our institution depicting hepatic arterial anatomic variants using CT angiography and 3D-rendered images (MICHEL Classification, II, III and IV, which have a prevalence of 12.5%, 7.5% and 1% respectively). 4)Using cases from our institution, review relevant imaging findings on digital subtraction angiography for identifying hepatic arterial variants during pre-procedure mapping for Y90 chemoembolization. 5) Discuss possible branches of replaced/accessory left and right hepatic arteries and impact of diffusion of Y90 spheres. 6) Discuss technical considerations when encountering hepatic arterial variants including; injection rate for mapping DSA, prophylactic embolization of branches, and microcatheter tip position.

## **IREE-6 Purchasing Decisions for an Interventional CT Program**

### **TEACHING POINTS**

(1) Interventional CT fluoroscopy is becoming widely used and scanner features that meet both diagnostic and interventional needs are becoming increasingly complex. In this paper, the most important scanner features are discussed and ranked for both diagnostic and interventional purposes. (2) Vendors provide different offerings for the features, so hypothetical comparisons for three vendors are included to facilitate explaining various tradeoffs in purchasing decisions.

### **TABLE OF CONTENTS/OUTLINE**

This education exhibit provides a complete overview of CT scanner features which are necessary, desired, or useful for meeting both diagnostic and interventional purposes. The viewer will become familiar with the nuances of each feature and leave more comfortable with purchasing decisions in an increasingly complex market.

## **IREE-60 Vascular Interventions in Angiosarcoma with Pulmonary Hemorrhage**

Participants

Denes Szekeres, BS, Rochester, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The aim of this exhibit is to identify the role of the radiologist in diagnosis and management of vascular tumors. We begin with a review the epidemiology and presentation of angiosarcoma, a rare and diverse subset of malignant soft tissue sarcoma that is often

insidious. We discuss the broad range of imaging findings for a variety of common sites of primary and secondary angiosarcoma through a review of SEER data and prior studies. We tie together the educational points with a case report of a cardiac angiosarcoma, including a review of the multidisciplinary approach to diagnostic workup and oncologic management. We end with a description of endovascular interventions (coil embolization) in treating pulmonary hemorrhage, a common complication of metastatic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Statistics and clinical pearls of angiosarcoma
2. Review of multimodality imaging findings
3. Case presentation of primary cardiac angiosarcoma
4. Technique for coil embolization of pulmonary arterial hemorrhage
5. Summary of educational points

#### IREE-61 **Oops, We Did It Again: A Review of CT- and US-Guided Thoracic Interventional Procedure Complications**

##### TEACHING POINTS

To review the potential complications of CT- and US-guided thoracic interventional procedures. To analyze the causes and risk factors of these complications and discuss how they could be prevented. To explain the different treatment options for these complications.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Lung biopsy and lung abscess drainage indications - Pleural biopsy indications- Thoracocentesis and pleural drainage indications - Techniques: CT- and US guided- Procedure: patient preparation, materials, technical considerations 2. Complications 2.1. Pneumothorax - Risk factors - Treatment 2.2. Lung Hemorrhage- Risk factors - Treatment 2.3. Subcutaneous Hematoma- Causes - Treatment 2.4. Seeding 2.5. Gas embolism- Clinical manifestations, causes - Treatment 2.6. Hemothorax- Causes - Treatment 2.7. Non-diagnostic biopsy- Risk factors - FNA vs CNB - Methods to increase biopsy performance 2.8. Non-productive pleural drainage- Causes- Treatment 3. Prevention of complications 4. Summary 5. Conclusion

#### IREE-62 **Intra-procedural Ablation Margin Confirmation for Thermal Ablation of Liver Tumors Using Open Source Software**

Participants

Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ; Stockholder, SOPHiA GENETICS

##### TEACHING POINTS

- 1) Dedicated software for confirmation of ablation margins is commercially available but expensive and often unavailable to in health care centers and research laboratories with limited budgets - even in developed nations. This abstract presents a workflow for ablation confirmation using free and open source software.
- 2) The minimum ablation margin (MAM) after thermal ablation of liver tumors is the most important predictor of local tumor progression.
- 3) Detecting an insufficient minimum ablation margin during the procedure allows for immediate re-ablation during the same treatment session.
- 4) Intra-operative images acquired using controlled breathing (e.g. apnea, high frequency jet ventilation) yield the most accurate results as they involve minimal tissue deformation.

#### TABLE OF CONTENTS/OUTLINE

- 1) Software requirements
- 2) Loading and organizing the data
- 3) Registering the pre- and post-ablation CT images
- 4) Segmentation of the tumor and ablation zone
- 5) Calculation and visualization of the minimum ablation margin

#### IREE-63 **The Role of Cone Beam Computed Tomography in Embolization of a Technically Challenging Distal Pulmonary Artery Mycotic Aneurysm**

##### TEACHING POINTS

Cone-Beam Computed Tomography (CBCT) has many potential applications for both diagnostic and interventional radiology. The use of CBCT, as exemplified by the following case, allowed for the expeditious identification and treatment of a distal pulmonary artery mycotic aneurysm. This exhibit will enable participants to directly compare the differences in appearance between traditional CT and CBCT of the same entity and to display how CBCT data can be fused to live fluoroscopy to hasten the time to intervention.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of the case example a. 42-year-old female with a complex medical history most notable for recent endocarditis treated with antibiotics and mitral valve replacement who presented with hemoptysis. 2. Description of traditional CTA findings a. CTA Chest demonstrated a distal, fourth-order pulmonary artery mycotic aneurysm. Axial images and coronal reformat provided. 3. Description of the CBCT findings a. Redemonstration of the aneurysm, comparing appearance to that of the CTA 4. Tutorial of fusing CBCT with live fluoroscopic images using guidance software, specifically using GE EMBO ASSIST ® as an example a. Images of the 3D reconstruction of the CBCT data b. Discussion of how guidance software is applied to the fluoroscopic images 5. Conclusion of case a. Successful, expeditious coil embolization of a difficult-to-access distal pulmonary artery mycotic aneurysm 6. Discussion of additional applications of this technique to other entities

#### IREE-64 **Overview of Diagnosis and Treatment of Large or Medium-sized Vessel Vasculitis**

##### TEACHING POINTS

Vasculitis is a group of disorders characterized by inflammation of the walls of blood vessels, and they are classified based on the diameter of the predominantly affected vessels. The clinical manifestations of vasculitis can be non-specific and may overlap with other disorders. Imaging techniques allow for direct evaluation of the arteries in large or medium-sized vessel vasculitis, and various interventional procedures may be used in these cases. However, the vessels involved in small vessel vasculitis are smaller than the current imaging resolution, meaning that only end organ changes secondary to the involvement of small vessels can be examined. This review presents the most important imaging modalities and typical findings in large and medium-sized vasculitis. The purpose of this exhibit is : (1) To list the vasculitis according to the vessel size affected. (2) To review the clinical and radiological manifestation of various vasculitis. (3) To learn the indication and technical tips for interventional procedures for vasculitis.

#### TABLE OF CONTENTS/OUTLINE

- 1) List of vasculitis A: large vessels (eg, giant cell arteritis, Takayasu arteritis), B: medium-sized vessels (eg, polyarteritis nodosa,

Kawasaki disease, primary granulomatous central nervous system vasculitis), C : small vessels (eg, Wegener granulomatosis, Churg-Strauss syndrome, microscopic polyangiitis, Henoch-Schönlein syndrome, systemic lupus erythematosus, rheumatoid vasculitis, Behçet syndrome). 2) Clinical manifestation and diagnostic criteria 3) Imaging modality and angiographic appearance 4) Treatment options : medical vs interventional 5) interventional procedures and their indication

## **IREE-65 Intra-arterial Treatment for Hepatocellular Carcinomas: How to Manage Shunting from the Artery**

### **TEACHING POINTS**

In the treatment of hepatocellular carcinomas, intra-arterial therapy such as chemoembolization and radioembolization is commonly used. However, operators may encounter shunts from the artery (such as arterioportal, arteriovenous, and arteriopulmonary shunts) that can hinder effective treatment. These shunts can be caused by various factors such as tumor invasion, previous percutaneous procedures, chronic inflammation, or congenital acquisition. If not properly occluded, embolic material can pass through the shunt and cause non-target embolization or serious complications. This exhibit aims to achieve three goals: (1) Review the radiologic appearance of arterioportal, arteriovenous, and arteriopulmonary shunts; (2) Learn how to manage these shunts with proper embolic materials; and (3) List the possible complications and their management.

### **TABLE OF CONTENTS/OUTLINE**

1) List of shunts Arterioportal shunt (hepatic artery - portal vein), Arteriovenous shunt (hepatic artery - hepatic vein), Arteriopulmonary shunt (hepatic artery - pulmonary artery/vein), 2) Imaging findings on CT/MR and angiography according to the cause (tumorous vs non-tumorous condition) 3) Embolization strategy and materials for shunts 4) Complications related with non-target embolization and their management

## **IREE-66 Nonsurgical Management of Renal Masses**

Participants

Laura Jorgenson, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Learn the nonsurgical approaches to treat renal masses, including ablation, embolization, and SBRT, the indications for treatment and intraprocedural tips and tricks to optimize response. Understand post ablation, embolization and SBRT changes in the renal tumor and how to avoid pitfalls in interpretation. How to evaluate for tumor recurrence post treatment and avoid pitfalls in assessment. Understand common complications following ablation, embolization, and SBRT.

### **TABLE OF CONTENTS/OUTLINE**

1. Ablation, embolization, and SBRT technique Discuss evolution of nonsurgical management of renal tumors as a viable treatment option. Discuss indications and fundamentals of ablation, embolization, and SBRT: Patient selection Tumor types Treatment planning Procedural insights to avoid complications Role of spectral CT during ablation 2. Post ablation SBRT and embolization changes in renal tumors and assessment of tumor response Response of renal masses to nonsurgical management Typical features on imaging (CT/MRI) which depict normal evolution of typical changes on imaging - acute, subacute and chronic changes Tips on how to avoid pitfalls in interpretation 3. Potential Complications and related imaging features in each modality Intraprocedural complications Immediate post-procedural complications Delayed complications

## **IREE-67 Radioembolization of Hepatocellular Carcinoma with Extrahepatic Collateral Blood Supply: Anatomic and Technical Considerations**

### **TEACHING POINTS**

The utilization of radioembolization as a treatment method for hepatocellular carcinoma (HCC) has significantly increased in recent years. Typically, HCC derives its blood supply from the hepatic artery; however, it can also obtain a parasitic blood supply from extrahepatic collateral arteries (EHC). While chemoembolization has been carried out through EHC without significant complications, there is limited experience with radioembolization via EHC. The aim of this exhibit is threefold: (1) to examine the critical anatomy of EHC utilizing cone-beam CT, (2) To review when we suspect the presence of EHC supplying HCC, (3) To learn how to do safe radioembolization through EHC.

### **TABLE OF CONTENTS/OUTLINE**

1) List of treated EHC, 2) Vascular anatomy of EHC by using cone-beam CT and safe point of each EHC, 3) Suggestive findings of EHC on CT/MR and cone-beam CT, 4) Special considerations for radioembolization through EHC: dosimetry, embolization of pulmonary shunt, protection of normal vessel, and redistribution by proximal embolization.

## **IREE-68 Reducing the Learning Curve: The Use of an Ex Vivo Model for Teaching Double J Ureteral Stent Insertion and Retrograde Exchange**

### **TEACHING POINTS**

Discuss the benefits of simulation-based training for procedure competence. To describe our experience with a new training model for learning double J ureteral stent (DJS) insertion and retrograde exchange.

### **TABLE OF CONTENTS/OUTLINE**

Introduction. Urinary tract obstruction and how the performance of DJS can provide relief. The current master-apprentice model and the importance of procedure competence for trainees before practicing on patients. Benefits of simulation-based training and the current models available. Illustration of a developed ex vivo model for simulating a DJS procedure. Conclusion: Percutaneous access into the renal collecting system is a crucial step when performing DJS. This developed model allows for training on this technical skill as well as the remaining steps in a realistic and safe environment.

## **IREE-69 Diagnostic and Interventional Radiology for Budd-Chiari: An Update on BCS Classification and IVUS**

Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**



1. Budd-Chiari syndrome (BCS) is the occlusion of one or more veins of the liver due to various disorders that result in sinusoidal congestion, portal hypertension, fibrosis, cirrhosis, and nodular regeneration. 2. The new BCS classifications can provide more appropriate treatment options; accurately determining the type of obstructor, number of blocked vessels, and length of the obstruction and categorizing the patients according to the updated BCS classification can improve the success of the patient's therapeutic treatment plan.

#### TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of Budd Chiari and the BCS classifications. 2. Briefly review potential mimics of Budd Chiari (i.e. other cause of sinusoidal or post hepatic obstruction). 3. Discuss general concepts of assessing the liver Doppler US, CTA, MRA, venography, and intravascular ultrasound (IVUS) with emphasis on technique, protocol, and image optimization for diagnosing Budd Chiari. a. Describe differentiating imaging features of various BCS presentations depending on the location of the occlusion. b. Review complications associated with BCS. c. Briefly demonstrate pitfalls of BCS. 4. Discuss management options with interventional radiology procedures (venoplasty and stenting, local pharmacologic and mechanical thrombolysis, transjugular intrahepatic portosystemic shunt (TIPS) placement), and potential complications.

#### IREE-7 Prophylactic Intervention for Placenta Accreta Spectrum

##### TEACHING POINTS

Placenta accreta spectrum (PAS) is an abnormal placentation with invasion of myometrium or extrauterine structures and can be associated with maternal morbidity and mortality. Not only the prenatal diagnosis but also the management are important to reach a better outcome. To date, pre-operative prophylactic balloon occlusion is developing with balloon placement in various sites including internal iliac arteries, common iliac arteries, uterine arteries and abdominal aorta. The purpose of this exhibit is: 1) to review the MRI features of PAS. 2) to review different treatment options including procedural risk, benefit and outcome. 3) to demonstrate techniques of balloon occlusion of internal iliac arteries. 4) to enhance the value of MRI image for preprocedural guidance or predictive indicator.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction of placenta accreta spectrum (PAS) 2) MRI diagnosis of PAS. 3) Management for abnormal placentation a. traditional approach b. prophylactic balloon occlusion in various anatomic regions c. outcome for each treatment 4) Case demonstration: balloon occlusion of internal iliac arteries. 5) Additional MRI role for interventional radiologist

#### IREE-70 Image-guided Percutaneous Cryoablation for Lung Malignancies: Giving the Tumor a Cold Send-off

Participants

Angel Castillo Fortuno, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- To describe the physical and therapeutical mechanisms of image-guided percutaneous lung cryoablation (L-CYOA).
- To discuss the clinical and imaging features and the diagnostic and therapeutical algorithms of patients with lung malignancies amenable to treatment L-CYOA, including a proposed systematic pre-procedural evaluation protocol.
- To explain the technique, intraprocedural considerations, imaging findings, and most common complications related to L-CYOA.
- To describe the short-, mid-, and long-term follow-up imaging findings, clinical outcomes, and prospects of L-CYOA in the treatment of lung malignancies.

#### TABLE OF CONTENTS/OUTLINE

1.- Introduction 1.1- Background 1.2 - Surgery, SBRT or lung ablation? 1.3.- Heat vs. cold ablation techniques: Why CYOA? 1.4.- CYOA: Basic principles 2.- Indications 2.1.- Non-small cell lung carcinoma (NSCLC). 2.2.- Oligometastatic lung disease (OLD). 3.- Assessment before L-CYOA 3.1.- Patient selection. 3.2.- Preprocedural evaluation and preparation. 3.3.- Proposal of a systematic protocol. 4.- L-CYOA procedure 4.1.- Technical considerations: CYOA equipment and CT protocol. 4.2.- Technique. 4.3.- Intraprocedural clinical and imaging evaluation. 4.4.- Immediate clinical and imaging findings. 4.5.- Complications. 5.- Post-L-CYOA follow-up 5.1.- Clinical and imaging follow-up scheme. 5.2.- Short-, mid-, and long-term follow-up imaging and clinical findings. 6.- Clinical outcomes 6.1.- Stage I NSCLC. 6.2.- Alternatives indications in NSCLC. 6.3.- OLD. 6.4.- Immunotherapy synergy. 7.- Summarize 8.- Conclusion

#### IREE-71 Superior Vena Cava Interventions

Participants

Irene Dixe de Oliveira Santo, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Review the causes, anatomic considerations, presentation, and grading of superior vena cava syndrome (SVCS); Describe the main treatment options for SVCS with a special focus upon the endovascular therapies (ET), including angioplasty, stenting and catheter-based thrombus removal; Provide a brief case-based overview of ET, including stent selection; Review the main complications of ET.

#### TABLE OF CONTENTS/OUTLINE

Causes of superior vena cava syndrome (SVCS); Review of the main anatomic considerations, including patterns of obstruction and collateral pathways; Clinical presentation and grading system of SVCS; Diagnostic approach for SVCS; Main treatment options including chemotherapy with or without RT, surgical bypass or ET, including angioplasty, stenting and catheter-based thrombus removal, with pros and cons of each modality; Selected cases from our institution to illustrate several ET options; Venous Stents: types, descriptions, benefits and drawbacks; Complications of ET: hematoma, local infection, pericardial tamponade, SVC rupture, stent migration, in-stent restenosis, pulmonary edema, major bleeding, pulmonary embolism, and cardiac injury.

#### IREE-72 Combined Y90 Radioembolization and Immunotherapy for the Treatment of Hepatocellular Carcinoma: Is it Effective or Harmful Due to Adverse Effects

Participants

Justin Ling Leblanc, MD, JACKSON, MS (*Presenter*) Nothing to Disclose

Johnny Yang, BS, BA, Fresh Meadows, NY (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Review the mechanism of immunotherapy and Yttrium-90 radioembolization for the treatment of hepatocellular carcinoma (HCC). Explore the risks, benefits, and safety of combined immunotherapy and radioembolization treatment. Review outcomes of real-life cases of combined therapy.

## TABLE OF CONTENTS/OUTLINE

Understanding the Hepatocellular carcinoma (HCC) immune microenvironment is important for developing effective immunotherapies. Suppression of the cytotoxic immune response - including CD8+ T lymphocytes, Natural Killer (NK) cells, and their associated cytokines - is associated with HCC progression. New drugs targeting immune checkpoint inhibitors, such as nivolumab, pembrolizumab, and atezolizumab have revolutionized the treatment of HCC. The latest research is exploring combination therapy with multiple immunotherapy agents and/or locoregional therapies such as surgical resection, ablation, or embolization. We reviewed stand alone widely used radioembolization with yttrium-90 (Y-90) therapy versus the safety of combining radioembolization with the PD-1 inhibitor nivolumab in HCC. Several Studies looked at the safety of the combination therapy by examining adverse events and overall survival. Results have shown that the combination therapy was well-tolerated, with no major adverse events reported. The most common side effects were fatigue, nausea, and abdominal pain. The median overall survival for the patients was 17 months, which is similar to prior studies. Some studies showed similar survival between these two therapies. Personalized selection based on age, burden of disease and other favorable criteria are important on which patient will benefit from single or combined therapy.

## IREE-73 Understanding the Complex Mechanisms of Complications in IR

Participants

Jorge Lopera, MD, San Antonio, TX (*Presenter*) Shareholder, Tecnostent SA; Consultant, Merit Medical Systems, Inc; Research Grant, AngioDynamics, Inc

## TEACHING POINTS

- To review how complications affect our performance in IR
- To understand the most common mechanism of IR complications
- To learn how to prevent and deal with complications
- To illustrate healthy and unhealthy ways to deal with complications

## TABLE OF CONTENTS/OUTLINE

Introduction : Error or complication ? Most common cause of complications : Judgmental errors : incorrect strategy of treatment is chosen. (1) overly heroic procedures (2) failure to intervene when the situation demands. Technical errors : poor technique , poor selection of devices . Normative or moral errors: irresponsible or unethical behavior. IR specific complications: Choosing the wrong materials . Not knowing your patient's history well. Poor communication. Rushing through cases. Poor technique . Bad luck? . Simple steps to prevent complications Coping with complications : What to do next . Healthy and unhealthy ways to deal with complications Economic and social cost of complications Conclusions

## IREE-74 Considerations for the Nonconventional Transjugular Intrahepatic Portosystemic Shunt (TIPS) Creation in Cancer Patients: Alternative Techniques and When to Use Them

## TEACHING POINTS

1. Review the indications and potential interfering factors to performing a TIPS procedure in cancer patients. 2. Present the standard technique for performing a TIPS; modifications that can be made; and when to use them to circumvent difficulties of the pre-, intra-, and post-operative process in cancer patients with altered post-surgical anatomy and acute or chronic splenoportal venous thrombosis.

## TABLE OF CONTENTS/OUTLINE

The transjugular intrahepatic portosystemic shunt (TIPS) is widely used in relieving pressure in the portal venous system (~90% success rate) in patients with refractory variceal bleeding or ascites, often due to cirrhosis. The standard process involves catheter guidance from a hepatic vein to a target portal vein branch. Several factors in cancer patients can complicate this procedure. These patients routinely have altered post-surgical anatomy such as a partial hepatectomy. Additionally, an association with increased thrombophilia can cause portal vein thrombosis. Moreover, certain tumors can compress or invade into splenic or mesenteric veins and result in occlusions interfering with a TIPS creation. For such cases, modifications to recanalize or bypass the obstruction have been demonstrated. We review the literature and present alternative techniques for shunt creation in a nonconventional TIPS: 1. The diagnostic presentation of patient factors that can interfere with a successful TIPS creation. 2. Case-based discussion regarding modifications to the TIPS technique to circumvent complicating factors.

## IREE-75 Local and Systemic Immune Cell Landscape after Transcatheter Arterial Embolotherapies for Hepatocellular Carcinoma

## TEACHING POINTS

- Review the magnitude and influence of post embolization hypoxic microenvironment on the local and systemic immune cell landscape in hepatocellular carcinoma (HCC)
- Illustrate preclinical and clinical data on T-cell and myeloid populations in post embolization and radioembolization in tumor microenvironment
- Describe the current status of systemic immune cell response after catheter-based therapies for HCC

## TABLE OF CONTENTS/OUTLINE

1. Introduction to catheter-based interventions for HCC and technical impact on post embolization hypoxia 2. Overview of the role of hypoxic stress and angiogenic factors induced by embolization on HCC cell survival 3. Characterize T-cell and myeloid cell local landscape after catheter-based interventions. 4. Discuss changes to splenic and plasma levels of inflammatory markers after HCC embolotherapies. 5. Demonstrate sustained immune responses after Y90 Radioembolization in Hepatocellular Carcinoma 6. Discuss future applications of embolization therapies in treating liver tumors.

## IREE-76 Imaging Findings and Interventional Management in Benign and Malignant Biliary Disease

Participants

Daniel Freedman, MD, New York, NY (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. Biliary disease consists of benign and malignant entities with a diverse spectrum of clinical presentation and imaging findings. 2. Benign biliary disease includes choledochal cysts, hamartomas, autoimmune diseases, chronic pancreatitis, HIV cholangiopathy, iatrogenic injury, gallstones, infection (cholangitis), and may develop after liver transplantation. 3. Malignant biliary disease includes primary biliary cancers (cholangiocarcinoma) and secondary tumor/metastatic disease, and causes severe illness secondary to local obstruction. 4. Multimodality imaging plays a critical role in guiding diagnosis and treatment options executed by interventional radiologists and advanced endoscopists including PTC, PTBD, ERCP, biliary stents, and surgery.

## TABLE OF CONTENTS/OUTLINE

1. Review of the clinical presentation and diagnostic imaging workup for benign and malignant biliary disease. 2. Multimodal imaging and procedural approach to the diagnosis, management, and treatment of benign and malignant biliary disease, including: a. Percutaneous transhepatic cholangiography and drain placement (PTC, PTBD) b. Endoscopic retrograde cholangiopancreatography (ERCP) c. Percutaneous transhepatic cholangioscopy d. Biliary stenting e. Surgical intervention

## IREE-77 Deep Gluteal Syndrome: Anatomy, Imaging and CT-guided Treatment (Sciatic Nerve Neurolysis)

Participants

Cristina Candelaria Linares Bello, MD, Santa Cruz De Tenerife, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Remember the anatomy of the subgluteal space and the sciatic nerve. Explain the causes of deep gluteal syndrome and the different imaging findings. Explain the procedure of CT-guided treatment (sciatic neurolysis).

## TABLE OF CONTENTS/OUTLINE

Deep gluteal syndrome is considered an underdiagnosed entity and defined as the compression or irritation of a non-discogenic origin of the sciatic nerve in the anatomical region of the subgluteal space. The typical symptoms are: dysesthesias and/or pain in the buttock and hip. There are many etiologies that can produce this syndrome: Specific musculoskeletal entrapments: fibrous, fibrovascular or vascular bands, piriformis syndrome, gemelli-obturator internus syndrome, pathology of the quadratus femoris muscle and the ischiofemoral space and insertional pathology of the hamstring muscles. Non-specific pathologies: iatrogenic, inflammatory, traumatic, infectious, gynecologic, vascular and tumors. For its diagnosis, physical examination and an adequate clinical history are of great importance. MR imaging is the procedure of choice for diagnosis. On the other hand, the CT-guided procedure to perform sciatic nerve neurolysis is both a diagnostic and therapeutic procedure and an alternative to surgical treatments. The deep gluteal syndrome is an underdiagnosed entity with multiple etiologies. The CT-guided sciatic nerve neurolysis is a safe procedure and an alternative to surgical treatments.

## IREE-78 Hidden Time Bombs: Image Features of Abdominal Visceral Pseudoaneurysms and Treatment

## TEACHING POINTS

- Describe the common locations of, and clinical presentation including the complications of abdominal visceral artery pseudoaneurysms.
- Review the key imaging features of abdominal pseudoaneurysms on different modalities.
- Discuss the non-surgical endovascular and percutaneous treatment approaches to abdominal pseudoaneurysms.

## TABLE OF CONTENTS/OUTLINE

- Definition of pseudoaneurysms and location of visceral abdominal aneurysm such as-Splenic Artery Pseudoaneurysm-Hepatic Artery Pseudoaneurysm -Renal Artery Pseudoaneurysm -Pancreatic Artery Pseudoaneurysm-Mesenteric Artery Pseudoaneurysm
- Clinical presentation of pseudoaneurysms
- Imaging features of pseudoaneurysms - Findings on doppler and contrast enhanced ultrasound- Features on computed tomography (CT) angiogram- Vasculature characteristics and assessment of pseudoaneurysm features on conventional angiogram.
- Indication of pseudoaneurysm treatment and non-surgical treatment options - Symptomatic versus non symptomatic pseudoaneurysm- Endovascular fluoroscopic guided pseudoaneurysm treatment.- Percutaneous CT guided treatment - Percutaneous US (doppler and or contrast enhanced) guided treatment.

## IREE-79 Non-invasive Radiofrequency Hyperthermia Enhances the Effect of OK-432 for Hepatocellular Carcinoma Via Activation of cGAS-STING Pathway

## TEACHING POINTS

1. OK-432 could activate cGAS-STING pathway in DC cells in the treatment of HCC. RFH could enhance the effect of cGAS-STING activation of OK-432. 2. The combination demonstrated an antitumorigenic immunologic microenvironment and an encouraging anti-cancer effect in the treatment of HCC.

## TABLE OF CONTENTS/OUTLINE

Abstract RFA has been accepted as an effective alternative to surgery in the treatment of early-stage HCC. However, a clear safety margin beyond the tumor confinement is difficult to obtain when the tumor is large or irregular HCC. Thus, generated a sublethal radiofrequency hyperthermia at the ablated tumor margin during RFA. This study aimed to investigate the feasibility of using RFH to enhance treatment the effect of OK-432 for HCC and explore the potential mechanisms. Our study showed OK-432 could activate the cGAS-STING pathway, and RFH could significantly enhance the effect of OK-432 by a stronger activation of STING pathway. The expression of IFN- $\beta$  and the pro-inflammatory cytokines were significantly higher in the RFH+OK-432 group. Meanwhile, we found RFH could cause a higher expression of TLR4. The administration of the shTLR4 in vitro and TLR4 antibody in vivo to eliminate the role of TLR4, the activation of Sting by OK-432 decreased significantly. In addition, the combination treatment augmented the maturation of DCs and the infiltration of the functional CD8+ T cells. Furthermore, this combined treatment resulted in a better tumor response and a prolonged survival. In conclusion, the combination therapy might be a new treatment strategy in reducing the residual tumor after RFA of medium-to-large or irregular HCCs, bringing a new option for other types of malignancies treated by RFA.

## IREE-8 Minimally Invasive Thoracic Oncology Treatments: Comprehensive Review and Comparison of RFA, MWA, Cryoablation, and Chemoembolization Techniques

Participants

Shakthi Ramasamy, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit aims to provide a comprehensive overview of minimally invasive thoracic oncology treatments, focusing on radiofrequency ablation (RFA), microwave ablation (MWA), cryoablation, and bronchial/pulmonary artery chemoembolization. RFA and MWA offer reduced morbidity and mortality, while preserving pulmonary function and allowing for repeatability. Cryoablation has shown promise in the treatment of early-stage lung cancer and advanced-stage palliative care, as well as in emerging applications such as ground-glass nodules. When lung metastases that are inoperable and unsuitable for ablation cease to respond to systemic chemotherapy, the prognosis becomes poor. Bronchial and pulmonary artery chemoembolization provide alternative treatment options for patients with large, multifocal lung tumors and those experiencing hemoptysis. The exhibit will delve into the principles, applications, imaging guidance, and outcomes associated with each technique, as well as the comparative efficacy of these treatments.

#### TABLE OF CONTENTS/OUTLINE

I. RFA, MWA, Cryoablation and Bronchial and Pulmonary Artery Chemoembolization will be discussed under the following categories:  
A. Principles and techniques B. Imaging guidance C. Patient selection and indications D. Treatment outcomes and comparisons E. Potential complications and management strategies  
II. Comparing the Treatments A. RFA, MWA, Cryoablation, and Chemoembolization B. Factors influencing treatment selection C. Efficacy and safety of each technique  
III. Future Directions and Research A. Ongoing clinical trials and studies B. Potential applications in personalized medicine and targeted therapy

#### **IREE-80 Gonadal Vein Embolization for the Management of Varicocele, Infertility, and Pelvic Congestion: Patient Anatomy, Evaluation, and Technique for Successful Treatment**

Participants  
Younes Attlassy, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Varicocele and PCS are similar disorders associated with vascular dysfunction. Varicocele occurs due to the pooling of venous blood while PCS is the result of vascular pressure buildup in the pelvic region. 2. Understanding the diagnostic and imaging workup for both conditions is imperative for radiologists and treatment teams to identify, grade, and treat both conditions. 3. Several interventions and treatments, including gonadal vein embolization, are available for patients with these conditions with varying success and complication rates. Information regarding the risks and benefits surrounding these interventions is paramount to ensuring the proper standard of care for each individual patient. 4. Interventional radiology percutaneous embolization has become a safe and effective minimally invasive option for varicocele and PCS treatment with high success rates and few complications.

#### TABLE OF CONTENTS/OUTLINE

1. Understanding the anatomy and pathophysiology of both PCS and varicocele including the anatomical variants and attributes that make gonadal vein embolization a more attractive treatment modality in certain cases. 2. A review of the clinical presentation, diagnostic imaging, workup, grading/classification systems, and the interventions for each one. 3. A look at the various treatment options and the risk-benefit analysis around each one. 4. An in-depth guide on IR-guided procedural protocol for the management of varicocele and PCS including how to address anatomical variants, contraindications, and expected post-procedural outcomes.

#### **IREE-81 Endovascular Interventions of the Mesenteric Vasculature Through Collaterals: A Technical Savior**

#### TEACHING POINTS

Vascular pathologies involving the arteries distal to stenosed or occluded main mesenteric arterial trunk is difficult to access. In these situations, one should be aware of arterial arcades and knowledge about these collateral pathways can bail the interventionalist out. We present four cases of endovascular interventions performed through the mesenteric collateral pathways.

#### TABLE OF CONTENTS/OUTLINE

Case 1. GLUE EMBOLIZATION OF SPLENIC ARTERY ANEURYSM (SAA) VIA HYPERTROPHIED RIGHT GASTRO-EPIPLOIC ARTERY (RGEA). 28-year/female - acute necrotizing pancreatitis with intraabdominal bleed. Status post proximal splenic artery embolization using coils. Embolization of the SAA was done via the hypertrophied RGEA. Case 2. SPLENIC PARENCHYMAL EMBOLIZATION (SPE) VIA INFERIOR PANCREATICO-DUODENAL (IPD) ARTERY - RIGHT GASTRIC ARTERY (RGA) COLLATERALS. 58-year/male - Post liver transplant and SA ligation. Refractory ascites due to persistent portal hypertension. Distal SA is reformed through collaterals from the RGEA (minor) and the IPD artery. Embolization was performed using PVA particles. Case 3. COIL EMBOLIZATION OF LEFT HEPATIC ARTERY (LHA) PSEUDOANEURYSM VIA THE IPD ARTERY. 32-year/male - Pseudoaneurysm arising from the LHA branch after removal of biliary catheter. Celiac artery stenosis was noted. Celiac axis reformed through IPD artery. A microcatheter was navigated across the hypertrophied collaterals and the pseudoaneurysm was coiled. Case 4. SPE VIA HYPERTROPHIED RGEA COLLATERALS. 42 years/male - Post liver transplant and SA ligation. Persistent hypersplenism and Splenomegaly. Splenic parenchymal embolization was done via the hypertrophied RGEA by injection of PVA particles

#### **IREE-82 From Classic to Quirky: A Journey through the Aunt Minnie's" of Angiography**

#### TEACHING POINTS

Provide radiology resident level review of classic, "Aunt Minnie" angiographic signs and findings. Briefly discuss pertinent management aspects of underlying pathology diagnosed on angiography. Review intravenous contrast agent selection, contrast injection rates and fluoroscopic projections as key technical components for optimizing image acquisition in angiography and venography.

#### TABLE OF CONTENTS/OUTLINE

Introduction:- Considerations for contrast selection- Contrast injection rates in angiography and venography- Common fluoroscopic projections for image acquisition  
Abdominal Angiography- Aortic dissection with Floating Viscera Sign- Budd Chiari- Non-inflammatory, non-atherosclerotic arteriopathies- Fibromuscular Dysplasia- Segmental Arterial Mediolysis- Standing Wave- Polyarteritis Nodosa  
Peripheral Angiography- Sciatic artery- Dissection- Popliteal Artery Entrapment Syndrome- Hypothenar Hammer Syndrome- Arterial Thoracic Outlet Syndrome  
Pelvic Angiography- Uterine Arteriovenous Malformation- Postpartum hemorrhage- Trauma- Corona Mortis- Pruning, truncation, petechial hemorrhage and vasospasm- Cavemosal Blush  
Angiography of Collateral

Pathways:- Arc of Buhler and Riolo- Subclavian Steal- Aortic occlusion and Winslow's pathway  
Venography- Venous Thoracic Outlet Syndrome- Paget-Schroetter Syndrome- Deep Vein Thrombosis- Azygos Continuation of the Inferior Vena Cava

### **IREE-83 Mechanical Thrombectomy for the Treatment of Deep Vein Thrombosis: A Primer for Interventional Radiologists**

Participants

Abinaya Ramakrishnan, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Teaching Points: Review treatment strategies using percutaneous mechanical thrombectomy devices including its indications and current state of literature. Review data from a single institution's experience and discuss factors that impact post-procedure outcomes.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/ Outlines: Background of management for acute deep vein thrombosis Discuss indications for percutaneous mechanical thrombectomy vs thrombolysis vs anticoagulation Discuss the diagnosis of May Thurner on incidence of recurrent DVT Discussion of major clinical trials of thrombectomy devices CLOUT Registry (Inari Medical) ATTRACT trial (Angiojet Rheolytic Thrombectomy System, Boston Scientific) Overview of current percutaneous mechanical thrombectomy devices on the market Data from a single-institution's experience with percutaneous mechanical thrombectomy Discuss findings from a single institution's retrospective analysis of thrombectomy procedures (n=82) Discuss specific factors that may influence post-procedure outcomes of re-thrombectomy, specifically sex, location of clot, chronicity of clot. Discuss intraprocedural characteristics that improve outcomes like placement of a stent and venoplasty. Review some of the contraindications for the use of percutaneous mechanical thrombectomy Highlight 2 successful cases with pre- and post-procedure imaging.

### **IREE-84 Straight to the Heart: State of the Art Thoracic Central Vein (Superior Vena Cava) Endovascular Recanalization, Thrombectomy and Stent Reconstruction**

#### **TEACHING POINTS**

Review anatomy and embryology of mediastinum and central thoracic veins. Recognize common etiologies and classifications of thoracic central vein obstruction (TCVO) including lesions of the brachiocephalic veins and superior vena cava. Describe endovascular treatment of TCVO including access, recanalization, thrombectomy, stent reconstruction, and extra-anatomic bypass creation as well as intraprocedural adverse event management. Discuss comprehensive care from initial work-up to post-procedure management.

#### **TABLE OF CONTENTS/OUTLINE**

Upper extremity and thoracic central vein anatomic review Common etiologies for TCVO Benign Malignant Patient evaluation Presentation, physical examination, and imaging evaluation Acute and chronic occlusive symptoms Patient centered care Technical aspects of procedure Sedation Access Venography Blunt and sharp recanalizations Thrombectomy and tissue sampling Stent selection and reconstruction Use of intravascular ultrasound (IVUS) Adverse event management Hemothorax and hemo-pericardium Stent migration Extra-anatomic bypass creation Post-procedure care and follow-up Antiplatelet and anticoagulation regimen Imaging surveillance Outcomes and patency Pediatric considerations

### **IREE-85 Extra Abdominal Desmoid Tumors and Image Guided Percutaneous Cryoablation**

Participants

Roberto Luigi Cazzato, Strasbourg, France (*Presenter*) Proctor, Medtronic plc

#### **TEACHING POINTS**

- Unique anatomy and pathophysiology of extra-abdominal desmoid tumors- Treatment planning including image and clinical evaluation- Procedural techniques of image guided percutaneous cryoablation- Adjunctive techniques including thermoprotection- Necessary clinical and imaging follow-up after treatment - Treatment guidelines for extra abdominal desmoids and the role of ablation

#### **TABLE OF CONTENTS/OUTLINE**

- Sporadic vs familial desmoid tumors- Rationale for using cryoablation to treat extra-abdominal desmoid tumors- Selection criteria for proposing cryoablation of extra-abdominal desmoid tumors- Follow-up

### **IREE-86 Minimally Invasive Treatment of Postoperative Pancreatic Fistula Using Interventional Radiology**

#### **TEACHING POINTS**

Although the incidence of surgical complications has gradually decreased with the advancement of minimally invasive surgical techniques and instruments, such as laparoscopic surgery and robot-assisted technology, postoperative pancreatic fistula remains a severe complication requiring prompt management. Percutaneous and endoscopic postoperative management has a lower mortality rate than surgical methods, and expectations for interventional radiology (IR) are increasing. Therefore, it is necessary to understand the etiology, diagnosis, and indications of postoperative pancreatic fistula and be familiar with appropriate IR intervention methods. Knowledge of technical tips in treatment is essential for successful procedures. The aims of this presentation are as follows: To explain the etiology, diagnosis, indications, and imaging features of postoperative pancreatic fistula. To discuss the treatment methods, management strategies, advancements, and complications in interventional radiology for postoperative pancreatic fistula, including techniques.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Overview Etiology, Diagnostic Criteria, and Treatment Indications for Postoperative Pancreatic Fistula Management Strategies for Postoperative Pancreatic Fistula 3. Illustrated Case Studies Management of Pancreatic Fistula after Pancreaticoduodenectomy Management of pancreatic fistula after combined resection of the body and tail of the pancreas Management of Pancreatic Fistula after Gastric Surgery Complications and Difficult Cases 4. Conclusion

### **IREE-9 Acute Massive Hematochezia Due to Colonic Varix: Antegrade Transsplenic Embolization of Abdominal**

## Garland Vein

### TEACHING POINTS

In patients with cirrhosis of liver, acute variceal bleeding can be a fatal complication. Varices may develop anywhere in GIT, in cirrhotic patient. Ectopic varices, are not so common, accounting less than 5% of all variceal bleeding. Among these, colonic varices are very rare. Here, in this report, we emphasize the role of endovascular intervention in the management of acute massively bleeding colonic varix in a hemodynamically unstable cirrhotic patient.

### TABLE OF CONTENTS/OUTLINE

In patients with cirrhosis of liver, acute variceal bleeding can be a fatal complication. Colonic varices are very rare cause of lower gastrointestinal bleeding that can bleed spontaneously and result in massive haemorrhage in patients with liver cirrhosis and portal hypertension. Here we present a case of 50-year-Male, known case of non-alcoholic cirrhosis of liver with portal hypertension (for past 15 years) and type 2 diabetes mellitus, who presented with massive fresh bleeding per rectum. Despite early colonoscopy and glue injection of the colonic varix, patient continued to bleed. Triple phase CT scan of abdomen was done which showed large portosystemic shunt (mesocaval shunt) arising from superior mesenteric vein (SMV) traversing around the ascending colon and forming sub mucosal varices protruding into the colon lumen and joining the right renal vein and draining into the inferior vena cava (IVC) giving a garland appearance. He underwent successful transsplenic antegrade obliteration of the varix by coil embolization and glue injection. There are no clear-cut established management guidelines for such patients. Endovascular embolization could be an effective treatment option of colonic variceal bleeding.

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## Abstract Archives of the RSNA, 2023

IREE-1

### Pre-operative Osseous Tumor Embolization: A Review of Presentation, Benefits, and Technical Details

#### Participants

Ashini Patel, MBA, BS, Davie, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Preoperative tumor embolization is a safe and effective adjunctive to tumor resection that has benefits including decreased estimated blood loss, and less complications. 2. There are only few contraindications to pre-operative embolizations, and most patients that undergo the procedure will benefit for later tumor resection.3. Importance of tumor feeding arteries.4. It is valuable to consider all patients with suspected hypervascular osseous for preoperative tumor angiography and embolization.

#### TABLE OF CONTENTS/OUTLINE

1. A review on osseous tumors, their typical management and and how preoperative embolization can improve outcomes.2. Selection of patients that would benefit from this procedure before tumor resection.3. Review of example cases outlining the technical details of the embolization procedure,to include devices used and the importance of tumor feeding arteries.4. Analyze the efficacy and safety of pre-operative embolization and its value in decreased estimated blood loss and transfusion need, and complications. Compare this data to surgical resection without embolization.

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## Abstract Archives of the RSNA, 2023

IREE-10

### To Sclerose or Decompress? Comparing BRTO and TIPS for Gastric Variceal Management

#### TEACHING POINTS

Objectives\* Understand gastric variceal (GV) anatomy\* Identify indications and contraindications for BRTO and TIPS\* List conventional and alternative procedure steps\* Recognize common and rare intra- and post-procedural complications

#### TABLE OF CONTENTS/OUTLINE

Outline:1. Introduction (epidemiology, mortality)2. Anatomy:\* Location (GOV and IGV classification)\* Afferent/efferent anatomy (Kiyosue classification)\* Uphill/downhill drainage patterns3. Indications:\* Variceal bleeding (active or prophylaxis)\* BRTO: HCC, refractory HE, preserving liver function\* TIPS: Portal HTN with  $\geq 12$  mmHg4. Contraindications:\* BRTO: Portal/splenic vein thrombosis, refractory ascites, uncontrolled EV, absent gastrosplenic shunt, severe portal HTN\* TIPS: HE, Child-Pugh C, CHF, pulmonary HTN, cystic liver disease5. Procedural Steps:\* BRTO (including both conventional approaches as well as modified approaches, including CARTO and PARTO)\* TIPS (including CO<sub>2</sub> venography, portography, various vascular approaches, and embolization)6. Complications:BRTO:\* Intra-procedural: sclerosant extravasation, balloon rupture, premature balloon deflation\* Post-procedural: ARF, hemolysis, cardiogenic shock, pulmonary edema, DIC, PE, portal/splenic/renal vein thrombosis, adrenal infarctTIPS:\* Intra-procedural: Liver capsule/parenchyma/biliary injury, PV rupture, arrhythmias\* Post-procedural: HE, hepatic failure, TIPS migration/dysfunction, infection

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## Abstract Archives of the RSNA, 2023

IREE-11

### Microwave Ablation of the Liver Lesions in Critical Locations: Are there No-No Zones

#### Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Thermal ablation is the mainstay of treatment for small hepatic tumors (<2 cm). Thermal ablation may not be preferred in these patients if the tumors are in high-risk locations, however. These high-risk locations include, but are not limited to, tumors adjacent to the main portal vein, the inferior vena cava, the gall bladder, the diaphragm, and the heart. 2. By discussing the literature and showing cases of successful microwave ablation of tumors in high-risk locations, we show that MWA can be a safe and effective.

#### TABLE OF CONTENTS/OUTLINE

1. The major differences between radiofrequency ablation and microwave ablation as it pertains to the management of malignancy. 2. Cases of microwave ablation of tumors in high-risk locations and a discussion of the current literature on the safety and efficacy of such procedures. 3. The cases display the ablation of tumors adjacent to the main portal vein, the inferior vena cava, the gall bladder, the diaphragm, and the heart. 4. Technical maneuvers will be described to increase safety and efficacy for the difficult lesions.

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## Abstract Archives of the RSNA, 2023

IREE-12

### **Ablation vs Free Life. Colorectal Cancer with Lung Metastases: Evaluation of Local Recurrence and Chemotherapy-free Interval in Patients Treated with Ablative Therapy**

#### **Participants**

Pedro L. Lino, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To discuss percutaneous ablation and its role as a safe and effective treatment option for colorectal cancer lung metastases, and the benefits of its minimally invasive nature. To determine patient selection characteristics, preprocedural planning, and tactics involved in a safe and successful outcome, particularly in challenging cases. To examine the impact of ablation (RFA and MWA) on overall survival and chemotherapy-free interval in patients with lung metastases from colorectal cancer.

#### **TABLE OF CONTENTS/OUTLINE**

1.Introduction and epidemiology 2.Procedure applied anatomy 3.RFA treatment techniques a.Patient positioning; b.Tactical pneumothorax; c.Leverage; d.Hydrodissection. 4.Acute complications 5.Evaluation of disease progression

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## Abstract Archives of the RSNA, 2023

IREE-13

### Thermal Protection: Heightened Safety for Minimally Invasive Percutaneous Thermal Ablation of Musculoskeletal Tumors

#### Participants

Anderanik Tomasian, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Over the past two decades, minimally invasive percutaneous image-guided thermal ablations have been progressively incorporated in the management paradigm of patients with musculoskeletal tumors and endorsed by the National Comprehensive Cancer Network and American College of Radiology. The high clinical success rates and durability of therapeutic effects of such interventions to achieve local tumor control, pain palliation, and cure have been documented in the recent literature. Therefore, safety of musculoskeletal thermal ablations is critical and must be ensured by radiologists in care of patients with bone tumors for improved patient outcomes. To enhance safety and minimize undesired thermal injury to surrounding vital tissues as a result of non-target ablation, several thermal protection strategies have been successfully implemented in clinical practice.

#### TABLE OF CONTENTS/OUTLINE

- General considerations
- Neuroanatomic considerations
- Tissues at risk (Spinal cord, spinal and peripheral nerves, torso organs, articular cartilage, subchondral bone plate/physis, skin)
- Thermal protection techniques (Indications and Choice of technique)
- Passive thermal protection (Patient Biofeedback and Clinical Assessment, Temperature Monitoring strategies, Neurophysiological Monitoring with somatosensory and motor-evoked potentials, Electrostimulation)
- Active thermal protection (Thermal Insulation strategies, Thermal Modification techniques)
- Thermal Injuries/Complications and their management

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## Abstract Archives of the RSNA, 2023

IREE-14

### The Rise of Robotics in Interventional Radiology

#### TEACHING POINTS

- The use of robotics in interventional radiology is an emerging trend following medical technology and engineering developments in recent years.
- Robotic-assisted interventional radiology is beginning to play a key role in cardiac and neurovascular interventions and expanding rapidly.
- Endovascular robotic systems can help facilitate precise and stable catheter navigation while reducing radiation exposure during procedures.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of the history and timeline of robotics in interventional radiology.
2. Introduction and summary of robotic systems and their advantages and disadvantages.
3. Key studies demonstrating the role of robotics for endovascular interventions.
4. Telerobotics in interventional radiology and its roles and limitations.
5. Future prospects for robotic-assisted interventional radiology.

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## Abstract Archives of the RSNA, 2023

IREE-15

### How to Perform a Correct Access for Minimally Invasive Lumbar Spine Procedures

#### Participants

Natalia Parra, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Fluoroscopy guided interventions in lumbar spine involve a variety of minimally invasive procedures for improving pain management. Three of the main approaches typically used to get access to the targeted structure are transforaminal, interlaminar and transpedicular. The aim of the proposed exhibit is to provide radiology residents and fellows with a quick guide to better understand the basics of these techniques and thus be able to perform a safer and more effective access. At the outset, the exhibit will list the different types of procedures enabled by the abovementioned approaches. Following, it will provide a pictorial review of the anatomical keys in preprocedural imaging studies. Finally, the exhibit will explain how to perform the approaches step-by-step, from the positioning of the angiograph and the anatomical references to the needle insertion, and will conclude by describing how to check its correct positioning.

#### TABLE OF CONTENTS/OUTLINE

1. Types of procedures and related approaches. 2. Imaging studies: what to look at and how to do it.3. Angiograph positioning and anatomical references.4. How to perform and correct the approaches in real time.5. How to check the positioning of the needle.

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## Abstract Archives of the RSNA, 2023

IREE-16

### Percutaneous Cryoablation: A Comprehensive Review of Whole-body Application

#### TEACHING POINTS

1) Percutaneous cryoablation is a minimally invasive procedure that is safe and effective in treating various solid benign and malignant lesions throughout the human body. 2) Imaging and tissue diagnosis is necessary before ablation to ensure that cryoablation is the most appropriate modality of treatment. 3) Percutaneous cryoablation can be performed with ultrasound, fluoroscopy, computed tomography, or magnetic resonance imaging guidance. Knowing the risks and benefits of each modality is important for choosing the best modality for individual patient lesions. 4) Cryoshock is a feared clinical syndrome after cryoablation for which early diagnosis and management is crucial. 5) Abscopal effect is a unique effect of cryoablation based on immune-mediated post-ablation antigen presentation.

#### TABLE OF CONTENTS/OUTLINE

1) Mechanism of action and physics of cryoablation leading to induction of cellular apoptosis and the understanding of ablation artifacts. 2) Indications and contraindications, diagnostic workup, and imaging diagnosis for lesions amenable to cryoablation. 3) Procedural protocols for the management of lung/kidney solid tumors, metastasis, bone and soft tissue solid/cystic lesions, nerve pain, and vascular malformations. 4) Adverse effects of cryoablation including cryoshock and the mitigation of these effects. 5) Abscopal effect and future directions for the use of cryoablation to prevent lesion recurrence and treat metastatic disease.

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## Abstract Archives of the RSNA, 2023

IREE-17

### **The Need for Virtual Fluoroscopic Imaging in Bronchial Artery Embolization: The Best for Radiation Exposure Dose Reduction**

#### **Participants**

Yoshihiro Tanaka, BA, Ibaraki, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

In this study, we investigated the relationship between supporting images of a new concept and exposure reduction in bronchial artery embolization <BAE>. This is research on exposure reduction aimed at shortening the procedure time by creating a support image similar to the IR image using CT volume data, in contrast to the existing exposure protection and exposure reduction mechanisms of IR equipment.

#### **TABLE OF CONTENTS/OUTLINE**

A virtual fluoroscopic image <VFI> is a Ray-summation image that is similar to a fluoroscopic image, and blood vessel running and the lesioned part are superimposed and displayed (Fig.1). Thereby it possible to use information intuitively alongside fluoroscopic images, and to avoid unnecessary mapping imaging for bronchial artery identification and time waste due to blind catheterization under fluoroscopy, aiming at rapid vascular selection and hemostasis (Fig.2,3). Also, a workstation can be easily installed and implemented, and the CT volume data obtained in advance is used so that there is no need to purchase new and expensive IR equipment. As a result, the number of angiographies required for dissection can be minimized, which not only reduces the amount of contrast agent and exposure, but also reduces complications by shortening the procedure time (Table1,2).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-18

### 2022 Barcelona Clinic Liver Cancer Update for the Interventional Radiologist

#### TEACHING POINTS

1) Understand the updates to the 2022 Barcelona Clinic Liver Cancer (BCLC) guidelines for managing patients with hepatocellular carcinoma (HCC) 2) Review supporting evidence for transarterial chemoembolization (TACE) and percutaneous ablation 3) Highlight recent evidence surrounding transarterial radioembolization (TARE) that warranted its inclusion in the new guidelines 4) Discuss the new systemic agents included in the 2022 BCLC guidelines and their supporting evidence

#### TABLE OF CONTENTS/OUTLINE

1) Introduction, including epidemiology of HCC and interventional radiology (IR) management options in the previous BCLC guidelines 2) BCLC framework for classifying HCC 3) Review of existing literature on TACE and percutaneous ablation for patients with HCC 4) Overview of updates in the 2022 BCLC guidelines for IRs: Sub-division of Intermediate Stage (Stage B) patients, extending the existing liver transplant criterion to include more patients and include systemic options for other patients at this stage 5) Overview of updates in the 2022 BCLC guidelines for IRs: Inclusion of TARE for the first time in the guidelines, with a review of new, high impact studies leading to the inclusion of TARE 6) Overview of updates in the 2022 BCLC guidelines for IRs: New systemic agents for patients with advanced stage disease, including a review of high impact studies leading to the addition of the new systemic agents in the guidelines 7) Discussion of combination therapies for HCC such as TACE + systemic therapy, TARE + systemic therapy, TACE + percutaneous ablation, and percutaneous ablation combined with adjuvant systemic therapy 8) Conclusion and summary

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## Abstract Archives of the RSNA, 2023

IREE-19

### Imaging and Interventional Management of Lymphatic System Disorders

#### Participants

Eric Castane, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the lymphatic system disorders. 2. Describe the radiologic management of the lymphatic system disorders.

#### TABLE OF CONTENTS/OUTLINE

1. Material and Methods / Background Lymphatic. 2. Anatomy and Physiology. 3. Disorders of the Lymphatic System. 3.1. Classification. 3.2. Diagnosis. 4. Imaging of the Lymphatic System. 4.1. Ultrasound. 4.2. Magnetic Resonance. 4.3. Nodal Lymphangiography. 4.4. Imaging in Lymphatic Disorders. 5. Interventional Management of Lymphatic Disorders. 5.1. Chylothorax. 5.2. Chyle Ascites. 5.3. Peripheral Lymphatic Leak. 5.4. Lymphatic Plastic Bronchitis. 6. Post Procedure 6.1. Complications. 6.2. Post Procedure Imaging. 7. Conclusions.

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## Abstract Archives of the RSNA, 2023

IREE-2

### Shoot Your Shot: Techniques and Pitfalls of Pelvic Collection Drainage

#### Participants

Kateryna Burlak, MBBS, Melbourne, Australia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Most pelvic collections can be drained safely and effectively through a percutaneous image-guided approach. Collections in locations that are difficult to access pose a unique challenge and invite consideration of alternative approaches. We aim to discuss the techniques and pitfalls of these approaches, to encourage drainage of collections initially considered difficult or inaccessible and to raise awareness about potential complications. Teaching points of this exhibit include the following: 1 - To review the methods and anatomy of potential approaches involved in drainage of pelvic collections (including transperineal, transgluteal, transrectal and transvaginal approaches) 2- To demonstrate general techniques used (Trocar vs Seldinger techniques) 3- To discuss potential complications which can occur in drainage of pelvic collections and how to avoid them

#### TABLE OF CONTENTS/OUTLINE

1. Methods and anatomy of potential approaches: Lateral abdominal wall, Anterior abdominal wall, Transgluteal, Transperineal, Transrectal, Transvaginal 2. General techniques used 3. Examples of potential pitfalls and complications 4. Summary and teaching points

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## Abstract Archives of the RSNA, 2023

IREE-20

### Next Step for Colorectal Liver Metastasis Ablation: Computed Tomography During Hepatic Arteriography Guidance in Percutaneous Thermal Ablation

#### Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) This study aims to show the feasibility and accuracy of using computed tomography during hepatic arteriography (CTHA) as a percutaneous ablation guidance tool for colorectal liver metastasis (CLM) patients. 2) CTHA is performed via a transarterial catheter inserted into the hepatic artery for arterial assessment. It involves dual-phase contrast medium acquisition with specific rates and acquisition delays during a breath hold on expiration. 3) CTHA improves CLM visibility due to high contrast resolution and absence of portal venous system contrast-media deposition. CLMs appear hypoattenuating with a necrotic center and ill-defined enhancing rim visible on the arterial phase. 4) In contrast to its high sensitivity, CTHA specificity for detecting small tumors is often limited by the presence of pseudolesions. Moreover, limitations include potential complications related to sheath and catheter placement, physician's costs and time, and arterial anatomy variants. 5) CTHA enables precise oncologic intervention planning, combined therapies, and intraprocedural treatment response monitoring. Further research is needed to fully evaluate its clinical utility for guiding CLM ablation.

#### TABLE OF CONTENTS/OUTLINE

1) 'Let's Put a Ring on It' - CLM imaging presentation on CTHA; 2) Setting the Target - Image-guiding techniques in percutaneous liver tumor ablation and CTHA protocol; 3) Tips or tricks - Pseudolesions or CLMs? 4) Thinking Outside the Box - Future Perspectives

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-21

### Minimally Invasive Thoracic Tumor Treatment and Palliation

#### TEACHING POINTS

Percutaneous ablation is an established safe treatment for primary and metastatic lung tumors. Adjunct intra-procedural maneuvers, such as creation of artificial pleural effusions or pneumothoraces, can permit treatment of tumors adjacent to critical structures. Emerging approaches such as arterial chemoembolization are altering the landscape of intervention for thoracic malignancies. Minimally invasive procedures such as percutaneous tumor localization, thoracic tumor embolization, and image-guided brachytherapy seed implantation can enable multidisciplinary treatment. Palliative interventions, ranging from embolization to shunt implantation, can provide palliation for thoracic oncology patients.

#### TABLE OF CONTENTS/OUTLINE

Tumor treatment  
Percutaneous ablation  
Radiofrequency ablation  
Cryoablation  
Microwave ablation  
Technical considerations during ablation  
Chemoembolization of lung tumors  
Interdisciplinary procedures  
Tumor localization prior to surgical resection  
Preoperative embolization of central thoracic tumors  
Image guided brachytherapy seed implantation  
Palliation  
Glue embolization of bronchopleural fistulas  
Bronchial artery embolization for hemoptysis  
Recurrent pleural effusion management  
Tunneled indwelling pleural catheters  
Denver pleurovenous shunt

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## Abstract Archives of the RSNA, 2023

IREE-22

### The Effects of Artificial Intelligence and ChatGPT on Interventional Radiology

#### TEACHING POINTS

\*Artificial intelligence (AI) learns from data, and processes it to perform tasks requiring human intelligence\*AI can help create customized treatment plans for patients\*Fluoroscopy systems with AI reduce radiation exposure to make procedures safer\*Pre-operative and intraoperative images integrated by AI, provide more accurate guidance for image-guided procedures\*AI can create virtual angiography, which can be used for education and planning purposes\*ChatGPT can assist radiologists in creating educational and research materials more efficiently

#### TABLE OF CONTENTS/OUTLINE

Artificial intelligence (AI) refers to computational models that use algorithms to process data, learn from it using the output to perform tasks traditionally associated with human intelligence. AI models utilize patient diagnostic images and clinical findings to anticipate procedural outcomes. This enables interventional radiologists to customize treatment plans for each patient beforehand. AI has enabled fluoroscopy systems to substantially decrease radiation exposure to patients and staff. This is evidenced by a significant reduction in median dose area product from 5,708 mGy·cm<sup>2</sup> to 2,178 mGy·cm<sup>2</sup> (P < 0.001). AI can integrate pre-operative 3D with intraoperative 2D images, improving guidance for biopsies and image-guided procedures. This added augmented-reality element enhances the accuracy and safety of interventional procedures. AI employs preoperative imaging to create virtual angiography, which acts as an educational and real-time planning aid for both trainees and seasoned interventionalists. With the advent of chatGPT radiologists can harness AI to aid in the composition of educational and research material.

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## Abstract Archives of the RSNA, 2023

IREE-23

### Intercostal Neurolysis: A Primer

#### Participants

Omar Al-Daoud, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review relevant anatomy of the intercostal nerves. Describe indications for neurolysis. Describe risks of intercostal neurolysis. Highlight tips and tricks for risk mitigation.

#### TABLE OF CONTENTS/OUTLINE

Goals and Objectives, Case Presentation, Intercostal Nerve Anatomy, Indications for Intercostal Nerve Block and Neurolysis, Risks of Intercostal Neurolysis, Mitigating Risks, Nerve Block Cocktail, Additional Case Presentations, Learning Points

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## Abstract Archives of the RSNA, 2023

IREE-24

### Gastrointestinal Tract Tumors: Imaging and Interventional Management of Bleeding

#### Participants

Forrest Linch, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Learn mesenteric angiographic anatomy with special attention to anatomical variations and the blood supply to specific portions of the GI tract, which may affect treatment approach. 2. Learn common primary and metastatic etiologies of gastrointestinal tract bleeding requiring intravascular intervention. 3. Understand diagnostic imaging findings and interventional radiologic techniques for managing gastrointestinal tract bleeding

#### TABLE OF CONTENTS/OUTLINE

1. Mesenteric angiography: A) Standard technique and anatomy, B) Normal variant anatomy, C) Blood supply to specific portions of the GI tract; 2. Angiography of gastrointestinal tract malignancies: A) Common pathologies by location, B) Angiographic finding of tumors; 3. Diagnostic imaging of gastrointestinal tract malignancies: A) Modality selection (CT, MRI, NM), B) Expected findings and treatment implications; 4. Intravascular management of bleeding gastrointestinal tract malignancies: A) Indications, contraindications, B) Pre-procedure planning - i) Clinical evaluation, ii) Role of cross-sectional imaging and endoscopy, iii) Anatomic/vascular considerations (arterial supply, collaterals, variants), C) Technique - i) Particle versus coil embolization, ii) Coil embolization for protection of non-target structures, D) Outcomes and complications;

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## Abstract Archives of the RSNA, 2023

IREE-25

### **Advancing Frontiers in Lung Malignancy Treatment: Unraveling the Potential of Interventional Radiology in the Ablation of Lung Malignancies**

#### **Participants**

Izzet Altun, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Interventional radiology has evolved as a promising modality for the ablation of lung malignancies. Various techniques such as Radiofrequency Ablation (RFA), Microwave Ablation (MWA), and Cryoablation are extensively utilized, each with unique benefits and limitations. The choice of technique is determined by factors such as lesion size, location, and patient condition. These image-guided percutaneous ablation techniques are particularly advantageous for patients unsuitable for surgery or stereotactic radiation therapy. Future directions point towards refining these techniques, improving patient selection criteria, and integrating these modalities with novel systemic and loco-regional therapies for comprehensive patient care.

#### **TABLE OF CONTENTS/OUTLINE**

The report provides an overview of image guided ablation of lung malignancies. The goal is to present mechanism, advantages, and limitations of RFA, MWA, cryoablation and other less common techniques such as laser ablation. Discussion on patient selection, pre and post-procedural evaluation for lung ablation will be presented. Outline: 1- Introduction to IR in lung ablation, highlighting the scope of RFA, MWA, and cryoablation. 2- Detailed exploration of ablative techniques, focusing on mechanisms, optimal application, and potential drawbacks. 3- Examination of patient selection criteria, pre and post-procedural evaluation, and contraindications. 4- Analysis of the anesthesia management, CT protocols, and periprocedural considerations for lung ablation. 5- Discussion on the current state of research and future directions, emphasizing the potential for improved techniques and integrative treatment approaches. 6- Conclusion

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## Abstract Archives of the RSNA, 2023

IREE-26

### Creating Transvenous Intrahepatic Portosystemic Shunts (TIPS) with the Aid of Ultrasound (US): Tips for US

#### TEACHING POINTS

Learning Objectives Review standard steps for conventional TIPS creation. Provide steps and tips for using intracardiac echography (ICE) catheters and transabdominal ultrasound for aiding in TIPS creation. Discuss advantages and disadvantages of the various equipment used for TIPS creation and when to consider each.

#### TABLE OF CONTENTS/OUTLINE

Content/Outline Introduction Review steps for performing TIPS creation using fluoroscopic guidance Review cross sectional imaging to aid in procedure planning Demonstrate indirect portography and limitations. Demonstrate each of the key steps for creating a TIPS. Review ICE catheter setup Jugular vs Femoral approach Tips for orienting user to key anatomy and needle directing Tips to improve efficiency Review Transabdominal US set up Tips for orienting user to key anatomy and needle directing Tips to improve efficiency Discuss advantages and disadvantages each approach Unique cases best managed by each guidance modality Prevention of complications by each guidance modality Cost accessibility of each guidance modality While TIPS procedures are most commonly done using conventional fluoroscopy guidance, ultrasound may be used in conjunction with benefit. This presentation reviews guidance modalities for TIPS creation focusing on key imaging and circumstances favorable and unfavorable to each guidance modality.

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## Abstract Archives of the RSNA, 2023

IREE-27

### The ABCs of CT-guided Lung Biopsy: Tips and Tricks for Optimal Outcomes

#### Participants

Miriana Mariussi, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: • Review the indications for the percutaneous CT-Guided lung biopsy • Comprehend the pre-procedural imaging analysis and planning • Assess the principles of the percutaneous biopsy techniques and co-axial techniques • Knowledge the common complications after the procedures and their management • Highlight the recommendations to avoid pneumothorax and other complications • Recognize common CT image findings observed in the post-procedural follow-up

#### TABLE OF CONTENTS/OUTLINE

Percutaneous biopsy of lung lesions is increasing due to the rise of cancer incidence and the growing need for molecular and immunohistologic analyses. The size of the lesion, the size of the biopsy needle and the chosen technique have a direct impact on the success of the procedure. A case based pictorial essay allows for a comprehensive assessment of: • Indications and patient selection for percutaneous CT-Guided lung biopsy • Establishing a concise pre-procedural imaging analysis and planning • Percutaneous technique and co-axial techniques • Needle positioning, trajectory and lesion sampling • Recognizing expected complications after the procedure • Strategies and tips for achieving a successful outcome • Reducing the risk of pneumothorax and other complications • Highlighting important post-procedural management steps • Understanding biopsy results and follow up

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## Abstract Archives of the RSNA, 2023

IREE-28

### CT Guided Trans-osseous Biopsy, a Road Less Traveled: A review of Indications, Technical Aspects and Literature Summary

#### TEACHING POINTS

CT guided transosseous biopsy is an alternative technique for lesions blocked by vital structures or apparently directly inaccessible. Coaxial technique is essential in transosseous biopsy, as it allows taking various samples through a secure access diminishing the number of skin punctures and risks of tumor seeding. The success of these procedures depends on the knowledge of regional anatomy, a correct planning and experience of the operator.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Usually when performing an image guided percutaneous biopsy, the access is selected using the shortest path, avoiding vessels, nerves, or organs. Sometimes, this is not possible and more aggressive procedures, such as surgery, are required. A transosseous access can be used as an alternative approach to tackle this setback and sample deep and challenging targets. Furthermore, CT guided transosseous biopsies can be performed in order to reduce complication risks. Approaches: -Trans-sternal: lesions in anterior mediastinum. -Trans-rib: for pleural-based lung lesions or immediately deep to a rib -Trans-scapular: for apical lung lesions abutting superior margin of major fissure. -Trans-vertebral: for lesions anterior to the vertebral body, aortocaval lymph nodes. -Trans-iliac, pubic or sacral for internal iliac lymph nodes, other deep pelvic nodes in patients with pelvic malignancy or presacral lesions. Technical considerations. Complications. Take home messages

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## Abstract Archives of the RSNA, 2023

IREE-29

### Multiple Cavitory Lung Lesions on CT: Biopsy Approach, Accuracy and Safety

#### Participants

Juan Wang, Beijing, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the different biopsy approaches available for multiple cavitory lung lesions on CT, including transthoracic needle biopsy, bronchoscopy, and surgical biopsy, and their relative advantages and disadvantages.2. Learn how to assess the accuracy of biopsy results, including sensitivity, specificity, and positive predictive value.3. Become familiar with the potential complications associated with each biopsy approach, such as pneumothorax, bleeding, and infection, and how to manage them.4. Appreciate the role of image guidance in improving the accuracy and safety of biopsy procedures for multiple cavitory lung lesions on CT.5. Understand the importance of multidisciplinary collaboration among radiologists, pulmonologists, and thoracic surgeons in developing a biopsy strategy.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: This section will provide an overview of multiple cavitory lung lesions and the importance of accurate diagnosis and treatment.2. Biopsy approaches: This section will discuss the different biopsy approaches for multiple cavitory lung lesions, including CT-guided biopsy, bronchoscopy, and surgical biopsy.3. Accuracy of biopsy: This section will focus on the accuracy of biopsy for multiple cavitory lung lesions. It will discuss factors that can affect the accuracy of biopsy, such as lesion size, location, and underlying pathology.4. Safety of biopsy: This section will review the safety of biopsy for multiple cavitory lung lesions. It will discuss potential complications associated with each biopsy approach, such as bleeding, pneumothorax, and infection.5. Conclusion: This section will summarize the key takeaways from the education exhibit.

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## Abstract Archives of the RSNA, 2023

IREE-3

### Sticky Situations: Expanding the Role of Glue in Trauma

#### TEACHING POINTS

Discuss the properties of liquid embolic (glue); Characterize ideal uses for glue in traumatic injuries; Use cases to review diagnostic trauma CT findings, angiographic correlates and post glue embolization appearances; Review potential complications and pitfalls of glue embolization.

#### TABLE OF CONTENTS/OUTLINE

Outline: Introduction; Review of traumatic injuries and ideal cases for liquid embolics; Properties of glue (N-butyl cyanoacrylate), how to prepare, mixtures and delivery techniques; CT findings before and after glue embolization and how to differentiate from evolving injuries; Case presentations: Pseudoaneurysms (Spleen, Liver, Renal, Pelvis, Extremity), Active Extravasation (Spleen, Liver, Pelvis), and Traumatic AV Fistulas; Complications of glue embolization (non-target embolization, portal vein embolization, pulmonary emboli, skin injury) and how to prevent them. Conclusion: Glue is a versatile embolic which can be safely deployed in traumatic intervention. As glue becomes more frequently used, an understanding of expected post embolization changes is necessary to minimize erroneous reporting.

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## Abstract Archives of the RSNA, 2023

IREE-30

### Thoracic Vent for Management of Pneumothorax: Review of Technique and Comparison to Conventional Thoracostomy

#### Participants

Latika Baranga, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Incidence of pneumothorax in patients undergoing transthoracic needle biopsy reported varying from 9-54%. Current treatment options include observation/conservative, simple aspiration, thoracostomy tube placement, ambulatory management with Thoracic vent placement or thoracostomy tube with or without Heimlich valve. Here we describe Thoracic vent device as an alternative to chest tube for iatrogenic pneumothorax. It is a simple one-piece device made of polyurethane catheter connected to a plastic chamber containing a one-way valve and comes with an adhesive tape to secure it. It does not require suture or additional securing devices nor additional tubing or bag/container attachments enabling early mobilization and outpatient monitoring. It's simple design without attachment makes it easier and safer to manage as an outpatient compared to thoracostomy with or without a Heimlich valve.

#### TABLE OF CONTENTS/OUTLINE

1. Brief introduction discussing epidemiology, and treatment options for management of pneumothorax including technique such as thoracostomy tube with Heimlich valve and Thoracic vent. 2. Description of Thoracic vent device components, mechanism of action, placement technique. 3. and 4. Case describing steps of CT guided Thoracic vent placement, and follow up imaging. Appearance of the device on chest radiograph is demonstrated to assist in recognition of the device by diagnostic radiologist. 5. Comparison of Thoracic vent with conventional thoracostomy with and without Heimlich valve.

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## Abstract Archives of the RSNA, 2023

IREE-31

### **Look Before You Leap: Anatomical and Technical Considerations of Image-guided C2 Dorsal Root Ganglion Ablation and C1-C2 Lateral Joint Injections**

#### **Participants**

Bahram Mohajer, MD,MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

i. Discuss the cervicogenic headache as the primary indication of Image-guided C2 dorsal root ganglion (DRG) ablation and C1-C2 lateral joint injections. ii. Review the general anatomy of C2 DRG and C1-C2 lateral articulation and notable anatomical structures. iii. Illustrate CT-guided C2 DRG ablation technique and considerations. iv. Illustrate Computed Tomography and Fluoroscopic-guided C1-C2 lateral articulation injection techniques and considerations.

#### **TABLE OF CONTENTS/OUTLINE**

i. Cervicogenic headache (1. Presentation 2. Prevalence and efficacy of intra-articular injections). 3. General anatomy of the C2 DRG and C1-C2 lateral articulation. 4. Degenerative arthritis of C1-C2 lateral articulation presentation on STIR MRI (a) and CT (b). ii. Important anatomical proximities of C2 DRG and lateral atlanto-axial joints (1. Vertebral artery 2. Thecal sac 3. C2 ventral ramus). iii. CT-guided C2 DRG ablation procedure, technique, and considerations (1. Patient positioning, 2. Trajectory selection, 3. Needle insertion, contrast administration, and ablation). iv. CT-guided intra-articular injection, technique, and considerations (1. Patient positioning, 2. Trajectory selection, 3. Needle insertion, contrast administration, and injection). v. Fluoroscopy-guided procedure, technique, and considerations (1. Trajectory selection, 2. Needle insertion, contrast administration, and injection).

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## Abstract Archives of the RSNA, 2023

IREE-32

### Utility Of Spectral CT During Percutaneous Thermal Ablation

#### Participants

Ahmad Parvinian, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to demonstrate the utility of spectral CT for interventional ablation procedures. Recently, an interventional suite was developed which combined a dual-layer detector spectral CT scanner on rails with an image guided-therapy system (Spectral Angio CT, Philips Healthcare). In this exhibit, case examples will highlight use cases for spectral CT in procedure planning, probe placement, iceball visualization, and post-ablation assessment. Teaching points include: (1) technical background on spectral CT, (2) clinical background on minimally invasive ablations, and (3) overcoming interventional challenges with spectral CT.

#### TABLE OF CONTENTS/OUTLINE

1. Title page: Utility Of Spectral CT During Percutaneous Thermal Ablation. 2. Teaching points: Technical background, clinical background, and overcoming interventional challenges. 3. Interventional ablations clinical background: Procedure planning, probe placement, treatment monitoring, and post-ablation assessment. 4. Background on spectral CT for interventions: Dual-layer spectral detector technology, visualization modes for spectral imaging, and spectral CT on rails for interventions. 5. Case examples: (A.) Procedure planning with low MonoE for lesion visualization. (B.) Probe placement with high MonoE to reduce needle artifact. (C.) Treatment monitoring with z-effective and low MonoE. (D.) Bone ablations with bone removal. (E.) Post-ablation assessment with low MonoE to reduce contrast dose. 6. Conclusions

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## Abstract Archives of the RSNA, 2023

IREE-33

### Transperineal Ultrasound-Guided Prostate Biopsy: Why and How

#### Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Review different prostatic biopsies approaches, emphasizing the transperineal technique and its peculiarities. Illustrate with cases different applications of the technique (systematic biopsy, cognitive guidance and MR imaging fusion). Identifying the radiological features of common postprocedural complications

#### TABLE OF CONTENTS/OUTLINE

Prostate cancer: epidemiology and imaging findings; Indications and patient selection for prostate biopsy; Different biopsy approaches and its characteristics; Technique steps; Illustrative cases of different applications of the transperineal prostate biopsy technique; Understanding and managing common complications post-procedure; Recognizing common image findings observed after the procedure; Interpreting biopsy outcomes and ensuring proper follow-up.

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## Abstract Archives of the RSNA, 2023

IREE-34

### Too Hot to Handle?" Non-worrisome Extrahepatic Localization of 99mTc MAA and Yttrium-90 During Planning and Radioembolization Procedures

#### Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. In the work-up of patients for Y-90 radioembolization of hepatic tumors, it is often revealed that 99mTc-macroaggregated albumin (MAA) has accumulated in extrahepatic organs and blood vessels. While substantial Y-90 localization in some extrahepatic sites, such as the lungs, is an absolute contraindication for treatment, other sites do not have strict guidelines.2. We show the safe, complication-free administration of Y-90 to five patients with off-target uptake in each the following locations: a persistent falciform artery, the gall bladder, a portal vein tumor thrombus, a perihepatic lymph node, and the spleen.3. The literature is consistent with the conclusion that uptake of Y-90 in the falciform artery, the gall bladder, and a tumor thromboses is generally safe and should not be an absolute contraindication to therapy. It has yet to be elucidated whether this is the case for uptake in the spleen and lymph nodes.4. Off-target Y-90 uptake in the spleen may actually be beneficial and help treat/prevent post-radioembolization hypersplenism and thrombocytopenia.

#### TABLE OF CONTENTS/OUTLINE

1. Cases of safe and successful Y-90 therapy to patients with extrahepatic uptake in the extrahepatic following locations2. Along with each case, the current literature regarding the safety of treatment of patients with these off-target uptakes is discussed.

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## Abstract Archives of the RSNA, 2023

IREE-35

### Contrast Enhanced CT Lymphangiography For Various Lymphatic Disorders

#### Participants

Yura Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Despite the physiologic and clinical significance of the lymphatic system, lymphatic imaging remains difficult and in the developmental stages. In recent years, MR lymphangiography has enabled the depiction of lymphatic structure, but its widespread use is limited by its inherent limitations: high cost, limited accessibility, contraindications to MR, inability to position change, and inability of bedside needle insertion in MR suite is still obstacles. CT, which is not restricted by these constraints, may be a solution for more accessible lymphatic imaging. We have utilized contrast enhanced CT lymphangiography for characterization of various thoracoabdominal lymphatic diseases and pre-interventional planning. Herein, we introduce our practice of CT lymphangiography. 1. Learn the protocol and technical aspect of contrast-enhanced CT lymphangiography 2. Describe normal lymphatics anatomy with contrast-enhanced CT lymphangiography 3. Learn the characteristics of various thoracoabdominal lymphatic diseases with CT lymphangiography

#### TABLE OF CONTENTS/OUTLINE

1. Protocol 1) Procedure: Inguinal LN cannulation under US guidance 2) CT technique for imaging the central lymphatics 2. Technical aspect of CT lymphangiography 1) Acquisition time and CT dose 2) Comparison with MR lymphangiography 3. Normal anatomy of the central lymphatics 4. Various lymphatic disorders 1) Iatrogenic thoracic duct injury with chylothorax 2) Lymphatic anomaly

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## Abstract Archives of the RSNA, 2023

IREE-36

### Artificial Intelligence in Interventional Radiology: A Primer for Residents

#### TEACHING POINTS

Artificial Intelligence (AI) has already demonstrated an ability to significantly improve efficiency in diagnostic radiology. There are however, unique challenges which need to be addressed to completely realise the potential of AI in Interventional Radiology (IR). Apart from key issues including data storage, lack of interoperability and non-standard practices, there are significant concerns about legal accountability and potential risks in interventions that prevent AI from being used independently or clinically without the oversight of an expert radiologist. Research and innovation involving AI in IR is limited to few higher centres, thus preventing adequate exposure of AI to Interventional Radiology residents, compared to their Diagnostic Radiology (DR) counterparts. Our Educational Exhibit aims to introduce IR residents and fellows to the vast possibilities of incorporating AI into their regular clinical practice (ranging from decision support and triaging of patients to prognostication and outcome prediction) and also introduce them to various open-source software and modules which can assist them in their day-to-day IR practice.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 1A. AI in Medical Imaging 1B. Types of Data in DR and IR 2. Unique Challenges in IR 3. Opportunities of AI Implementation 3A. Pre-Procedural Support 3B. Peri-Procedural Support 3C. Post-Procedural Support 4. Established AI algorithms in Interventions 5. Open-Source software and modules 6. Opportunities for AI innovation in IR 7. Can AI Replace Us? 8. The way ahead for an AI-assisted Interventional Radiology practice

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-37

### Portosystemic Shunts: A Comprehensive Review

#### Participants

John Walker, MD, PhD, San Antonio, TX (*Presenter*) Speaker, Shionogi & Co, Ltd; Consultant, Shionogi & Co, Ltd

#### TEACHING POINTS

1. To review the development of the portal system and teach normal and variant anatomy. 2. To become familiar with cross sectional and angiographic appearances of both common and uncommon portosystemic shunts. 3. To understand the clinical relevance of portosystemic shunts from congenital to acquired. 4. To demonstrate minimally invasive treatment options for portosystemic shunts.

#### TABLE OF CONTENTS/OUTLINE

1. Review the development of normal portal venous anatomy and subsequently congenital variant anatomy. In addition, understand shared territories with systemic veins that may allow shunts to form 2. Use cross sectional and angiographic images to teach the anatomy of portosystemic shunts to include congenital intra-hepatic and extrahepatic (Abernethy) shunts, as well as common acquired gastroesophageal, splenorenal, paraumbilical shunts and less common acquired mesenteric to retroperitoneal territories and consider surgically altered sites allowing for unique shunts 3. Discuss clinical implications of untreated portosystemic shunt and 4. Explore indications and techniques for treating shunts by type and location, to include discussion on expected sequelae of treating and potential complications.

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## Abstract Archives of the RSNA, 2023

IREE-38

### Training of Interventional Radiology Procedures Using Virtual Reality: Current Status and Potential Metaverse

#### Participants

Yukiko Honda, MD, Kure, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The COVID-19 pandemic made it difficult to train learners on procedures that involve direct patient contact, such as interventional radiology (IR). For this reason, we developed training materials for learners on endovascular procedures of the abdominal pelvis in IR using virtual reality (VR). Advantages of VR-based IR education include the ability to conduct training at any time, repeated training exercises, no invasiveness to the patients, and no risk of infection to both the patient and the learner. Even after the pandemic, to further develop the good points of VR education, many educators are attempting to apply metaverse to the education of their specialty. Although metaverse education is considered useful in IR education, it is not widely used at present. This educational exhibit will provide a brief overview of simulators available for purchase, benefits of metaverse education, and our VR-based training software, and discuss its advantages, current issues, and future prospects.

#### TABLE OF CONTENTS/OUTLINE

1. Features of the currently commercially available VR simulators of endovascular procedures.
2. Benefits of metaverse education.
3. What is needed to spread metaverse education.
  - a. Three components: hardware, software, and contents,
  - b. High-speed networks,
  - c. Computing technologies: edge computing, and cloud computing,
  - d. Modeling and rendering technologies: Unity or Blender,
  - e. Interaction technologies: Sensors, or real-time tracking,
  - f. Authentication technologies: blockchain,
  - g. Wearable device: head-mounted displays or smart glasses,
  - h. Concerning the learner: learning logging, and analysis.
4. Review of reports on the cases of metaverse education.
5. Future challenges and our approach.

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## Abstract Archives of the RSNA, 2023

IREE-39

### Interventional Radiology Role in Treating Primary Pancreatic Cancer: Current Treatments and Future Prospects

#### Participants

Fereshteh Khorshidi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review primary pancreatic cancer epidemiology, current therapies and prognosis- Review interventional radiology role in diagnosis of pancreatic cancer and palliative care- Review percutaneous and transarterial image-guided treatment options for unresectable primary pancreatic cancer offered by interventional radiology.- Importance of having a multidisciplinary approach and individually tailored treatment plan.

#### TABLE OF CONTENTS/OUTLINE

Primary pancreatic cancer- Prevalence- Significance- Clinical stages- Survival rate- Current therapies for resectable tumors Minimally invasive treatments of unresectable pancreatic cancer, their advantages, effectiveness and complications  
Treatments- Transarterial therapies  
o Regional intra-arterial chemotherapy with double-balloon catheter (RenovoCath)  
• Mechanism of action  
• Safety and efficacy  
• Ongoing Trials  
- Percutaneous ablative therapies:  
o Non-thermal ablation: Irreversible electroporation  
• Mechanism of action  
• Safety and efficacy  
• Ongoing Trials  
Synergetic effect of ablative therapies and immunotherapy; a future prospective  
Cases?. A few cases of ablation?

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## Abstract Archives of the RSNA, 2023

IREE-4

### Superior Vena Cava Syndrome Imaging and Management

#### TEACHING POINTS

1. Review central venous anatomy and highlight potential collateral pathways. 2. Review the historical and current superior vena cava (SVC) syndrome etiologies. 3. Review the pathophysiology of SVC syndrome. 4. Present SVC syndrome classification systems. 5. Discuss SVC syndrome treatment and management. 6. Detail indications, benefits, and complications of endovascular treatment of SVC syndrome.

#### TABLE OF CONTENTS/OUTLINE

I. History and evolution of SVC syndrome etiologies. II. Central venous anatomy. III. Pathophysiology and symptoms of SVC syndrome. IV. SVC syndrome classification systems. V. SVC syndrome treatment algorithm. VI. Endovascular therapy cases. VII. Endovascular therapy techniques. VIII. SVC syndrome endovascular complications. IX. Projected future of SVC syndrome therapy.

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## Abstract Archives of the RSNA, 2023

IREE-40

### Thermoprotective Techniques in Musculoskeletal Ablation

#### Participants

Ahmad Parvinian, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to provide a case-based review of thermoprotective techniques used during percutaneous thermal ablation of musculoskeletal tumors. The exhibit will demonstrate the basic principles of musculoskeletal ablations performed using ultrasound, CT, fluoroscopic, and MRI guidance, depict the various active and passive thermoprotective techniques that are critical to safe and effective ablation, and provide a framework for recognizing and addressing complications. Teaching points include: (1) clinical background and principles of musculoskeletal ablation, (2) active thermoprotective techniques, (3) passive thermoprotective techniques, (4) complication management.

#### TABLE OF CONTENTS/OUTLINE

1. Title page  
2. Teaching points  
3. Musculoskeletal ablation background  
4. Preprocedural Considerations  
5. Passive thermoprotection- Ablation zone monitoring- Temperature monitoring- Neurophysiologic monitoring  
6. Active thermoprotection- Hydrodisplacement- Pneumodisplacement- Balloon interposition- Probe traction- Internal warming- External warming  
7. Complication recognition and management  
8. Conclusions

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## Abstract Archives of the RSNA, 2023

IREE-41

### Thyroid Nodule Fine Needle Aspiration: What the Pathologist Wants You to Know

#### TEACHING POINTS

- Fine needle aspiration (FNA) is an optimal diagnostic tool for thyroid nodules because it is cost-effective, safe, and accurate .
- The Bethesda guidelines for thyroid FNA consider that the unsatisfactory rate on cytopathology is of about 10% , however different studies have shown that the unsatisfactory rate can range from 0.4% up to 40% .
- Some of the reasons why FNA results may be inaccurate include:
  1. Sampling error: the sample may not accurately represent the entire nodule.
  2. Inadequate sample size: the sample taken during FNA may be too small to yield accurate results.
  3. Technical error: The accuracy of FNA results can be affected by technical errors, such as improper handling or processing of the tissue sample.
  4. Nodule size: multiple studies have shown that the diagnostic accuracy of FNA is limited in large thyroid nodules.
- The technique of the specimen collection and evaluation and the preparation of the slide can play a decisive role in the diagnostic accuracy therefore it's important for the radiologist to recognize the correct technique.
- The "classic" technique uses three slides and generates two slides for interpretation. A slide to be deposited in fixative, a slide to be air dried , and a spreader slide.
- The two-slide technique has been called the "butterfly" or "book-end" technique. It has the advantage of simplicity and better reproducibility. It produces a relatively uniform and rounded imprint of FNA material for evaluation on two mirror image slides.

#### TABLE OF CONTENTS/OUTLINE

1. Patient selection
2. Equipment needed for thyroid biopsy
3. Patient preparation
4. Needle based sample collection techniques
5. Sample preparation
6. Pathologist recommendations in order to reduce inconclusive results

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## Abstract Archives of the RSNA, 2023

IREE-42

### Nutcracker Syndrome: Diagnosis and the Role of Minimally Invasive Interventions

#### Participants

Alina Hasanain, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Nutcracker phenomenon is an anatomic condition characterized by extrinsic compression of the left renal vein, causing entrapment, and subsequent diminished outflow to the inferior vena cava. 2. Nutcracker syndrome refers to Nutcracker phenomenon with clinically apparent sequelae, which include hematuria, abdominal pain, and gonadal varices among a variety of other symptoms, the severity of which can depend on the severity of the anatomic findings. 3. The role of interventions, especially minimally invasive interventions such as endovascular treatment, has become more prominent in the treatment of severe Nutcracker syndrome. This exhibit will outline diagnostic methods and management options for Nutcracker syndrome with a focus on endovascular approaches.

#### TABLE OF CONTENTS/OUTLINE

1. Review the pathophysiology of Nutcracker syndrome with anatomic causes and variations. 2. Discuss diagnostic methods: doppler ultrasound, CT, MRI and angiography, venography and intravascular ultrasound. a. Imaging criteria and classification. b. Examples of cases from a single institution. 3. Discuss management options including conservative management and surgical options with an emphasis on endovascular approaches (stenting, coil embolization of varices). a. Advantages over open or laparoscopic interventions. b. Complications and pitfalls. c. Future directions.

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## Abstract Archives of the RSNA, 2023

IREE-43

### Managing Hemoptysis from Diagnosis to the Angio Suite: A How-to Guide for the Radiologist

#### TEACHING POINTS

Hemoptysis is the airway bleeding, ranging from blood-tinged mucus to gross hemorrhage: when massive -almost defined as a >300mL/24h bleeding- it is a life-threatening and challenging condition. Angiography with embolization is the front-line therapy for emergent cases of hemoptysis. The aim of this study is to give a concise guide to the diagnostic and interventional management of hemoptysis in the angiography suite.

#### TABLE OF CONTENTS/OUTLINE

Hemoptysis generally arises from the bronchial arteries (BAs,~90%) and encompasses infectious, inflammatory and malignant causes, being tuberculosis the most common worldwide. After airway securing, underlying conditions and laterality must be assessed: CT angiogram -eventually along with bronchoscopy- is a useful tool to review and report origin (orthotopic/ectopic), course and morphology of BAs or to identify nonbronchial systemic/pulmonary bleeding source. On conventional bronchial arteriograms, selective catheterization of BAs origins is mandatory, while the anterior spinal artery and its medullary branches must be identified in order to avoid iatrogenic transverse myelitis or paralysis, the major complications. Hypertrophied vessels, parenchymal hyperemia, blushing or pseudoaneurysm suggest bleed source. For BAs, embolic particles (350-700microm) are usually preferred, while coils and plugs preclude reintervention if hemoptysis recurs and are thus limited to bronchial aneurysms and pulmonary arteries embolization. Recurrence rates range from 10 to 58% and increase over time and in certain diseases (e.g. cystic fibrosis).

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## Abstract Archives of the RSNA, 2023

IREE-44

### Abernethy Malformations: Making Sense of Congenital Portosystemic Shunts

#### TEACHING POINTS

Abernethy malformation, or congenital portosystemic shunt, is a rare abnormality of the portal venous system. The portal vein either fails to form or forms abnormally, resulting in an anomalous shunt that diverts blood from the portal vein to the systemic circulation without passing through the liver. The clinical manifestations of Abernethy malformation can vary depending on the severity and location of the shunt, and may include encephalopathy, portal hypertension, and liver failure. Abernethy malformation can be detected via ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI). Patients with Abernethy malformation are at risk for liver lesions, thus particular attention must be paid to the liver parenchyma. The orientation and size of the shunt can be confirmed via catheter-directed angiography and balloon occlusion. Treatment options for Abernethy malformation include interventional or surgical shunt closure, liver transplantation, or conservative medical management of symptoms. The choice of treatment depends on the severity of the malformation and the patient's clinical condition.

#### TABLE OF CONTENTS/OUTLINE

(1) Introduction: Overview of Abernethy malformation (2) Clinical presentation: Signs and symptoms (3) Imaging: Detection, associated findings, characterization, and confirmation (4) Treatment: To close or not to close?

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## Abstract Archives of the RSNA, 2023

IREE-45

### Sharp Recanalization for Central Venous Occlusive Disease: Advanced Techniques and Evidence-Based Outcomes

#### Participants

John Domini, Columbus, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Define the role of and indications for sharp endovascular recanalization in the management of central venous occlusive disease (CVOD). Examine relevant clinical and vascular anatomy relevant to CVOD. Describe the conventional interventional methods of central venous recanalization. Discuss pertinent procedural techniques, devices, technical challenges, and special considerations of sharp central venous recanalization. Review risks, evidence-based outcomes, complications, and post-procedural care.

#### TABLE OF CONTENTS/OUTLINE

A review of indications and rationale for patient selection will be discussed. Central venous anatomy with marked implications on technical approaches will be examined. Procedural details will review the conventional methods and highlight indications for sharp recanalization and advanced techniques. Technical aspects including equipment choices, procedural techniques, practical pearls and potential pitfalls will be discussed, guided by a case-based review. Interpretation of clinical results, evidence-based outcomes will also be reviewed with a focus on complications, risks and post-procedural care.

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## Abstract Archives of the RSNA, 2023

IREE-46

### Vasculitis: Clinical Evaluation, Imaging, and Treatment

#### Participants

Kausthubh Hegde, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the definition and types of Vasculitis. 2. Discuss the signs, symptoms, and clinical evaluation of the most common types of Vasculitis. 3. Diagnosis with an emphasis on the role of imaging in diagnosing Vasculitis. 4. Case-based examples of IR treatment options and follow-up care.

#### TABLE OF CONTENTS/OUTLINE

1. Vasculitis: definition and pathophysiology of the disease. 2. Classification of vasculitis - Lie classification of vasculitis (1994) - 2012 revised International Chapel Hill Consensus Conference nomenclature of vasculitides 3. Review of the signs and symptoms of different types of vasculitis. 4. Role of diagnostic imaging modalities in the evaluation of vasculitis (with case-based examples). 5. Indications and contraindications for endovascular treatment of vasculitis (with case-based examples). 6. Complications and follow-up care after IR procedures.

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## Abstract Archives of the RSNA, 2023

IREE-47

### Embolization of Extracranial Arteriovenous Malformations: Strategies of Interventional Approaches According to the Yakes Classification

#### TEACHING POINTS

Learn imaging findings associated with arteriovenous malformations (AVM) and present the Yakes classification  
Present briefly the main genetic mutations associated pathways and potential drug therapies  
Understand interventional management of AVM according to the Yakes classification  
Discuss embolization strategies according to the Yakes classification and AVM territory  
Discuss outcomes, follow-up and complications  
Propose a therapeutic algorithm based on the Yakes classification, clinical staging and genotyping

#### TABLE OF CONTENTS/OUTLINE

Overview and classification of AVM according to the Yakes classification  
Clinical and imaging evaluation before procedure  
Presentation of the Shobinger classification and discussion of the relative roles of Doppler ultrasound, CT, MRI, DSA  
Embolization techniques  
Presentation of liquid and mechanical embolizing agents and their use according to the approach (endovascular transarterial approach, direct puncture, retrograde venous approach). The safe use of ethanol and bleomycin will be also discussed  
Treatment techniques according to AVM territory and Yakes classification  
Discuss specific considerations for head and neck, limbs, thoracic, abdominal and pelvic AVMs  
Yakes Type I (transarterial, transvenous, coils, plug)  
Yakes Type II (transarterial, direct puncture, retrograde venous, liquid agent)  
Yakes IIIa (transvenous, coils, plug ± liquid agents)  
Yakes IIIb (transarterial, direct puncture, retrograde venous, liquid agent, coils)  
Yakes IV (direct puncture ethanol, interstitial infiltration bleomycin)  
Follow-up and outcomes evaluation  
Clinical and imaging criteria to assess therapeutic response  
Conclusion  
Therapeutic algorithm proposed

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## Abstract Archives of the RSNA, 2023

IREE-48

### Fluid Solutions for Complex Cases: A Comprehensive Guide to Sclerosant and Liquid Embolic Agents for Radiologists

#### Participants

Keith Ameyaw, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Liquid embolic and sclerosant agents are vital tools in interventional procedures capable of achieving targeted vessel occlusion, space occupation or tissue fibrosis. 2. Understanding the mechanism of action of these agents is essential for optimal use, procedural technique, and informing operator preference. 3. Different agents have unique advantages and complications. Selecting the appropriate agent is critical for optimizing patient outcomes. 4. Radiologists must be intimately familiar with the unique post-procedural imaging characteristics of liquid embolics/sclerosants. These imaging findings play a crucial role in assessing both the success of the procedure and informing follow-up care.

#### TABLE OF CONTENTS/OUTLINE

1. Mechanism of action of sclerosant and liquid embolic agents. 2. Indications for use in several disease entities, including: intracranial and extracranial vascular malformations, lymphatic malformations, tumors, cysts, benign prostatic hyperplasia, venous insufficiency, arterial hemorrhage, portal hypertensive variceal hemorrhage, aortic graft endoleak, lymphatic leak/chylothorax, lymphoceles, post-operative seroma, and gonadal vein embolization. 3. Technique and procedural considerations. 4. Advantages and associated complications of different agents. 5. Imaging findings with descriptions of associated artifacts necessary for appropriately assessing procedural success and informing follow-up care.

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## Abstract Archives of the RSNA, 2023

IREE-49

### Benefits of Hybrid CT/Angiography Utilization for Microsphere Trans-arterial Radioembolization with Yttrium-90

#### TEACHING POINTS

Hybrid angiography/CT (Angio-CT) employs both traditional CT imaging with concurrent fluoroscopic angiography in the same procedure room. Although introduced prior to cone-beam CT, Angio-CT has been under-utilized due to cost and availability. The resurgence of Angio-CT has proven to be a very useful tool in interventional oncology; however, its application in microsphere trans-arterial radioembolization is not well documented through the literature. Angio-CT shows unique advantages in the image resolution regardless of patient preparation, catheter directed contrast imaging in the planned treatment field to precisely calculate more accurate dosimetry in routine and multifocal lesions, to more accurately characterize lesions and any potential changes in lesions with higher sensitivity and specificity, and to more accurately detect anatomic variants and/or accessory tumor feeding vessels. Lastly, early data suggests Angio-CT systems utilization could improve survival in patients with HCC when performing trans-arterial therapy, likely due to more accurate and precise pre-treatment and intraprocedural imaging.

#### TABLE OF CONTENTS/OUTLINE

1. What is Angio/CT? 2. Practical points and precision of dosimetry with Angio/CT 3. Unique Advantages in image quality and predicting success 4. Optimal Utility of Each Modality 5. The Unknowns and the Research Potential 6. Case Examples a. Improved detection and characterization b. Anatomic variants potentially unnoticed with cone-beam c. Improving dosimetry accuracy 7. Quantifiable benefit in outcome?

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## Abstract Archives of the RSNA, 2023

IREE-5

### Advances in Percutaneous Jejunostomy: Novel Techniques and Their Clinical Implications

#### TEACHING POINTS

Percutaneous radiologic jejunostomy (PRJ) is a minimally invasive procedure for patients requiring enteral feeding and access for biliary interventions, especially in patients who have altered anatomy, such as after gastric resection, gastric bypass surgery, Whipple procedure, or liver transplant. After reviewing this exhibit learners should be able to: 1. Recognize common indications for PRJ. 2. Understand novel techniques to aid in successful PRJ access. 3. Recognize and address complications related to PRJ.

#### TABLE OF CONTENTS/OUTLINE

This exhibit will: 1. Review imaging and anatomical considerations for jejunal access. 2. Discuss common indications, contraindications and patient selection for PRJ. 3. Introduce procedural advancements in PRJ through a case-based approach- Traditional techniques in PRJ- Modified coaxial technique for T fastener deployment through a sheath- Utilizing cone beam CT to ensure proper T fastener placement- Using an orogastric magnetic balloon and ultrasound guidance to assist in complicated cases where traditional methods fail. 4. Address pitfalls and potential complications of PRJ. Summary Clinical Implications: As the number of liver transplants, cholecystectomies and gastric surgeries increase every year, there may be more demand for jejunal access to manage potential complications of these procedures. PRJ can allow for enteral nutrition and access for repeated biliary interventions.

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## Abstract Archives of the RSNA, 2023

IREE-50

### A Review of Superior Vena Cava Interventions

#### Participants

Jorge Lopera, MD, San Antonio, TX (*Presenter*) Shareholder, Tecnostent SA; Consultant, Merit Medical Systems, Inc; Research Grant, AngioDynamics, Inc

#### TEACHING POINTS

To review the clinical presentation and treatment options for SVC syndrome. To understand the role of different endovascular techniques to treat stenoses, occlusions and thrombosis of the SVC. To illustrate the challenges when treating SVC stenoses in patients with existing central lines. To discuss the different recanalization techniques to treat complex chronic occlusions of the SVC. To review the different complications with SVC interventions and how to treat them .

#### TABLE OF CONTENTS/OUTLINE

1. Clinical presentations and imaging of central venous and SVC stenoses and occlusions. 2. Review of treatment options in malignant SVC syndrome. 3. Treatment options in SVC syndrome - special situations: a. SVC syndrome with existing ports and dialysis lines. b. SVC syndrome with thrombus c. Endovascular stenting : single or kissing stents. Covered or bare stents. d. Recanalization techniques for complex chronic occlusions. 4. Complications .

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## Abstract Archives of the RSNA, 2023

IREE-51

### Percutaneously Induced Neuroregeneration for Treatment of Chronic Neuropathic Pain

#### TEACHING POINTS

1) Review the pathophysiology of neuropathic pain and the Sunderland classification of nerve injury. 2) Explain how percutaneous cryoneurolysis can induce regeneration of damaged peripheral nerves causing chronic pain. 3) Demonstrate the ability of percutaneous cryoneurolysis to provide long term relief and neuroregeneration for the treatment of chronic neuropathic pain. 4) Discuss current indications and potential new applications of cryoneurolysis.

#### TABLE OF CONTENTS/OUTLINE

1) Incidence and causes of neuropathic pain. 2) Pathophysiology of nerve injury and chronic peripheral nerve pain. 3) Mechanism of cryoneurolysis and neuroregeneration. 4) Current indications and patient selection. 5) Techniques for cryoneurolysis, including approaches and duration/temperature of ablation. 6) Post-procedure follow-up and outcomes. 7) Case examples of cryoneurolysis for pain relief and neuroregeneration. 8) The pre-operative use of cryoneurolysis to reduce pain caused by other interventions including ablation, embolization, and post-mastectomy pain. 9) Exploring new applications of cryoneurolysis.

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## Abstract Archives of the RSNA, 2023

IREE-52

### Super Selective Radioembolization for Hepatocellular Carcinoma: Radiation Segmentectomy and Beyond

#### TEACHING POINTS

Radioembolization has emerged as an effective treatment option for hepatocellular carcinoma that cannot be surgically removed. The procedure involves the preferential deposition of radioactive microspheres into the hypervascular tumor through a siphoning effect, typically achieved by injecting the microspheres at the lobar artery level. However, to improve tumor response and minimize potential complications, superselective radioembolization is recommended. The purpose of this exhibit is : (1) To review the rationale behind radiation segmentectomy. (2) To learn when superselective radioembolization is necessary, (3) to offer technical tips for performing superselective radioembolization.

#### TABLE OF CONTENTS/OUTLINE

1) Radiation segmentectomy : rationale and evidence 2) Dosimetry : Practical guide for dosimetry of superselective radioembolization 3) When superselective radioembolization is needed A. small single tumor : radiation segmentectomy B. Large single tumor saddling on both lobes C. Small remnant liver D. Hepatic artery branching at acute angle E. Extrahepatic collateral artery supplying the tumor 4) Technical consideration of superselective radioembolization A. Protection of distal normal liver by using balloon microcatheter and detachable coil B. Combination treatment of lobar and segmental artery C. Combination treatment of 1st and 2nd week dosing of glass microsphere 5) Follow-up imaging after superselective radioembolization A. Early loss of arterial enhancement of the tumor B. Focal radiation necrosis mimicking new hypovascular tumor

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## Abstract Archives of the RSNA, 2023

IREE-53

### TESLA: The Future in Treatment for Malignant Perihilar Obstruction

#### TEACHING POINTS

In malignant bile duct obstructions the most common treatment in the Netherlands is endoscopic drainage (ERCP) with placing plastic tubes, combined with biliary drainage. Cholangitis due to ERCP occurs often, in 40-60% of the patients, probably caused by colonization of bowel bacteria and infection of undrained segments. Patients often need multiple re-interventions. The 90days mortality after diagnosis is 35%. In the TESLA trial the hypothesis is that primary percutaneous stenting, without placing a biliary drain and without stenting the ampulla of Vater, provides less infectious complications and less reinterventions compared to endoscopic drainage. Ensuring a decrease in morbidity and mortality and improving the quality of life.

#### TABLE OF CONTENTS/OUTLINE

Compare primary percutaneous stenting above the ampulla versus endoscopic drainage for palliative treatment of malignant hilar biliary obstruction in the TESLA study. Primary providing a lower complication rate and furthermore lowering the absolute and relative bilirubin levels, decreasing the number of reinterventions and providing a better quality of life. This abstract provides an overview of the TESLA trial, an education of the interventional procedure and materials and provides the first promising data retrieved from the TESLA trial.

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## Abstract Archives of the RSNA, 2023

IREE-54

### Advancing Interventional Procedures With Mixed Reality

#### TEACHING POINTS

Introduction: The presentation focuses on Microsoft's HoloLens2 for visualization on an angiography biplane system. The HoloLens2 device is a mixed reality device that uses depth, light, and infrared cameras to track its environment and anchor multiple virtual displays to view ultrasound and fluoroscopy in real-time during image-guided interventions. Teaching Points: • Overview of the HoloLens2 device and its functionalities as they relate to interventional procedures • Demonstrate improvements in customization, decrease visual field discrepancies, and reduce ergonomic challenges associated with the current angiography systems • Evaluation of the image quality, latency, customization capabilities, and overall user experience • Demonstrate functionality like voice, gaze, and gesture controls in the live angiography environment • Case examples of the HoloLens2 integration in image-guided interventions on secondary personnel and primary phantom work

#### TABLE OF CONTENTS/OUTLINE

Outline: The presentation will cover the various teaching points related to HoloLens2 integration into an angiography suite. Attendees will learn how the device facilitates the clinician seeing what they want and where they want. The presentation will conclude with a summary of the promising role the HoloLens2 provides in advancing the clinician experience in interventional radiology and answer the question of why integrating this emerging technology will be beneficial in the clinical environment.

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## Abstract Archives of the RSNA, 2023

IREE-55

### Percutaneous Cryoneurolysis for Complex Pain: Indications, Technique, and Expectations

#### TEACHING POINTS

1. Review the epidemiology of complex pain syndromes and current need for analgesic adjuncts in pain management  
2. Discuss the mechanisms of how percutaneous cryoneurolysis affects pain  
3. Review the uses and techniques of various procedures including intercostal, ilioinguinal, intercostobrachial, and pudendal nerve cryoneurolysis  
4. Demonstrate successful approaches to complex pain including pathologies involving the rib, hip, arm, and groin  
5. Discuss common complications after percutaneous cryoneurolysis, including their diagnosis and management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction, including epidemiology of complex pain syndromes  
2. Mechanism and physiology behind cryoneurolysis effect on pain  
3. Indication, technique, and successful case of intercostal nerve cryoneurolysis  
4. Indication, technique, and successful case of ilioinguinal nerve cryoneurolysis  
5. Indication, technique, and successful case of intercostobrachial nerve cryoneurolysis  
6. Indication, technique, and successful case of pudendal nerve cryoneurolysis  
7. Recognition and management of common complications  
8. Conclusion and summary

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## Abstract Archives of the RSNA, 2023

IREE-56

### Ectopic Varices: Anatomic and Hemodynamic Features and Endovascular Techniques

#### TEACHING POINTS

Ectopic varices arise in the hepatopetal or hepatofugal collateral vessels outside the gastro-esophageal region account for up to 5% of variceal bleeding. Various endovascular techniques can be effectively applied based upon their anatomic and hemodynamic features. Duodenal varices (DVs) are the most common type and arise in either hepatopetal collaterals or hepatofugal collaterals. DVs with hepatopetal collaterals are treated by portal vein (PV) stenting and those with hepatofugal collateral are treated by antegrade and/or retrograde obliteration techniques with or without TIPS. Rectal varices (RVs) are common complication in portal hypertension and arise in hepatofugal collaterals from the superior rectal vein to the bilateral internal iliac veins. Antegrade obliteration is often required to eradication of RVs because of their complicated drainage system. TIPS is effective to prevent recurrent bleeding. (Peri)stomal varices (SVs) can develop after ileostomy. SVs are supplied by the ileal veins and drains into the epigastric veins. They are often associated with portal hypertension but also with local hemodynamic abnormality. SVs with refractory bleeding have been treated by direct puncture embolization, antegrade obliteration and TIPS. Choledochal (-jejunal) varices arise in hepatopetal collaterals with extrahepatic PV occlusion often associated with choledocojejunostomy. They are treated by PV stenting with additional endovascular techniques.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline 1. Basics of ectopic varices and various endovascular techniques 2. Duodenal varices 3. Rectal varices 4. Stomal varices 5. Choledochal (-jejunal) varices 6. Miscellaneous/ infrequent varices

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## Abstract Archives of the RSNA, 2023

IREE-57

### Thermoablation of Pulmonary Metastasis: A Standard for a Secure Approach

#### Participants

Barbara Nunes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To illustrate noble structures in the pulmonary ablation areas under risk, which should be minded during the procedure.- To discuss patient selection, positioning, rationale of safe routes for the probe, and safety maneuvers in order to avoid and protect the above structures.- To assess the criterias of an adequate ablation zone and its expected course.- To illustrate the most important complications involved in the thermoablation of pulmonary metastasis.

#### TABLE OF CONTENTS/OUTLINE

- Anatomy- Thermoablation mechanics- Patient positioning rationale and safe routes on pulmonary nodules ablation- Protective maneuvers- Defining an adequate ablation zone- Expected course of an adequate ablation zone- Most important acute complications

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-58

### Buffalo Lung: A Human Complication after Lung Biopsy

#### Participants

Nicole Law, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Buffalo lung is a rare occurrence of bilateral pneumothoracies due to an abnormal physical communication between the two pleural spaces. 2. Iatrogenic buffalo lung can occur following intrathoracic procedures such as median sternotomy, laparoscopic surgery and heart-lung transplantation, putting these patients at higher risk for bilateral pneumothoracies during a lung biopsy procedure. 3. Presentation of buffalo chest can be worse than that of unilateral pneumothorax, including severe and sudden onset of dyspnea and pleuritic chest pain, tachycardia, hypotension, and even cardiac arrest or death. 4. Quick action should be taken in these patients to place bilateral chest tubes in order to re-expand the collapsed lungs. For this reason, it is important for IR physicians to be aware of the risk of buffalo lung in lung biopsy patients.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Patient case example. Picture examples. Discussion of buffalo lung and its' presentations. Patient risk factors. Treatment and case outcome.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-59

### Anatomic Variants of the Hepatic Arteries and Technical Considerations for Y90 Radioembolization

#### Participants

Taylor Loon, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Review hepatic arterial variants that a radiologist should be able to recognize using the MICHEL classification. 2) Identify and familiarize the most common hepatic arterial variants encountered in pre-treatment mapping for Yttrium-90 radioembolization based on imaging findings. 3) Highlight the possible complications of Y90 microsphere diffusion into replaced right and left hepatic arteries and technical considerations when encountering variants.

#### TABLE OF CONTENTS/OUTLINE

1) Review standard hepatic artery anatomy and the relevant imaging findings trainees should know to quickly evaluate using CT and digital subtraction angiography. 2) Introduce the MICHEL classification and subclassify based on right, left and common hepatic arterial origins. Present digitally drawn visual diagrams demonstrating each MICHEL classification. 3) Present cases from our institution depicting hepatic arterial anatomic variants using CT angiography and 3D-rendered images (MICHEL Classification, II, III and IV, which have a prevalence of 12.5%, 7.5% and 1% respectively). 4) Using cases from our institution, review relevant imaging findings on digital subtraction angiography for identifying hepatic arterial variants during pre-procedure mapping for Y90 chemoembolization. 5) Discuss possible branches of replaced/accessory left and right hepatic arteries and impact of diffusion of Y90 spheres. 6) Discuss technical considerations when encountering hepatic arterial variants including; injection rate for mapping DSA, prophylactic embolization of branches, and microcatheter tip position.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-6

### Purchasing Decisions for an Interventional CT Program

#### TEACHING POINTS

(1) Interventional CT fluoroscopy is becoming widely used and scanner features that meet both diagnostic and interventional needs are becoming increasingly complex. In this paper, the most important scanner features are discussed and ranked for both diagnostic and interventional purposes. (2) Vendors provide different offerings for the features, so hypothetical comparisons for three vendors are included to facilitate explaining various tradeoffs in purchasing decisions.

#### TABLE OF CONTENTS/OUTLINE

This education exhibit provides a complete overview of CT scanner features which are necessary, desired, or useful for meeting both diagnostic and interventional purposes. The viewer will become familiar with the nuances of each feature and leave more comfortable with purchasing decisions in an increasingly complex market.

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## Abstract Archives of the RSNA, 2023

IREE-60

### Vascular Interventions in Angiosarcoma with Pulmonary Hemorrhage

#### Participants

Denes Szekeres, BS, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibit is to identify the role of the radiologist in diagnosis and management of vascular tumors. We begin with a review the epidemiology and presentation of angiosarcoma, a rare and diverse subset of malignant soft tissue sarcoma that is often insidious. We discuss the broad range of imaging findings for a variety of common sites of primary and secondary angiosarcoma through a review of SEER data and prior studies. We tie together the educational points with a case report of a cardiac angiosarcoma, including a review of the multidisciplinary approach to diagnostic workup and oncologic management. We end with a description of endovascular interventions (coil embolization) in treating pulmonary hemorrhage, a common complication of metastatic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Statistics and clinical pearls of angiosarcoma  
2. Review of multimodality imaging findings  
3. Case presentation of primary cardiac angiosarcoma  
4. Technique for coil embolization of pulmonary arterial hemorrhage  
5. Summary of educational points

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## Abstract Archives of the RSNA, 2023

IREE-61

### Oops, We Did It Again: A Review of CT- and US-Guided Thoracic Interventional Procedure Complications

#### TEACHING POINTS

To review the potential complications of CT- and US-guided thoracic interventional procedures. To analyze the causes and risk factors of these complications and discuss how they could be prevented. To explain the different treatment options for these complications.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Lung biopsy and lung abscess drainage indications - Pleural biopsy indications- Thoracocentesis and pleural drainage indications - Techniques: CT- and US guided- Procedure: patient preparation, materials, technical considerations 2. Complications 2.1. Pneumothorax - Risk factors - Treatment 2.2. Lung Hemorrhage- Risk factors - Treatment 2.3. Subcutaneous Hematoma- Causes - Treatment 2.4. Seeding 2.5. Gas embolism- Clinical manifestations, causes - Treatment 2.6. Hemothorax- Causes - Treatment 2.7. Non-diagnostic biopsy- Risk factors - FNA vs CNB - Methods to increase biopsy performance 2.8. Non-productive pleural drainage- Causes- Treatment 3. Prevention of complications 4. Summary 5. Conclusion

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## Abstract Archives of the RSNA, 2023

IREE-62

### Intra-procedural Ablation Margin Confirmation for Thermal Ablation of Liver Tumors Using Open Source Software

#### Participants

Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS

#### TEACHING POINTS

1) Dedicated software for confirmation of ablation margins is commercially available but expensive and often unavailable to in health care centers and research laboratories with limited budgets - even in developed nations. This abstract presents a workflow for ablation confirmation using free and open source software.2) The minimum ablation margin (MAM) after thermal ablation of liver tumors is the most important predictor of local tumor progression.3) Detecting an insufficient minimum ablation margin during the procedure allows for immediate re-ablation during the same treatment session.4) Intra-operative images acquired using controlled breathing (e.g. apnea, high frequency jet ventilation) yield the most accurate results as they involve minimal tissue deformation.

#### TABLE OF CONTENTS/OUTLINE

1) Software requirements2) Loading and organizing the data3) Registering the pre- and post-ablation CT images4) Segmentation of the tumor and ablation zone5) Calculation and visualization of the minimum ablation margin

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

IREE-63

### **The Role of Cone Beam Computed Tomography in Embolization of a Technically Challenging Distal Pulmonary Artery Mycotic Aneurysm**

#### **TEACHING POINTS**

Cone-Beam Computed Tomography (CBCT) has many potential applications for both diagnostic and interventional radiology. The use of CBCT, as exemplified by the following case, allowed for the expeditious identification and treatment of a distal pulmonary artery mycotic aneurysm. This exhibit will enable participants to directly compare the differences in appearance between traditional CT and CBCT of the same entity and to display how CBCT data can be fused to live fluoroscopy to hasten the time to intervention.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction of the case example a. 42-year-old female with a complex medical history most notable for recent endocarditis treated with antibiotics and mitral valve replacement who presented with hemoptysis. 2. Description of traditional CTA findings a. CTA Chest demonstrated a distal, fourth-order pulmonary artery mycotic aneurysm. Axial images and coronal reformat provided. 3. Description of the CBCT findings a. Redemonstration of the aneurysm, comparing appearance to that of the CTA 4. Tutorial of fusing CBCT with live fluoroscopic images using guidance software, specifically using GE EMBO ASSIST ® as an example a. Images of the 3D reconstruction of the CBCT data b. Discussion of how guidance software is applied to the fluoroscopic images 5. Conclusion of case a. Successful, expeditious coil embolization of a difficult-to-access distal pulmonary artery mycotic aneurysm 6. Discussion of additional applications of this technique to other entities

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## Abstract Archives of the RSNA, 2023

IREE-64

### Overview of Diagnosis and Treatment of Large or Medium-sized Vessel Vasculitis

#### TEACHING POINTS

Vasculitis is a group of disorders characterized by inflammation of the walls of blood vessels, and they are classified based on the diameter of the predominantly affected vessels. The clinical manifestations of vasculitis can be non-specific and may overlap with other disorders. Imaging techniques allow for direct evaluation of the arteries in large or medium-sized vessel vasculitis, and various interventional procedures may be used in these cases. However, the vessels involved in small vessel vasculitis are smaller than the current imaging resolution, meaning that only end organ changes secondary to the involvement of small vessels can be examined. This review presents the most important imaging modalities and typical findings in large and medium-sized vasculitis. The purpose of this exhibit is : (1) To list the vascularitis according to the vessel size affected. (2) To review the clinical and radiological manifestation of various vascularitis. (3) To learn the indication and technical tips for interventional procedures for vascularitis.

#### TABLE OF CONTENTS/OUTLINE

1) List of vascularitis A: large vessels (eg, giant cell arteritis, Takayasu arteritis), B: medium-sized vessels (eg, polyarteritis nodosa, Kawasaki disease, primary granulomatous central nervous system vasculitis), C : small vessels (eg, Wegener granulomatosis, Churg-Strauss syndrome, microscopic polyangiitis, Henoch-Schönlein syndrome, systemic lupus erythematosus, rheumatoid vasculitis, Behçet syndrome). 2) Clinical manifestation and diagnostic criteria 3) Imaging modality and angiographic appearance 4) Treatment options : medical vs interventional 5) interventional procedures and their indication

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## Abstract Archives of the RSNA, 2023

IREE-65

### Intra-arterial Treatment for Hepatocellular Carcinomas: How to Manage Shunting from the Artery

#### TEACHING POINTS

In the treatment of hepatocellular carcinomas, intra-arterial therapy such as chemoembolization and radioembolization is commonly used. However, operators may encounter shunts from the artery (such as arterioportal, arteriovenous, and arteriopulmonary shunts) that can hinder effective treatment. These shunts can be caused by various factors such as tumor invasion, previous percutaneous procedures, chronic inflammation, or congenital acquisition. If not properly occluded, embolic material can pass through the shunt and cause non-target embolization or serious complications. This exhibit aims to achieve three goals: (1) Review the radiologic appearance of arterioportal, arteriovenous, and arteriopulmonary shunts; (2) Learn how to manage these shunts with proper embolic materials; and (3) List the possible complications and their management.

#### TABLE OF CONTENTS/OUTLINE

1) List of shunts Arterioportal shunt (hepatic artery - portal vein), Arteriovenous shunt (hepatic artery - hepatic vein), Arteriopulmonary shunt (hepatic artery - pulmonary artery/vein), 2) Imaging findings on CT/MR and angiography according to the cause (tumorous vs non-tumorous condition) 3) Embolization strategy and materials for shunts 4) Complications related with non-target embolization and their management

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## Abstract Archives of the RSNA, 2023

IREE-66

### Nonsurgical Management of Renal Masses

#### Participants

Laura Jorgenson, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learn the nonsurgical approaches to treat renal masses, including ablation, embolization, and SBRT, the indications for treatment and intra-procedural tips and tricks to optimize response. Understand post ablation, embolization and SBRT changes in the renal tumor and how to avoid pitfalls in interpretation. How to evaluate for tumor recurrence post treatment and avoid pitfalls in assessment. Understand common complications following ablation, embolization, and SBRT.

#### TABLE OF CONTENTS/OUTLINE

1. Ablation, embolization, and SBRT technique Discuss evolution of nonsurgical management of renal tumors as a viable treatment option. Discuss indications and fundamentals of ablation, embolization, and SBRT: Patient selection Tumor types Treatment planning Procedural insights to avoid complications Role of spectral CT during ablation 2. Post ablation SBRT and embolization changes in renal tumors and assessment of tumor response Response of renal masses to nonsurgical management Typical features on imaging (CT/MRI) which depict normal evolution of typical changes on imaging - acute, subacute and chronic changes Tips on how to avoid pitfalls in interpretation 3. Potential Complications and related imaging features in each modality Intra-procedural complications Immediate post-procedural complications Delayed complications

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## Abstract Archives of the RSNA, 2023

IREE-67

### Radioembolization of Hepatocellular Carcinoma with Extrahepatic Collateral Blood Supply: Anatomic and Technical Considerations

#### TEACHING POINTS

The utilization of radioembolization as a treatment method for hepatocellular carcinoma (HCC) has significantly increased in recent years. Typically, HCC derives its blood supply from the hepatic artery; however, it can also obtain a parasitic blood supply from extrahepatic collateral arteries (EHC). While chemoembolization has been carried out through EHC without significant complications, there is limited experience with radioembolization via EHC. The aim of this exhibit is threefold: (1) to examine the critical anatomy of EHC utilizing cone-beam CT, (2) To review when we suspect the presence of EHC supplying HCC, (3) To learn how to do safe radioembolization through EHC.

#### TABLE OF CONTENTS/OUTLINE

1) List of treated EHC, 2) Vascular anatomy of EHC by using cone-beam CT and safe point of each EHC, 3) Suggestive findings of EHC on CT/MR and cone-beam CT, 4) Special considerations for radioembolization through EHC: dosimetry, embolization of pulmonary shunt, protection of normal vessel, and redistribution by proximal embolization.

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## Abstract Archives of the RSNA, 2023

IREE-68

### Reducing the Learning Curve: The Use of an Ex Vivo Model for Teaching Double J Ureteral Stent Insertion and Retrograde Exchange

#### TEACHING POINTS

Discuss the benefits of simulation-based training for procedure competence. To describe our experience with a new training model for learning double J ureteral stent (DJS) insertion and retrograde exchange.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Urinary tract obstruction and how the performance of DJS can provide relief. The current master-apprentice model and the importance of procedure competence for trainees before practicing on patients. Benefits of simulation-based training and the current models available. Illustration of a developed ex vivo model for simulating a DJS procedure. Conclusion: Percutaneous access into the renal collecting system is a crucial step when performing DJS. This developed model allows for training on this technical skill as well as the remaining steps in a realistic and safe environment.

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## Abstract Archives of the RSNA, 2023

IREE-69

### Diagnostic and Interventional Radiology for Budd-Chiari: An Update on BCS Classification and IVUS

#### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Budd-Chiari syndrome (BCS) is the occlusion of one or more veins of the liver due to various disorders that result in sinusoidal congestion, portal hypertension, fibrosis, cirrhosis, and nodular regeneration. 2. The new BCS classifications can provide more appropriate treatment options; accurately determining the type of obstructor, number of blocked vessels, and length of the obstruction and categorizing the patients according to the updated BCS classification can improve the success of the patient's therapeutic treatment plan.

#### TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of Budd Chiari and the BCS classifications. 2. Briefly review potential mimics of Budd Chiari (i.e. other cause of sinusoidal or post hepatic obstruction). 3. Discuss general concepts of assessing the liver Doppler US, CTA, MRA, venography, and intravascular ultrasound (IVUS) with emphasis on technique, protocol, and image optimization for diagnosing Budd Chiari. a. Describe differentiating imaging features of various BCS presentations depending on the location of the occlusion. b. Review complications associated with BCS. c. Briefly demonstrate pitfalls of BCS. 4. Discuss management options with interventional radiology procedures (venoplasty and stenting, local pharmacologic and mechanical thrombolysis, transjugular intrahepatic portosystemic shunt (TIPS) placement), and potential complications.

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## Abstract Archives of the RSNA, 2023

IREE-7

### Prophylactic Intervention for Placenta Accreta Spectrum

#### TEACHING POINTS

Placenta accreta spectrum (PAS) is an abnormal placentation with invasion of myometrium or extrauterine structures and can be associated with maternal morbidity and mortality. Not only the prenatal diagnosis but also the management are important to reach a better outcome. To date, pre-operative prophylactic balloon occlusion is developing with balloon placement in various sites including internal iliac arteries, common iliac arteries, uterine arteries and abdominal aorta. The purpose of this exhibit is: 1) to review the MRI features of PAS. 2) to review different treatment options including procedural risk, benefit and outcome. 3) to demonstrate techniques of balloon occlusion of internal iliac arteries. 4) to enhance the value of MRI image for preprocedural guidance or predictive indicator.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction of placenta accreta spectrum (PAS) 2) MRI diagnosis of PAS. 3) Management for abnormal placentation a. traditional approach b. prophylactic balloon occlusion in various anatomic regions c. outcome for each treatment 4) Case demonstration: balloon occlusion of internal iliac arteries. 5) Additional MRI role for interventional radiologist

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## Abstract Archives of the RSNA, 2023

IREE-70

### Image-guided Percutaneous Cryoablation for Lung Malignancies: Giving the Tumor a Cold Send-off

#### Participants

Angel Castillo Fortuno, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the physical and therapeutical mechanisms of image-guided percutaneous lung cryoablation (L-CYOA).
- To discuss the clinical and imaging features and the diagnostic and therapeutical algorithms of patients with lung malignancies amenable to treatment L-CYOA, including a proposed systematic pre-procedural evaluation protocol.
- To explain the technique, intraprocedural considerations, imaging findings, and most common complications related to L-CYOA.
- To describe the short-, mid-, and long-term follow-up imaging findings, clinical outcomes, and prospects of L-CYOA in the treatment of lung malignancies.

#### TABLE OF CONTENTS/OUTLINE

1.- Introduction 1.1- Background 1.2 - Surgery, SBRT or lung ablation? 1.3.- Heat vs. cold ablation techniques: Why CYOA? 1.4.- CYOA: Basic principles 2.- Indications 2.1.- Non-small cell lung carcinoma (NSCLC). 2.2.- Oligometastatic lung disease (OLD). 3.- Assessment before L-CYOA 3.1.- Patient selection. 3.2.- Preprocedural evaluation and preparation. 3.3.- Proposal of a systematic protocol. 4.- L-CYOA procedure 4.1.- Technical considerations: CYOA equipment and CT protocol. 4.2.- Technique. 4.3.- Intraprocedural clinical and imaging evaluation. 4.4.- Immediate clinical and imaging findings. 4.5.- Complications. 5.- Post-L-CYOA follow-up 5.1.- Clinical and imaging follow-up scheme. 5.2.- Short-, mid-, and long-term follow-up imaging and clinical findings. 6.- Clinical outcomes 6.1.- Stage I NSCLC. 6.2.- Alternatives indications in NSCLC. 6.3.- OLD. 6.4.- Immunotherapy synergy. 7.- Summarize 8.- Conclusion

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## Abstract Archives of the RSNA, 2023

IREE-71

### Superior Vena Cava Interventions

#### Participants

Irene Dixe de Oliveira Santo, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the causes, anatomic considerations, presentation, and grading of superior vena cava syndrome (SVCS); Describe the main treatment options for SVCS with a special focus upon the endovascular therapies (ET), including angioplasty, stenting and catheter-based thrombus removal; Provide a brief case-based overview of ET, including stent selection; Review the main complications of ET.

#### TABLE OF CONTENTS/OUTLINE

Causes of superior vena cava syndrome (SVCS); Review of the main anatomic considerations, including patterns of obstruction and collateral pathways; Clinical presentation and grading system of SVCS; Diagnostic approach for SVCS; Main treatment options including chemotherapy with or without RT, surgical bypass or ET, including angioplasty, stenting and catheter-based thrombus removal, with pros and cons of each modality; Selected cases from our institution to illustrate several ET options; Venous Stents: types, descriptions, benefits and drawbacks; Complications of ET: hematoma, local infection, pericardial tamponade, SVC rupture, stent migration, in-stent restenosis, pulmonary edema, major bleeding, pulmonary embolism, and cardiac injury.

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## Abstract Archives of the RSNA, 2023

IREE-72

### Combined Y90 Radioembolization and Immunotherapy for the Treatment of Hepatocellular Carcinoma: Is it Effective or Harmful Due to Adverse Effects

#### Participants

Justin Ling Leblanc, MD, JACKSON, MS (*Presenter*) Nothing to Disclose

Johnny Yang, BS, BA, Fresh Meadows, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the mechanism of immunotherapy and Yttrium-90 radioembolization for the treatment of hepatocellular carcinoma (HCC). Explore the risks, benefits, and safety of combined immunotherapy and radioembolization treatment. Review outcomes of real-life cases of combined therapy.

#### TABLE OF CONTENTS/OUTLINE

Understanding the Hepatocellular carcinoma (HCC) immune microenvironment is important for developing effective immunotherapies. Suppression of the cytotoxic immune response - including CD8+ T lymphocytes, Natural Killer (NK) cells, and their associated cytokines - is associated with HCC progression. New drugs targeting immune checkpoint inhibitors, such as nivolumab, pembrolizumab, and atezolizumab have revolutionized the treatment of HCC. The latest research is exploring combination therapy with multiple immunotherapy agents and/or locoregional therapies such as surgical resection, ablation, or embolization. We reviewed stand alone widely used radioembolization with yttrium-90 (Y-90) therapy versus the safety of combining radioembolization with the PD-1 inhibitor nivolumab in HCC. Several Studies looked at the safety of the combination therapy by examining adverse events and overall survival. Results have shown that the combination therapy was well-tolerated, with no major adverse events reported. The most common side effects were fatigue, nausea, and abdominal pain. The median overall survival for the patients was 17 months, which is similar to prior studies. Some studies showed similar survival between these two therapies. Personalized selection based on age, burden of disease and other favorable criteria are important on which patient will benefit from single or combined therapy.

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## Abstract Archives of the RSNA, 2023

IREE-73

### Understanding the Complex Mechanisms of Complications in IR

#### Participants

Jorge Lopera, MD, San Antonio, TX (*Presenter*) Shareholder, Tecnostent SA; Consultant, Merit Medical Systems, Inc; Research Grant, AngioDynamics, Inc

#### TEACHING POINTS

- To review how complications affect our performance in IR
- To understand the most common mechanism of IR complications
- To learn how to prevent and deal with complications
- To illustrate healthy and unhealthy ways to deal with complications

#### TABLE OF CONTENTS/OUTLINE

Introduction : Error or complication ? Most common cause of complications : Judgmental errors : incorrect strategy of treatment is chosen.(1) overly heroic procedures(2) failure to intervene when the situation demands. Technical errors : poor technique , poor selection of devices .Normative or moral errors: irresponsible or unethical behavior. IR specific complications: Choosing the wrong materials .Not knowing your patient's history well. Poor communication. Rushing through cases. Poor technique .Bad luck? . Simple steps to prevent complications Coping with complications : What to do next . Healthy and unhealthy ways to deal with complications Economic and social cost of complications Conclusions

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## Abstract Archives of the RSNA, 2023

IREE-74

### Considerations for the Nonconventional Transjugular Intrahepatic Portosystemic Shunt (TIPS) Creation in Cancer Patients: Alternative Techniques and When to Use Them

#### TEACHING POINTS

1. Review the indications and potential interfering factors to performing a TIPS procedure in cancer patients. 2. Present the standard technique for performing a TIPS; modifications that can be made; and when to use them to circumvent difficulties of the pre-, intra-, and post-operative process in cancer patients with altered post-surgical anatomy and acute or chronic splenoportal venous thrombosis.

#### TABLE OF CONTENTS/OUTLINE

The transjugular intrahepatic portosystemic shunt (TIPS) is widely used in relieving pressure in the portal venous system (~90% success rate) in patients with refractory variceal bleeding or ascites, often due to cirrhosis. The standard process involves catheter guidance from a hepatic vein to a target portal vein branch. Several factors in cancer patients can complicate this procedure. These patients routinely have altered post-surgical anatomy such as a partial hepatectomy. Additionally, an association with increased thrombophilia can cause portal vein thrombosis. Moreover, certain tumors can compress or invade into splenic or mesenteric veins and result in occlusions interfering with a TIPS creation. For such cases, modifications to recanalize or bypass the obstruction have been demonstrated. We review the literature and present alternative techniques for shunt creation in a nonconventional TIPS: 1. The diagnostic presentation of patient factors that can interfere with a successful TIPS creation. 2. Case-based discussion regarding modifications to the TIPS technique to circumvent complicating factors.

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## Abstract Archives of the RSNA, 2023

IREE-75

### Local and Systemic Immune Cell Landscape after Transcatheter Arterial Embolotherapies for Hepatocellular Carcinoma

#### TEACHING POINTS

- Review the magnitude and influence of post embolization hypoxic microenvironment on the local and systemic immune cell landscape in hepatocellular carcinoma (HCC)• Illustrate preclinical and clinical data on T-cell and myeloid populations in post embolization and radioembolization in tumor microenvironment• Describe the current status of systemic immune cell response after catheter-based therapies for HCC

#### TABLE OF CONTENTS/OUTLINE

1.Introduction to catheter-based interventions for HCC and technical impact on post embolization hypoxia 2. Overview of the role of hypoxic stress and angiogenic factors induced by embolization on HCC cell survival 3. Characterize T-cell and myeloid cell local landscape after catheter-based interventions. 4. Discuss changes to splenic and plasma levels of inflammatory markers after HCC embolotherapies. 5. Demonstrate sustained immune responses after Y90 Radioembolization in Hepatocellular Carcinoma 6. Discuss future applications of embolization therapies in treating liver tumors.

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## Abstract Archives of the RSNA, 2023

IREE-76

### Imaging Findings and Interventional Management in Benign and Malignant Biliary Disease

#### Participants

Daniel Freedman, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Biliary disease consists of benign and malignant entities with a diverse spectrum of clinical presentation and imaging findings.2. Benign biliary disease includes choledochal cysts, hamartomas, autoimmune diseases, chronic pancreatitis, HIV cholangiopathy, iatrogenic injury, gallstones, infection (cholangitis), and may develop after liver transplantation.3. Malignant biliary disease includes primary biliary cancers (cholangiocarcinoma) and secondary tumor/metastatic disease, and causes severe illness secondary to local obstruction.4. Multimodality imaging plays a critical role in guiding diagnosis and treatment options executed by interventional radiologists and advanced endoscopists including PTC, PTBD, ERCP, biliary stents, and surgery.

#### TABLE OF CONTENTS/OUTLINE

1. Review of the clinical presentation and diagnostic imaging workup for benign and malignant biliary disease.2. Multimodal imaging and procedural approach to the diagnosis, management, and treatment of benign and malignant biliary disease, including: a. Percutaneous transhepatic cholangiography and drain placement (PTC, PTBD)b. Endoscopic retrograde cholangiopancreatography (ERCP)c. Percutaneous transhepatic cholangioscopyd. Biliary stentinge. Surgical intervention

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## Abstract Archives of the RSNA, 2023

IREE-77

### Deep Gluteal Syndrome: Anatomy, Imaging and CT-guided Treatment (Sciatic Nerve Neurolysis)

#### Participants

Cristina Candelaria Linares Bello, MD, Santa Cruz De Tenerife, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Remember the anatomy of the subgluteal space and the sciatic nerve. Explain the causes of deep gluteal syndrome and the different imaging findings. Explain the procedure of CT-guided treatment (sciatic neurolysis).

#### TABLE OF CONTENTS/OUTLINE

Deep gluteal syndrome is considered an underdiagnosed entity and defined as the compression or irritation of a non-discogenic origin of the sciatic nerve in the anatomical region of the subgluteal space. The typical symptoms are: dysesthesias and/or pain in the buttock and hip. There are many etiologies that can produce this syndrome: Specific musculoskeletal entrapments: fibrous, fibrovascular or vascular bands, piriformis syndrome, gemelli-obturator internus syndrome, pathology of the quadratus femoris muscle and the ischiofemoral space and insertional pathology of the hamstring muscles. Non-specific pathologies: iatrogenic, inflammatory, traumatic, infectious, gynecologic, vascular and tumors. For its diagnosis, physical examination and an adequate clinical history are of great importance. MR imaging is the procedure of choice for diagnosis. On the other hand, the CT-guided procedure to perform sciatic nerve neurolysis is both a diagnostic and therapeutic procedure and an alternative to surgical treatments. The deep gluteal syndrome is an underdiagnosed entity with multiple etiologies. The CT-guided sciatic nerve neurolysis is a safe procedure and an alternative to surgical treatments.

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## Abstract Archives of the RSNA, 2023

IREE-78

### Hidden Time Bombs: Image Features of Abdominal Visceral Pseudoaneurysms and Treatment

#### TEACHING POINTS

- Describe the common locations of, and clinical presentation including the complications of abdominal visceral artery pseudoaneurysms.
- Review the key imaging features of abdominal pseudoaneurysms on different modalities.
- Discuss the non-surgical endovascular and percutaneous treatment approaches to abdominal pseudoaneurysms.

#### TABLE OF CONTENTS/OUTLINE

- Definition of pseudoaneurysms and location of visceral abdominal aneurysm such as-Splenic Artery Pseudoaneurysm-Hepatic Artery Pseudoaneurysm -Renal Artery Pseudoaneurysm -Pancreatic Artery Pseudoaneurysm-Mesenteric Artery Pseudoaneurysm
- Clinical presentation of pseudoaneurysms
- Imaging features of pseudoaneurysms - Findings on doppler and contrast enhanced ultrasound- Features on computed tomography (CT) angiogram- Vasculature characteristics and assessment of pseudoaneurysm features on conventional angiogram.
- Indication of pseudoaneurysm treatment and non-surgical treatment options - Symptomatic versus non symptomatic pseudoaneurysm- Endovascular fluoroscopic guided pseudoaneurysm treatment.- Percutaneous CT guided treatment - Percutaneous US (doppler and or contrast enhanced) guided treatment.

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## Abstract Archives of the RSNA, 2023

IREE-79

### Non-invasive Radiofrequency Hyperthermia Enhances the Effect of OK-432 for Hepatocellular Carcinoma Via Activation of cGAS-STING Pathway

#### TEACHING POINTS

1.OK-432 could activate cGAS-STING pathway in DC cells in the treatment of HCC. RFH could enhance the effect of cGAS- STING activation of OK-432. 2.The combination demonstrated an antitumorigenic immunologic microenvironment and an encouraging anti-cancer effect in the treatment of HCC.

#### TABLE OF CONTENTS/OUTLINE

Abstract RFA has been accepted as an effective alternative to surgery in the treatment of early-stage HCC. However, a clear safety margin beyond the tumor confinement is difficult to obtain when the tumor for large or irregular HCC. Thus, generated a sublethal radiofrequency hyperthermia at the ablated tumor margin during RFA. This study aimed to investigate the feasibility of using RFH to enhance treatment the effect of OK-432 for HCC and explore the potential mechanisms. Our study showed OK-432 could activate the cGAS-STING pathway, and RFH could significantly enhance the effect of OK-432 by a stronger activation of STING pathway. The expression of IFN- $\beta$  and the pro-inflammatory cytokines were significantly higher in the RFH+OK-432 group. Meanwhile, we found RFH could cause a higher expression of TLR4. The administration of the shTLR4 in vitro and TLR4 antibody in vivo to eliminate the role of TLR4, the activation of Sting by OK-432 decreased significantly. In addition, the combination treatment augmented the maturation of DCs and the infiltration of the functional CD8+ T cells. Furthermore, this combined treatment resulted in a better tumor response and a prolonged survival. In conclusion, the combination therapy might be a new treatment strategy in reducing the residual tumor after RFA of medium-to-large or irregular HCCs, bringing a new option for other types of malignancies treated by RFA.

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## Abstract Archives of the RSNA, 2023

IREE-8

### Minimally Invasive Thoracic Oncology Treatments: Comprehensive Review and Comparison of RFA, MWA, Cryoablation, and Chemoembolization Techniques

#### Participants

Shakthi Ramasamy, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit aims to provide a comprehensive overview of minimally invasive thoracic oncology treatments, focusing on radiofrequency ablation (RFA), microwave ablation (MWA), cryoablation, and bronchial/pulmonary artery chemoembolization. RFA and MWA offer reduced morbidity and mortality, while preserving pulmonary function and allowing for repeatability. Cryoablation has shown promise in the treatment of early-stage lung cancer and advanced-stage palliative care, as well as in emerging applications such as ground-glass nodules. When lung metastases that are inoperable and unsuitable for ablation cease to respond to systemic chemotherapy, the prognosis becomes poor. Bronchial and pulmonary artery chemoembolization provide alternative treatment options for patients with large, multifocal lung tumors and those experiencing hemoptysis. The exhibit will delve into the principles, applications, imaging guidance, and outcomes associated with each technique, as well as the comparative efficacy of these treatments.

#### TABLE OF CONTENTS/OUTLINE

I. RFA, MWA, Cryoablation and Bronchial and Pulmonary Artery Chemoembolization will be discussed under the following categories:  
A. Principles and techniques B. Imaging guidance C. Patient selection and indications D. Treatment outcomes and comparisons E. Potential complications and management strategies  
II. Comparing the Treatments A. RFA, MWA, Cryoablation, and Chemoembolization B. Factors influencing treatment selection C. Efficacy and safety of each technique  
III. Future Directions and Research A. Ongoing clinical trials and studies B. Potential applications in personalized medicine and targeted therapy

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## Abstract Archives of the RSNA, 2023

IREE-80

### **Gonadal Vein Embolization for the Management of Varicocele, Infertility, and Pelvic Congestion: Patient Anatomy, Evaluation, and Technique for Successful Treatment**

#### **Participants**

Younes Attlassy, New York, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Varicocele and PCS are similar disorders associated with vascular dysfunction. Varicocele occurs due to the pooling of venous blood while PCS is the result of vascular pressure buildup in the pelvic region. 2. Understanding the diagnostic and imaging workup for both conditions is imperative for radiologists and treatment teams to identify, grade, and treat both conditions. 3. Several interventions and treatments, including gonadal vein embolization, are available for patients with these conditions with varying success and complication rates. Information regarding the risks and benefits surrounding these interventions is paramount to ensuring the proper standard of care for each individual patient. 4. Interventional radiology percutaneous embolization has become a safe and effective minimally invasive option for varicocele and PCS treatment with high success rates and few complications.

#### **TABLE OF CONTENTS/OUTLINE**

1. Understanding the anatomy and pathophysiology of both PCS and varicocele including the anatomical variants and attributes that make gonadal vein embolization a more attractive treatment modality in certain cases. 2. A review of the clinical presentation, diagnostic imaging, workup, grading/classification systems, and the interventions for each one. 3. A look at the various treatment options and the risk-benefit analysis around each one. 4. An in-depth guide on IR-guided procedural protocol for the management of varicocele and PCS including how to address anatomical variants, contraindications, and expected post-procedural outcomes.

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## Abstract Archives of the RSNA, 2023

IREE-81

### Endovascular Interventions of the Mesenteric Vasculature Through Collaterals: A Technical Savior

#### TEACHING POINTS

Vascular pathologies involving the arteries distal to stenosed or occluded main mesenteric arterial trunk is difficult to access. In these situations, one should be aware of arterial arcades and knowledge about these collateral pathways can bail the interventionalist out. We present four cases of endovascular interventions performed through the mesenteric collateral pathways.

#### TABLE OF CONTENTS/OUTLINE

Case 1. GLUE EMBOLIZATION OF SPLENIC ARTERY ANEURYSM (SAA) VIA HYPERTROPHIED RIGHT GASTRO-EPIPLOIC ARTERY (RGEA). 28-year/female - acute necrotizing pancreatitis with intraabdominal bleed. Status post proximal splenic artery embolization using coils. Embolization of the SAA was done via the hypertrophied RGEA. Case 2. SPLENIC PARENCHYMAL EMBOLIZATION (SPE) VIA INFERIOR PANCREATICO-DUODENAL (IPD) ARTERY - RIGHT GASTRIC ARTERY (RGA) COLLATERALS. 58-year/male - Post liver transplant and SA ligation. Refractory ascites due to persistent portal hypertension. Distal SA is reformed through collaterals from the RGEA (minor) and the IPD artery. Embolization was performed using PVA particles. Case 3. COIL EMBOLIZATION OF LEFT HEPATIC ARTERY (LHA) PSEUDOANEURYSM VIA THE IPD ARTERY. 32-year/male - Pseudoaneurysm arising from the LHA branch after removal of biliary catheter. Celiac artery stenosis was noted. Celiac axis reformed through IPD artery. A microcatheter was navigated across the hypertrophied collaterals and the pseudoaneurysm was coiled. Case 4. SPE VIA HYPERTROPHIED RGEA COLLATERALS. 42 years/male - Post liver transplant and SA ligation. Persistent hypersplenism and Splenomegaly. Splenic parenchymal embolization was done via the hypertrophied RGEA by injection of PVA particles

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## Abstract Archives of the RSNA, 2023

IREE-82

### From Classic to Quirky: A Journey through the Aunt Minnie's" of Angiography

#### TEACHING POINTS

Provide radiology resident level review of classic, "Aunt Minnie" angiographic signs and findings. Briefly discuss pertinent management aspects of underlying pathology diagnosed on angiography. Review intravenous contrast agent selection, contrast injection rates and fluoroscopic projections as key technical components for optimizing image acquisition in angiography and venography.

#### TABLE OF CONTENTS/OUTLINE

Introduction:- Considerations for contrast selection- Contrast injection rates in angiography and venography- Common fluoroscopic projections for image acquisition  
Abdominal Angiography- Aortic dissection with Floating Viscera Sign- Budd Chiari- Non-inflammatory, non-atherosclerotic arteriopathies- Fibromuscular Dysplasia- Segmental Arterial Mediolysis- Standing Wave- Polyarteritis Nodosa  
Peripheral Angiography- Sciatic artery- Dissection- Popliteal Artery Entrapment Syndrome- Hypothenar Hammer Syndrome- Arterial Thoracic Outlet Syndrome  
Pelvic Angiography- Uterine Arteriovenous Malformation- Postpartum hemorrhage- Trauma- Corona Mortis- Pruning, truncation, petechial hemorrhage and vasospasm- Cavemosal Blush  
Angiography of Collateral Pathways:- Arc of Buhler and Riolo- Subclavian Steal- Aortic occlusion and Winslow's pathway  
Venography- Venous Thoracic Outlet Syndrome- Paget-Schroetter Syndrome- Deep Vein Thrombosis- Azygos Continuation of the Inferior Vena Cava

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## Abstract Archives of the RSNA, 2023

IREE-83

### Mechanical Thrombectomy for the Treatment of Deep Vein Thrombosis: A Primer for Interventional Radiologists

#### Participants

Abinaya Ramakrishnan, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: Review treatment strategies using percutaneous mechanical thrombectomy devices including its indications and current state of literature. Review data from a single institution's experience and discuss factors that impact post-procedure outcomes.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/ Outlines: Background of management for acute deep vein thrombosis Discuss indications for percutaneous mechanical thrombectomy vs thrombolysis vs anticoagulation Discuss the diagnosis of May Thurner on incidence of recurrent DVT Discussion of major clinical trials of thrombectomy devices CLOUT Registry (Inari Medical) ATTRACT trial (Angiojet Rheolytic Thrombectomy System, Boston Scientific) Overview of current percutaneous mechanical thrombectomy devices on the market Data from a single-institution's experience with percutaneous mechanical thrombectomy Discuss findings from a single institution's retrospective analysis of thrombectomy procedures (n=82) Discuss specific factors that may influence post-procedure outcomes of re-thrombectomy, specifically sex, location of clot, chronicity of clot. Discuss intraprocedural characteristics that improve outcomes like placement of a stent and venoplasty. Review some of the contraindications for the use of percutaneous mechanical thrombectomy Highlight 2 successful cases with pre- and post-procedure imaging.

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## Abstract Archives of the RSNA, 2023

IREE-84

### **Straight to the Heart: State of the Art Thoracic Central Vein (Superior Vena Cava) Endovascular Recanalization, Thrombectomy and Stent Reconstruction**

#### **TEACHING POINTS**

Review anatomy and embryology of mediastinum and central thoracic veins. Recognize common etiologies and classifications of thoracic central vein obstruction (TCVO) including lesions of the brachiocephalic veins and superior vena cava. Describe endovascular treatment of TCVO including access, recanalization, thrombectomy, stent reconstruction, and extra-anatomic bypass creation as well as intraprocedural adverse event management. Discuss comprehensive care from initial work-up to post-procedure management.

#### **TABLE OF CONTENTS/OUTLINE**

Upper extremity and thoracic central vein anatomic review  
Common etiologies for TCVO  
Benign Malignant Patient evaluation  
Presentation, physical examination, and imaging evaluation  
Acute and chronic occlusive symptoms  
Patient centered care  
Technical aspects of procedure  
Sedation Access  
Venography  
Blunt and sharp recanalizations  
Thrombectomy and tissue sampling  
Stent selection and reconstruction  
Use of intravascular ultrasound (IVUS)  
Adverse event management  
Hemothorax and hemopericardium  
Stent migration  
Extra-anatomic bypass creation  
Post-procedure care and follow-up  
Antiplatelet and anticoagulation regimen  
Imaging surveillance  
Outcomes and patency  
Pediatric considerations

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## Abstract Archives of the RSNA, 2023

IREE-85

### Extra Abdominal Desmoid Tumors and Image Guided Percutaneous Cryoablation

#### Participants

Roberto Luigi Cazzato, Strasbourg, France (*Presenter*) Proctor, Medtronic plc

#### TEACHING POINTS

- Unique anatomy and pathophysiology of extra-abdominal desmoid tumors- Treatment planning including image and clinical evaluation- Procedural techniques of image guided percutaneous cryoablation- Adjunctive techniques including thermoprotection- Necessary clinical and imaging follow-up after treatment - Treatment guidelines for extra abdominal desmoids and the role of ablation

#### TABLE OF CONTENTS/OUTLINE

- Sporadic vs familial desmoid tumors- Rationale for using cryoablation to treat extra-abdominal desmoid tumors- Selection criteria for proposing cryoablation of extra-abdominal desmoid tumors-Follow-up

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## Abstract Archives of the RSNA, 2023

IREE-86

### Minimally Invasive Treatment of Postoperative Pancreatic Fistula Using Interventional Radiology

#### TEACHING POINTS

Although the incidence of surgical complications has gradually decreased with the advancement of minimally invasive surgical techniques and instruments, such as laparoscopic surgery and robot-assisted technology, postoperative pancreatic fistula remains a severe complication requiring prompt management. Percutaneous and endoscopic postoperative management has a lower mortality rate than surgical methods, and expectations for interventional radiology (IR) are increasing. Therefore, it is necessary to understand the etiology, diagnosis, and indications of postoperative pancreatic fistula and be familiar with appropriate IR intervention methods. Knowledge of technical tips in treatment is essential for successful procedures. The aims of this presentation are as follows: To explain the etiology, diagnosis, indications, and imaging features of postoperative pancreatic fistula. To discuss the treatment methods, management strategies, advancements, and complications in interventional radiology for postoperative pancreatic fistula, including techniques.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Overview Etiology, Diagnostic Criteria, and Treatment Indications for Postoperative Pancreatic Fistula Management Strategies for Postoperative Pancreatic Fistula 3. Illustrated Case Studies Management of Pancreatic Fistula after Pancreaticoduodenectomy Management of pancreatic fistula after combined resection of the body and tail of the pancreas Management of Pancreatic Fistula after Gastric Surgery Complications and Difficult Cases 4. Conclusion

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## Abstract Archives of the RSNA, 2023

IREE-9

### Acute Massive Hematochezia Due to Colonic Varix: Antegrade Transsplenic Embolization of Abdominal Garland Vein

#### TEACHING POINTS

In patients with cirrhosis of liver, acute variceal bleeding can be a fatal complication. Varices may develop anywhere in GIT, in cirrhotic patient. Ectopic varices, are not so common, accounting less than 5% of all variceal bleeding. Among these, colonic varices are very rare. Here, in this report, we emphasize the role of endovascular intervention in the management of acute massively bleeding colonic varix in a hemodynamically unstable cirrhotic patient.

#### TABLE OF CONTENTS/OUTLINE

In patients with cirrhosis of liver, acute variceal bleeding can be a fatal complication. Colonic varices are very rare cause of lower gastrointestinal bleeding that can bleed spontaneously and result in massive haemorrhage in patients with liver cirrhosis and portal hypertension. Here we present a case of 50-year-Male, known case of non-alcoholic cirrhosis of liver with portal hypertension (for past 15 years) and type 2 diabetes mellitus, who presented with massive fresh bleeding per rectum. Despite early colonoscopy and glue injection of the colonic varix, patient continued to bleed. Triple phase CT scan of abdomen was done which showed large portosystemic shunt (mesocaval shunt) arising from superior mesenteric vein (SMV) traversing around the ascending colon and forming sub mucosal varices protruding into the colon lumen and joining the right renal vein and draining into the inferior venacava (IVC) giving a garland appearance. He underwent successful transsplenic antegrade obliteration of the varix by coil embolization and glue injection. There are no clear-cut established management guidelines for such patients. Endovascular embolization could be an effective treatment option of colonic variceal bleeding.

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## Abstract Archives of the RSNA, 2023

MKEE

### Musculoskeletal Imaging Education Exhibits

#### Sub-Events

#### **MKEE-1 Imaging-Guided Perineural Injections of the Lower Extremity from the Pelvis to the Foot**

##### Participants

Tanya L. Tivorsak, MD, (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Perineural injections can be performed under CT or ultrasound guidance for diagnostic and therapeutic purposes. 2. Ultrasound guidance can be used for peripheral nerve injections as peripheral nerves can be localized well on ultrasound and with real-time guidance. 3. CT guidance can be used for certain perineural injections such as in the pelvis that may be difficult to visualize under ultrasound. 4. This exhibit will provide a guide for injecting certain nerves that are commonly requested at our institution.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction and indications for perineural injections - relieve nerve pain, pinpoint site of potential nerve injury prior to nerve surgery. 2. Procedure preparation - pre-procedure imaging review (MR neurography), ultrasound transducers, needle size, and volume of injectant. 3. Technique for injecting certain nerves from the pelvis to the foot including lateral femoral cutaneous, pudendal, genitofemoral, sciatic and piriformis muscle, saphenous (adductor canal), common peroneal, sural, superficial peroneal, and tibial nerves. 4. Risks and complications. 5. Overview of cryoneurolysis application and techniques.

#### **MKEE-10 Out of Shape: Musculoskeletal Manifestations of Sickle Cell Disease**

##### Participants

Leonardo Kazunori Tsuji, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Review the main aspects related to musculoskeletal findings of sickle cell disease, including etiology, pathophysiology, epidemiology, clinical classification. 2. To illustrate the main imaging findings and how to assess this condition in a multimodality approach, focusing on radiographs, CT and MRI studies, including new concepts and advanced sequences.

##### TABLE OF CONTENTS/OUTLINE

1. Review the main aspects related to musculoskeletal findings of sickle cell disease, including etiology, pathophysiology, epidemiology, clinical classification. 2. Clinical and imaging findings in a multimodality approach, focusing on radiographs, CT and MRI studies. 3. Musculoskeletal findings of sickle cell disease, as microcirculation or anemia related, and major complications (including septic arthritis and osteomyelitis). 4. Bring the most updated concepts of the disease and the imaging role, including advanced MRI sequences, involving diagnosis and patient care.

#### **MKEE-100 Energy Spectrum CT Application: Analysis of Changes in Bone Density of Vertebral and Paravertebral Muscle Composition Before and After Kidney Transplantation**

##### TEACHING POINTS

1) To illustrate most patients with chronic kidney disease before and after renal transplantation have abnormal mineral and bone metabolism due to chronic kidney disease-mineral bone disorder (CKD-MBD). 2) To illustrate energy spectrum CT can quantify vertebral bone mineral density and paravertebral tissue composition through base material separation. 3) To demonstrate energy spectrum CT can apply the separation and quantitative analysis of base substances to provide more data for clinical treatment.

##### TABLE OF CONTENTS/OUTLINE

1) The abnormal bone metabolism and the changes of paravertebral constitution components caused by CKD-MBD before and after kidney transplantation. ·Long term dialysis treatment and drug treatment may cause abnormal bone loss and paravertebral component changes. ·The bone mass of renal transplant recipients decreased rapidly within 1 year after transplantation. 2) Accurate and flexible analysis of basic substances by energy spectrum CT. ·Energy spectrum CT can quickly switch between high and low energies (80/140kVp) to obtain the two energies of the substance, so as to separate the base substance. ·Base material separation: Hydroxyapatite (HAP) is the main similar component of bone in the vertebral body. ·A variety of energy attenuation and image quality pictures are generated under different keV. 3) More imaging information at low radiation dose. ·Energy spectrum CT (80/140kVp) fast switching scanning, lower radiation dose. ·Energy spectrum CT plain scan mono energy diagram: base material pair analysis at 70keV for HAP (water), HAP (fat), calcium (water) to obtain vertebral bone density, and muscle (fat) analysis to obtain paravertebral muscle composition.

#### **MKEE-101 Rewriting the story back: Spondyloarthritis**

##### Participants

Sara Siguenza-Gonzalez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Bone marrow edema (BME) is the key requirement for a "MRI positive of sacroiliitis" in the Assessment of Spondyloarthritis international Society (ASAS). The radiologist should be careful when applying the ASAS classification criteria, because BME could also be found in early mechanical and degenerative changes, which are much more common than inflammatory disorders. Knowing the type of BME pattern, other radiological features (bone erosion, ankylosis or the spine disease), as well as the clinical picture, increase radiologists diagnostic confidence and reduce overdiagnosis of inflammatory sacroiliitis.

## TABLE OF CONTENTS/OUTLINE

Anatomy and biomechanics of the Sacroiliac Joints (SIJs) and Spine. Including anatomical variants and pitfalls. Some clues to difference between mechanical issues and inflammatory disorders. Subchondral BME in the SIJs is a common finding in both entities, so radiologists should be careful when interpreting. Recognise principal features of spondyloarthritis in the main radiological techniques (Rx, TC, MRI and also with new techniques). Describe and illustrate general features and typical image findings in the spondyloarthritis: Ankylosing Spondylitis (AS), Psoriatic Arthritis (PsA), Reactive Arthritis (RA), enteropathy-associated arthritis and undifferentiated spondylitis. Common pitfalls and differential diagnosis with other diseases that affect the axial bone: infection, amyloidosis, tumors, DISH and traumatism.

## MKEE-102 Deep Learning Imaging Reconstruction Based Virtual Non-calcium Image Can Improve the Bone Metastasis Detection Compared with Conventional CT, Hybrid IR Based Virtual Non-calcium Image

Participants  
Hirota Nakashima, MSc, RT, Sapporo, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. Deep learning imaging reconstruction (DLIR)-based virtual non-calcium (VNCa) images were created by two-material decomposition processing based on dual-energy acquisition using a fast kV switching method.
2. Compared the diagnostic performance of DLIR-based VNCa images with conventional CT in 57 patients with clinically confirmed bone metastasis.
3. Compared the diagnostic performance of DLIR-based VNCa images with hybrid IR-based VNCa images.
4. DLIR-based VNCa images were superior to the diagnostic performance of conventional CT and Hybrid IR-based VNCa images.

## TABLE OF CONTENTS/OUTLINE

Bone metastasis is a possible disease of all carcinomas and reduces the quality of life of patients. Since CT can detect bone calcification sensitively, it is excellent in diagnosing bone metastasis with bone destruction, but bone metastasis without bone destruction is difficult to diagnose and has a problem that it is easy to overlook. Virtual non-calcium image (VNCa) is one of the material decomposition images created by dual energy CT, which is also a density image obtained by emphasizing the water component and removing the calcium component. While previous studies have reported that VNCa images are superior in detecting bone metastases, DLIR-based VNCa images offer better discrimination of metastatic lesions due to their noise reduction effect. In this exhibition, we compared the diagnostic performance of DLIR-based VNCa images with that of conventional CT and hybrid IR-based VNCa images. The results show that DLIR-based VNCa images have a higher discrimination ability than conventional images for bone metastasis.

## MKEE-103 Osteoid Osteoma in Small Bones of Hands and Feet: 'Not' So Common with 'Not' So Small Challenges in RF Ablation

## TEACHING POINTS

1. Osteoid osteomas are benign painful lesions usually seen in the long bones. Less commonly they may be seen in the small bones of hands and feet especially in the pediatric age group.
2. They have typical imaging features on MRI and CT which are diagnostic.
3. RF ablation is the recommended treatment for osteoid osteomas and are regularly done. However, the small size of the bones results in challenges that can be dealt with by using some modifications.

## TABLE OF CONTENTS/OUTLINE

Osteoid osteomas are common benign tumor found commonly in children and young adults. They classically present with night pain that is relieved by non steroidal anti-inflammatory drugs. They are usually cortical lesions and most commonly occur in the long bones, with proximal femur being the most common location. Less commonly they may be seen in the spine and small bones of the hands and feet. CT is excellent at diagnosing the lesion and shows small lucent nidus and surrounding reactive bone sclerosis. MRI may be confusing due to the disproportionate marrow edema and the poor delineation of nidus if it is very tiny. CT guided radiofrequency ablation is the current accepted standard treatment for osteoid osteomas. However in small bones, this may be challenging due to the very small size as well as proximity of neurovascular structures. We will discuss the imaging appearances of osteoid osteomas in small bones of hands and feet as well as highlight the challenges faced during RF ablation is some of these cases and some of the ways these can be overcome.

## MKEE-104 Zero Echo Time Magnetic Resonance Imaging: Physics and Clinical Utility in Musculoskeletal System

Participants  
Takatoshi Aoki, MD, PhD, Kitakyushu, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. To recognize the clinical utilities of zero echo-time (ZTE) sequences in various disorders of the musculoskeletal system.
2. To understand the imaging physics of ZTE sequence, practical limitations, and image reconstruction.
3. To discuss how to incorporate ZTE sequence into the clinical workflow.

## TABLE OF CONTENTS/OUTLINE

Physics of ZTE imaging 1 Pulse sequence design 2 Image reconstruction 3 Parameter optimization Clinical utility of ZTE in musculoskeletal system 1 Inflammatory arthritis 2 Soft tissue calcification/ossification 3 Bone and soft tissue tumors and tumor-like lesions 4 Osteoarthritis and spondylitis 5 Trauma 6 Morphometric evaluation before surgery 7 Children and fetuses Summary ZTE MRI can be readily incorporated into the clinical workflow, and CT-like images generated by ZTE MRI would minimize the need for CT contemporaneously with MRI in various musculoskeletal disorders. We systematically review the imaging physics of these sequences, practical limitations, and image reconstruction, and then discuss the clinical utilities in the musculoskeletal system while

presenting several imaging examples.

### **MKEE-105 Hamstring Sport Injuries: What, How, Why and Where**

Participants

Agustin Marrero SR, MD, La Plata, Argentina (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To know the anatomy, function, and biodynamic aspects of the hamstrings complex. To recognize the spectrum of tearing of hamstring muscles and tendons during sports practice analyzing their mechanism of injury. To evaluate the imaging methods in the different hamstrings lesions to describe the precise location and characteristics. To describe ultrasound and magnetic resonance signs of these tears, emphasizing the prognostic criteria for recovery, return to play, and re-injury.

#### **TABLE OF CONTENTS/OUTLINE**

Most of muscle tears occur in the lower extremities and commonly in the hamstrings. The hamstrings complex consists of the semimembranosus (SM), semitendinosus (ST) and biceps femoris (BF) muscles. They originate from the ischial tuberosity. BF muscle has two portions, the long and short head and its distal insertion is at fibular head. ST and SM are medial, and their distal insertion is in the medial aspect of the leg. BF and ST are close to the sciatic nerve. Except for BF's short head, the hamstrings are primarily hip extensors and knee flexors. Hamstring injuries are grouped and classified, with typical tear sites that recur in sports practices during forceful stretching or high-speed running. Proximal injuries result in a large amount of time away from sports and a high risk of re-injury. Sprint tears are generally located on BF. Depending on its extent and location, we can estimate the evolution of injuries and the return to play. Finally, we will include insertional injuries in children.

### **MKEE-106 Acute Traumatic Craniocervical Injuries: What to Look for and Not to Miss**

Participants

María Carvajo, MD, Seville, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To describe acute traumatic craniocervical injuries and its classification based on a revision of cervical CTs performed in the emergency setting at 3rd level hospital. - To show key imaging features to identify stable and unstable injuries. - To present most common errors and missed craniocervical injuries as well as tips to avoid them.

#### **TABLE OF CONTENTS/OUTLINE**

1. Anatomy and biomechanics of craniocervical junction and ligaments. 2. Key measurements and anatomy landmarks to assess alignment of craniocervical junction. 3. Craniocervical injuries classification. 3.1. Atlanto-occipital dissociation. 3.1.1. Traynelis classification. 3.2. Occipital condyle fractures. 3.2.1. Anderson-Montesano classification. 3.2.2. Alar ligament injuries. 3.2.3. Stable and unstable injuries. 3.3. Atlas fractures. 3.3.1. Gehweiler classification. 3.3.2. Transverse ligament injuries. Dickson classification. 3.3.3. Stable and unstable injuries. 3.4. Axis fractures. 3.4.1. Odontoid fractures. Anderson and D'Alonzo classification. 3.4.2. Hangman fractures. Effendi/Francis modified by Levine classification. 3.4.3. Non-odontoid non-hangman fractures (axis body fractures). 3.4.4. Teardrop fractures. 3.4.5. Stable and unstable injuries. 3.5. Atlantoaxial subluxation. 3.5.1. Atlantoaxial rotatory fixation. Fielding and Hawkins classification. 3.5.2. Stable and unstable injuries. 4. Pitfalls of craniocervical injuries at CT imaging. 5. Conclusions.

### **MKEE-107 Ultrasound Guide to Have at Your Fingertips: Wrist and Hand Evaluation**

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To emphasize the potential of ultrasound in the assessment of musculoskeletal structures. 2. To become familiar with the normal sonographic appearance of the wrist, hand and fingers. 3. To propose a systematic approach to perform a complete ultrasound of the wrist, hand and fingers. 4. To show the correlation of the ultrasound findings with MR images and anatomical drawings for a better understanding.

#### **TABLE OF CONTENTS/OUTLINE**

Ultrasound is an imaging technique very useful in the assessment of musculoskeletal structures. However, for its correct interpretation, it is essential for the explorer to be familiar with the ultrasound appearance of normal anatomical structures, which can be difficult at the beginning. This work is intended to be an aid for anyone who wants to get started in musculoskeletal ultrasound of the wrist, hand and fingers. First of all, we will check the basic requirements to perform a proper musculoskeletal ultrasound. Then, we will systematically review the normal ultrasound anatomy of the different musculoskeletal structures of the wrist, hand and fingers, dividing them according to their dorsal or ventral location. We will also propose some tips and tricks, and we will highlight the importance of dynamic maneuvers. In order to make our work more visual, we will correlate the different ultrasound images with anatomical drawings and MR images, which will allow a better understanding.

### **MKEE-108 MR Imaging of Traumatic Injury of the Fingers**

#### **TEACHING POINTS**

1. To review the anatomy of the fingers, focusing on the extensor and flexor complexes, as well as the passive stabilizers of their joints. 2. To detail the MRI protocol used for the study of traumatic pathology of the fingers. 3. To illustrate by means of representative cases the most frequent pathology of the fingers after blunt trauma. 4. To teach instability patterns, which may be useful when understanding and describing the MRI findings in these patients.

#### **TABLE OF CONTENTS/OUTLINE**

Traumatic injuries of the fingers are one of the frequent reasons for musculoskeletal MRI evaluation. It is important to know the specific anatomy of the tendon structures and ligaments, as well as the most frequent injury patterns. Extensor finger complex, including central and lateral slips, as well as sagittal bands; flexor tendon, pulleys and articular structures (main and accessory collateral ligaments, and volar plate) play a capital role in finger biomechanics. Closed finger trauma frequently causes instability

patterns (in coronal, sagittal or combined planes) that should be recognized and that facilitate the understanding of the lesion mechanism and its diagnosis. Thus favoring an adequate treatment and a prompt recovery. Injuries secondary to closed trauma of the fingers will be reviewed, with a detailed description of their semiology and the injured structures and their complications.

#### **MKEE-109 Read It Like a Pro: Tips And Tricks To Interpret Lumbar Spine MRI**

Participants

Ana Cristina Delgado, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Describe the normal spine anatomy of lumbar spine 2. review lumbar spine MRI protocol 3. Analyze step by step the systematic of lecture of spine lumbar MRI, learn how to make a good MRI report, describe findings with standardized nomenclature. 4. Identify, review the most common findings in lumbar benign-malignant pathology.

##### **TABLE OF CONTENTS/OUTLINE**

Description of general characteristics in lumbar spine a) Anatomy review b) MRI protocol sequences c) Systematic lecture of lumbar spine MRI, how to elaborate a good report. Review of MRI cases, common findings in lumbar spine pathology Pathologies included: a) Degenerative changes of intervertebral disc. b) Degenerative changes of vertebral body. c) Degenerative changes of facet joint. d) Malignant pathology. e) Others: infection, cystic lesions, trauma.

#### **MKEE-11 Exploring Osteochondral Lesions of the Talus: Imaging Evaluation and Treatment Options**

##### **TEACHING POINTS**

The purpose of this exhibit is to: 1. Review the talar dome anatomy, and pathophysiology of osteochondral lesions 2. Illustrate and discuss the patterns of osteochondral injuries and main surgical options with didactic cases. 3. Highlight the main information that radiologists should include in the report when analyzing an osteochondral lesion of the talus and their postoperative imaging.

##### **TABLE OF CONTENTS/OUTLINE**

Osteochondral lesions of the talus are lesions of the articular cartilage of the talus and underlying subchondral bone. Trauma accounts for the majority of osteochondral lesions, with an osteochondral lesion occurring with over half of ankle sprains, especially if there is a fracture. Introduction: General review of talar dome anatomy, and pathophysiology of osteochondral lesions. Preoperative evaluation: Main information that should be included in the radiological report. Clinical relevance of the findings. Staging: Didactic illustration about the historical classic staging systems. Postoperative evaluation: Main surgical techniques considerations. Main information that should be included in the radiological report. Bibliographical references.

#### **MKEE-110 Under Pressure: Exploring Normal Anatomy and Entrapment Neuropathy of the Ulnar Nerve**

##### **TEACHING POINTS**

1. Describe the normal course and imaging appearance of the ulnar nerve with emphasis on the cubital tunnel and Guyon's Canal. 2. Describe the anatomical boundaries of both the cubital tunnel and Guyon's Canal. 3. Discuss ulnar neuropathy symptoms. 4. List common etiologies of ulnar nerve compression. 5. Discuss the MR appearances of ulnar nerve impingement in the cubital tunnel and Guyon's Canal. 6. Identify the normal motion of the ulnar nerve within the cubital fossa under ultrasound as well as the abnormal motion of the nerve in the setting of symptomatic anterior dislocation and snapping triceps syndrome.

##### **TABLE OF CONTENTS/OUTLINE**

We review the normal course of the ulnar nerve with attention to sites of potential compression, namely the cubital tunnel and Guyon's Canal. We review the anatomical boundaries of the cubital tunnel and Guyon's canal on MR imaging. We examine the structures innervated by the ulnar nerve and the clinical signs/symptoms of ulnar neuropathy corresponding to the site of impingement. We list common etiologies of entrapment neuropathies. We review the normal MR appearance of the ulnar nerve and utilize MR cases to illustrate the abnormal appearance of impingement in the setting of cubital tunnel and Guyon's canal syndrome. We present dynamic ultrasound examples demonstrating both the typical movement of the ulnar nerve in the cubital fossa, as well as abnormal motion in the setting of dislocation and snapping triceps syndrome. We discuss common surgical treatments of ulnar nerve dislocation and review the expected MR appearance of ulnar nerve anterior transposition.

#### **MKEE-111 Fight of Phyte Calcification Ossification Around Spine**

Participants

Kengo Ikejima, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Understand the mechanism of perivertebral sclerotic changes 2. Learn the imaging findings of representative perivertebral sclerotic changes along with specific cases 3. Learn about complications associated with perivertebral sclerotic changes 4. Learn key points for differentiating perivertebral sclerotic changes

##### **TABLE OF CONTENTS/OUTLINE**

Spine anatomy, particularly joint structures and ligaments Pathophysiology of Osteophytes Pathophysiology of Syndesmophytes Pathophysiology of common calcium deposition diseases that occur in the perivertebral region Cases:- Spondylosis-Ossification of the posterior longitudinal ligament- Ossification of the ligamentum flavum- Calcium pyrophosphate dihydrate deposition disease- Calcific tendinitis of the longus colli muscle- Ankylosing Spondylitis- Psoriatic arthritis- Diffuse idiopathic skeletal hyperostosis (DISH)- SAPHO syndrome- Osteitis condensans ilii- Dystrophic calcification- Intervertebral disc calcification

#### **MKEE-112 Looking Beneath the Surface: Imaging of Bone Surface Lesions**

Participants

Utkarsh Parwal, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Define intracortical, subperiosteal, periosteal, and parosteal/juxtacortical locations along the bone surface 2. Understand that



1. Define intracortical, subperiosteal, periosteal, and parosteal/juxtacortical locations along the bone surface. Understand that multiple cell types within the bone surface give rise to bone-forming, cartilage-forming, and fibrous surface lesions. 2. Case based review of multiple surface lesions. Bone forming: Osteoid osteoma, Surface osteosarcomas (OS) - periosteal OS, parosteal OS, high grade surface OS. Cartilage forming: Osteochondroma, Periosteal chondroma, Bizarre parosteal osteochondromatous proliferation, Periosteal chondrosarcoma. Fibrous: Nonossifying fibroma, Juxtacortical desmoid tumor, Osteofibrous dysplasia. Infectious: Cortical osteomyelitis, Subperiosteal abscess. Traumatic: Stress reaction, Periostitis ossificans

#### TABLE OF CONTENTS/OUTLINE

1. Bone surface anatomy and terminology. Define intracortical, subperiosteal, periosteal, and parosteal/juxtacortical locations. Illustrate the two layers of the periosteum: inner cambial and outer fibrous. Briefly discuss important cell types within the bone surface as the originators of bone-forming, cartilage-forming, and fibrous surface lesions. 2. Case based review of multiple surface lesions. Bone forming: Osteoid osteoma, Surface osteosarcomas (OS) - periosteal OS, parosteal OS, high grade surface OS. Cartilage forming: Osteochondroma, Periosteal chondroma, Bizarre parosteal osteochondromatous proliferation, Periosteal chondrosarcoma. Fibrous: Nonossifying fibroma, Juxtacortical desmoid tumor, Osteofibrous dysplasia. Infectious: Cortical osteomyelitis, Subperiosteal abscess. Traumatic: Stress reaction, Periostitis ossificans

#### MKEE-113 Can you See Me Now? A Case Based Quiz Of Shoulder Instability Lesions

Participants

Ana Cristina Delgado, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe and recognize the different key clinical/imaging features that help diagnose each glenohumeral instability entity. 2. Identify through a series of MRI/ Arthrography MRI image based cases the different glenohumeral anterior, posterior instability lesions. 3. Describe the role of different imaging modalities in the diagnosis of glenohumeral instability, evaluate the MRI/ Arthrography MRI imaging findings that can help radiologists discriminate differential diagnosis. 4. Review static dynamic glenohumeral stabilizers.

#### TABLE OF CONTENTS/OUTLINE

-Pathologies will be presented in a case based format with pertinent MRI/ Arthrography MRI images and a brief clinical history. - Diagnostic clue section divided in clinical facts ( general features, miscellaneous information) radiological facts ( key imaging findings, best image modality for further evaluation). -Review the concepts and important tips for image diagnosis. -Review anatomy of static dynamic glenohumeral stabilizers. -Pathologies included: a) Anterior instability: Classic Bankart, HAGL ( Humeral avulsion of glenohumeral ligament), GLAD ( Gleno labral articular disruption), Perthes, ALPSA ( Anterior Labroligamentous sleeve avulsion), Hillsachs. b) Posterior Instability: Reverse Bankart, POLPSA: Posterior labro capsular periosteal sleeve avulsion), Kim, Bennet, Reverse Hillsachs. c) Variants Pitfalls: Sublabral Recess, Sublabral foramen, Buford Complex.

#### MKEE-114 Elasticity Matters: Role of Shear Wave Elastography in Rheumatology

Participants

Alejandra Micolich Vergara, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

General principles of shear wave elastography in musculoskeletal radiology. Potential applications in the assessment of rheumatologic diseases. Future directions and limitations.

#### TABLE OF CONTENTS/OUTLINE

Elasticity is a fundamental characteristic closely related to the pathological state of tissues. Elastasonography is a diagnostic technique that assesses the biomechanical properties such as stiffness and elasticity of tissues by exposing them to a specific ultrasound beam. Shear Wave Elastasonography (SWE) is a non-invasive and objective method that determines the absolute stiffness value of various tissues. SWE has been validated in liver disease, thyroid, breast, prostate, skin and ocular pathologies and is being considered a promising tool in rheumatologic disorders. Greyscale and Power Doppler ultrasound as well as Magnetic Resonance Imaging (MRI) have been extensively studied as diagnostic techniques in rheumatologic pathologies and in 2021 the European League Against Rheumatism (EULAR) recommends elastasonography in the reporting of ultrasound studies in musculoskeletal disease. There has been advancements in recognizing the role of SWE in entities such as Primary Sjögren's Syndrome and Gout Arthritis, however, future prospects include exploring its utility in the early diagnosis and therapeutic response monitoring in Rheumatoid Arthritis, Systemic Lupus Erythematosus and Thumb Osteoarthritis. We will review the potential applications of SWE in different rheumatologic disorders using a case based approach.

#### MKEE-115 Not Normal: An Illustrated Guide to Potentially Symptomatic Musculoskeletal Anatomic Variants

#### TEACHING POINTS

- Review commonly discovered anatomic variants on routine musculoskeletal imaging that may be symptomatic or become symptomatic.
- Recognize what imaging features suggest a given variant may be at risk of being symptomatic or require treatment, and what additional imaging may be required for a more definitive diagnosis.
- Discuss treatment options available for the management of pain associated with anatomic variants, including: activity modification, physical therapy, image-guided injection, and surgery.

#### TABLE OF CONTENTS/OUTLINE

- Spinal variants
  - o Upper cervical § Dens retroversion § Posterior arch agenesis § Short arch
  - o Rib anomalies cervical ribs
  - o Segmentation anomalies § Congenital block § Occipitalization § Hemivertebra § Butterfly
  - o Oppenheimer ossicle
  - o Lumbosacral transitional vertebra
  - o Sacroiliac variants
  - o Coccyx angulation
  - o Posterior elements § Baastrup pseudoarthrosis § Hypoplastic facets § Facet tropism
  - o Piriformis sciatic nerve
  - o Other • Hip
  - o Developmental dysplasia
  - o Cam/pincer
  - o Coxa profunda protrusio
  - o AIIS morphology
  - o Coxa vara valga
  - Wrist hand
  - o Ulnar variance
  - o Type 2 lunate
  - o Coalition
  - o Os styloideum
  - Shoulder
  - o Acromion shape slope
  - o subcoracoid
  - o Coracoclavicular joint
  - o glenoid dysplasia hypoplasia
  - o Luschka tubercle
  - o Os acromiale
  - Elbow
  - o Anconeus epitrochlearis
  - o Gantzer's muscle
  - o Synovial fold
  - o Os supratrochlear dorsale
  - Knee
  - o Patellofemoral anomalies § Patella type § Trochlear groove § Patella alta/baja § Bi/multipartite patella
  - o Aberrant popliteal and anterior tibial artery
  - o Discoid meniscus
  - o Plica
  - Foot ankle
  - o Os trigonum syndrome
  - o Painful os peroneum
  - o Accessory muscles
  - o Type II os naviculare
  - o Coalition
  - o Os intermetatarsium
  - o Sesamoid anomalies

## **MKEE-116 Calcifications as Harbingers of Malignancy in Soft Tissue Tumors: A Case-Based Review**

Participants

Atefe Pooyan, MD, MPH, Seattle, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Gain familiarity with the morphology of calcifications in soft tissues 2. Demonstrate that approaching soft tissue calcifications based on morphologic appearance, distribution, and tumor cell-type can yield clues when triaging lesions 3. Present scenarios in which soft tissue calcifications are helpful in assessing the malignancy or benignity of a lesion

### **TABLE OF CONTENTS/OUTLINE**

Key Anatomic or Pathophysiologic Issues, Imaging Findings or Imaging Technique This case-based exhibit will review the morphology of soft tissue calcifications (e.g. stippled, chondroid, coarse, osseous, amorphous), with imaging correlation using multiple modalities (i.e. radiographs, CT, and MR), as demonstrated by various cases of benign and malignant pathophysiologic processes of calcification. Conclusion 1. Approaching soft tissue calcifications according to their descriptive morphology and location can yield clues into interpreting a lesion's malignant potential. 2. Calcifications are disproportionately represented by the most common high-grade soft tissue neoplasms, including synovial sarcoma, liposarcoma, and undifferentiated pleomorphic sarcoma, which comprise more than half of all soft tissue malignancies. 3. Malignant tumors can have a characteristic morphology of calcifications, such as stippled calcifications in synovial sarcoma and central osseous calcifications in extra-skeletal

## **MKEE-117 Posterior Ankle Pain: Pathologies Surrounding the Kager Fat Pad**

Participants

Leandro Mazza, MD, La Plata, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To describe the anatomy of the Kager fat pad (KFP) and its relationships with the rest of the structures of the posterior region of the ankle. To analyze the different pathologies responsible for posterior ankle pain and the degree of involvement of the KFP in each of them. To discuss the role of KFP in the symptomatology of these entities

### **TABLE OF CONTENTS/OUTLINE**

KFP is a mass of adipose tissue that occupies the Kager triangle, located between the Achilles tendon, the flexor hallucis longus and the calcaneus. Although its content is predominantly fatty, it also contains nerves and small vessels. It presents multiple connections with the different anatomical structures that surround. Three regions that are closely related to the sides of this triangle have been described. The most firmly linked to the Achilles tendon being an important part of its entheses. The more mobile, wedge-shaped and closely related to the calcaneus moves passively and actively towards the retrocalcaneal bursa during plantarflexion. These relationships make the KFP a necessary participant, to a greater or lesser extent, in a large part of the different entities that present with posterior ankle pain. We will describe tendinopathies, os trigonum syndrome and other causes, with particular interest in the degree of involvement of the KFP.

## **MKEE-118 Don't Touch Lesions: How Can We Avoid the Misdiagnosis**

Participants

Janaina Moreira, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Don't touch lesions are incidental findings, that are divided into three categories: Post traumatic, normal variants, and lesions that are real but obviously benign. Radiography is the first method used for the identification, characterization, and classification of these type of lesions. However, some cases can be so challenging that computed tomography or magnetic resonance imaging are used to evaluate the lesion, therefore increasing the accuracy of the diagnosis. The purpose of this presentation is to review the imaging characteristics of typical skeletal "don't touch" lesions in the many imaging methods such as X-Ray, computed tomography (CT) and magnetic resonance imaging (MRI) therefore avoiding misdiagnosis and invasive procedures, which reduces the morbidity and costs in the health care system.

### **TABLE OF CONTENTS/OUTLINE**

Case based didactic review of the radiological appearance of the "don't touch" lesions including clinical and epidemiological aspects of bone infarction, osteopoikilosis, intraosseous migration of tendinous calcification, myositis ossificans, aggressive vertebral hemangioma, among others, based on our service's digital archive.

## **MKEE-119 High-Resolution Ultrasound of the Nerves of the Foot and Ankle: A Landmark Approach to Scanning and Review of Common Pathologies**

### **TEACHING POINTS**

The purpose of this exhibit is to: 1. Review the anatomy of the nerves at the level of the foot and ankle, using a landmark approach with cadaveric correlation. 2. Highlight clinical signs and symptoms warranting a detailed ultrasound nerve assessment, relating them to specific nerves. 3. Review common sites and causes of nerve injury and entrapment at the foot and ankle and demonstrate associated abnormal direct and indirect sonographic findings using diagrams, images and video clips from case-examples.

### **TABLE OF CONTENTS/OUTLINE**

1. OBJECTIVES 2. INTRODUCTION 3. ANATOMY, ULTRASOUND TECHNIQUE, PATHOLOGY WITH CASE EXAMPLES FOR THE: a) Tibial nerve and medial and lateral plantar branches b) Plantar digital nerves c) Sural nerve d) Saphenous nerve e) Deep peroneal nerve f) Superficial peroneal nerve 4. TAKE HOME POINTS

## **MKEE-12 PET-MR Imaging Applications in Pediatric Musculoskeletal Tumors**

### **TEACHING POINTS**

3 PET-MR imaging is a powerful tool for the assessment of pediatric musculoskeletal tumors, with specific applications in

? PET-MRI imaging is emerging as a suitable technique for the assessment of pediatric malignancies, with specific applications in musculoskeletal tumors. ? Its utility includes primary tumor characterization, local / distant staging and post-treatment follow-up. ? Dose reduction of ionizing radiation and overall scanning time decrease are remarkable advantages. ? However, it has low sensibility for detection of pulmonary nodules. Chest CT remains essential in thoracic staging of pediatric musculoskeletal malignancies.

#### TABLE OF CONTENTS/OUTLINE

? Introduction: Integrated MRI and PET provide efficient staging of children and adolescents with malignant bone tumors by evaluating the primary tumor and the whole body in one session. ? Our protocol included a whole-body and a local tumor scan. ? Applications in pediatric musculoskeletal tumors: PET-MRI is useful in the study of osteosarcoma, Ewing sarcoma, bone lymphoma, Langerhans cell histiocytosis and bone and bone marrow metastases. We report our experience in the last ten years. ? Conclusions: the combination of functional PET imaging with the lack of non-ionizing radiation of MRI is ideal in a pediatric population.

#### MKEE-120 Do Not Harm: Thermal Protection in Musculoskeletal Abdominal Wall Soft Tissue Tumors Cryoablation

Participants

Albert Castillo Pinar, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching points: To review the main characteristics of thermoablation in musculoskeletal soft tissue tumors. To illustrate different techniques and indications of thermoprotection procedures. To show possible complications if the thermoprotection techniques are not performed correctly. Thermoablation of musculoskeletal tumors is a growing technique with good results; however, it can be limited by the location of the tumors. There are close anatomical relationships related to the tumor such as different intra-abdominal structures or the skin itself which can contraindicate the technique, make it difficult or lead to complications if the correct thermo-protection techniques are not applied. Radiologists must be familiar with the thermoprotective techniques in order to be able to choose the most appropriate in each case.

#### TABLE OF CONTENTS/OUTLINE

Table of contents/Outline Introduction. Classification and description of thermoprotective technique. Case series illustrating clinical situations and the application of thermoprotection techniques. Conclusion.

#### MKEE-121 Non-infectious Spinal Diseases Mimicking Infection

#### TEACHING POINTS

Infectious spinal disease may be suspected if inflammatory markers are increased in blood tests in patients with acute spinal pain and limited range of motion. These clinical findings can also be seen in spinal crystal deposition disease and intraspinal rupture of synovial cysts located in facet joints. In cases of acute inflammation in these two diseases, there is a risk of unnecessary biopsies and antibiotic treatments because the clinical and imaging findings overlap with those of infectious spinal diseases. Recognizing the radiographic characteristics of these diseases and raising awareness of these findings will be helpful in accurate diagnosis and treatment. We present various cases of spinal crystal deposition disease (crowned dens syndrome, calcific tendinitis of longus colli, calcific tendinitis of levator scapulae, facet joint crystal arthropathy, and interspinous bursitis with crystal deposition) and intraspinal rupture of facet joint synovial cyst, and present their clinical and imaging findings. This aims to raise awareness of these diseases and facilitate accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction Case 1: Calcified tendinitis of longus colli Case 2: Calcific tendinitis of levator scapulae Case 3: Crowned Dens syndrome Case 4: Crystal arthropathy of facet joint Case 5: Facet joint infection

#### MKEE-122 The Bubble Trouble: Differential Diagnosis of Cystic Bone Tumors and the Importance of Not Missing the Mark

Participants

Leticia dos Reis Morimoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. To review the main differential diagnosis of cystic bone lesions. 2. To expose the general evaluation of cystic bone tumors - what is necessary to report: review of the characteristics by image that must be reported and propose a structured report for bone tumors in a multimodality approach (CR, US, CT and MRI). 3. To review the main combined injuries and when to think about them. 4. To demonstrate through didactic illustrative cases the main complications that can be found due to cystic bone lesions. 5. To demonstrate currently available treatment modalities for those conditions.

#### TABLE OF CONTENTS/OUTLINE

1 - Radiological propaedeutics of cystic bone tumors. 2 - Radiograph, ultrasound (US) computed tomography (CT), and MRI findings in: 2.1 - Unicameral bone cyst 2.2 - Multicameral bone cyst 2.3 - Aneurysmal bone cyst 2.4 - Cystic fibrous dysplasia 2.5 - Vascular malformation (cystic angiomas) 2.6 - Telangiectatic osteosarcoma 2.7 - Other miscellaneous cystic tumors 3 - General evaluation of cystic bone tumors - what is necessary to report? - review of the main image characteristics. 4 - When to be suspicious of concomitant lesions and their primary associations. 5 - Propose a structured report for cystic bone tumors in a multimodality approach (CR, US, CT, and MRI). 6 - Complications related to cystic bone tumors. 7 - Therapies currently used in cystic bone tumors. 8 - Last updates and trendings of cystic bone tumors 9 - Summary and take-home message

#### MKEE-123 Knee-ding a Closer Look: MRI Evaluation of Cartilage Surgical Repair

Participants

Leticia dos Reis Morimoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. Revisit the anatomy and biomechanics of knee joint and focusing in cartilage 2. To demonstrate the MRI image findings in chondral lesions of the knee, with the main classifications 3. To illustrate the main operative techniques involved in knee cartilage surgery with radiology and surgery imaging correlation 4. Demonstrate through didactic illustrative cases

the normal and pathological postoperative image findings, focusing on MRI

#### TABLE OF CONTENTS/OUTLINE

1 - Anatomy and biomechanics of knee joint and cartilage  
2 - MRI findings in chondral lesions of the knee  
3 - Modified Outerbridge classification (MRI and arthroscopy imaging)  
4 - Noyes Classification (MRI and arthroscopy imaging)  
5 - International Cartilage Repair Society (ICRS) classification (MRI and arthroscopy imaging)  
6 - Surgery and radiologic imaging of:  
6.1 - Marrow-Stimulating Procedures (microfracture) (surgery and radiologic imaging)  
6.2 - Osteochondral Autograft Transplantation  
6.3 - Osteochondral Allograft Transplantation  
6.4 - Autologous Chondrocyte Implantation  
7 - Normal postoperative findings after surgical repair of the knee cartilage  
8 - Pathological postoperative findings after surgical repair of the knee cartilage

#### MKEE-124 Dual Energy CT in Spinal Disease: Application Review

##### TEACHING POINTS

Dual-energy CT (DECT) separately acquires high and low energy X-ray data to enable material characterization applications for substances that exhibit different energy-dependent x-ray absorption behavior. Based on conventional CT imaging, DECT significantly improves the detection ability of spinal lesions and adds more quantitative indicators. Virtual non-calcium (VNCa), virtual monochromatic imaging (VMI), and other parameters have unique advantages over traditional CT imaging in displaying bone marrow edema and tumor, detecting spinal urate crystal deposition, reducing spinal related metal artifacts, and intervertebral disc degeneration, showing a good clinical application prospect.

#### TABLE OF CONTENTS/OUTLINE

Vertebral fracture, Bone Marrow Lesions and Mimics, Herniation of intervertebral disc, Gout, Artifact Suppression

#### MKEE-125 Myopathies: Radiologist's Essential Tips for Clinical, Pathological, and Imaging Findings

Participants

Yumi Tai, Kashihara, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1) To review inherited and acquired myopathies including clinical, pathological, and diagnostic imaging findings. 2) To discuss clinico-radiological key findings in the differential diagnosis of myopathies for radiologists.

#### TABLE OF CONTENTS/OUTLINE

1) Imaging techniques and general imaging findings of muscle  
2) Illustrated findings of the following myopathies:  
1. Hereditary myopathies: Congenital myopathies (Nemaline myopathies, Central core disease, Congenital fiber type disproportion myopathy), Muscular dystrophies (Duchenne, Becker, Limb-girdle, Myotonic, Facioscapulohumeral, Emery-Dreifuss, Oculopharyngeal), Distal myopathies (GNE myopathy, Oculopharyngodistal myopathy), Metabolic myopathies (Mitochondrial disease, Lipid storage myopathies).  
2. Acquired myopathies: Inflammatory myopathies (Dermatomyositis, Antisynthetase syndrome, Immune-mediated necrotizing myopathy, Inclusion body myositis, Eosinophilic myositis, Drug-induced (Immune checkpoint inhibitor (ICI)-related myositis), Associated with GVHD), Associated with systemic disease (Overlap myositis, Muscle Sarcoidosis)  
3) Clinico-radiological key findings in the differential diagnosis

#### MKEE-126 Winging It: The Radiologist's Guide to the Scapula

##### TEACHING POINTS

[1] Understanding the anatomy and bony landmarks of the scapula is important for identifying a range of pathologies, including fractures, tumors, and degenerative changes. [2] The scapula has a number of anatomic variants, particularly in the pediatric population, that may mimic trauma or other pathologies. [3] While radiographs can provide an initial assessment of the scapula, CT and MRI are useful imaging modalities to evaluate complex or subtle bony and adjacent soft tissue pathologies.

#### TABLE OF CONTENTS/OUTLINE

[1] Overview [2] Normal anatomy: important radiological landmarks [3] Imaging technique: dedicated scapula radiographs and the importance of CT/MRI [4] Case-based review by pathology [5] Congenital/developmental variants: acromial ossification centers; os acromiale; Sprengel deformity; glenoid dysplasia [6] Traumatic processes: different fracture patterns (including of the scapular body, neck, glenoid, acromion, and coracoid process) and stress fractures [7] Degenerative/inflammatory processes: osteoarthritis; rheumatic conditions; elastofibroma dorsi; scapulothoracic bursitis [8] Infection and inflammation: osteomyelitis; septic arthritis [9] Neoplasm: benign and malignant [10] Hardware and related complications: curettage and graft; shoulder arthroplasty notching [11] Miscellaneous conditions: Looser's zones in osteomalacia [12] Conclusion

#### MKEE-127 Worth the Weight: Weight-bearing Cone-beam CT in Foot and Ankle Pathology

Participants

Maryam Soltanolkotabi, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Weight-bearing computed tomography (WBCT) has advantages over conventional CT and radiography, namely the ability to identify alignment issues and evaluate joint line congruencies. 2. WBCT can be used for the assessment of fracture healing, pre-operative planning, and evaluation of treatment efficacy. 3. WBCT offers technical and logistic advantages over conventional CT including decreased radiation dose, less technical training for use, and decreased space and energy demands. 4. WBCT enables reliable 3D measurements in a functionally relevant position (weight-bearing).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Objectives/goals 3. What is weight-bearing CT and how does it work? 4. What are the advantages and disadvantages of WBCT? 5. What is the impact of WBCT on radiation dose, cost, and workflow? 6. What are the indications of WBCT? a. Fracture detection b. Alignment evaluation c. Pre-operative planning d. Evaluation of fracture healing e. Post-operative evaluation 7. How to measure in 3D? 8. What further developments are to be expected? 9. Summary/conclusion

## **MKEE-128 Percutaneous Bone Consolidation in Cancer Patients: Who and How**

Participants

Roberto Luigi Cazzato, Strasbourg, France (*Presenter*) Proctor, Medtronic plc

### **TEACHING POINTS**

- To promote the indications of percutaneous bone and spine consolidation in multi disciplinary tumor boards- To present the interventional techniques applied to consolidate impending, pathological, and secondary bone insufficiency fractures in cancer patients- To propose an algorithm useful to select the best consolidative method based on the biomechanics of the affected bone

### **TABLE OF CONTENTS/OUTLINE**

- Indications- Techniques available based on biomechanics- Definition of the target fracture- Algorithm for bone consolidation

## **MKEE-129 Spectrum of Common and Uncommon Multiple Bone Tumors: Imaging Findings with Pathologic Correlations**

### **TEACHING POINTS**

1. Multifocality is common in metastasis, myeloma, histiocytosis, and vascular tumors, including the location of spine; occasional in fibrous dysplasia, osteofibrous dysplasia, adamantinoma, enchondroma, and osteochondroma; extremely rare in osteosarcoma and giant cell tumor. 2. Multiple bone tumors carry an increased risk of malignant transformation, especially in the enchondroma, osteochondroma, and giant cell tumor. 3. Non-ossifying fibroma are typically cortically based; osteofibrous dysplasia and osteofibrous dysplasia-like adamantinoma can be pure cortical lesions, or with medullary cavity involvement; the majority of the adamantinoma involve the cortex and complete medullary cavity; fibrous dysplasia and metastasis primarily involve the medullary cavity and occasional the cortex. 4. A stippled or ring-like pattern indicates cartilage calcification, cloud-like appearance indicates osteoid mineralization, and a ground-glass density indicates fiber matrix. 5. Age needs to be considered in solid tumors with non-specific imaging features. Metastasis, myeloma, lymphoma, and Erdheim-Chester disease are common in adults; whereas, multiple chondrogenic tumours, fibrous dysplasia, langerhans cell histiocytosis, and osteosarcoma are more frequent in young individuals.

### **TABLE OF CONTENTS/OUTLINE**

1. Enchondroma 2. Osteochondroma 3. Osteoma 4. Osteosarcoma 5. Haemangioma 6. Epithelioid haemangioendothelioma 7. Giant cell tumour 8. Non-ossifying fibroma 9. Simple bone cyst 10. Osteofibrous dysplasia 11. Adamantinoma 12. Fibrous dysplasia 13. Metastasis 14. Myeloma 15. Lymphoma 16. Langerhans cell histiocytosis 17. Erdheim-Chester disease 18. Rosai-Dorfman disease

## **MKEE-13 Thermal Protection Techniques During Musculoskeletal Ablation**

Participants

Arash Azhideh, MD, MPH, Seattle, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Percutaneous thermal ablation of benign and malignant musculoskeletal tumors has expanded in scope and popularity in recent years. Although safe and efficacious, thermal ablation requires a thorough knowledge of the range of thermal protection techniques in order to limit the risk of thermal injury to adjacent nerves and other sensitive structures. In this educational exhibit, we briefly review the most commonly used musculoskeletal thermal ablation techniques, describe the spectrum of thermal protection techniques utilized during musculoskeletal thermal ablation, and discuss the mitigation techniques employed prophylactically or once nerve injury has occurred.

### **TABLE OF CONTENTS/OUTLINE**

1. Overview of Musculoskeletal Thermal Ablation Techniques a. Radiofrequency Ablation b. Cryoablation c. Microwave Ablation d. Other 2. Thermal Protection Techniques a. Active Thermoprotection Techniques i. Hydrodissection ii. Gas Dissection iii. Dissection with Other Agents iv. Physical displacement methods 1. Balloon interposition 2. Blunt needle displacement b. Passive Thermoprotection Techniques i. Biofeedback ii. Neurophysiologic intraoperative monitoring 1. Somatosensory evoked potentials 2. Motor evoked potentials 3. Electromyography iii. Temperature monitoring 3. Mitigation strategies to reduce thermal nerve injury

## **MKEE-14 Post-treatment Changes in Bone and Soft Tissue Tumors: A Primer for Radiologists**

Participants

Daniel Lobo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• To review the normal and pathologic findings following different therapeutic modalities in bone and soft tissue tumors: systemic treatment (chemotherapy, immunotherapy), radiotherapy and surgery. • To illustrate complications and signs of tumor response to treatment, persistent or recurrent disease, as well as non-neoplastic complications.

### **TABLE OF CONTENTS/OUTLINE**

• Brief introduction: relevance and challenges associated with post-treatment musculoskeletal tumors cases in the daily practice of the radiologist. • Post-systemic treatment (chemotherapy and immunotherapy): Signs of treatment response; Signs of tumor progression; Systemic effect on the musculoskeletal system. • Post-radiotherapy changes: Signs of treatment response; Local progression; Actinic changes; Others (infection, radioinduced tumors). • Post-operative changes: Normal post-operative findings; Non-neoplastic complication; Signs of recidivant lesion. • Conclusion and key takeaways.

## **MKEE-15 Temporomandibular Joint: A Jaw-Some Multimodality Guide of TMJ Disorders**

### **TEACHING POINTS**

1. Review anatomy of the Temporomandibular joint (TMJ) and its biomechanics. 2. Review clinical presentation of temporomandibular joint disorder (TMJD) 3. Discuss different causes of TMJD. 4. Multimodality overview of TMJD with emphasis on pertinent MRI findings. 5. Overview of management of TMJD.

## TABLE OF CONTENTS/OUTLINE

Background- Temporomandibular anatomy- Clinical presentation of TMJD Causes of TMJD- Biomechanical/Traumatic- Internal derangement (Disk Displacement with reduction and Disk displacement without reduction)- Fractures- Dislocation.- Inflammatory Arthritis (Rheumatoid Arthritis, Psoriatic Arthritis Juvenile and Inflammatory Arthritis)- Degenerative Arthritis- Crystal Arthropathy- Neoplastic/Variant (Synovial chondromatosis, Tenosynovial giant cell tumor, TMJ aplasia/hypoplasia and TMJ hyperplasia) Pertinent MRI Findings- Direct Signs (Abnormal disk morphology Abnormal disk displacement in closed-mouth position Abnormal disk movement in open-mouth position Osteoarthritic changes)- Indirect Signs (Joint Effusion and Rupture of retrodiscal layers) Management (Physical Therapy, Joint Injection, TMJ Arthroplasty, Disc Plication, Discectomy and Recontouring of the articular eminence)

### MKEE-16 Augmented Bone Remodeling: An Emerging Concept in Bone Marrow MRI

#### TEACHING POINTS

1. Normal bone remodeling, the lifelong process of bone removal and reconstruction, can not be seen at CT and MRI. 2. Bone remodeling can accelerate as a physiological response to many non destructive insults to bone such as a change in biomechanical load, or adjacent bone and soft tissue lesions. 3. Accelerated bone remodeling can be seen at MRI as a marrow area with a moderate increase in signal intensity on fat-saturated fluid-sensitive images with limited or no signal changes on fat-sensitive images. 4. Signal changes patterns in accelerated bone remodeling can be linear subcortical, patchy or diffuse. 5. Knowledge of these marrow patterns at MRI is important to increase our understanding of bone pathophysiology and avoid confusion with more destructive bone lesions.

## TABLE OF CONTENTS/OUTLINE

A/ Bone remodeling in normal and abnormal situations B/ The « regional acceleratory phenomenon » concept developed by H. Frost C/ MRI of accelerated bone remodeling Signal patterns Signal distribution D/ Correlations with pathological, radionuclide and radiological findings E/ Limitations and perspectives

### MKEE-17 Uncovering Common Lesions in the Sternoclavicular Joint and Costal Cartilages: A Diagnostic Guide

Participants

Giancarlo Domingues, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this study is: • To provide a comprehensive review of the normal anatomy and imaging appearance of the sternoclavicular joint and costal cartilages. • To improve understanding and diagnostic accuracy of the pathologies by didactically categorizing them into five distinct groups: degenerative, inflammatory, metabolic, traumatic, and infection.

## TABLE OF CONTENTS/OUTLINE

The sternoclavicular joint is a critical structure that connects the axial skeleton and upper extremities and enables the movement of the upper limbs. This synovial joint can undergo degenerative alterations, with osteoarthritis being the most prevalent pathology. Additionally, degenerative calcifications in the costal cartilages are frequently observed. Inflammatory conditions, such as costochondritis, SAPHO syndrome, rheumatoid arthritis and spondyloarthritis also affect these structures. Differentiating between metabolic and inflammatory disorders often requires a detailed clinical history. Infections usually occur in immunosuppressed patients and spread hematogenously. Traumatic injuries are often misdiagnosed, leading to persistent chronic pain. Although rare, posterior sternoclavicular dislocation is potentially dangerous as it can compress vital structures.

### MKEE-18 Opportunistic Imaging in Musculoskeletal Radiology

Participants

Vivek Kalia, MD, MPH, Frisco, TX (*Presenter*) Research Consultant, Hyalex Orthopaedics, Inc

#### TEACHING POINTS

1. Opportunistic imaging is leveraging existing imaging data, commonly in the form of DICOM-format CT images, to extract potentially useful clinical information unrelated to the examination's original indication. 2. Opportunistic imaging, currently employed for a fairly narrow list of indications such as osteoporosis screening, is poised to enable large-scale population-based screening in the very near future. 3. At-scale deployment of opportunistic imaging creates opportunities and challenges in MSK radiology.

## TABLE OF CONTENTS/OUTLINE

1. Definition and technical requirements a. Artificial intelligence (AI)/machine learning (ML) algorithms 2. Areas of Current Use a. Osteoporosis screening to predict fractures i. Bone mineral density (BMD) assessment ii. Finite element analysis for bone strength assessment b. Body composition analysis to predict cardiometabolic risk and mortality i. Muscle mass (sarcopenia) and quality (fatty infiltration) ii. Visceral adiposity iii. Hepatic steatosis iv. Atherosclerotic calcifications 3. Opportunities / Areas of Potential Use in the Future a. Individual risk stratification and customization of therapy b. Large-scale population screening c. Integration into electronic health records 4. Ongoing Challenges Considerations a. Potentially important and/or confounding information will be revealed by opportunistic imaging b. Potential for overdiagnosis and patient anxiety c. Potential for increased costs of care to healthcare system and/or individual patient

### MKEE-19 Scapulothoracic Disorders: Anatomy, Kinematics and Imaging Approach

Participants

Marília Da Cruz Fagundes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The scapulothoracic is a functional joint and an important part of the shoulder kinematic chain, supporting the center of the humeral head correctly aligned with the glenoid fossa during arm elevation and increasing the range of motion and strength of the rotator cuff muscles. Scapulothoracic disorders usually result in abnormal contact between scapula and chest wall. Pathophysiology includes structural abnormalities (such as scapula anatomic variants and bone and soft tissue expansive lesions), scapular dyskinesia (caused by denervation injuries or imbalance in muscle strength) and microtrauma (associated with overuse). Rarely, the joint may experience acute trauma leading to scapulothoracic dissociation. Primary pathologies are more frequent in young athletes, especially in throwing sports. Due to its functional nature, the identification of disorders related to scapulothoracic joint can be a

diagnostic challenge for radiologists. Radiography and Computed Tomography allows the assessment of bone anatomy and anomalies, while Magnetic Resonance Imaging provides information on soft tissue causes and consequences of these disorders. Finally, imaging plays an important role in guiding treatment, whether clinical, including physiotherapy and other conservative measures, or surgical if necessary.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. Anatomy and Kinematics; 3. Pathophysiology: a. Morphological causes; b. Functional causes; 4. Imaging Assessment; 5. Management.

#### MKEE-2 Beyond the Surface: The Power of Ultrasound in Diagnosing Epidermal Inclusion Cysts

Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To know the typical sonographic features of the epidermal inclusion cyst. - To describe the different complications of epidermal inclusion cysts and their characteristic sonographic findings. - To review other cysts and tumors that, given their location, are part of the differential diagnosis of the epidermal inclusion cyst, as well as the sonographic features that allow us to suspect them.

#### TABLE OF CONTENTS/OUTLINE

Epidermal inclusion cysts are very frequent lesions, and their ultrasound evaluation is a daily request. As radiologists, we must be able to recognize their representative characteristics, as well as other atypical findings that should make us think of other lesions of the same location. Our work is organized as follows: 1. The epidermal inclusion cyst: brief review of its definition, etiopathogenesis, clinical presentation and histopathology. 2. Ultrasonographic features of the epidermal inclusion cyst: everything we should take into account. - Location/relation to the dermis. - Morphology. - Echostructure. - Relation with adjacent tissues. - Vascularization. - Elastography. 3. Ultrasonographic features of the different complications of the epidermal inclusion cyst, including: - Rupture. - Inflammation and infection. - Degeneration in giant cysts. 4. Differential diagnosis of the epidermal inclusion cyst: when to suspect other lesions? - Cystic lesions of adnexal origin. - True dermal and hair follicle sweat gland derived tumors. - Differential diagnosis of complicated inclusion cysts.

#### MKEE-20 The Weight of the Neck: Understanding Subaxial Cervical Spine Injuries

Participants

Francis Cedeno Rodriguez, Caguas, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Subaxial cervical spine injuries occur in the lower part of the neck (C3-C7) due to trauma and can range from mild to life-threatening. 2. Compression fractures are the most common, these fractures consist of a collapse of the vertebral body height due to trauma. Burst fractures involve posterior vertebral body wall fracture and can compromise the spinal canal. 3. Flexion and extension teardrop fractures present with typical corner fractures at typical locations. 4. Translation injuries are seen in high energy trauma mechanisms with severe flexion distraction and often associated with severe neurological sequelae. 5. Unilateral and bilateral facet dislocation result from rotational and/or flexion distraction injuries.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction  
A. Overview of Subaxial Cervical Spine Injuries  
B. Review of AO Spine Subaxial Cervical Spine Classification  
II. Radiologic Review of Types of Fractures  
A. Compression Fracture (CF)  
B. Burst Fracture (BF)  
C. Flexion Teardrop Fracture versus Linear Nondisplaced Anterior Inferior Corner Fracture  
D. Extension Teardrop Fracture (ETF)  
III. Rotation and Translation Injuries  
A. Facet Subluxation  
B. Facet Dislocation  
C. Vertebral Translation  
IV. Complications of Cervical Spine Injury  
A. Vascular Injury  
B. Spinal Cord and/or Exiting Nerve Injury  
C. Hematomas (Epidural / Prevertebral)  
D. Ligament Injury  
E. Disc Injury  
V. Conclusion  
VI. Self Assessment

#### MKEE-21 Flying High and Falling Hard: A Radiological Review of Ultimate Frisbee Injury Patterns

Participants

Shaun Johnson, BS, Cleveland Heights, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the game of ultimate frisbee Learn how injuries commonly occur in this sport Understand commonly reported injuries from previous literature Review imaging findings in these patients

#### TABLE OF CONTENTS/OUTLINE

Introduction to ultimate frisbee Defining terminology and gameplay Discussion of rules Common maneuvers Prior reports of common injuries, epidemiology Literature review of common ultimate frisbee related injuries Fajardo Pulido et al 2020 Demonstrated a high lifetime prevalence of injury with injury to the knee, thigh, ankle, and shoulder being most common Akinbola et al 2015 Ultimate frisbee accounts for a high percentage of collegiate athlete injuries with similar trends to other sports Imaging review of patients with ultimate frisbee related injuries Discussion of diagnosis, mechanism injury, correlation with activity, and management strategies, from most common to least common Knee Ligament, meniscal, tendon pathologies Overuse injuries Foot/Ankle Ankle sprains Overuse injuries Shoulder Glenohumeral dislocation Acromioclavicular joint injuries Clavicular fractures Head Concussion Wrist Injuries related to fall on outstretched hand Chest Contusions Thigh Muscle strains Elbow Conclusion Discuss similarities and differences with various sports and known injury patterns such as soccer (football), American football, rugby.

#### MKEE-22 Did You Know that Your Slot-Scan Radiograph for Scoliosis can Artefactually Cause a Worsening Spinal Curvature? Plus Other Stories of Artifacts Associated with Digital Slot-Scanning Radiography

Participants

Sean Schoeman, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Digital slot scanning technology is a stereoradiography imaging (SDI) system that reduces radiation exposure for patients

Biplanar digital slot-scanning technology is a stereoradiography imaging (SRI) system that reduces radiation exposure for patients requiring serial imaging for chronic and progressive skeletal conditions (1). This has become preferred to standard x-ray additionally because of the ability to image full length spine and lower limbs for follow-up of children with scoliosis and leg-length discrepancy - images are interpreted by pediatric radiologists and orthopedic surgeons. Here we use our experience reviewing multiple images of patients at different time points to demonstrate distinct types of imaging artifact with this imaging modality. Reviewing physicians should be aware of such artifacts so as not to confuse artifacts with pathology which may lead to misdiagnosis or unnecessary management. The purpose of this educational abstract is to demonstrate common artifacts found at our institution.1. Melhem E, Assi A, El Rachkidi R, Ghanem I. EOS(®) biplanar X-ray imaging: concept, developments, benefits, and limitations. J Child Orthop. 2016 Feb 16;10(1):1-14.

#### TABLE OF CONTENTS/OUTLINE

1. Image acquisition technique for slot-scanning and resultant artifacts 2. Incorrect image centering artifact - causing change in Cobb angle and mimicking worsening scoliosis 3. Movement artifacts a. Wavy cardiac margin b. Wavy bones c. Wavy hardware 4. Edge enhancement artifacts a. Halo around hardware b. Pseudo-pneumomediastinum c. Lucency above diaphragm

#### MKEE-23 Improving Bone Tissue Characterization on MRI Using Gradient-echo: The Role of Simulated CT (sCT) Sequences

Participants

Felipe Correa, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Conventional MRI has limited ability to assess trabecular and cortical bone due to low proton density and markedly reduced T2 decay time. The FRACTURE sequence (Fast field echo Resembling A CT Using Restricted Echo-spacing) aims to improve the visualization of trabecular and cortical bone on MRI by simulating CT tissue contrast. In FRACTURE multiple echoes are acquired at a precise echo-spacing that corresponds to in-phase TEs. Following acquisition, the first post-processing step consists of a magnitude summation of all echoes. After summation, the images from the last echo are subtracted from the summated images to invert the grayscale and give bone a CT-like contrast. Simulated CT contrast sequences have great potential to assist in the diagnosis of inflammatory diseases, neoplasms, trauma, and normal variants. These sequences are useful for demonstrating bone fragmentation, resorption, and bone reaction, which facilitates the identification and understanding of deformities and complex bone remodeling. The great advantages of the FRACTURE sequence are the possibility of using gradient sequences available in all MRI devices and simple post-processing steps.

#### TABLE OF CONTENTS/OUTLINE

How sCT sequence acquisition and post-processing are performed. Role of the sCT sequence to evaluate the trabecular and cortical bone in routine examinations. Cases of clinical practice in which the sCT sequence turned out to be superior to conventional MRI for trabecular and cortical bone abnormalities.

#### MKEE-24 Shouldering the Load: Bridging the Gap of Rotator Cuff Tears with Patch Augmentation

Participants

Sirui Jiang, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Anatomy of the rotator cuff 2. Common patterns of rotator cuff tears 3. Standard of practice for surgical repair 4. Emerging treatments in graft augmentation 5. Advanced imaging characteristics of graft-augmented versus conventional repairs

#### TABLE OF CONTENTS/OUTLINE

1. Review of rotator cuff anatomy, 2. Clinical presentations of rotator cuff tears 3. Spectrum of rotator cuff disease 3a. Prevalence of tears and common tear patterns, 3a.i. Acute versus chronic tear presentations and diagnosis, 3a.ii. MRI findings and Goutallier classification, 3a.iii. Ellman classification of partial-thickness rotator cuff tears, 3a. iv. Massive rotator cuff tears, 4. Arthroscopic Repair Techniques, 4a. Single versus double row repair, 4b. MRI findings after conventional arthroscopic repair, 4b.i. Failure findings, 4b.ii. Assessment of repaired tendon quality (Sugaya Classification), 5. Patch augmentation, 5a. Indications for patch augmentation, 5b. Benefits and complications of patch augmentation, 5b.i. Reduction in retear rate and improvement in tendon thickness/quality, 5b.ii. Complications with xenografts, 5c. Types of patch augments, 5c.i. Collagen Scaffold (Regeneten), 5c.i.a. Clinical outcomes and MRI features of healed Regeneten patch, 5c.ii. Acellular dermal allograft (Dermis-on-demand), 5c.ii.a. Clinical outcomes and MRI features of healed Dermis-on-demand, 6. Future directions, 6a. Anticipated advancements, 6b. Biologic injections (PRP, stem cells) with concomitant patch augmentation

#### MKEE-25 Checkmate to Chest Wall Tumors: A Strategical Approach to Diagnosis

Participants

Rebeca Francelino, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Although chest wall tumors and tumor-like lesions are rare, familiarity with the main diagnostic entities is important. There is a large 'overlap' between the different etiologies, with many non-specific features between benign and malignant tumors. In the absence of other auxiliary tests, such knowledge allows narrowing the differential diagnoses, in addition to facilitating the decision to recommend further investigation when necessary. The purpose of this exhibit is: 1. To review the most common tumors and their characteristic imaging findings. 2. To discuss the diagnosis and management of benign and malignant tumors. 3. To correlate the imaging findings and clinical clues on a systematic approach to help narrowing the differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1- Institutional Protocol to evaluate the chest wall; 2- Epidemiological assessment of the main lesions and best imaging modality 3- Benign bone and cartilaginous tumors Osteochondroma Fibrous dysplasia Aneurysmal bone cyst (ABC) Giant cell tumor (GCT) Ossifying fibromyxoid tumor Chondromyxoid fibroma 4- Malignant bone and cartilaginous tumors Chondrosarcoma Multiple Myeloma Metastasis Osteosarcoma 5- Benign soft tissue lesions Hemangioma Elastofibroma dorsi Fibrous Hamartoma of Infancy Lipoma Schwannoma Desmoid Tumor Neurofibroma Ganglioneuroma Paraganglioma Hemangiopericytoma 6- Malignant soft tissue lesions Ewing sarcoma Rhabdomyosarcoma Synovial sarcoma Pleomorphic



sarcomaGanglioneuroblastomaNeuroblastomaAngiosarcomaLeiomyosarcomaMalignant fibrous histiocytoma (MFH)Malignant peripheral nerve sheath tumorDermatofibrosarcoma protuberans7- Miscellaneous Brown Tumor

## **MKEE-26 Navigating the Lumbosacral Plexus: A Guide to Understanding its Normal Anatomy and Injuries.**

### **TEACHING POINTS**

The aim of this study is: 1. Review with didactic illustrations the anatomy of the lumbosacral plexus, including how to recognize it on MRI. 2. Demonstrate how various lumbosacral plex injuries manifest clinically and on imaging studies. 3. Present didactic cases of lumbosacral plexus injuries, highlighting the main findings that the radiologist should expect.

### **TABLE OF CONTENTS/OUTLINE**

- Introduction and review of lumbosacral brachial anatomy, with didactic illustration.
- Review normal anatomy without MRI, highlighting anatomical landmarks.
- Overview of the main lumbosacral plexus injuries, their clinical and epidemiological manifestations and their imaging findings.
- Demonstrate with challenging clinical cases traumatic and non-traumatic pathologies, such as inflammatory polyneuropathy, other neuropathies, and associated alterations such as piriformis syndrome.
- Present a case series of lumbosacral plexus injuries and what you should actively look for depending on the clinical history.
- Propose a diagnostic checklist for evaluating lumbosacral plexus injuries, simplifying the reading of these challenging exams.
- Summary.

## **MKEE-27 Crystal Spine: Findings of Spinal Crystal Deposition Disease on CT and MRI**

Participants

Andrea S. Costacurta, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1- Crystal Deposition Disease must be considered in the differential of spinal pain.2- Findings are often located outside de spinal canal, in the soft tissues, and can be overlooked. 3- MRI has a high sensitivity in detecting inflammation but poorly detects calcification. CT on the other hand has high sensitivity to calcification however the amount of associated inflammation is often underestimated. Awareness of the disease may help in the diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

1. Definition and clinical aspects of Crystal Deposition Disease.2. Classification. 3. Brief review of pathophysiology. 4. Description of the main imaging findings in the spine: longus colli tendinitis, crowned dens syndrome, aseptic spondylodiscitis, disc, ligament or dural calcifications, facet joint arthropathy. 5. Discussion of the differential diagnosis.

## **MKEE-28 Assessment of Sagittal Balance in Degenerative Spine Disease: Role of Imaging Modalities in Post-operative Follow-up**

Participants

Pedro Arruda, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The sagittal balance depends on the correlation of the spine, pelvis and lower limbs for proper body alignment, which is crucial for maintaining a healthy posture and optimal body functioning. The pelvis sets the foundation of this alignment through pelvic incidence, which is a fixed anatomical parameter that determines the amount of lumbar lordosis required to maintain a proper balance. An increase in spinal fusion for degenerative diseases has led to a rise in postoperative complications, such as sagittal imbalance. Spinal fusion can result in a reduction of the lumbar lordosis, thus shifting forward the body's center of gravity. The body tries to compensate by pelvis retroversion or knee flexion, leading to an altered gait pattern and pain. Increased stress on the discs and facet joints adjacent to the fused spine segment may also be depicted. Imaging modalities play a crucial role in alignment monitoring. X-rays provide an orthostatic two-dimensional image of the spine or lower limbs, while MRI and CT scans identify structural abnormalities that predispose to spine imbalance, as well as disc herniation, spinal stenosis or adjacent disc syndrome. EOS imaging is a recently specialized modality that provides an orthostatic full-body and low-dose tridimensional image. Therefore, it is important to know the concept of sagittal alignment of the spine, the main measures performed, and how to interpret and describe the normal and abnormal findings.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Sagittal imbalance and compensatory mechanisms 3. Sagittal Alignment assessment A- Care in image acquisition B- What measures to perform C- How to interpret and describe 4. Pre and postoperative spine balance analysis 5. Conclusion

## **MKEE-29 Back to the Future: Automatic Deep Learning Approaches to Opportunistically Assess Spine Health**

### **TEACHING POINTS**

Complications from spine diseases are highly prevalent across the world. For example, over 1.5 million individuals suffer from back pain due to vertebral fractures and millions more are afflicted with neurogenic back pain. One way to prevent these diseases from developing is to opportunistically assess imaging studies for overall spine health by trending changes in quantitative spine metrics. However, the process of making measurements necessary to diagnose such pathologies is time-consuming, resulting in high underreporting rates for some of the aforementioned conditions (as high as 85%). This exhibit will focus on explaining how deep learning algorithms can be used for detecting vertebral body and disc deformities, trending Cobb angle, assessing paraspinal muscle fat content, and quantifying spinal cord/foramen compression.

### **TABLE OF CONTENTS/OUTLINE**

At the end of this presentation the learner should have knowledge about the following:1. Overview of the prevalence of vertebral fractures, disc herniation, spinal cord compression, scoliosis and current manual methods used to quantify severity of these pathologies.2. How neural networks can be used for anatomic object detection across multiple modalities using novel visual transformer and deep convolutional neural networks.3. How keypoint detection networks can be used for automated quantitative vertebral deformity diagnoses.4. How segmentation networks can be used to extract vertebral bodies, intervertebral discs, paraspinal muscles, spinal canal/cord/foramina using 2D and 3D UNets and Swin3D transformer networks.5. A framework for how these measurements can be used for comprehensive spine health assessment in an opportunistic manner.

### **MKEE-3 Imaging of Meniscal Root Tears: A Practical Review**

Participants

Bruno Watabe, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to: • Review and illustrate the anatomy of the meniscal roots and their specific characteristics. • Illustrate and discuss patterns and classifications of injuries involving these structures, along with their clinical relevance. • Illustrate and discuss various surgical treatments, arthroscopic correlation, and postoperative imaging findings of meniscectomy and repair with suture techniques.

#### **TABLE OF CONTENTS/OUTLINE**

The meniscal roots and supporting structures anchor the menisci to the tibial plateau, resisting hoop stress and preventing radial displacement of the menisci and subsequent degeneration of the tibiofemoral compartment. Imaging helps determine the type and location of lesions, guiding treatment decisions. An accurate description of lesions and associated imaging findings helps orthopedic surgeons determine the best surgical technique and improve patient outcomes. • Anatomy: Illustration and imaging of the tibial plateau and sites of meniscal root fixation, highlighting their specific characteristics. • Pathological Conditions: Recognition of degenerative changes and various types of traumatic tears in the meniscal roots, along with commonly associated findings, can aid in treatment decisions and potentially delay the onset of secondary osteoarthritis due to meniscal lesions. • Surgical Treatment and Postoperative Imaging: Illustration of different surgical techniques, including partial meniscectomy and meniscus repair, along with their indications and contraindications. Arthroscopic correlation and postoperative images showing follow-up within a certain time interval and potential outcomes.

### **MKEE-30 Hip Instability Beyond Dislocation: An Overview of New Concepts and Current Radiological Approaches**

Participants

Julio Guimaraes, MD, Sorocaba, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Hip instability is conceptually divided into traumatic and atraumatic causes, eventually leading to long-term complications, such as osteoarthritis. Hip dislocation and subluxation are well-established entities associated with high and low-energy trauma. Conversely, microinstability is a developing concept, mainly atraumatic, characterized by the inability to keep the femoral head centered within the acetabular fossa in extra physiological movements, which diagnosis involves detailed anamnesis and physical examination, as well as imaging approach. Bone markers for instability are classified into acetabular and femoral subgroups, which can be evaluated by radiographs and CT scans. Acetabular coverage and orientation are assessed to diagnose developmental hip dysplasia. In patients with borderline acetabular coverage, the concomitant evaluation of the Shenton line and femoral physeal scar orientation can determine microinstability diagnosis. The femoral head is assessed for bone morphology, CAM deformity, femoral torsion and neck-shaft angle. Connective tissue disorders are best depicted with MRI, related to capsular laxity, thinning or redundancy. Iatrogenic causes are related to capsular disruption due to intra-articular assessment during hip procedures. MRI can also reveal specific secondary chondral and labral lesions resulting from those structural abnormalities.

#### **TABLE OF CONTENTS/OUTLINE**

1. Definition; 2. Anatomy; 3. Pathophysiology: a. Traumatic: i. Dislocation and subluxation; b. Microinstability (atraumatic): i. Bone insufficiency; ii. Soft tissue insufficiency; iii. Post-surgical; 4. Imaging Assessment; 5. Management.

### **MKEE-31 Imaging Spectrum of Foot Infections: A Practical Guide to Radiologists**

Participants

Carlos Francisco Kallas Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The differentiation between foot infection imaging patterns is a common challenge for radiologists. Imaging methods provide detailed anatomical information in the assessment of infections, thus helping clinicians to reach the most accurate diagnosis. CT scans play a key role in providing multi planar reconstructions for bone evaluations, whereas MRI is highly sensitive for detecting osteomyelitis in initial stages and can help particularly in looking for soft tissues' complications. In this evaluation it is also important to understand the particularities of each etiological agent. Bacteria is the most common cause of infection, frequently associated with synovitis and osteomyelitis. Tuberculosis can also be related to tenosynovitis and osteomyelitis, especially in immunocompromised patients. Fungal infections have been described to have the classic "dot in a circle" sign on T2 weighted images. It is also important to remember foreign bodies related infections, to avoid misdiagnosis. The diabetic foot is another condition that requires special attention by radiologists. Neuropathic arthropathy predisposes to a greater risk of infection, mostly due to the loss of sensitivity, repetitive trauma and poor healing. Osteomyelitis and Charcot arthropathy frequently coexists, therefore, it is essential radiologists to understand the particular imaging features of these conditions and how they affect the foot compartments, to aid in diagnosis and proper management.

#### **TABLE OF CONTENTS/OUTLINE**

Background/epidemiology Anatomy, vascularity and foot compartments Etiological agents Diabetic foot Imaging techniques Diagnostic approach: what to report? Differential diagnosis Take-home Points

### **MKEE-32 MRI and US Evaluation of the Carpal Tunnel and Guyon's Canal: Normal Anatomy, Pathological and Postoperative Findings**

Participants

Diego dos Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Report general information about the carpal tunnel and Guyon's canal. - Review the normal anatomy of these canals and their main anatomical variations. - Describe its pathological involvement and its imaging patterns and postoperative evaluation on

ultrasonography (US) and magnetic resonance imaging (MRI), through clinical cases from our service.

#### TABLE OF CONTENTS/OUTLINE

Introduction:- General information about the carpal tunnel and Guyon's canal. Normal anatomy of carpal tunnel and Guyon's canal. Clinical cases of pathological and postoperative findings and its imaging patterns on US and MRI.\* Carpal Tunnel:- Carpal tunnel syndrome- Anatomical variation of carpal bones with tunnel reduction- Accessory tendon of the superficial flexor muscle- Arthrosynovial cyst determining median nerve neuropathy- Calcium deposit in the carpal tunnel- Thrombosis of the ulnar tributary artery\* Guyon's canal:- Arthrosynovial cyst in Guyon's canal- Thrombosis of the ulnar artery\* Other structures:- Neuropathy of the palmar cutaneous branch of the median nerve\* Postoperative findings:- Postoperative changes from carpal tunnel decompression / median nerve injury- Postoperative median nerve neuroma\* Other cases

#### MKEE-33 Plain Film Evaluation of the Traumatic Knee: A Case-Based Primer

##### TEACHING POINTS

The knee is a commonly injured joint in both children and adults. Plain film evaluation is often first line and familiarity with knee anatomy on plain films is critical for appropriate imaging evaluation. This exhibit reviews normal anatomy of the knee on plain films and illustrates the utility and limitations of plain films in evaluation of the knee joint in the setting of trauma. Utilizing a case-based approach, it reviews common and uncommon knee injuries, their mechanisms, and offers pearls and pitfalls to aid the radiologist in comprehensive radiographic assessment.

#### TABLE OF CONTENTS/OUTLINE

Anatomy Intercondylar Fractures Tibial Plateau Fractures Patellar Fractures Patellar Dislocation Avulsion Injuries Physeal Injuries Stress Fractures Knee Dislocation

#### MKEE-34 Avoiding the Iceberg and the Ring of Fire: Thermal Protection on Musculoskeletal Ablations

##### TEACHING POINTS

1 - Review and explain the methods that can be used to protect the tissues surrounding thermoablation areas. 2 - Discuss the monitoring methods and devices to evaluate sensitive structures near procedure sites. 3 - Didactic clinical cases with images of musculoskeletal ablations, each kind of protecting measures and potential complications.

#### TABLE OF CONTENTS/OUTLINE

1 - Types of musculoskeletal ablations; 2 - Radiofrequency; 3 - Cryoablation; 4 - Microwave; 5 - Interstitial laser; 6 - Complications; 7 - Safety measures on ablations; 8 - Preparation and monitoring; 9 - Thermal protection types; 10 - Hydrodissection; 11 - Pneumodissection; 12 - Mechanical manipulation; 13 - Skin temperature control.

#### MKEE-35 Anterior Glenohumeral Instability: Biomechanics, Preoperative and Postoperative Evaluations

Participants

Thais Kuwazuru, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Renata Leao, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

-Traumatic dislocation of the shoulder leads to labral detachment and elongation of the capsular ligamentous restraints, as well as bone loss on the glenoid, humerus or both.-Characterization of the bone loss, with glenoid track, allows an accurate treatment choice.-Most common procedures: Labral repair, glenoid augmentation and humeral reconstruction.-Labral retear: 1.fluid insinuation between the labrum and the glenoid bone margin; 2. Fluid insinuation within the labrum; 3. Morphologic abnormality greater than expected; 4. Anchor detachment.-Latarjet: 1.Graft complications: non-union, dislocation, mispositioning; 2.Hardware complications: loosening, fracture, dislocation; 3.Others: glenohumeral arthritis, neurovascular injuries, subscapularis muscle injury.-Remplissage: indications and normal/abnormal postoperative findings.

#### TABLE OF CONTENTS/OUTLINE

1.Glenohumeral biomechanics and anterior instability2.Anterior glenohumeral dislocation and associated injuries3.Glenoid labrum tears4.Bone compression and bone loss - glenoid - humerus and bipolar bone loss5.Labral repair procedure: indications, normal and abnormal postoperative imaging6.Glenoid reconstruction techniques: indications, Latarjet/Bristow and others7.Normal and abnormal imaging findings in glenoid reconstruction techniques8.Humeral head reconstruction: indications, normal and abnormal findings9.Conclusion: the correct assessment of glenohumeral instability is important for the surgical decision. It is essential to know the expected imaging patterns of each surgical technique and the corresponding pathological findings to properly manage potential complications in patients.

#### MKEE-36 Giant Cell Tumor of Bone: Atypical Imaging Features, Treatment and Complications

Participants

Adriano Silveira Moreira Novaes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The purpose of this exhibit is: 1. Briefly review of the most important features suggesting the diagnosis of the giant cell tumors (GCT) of bone. 2. Demonstrate the unusual locations of the GCT. 3. Review de atypical imaging findings of the GCT and complications in follow-up.

#### TABLE OF CONTENTS/OUTLINE

Giant cell tumor (GCT) of the bone is a generally benign tumor that has recently been reclassified as osteoclastic giant cell-rich tumors according to WHO 2020 classification.It is typically diagnosed through conventional radiographs that show a lytic lesion with a well-defined, non-sclerotic margin, eccentric location, extension to the subchondral bone, and centered in the metaepiphysis of mature long bones. Fluid-fluid levels are seen in 15% of cases, consistent with secondary formation of aneurysmal bone cyst. GCT commonly develops in long bones, particularly around the knee, but can occur in atypical locations with less characteristic radiographic features.Pediatric patients with open epiphyseal growth plates are infrequently affected. Lung metastases are rare,

occurring in 1-6% of cases. Recurrence after curettage with cement placement is a possible complication, but this has become less common with the use of adjuvant therapies such as Denosumab.

### **MKEE-37 Congenital Hand Malformations: A Review in the Palm of Your Hand**

Participants

Karla Ortega Rivera, MD, Queretaro, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Congenital hand malformations can have a significant impact on hand function and aesthetics, and thus, management should be multidisciplinary and involve specialists in plastic surgery, orthopedics, radiology, and psychology. 2. Radiographic imaging allows for visualization of bone structures, assessment of alignment, and morphology of the hand. 3. Radiographic evaluation is a crucial tool in the assessment of congenital hand malformations. Radiographic findings can help determine the type and severity of the malformation, which can be useful in treatment planning. 4. The aim is to provide a review of the most common congenital hand malformations, their radiographic findings, classifications, and therapeutic approaches, along with illustrative cases both pre- and post-surgery.

#### **TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Embryology III. Classification IV. Specific types of congenital hand malformations and radiographic evaluation Polydactyly, syndactyly, camptodactyly, brachydactyly, clinodactyly, constriction ring syndrome V. Management of congenital hand malformations VI. Cases

### **MKEE-38 The Muscle Fascia: From Anatomy to Pathological Findings**

Participants

Diego dos Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Report some concepts related to the muscle fascia, clarifying its definition. - Review the normal anatomy of the muscle fascia through illustrative schemes and correlation with imaging methods - magnetic resonance imaging (MRI) and ultrasonography (US). - Describe its pathological findings and its imaging patterns, through clinical cases gathered in our service.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction:- Definition and general information about the muscle fascia: fascia superficialis, deep peripheral fascia and deep intermuscular fascia Normal anatomy of the muscle fascia and correlation with MRI and US. Clinical cases of pathological findings and its imaging patterns on US and MRI: \* Traumatic:- Morel-Lavallée lesion- Plantar fascia injury- Muscle hernia / Myo-aponeurotic injuries\* Inflammatory:- Post viral inflammatory fasciitis- Nodular fasciitis- Plantar fasciitis\* Infectious:- Necrotizing and non-necrotizing cellulitis and fasciitis\* Autoimmune: - Eosinophilic fasciitis- Systemic lupus erythematosus- Polymyalgia rheumatica\* Neoplastic:- Superficial fibromatosis- Desmoid tumor / Hibernoma- Sarcoma\* Postoperative:- Assessment of muscle fascia after fasciotomy\* Other:- Compartment syndromes- Granulomatous disease\* Other cases

### **MKEE-39 The Resident's Thriller: A Pictorial Essay on Benign Bone Tumors**

Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

This essay aims to review the main benign bone tumors and its multimodality radiological features. Although many tumors' diagnoses are histopathological, radiologists and radiology residents must be able to identify several entities, especially those whose correct identification are imaging-made.

#### **TABLE OF CONTENTS/OUTLINE**

Bone cysts. Chondroblastoma. Chondromyxoid fibroma. Enchondroma. Eosinophilic granuloma. Fibrous dysplasia. Giant cell tumor. Intraosseous hemangioma. Lipoma of the bone. Non-ossifying fibroma. Osteochondroma. Osteoid osteoma.

### **MKEE-4 Glenohumeral Osteoarthritis: Overview, Imaging Approach and Preoperative Assessment**

Participants

Marco Aurelio Soato Ratti, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Glenohumeral osteoarthritis (GHOA) has a prevalence as high as 20% in the middle-age and elderly population, predominantly observed as the primary form (no specific risk factors). Conversely, secondary GHOA is associated with diverse causes, including rotator cuff tear, post-traumatic degeneration, gleno-humeral morphology (retroversion and glenoid dysplasia), shoulder instability, inflammatory arthropathies and microcrystal deposition. Imaging plays a pivotal role for GHOA diagnosis, investigation of underlying predisposing factors, evaluation of the extent of degeneration and of local complications. Since surgery can be considered in symptomatic patients with moderate to severe degenerative changes, unresponsive to conservative treatment, preoperative assessment by imaging is fundamental. A multimodality approach including radiographic images, computed tomography and magnetic resonance imaging helps the surgeon to choose the ideal technique for better outcomes. Pathologic glenoid version, bone loss and rotator cuff atrophy, as examples, have established association with poor clinical outcomes and hardware complications following arthroplasty. Thus, complete preoperative assessment of glenohumeral joint includes the following aspects: evaluation of bone stock, glenoid version, glenoid tilt, assessment of the rotator cuff with Goutallier classification and Walch classification.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction; 2. Epidemiology; 3. Definition and pathophysiology; 4. Etiology, a. Primary form (or non-specific risk factors), b. Secondary form (or specific risk factors); 5. Multimodality imaging evaluation; 6. Preoperative imaging assessment: what to report.

### **MKEE-40 CT Myelography and Blood Patches in Intracranial Hypotension: A Primer**

## TEACHING POINTS

1 - Review and explain the intracranial hypotension syndrome, its image manifestations, causes and treatments. 2 - Present didactic clinical cases with images of cerebrospinal fluid (CSF) leaks and fistulas. 3 - Discuss CT myelography technique and interpretation. 4- Show the treatment options for CSF leaks and fistulas. 5 - Demonstrate guided epidural blood patch treatment with real cases images.

## TABLE OF CONTENTS/OUTLINE

1 - Intracranial hypotension syndrome; 2 - Etiologies; 3 - Diagnostic criteria; 4 - Most common image manifestations; 5 - Imaging methods for etiology investigation. 6 - Spine MRI; 7 - CT myelography; 8 - CSF leaks; 9 - CSF-venous fistulas; 10 - Conservative, interventional and surgical treatments. 11 - Epidural blood patch: how to.

## MKEE-41 Distal Tibiofibular Syndesmosis: Stabilize Your Knowledge and Leave the Instability to the Injuries

Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The purpose of this exhibit is: To review the anatomy and biomechanics of the distal tibiofibular syndesmosis; Discuss the role of each imaging method, including indications, advantages and disadvantages of each modality; To illustrate the main acute and chronic alterations in radiological and orthopedic practice, through didactic cases illustrating our institution through a multimodality approach; Discuss surgical indications and the importance of the findings for the orthopaedic surgeon, according to the imaging methods.

## TABLE OF CONTENTS/OUTLINE

Anatomy. Biomechanics. Indication for requesting imaging exams in general. Role of radiography, main views and how to evaluate. Role of ultrasonography. Role of CT in neutral. Role of CT with stress maneuvers. Role of Weight-bearing CT. Role of MRI. Surgical indications, importance of radiological findings, and radiological and surgical correlation. Summary and proposed evaluation and test request flowchart. Future perspectives.

## MKEE-42 Capturing Psoriatic Arthritis on Film: A Comprehensive Guide to Radiographic Assessment

## TEACHING POINTS

- Provide an overview of psoriatic arthritis.
- Emphasize the indications, limitations, and benefits of radiography in psoriatic arthritis.
- Compare different imaging techniques for psoriatic arthritis.
- Discuss the normal anatomy of the hand on plain film radiography.
- Emphasize the importance of a systematic approach to hand radiography.
- Become familiar with descriptive terms for common bone and soft tissue abnormalities seen in psoriatic arthritis.
- Provide case studies to illustrate the practical application of theoretical concepts.
- Analyze differential diagnostics, tips, and tricks.

## TABLE OF CONTENTS/OUTLINE

Overview of psoriatic arthritis: definition, epidemiology, pathogenesis, and clinical manifestations. Radiography in psoriatic arthritis: indications, limitations, and benefits. Comparison of imaging techniques for psoriatic arthritis: radiography, ultrasound, and MRI. Normal anatomy and systematic approach to the hand on plain film radiography. X-rays and psoriatic arthritis: descriptive terms for common bone and soft tissue abnormalities. Case studies: practical application of theoretical concepts. Differential diagnostics: osteoarthritis, gout, and rheumatoid arthritis. Tips and tricks for improving radiology reports. Conclusions: What rheumatologists want to know?

## MKEE-43 Bad to the Bone! Understanding and Applying Bone-RADS: A Standardized Scoring System for Bone Lesions

Participants

Ellis Mejias Febres, BS, Carolina, PR (*Presenter*) Nothing to Disclose

## TEACHING POINTS

-Review pathology of bone anatomy-Bone-RADS provides an algorithmic-type approach to assessing differential diagnosis of bone tumors -Each Bone-RADS score is determined by certain criteria that includes the clinical implications for each -Provision of case examples on conventional radiography and computed tomography (CT) to better understand Bone-RADS In this educational exhibit, we will review the standardized scoring system Bone-RADS, as well as provide radiologists and other health professionals with an understanding of Bone-RADS. The scoring system itself will be explained, supported by imaging from real cases. Finally, we will explain the implications every score has on the management of individual cases based on the Bone-RADS score assigned.

## TABLE OF CONTENTS/OUTLINE

I. Introduction-Review of bony anatomy Creation of Bone-RADS II. Overview of the criteria used in Bone-RADS III. Clinical implications/management of bone tumors based on Bone Rads-How Bone-RADS serves as a guide to assessing bone lesions. IV. Imaging examples-Case by case analysis of how Bone-RADS scores are determined. V. Conclusion-Recap of teaching points.

## MKEE-44 Anterior Cruciate Ligament Reconstruction: Imaging Evaluation of the Techniques, Normal Appearance and Complications

Participants

Andre Y. Aihara, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Anterior cruciate ligament (ACL) reconstruction aims to restore knee stability. The surgical techniques for ACL reconstruction include single and double bundle, while the most frequently used autografts are bone-patellar tendon-bone and hamstring tendons. CT is the gold standard for evaluating tunnel placement, while MRI is best for assessing graft continuity and soft tissue complications. MRI signal intensity of the graft changes over time, with low signal immediately after surgery, increased signal in the

first year due to remodeling, and low signal at 18 months. The objectives of this exhibit are: 1. To review ACL reconstruction techniques 2. Discuss imaging findings of normal postoperative ACL 3. Illustrate post-operative complications according to the potential sources: graft, technical and hardware complications, and soft tissues.

#### TABLE OF CONTENTS/OUTLINE

ACL reconstruction Techniques Normal postoperative Imaging • Femoral and tibial tunnels: position and size • Signal intensity of the graft over time • Harvest sites • Radiographic findings • CT findings • MRI findings Complications • Graft Partial tear Complete tear Porto-Knee Testing Device • Technical and hardware complications Anterior tibial tunnel with impingement Anterior femoral tunnel Tunnel widening Hardware migration Hardware fracture • Soft tissues Arthrofibrosis Infection Adventitious Bursitis

#### MKEE-45 Imaging Evaluation of the Patella as the Largest Sesamoid Bone

Participants

Andre Rosenfeld, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The patella is the largest sesamoid bone in the human body, developing within the quadriceps tendon and becoming a part of the knee's extensor mechanism. Ossification centers can be associated with congenital disorders. Forceful contraction of the extensor mechanism can lead to chronic apophysitis or acute avulsion fractures. Although rare, tumors of the patella can occur, with the majority being benign. Additionally, crystal arthropathies such as gout and CPPD can affect the patella through the deposit of crystals in the tendons or cartilage. Certain diseases are associated with typical patellar morphologies. For example, multiple epiphyseal dysplasia is characterized by a double-layered patella, Cryopyrin-Associated periodic syndromes result in a disproportionately diffuse increase in size, and CPPD deposits cause a gear-like morphology. The purpose of this study is to Review the normal development and anatomy of the patella. Discuss and illustrate the imaging findings of pathologies of the patella, which can be didactically divided into congenital disorders, mechanical/trauma, tumors, and crystal arthropathies. For this purpose, radiographs, CT scans, and MR images will be used. Highlight the typical patellar morphologies associated with various diseases. Elucidate how to differentiate normal variants from pathological conditions.

#### TABLE OF CONTENTS/OUTLINE

Normal development of the patella and anatomy Pathologies • Congenital: Bipartite, tripartite, double-layered patella, absence of the patella • Mechanical/trauma: Fracture, sleeve avulsion, Sinding-Larsen-Johansson • Tumors: benign and malign • Cryopyrin-Associated periodic syndromes • Crystal arthropathies: gout and CPPD

#### MKEE-46 3D Printing and Metaverse in Musculoskeletal Tumors - A New Assessment Tool

Participants

Flavia M. Costa, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 3D printing preoperative planning for the treatment of MSK tumors (soft tissue and bone tumors). a. Segmentation. Virtual modeling. Build preparations. Quality assessment • Patient-specific devices - Personal surgical instruments (PSIs); • Identify what sequences should be used for Preoperative planning in many oncological patients with computed tomography (CT) (maximum slice thickness of 1 mm) and contrast-enhanced magnetic resonance (MR- 3 Tesla -Siemens) and multiplanar reconstruction; • Mixed Reality (MR) is a technology of real and virtual worlds to enhance visualizations, where physical and digital objects coexist and allow users to interact with both in real-time • Special considerations and Pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1) The value of the combination of 3D printing and metaverse in surgical planning procedures in soft tissue and bone tumors; 2) These techniques promise improvements and outcomes for complex bone tumor resection 2) Case discussion: • Osteosarcomas resection and prosthesis manufacture • Pleomorphic liposarcomas recidive assessment • Schwannomas • Condrossarcomas • Bone marrow metastasis 3) To demonstrate many indirect effects of 3D printing on surgical procedures: • reduced surgery time; • to a reduced complication rate of wound infections and wound healing disorders and therefore enable earlier adjuvant therapy initiation 4) Common pitfalls 5) Conclusion Surgical planning using 3D printing and metaverse/ may result in negative tumor resection margins that reduce the risk of local recurrence and adversely affect patients' survival. Computer navigation and 3D-printed resection guides have been reported to be surgical accurate.

#### MKEE-47 What, Where, and Why - A Primer on Sonographic Evaluation of Traumatic Injuries to the Tendons of the Wrist and Hand

Participants

Kevin Sweetwood, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Ultrasound of the tendons of the wrist and hand can provide a high spatial resolution evaluation of tendon pathology which is augmented by the ability to perform dynamic maneuvers that are unavailable with MRI studies. 2. Knowledge of the sonographic appearance and anatomy of these tendons and their associated structures is essential in correctly identifying pathology, providing relevant information to the referring physicians to guide appropriate management, and avoiding pitfalls leading to misdiagnosis. 3. Review of common injuries to the tendons of the wrist and hand focusing on relevant anatomy, sonographic findings, mechanisms of injury, and associated complications and classification schema that are significant for surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. What - Different traumatic pathologies of the tendons with review of terminology, sonographic appearance, and image acquisition techniques a. Partial versus complete tendon tears, tendon stump separation and retraction b. Pulley injuries c. Sagittal band injuries 2. Where - Review of relevant anatomy, sonographic landmarks, and surgical classification a. Appearance and relationships of the flexor digitorum profundus tendon, flexor digitorum superficialis tendon slips, and pulleys b. Identification of flexor tendon zones utilizing landmarks c. Appearance and relationships of the extensor tendons and sagittal bands 3. Why - Isolated tendon injury versus secondary post-traumatic injuries and significance of findings for surgical approach a. Distal radius fractures b. Hardware complications c. Surgical management

## **MKEE-48 Solving the Puzzle: Trying to Simplify Postsurgical Shoulder Images**

### **TEACHING POINTS**

To explain the main surgical shoulder techniques performed for the treatment of the rotator cuff lesions, long biceps tendon injuries and shoulder instability. Characterize the normal findings frequently seen in post surgery images, and differentiate them from potential pitfalls. Analyze the most common post surgical complications and describe the most frequent lesion recurrences.

### **TABLE OF CONTENTS/OUTLINE**

Postsurgical evaluation of the shoulder can be challenging for radiologists due to the complexity of the shoulder's anatomy and the variety of surgical techniques. The main surgeries involve repairing the rotator cuff and or long head of the biceps tendon injuries, and treating glenohumeral instability. Imaging methods play a fundamental role, particularly in cases where there are suspected surgical complications or reinjuries. They have precise indications, and sometimes, they need to be used in combination for the best accuracy. Misinterpretation of expected findings in postsurgical imaging studies is common due to changes in the anatomy and a lack of knowledge about surgical techniques. This can lead to incorrect reports, unnecessary reinterventions, and even legal issues to the surgeon. This work aims to provide a practical and organized overview of the different surgical techniques, normal postsurgical anatomical changes, common complications, and reinjuries on the operated shoulder, so as to allow the radiologist to perform an adequate interpretation of the images.

## **MKEE-49 Carpal Instability: Current Concepts and Diagnostic Approach**

### **TEACHING POINTS**

To show the complex anatomy of the wrist ligaments and its assess in imaging studies. Describe the different types of carpal instability, its pathomechanism, clinical prognosis and treatment implications. Review the different stages of nondissociative carpal instability, integrating images into the pathological process and clinical stages.

### **TABLE OF CONTENTS/OUTLINE**

Carpal instability refers to a group of ligament injuries that are responsible for a considerable degree of wrist pain and dysfunction, interfering with sports and daily life activities. Scapholunate and lunotriquetral ligament injuries are the most frequent cause of carpal instability. Depending on the type of injury, these ligaments may be the harbinger of a relentless progression to abnormal joint mechanics, cartilage wear, and degenerative changes. Imaging methods play a crucial role in the diagnosis and staging of this type of injuries which, if not treated, can lead to wrist osteoarthritis

## **MKEE-5 Diagnostic Evaluation of Very Small Peripheral Nerves: When Ultrasonography Made the Difference**

Participants

Marcos Felipe Correa, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Describe the role of the high frequency ultrasound (US) in the assessment of very small peripheral nerves and its comparison with magnetic resonance imaging (MRI). Review the sonoanatomy and the topographic anatomy of the reported nerves and its correlation with MRI. Report selected clinical cases from our service, highlighting pathological involvement of very small peripheral nerves on US and its correlation with MRI, through illustrative images and videos.

### **TABLE OF CONTENTS/OUTLINE**

Introduction  
The role of the high frequency US in the assessment of the very small peripheral nerves  
Clinical cases of pathological involvement of very small peripheral nerves on US and its correlation with MRI:  
Palmar cutaneous neuropathy  
Posterior interosseous nerve syndrome  
Digital palmar proper nerve injury (stump neuroma neurotmesis)  
Lateral femoral cutaneous neuropathy (meralgia paresthetica)  
Postoperative radial nerve neuropathy  
Postoperative sural nerve (stump neuroma neurotmesis)

## **MKEE-50 An Ounce of Prevention is Worth a Pound of Cure**

### **TEACHING POINTS**

The purpose of this exhibit is:  
A. Discuss the classic concepts of instability and the relatively new concepts of microinstability of the spine;  
B. Demonstrate the cascade of degenerative instability going through three stages: (1) temporary dysfunction, (2) unstable dysfunction and a (3) final phase of restabilization;  
C. Correlate the phases of spinal instability and radiological findings in a multimodality approach;  
D. To review the main therapeutic options in the context of chronic spinal pain, microinstability and instability.

### **TABLE OF CONTENTS/OUTLINE**

A. Spine anatomy and biomechanics of spinal pain; B. Classic spinal instability concepts and degenerative stages; C. Concepts of microinstability and imaging findings in a multimodality approach; D. Discussion of the therapy decision, including conservative treatment measures, surgical indications and modalities of intervention.

## **MKEE-51 MR Neurography of the Lumbosacral Plexus- Tips on Technique and Injury Patterns**

### **TEACHING POINTS**

Pelvic and lower extremity sensorimotor disturbances frequently present a diagnostic challenge for referring clinicians and radiologists. Complex anatomy of the lumbosacral plexus in addition to varied clinical presentations make it difficult to pinpoint the site of pathology accounting for patients' symptoms. MR Neurography is a useful modality for evaluation of the nerves in the lumbosacral plexus and can serve as an adjunct to conventional MRI lumbar spine. 1-5 Significant improvements in signal to noise ratio and spatial resolution, particularly with 3D isotropic sequences, and emerging techniques such as deep learning reconstruction facilitate improved nerve visualization. When performing MR neurography, it is important for the radiologist to understand the anatomy of the lumbosacral plexus and to be aware of technical considerations in the pelvis.

### **TABLE OF CONTENTS/OUTLINE**

Background Anatomy Overview; Technical Considerations; Protocol/Sequences: high field strength, heavily T2W FS images

perpendicular to nerve, 2D/3D; Fat suppression: STIR, DIXON; Vascular suppression: DESS/MENSA; Motion reduction; Contrast-Gadolinium, Ferrumoxytol; Imaging around Metal; Deep learning reconstruction; Imaging features; Normal Injury Patterns; Case examples Iatrogenic, Traumatic

## **MKEE-52 Whole Body of MRI of Castration-Resistant Prostate Bone Metastasis: How and When**

Participants

Javier Hernandez Ganan, Hospitalet, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To explain Whole-Body MRI protocol focusing on Dixon and Dwi sequences. 2. To discuss main indications. 3. To select target lesion to biopsy. Whole-body MRI is becoming increasingly important in patients diagnosed with disseminated prostate neoplasia, not only in clinical trials but also in daily practice. Specifically in patients with biochemical progression with bone disease, where more scenarios open up for adequate therapeutic guidance.

### **TABLE OF CONTENTS/OUTLINE**

Natural history of prostate cancer. WB MRI protocol: MET RADS. Role of Dixon and DWI sequences. Indications. 1. Before starting a new treatment. 2. Follow-up. 3. Select viable lesion to perform percutaneous biopsy. Current developments. 1. WB MRI at diagnosis in patients at high risk for prostate cancer: 'all in one' study. 2. PET MRI future indications.

## **MKEE-53 Hematopoietic Tumors of Bone - Growing Your Knowledge**

Participants

Bruno Cardoso, MD, Barbacena, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Obtaining a differential diagnosis for hematopoietic bone tumors is often challenging due to their varied features. Hematopoietic bone tumors encompass a wide spectrum, including multiple myeloma, lymphoma, histiocytosis, Erdheim-Chester disease, and Rosai-Dorfman disease. In some cases, these pathologies can mimic osteomyelitis or bone metastasis, making an accurate diagnosis crucial prior to treatment. X-rays are often the initial imaging study used to evaluate hematopoietic bone tumors, but they have limited sensitivity and specificity in some cases. CT scans, which provide detailed images of the spine and pelvis, are particularly useful for evaluating bony structures while avoiding the effects of overlapping structures. On the other hand, MRI provides better soft tissue contrast, aiding in the differentiation of benign and malignant conditions. Overall, the DWI technique can provide information about tumor cellularity and aggressiveness, potentially improving the accuracy and efficiency of MRI and enhancing patient care.

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction, II. Imaging Modalities, III. Multiple myeloma, IV. Lymphoma, V. Langerhans cell histiocytosis, VI. Erdheim-Chester disease, VII. Rosai-Dorfman disease, IX. Differential diagnosis, X. Conclusion.

## **MKEE-54 Measurement of Bone Mineral Density in CT: Current Status and Future Perspectives**

### **TEACHING POINTS**

Screening bone mineral density at opportunistic CT is under active research to be adopted in daily practice. The major teaching points of this exhibit are 1) the history of measuring bone mineral density at CT, 2) the pros and cons of measuring bone mineral density at CT in comparison with DEXA, 3) technical considerations of measuring bone mineral density at CT, and 4) future perspectives of measuring bone mineral density at CT including deep learning technique.

### **TABLE OF CONTENTS/OUTLINE**

1. History of measuring bone mineral density using CT: QCT and opportunistic CT. 2. Pros and cons of measuring bone mineral density at CT in comparison with DEXA. 3. Technical considerations when measuring bone mineral density at CT. 4. Future perspectives of measuring bone mineral density at CT: deep learning technique and finite element analysis. 5. References

## **MKEE-55 Inside the Spinal Canal: A Journey Through Intraspinial Pathologies**

Participants

Alan Strapasson, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Lesions within the spinal canal can range from benign to highly malignant, with only 20% of these lesions being intramedullary. Other possible origins include nerves, meninges, and vessels. The main objective of this exhibit are: 1. Review the anatomy, imaging protocols, and main pathologies affecting the medullary canal of the lumbar spine or the thoracolumbar transition. 2. Create a diagnostic flowchart for main intraspinal lesions based on age and comorbidities. 3. Describe the main imaging characteristics used to narrow down differentials. 4. Provide an updated classification of intramedullary lesions according to the World Health Organization's 5th edition.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to lumbar spine anatomy, including transitional vertebra classification. 2. MRI protocols for the lumbar spine. 3. Diagnostic flowchart for lesions categorized by age and comorbidities. 4. Discussion of main imaging findings for various conditions such as Mixopapillary ependymoma, Intradural spinal lipoma, Schwannoma, Lipoma of the filum terminale, Plexiform neurofibroma, Metastases, Vertebral body hemangioma with epidural component, Chordoma, Dermoid cyst, and Epidermoid cyst, using illustrative cases. 5. Highlighting the main clinical and imaging aspects that differentiate lesions within the vertebral canal, to aid in prompt diagnosis and proper treatment. Overall, this exhibit provides a comprehensive overview of intraspinal lesions and their characteristics, contributing to accurate diagnosis and treatment planning.



## **MKEE-56 So, You Have a Trained AI Model, Now What? Step-by-step Guide to Deploying a Prototype Interface Using Open-source Python Tools to Test Newly Developed Internal MSK AI Tools**

Participants

Brendan Franz, MD, Detroit, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. A brief overview of the initial process of training, and validation of an AI model. 2. Overview of open-source tools in python which can be used to deploy a test of an AI solution. 3. Walkthrough of implementation of tools to create a platform to internally test custom AI tools.

### **TABLE OF CONTENTS/OUTLINE**

-A brief overview of the initial process of training, and validation of an AI model.--Expected output of a training/validation process during AI model creation.--Walkthrough of open-source tools to deploy a test of an AI solution--Anaconda / Python Flask--Flask--Streamlit--Walkthrough of implementation of a web-based interface to test internally create AI tools--Conda installation--Installation of Flask, Streamlit and other related dependencies--Creating a simple HTML website to take an MSK radiograph and predict the image projection using a custom model file--Using Streamlit to visualize imaging data, masks and output.--Review of the utility of open-source software in healthcare--Conclusion/Summary

## **MKEE-57 MR Arthrograms: Expecting the Unexpected**

### **TEACHING POINTS**

After reviewing this education exhibit, the reader will understand: 1. Technique of normal arthrograms discussing the major large and medium joints with brief overview of normal post direct arthrogram anatomy. 2. Pitfalls and imaging findings related to common errors or unexpected findings in MR arthrography of larger and medium joints with focus on shoulder and knee. 3. Genesis of common errors and general procedural techniques to avoid these.

### **TABLE OF CONTENTS/OUTLINE**

1. Basic technique of fluoroscopic guided direct MR arthrogram for major joints. 2. Overview of normal appearance of common joint spaces post direct arthrogram 3. Unexpected findings or errors related to: a. Contrast media preparation -Over dilution -Increased concentration b. Injection technique -Over distention and contrast extravasation -Extra-articular injection -Intra-articular gas -Extra-articular local anesthetic c. Soft tissue injury d. Unexpected findings related to -Enhancing lesions e.g. fracture, vascular malformation -Anatomic variants e. Scanning -Timing -Incorrect sequence

## **MKEE-58 Cervical and Lumbar Spinal Fusion and Arthroplasty Beyond the Basics: From Surgical Techniques to Postoperative Imaging**

Participants

Gabriel Miranda, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

I) Discuss the role of each imaging method in postoperative evaluation of patients who have undergone cervical/lumbar spinal fusion or total disc replacement/disc arthroplasty. II) Review the different techniques of cervical and lumbar spinal surgery (indications, advantages and limitations), and describe the various surgical instrumentations/devices used in spinal fusion and total disc replacement (TDR)/disc arthroplasty procedures. III) Discuss a basic primer/checklist for radiological evaluation after cervical and lumbar spinal fusion or total disc replacement/disc arthroplasty, to help identify normal and abnormal postoperative findings on the various imaging modalities. IV) List the main early and late postoperative complications.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: The importance of imaging in the evaluation after cervical/lumbar spinal fusion or disc arthroplasty. The main uses of each imaging modalities Spinal instrumentation nomenclature: Spinal fusion instrumentation: screws, plates, rods, interbody cages, bone grafts. Disc arthroplasty devices: disc prosthesis and its various models. Surgery techniques: Cervical spine: anterior cervical corpectomy and fusion, anterior cervical discectomy and fusion, posterior laminoforaminotomy, cervical disc arthroplasty. Lumbar spine: anterior lumbar interbody fusion, oblique lumbar interbody fusion, lateral/extreme/direct lumbar interbody fusion, transforaminal lumbar interbody fusion, posterior lumbar interbody fusion, and lumbar disc arthroplasty. Checklist for radiological postoperative evaluation: Normal postoperative findings. Early and late postoperative complications.

## **MKEE-59 Blossom with Artificial Intelligence: Hidden MSK Imaging Biomarkers for Cardiothoracic Diseases from Conventional Chest CT Examination**

### **TEACHING POINTS**

\*Definition and benefits: Opportunistic CT imaging means analyzing CT scans initially taken for other purposes but with potential to contribute to medical screening levels (primary, secondary, and tertiary screening), and identify incidental pathologies at zero additional costs or radiation exposure. \*Extraction of important musculoskeletal biomarkers is now feasible from conventional CT scans as predictors of cardiothoracic diseases, such as: -Bone density, osteoporosis and osteopenia, using phantomless measures of bone density- Thoracic spine degeneration, using modified Pfirrmann grading- Detailed pectoralis muscle composition measures loss (subcutaneous adipose tissue, intermuscular and perimuscular adipose tissue, extramyocellular lipids), sarcopenia, and prevention of adverse outcomes- Measures of costochondral and tracheal calcification as a marker for extraosseous calcium deposition \*Implementation of artificial intelligence (AI): AI algorithms hold promise for enhancing the precision and speed of the opportunistic CT imaging and can generate robust, reliable, and fast quantitative measurements that may not be readily apparent to the human eye.

### **TABLE OF CONTENTS/OUTLINE**

-Introduction-Methodology: Development of deep-learning algorithm -Clinical application: Current evidences for predictive values for various common cardiothoracic disease-Future directions: AI role for efficient implementation in routine clinical practice

## **MKEE-6 All Grown Up: Pictorial Review of Premalignant Bone and Soft Tissue Lesions**

## TEACHING POINTS

• There are several bones and soft tissue lesions that can undergo malignant transformation. • It is important to understand the characteristic imaging appearance and pitfalls of these lesions. • Radiologists should be familiar with the clinical and imaging management of these premalignant lesions to prevent misdiagnosis.

## TABLE OF CONTENTS/OUTLINE

Several bones and soft tissue lesions can undergo malignant transformation. This includes premalignant benign tumors and non-neoplastic conditions that injure bone and soft tissue. Both groups require an understanding of key clinical and imaging features to arrive at the correct diagnosis. Enlargement, new pain, or aggressive imaging features can raise suspicion for malignant transformation. This exhibit will discuss 3 main categories of premalignant musculoskeletal lesions: Benign tumors • Osteochondroma/multiple hereditary exostoses (MHE) ? chondrosarcoma • Enchondroma (Maffucci, Olliers) ? chondrosarcoma • Fibrous dysplasia? osteosarcoma • Giant cell tumor of bone? malignant giant cell tumor Prior bone injury (non-neoplastic) • Osteomyelitis ? squamous cell carcinoma, osteosarcoma. • Radiation ? osteosarcomas, soft tissue sarcomas • Bone infarct ? secondary osteosarcoma • Paget disease ? osteosarcomas, chondrosarcomas, or fibrosarcoma. Soft tissue lesions • Burns/scars ? squamous cell carcinoma, basal cell carcinoma • Synovial Chondromatosis ? chondrosarcoma • Neurofibroma ? Malignant peripheral nerve sheath tumor • Atypical lipomatous tumor (ALT) ? dedifferentiated Liposarcoma

## MKEE-60 Unraveling Wrist Radiographs: A Review of Traumatic Wrist Injuries Focusing on Radiographic Imaging

### TEACHING POINTS

?? After reviewing this education exhibit, the reader will: 1. Understand how various views of the wrist are obtained and the indications of different special views. 2. Understand normal anatomy and imaging appearance of the wrist on radiographs. 3. Understand the imaging appearance and clinical context of common and uncommon traumatic carpal injuries and carpal joint disruptions.?

### TABLE OF CONTENTS/OUTLINE

1. Wrist radiographs - indications of various views (including standard views and less common views such as carpal tunnel) and optimal patient positioning. 2. Normal wrist anatomy on standard radiographs. 3. Approach to interpretation?? 4. Relevant anatomy, mechanism of injury/ pathogenesis, imaging examples, brief review of clinical presentation and implications, and management of: a. Different carpal bone fractures b. Different types of carpal dislocations c. Carpo-metacarpal joint fracture-dislocations? ??

## MKEE-61 Microinstability and MRI: Unveiling the Invisible

Participants

Natan Ribeiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Introduce microinstability as a disorder with subtle joint instability- Understand the significance of MRI in diagnosing microinstability- Explore the application of MRI in various joints affected by microinstability- Discuss advanced MRI techniques for accurate detection and staging of joint lesions- Review the evolving relationship between MRI and arthroscopy for microinstability diagnosis and treatment

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Microinstability and MRI 2. The Role of MRI in the Diagnosis and Management of Joint Microinstability 3. Comprehensive Imaging Evaluation of Microinstability in Various Joints 4. Dynamic MRI for Detection of Functional Causes of Joint Instability 5. Quantitative MRI Techniques for Objective Evaluation of Cartilage Health 6. The Benefits of Functional MRI in Understanding Joint Microinstability 7. Advanced MRI Techniques for Accurate Detection and Staging of Joint Lesions 8. The Evolving Relationship Between MRI and Arthroscopy for Microinstability Diagnosis and Treatment 9. The Pivotal Role of Radiologists in Microinstability Diagnosis and Management 10. Imaging Findings in Anterior Shoulder Microinstability: An MRI-Based Approach 11. MRI Findings Suggestive of Knee Microinstability: A Comprehensive Review 12. Management of Microinstability in Different Joints: An Evidence-Based Approach 13. Role of MRI in Guiding Surgical Intervention for Joint Microinstability 14. Understanding the Pathophysiology and Anatomy of Joint Microinstability for Accurate MRI Interpretation 15. Advancements in MR Imaging Technology for Improved Detection and Characterization of Microinstability

## MKEE-62 Lateral Meniscus Instability: Understanding Its Anatomy and Unraveling Posterior Attachment Lesions

Participants

Carlos H. Longo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The lateral meniscus is more mobile than the medial meniscus due to its less extensive attachments, and its posterior attachment anatomy has been less studied than the medial meniscus. The posterior root attachment and meniscotibial (coronary) ligaments serve as important static stabilizers, but it is the thin popliteomeniscal fascicles (PMF) that play an important role in the dynamic stabilization of the lateral meniscus during knee flexion. The anterior (Humphrey) and posterior (Wrisberg) meniscofemoral ligaments also contribute to stabilization. The absence of popliteomeniscal ligaments (congenital or traumatic origin) allows an anterior displacement of the posterior horn of the lateral meniscus during the flexion of the knee (hypermobile meniscus). It can cause symptoms, including pain, blockage and snapping ("snapping knee syndrome"). Peripheric tears of the posterior horn can be associated with buckle-handle tears and meniscal flap dislocation. Posterior root tear is less common in the lateral meniscus than the medial meniscus. The purpose of this study is to: - Review the normal anatomy of the posterior horn of the lateral meniscus and its attachments. - Discuss and illustrate cases of hypermobile meniscus associated with absence of the PMF on MRI. - Illustrate cases of posterior attachments tear on MRI

### TABLE OF CONTENTS/OUTLINE

Normal anatomy of the posterior attachments of the lateral meniscus and its normal appearance on MRI Hypermobile meniscus

associated with tear of the PMFBuckle-handle tearPosterior root tearMeniscofemoral ligaments tear

### **MKEE-63 Geographic Superficial Soft Tissue Masses: A Guide for Ill-defined Masses**

Participants

Rachel Bass, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Masses in the superficial soft tissues often have ill-defined borders, and are often benign. Framing the differential into dermal, lipomatous, fibrous, lymphatic and vascular categories may be helpful. 2. Skin thickening with ill-defined underlying edema without enhancement suggests lymphatic origin. This may be localized, and correspond to a pedunculated mass in the morbidly obese, known as a "pseudosarcoma". 3. Ill-defined mass with a fascial tail suggests fibromatosis, which may be desmoid type or superficial. Degree of hyperintensity of fluid weighted sequences corresponds to immature collagen and active tumor. 4. Diffuse fibromatosis is a unique form of neurofibroma that is uncommonly associated with NF-1, and presents with geographic skin thickening with ill-defined subcutaneous edema, nodularity and enhancement. 5. Superficial angiosarcoma will be a nodular, vascular tumor with enhancement and increased activity hot on PET. Often metastatic at presentation.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Lymphatic: Massive localized lymphedema, papillomatosis cutis lymphocystica, Proteus syndrome, cutaneous lymphoma 3. Vascular: Vascular malformation, angiosarcoma 4. Lipomatous: Fat necrosis, adiposis delorosa 5. Fibrous: Desmoid type fibromatosis, superficial fibromatosis, fibrosarcoma 5. Neurogenic: Diffuse neurofibroma 6. Dermal: Squamous cell carcinoma

### **MKEE-64 "Thinking On Your Feet" - A Step Forward on the Evaluation and Treatment of Morton Neuromas**

Participants

Mary Creedon, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Overview of Morton neuromas and relevant anatomy 2. Review of the sonographic evaluation of Morton neuromas including patient position, transducer position, and dynamic maneuvers 3. Review of the MRI protocol and findings related to Morton neuromas 4. Differential diagnoses and pitfalls 5. Treatment overview including ultrasound-guided procedure indications, required materials, and technique for steroid, anesthetic, and alcohol Morton neuroma injections

#### **TABLE OF CONTENTS/OUTLINE**

Introduction and overview Pathophysiology and types of traumatic neuromas Nomenclature Epidemiology Clinical Findings Most common locations Ultrasound evaluation Transducer selection and settings Patient and transducer position (dorsal versus plantar imaging) Dynamic maneuvers Sonographic findings Differential diagnoses (including plantar plate tears and intermetatarsal bursitis) and ways to differentiate sonographically MRI evaluation MRI protocol and the use of intravenous gadolinium contrast Literature favoring prone vs supine patient position for MRI and US Differential diagnoses and pitfalls Treatment options Non-operative, non-invasive treatments Ultrasound-guided procedures: a. Indications, risks, and precautions, b. Required materials for steroid, anesthetic, and alcohol injections, c. Technique details Surgical excision Summary

### **MKEE-65 Post-operative Fluid Collections Following Lumbar Spine Surgery: Differential Diagnosis and Surgical Considerations**

#### **TEACHING POINTS**

Post-operative fluid collections represent a common imaging finding in patients who have undergone recent lumbar spine surgery. Radiologists must be familiar with different types of post-operative fluid collections that can occur following lumbar spine surgery and their salient imaging findings to guide patient management. 1) Recognize different types of lumbar spine surgical techniques including posterior spinal, transforaminal, anterior, extreme lateral, and oblique lateral interbody fusions 2) Review different types of lumbar spine post-operative fluid collections, including cerebrospinal fluid leak (CSF) and pseudomeningocele, lymphocele, bone morphogenetic protein (BMP)-related fluid collection, hematoma, abscess, and urinoma 3) Identify which types of surgical techniques are associated with different post-operative lumbar fluid collections 4) Review treatment considerations for different types of post-operative lumbar spine fluid collections

#### **TABLE OF CONTENTS/OUTLINE**

Review anterior and posterior approach lumbar spine fusion techniques, relevant anatomy, and post-operative imaging appearance Anterior approach - Anterior lumbar interbody fusion (ALIF) - Oblique lateral interbody fusion (OLIF) - Extreme lateral lumbar interbody fusion (XLIF) Posterior approach - Posterior lumbar interbody fusion (PLIF) - Transforaminal lumbar interbody fusion (TLIF) Review the imaging appearance and management, of different types of post-operative fluid collections after lumbar spine fusion - Pseudomeningocele/CSF leak - Bone morphogenetic protein (BMP)-related fluid collections - Lymphocele - Hematoma - Abscess with discitis/osteomyelitis - Urinoma

### **MKEE-66 MRI Evaluation of Oblique Injuries: Introduction of the Deadrise Sign**

#### **TEACHING POINTS**

Importance of oblique injuries in sports imaging Primary muscle involved and location of injuries Common MRI findings Basic MRI protocol and treatment algorithm

#### **TABLE OF CONTENTS/OUTLINE**

Epidemiology of oblique injuries - Target population - Mechanism of injury - Value of MRI Anatomy of the lateral abdominal wall - Muscle layers, fiber orientation, and important attachments - Normal variations in the lower "floating" ribs Single institution retrospective cohort of 29 unique injuries in 23 patients - Primary muscle involved - Surrounding injury - Location - Average length of injury Common MRI findings and pitfalls - Introduction of the "deadrise" imaging sign - Severity grading considerations Case examples - Low grade strain (muscle edema only; no macroscopic tear) - Tears at the lower rib insertions (deadrise sign) - Tears at the iliac attachment (less common) - Differential diagnosis MRI protocol considerations - Sequences, scanning time, and short and long-axis views of the rib/cartilage at the site of injury - Common MRI artifacts - Rib level identification Treatment algorithm -

Collaboration with orthopedic surgery

## **MKEE-67 The Musculoskeletal Manifestations of Aging: What the Radiologist Needs to Know in Caring for Our Growing Elderly Population**

### **TEACHING POINTS**

1. Briefly discuss the multifactorial biochemical processes that contribute to normal aging of the musculoskeletal system. 2. Familiarize the radiologist with the normal radiologic manifestations seen in the musculoskeletal system that arise from aging. 3. Review the radiologic manifestations of the most common musculoskeletal pathologies that occur in the elderly population resulting from normal aging.

### **TABLE OF CONTENTS/OUTLINE**

A. Brief review of the biochemical processes that contribute to normal aging in the context of musculoskeletal manifestations. B. Illustrate normal and pathologic radiologic manifestations of aging in the musculoskeletal system a) Changes in bone homeostasis i. Osteopenia/osteoporosis, Paget's disease ii. Insufficiency fractures iii. Fragility fractures b) Architectural changes in skeletal muscle composition i. Sarcopenia c) Architectural changes in articular cartilage composition i. Osteoarthritis d) Architectural changes in tendon composition decreased cellular response to injury i. Tendinopathy and tendon tears e) Metabolic derangement and predisposing co-morbidities seen in the elderly population i. Diffuse idiopathic skeletal hyperostosis ii. Crystal deposition disease f) Genomic instability from accumulated oxidative damage and decreased repair mechanisms i. Multiple myeloma ii. Metastatic disease

## **MKEE-68 Where is the Contrast? Patterns to Recognize and Pitfalls to Avoid for Successful MSK Arthrography**

Participants

Maxine Kresse, MD, (Presenter) Nothing to Disclose

### **TEACHING POINTS**

-Review of arthrogram techniques of the major joints to include range of normal appearances and demonstrate pathology with successful injection-Recognition of extra-articular injection, with cross-sectional correlates-How to avoid and correct for common pitfalls

### **TABLE OF CONTENTS/OUTLINE**

-Brief introduction to fluoroscopy guided arthrograms of the major joints (including shoulder, elbow, wrist, hip, knee, and ankle)-For each of the major joints: a. Normal arthrogram appearance, including normal bursa/recess communications with the joint; b. Successful intra-articular injection with pathology diagnosed by the arthrogram fluoroscopy images (i.e. full thickness rotator cuff tear); c. Numerous examples of extra-articular injections, with cross sectional correlates on the location of the contrast; d. Tips to avoid common pitfalls and ways to adjust to achieve an intra-articular injection-Summarize pearls and pitfalls to aid in troubleshooting to avoid compromised cross-sectional exams

## **MKEE-69 "Untangling the Nerves" - Sonographic Findings of Upper Extremity Nerve Entrapments and Injuries with MRI Correlation**

Participants

Preethi Kesavan, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

### **TEACHING POINTS**

1. Benefits in the use of ultrasound with technique details 2. Classification and sonographic imaging of peripheral nerve injuries with MRI correlation 3. Ultrasound of nerve entrapment syndromes of the upper extremity with MRI correlation 4. Ultrasound-guided peripheral nerve interventions

### **TABLE OF CONTENTS/OUTLINE**

Why ultrasound and how? Benefits and advantages in the use of ultrasound Technique details, including transducer selection and machine settings Dynamic imaging and the use of Doppler (including newer microvascular imaging techniques) Sonographic findings including normal reference cross-sectional measurements Types of peripheral nerve injuries Classification and types of peripheral nerve injuries Sonographic findings of normal versus abnormal peripheral nerves MRI correlative imaging Ultrasound imaging of upper extremity nerve entrapment syndromes Sites of entrapment, relevant anatomy, and associated pathophysiology Sonographic imaging findings with MRI correlation Secondary imaging findings including muscle denervation edema, atrophy, and myosteatosis Ultrasound-guided peripheral nerve interventions Indications, risks, precautions, and benefits of ultrasound. Required materials including what to inject (e.g., nonparticulate versus particulate corticosteroids) Ultrasound-guided diagnostic and therapeutic injections including hydrodissection and alcohol/ethanol neurolysis Ultrasound-guided cyst aspiration/decompression to relieve nerve compression Summary

## **MKEE-7 Tibial Plateau Fractures: Common Classification Systems and Clinical Considerations**

Participants

Rachel Bass, MD, Birmingham, AL (Presenter) Nothing to Disclose

### **TEACHING POINTS**

1. The Schatzker classification of tibial plateau fractures is commonly used but lacks description for coronally oriented fractures. The three column approach highlights the importance of the posterior tibial plateau. 2. The Kfuri (modified Schatzker) classification system was introduced in 2018, and marries the Schatzker classification with anterior and posterior modifiers, and is accepted among orthopedic surgeons. 3. Involvement of the posterior column affects surgical approach and technique, and stabilization of the posterior medial column and tibial rim is critical for good functional outcome. 4. Preoperative CT provides critical information regarding fracture orientation, depression, and vascular injury. 5. Preoperative MRI following external fixation may provide critical information to the orthopedic surgeon regarding meniscus and ligamentous injury that will be addressed at the time of definitive internal fixation.

### **TABLE OF CONTENTS/OUTLINE**

1. Tibial Plateau Classification systems: AO/OTA, Schatzker, Three Column, Kfuri (Modified Schatzker) 2. Surgical Approach and

clinical importance: Buttress fixation, posterior column fixation, graft placement 3. Soft tissue injury: Open fracture, vascular injury, meniscal tear, cruciate ligament tear, compartment syndrome 4. Long term outcomes: Expected healing, postoperative osteoarthritis leading to arthroplasty.

## **MKEE-70 Don't Miss a Step: Ligament Injury in Midtarsal Sprain**

### **TEACHING POINTS**

Review anatomy of themidtarsal (Chopart) joint complexDescribe variant anatomy and common pitfallsProvide recommendations for best visualization of ligaments ofmidtarsal joint complex in MRI-scansDiscuss trauma mechanisms ofmidtarsal sprain and deduce possible injury patternsProvide imaging examples ofmidtarsal sprains (MRI and X-ray)Discuss treatment

### **TABLE OF CONTENTS/OUTLINE**

Background: • Epidemiology• Role of imagingLigament anatomy visualized by 3D-renderings and MRI-imaging examples (with common variant appearances):Talocalcaneonavicular joint • Dorsal talonavicular ligament• Calcaneonavicular portion of bifurcate ligament• Spring ligament complexCalcaneocuboid joint• Dorsal calcaneocuboid ligament• Calcaneocuboid portion of bifurcate ligament• Short and long plantar ligamentsPathomechanisms ofmidtarsal sprain:• Inversion-type trauma (most common): lateral and possible dorsal distraction with medial compression• Eversion-type trauma: medial distraction with lateral compressionImaging examples ofmidtarsal ligament injuries:• Ligament tear and sprain• Common findings accompanying ligament injuriesTreatment

## **MKEE-71 Keeping Cool: Thermoprotection Strategies for Musculoskeletal Ablations**

### **TEACHING POINTS**

Basic principles of how to ablate targeted tissues and minimize damage to surrounding structures.-Review passive monitoring and active protection techniques during thermoablation.

### **TABLE OF CONTENTS/OUTLINE**

Percutaneous thermal ablation is being increasingly performed for oncologic treatment within bone and non-visceral soft tissue.- Certain risks are of interest during musculoskeletal ablation, namely skin and neurovascular bundle injury when compared to other deep organ ablations. Given this, concurrent multi-modal thermoprotective measures should be used to prevent non-target destruction of overlying skin and adjacent structures. Both active and passive protective measures are outlined in our presentation.-Passive techniques are utilised to monitor the patient and can include clinical monitoring and real-time intra-procedural imaging. Direct patient interaction and instruction, such as asking the patient to move intermittently or report altered sensation is a subjective method of clinical monitoring in order to detect neural injury. In contrast, intra-procedural imaging is more objective, whereby the radiologist can view the ablation zone in real-time, allowing confident treatment of the target lesion while avoiding non-target structures.-By comparison, active techniques are utilised to protect non-target structures and can be subdivided into temperature modulation and displacement techniques. Temperature modulation can be achieved with warmed/cooled saline gloves on the skin or subcutaneous fluid injection to dissipate temperature. Displacement of non-target adjacent structures is usually achieved with hydrodisplacement or pneumodisplacement.

## **MKEE-72 Dual Energy X-ray Absorptiometry (DXA): Principles and Tips in Classic and New Applications**

### **TEACHING POINTS**

• To review the basics of dual energy x-ray absorptiometry (DXA) • To discuss the use of DXA in the assessment of bone density, also reviewing the contribution of new developments such as trabecular bone score (TBS) in the diagnosis of osteoporosis. • To analyze the evolving role of DXA in the evaluation of soft tissues especially for body composition such as quantification of fat and estimation of skeletal muscle mass in sarcopenia. • To emphasize pitfalls, diagnostic difficulties, and provide clue points in order to improve performance in DXA exams.

### **TABLE OF CONTENTS/OUTLINE**

DXA is the 'gold-standard' in quantitative assessment of bone mineral density in the diagnosis of osteoporosis. The use of DXA has been also recommended in sarcopenia, to assess lean mass as an estimation of all non-fat/non-bone tissues, fat mass and bone mineral content. We review: 1. Basics and technique of DXA. DXA principle is based on attenuation coefficient of different tissues with low energy X-ray beams. 2. Uses of DXA. BMD study. Body composition and sarcopenia studies 3. BMD study. DXA performance. Causes of mistakes in different steps of DXA study: 3.1 Before the study: technologist training and competence, daily calibration, anthropometric data, regions to scan. 3.2 During the study: Patient positioning, Image acquisition: regions of interest. 4. Osteoporosis diagnosis. Image interpretation: Parameters. Adequate use of T-score and Z-score; Report. Detection of vertebral fractures or bone diseases (osteoarthritis, metastases, Paget's disease), soft tissue lesions, detection of artifacts-foreign bodies. New developments: TBS. 5. Body composition. Sarcopenia. DXA software analysis. Comparison with different techniques.

## **MKEE-73 A Radiological Overview of Elbow Arthroplasty: Practical Keys in the Assessment of Elbow Replacement**

Participants

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-To know the different types of elbow replacement. -To review the role of imaging techniques (plain radiograph, CT, MR, US, scintigraphy) in the evaluation of elbow replacements. -To understand usefulness and limitations of plain radiographs and CT in the evaluation of elbow replacements, emphasizing useful parameters and illustrating image analysis and interpretation. -To become familiar with normal and abnormal postoperative imaging findings and signs of complications

### **TABLE OF CONTENTS/OUTLINE**

We review imaging of elbow replacement, highlighting key concepts perceived as important variables by the surgeon and correlating images with clinical considerations and functional outcomes. We present: 1. A review of types of replacement. 2. Surgery. Aims. 3. Imaging. Plain radiographs: -Technique and views. Standard image acquisition: beam and anatomical landmarks -Parameters that should be evaluated: description of the components, alignment relative to normal anatomic alignment. 4. Imaging. CT: -Technique. -Parameters that should be evaluated. -Imaging of complications: Aseptic loosening, infections, ulnar nerve complications,

instability, disassembly, dislocation, subluxation, intraoperative fractures, mechanical failure of prosthetic components, and ectopic bone formation 5. Role of MRI, US and scintigraphy. .

#### **MKEE-74 Beyond the Surface: Exploring Extradigital Glomus Tumors - A Comprehensive Review of 64 Cases with Radiologic-Pathologic Correlation**

Participants

Gabriela Serra Del Carpio, Madrid, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- In our study males outnumbered females with a male-female ratio of 2.1:1. - The mean age at the time of diagnosis was 55,8 years. - The tumors had a mean size of 1 cm and were located in the lower limbs in most cases (38/64).- In 17 cases (27%) a diagnostic imaging test was performed (US, MRI or both). - The radiological appearance of a glomus tumor on ultrasound was in most cases as a circumscribed hypoechoic oval nodule located in the subcutaneous layer and horizontally oriented. - Spectral Doppler can demonstrate both venous and arterial intralesional flow and in some cases a "Vascular stalk sign". - Images obtained by ultrasound are not specific but they play an important role in early diagnosis, give precise information on location, and provide guidance for excision of glomus tumors.

##### **TABLE OF CONTENTS/OUTLINE**

IntroductionMaterials and Methods1.Results- Clinical findings - Radiological findings- Histological, cytological and immunohistochemical features- Differential diagnosis- Discussion2. Conclusions

#### **MKEE-75 Weight-Bearing MRI: A New Technology for Changing the Approach to Pathology from Diagnosis to Therapy**

Participants

Joan C. Vilanova, MD, PhD, Girona, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

• Learn the technical methodology to perform a weight bearing MRI (WB) for the different areas of the body/joints • Show the proper analysis of the weight bearing examination to distinguish physiological changes from pathology on a clinical-radiological correlation • Know the most common and appropriate indications for weight bearing MRI from the different areas/joints of the body

##### **TABLE OF CONTENTS/OUTLINE**

•Introduction • WB MRI equipment characteristics • WB MRI technique of different areas/joints, procedure to perform the upright examination: craniovertebral junction (CVJ), spine, shoulder, knee, hip, ankle, foot, temporomandibular joint (TMJ); showing dynamic MRI evaluation • WB postprocessing: quantification of the changes from non-WB to the WB examination • Indications: CVJ: instability; Spine: instability, postural alignments changes, discopathy, lateral recess - foramen - central canal, postsurgical evaluation; Shoulder: instability, impingement; Knee: meniscal-ligamentous instability, patellar shift, Impingement; Hip: impingement, microinstability; Ankle: ligamentous instability, impingement, plantar fascia; Foot: metatarsalgia evaluation; TMJ: internal joint disorders • Benefits and limitations • Conclusions

#### **MKEE-76 Radiologic Stranger Thing: Phosphaturic Mesenchymal Tumor (PMT) and Pitfalls**

Participants

Jacobo Porto Alvarez, MD, Vedra, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

-To describe and understand the physiopathology of PMT. -To learn about the most typical presentation of PMT. -To describe that the diagnosis is based on pathologic and biochemical analysis, but the imaging techniques are crucial in the tumor location for surgery treatment. -To alert about PMT and emphasise the radiologist's role in the management of PMT and when a radiologist can be crucial in raising the suspicion of PMT. -To describe some of the most common radiologic pitfalls.

##### **TABLE OF CONTENTS/OUTLINE**

-Introduction: Actions of FGF-23, analytic changes and the bone implication. -Location and symptoms of PMT.-Diagnoses and treatment of PMT.-The radiologist's role in the management of PMT.-Pitfalls of PMT.

#### **MKEE-77 Soft Tissue Tumours: Anatomic-Based Approach**

Participants

Imran Ladak, MD,BSC, London, ON (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Review the 2020 World Health Organization (WHO) classification of soft tissue tumours. Understand the role of imaging in the diagnosis and management of soft tissue tumours Learn an approach to benign and malignant soft tissue tumours based on characteristic location and imaging appearance.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction Introduction to soft tissue tumours 2020 World Health Organization classification of soft tissue tumours Role of imaging in soft tissue tumours Soft tissue tumours by location and appearance Common/benign soft tissue tumours Lipoma Venous hemangioma Peripheral nerve sheath tumour Skin Dermatofibrosarcoma protuberans Chest Elastofibroma dorsi Solitary fibrous tumour of the pleura Arm Desmoid-type fibromatosis Nodular fasciitis Trunk Desmoid tumour Leiomyosarcoma Retroperitoneal liposarcoma Hand Fibrolipomatous hamartoma Giant cell tumour of tendon sheath Palmar fibromatosis Thigh Intramuscular myxoma Liposarcoma Undifferentiated pleomorphic sarcoma Leg/foot Synovial sarcoma Palmar fibromatosis

#### **MKEE-78 Breaking Down Bone and Muscle: The Nitty-gritty of MSK Infections**

Participants

Alba Salgado Parente, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To revise the physiopathology and imaging findings of musculoskeletal infections (soft tissue, bone and joint, spine and periprosthetic infections) with different imaging modalities (conventional radiography, US, CT, MRI, PET)2. To discuss the differential entities that can mimic septic arthritis and osteomyelitis, focusing on pearls and potential pitfalls to make a correct diagnosis3. To develop a systematic approach for interpreting imaging findings of MSK infections, including evaluation of the extent and severity of infection and potential complications

#### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Imaging techniques in the evaluation of MSK infections: conventional radiography, ultrasound, CT, MRI and nuclear medicine techniques3. MSK infections: Pathophysiology and key conceptsa. Soft tissue infections: Cellulitis, abscess/phlegmon, myositis/pyomyositis, superficial, deep and necrotizing fasciitisb. Bone and joint infections: Septic arthritis, septic bursitis, tenosynovitis, acute osteomyelitis, chronic osteomyelitis, Diabetic footc. Spine infections: Spondylodiscitis, facet joint septic arthritisd. Periprosthetic infections: Technical considerations and imaging4. Pitfalls and mimics - How to avoid them: Is this septic arthritis?, Is this osteomyelitis?5. Systematic approach to MSK infections: What steps to follow6. Conclusions7. References

#### MKEE-79 **Spotlight on Musculoskeletal Lymphoma: A Radiological Exploration of an Uncommon Entity**

Participants

Maxine Kresse, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiology plays a central role in the diagnosis of musculoskeletal lymphoma.2. Musculoskeletal lymphoma can present with different patterns.3. Lymphoma involving the muscle, skin, and bones can occur at nearly every age and may present with atypical features that can distinguish it from other entities.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction-Overview of musculoskeletal lymphoma-Importance of radiology in diagnosis2. Imaging modalities for musculoskeletal lymphoma, including Radiography, Ultrasound (US), Computed Tomography (CT), Positron Emission Tomography (PET), and Magnetic Resonance Imaging (MRI)3. Imaging features and patterns of musculoskeletal lymphoma-Osseous lymphoma: lytic pattern, sclerotic pattern, and "near normal" radiographic findings-Soft tissue lymphoma-Trans-spatial lymphoma4. Differential diagnosis-Other primary bone and soft tissue neoplasms-Metastatic lesions-Inflammatory and infectious conditions5. Conclusion: key takeaways from radiologic evaluation of musculoskeletal lymphoma

#### MKEE-8 **Non-Tumoral Spine Bone Lesions: A Pictorial Review of Common and Uncommon Pathologies**

Participants

Andre Mannato, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The features of non-neoplastic bone lesions in the spine are often similar to those of malignant tumors, and a differential diagnosis is challenging to obtain in some cases. Non-tumoral bone lesions of the spine have a broad spectrum, including mechanical, infectious, inflammatory, vascular, and other causes. The clinical manifestations of ranging from back pain to neurological deficits mimicking myelopathy or radiculopathy. A careful and attentive imaging evaluation can help narrow differential diagnosis and potentially avoid unnecessary biopsy. Therefore, an accurate diagnosis is important prior to treatment.X-rays are often the first imaging study used to evaluate spinal tumors, but they have limited sensitivity and specificity for diagnosing benign tumors. CT scans provide detailed images of the spine and are particularly useful for evaluating the bony structures, such as in the case of vertebral hemangiomas. MRI, on the other hand, provides better soft tissue contrast and can help differentiate between benign and malignant tumors.Overall, the DWI and Dixon techniques offer several advantages in magnetic resonance imaging, including improved detection of diseases, improved visualization of structures, can help distinguish between benign and malignant tumors and provide information about tumor cellularity and aggressiveness. These techniques have the potential to improve the accuracy and efficiency of MRI and enhance patient care.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction; II. Imaging Modalities; III. Mechanical Causes; IV. Infectious Lesions of the Spine; V. Inflammatory Causes; VI. Vascular; VII. Miscellaneous; IX. Conclusion.

#### MKEE-80 **Imaging Review of Knee Ligament Reconstructions Other Than the ACL**

Participants

Thurl Hugh Cledera, MD, Taguig, Philippines (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Knee ligament injuries are common and operative techniques are continually evolving. Accurate clinical information along with imaging diagnosis aids in selection of the appropriate operative technique. While imaging features of anterior cruciate ligament (ACL) reconstruction are well-described in literature, data on indications, postoperative imaging findings and complications of reconstructions of other ligaments of the knee are limited. In this education exhibit, we discuss the imaging findings and complications of reconstructions of knee ligaments other than the ACL.The objectives of this education exhibit are:1. Recognize normal radiographic and MR appearing of non-ACL ligament reconstructions 2. Understand the basic operative concepts and techniques for each type of reconstruction including indications and common grafts used 3. Recognize commonly encountered postoperative complications to aid in providing a precise and meaningful radiologic report

#### TABLE OF CONTENTS/OUTLINE

TECHNICAL CONSIDERATIONS •Conventional radiographs •Stress radiographs•Pre and postoperative MRI BASIC INDICATIONS AND NORMAL RADIOGRAPHS AND MRI OF THE FOLLOWING PROCEDURES Posterior cruciate ligament (PCL) reconstruction Posterolateral corner reconstruction •Laprade technique •Andrews technique •Lemaire technique Anterolateral knee reconstruction •Lateral extra-

articular tenodesis (LET) •Anterolateral ligament (ALL) reconstruction Posteromedial corner reconstruction Medial patellofemoral ligament (MPFL) reconstruction Multiligament reconstruction COMPLICATIONS •Graft failure •Malpositioned graft •Femoral and/or tibial tunnel widening •Arthrofibrosis •Graft impingement

### **MKEE-81 Radiographs and MRI of Tendon and Ligament Surgeries: A Resident's Primer**

Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Radiodense hardware such as in metallic fixation and arthroplasties are easily evaluated on radiographs by both trainees and nontrainees alike. On the other hand, surgeries that utilize mostly radiolucent or nonmetallic components such as tendon transfer, ligament reconstruction and other soft tissue procedures may be more challenging to assess, especially by trainees. These procedures may manifest with nodular or tubular lucencies that may be mistaken for cysts, infection or tumors.??In this education exhibit, we provide a concise review or "pocket guide" of normal and abnormal imaging appearance of commonly encountered soft tissue procedures to aid the radiology resident/trainee in appropriate assessment of non-radiodense operative hardware. ??The objectives of this education exhibit are: ?1. Recognize normal radiographic appearance of commonly encountered non-radiodense operative hardware ?2. Understand the basic operative concepts and indications of these soft tissue procedures?3. Recognize radiographic and basic MR appearance of complications of these soft tissue procedures?

#### **TABLE OF CONTENTS/OUTLINE**

For each procedure, the following will be discussed: PROCEDURE: INDICATIONS: RADIOGRAPHS: MRI: COMPLICATIONS: SHOULDER Rotator cuff repair Biceps tenodesis Anterior stabilization ELBOW UCL reconstruction Distal biceps repair WRIST and HAND Volar oblique ligament reconstruction Thumb UCL reconstruction KNEE ACL reconstruction MPFL reconstruction Patellar tendon transfer ANKLE Tendon transfer procedures Lateral ligament reconstruction

### **MKEE-82 Utilizing Dual Energy CT for Evaluating Gout: A Review of Imaging Artifacts and Pitfalls for Trainees to Avoid**

#### **TEACHING POINTS**

Discuss the basics of dual-energy CT (DECT) technology and its current clinical application in the detection of gout. Demonstrate typical imaging findings of gout on DECT. Review imaging artifacts commonly seen when utilizing DECT gout protocol, including those related to keratin, metallic objects, and image noise. Explore additional pitfalls for trainees to avoid including the physiologic deposition of monosodium urate in various tissues. Understand techniques to minimize DECT artifacts.

#### **TABLE OF CONTENTS/OUTLINE**

Epidemiology and clinical presentation of gout, a crystal arthropathy caused by the deposition of monosodium urate (MSU) crystals Typical imaging findings of gout on radiography, conventional CT and MRI Physics of DECT and its clinical application for the evaluation of gout Reviewing artifacts causing misregistration of non-MSU crystals as gout: Keratin: Nailbed keratin and skin callous Metallic objects: Foreign bodies, CT table and orthopedic hardware including intervertebral disc spacer material Image noise: Quantum mottle causing image noise artifact with incorrectly-labeled submillimeter foci of MSU crystals Additional miscellaneous pitfalls for trainees to avoid: Limitations of DECT for evaluating chronic gout Physiologic deposition of MSU crystals in non-gout patients Troubleshooting and minimizing DECT artifacts Physiologic deposition of MSU crystals in non-gout patients Troubleshooting and minimizing DECT artifacts

### **MKEE-83 CUP - A Novel Comprehensive Classification System for Triangular Fibrocartilage Complex Lesions**

Participants

Jan Grunz, MD, Wuerzburg, Germany (*Presenter*) Research Consultant, Siemens AG

#### **TEACHING POINTS**

The classifications of Palmer (1989) and Atzei/Luchetti (2011) constitute the current standard to characterize lesions of the triangular fibrocartilage complex (TFCC). However, both systems have substantial drawbacks that limit clinical applicability. The Palmer classification does not discern between the foveal and styloid insertions of the radioulnar ligaments, which is essential for treatment, while differentiating between traumatic and degenerative lesions is often not feasible. In contrast, the Atzei classification focuses exclusively on the ulnar-sided periphery. Several less common lesion types are not included in either system. These limitations motivated us to develop a new comprehensive and clinically-oriented classification for lesions of the TFCC. In the proposed system, the acronym 'CUP' refers to central lesions (C) limited to the articular disc, ulnar lesions (U) affecting the insertions of the radioulnar ligaments, and peripheral lesions (P), which comprise injuries of the ulnocarpal meniscus and ligaments, the dorsal joint capsule, and the extensor carpi ulnaris tendon sheath. Each group is subdivided into three grades of severity with adequate treatment recommendations.

#### **TABLE OF CONTENTS/OUTLINE**

1. TFCC anatomy 1.1 Biomechanical properties 1.2 Vascularization 2. Imaging 2.1 MRI with and without intravenous contrast enhancement 2.2 CT and MR arthrography 3. Lesion types 3.1 Central lesions 3.2 Ulnar lesions 3.3 Peripheral lesions 3.4 Combinations with fractures and avulsion injuries 4. Therapy 4.1 Surgery versus conservative treatment 4.2 Overview of surgical procedures 5. Discussion

### **MKEE-84 There's Light at the End of the Carpal Tunnel - But is it a Good Thing**

Participants

Jan Grunz, MD, Wuerzburg, Germany (*Presenter*) Research Consultant, Siemens AG

#### **TEACHING POINTS**

Constituting the most common entrapment neuropathy by far, carpal tunnel syndrome (CTS) is caused by compression of the median nerve within a narrow passage on the palmar side of the wrist. The carpal tunnel is located beneath the transverse carpal ligament and extends from the scaphoid and trapezium to the hamate and pisiform bone. Containing the deep and superficial flexor tendons in addition to the median nerve, entrapment neuropathy can occur in case of mismatches between the tunnel's size and



the volume of its contents. CTS patients typically report painful paresthesia of digits I-III with aggravation at night, when provoked by tapping the median nerve at the carpal tunnel entrance (Hoffmann-Tinel sign), and when flexing the wrist (Phalen test). Chronic CTS results in atrophy of the thenar muscles with limited opposition and abduction of the thumb. Among several causes, tenosynovialitis of the flexor tendons is the most frequent. While CTS is usually diagnosed in clinical and electrophysiological examinations, radiologists can provide valuable insights by performing cross-sectional measurements and qualitative assessment of the edematous nerve structure in ultrasound and MRI. Particularly if symptoms persist after carpal tunnel release surgery, both imaging methods are of great importance.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of the carpal tunnel 2. Imaging techniques 2.1 Ultrasound 2.2 MRI with and without i.v. contrast enhancement 3. Pathophysiology of CTS 3.1 Tenosynovialitis 3.2 Congenital anatomical variants 3.2 Bony stenoses 3.4. Tumors 4. Postoperative imaging 5. Discussion

#### **MKEE-85 The Many Faces of Heterotopic Ossification: Pathogenesis, Imaging Features and Differential Diagnosis**

Participants  
Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Three requisites stand out for heterotopic ossification (HO) formation: osteogenic precursor cells, multiple inducing factors and pertinent biochemical signaling pathways, a favorable microenvironment.
- Recent evidence suggests that the initiation of HO particularly necessitates local hypoxia in the microenvironment.
- Heterotopic ossification is a commonly encountered condition on imaging with characteristic—if not pathognomonic—findings involving musculoskeletal soft tissues such as muscles, ligaments, and tendons.
- A host of differential diagnostic possibilities need to be considered when there is concern for heterotopic ossification.

#### TABLE OF CONTENTS/OUTLINE

- Pathophysiologic background of HO.
- Case examples of various manifestations of HO on imaging with pearls and pitfalls (e.g., myositis ossificans [traumatic, neurogenic], periostitis ossificans, arachnoiditis ossificans, panniculitis ossificans, Pellegrini-Stieda lesion [HO of the medial collateral ligament of the knee], HO of the posterior longitudinal ligament [OPLL] or nuchal ligament, Bennett lesion [HO of the posterior band of the inferior glenohumeral ligament], other enthesal ossifications [diffuse idiopathic skeletal hyperostosis], tendon ossifications [Achilles, hip abductors, rotator cuff], fibrodysplasia ossificans progressiva).
- Differential diagnostic considerations for HO on imaging (e.g., calcific tendinitis, calcific periarthritis, dystrophic calcifications, extraskeletal bone tumors, synovial sarcoma, calcinosis cutis, calcinosis of chronic renal failure).

#### **MKEE-86 Spectrum of Calcaneal Tumors and Tumor-like Lesions: Imaging Findings with Pathological Correlations**

#### TEACHING POINTS

1. Lipomas can be distinguished from simple bone cysts based on central dystrophic calcification, particularly with fat necrosis and cyst formation. 2. An associated primary bone lesion should always be considered in older patients with aneurysmal bone cyst-like changes. The differential diagnosis can be narrowed down using a combination of imaging features (lesion components, location) and clinical information (age). 3. The age for some calcaneal tumors is different from tumors in other locations. This makes it difficult to differentiate between chondroblastomas, characterized by marginal sclerosis and calcifications, and giant cell tumors (GCTs). 4. The tumor matrix pattern should be emphasized. A stippled or ring-like pattern indicates cartilage calcification, cloud-like appearance indicates osteoid mineralization, and a ground-glass density indicates fiber matrix. 5. Age needs to be considered in solid tumors with non-specific imaging features. Enchondromas, chondrosarcomas, metastatic tumors, myelomas, lymphomas, and undifferentiated pleomorphic sarcomas are common in adults, whereas, GCTs, chondroblastomas, osteosarcomas, Ewing sarcomas, and Langerhans cell histiocytosis are more common in young individuals.

#### TABLE OF CONTENTS/OUTLINE

1. Chondroblastoma 2. Chondromyxoid fibroma 3. Secondary peripheral atypical cartilaginous tumor 4. Chondrosarcoma 5. Osteoid osteoma 6. Osteosarcoma 7. Hemangioma 8. Epithelioid hemangioendothelioma 9. Aneurysmal bone cyst 10. Giant cell tumor 11. Simple bone cyst 12. Fibrous dysplasia 13. Lipoma 14. Undifferentiated pleomorphic sarcoma 15. Metastases 16. Myeloma 17. Primary lymphoma 18. Ewing sarcoma

#### **MKEE-87 Discordance Between Bone Mineral Density and Trabecular Bone Scores for the Lumbar Spine in the Setting of Intra-Abdominal Calcifications and Dense Surgical Materials**

#### TEACHING POINTS

Spinal vertebrae contain the most metabolically active components, and they are therefore commonly the first site to manifest the osteoporotic process. Calcifications (i.e., fibroids, vascular calcifications, and degenerative joint disease) and dense surgical material (i.e., vertebroplasty, stents, embolization coils, and IVC filters) within the field of view falsely elevate bone mineral density (BMD) measurements. To mitigate such artifactual elevation of BMD measurements, the International Society of Clinical Densitometry (ISCD) has come up with guidelines for BMD reporting such as excluding affected vertebrae from analysis. Trabecular Bone Score (TBS), on the other hand, is a novel tool for assessing fracture risk by analyzing bone trabecular microarchitecture. Despite being adherent to ISCD guidelines, we have found in clinical practice that many patients with intra-abdominal calcifications and surgical material have normal lumbar spine BMD measurements but low TBS scores. These inconsistencies suggest that the utilization of DXA BMD measurements alone may under-predict fracture risk, especially in patients with calcifications or surgical material, and that TBS may be especially helpful as an adjunct to DXA in this patient population.

#### TABLE OF CONTENTS/OUTLINE

1. Fundamentals of DXA. 2. Pathophysiology of osteoporosis. 3. Fundamentals of TBS. 4. Limitations of DXA in the setting of intra-abdominal calcifications and surgical material. 5. Case comparisons of DXA and TBS scores to demonstrate discordances. 6. Conclusion.

## **MKEE-88 Peripheral Arthropathies: Step by Step**

Participants

Raquel Acosta Hernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Introduction: Despite the development of CT and MRI, plain radiography stands as the irreplaceable test of first diagnostic approach in peripheral arthropathies. Following a complete diagnostic algorithm helps to emphasize the key points in the differential diagnosis between inflammatory versus osteoarthritis disease. Once joint space narrowing is evaluated, the presence of bone erosions (as a hallmark of joint inflammatory arthritis in ankylosing spondylitis, psoriatic arthritis, and reactive arthritis), osteophytes (typical of degenerative arthritis), and their distribution are basic pillars on guiding an accurate diagnosis. Teaching points Approach the radiographic algorithm evaluation of peripheral arthropathies based on classification into inflammatory or degenerative pattern: joint space narrowing (uniform and non-uniform), bone erosion and distribution pattern. Introduced a systematic reading of hands and feet plain radiographs following the ABCDs acronym: articular, bone, cartilage, distribution and soft tissue. Correlate typical plain radiographic of peripheral arthritis findings with CT and MRI studies.

### **TABLE OF CONTENTS/OUTLINE**

- Radiographic algorithm evaluation of peripheral arthropathies based on joint space narrowing and typical examples of articular erosions patterns.- Systematic ABCDs acronym reading: articular (deformity and destruction), bone (erosion, osteopenia, proliferative changes and distal affectation), cartilage, distribution and soft tissue (soft tissue swelling).

## **MKEE-89 Imaging Findings of Monoclonal Gammopathy of Clinical Significance**

Participants

Anika Dutta, MD, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Monoclonal Gammopathy of Clinical Significance (MGCS) describes a constellation of diseases involving clonal B cells or plasma cells which produce monoclonal proteins and cause organ damage. MGCSs can be divided into groups based on which organ systems are most affected. Some of these entities have distinct imaging findings that suggest the diagnosis. By the end of this education exhibit, the viewer should be able to identify those findings and clinical symptoms that characterize them. Recognizing these findings may help lead to an expedited and accurate diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction - what is MGCS? 2. MGCS definition and symptom classes 3. Detailed description of syndromes, for example: -POEMS syndrome (polyradiculoneuropathy, organomegaly, endocrinopathy, monoclonal plasma cell disorder, and skin changes): Description, Imaging findings with case example -AL Amyloid: Description, Imaging findings with examples 4. Conclusions 5. References

## **MKEE-9 Patellofemoral Dysfunction: A Practical Approach and New Radiological Insights**

Participants

Lucas Bettin, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Patellofemoral dysfunction occurs as a result of an imbalance in the dynamic relationship between the patella and the trochlea during knee flexion, secondary to anatomical or functional abnormalities. Classic risk factors are usually limited to local anatomy, such as trochlear dysplasia, patella alta, patellar tilt and increased TT-GT distance. Recently, new concepts on the functional evaluation of the lower limbs and their relationship with the pelvis have earned more attention, including muscle function. Imaging of the patellofemoral joint includes standard radiographs of the knee to evaluate bone morphology and patellofemoral relationship. MR imaging is important to also assess cartilage, capsule and ligaments. For preoperative planning, computed tomography can assess the knee in different degrees of flexion, besides providing multiplanar reconstructions. The evaluation of the entire mechanical axis of the lower limb is also of fundamental importance. Findings such as the anterior tilt of the pelvis, femoral or tibial torsion abnormalities, increased femorotibial rotation and deviations of the mechanical axis significantly modify the dynamics of the extensor mechanism. Clinical treatment and physiotherapy are typically the first-line approach, taking into account the particularities of the mechanical axis. Surgical intervention is indicated for recurrent dislocations. Therefore, anatomical and functional concepts of the patellofemoral joint and the entire lower limb are necessary to determine the optimal treatment.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction; 2. Anatomy biomechanics; 3. Dysfunction vs. instability; 4. Radiological approach; 5. Beyond Dejour; 6. Conclusion.

## **MKEE-90 What's New and Not So New in Postoperative MRI of Rotator Cuff Tendon Repair: Conventional and New Surgical Techniques, Normal and Abnormal Postoperative Findings**

Participants

Yeongseo Yoo, MD, Hwaseong, Korea, Republic Of (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To review conventional techniques for rotator cuff tendon (RCT) repair, including correlation with postoperative MRI findings 2. To introduce newer techniques of RCT repair with MRI correlation 3. To diagnose normal and abnormal postoperative MRI findings of RCT repair, including complications and RCT repair failures

### **TABLE OF CONTENTS/OUTLINE**

I. Surgical techniques on postoperative MRI of RCT repair A. Conventional suture techniques (single, double row, transosseous equivalent suture bridge) B. Newer techniques- Augmentation, pectoralis major transfer, biceps transfer, Polyglycolic acid insertion, allograft patch graft (fascia lata, dermis), biceps splinting, Others (biceps tenotomy, deltoidoplasty) II. Normal postoperative MRI findings 1. MR appearance of repaired SST tendon (SI, morphology changes, gap) - thinning, high SI (Sugaya type I, II -Sugaya classification) 2. Significance of fluid collections: glenohumeral joint, subacromial-subdeltoid bursa, subcoracoid bursa 3. Susceptibility artifacts (air, anchor, metal from burr) 4. Suture anchor positions: absorbable vs. non-absorbable 5. Rotator interval

change: arthroscopy portal III. Abnormal postoperative MRI findings 1. Thinning of repaired tendon (Sugaya type III) 2. Focal defect/minor discontinuity of repaired tendon (Sugaya type IV) 3. Major discontinuity/full thickness tear with retraction (Sugaya type V) 4. Displacement of anchors 5. Infection (arthritis, bursitis, soft tissue infection) 6. Fracture

### **MKEE-91 The Key Determinant of Purely Lytic Diaphyseal Lesion Visibility on Radiographs: Exclusively Trabecular Versus Concurrent Endosteal Cortical Involvement**

Participants

Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Location of a lytic lesion within a long bone (i.e., metaphyseal versus diaphyseal; trabecular versus cortical involvement) is a key determinant of the lesion's conspicuity on conventional radiographs.
- Due to the sparseness of trabeculae at diaphysis, lytic diaphyseal bone lesions without matrix mineralization are visible on radiographs only if they involve the endosteal cortex.
- The oft-repeated statement that "30%-50% of trabecular bone must be removed before radiolucency becomes visible on radiographs" can be misleading: A large diaphyseal trabecular lytic lesion involving 100% of the cancellous bone may not be visible on radiographs, if it is confined to the medullary space and does not also involve at least the endosteal surface of the cortex—constituting a major limitation for conventional radiography.
- This is true for lytic lesions of all Lodwick grades: Moth-eaten or permeative lytic bone lesions that involve the diaphysis are not be visible on radiographs at sites where they spare the cortex.
- Such lytic lesions that are obscure on conventional radiography are readily detected on MRI; when a primary bone tumor is suspected and radiographs are negative, MRI is appropriate.

#### **TABLE OF CONTENTS/OUTLINE**

- The modified Lodwick classification of lytic bone lesions on conventional radiographs.
- Radiographic/anatomic explanation of the crucial role the location plays in lytic lesion conspicuity on radiography at different sites (i.e., metaphyseal versus diaphyseal; trabecular versus trabecular plus cortical) on anatomic specimens.
- Case examples of lytic lesions that are obscure on conventional radiographs (due to their diaphyseal medullary space involvement) but are visible on CT or MRI.

### **MKEE-92 Ultrasound of Acute Tendon Tears with Emphasis on Anatomic Landmarks**

Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Ultrasound of acute tendon tears with emphasis on anatomic landmarks Sonography has become an essential imaging tool in musculoskeletal imaging, with precision nearly equal to that of MRI for imaging tendon abnormalities. In emergency setting, the rarity of acute tendon tears compared to overuse tendon abnormalities may result in a challenging scan for trainees, sonographers, emergency and musculoskeletal radiologists. In this education exhibit, we present an approach to sonography of acute tendon tears that may be encountered in the emergency or radiology department. The objectives of this educational exhibit are: Brief review of scanning techniques of the various tendons Recognize the normal appearance of the outlined tendons with MRI correlation and emphasizing important anatomic landmarks Recognize imaging presentation of the various traumatic tendon tears

#### **TABLE OF CONTENTS/OUTLINE**

For each structure, the following will be discussed:1. US scanning technique2. US anatomy and landmarks with MRI correlate3. Pathology (strains, partial, complete tears)Pectoralis Distal biceps Triceps Quadriceps Hamstrings Achilles tendon and related structures

### **MKEE-93 A 360-degree Imaging Tour of Sports Injuries in the Elbow**

Participants

Lauren Pringle, MD, Columbia, MO (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Review of anatomy of the elbow, with detail of the ulnar collateral ligament bundles and bands of the anterior bundle.
2. Phases of throwing mechanism are important in understanding forces applied to different structures of the elbow and how injuries then develop.
3. Pediatric throwers are susceptible to injuries also seen in adults but can experience additional injuries seen only during certain phases of development.
4. Medial elbow injuries are among the most common and well-known in athletes but specific injuries in the posterior elbow, lateral elbow, and anterior elbow are not infrequent and will be described.
5. Illustrative cases of these injuries demonstrate important imaging findings and diagnostic tools to improve detection for learners.
6. Treatment/surgical strategies and the surgeon's perspective will also be reviewed for some of these conditions.

#### **TABLE OF CONTENTS/OUTLINE**

1. Anatomy review
2. Throwing mechanism and stresses
3. Medial elbow injuries
  - a. Ulnar collateral ligament
  - b. Medial epicondylitis
  - c. Medial epicondylar apophysitis
  - d. Ulnar neuritis
  - e. Posteromedial impingement syndrome
4. Posterior elbow injuries
  - a. Olecranon stress fractures
  - b. Triceps
  - i. Tendon
  - ii. Muscle
  - c. Snapping triceps
5. Lateral elbow injuries
  - a. Panner's disease
  - b. Capitellum osteochondral lesion
  - c. Tennis elbow
6. Anterior elbow injuries
  - a. Biceps
  - b. Brachialis

### **MKEE-94 Image-guided Symphyseal and Perisymphiseal Musculoskeletal Interventions: Indications, Challenges and Authors' Experience**

Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Image-guided musculoskeletal interventions in and about the symphysis pubis can be technically challenging. The joint and surrounding region are small, resulting in limited ability to maneuver and an often cumbersome procedure. Important neurovascular and visceral structures are present nearby, including the dorsal vessels of the penis in males, pudendal nerve, branches of the ilioinguinal nerve and urinary bladder, necessitating judicious pre-procedure planning. Lastly, most procedures require inguinal or

groin exposure thereby making careful draping of the pelvis of paramount importance. The main benefits of image guidance are improved precision of needle placement and simultaneous visualization of the needle and critical neurovascular structures that must be avoided during needle insertion. In this education exhibit, we provide an overview of symphyseal and perisymphyseal interventions including injections, aspirations, percutaneous tendon treatments and biopsies, their indications, risks, and complications, focusing on approaches, tips and tricks to a successful procedure.

#### TABLE OF CONTENTS/OUTLINE

Relevant anatomy of the symphysis and parasymphyseal spaces  
Pre-procedural considerations  
General technical considerations  
For each specific procedure, the following will be outlined: Purpose, patient position, equipment, technique, anatomic considerations (critical structures to avoid)  
Specific procedures: Fluoroscopy-guided diagnostic injection  
US and fluoroscopy-guided therapeutic injection  
US and fluoroscopy-guided joint and soft tissue aspiration  
Percutaneous tendon treatments  
US and CT-guided bone biopsies

#### MKEE-95 Solitary Bone Metastasis: Multimodality Imaging Approach and Ten Years Experience

Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To analyze the radiological presentation and spectrum of solitary bone metastasis (SBM) through the different techniques: plain x-ray, Computed Tomography (CT), Magnetic Resonance imaging and Positron Emission Tomography/CT (PET/CT).  
-To present our ten year experience in two centers.

#### TABLE OF CONTENTS/OUTLINE

Metastatic bone disease occurs frequently in malignant tumors, but isolated involvement is unusual and has been proposed as a favorable prognostic factor against multiple bone metastatic involvement. This study aims to analyze the radiological presentation of these unique metastasis. We reviewed all bone metastases diagnosed in the last 10 years in two centers and we included patients with SBM with histological confirmation and no visceral, brain or lymph node metastases (n= 79). The primary tumors, in order of frequency, were lung, breast, prostate and melanoma. In up to 36% of SBM, the primary tumor was unknown at the time of diagnosis. 86% of the lesions were located in the spine, pelvis or femur. The most frequent radiological and clinical presentation was osteolytic lesion without periosteal reaction (75%) causing pain (42%). 68% were treated, mostly with radiotherapy. The detection of these lesions depends on their size, so the methods of choice are MR or PET/CT, with good correlation for the evaluation of the associated soft tissue mass component. In the presence of a solitary bone lesion, metastasis should be included in the differential diagnosis along with primary bone tumors, especially osteolytic lesions in patients older than 40 years with or without cancer disease history. Radiologists should be aware of the characteristics of suspicious malignant lesions that would require biopsy.

#### MKEE-96 Musculoskeletal Paraneoplastic Syndromes

#### TEACHING POINTS

Early recognition of a paraneoplastic syndrome allows for diagnosis of an occult malignancy, and earlier treatment. This review describes unique imaging findings and clinical associations of musculoskeletal paraneoplastic disorders.  
1. Oncogenic osteomalacia is associated with phosphaturic mesenchymal tumors (PMT), which produces FGF23, leading to decreased calcium/phosphate absorption, and consequently insufficiency fractures.  
2. Secondary hypertrophic osteoarthropathy, associated with non-small cell lung cancer, manifests with digital clubbing or joint effusions and symmetric long bone periostitis.  
3. Cancer-associated myositis, most commonly dermatomyositis, occurs within 3 years of the diagnosis of an underlying malignancy.  
4. Palmar fasciitis and polyarthritits presents with painful hand swelling and palmar skin thickening. It is associated with breast and female genitourinary malignancies.  
5. Remitting seronegative symmetric synovitis with pitting edema presents with nonerosive polyarthritits and is associated with hematopoietic and lung malignancies.  
6. Pancreatic panniculitis with polyarthritits, associated with pancreatic neoplasms, shows osteolytic lesions of the distal extremities with increased periarticular edema and synovitis on MRI.  
7. Sweet Syndrome, associated with acute myeloid leukemia, presents with fever and erythematous skin lesions.  
8. Eosinophilic fasciitis presents with fascial edema and enhancement, and is associated with hematologic malignancies.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Musculoskeletal Paraneoplastic Syndromes including malignant associations, clinical manifestations, and imaging features.

#### MKEE-97 Principles, Anatomy and Imaging of Ankle and Foot Tendon Transfers

Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goals of any tendon transfer are to create a stable, functioning, and plantigrade foot. Tendon transfers were reported first in the literature as early as 1881; the first case was transfer of peroneal tendons to the Achilles in a young patient who had poliomyelitis. With the eradication of polio in developed countries, experience with a variety of tendon transfers has been lost. Aside from correction of foot deformities, tendon transfer can be performed for tendon dysfunction and tendinopathy and correction of lateral ankle instability. In this education exhibit, we discuss common foot and ankle tendon transfers highlighting principles, anatomy and imaging.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and biomechanics of ankle tendon transfers  
Principles of tendon transfers  
Types of ankle tendon transfers:  
1. For correction of foot deformity  
PTT transfer for adult acquired flatfoot deformity  
Extensor tendon transfer for equinovarus deformity  
Peroneus longus to peroneus brevis tendon transfer for Charcot-Marie-Tooth disease  
2. For reinforcement of a diseased tendon (tendinopathy or tendon tear)  
FHL transfer for Achilles tendon  
FHL transfer for peroneal tendons  
FDL transfer for tibialis posterior tendon  
3. For correction of lateral ankle instability  
Lee procedure  
Evans procedure  
Chrisman Snook procedure  
Ancillary osseous (i.e. calcaneal osteotomy) and soft tissue (i.e. Achilles tendon lengthening) procedures

#### MKEE-98 Cricket is Coming; Are You Ready to Image

## TEACHING POINTS

1. Cricket is one of the fastest growing sports in the world, with popularity growth in non-traditional cricketing nations like the United States and continental Europe. 2. Understanding player roles and biomechanics is key to understanding common injury patterns.

## TABLE OF CONTENTS/OUTLINE

From starting in south east England in the 1600s and traditionally played in the Commonwealth countries, played over 5 days with a rest day to the current 100 ball and 20 over three to four hour formats with night games, entertainment value, advertisement, immigration, universal online access and money spinning leagues have resulted in unprecedented growth in popularity of cricket across the world. In the United States alone, from 30,000 people watching/playing cricket in 2006, there are now more than 200,000 people playing cricket in over 6000 teams. The Indian premier league (IPL) is the most popular league, and had a value of \$10.9 billion in 2022. Specific player roles actions in cricket predispose them to different injury patterns. This exhibit provides a comprehensive overview of common cricketing injuries based on player role actions. The three basic roles in cricket are batting, bowling and fielding, each with sub specializations. Fast/medium pace bowlers are most prone to injuries in the spine (pars/pedicle stress), elbow, ankle (instability, posterior impingement), abdominal wall (side strain) and groin (athletic pubalgia) due to the nature of bowling action. Batsmen and fielders are prone to hamstring and quadriceps strains due to sudden sprints. Acrobatic fielding attempts diving result in shoulder injuries. Contact injuries of the fingers like dislocations fractures are common in the wicketkeeper and fielders.

## MKEE-99 Microinstability in the Musculoskeletal System: Biomechanical Concepts to Imaging Interpretation

Participants

Aurea Mohana-Borges, MD, MSc, (*Presenter*) Nothing to Disclose

## TEACHING POINTS

To introduce joint biomechanics as a guide for imaging interpretation of microinstability, emphasizing its relationship with osseous and soft tissue (capsule, ligaments, and muscles) integrity and the role of imaging [Radiographs (Rx), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI)] in its diagnosis. This guide will highlight anatomic landmarks implicated in joint stability, their relevance in different types of synovial joints, and implications in joint biomechanics. It will compare and contrast normal anatomy with examples of commonly encountered pathologies associated with microinstability.

## TABLE OF CONTENTS/OUTLINE

Explanation of the concept of microinstability. Demonstration of types of movements in different synovial joints. Demonstration of normal anatomy of joint stabilizers with Rx, CT, and MRI. Examples of microinstability with corresponding commonly encountered pathologies in the osseous structure and soft tissues, with emphasis on the shoulder, hip, knee, and ankle joints.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MKEE-1

### Imaging-Guided Perineural Injections of the Lower Extremity from the Pelvis to the Foot

#### Participants

Tanya L. Tivorsak, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Perineural injections can be performed under CT or ultrasound guidance for diagnostic and therapeutic purposes. 2. Ultrasound guidance can be used for peripheral nerve injections as peripheral nerves can be localized well on ultrasound and with real-time guidance. 3. CT guidance can be used for certain perineural injections such as in the pelvis that may be difficult to visualize under ultrasound. 4. This exhibit will provide a guide for injecting certain nerves that are commonly requested at our institution.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction and indications for perineural injections - relieve nerve pain, pinpoint site of potential nerve injury prior to nerve surgery. 2. Procedure preparation - pre-procedure imaging review (MR neurography), ultrasound transducers, needle size, and volume of injectant. 3. Technique for injecting certain nerves from the pelvis to the foot including lateral femoral cutaneous, pudendal, genitofemoral, sciatic and piriformis muscle, saphenous (adductor canal), common peroneal, sural, superficial peroneal, and tibial nerves. 4. Risks and complications. 5. Overview of cryoneurolysis application and techniques.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MKEE-10

### Out of Shape: Musculoskeletal Manifestations of Sickle Cell Disease

#### Participants

Leonardo Kazunori Tsuji, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the main aspects related to musculoskeletal findings of sickle cell disease, including etiology, pathophysiology, epidemiology, clinical classification. 2. To illustrate the main imaging findings and how to assess this condition in a multimodality approach, focusing on radiographs, CT and MRI studies, including new concepts and advanced sequences.

#### TABLE OF CONTENTS/OUTLINE

1. Review the main aspects related to musculoskeletal findings of sickle cell disease, including etiology, pathophysiology, epidemiology, clinical classification. 2. Clinical and imaging findings in a multimodality approach, focusing on radiographs, CT and MRI studies. 3. Musculoskeletal findings of sickle cell disease, as microcirculation or anemia related, and major complications (including septic arthritis and osteomyelitis). 4. Bring the most updated concepts of the disease and the imaging role, including advanced MRI sequences, involving diagnosis and patient care.

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## Abstract Archives of the RSNA, 2023

MKEE-100

### Energy Spectrum CT Application: Analysis of Changes in Bone Density of Vertebral and Paravertebral Muscle Composition Before and After Kidney Transplantation

#### TEACHING POINTS

1) To illustrate most patients with chronic kidney disease before and after renal transplantation have abnormal mineral and bone metabolism due to chronic kidney disease-mineral bone disorder (CKD-MBD). 2) To illustrate energy spectrum CT can quantify vertebral bone mineral density and paravertebral tissue composition through base material separation. 3) To demonstrate energy spectrum CT can apply the separation and quantitative analysis of base substances to provide more data for clinical treatment.

#### TABLE OF CONTENTS/OUTLINE

1) The abnormal bone metabolism and the changes of paravertebral constitution components caused by CKD-MBD before and after kidney transplantation. · Long term dialysis treatment and drug treatment may cause abnormal bone loss and paravertebral component changes. · The bone mass of renal transplant recipients decreased rapidly within 1 year after transplantation. 2) Accurate and flexible analysis of basic substances by energy spectrum CT. · Energy spectrum CT can quickly switch between high and low energies (80/140kVp) to obtain the two energies of the substance, so as to separate the base substance. · Base material separation: Hydroxyapatite (HAP) is the main similar component of bone in the vertebral body. · A variety of energy attenuation and image quality pictures are generated under different keV. 3) More imaging information at low radiation dose. · Energy spectrum CT (80/140kVp) fast switching scanning, lower radiation dose. · Energy spectrum CT plain scan mono energy diagram: base material pair analysis at 70keV for HAP (water), HAP (fat), calcium (water) to obtain vertebral bone density, and muscle (fat) analysis to obtain paravertebral muscle composition.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

MKEE-101

### Rewriting the story back: Spondyloarthritis

#### Participants

Sara Siguenza-Gonzalez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Bone marrow edema (BME) is the key requirement for a “MRI positive of sacroiliitis” in the Assessment of Spondyloarthritis international Society (ASAS). The radiologist should be careful when applying the ASAS classification criteria, because BME could also be found in early mechanical and degenerative changes, which are much more common than inflammatory disorders. Knowing the type of BME pattern, other radiological features (bone erosion, ankylosis or the spine disease), as well as the clinical picture, increase radiologists diagnostic confidence and reduce overdiagnosis of inflammatory sacroiliitis.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and biomechanics of the Sacroiliac Joints (SIJs) and Spine. Including anatomical variants and pitfalls. Some clues to difference between mechanical issues and inflammatory disorders. Subchondral BME in the SIJs is a common finding in both entities, so radiologists should be careful when interpreting. Recognise principal features of spondyloarthritis in the main radiological techniques (Rx, TC, MRI and also with new techniques). Describe and illustrate general features and typical image findings in the spondyloarthritis: Ankylosing Spondylitis (AS), Psoriatic Arthritis (PsA), Reactive Arthritis (RA), enteropathy-associated arthritis and undifferentiated spondylitis. Common pitfalls and differential diagnosis with other diseases that affect the axial bone: infection, amiloidosis, tumors, DISH and traumatism.

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## Abstract Archives of the RSNA, 2023

MKEE-102

### Deep Learning Imaging Reconstruction Based Virtual Non-calcium Image Can Improve the Bone Metastasis Detection Compared with Conventional CT, Hybrid IR Based Virtual Non-calcium Image

#### Participants

Hirotaaka Nakashima, MSc, RT, Sapporo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Deep learning imaging reconstruction (DLIR)-based virtual non-calcium (VNCA) images were created by two-material decomposition processing based on dual-energy acquisition using a fast kV switching method. 2. Compared the diagnostic performance of DLIR-based VNCA images with conventional CT in 57 patients with clinically confirmed bone metastasis. 3. Compared the diagnostic performance of DLIR-based VNCA images with hybrid IR-based VNCA images. 4. DLIR-based VNCA images were superior to the diagnostic performance of conventional CT and Hybrid IR-based VNCA images.

#### TABLE OF CONTENTS/OUTLINE

Bone metastasis is a possible disease of all carcinomas and reduces the quality of life of patients. Since CT can detect bone calcification sensitively, it is excellent in diagnosing bone metastasis with bone destruction, but bone metastasis without bone destruction is difficult to diagnose and has a problem that it is easy to overlook. Virtual non-calcium image (VNCA) is one of the material decomposition images created by dual energy CT, which is also a density image obtained by emphasizing the water component and removing the calcium component. While previous studies have reported that VNCA images are superior in detecting bone metastases, DLIR-based VNCA images offer better discrimination of metastatic lesions due to their noise reduction effect. In this exhibition, we compared the diagnostic performance of DLIR-based VNCA images with that of conventional CT and hybrid IR-based VNCA images. The results show that DLIR-based VNCA images have a higher discrimination ability than conventional images for bone metastasis.

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## Abstract Archives of the RSNA, 2023

MKEE-103

### **Osteoid Osteoma in Small Bones of Hands and Feet: 'Not' So Common with 'Not' So Small Challenges in RF Ablation**

#### **TEACHING POINTS**

1. Osteoid osteomas are benign painful lesions usually seen in the long bones. Less commonly they may be seen in the small bones of hands and feet especially in the pediatric age group. 2. They have typical imaging features on MRI and CT which are diagnostic. 3. RF ablation is the recommended treatment for osteoid osteomas and are regularly done. However, the small size of the bones results in challenges that can be dealt with by using some modifications.

#### **TABLE OF CONTENTS/OUTLINE**

Osteoid osteomas are common benign tumor found commonly in children and young adults. They classically present with night pain that is relieved by non steroidal anti-inflammatory drugs. They are usually cortical lesions and most commonly occur in the long bones, with proximal femur being the most common location. Less commonly they may be seen in the spine and small bones of the hands and feet. CT is excellent at diagnosing the lesion and shows small lucent nidus and surrounding reactive bone sclerosis. MRI may be confusing due to the disproportionate marrow edema and the poor delineation of nidus if it is very tiny. CT guided radiofrequency ablation is the current accepted standard treatment for osteoid osteomas. However in small bones, this may be challenging due to the very small size as well as proximity of neurovascular structures. We will discuss the imaging appearances of osteoid osteomas in small bones of hands and feet as well as highlight the challenges faced during RF ablation in some of these cases and some of the ways these can be overcome.

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## Abstract Archives of the RSNA, 2023

MKEE-104

### Zero Echo Time Magnetic Resonance Imaging: Physics and Clinical Utility in Musculoskeletal System

#### Participants

Takatoshi Aoki, MD, PhD, Kitakyushu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To recognize the clinical utilities of zero echo-time (ZTE) sequences in various disorders of the musculoskeletal system. 2. To understand the imaging physics of ZTE sequence, practical limitations, and image reconstruction. 3. To discuss how to incorporate ZTE sequence into the clinical workflow.

#### TABLE OF CONTENTS/OUTLINE

Physics of ZTE imaging 1 Pulse sequence design 2 Image reconstruction 3 Parameter optimization Clinical utility of ZTE in musculoskeletal system 1 Inflammatory arthritis 2 Soft tissue calcification/ossification 3 Bone and soft tissue tumors and tumor-like lesions 4 Osteoarthritis and spondylitis 5 Trauma 6 Morphometric evaluation before surgery 7 Children and fetuses Summary ZTE MRI can be readily incorporated into the clinical workflow, and CT-like images generated by ZTE MRI would minimize the need for CT contemporaneously with MRI in various musculoskeletal disorders. We systematically review the imaging physics of these sequences, practical limitations, and image reconstruction, and then discuss the clinical utilities in the musculoskeletal system while presenting several imaging examples.

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## Abstract Archives of the RSNA, 2023

MKEE-105

### Hamstring Sport Injuries: What, How, Why and Where

#### Participants

Agustin Marrero SR, MD, La Plata, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To know the anatomy, function, and biodynamic aspects of the hamstrings complex. To recognize the spectrum of tearing of hamstring muscles and tendons during sports practice analyzing their mechanism of injury. To evaluate the imaging methods in the different hamstrings lesions to describe the precise location and characteristics. To describe ultrasound and magnetic resonance signs of these tears, emphasizing the prognostic criteria for recovery, return to play, and re-injury.

#### TABLE OF CONTENTS/OUTLINE

Most of muscle tears occur in the lower extremities and commonly in the hamstrings. The hamstrings complex consists of the semimembranosus (SM), semitendinosus (ST) and biceps femoris (BF) muscles. They originate from the ischial tuberosity. BF muscle has two portions, the long and short head and its distal insertion is at fibular head. ST and SM are medial, and their distal insertion is in the medial aspect of the leg. BF and ST are close to the sciatic nerve. Except for BF's short head, the hamstrings are primarily hip extensors and knee flexors. Hamstring injuries are grouped and classified, with typical tear sites that recur in sports practices during forceful stretching or high-speed running. Proximal injuries result in a large amount of time away from sports and a high risk of re-injury. Sprint tears are generally located on BF. Depending on its extent and location, we can estimate the evolution of injuries and the return to play. Finally, we will include insertional injuries in children.

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## Abstract Archives of the RSNA, 2023

MKEE-106

### Acute Traumatic Craniocervical Injuries: What to Look for and Not to Miss

#### Participants

María Carvajo, MD, Seville, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe acute traumatic craniocervical injuries and its classification based on a revision of cervical CTs performed in the emergency setting at 3rd level hospital. - To show key imaging features to identify stable and unstable injuries. - To present most common errors and missed craniocervical injuries as well as tips to avoid them.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy and biomechanics of craniocervical junction and ligaments. 2. Key measurements and anatomy landmarks to assess alignment of craniocervical junction. 3. Craniocervical injuries classification. 3.1. Atlanto-occipital dissociation. 3.1.1. Traynelis classification. 3.2. Occipital condyle fractures. 3.2.1. Anderson-Montesano classification. 3.2.2. Alar ligament injuries. 3.2.3. Stable and unstable injuries. 3.3. Atlas fractures. 3.3.1. Gehweiler classification. 3.3.2. Transverse ligament injuries. Dickson classification. 3.3.3. Stable and unstable injuries. 3.4. Axis fractures. 3.4.1. Odontoid fractures. Anderson and D'Alonzo classification. 3.4.2. Hangman fractures. Effendi/Francis modified by Levine classification. 3.4.3. Non-odontoid non-hangman fractures (axis body fractures). 3.4.4. Teardrop fractures. 3.4.5. Stable and unstable injuries. 3.5. Atlantoaxial subluxation. 3.5.1. Atlantoaxial rotatory fixation. Fielding and Hawkins classification. 3.5.2. Stable and unstable injuries. 4. Pitfalls of craniocervical injuries at CT imaging. 5. Conclusions.

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## Abstract Archives of the RSNA, 2023

MKEE-107

### Ultrasound Guide to Have at Your Fingertips: Wrist and Hand Evaluation

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To emphasize the potential of ultrasound in the assessment of musculoskeletal structures. 2. To become familiar with the normal sonographic appearance of the wrist, hand and fingers. 3. To propose a systematic approach to perform a complete ultrasound of the wrist, hand and fingers. 4. To show the correlation of the ultrasound findings with MR images and anatomical drawings for a better understanding.

#### TABLE OF CONTENTS/OUTLINE

Ultrasound is an imaging technique very useful in the assessment of musculoskeletal structures. However, for its correct interpretation, it is essential for the explorer to be familiar with the ultrasound appearance of normal anatomical structures, which can be difficult at the beginning. This work is intended to be an aid for anyone who wants to get started in musculoskeletal ultrasound of the wrist, hand and fingers. First of all, we will check the basic requirements to perform a proper musculoskeletal ultrasound. Then, we will systematically review the normal ultrasound anatomy of the different musculoskeletal structures of the wrist, hand and fingers, dividing them according to their dorsal or ventral location. We will also propose some tips and tricks, and we will highlight the importance of dynamic maneuvers. In order to make our work more visual, we will correlate the different ultrasound images with anatomical drawings and MR images, which will allow a better understanding.

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## Abstract Archives of the RSNA, 2023

MKEE-108

### MR Imaging of Traumatic Injury of the Fingers

#### TEACHING POINTS

1. To review the anatomy of the fingers, focusing on the extensor and flexor complexes, as well as the passive stabilizers of their joints. 2. To detail the MRI protocol used for the study of traumatic pathology of the fingers. 3. To illustrate by means of representative cases the most frequent pathology of the fingers after blunt trauma. 4. To teach instability patterns, which may be useful when understanding and describing the MRI findings in these patients.

#### TABLE OF CONTENTS/OUTLINE

Traumatic injuries of the fingers are one of the frequent reasons for musculoskeletal MRI evaluation. It is important to know the specific anatomy of the tendon structures and ligaments, as well as the most frequent injury patterns. Extensor finger complex, including central and lateral slips, as well as sagittal bands; flexor tendon, pulleys and articular structures (main and accessory collateral ligaments, and volar plate) play a capital role in finger biomechanics. Closed finger trauma frequently causes instability patterns (in coronal, sagittal or combined planes) that should be recognized and that facilitate the understanding of the lesion mechanism and its diagnosis. Thus favoring an adequate treatment and a prompt recovery. Injuries secondary to closed trauma of the fingers will be reviewed, with a detailed description of their semiology and the injured structures and their complications.

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## Abstract Archives of the RSNA, 2023

MKEE-109

### Read It Like a Pro: Tips And Tricks To Interpret Lumbar Spine MRI

#### Participants

Ana Cristina Delgado, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the normal spine anatomy of lumbar spine 2. review lumbar spine MRI protocol 3. Analyze step by step the systematic of lecture of spine lumbar MRI, learn how to make a good MRI report, describe findings with standardized nomenclature. 4. Identify, review the most common findings in lumbar benign-malignant pathology.

#### TABLE OF CONTENTS/OUTLINE

Description of general characteristics in lumbar spine a) Anatomy review b)MRI protocol sequences c)Systematic lecture of lumbar spine MRI,how to elaborate a good report.Review of MRI cases, common findings in lumbar spine pathology Pathologies included:a) Degenerative changes of intervertebral disc.b) Degenerative changes of vertebral body.c) Degenerative changes of facet joint. d) Malignant pathology. e) Others: infection, cystic lesions, trauma.

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## Abstract Archives of the RSNA, 2023

MKEE-11

### Exploring Osteochondral Lesions of the Talus: Imaging Evaluation and Treatment Options

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Review the talar dome anatomy, and pathophysiology of osteochondral lesions 2. Illustrate and discuss the patterns of osteochondral injuries and main surgical options with didactic cases. 3. Highlight the main information that radiologists should include in the report when analyzing an osteochondral lesion of the talus and their postoperative imaging.

#### TABLE OF CONTENTS/OUTLINE

Osteochondral lesions of the talus are lesions of the articular cartilage of the talus and underlying subchondral bone. Trauma accounts for the majority of osteochondral lesions, with an osteochondral lesion occurring with over half of ankle sprains, especially if there is a fracture. Introduction: General review of talar dome anatomy, and pathophysiology of osteochondral lesions. Preoperative evaluation: Main information that should be included in the radiological report. Clinical relevance of the findings. Staging: Didactic illustration about the historical classic staging systems. Postoperative evaluation: Main surgical techniques considerations. Main information that should be included in the radiological report. Bibliographical references.

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## Abstract Archives of the RSNA, 2023

MKEE-110

### Under Pressure: Exploring Normal Anatomy and Entrapment Neuropathy of the Ulnar Nerve

#### TEACHING POINTS

1. Describe the normal course and imaging appearance of the ulnar nerve with emphasis on the cubital tunnel and Guyon's Canal. 2. Describe the anatomical boundaries of both the cubital tunnel and Guyon's Canal. 3. Discuss ulnar neuropathy symptoms. 4. List common etiologies of ulnar nerve compression. 5. Discuss the MR appearances of ulnar nerve impingement in the cubital tunnel and Guyon's Canal. 6. Identify the normal motion of the ulnar nerve within the cubital fossa under ultrasound as well as the abnormal motion of the nerve in the setting of symptomatic anterior dislocation and snapping triceps syndrome.

#### TABLE OF CONTENTS/OUTLINE

We review the normal course of the ulnar nerve with attention to sites of potential compression, namely the cubital tunnel and Guyon's Canal. We review the anatomical boundaries of the cubital tunnel and Guyon's canal on MR imaging. We examine the structures innervated by the ulnar nerve and the clinical signs/symptoms of ulnar neuropathy corresponding to the site of impingement. We list common etiologies of entrapment neuropathies. We review the normal MR appearance of the ulnar nerve and utilize MR cases to illustrate the abnormal appearance of impingement in the setting of cubital tunnel and Guyon's canal syndrome. We present dynamic ultrasound examples demonstrating both the typical movement of the ulnar nerve in the cubital fossa, as well as abnormal motion in the setting of dislocation and snapping triceps syndrome. We discuss common surgical treatments of ulnar nerve dislocation and review the expected MR appearance of ulnar nerve anterior transposition.

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## Abstract Archives of the RSNA, 2023

MKEE-111

### Fight of Phyte Calcification Ossification Around Spine

#### Participants

Kengo Ikejima, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the mechanism of perivertebral sclerotic changes  
2. Learn the imaging findings of representative perivertebral sclerotic changes along with specific cases  
3. Learn about complications associated with perivertebral sclerotic changes  
4. Learn key points for differentiating perivertebral sclerotic changes

#### TABLE OF CONTENTS/OUTLINE

Spine anatomy, particularly joint structures and ligaments  
Pathophysiology of Osteophytes  
Pathophysiology of Syndesmophytes  
Pathophysiology of common calcium deposition diseases that occur in the perivertebral region  
Cases:- Spondylosis- Ossification of the posterior longitudinal ligament- Ossification of the ligamentum flavum- Calcium pyrophosphate dihydrate deposition disease- Calcific tendinitis of the longus colli muscle- Ankylosing Spondylitis- Psoriatic arthritis- Diffuse idiopathic skeletal hyperostosis (DISH)- SAPHO syndrome- Osteitis condensans ilii- Dystrophic calcification- Intervertebral disc calcification

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## Abstract Archives of the RSNA, 2023

MKEE-112

### Looking Beneath the Surface: Imaging of Bone Surface Lesions

#### Participants

Utkarsh Parwal, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Define intracortical, subperiosteal, periosteal, and parosteal/juxtacortical locations along the bone surface. 2. Understand that multiple cell types within the bone surface give rise to bone-forming, cartilage-forming, and fibrous surface lesions. 3. Generate a differential diagnosis for surface lesions spanning benign, malignant, infectious, and traumatic etiologies.

#### TABLE OF CONTENTS/OUTLINE

1. Bone surface anatomy and terminology. a. Define intracortical, subperiosteal, periosteal, and parosteal/juxtacortical locations. b. Illustrate the two layers of the periosteum: inner cambrial and outer fibrous. Briefly discuss important cell types within the bone surface as the originators of bone-forming, cartilage-forming, and fibrous surface lesions. 2. Case based review of multiple surface lesions. a. Bone forming: Osteoid osteoma, Surface osteosarcomas (OS) - periosteal OS, parosteal OS, high grade surface OS. b. Cartilage forming: Osteochondroma, Periosteal chondroma, Bizarre parosteal osteochondromatous proliferation, Periosteal chondrosarcoma. c. Fibrous: Nonossifying fibroma, Juxtacortical desmoid tumor, Osteofibrous dysplasia. d. Infectious: Cortical osteomyelitis, Subperiosteal abscess. e. Traumatic: Stress reaction, Periostitis ossificans

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## Abstract Archives of the RSNA, 2023

MKEE-113

### Can you See Me Now? A Case Based Quiz Of Shoulder Instability Lesions

#### Participants

Ana Cristina Delgado, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe and recognize the different key clinical/imaging features that help diagnose each glenohumeral instability entity. 2. Identify through a series of MRI/ Arthrography MRI image based cases the different glenohumeral anterior, posterior instability lesions. 3. Describe the role of different imaging modalities in the diagnosis of glenohumeral instability, evaluate the MRI/ Arthrography MRI imaging findings that can help radiologists discriminate differential diagnosis. 4. Review static dynamic glenohumeral stabilizers.

#### TABLE OF CONTENTS/OUTLINE

-Pathologies will be presented in a case based format with pertinent MRI/ Arthrography MRI images and a brief clinical history. - Diagnostic clue section divided in clinical facts ( general features, miscellaneous information) radiological facts ( key imaging findings, best image modality for further evaluation). -Review the concepts and important tips for image diagnosis. -Review anatomy of static dynamic glenohumeral stabilizers. -Pathologies included: a) Anterior instability: Classic Bankart, HAGL ( Humeral avulsion of glenohumeral ligament), GLAD ( Gleno labral articular disruption), Perthes, ALPSA ( Anterior Labroligamentous sleeve avulsion), Hillsachs. b) Posterior Instability: Reverse Bankart, POLPSA: Posterior labro capsular periosteal sleeve avulsion), Kim, Bennet, Reverse Hillsachs. c) Variants Pitfalls: Sublabral Recess, Sublabral foramen, Buford Complex.

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## Abstract Archives of the RSNA, 2023

MKEE-114

### Elasticity Matters: Role of Shear Wave Elastography in Rheumatology

#### Participants

Alejandra Micolich Vergara, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

General principles of shear wave elastography in musculoskeletal radiology. Potential applications in the assessment of rheumatologic diseases. Future directions and limitations.

#### TABLE OF CONTENTS/OUTLINE

Elasticity is a fundamental characteristic closely related to the pathological state of tissues. Elastasonography is a diagnostic technique that assesses the biomechanical properties such as stiffness and elasticity of tissues by exposing them to a specific ultrasound beam. Shear Wave Elastasonography (SWE) is a non-invasive and objective method that determines the absolute stiffness value of various tissues. SWE has been validated in liver disease, thyroid, breast, prostate, skin and ocular pathologies and is being considered a promising tool in rheumatologic disorders. Greyscale and Power Doppler ultrasound as well as Magnetic Resonance Imaging (MRI) have been extensively studied as diagnostic techniques in rheumatologic pathologies and in 2021 the European League Against Rheumatism (EULAR) recommends elastasonography in the reporting of ultrasound studies in musculoskeletal disease. There has been advancements in recognizing the role of SWE in entities such as Primary Sjögren's Syndrome and Gout Arthritis, however, future prospects include exploring its utility in the early diagnosis and therapeutic response monitoring in Rheumatoid Arthritis, Systemic Lupus Erythematosus and Thumb Osteoarthritis. We will review the potential applications of SWE in different rheumatologic disorders using a case based approach.

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## Abstract Archives of the RSNA, 2023

MKEE-115

### Not Normal: An Illustrated Guide to Potentially Symptomatic Musculoskeletal Anatomic Variants

#### TEACHING POINTS

- Review commonly discovered anatomic variants on routine musculoskeletal imaging that may be symptomatic or become symptomatic.
- Recognize what imaging features suggest a given variant may be at risk of being symptomatic or require treatment, and what additional imaging may be required for a more definitive diagnosis.
- Discuss treatment options available for the management of pain associated with anatomic variants, including: activity modification, physical therapy, image-guided injection, and surgery.

#### TABLE OF CONTENTS/OUTLINE

- Spinal variants o Upper cervical § Dens retroversion § Posterior arch agenesis § Short arch o Rib anomalies cervical ribs o Segmentation anomalies § Congenital block § Occipitalization § Hemivertebra § Butterfly o Oppenheimer ossicle o Lumbosacral transitional vertebra o Sacroiliac variants o Coccyx angulation o Posterior elements § Bastrup pseudoarthrosis § Hypoplastic facets § Facet tropism o Piriformis sciatic nerve o Other
- Hip o Developmental dysplasia o Cam/pincer o Coxa profunda protrusio o AIIS morphology o Coxa vara valga
- Wrist hand o Ulnar variance o Type 2 lunate o Coalition o Os styloideum
- Shoulder o Acromion shape slope o subcoracoid o Coracoclavicular joint o glenoid dysplasia hypoplasia o Luschka tubercle o Os acromiale
- Elbow o Anconeus epitrochlearis o Gantzer's muscle o Synovial fold o Os supratrochlear dorsale
- Knee o Patellofemoral anomalies § Patella type § Trochlear groove § Patella alta/baja § Bi/multipartite patella o Aberrant popliteal and anterior tibial artery o Discoid meniscus o Plica
- Foot ankle o Os trigonum syndrome o Painful os peroneum o Accessory muscles o Type II os naviculare o Coalition o Os intermetatarsium o Sesamoid anomalies

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## Abstract Archives of the RSNA, 2023

MKEE-116

### Calcifications as Harbingers of Malignancy in Soft Tissue Tumors: A Case-Based Review

#### Participants

Atefe Pooyan, MD, MPH, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Gain familiarity with the morphology of calcifications in soft tissues 2. Demonstrate that approaching soft tissue calcifications based on morphologic appearance, distribution, and tumor cell-type can yield clues when triaging lesions 3. Present scenarios in which soft tissue calcifications are helpful in assessing the malignancy or benignity of a lesion

#### TABLE OF CONTENTS/OUTLINE

Key Anatomic or Pathophysiologic Issues, Imaging Findings or Imaging Technique This case-based exhibit will review the morphology of soft tissue calcifications (e.g. stippled, chondroid, coarse, osseous, amorphous), with imaging correlation using multiple modalities (i.e. radiographs, CT, and MR), as demonstrated by various cases of benign and malignant pathophysiologic processes of calcification. Conclusion 1. Approaching soft tissue calcifications according to their descriptive morphology and location can yield clues into interpreting a lesion's malignant potential. 2. Calcifications are disproportionately represented by the most common high-grade soft tissue neoplasms, including synovial sarcoma, liposarcoma, and undifferentiated pleomorphic sarcoma, which comprise more than half of all soft tissue malignancies. 3. Malignant tumors can have a characteristic morphology of calcifications, such as stippled calcifications in synovial sarcoma and central osseous calcifications in extra-skeletal

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## Abstract Archives of the RSNA, 2023

MKEE-117

### Posterior Ankle Pain: Pathologies Surrounding the Kager Fat Pad

#### Participants

Leandro Mazza, MD, La Plata, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the anatomy of the Kager fat pad (KFP) and its relationships with the rest of the structures of the posterior region of the ankle. To analyze the different pathologies responsible for posterior ankle pain and the degree of involvement of the KFP in each of them. To discuss the role of KFP in the symptomatology of these entities

#### TABLE OF CONTENTS/OUTLINE

KFP is a mass of adipose tissue that occupies the Kager triangle, located between the Achilles tendon, the flexor hallucis longus and the calcaneus. Although its content is predominantly fatty, it also contains nerves and small vessels. It presents multiple connections with the different anatomical structures that surround. Three regions that are closely related to the sides of this triangle have been described. The most firmly linked to the Achilles tendon being an important part of its entheses. The more mobile, wedge-shaped and closely related to the calcaneus moves passively and actively towards the retrocalcaneal bursa during plantarflexion. These relationships make the KFP a necessary participant, to a greater or lesser extent, in a large part of the different entities that present with posterior ankle pain. We will describe tendinopathies, os trigonum syndrome and other causes, with particular interest in the degree of involvement of the KFP.

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## Abstract Archives of the RSNA, 2023

MKEE-118

### Don't Touch Lesions: How Can We Avoid the Misdiagnosis

#### Participants

Janaina Moreira, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Don't touch lesions are incidental findings, that are divided into three categories: Post traumatic, normal variants, and lesions that are real but obviously benign. Radiography is the first method used for the identification, characterization, and classification of these type of lesions. However, some cases can be so challenging that computed tomography or magnetic resonance imaging are used to evaluate the lesion, therefore increasing the accuracy of the diagnosis. The purpose of this presentation is to review the imaging characteristics of typical skeletal "don't touch" lesions in the many imaging methods such as X-Ray, computed tomography (CT) and magnetic resonance imaging (MRI) therefore avoiding misdiagnosis and invasive procedures, which reduces the morbidity and costs in the health care system.

#### TABLE OF CONTENTS/OUTLINE

Case based didactic review of the radiological appearance of the "don't touch" lesions including clinical and epidemiological aspects of bone infarction, osteopoikilosis, intraosseous migration of tendinous calcification, myositis ossificans, aggressive vertebral hemangioma, among others, based on our service's digital archive.

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## Abstract Archives of the RSNA, 2023

MKEE-119

### High-Resolution Ultrasound of the Nerves of the Foot and Ankle: A Landmark Approach to Scanning and Review of Common Pathologies

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Review the anatomy of the nerves at the level of the foot and ankle, using a landmark approach with cadaveric correlation. 2. Highlight clinical signs and symptoms warranting a detailed ultrasound nerve assessment, relating them to specific nerves. 3. Review common sites and causes of nerve injury and entrapment at the foot and ankle and demonstrate associated abnormal direct and indirect sonographic findings using diagrams, images and video clips from case-examples.

#### TABLE OF CONTENTS/OUTLINE

1. OBJECTIVES 2. INTRODUCTION 3. ANATOMY, ULTRASOUND TECHNIQUE, PATHOLOGY WITH CASE EXAMPLES FOR THE: a) Tibial nerve and medial and lateral plantar branches b) Plantar digital nerves c) Sural nerve d) Saphenous nerve e) Deep peroneal nerve f) Superficial peroneal nerve 4. TAKE HOME POINTS

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## Abstract Archives of the RSNA, 2023

MKEE-12

### PET-MR Imaging Applications in Pediatric Musculoskeletal Tumors

#### TEACHING POINTS

? PET-MR imaging is emerging as a suitable technique for the assessment of pediatric malignancies, with specific applications in musculoskeletal tumors. ? Its utility includes primary tumor characterization, local / distant staging and post-treatment follow-up. ? Dose reduction of ionizing radiation and overall scanning time decrease are remarkable advantages. ? However, it has low sensibility for detection of pulmonary nodules. Chest CT remains essential in thoracic staging of pediatric musculoskeletal malignancies.

#### TABLE OF CONTENTS/OUTLINE

? Introduction: Integrated MRI and PET provide efficient staging of children and adolescents with malignant bone tumors by evaluating the primary tumor and the whole body in one session. ? Our protocol included a whole-body and a local tumor scan. ? Applications in pediatric musculoskeletal tumors: PET-MRI is useful in the study of osteosarcoma, Ewing sarcoma, bone lymphoma, Langerhans cell histiocytosis and bone and bone marrow metastases. We report our experience in the last ten years. ? Conclusions: the combination of functional PET imaging with the lack of non-ionizing radiation of MRI is ideal in a pediatric population.

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## Abstract Archives of the RSNA, 2023

MKEE-120

### Do Not Harm: Thermal Protection in Musculoskeletal Abdominal Wall Soft Tissue Tumors Cryoablation

#### Participants

Albert Castillo Pinar, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching points: To review the main characteristics of thermoablation in musculoskeletal soft tissue tumors. To illustrate different techniques and indications of thermoprotection procedures. To show possible complications if the thermoprotection techniques are not performed correctly. Thermoablation of musculoskeletal tumors is a growing technique with good results; however, it can be limited by the location of the tumors. There are close anatomical relationships related to the tumor such as different intra-abdominal structures or the skin itself which can contraindicate the technique, make it difficult or lead to complications if the correct thermo-protection techniques are not applied. Radiologists must be familiar with the thermoprotective techniques in order to be able to choose the most appropriate in each case.

#### TABLE OF CONTENTS/OUTLINE

Table of contents/Outline Introduction. Classification and description of thermoprotective technique. Case series illustrating clinical situations and the application of thermoprotection techniques. Conclusion.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MKEE-121

### Non-infectious Spinal Diseases Mimicking Infection

#### TEACHING POINTS

Infectious spinal disease may be suspected if inflammatory markers are increased in blood tests in patients with acute spinal pain and limited range of motion. These clinical findings can also be seen in spinal crystal deposition disease and intraspinal rupture of synovial cysts located in facet joints. In cases of acute inflammation in these two diseases, there is a risk of unnecessary biopsies and antibiotic treatments because the clinical and imaging findings overlap with those of infectious spinal diseases. Recognizing the radiographic characteristics of these diseases and raising awareness of these findings will be helpful in accurate diagnosis and treatment. We present various cases of spinal crystal deposition disease (crowned dens syndrome, calcific tendinitis of longus colli, calcific tendinitis of levator scapulae, facet joint crystal arthropathy, and interspinous bursitis with crystal deposition) and intraspinal rupture of facet joint synovial cyst, and present their clinical and imaging findings. This aims to raise awareness of these diseases and facilitate accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Case 1: Calcified tendinitis of longus colli  
Case 2: Calcific tendinitis of levator scapulae  
Case 3: Crowned Dens syndrome  
Case 4: Crystal arthropathy of facet joint  
Case 5: Facet joint infection

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## Abstract Archives of the RSNA, 2023

MKEE-122

### The Bubble Trouble: Differential Diagnosis of Cystic Bone Tumors and the Importance of Not Missing the Mark

#### Participants

Leticia dos Reis Morimoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is:1. To review the main differential diagnosis of cystic bone lesions.2. To expose the general evaluation of cystic bone tumors - what is necessary to report: review of the characteristics by image that must be reported and propose a structured report for bone tumors in a multimodality approach (CR, US, CT and MRI).3. To review the main combined injuries and when to think about them.4. To demonstrate through didactic illustrative cases the main complications that can be found due to cystic bone lesions.5. To demonstrate currently available treatment modalities for those conditions.

#### TABLE OF CONTENTS/OUTLINE

1 - Radiological propaedeutics of cystic bone tumors.2 - Radiograph, ultrasound (US) computed tomography (CT), and MRI findings in:  
2.1 - Unicameral bone cyst  
2.2 - Multicameral bone cyst  
2.3 - Aneurysmal bone cyst  
2.4 - Cystic fibrous dysplasia  
2.5 - Vascular malformation (cystic angiomatosis)  
2.6 - Telangiectasic osteosarcoma  
2.7 - Other miscellaneous cystic tumors  
3 - General evaluation of cystic bone tumors - what is necessary to report? - review of the main image characteristics.  
4 - When to be suspicious of concomitant lesions and their primary associations.  
5 - Propose a structured report for cystic bone tumors in a multimodality approach (CR, US, CT, and MRI).  
6 - Complications related to cystic bone tumors.  
7 - Therapies currently used in cystic bone tumors.  
8 - Last updates and trendings of cystic bone tumors  
9 - Summary and take-home message

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

MKEE-123

### Knee-ding a Closer Look: MRI Evaluation of Cartilage Surgical Repair

#### Participants

Leticia dos Reis Morimoto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. Revisit the anatomy and biomechanics of knee joint and focusing in cartilage 2. To demonstrate the MRI image findings in chondral lesions of the knee, with the main classifications 3. To illustrate the main operative techniques involved in knee cartilage surgery with radiology and surgery imagings correlation 4. Demonstrate through didactic illustrative cases the normal and pathological postoperative image findings, focusing on MRI

#### TABLE OF CONTENTS/OUTLINE

1 - Anatomy and biomechanics of knee joint and cartilage 2 - MRI findings in chondral lesions of the knee 3 - Modified Outerbridge classification (MRI and arthroscopy imaging) 4 - Noyes Classification (MRI and arthroscopy imaging) 5 - International Cartilage Repair Society (ICRS) classification (MRI and arthroscopy imaging) 6 - Surgery and radiologic imagings of: 6.1 - Marrow-Stimulating Procedures (microfracture) (surgery and radiologic imagings) 6.2 - Osteochondral Autograft Transplantation 6.3 - Osteochondral Allograft Transplantation 6.4 - Autologous Chondrocyte Implantation 7 - Normal postoperative findings after surgical repair of the knee cartilage 8 - Pathological postoperative findings after surgical repair of the knee cartilage

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## Abstract Archives of the RSNA, 2023

MKEE-124

### Dual Energy CT in Spinal Disease: Application Review

#### TEACHING POINTS

Dual-energy CT (DECT) separately acquires high and low energy X-ray data to enable material characterization applications for substances that exhibit different energy-dependent x-ray absorption behavior. Based on conventional CT imaging, DECT significantly improves the detection ability of spinal lesions and adds more quantitative indicators. Virtual non-calcium (VNCa), virtual monochromatic imaging (VMI), and other parameters have unique advantages over traditional CT imaging in displaying bone marrow edema and tumor, detecting spinal urate crystal deposition, reducing spinal related metal artifacts, and intervertebral disc degeneration, showing a good clinical application prospect.

#### TABLE OF CONTENTS/OUTLINE

Vertebral fracture, Bone Marrow Lesions and Mimics, Herniation of intervertebral disc, Gout, Artifact Suppression

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## Abstract Archives of the RSNA, 2023

MKEE-125

### Myopathies: Radiologist's Essential Tips for Clinical, Pathological, and Imaging Findings

#### Participants

Yumi Tai, Kashihara, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To review inherited and acquired myopathies including clinical, pathological, and diagnostic imaging findings. 2) To discuss clinico-radiological key findings in the differential diagnosis of myopathies for radiologists.

#### TABLE OF CONTENTS/OUTLINE

1) Imaging techniques and general imaging findings of muscle 2) Illustrated findings of the following myopathies: 1. Hereditary myopathies : Congenital myopathies (Nemaline myopathies, Central core disease, Congenital fiber type disproportion myopathy), Muscular dystrophies (Duchenne, Becker, Limb-girdle, Myotonic, Facioscapulohumeral, Emery-Dreifuss, Oculopharyngeal), Distal myopathies (GNE myopathy, Oculopharyngodistal myopathy), Metabolic myopathies (Mitochondrial disease, Lipid storage myopathies). 2 Acquired myopathies : Inflammatory myopathies (Dermatomyositis, Antisynthetase syndrome, Immune-mediated necrotizing myopathy, Inclusion body myositis, Eosinophilic myositis, Drug-induced (Immune checkpoint inhibitor (ICI)-related myositis), Associated with GVHD), Associated with systemic disease (Overlap myositis, Muscle Sarcoidosis) 3) Clinico-radiological key findings in the differential diagnosis

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## Abstract Archives of the RSNA, 2023

MKEE-126

### Winging It: The Radiologist's Guide to the Scapula

#### TEACHING POINTS

[1] Understanding the anatomy and bony landmarks of the scapula is important for identifying a range of pathologies, including fractures, tumors, and degenerative changes.[2] The scapula has a number of anatomic variants, particularly in the pediatric population, that may mimic trauma or other pathologies.[3] While radiographs can provide an initial assessment of the scapula, CT and MRI are useful imaging modalities to evaluate complex or subtle bony and adjacent soft tissue pathologies.

#### TABLE OF CONTENTS/OUTLINE

[1] Overview[2] Normal anatomy: important radiological landmarks[3] Imaging technique: dedicated scapula radiographs and the importance of CT/MRI[4] Cased-based review by pathology[5] Congenital/developmental variants: acromial ossification centers; os acromiale; Sprengel deformity; glenoid dysplasia[6] Traumatic processes: different fracture patterns (including of the scapular body, neck, glenoid, acromion, and coracoid process) and stress fractures[7] Degenerative/inflammatory processes: osteoarthritis; rheumatic conditions; elastofibroma dorsi; scapulothoracic bursitis[8] Infection and inflammation: osteomyelitis; septic arthritis[9] Neoplasm: benign and malignant[10] Hardware and related complications: curettage and graft; shoulder arthroplasty notching[11] Miscellaneous conditions: Looser's zones in osteomalacia[12] Conclusion

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## Abstract Archives of the RSNA, 2023

MKEE-127

### Worth the Weight: Weight-bearing Cone-beam CT in Foot and Ankle Pathology

#### Participants

Maryam Soltanolkotabi, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Weight-bearing computed tomography (WBCT) has advantages over conventional CT and radiography, namely the ability to identify alignment issues and evaluate joint line congruencies. 2. WBCT can be used for the assessment of fracture healing, pre-operative planning, and evaluation of treatment efficacy. 3. WBCT offers technical and logistic advantages over conventional CT including decreased radiation dose, less technical training for use, and decreased space and energy demands. 4. WBCT enables reliable 3D measurements in a functionally relevant position (weight-bearing).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Objectives/goals 3. What is weight-bearing CT and how does it work? 4. What are the advantages and disadvantages of WBCT? 5. What is the impact of WBCT on radiation dose, cost, and workflow? 6. What are the indications of WBCT? a. Fracture detection b. Alignment evaluation c. Pre-operative planning d. Evaluation of fracture healing e. Post-operative evaluation 7. How to measure in 3D? 8. What further developments are to be expected? 9. Summary/conclusion

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## Abstract Archives of the RSNA, 2023

MKEE-128

### Percutaneous Bone Consolidation in Cancer Patients: Who and How

#### Participants

Roberto Luigi Cazzato, Strasbourg, France (*Presenter*) Proctor, Medtronic plc

#### TEACHING POINTS

- To promote the indications of percutaneous bone and spine consolidation in multi disciplinary tumor boards- To present the interventional techniques applied to consolidate impending, pathological, and secondary bone insufficiency fractures in cancer patients- To propose an algorithm useful to select the best consolidative method based on the biomechanics of the affected bone

#### TABLE OF CONTENTS/OUTLINE

- Indications- Techniques available based on biomechanics- Definition of the target fracture- Algorithm for bone consolidation

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## Abstract Archives of the RSNA, 2023

MKEE-129

### Spectrum of Common and Uncommon Multiple Bone Tumors: Imaging Findings with Pathologic Correlations

#### TEACHING POINTS

1. Multifocality is common in metastasis, myeloma, histiocytosis, and vascular tumors, including the location of spine; occasional in fibrous dysplasia, osteofibrous dysplasia, adamantinoma, enchondroma, and osteochondroma; extremely rare in osteosarcoma and giant cell tumor. 2. Multiple bone tumors carry an increased risk of malignant transformation, especially in the enchondroma, osteochondroma, and giant cell tumor. 3. Non-ossifying fibroma are typically cortically based; osteofibrous dysplasia and osteofibrous dysplasia-like adamantinoma can be pure cortical lesions, or with medullary cavity involvement; the majority of the adamantinoma involve the cortex and complete medullary cavity; fibrous dysplasia and metastasis primarily involve the medullary cavity and occasional the cortex. 4. A stippled or ring-like pattern indicates cartilage calcification, cloud-like appearance indicates osteoid mineralization, and a ground-glass density indicates fiber matrix. 5. Age needs to be considered in solid tumors with non-specific imaging features. Metastasis, myeloma, lymphoma, and Erdheim-Chester disease are common in adults; whereas, multiple chondrogenic tumours, fibrous dysplasia, langerhans cell histiocytosis, and osteosarcoma are more frequent in young individuals.

#### TABLE OF CONTENTS/OUTLINE

1. Enchondroma 2. Osteochondroma 3. Osteoma 4. Osteosarcoma 5. Haemangioma 6. Epithelioid haemangioendothelioma 7. Giant cell tumour 8. Non-ossifying fibroma 9. Simple bone cyst 10. Osteofibrous dysplasia 11. Adamantinoma 12. Fibrous dysplasia 13. Metastasis 14. Myeloma 15. Lymphoma 16. Langerhans cell histiocytosis 17. Erdheim-Chester disease 18. Rosai-Dorfman disease

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## Abstract Archives of the RSNA, 2023

MKEE-13

### Thermal Protection Techniques During Musculoskeletal Ablation

#### Participants

Arash Azhideh, MD,MPH, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Percutaneous thermal ablation of benign and malignant musculoskeletal tumors has expanded in scope and popularity in recent years. Although safe and efficacious, thermal ablation requires a thorough knowledge of the range of thermal protection techniques in order to limit the risk of thermal injury to adjacent nerves and other sensitive structures. In this educational exhibit, we briefly review the most commonly used musculoskeletal thermal ablation techniques, describe the spectrum of thermal protection techniques utilized during musculoskeletal thermal ablation, and discuss the mitigation techniques employed prophylactically or once nerve injury has occurred.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of Musculoskeletal Thermal Ablation Techniques a. Radiofrequency Ablation b. Cryoablation c. Microwave Ablation d. Other 2. Thermal Protection Techniques a. Active Thermoprotection Techniques i. Hydrodissection ii. Gas Dissection iii. Dissection with Other Agents iv. Physical displacement methods 1. Balloon interposition 2. Blunt needle displacement b. Passive Thermoprotection Techniques i. Biofeedback ii. Neurophysiologic intraoperative monitoring 1. Somatosensory evoked potentials 2. Motor evoked potentials 3. Electromyography iii. Temperature monitoring 3. Mitigation strategies to reduce thermal nerve injury

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## Abstract Archives of the RSNA, 2023

MKEE-14

### Post-treatment Changes in Bone and Soft Tissue Tumors: A Primer for Radiologists

#### Participants

Daniel Lobo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To review the normal and pathologic findings following different therapeutic modalities in bone and soft tissue tumors: systemic treatment (chemotherapy, immunotherapy), radiotherapy and surgery.
- To illustrate complications and signs of tumor response to treatment, persistent or recurrent disease, as well as non-neoplastic complications.

#### TABLE OF CONTENTS/OUTLINE

- Brief introduction: relevance and challenges associated with post-treatment musculoskeletal tumors cases in the daily practice of the radiologist.
- Post-systemic treatment (chemotherapy and immunotherapy): Signs of treatment response; Signs of tumor progression; Systemic effect on the musculoskeletal system.
- Post-radiotherapy changes: Signs of treatment response; Local progression; Actinic changes; Others (infection, radioinduced tumors).
- Post-operative changes: Normal post-operative findings; Non-neoplastic complication; Signs of recidivant lesion.
- Conclusion and key takeaways.

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## Abstract Archives of the RSNA, 2023

MKEE-15

### Temporomandibular Joint: A Jaw-Some Multimodality Guide of TMJ Disorders

#### TEACHING POINTS

1. Review anatomy of the Temporomandibular joint (TMJ) and its biomechanics. 2. Review clinical presentation of temporomandibular joint disorder (TMJD) 3. Discuss different causes of TMJD. 4. Multimodality overview of TMJD with emphasis on pertinent MRI findings. 5. Overview of management of TMJD.

#### TABLE OF CONTENTS/OUTLINE

Background- Temporomandibular anatomy- Clinical presentation of TMJD Causes of TMJD- Biomechanical/Traumatic- Internal derangement (Disk Displacement with reduction and Disk displacement without reduction)- Fractures- Dislocation.- Inflammatory Arthritis (Rheumatoid Arthritis, Psoriatic Arthritis Juvenile and Inflammatory Arthritis)- Degenerative Arthritis- Crystal Arthropathy- Neoplastic/Variant (Synovial chondromatosis, Tenosynovial giant cell tumor, TMJ aplasia/hypoplasia and TMJ hyperplasia) Pertinent MRI Findings- Direct Signs (Abnormal disk morphology Abnormal disk displacement in closed-mouth position Abnormal disk movement in open-mouth position Osteoarthritic changes)- Indirect Signs (Joint Effusion and Rupture of retrodiscal layers) Management (Physical Therapy, Joint Injection, TMJ Arthroplasty, Disc Plication, Discectomy and Recontouring of the articular eminence)

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## Abstract Archives of the RSNA, 2023

MKEE-16

### Augmented Bone Remodeling: An Emerging Concept in Bone Marrow MRI

#### TEACHING POINTS

1. Normal bone remodeling, the lifelong process of bone removal and reconstruction, can not be seen at CT and MRI. 2. Bone remodeling can accelerate as a physiological response to many non destructive insults to bone such as a change in biomechanical load, or adjacent bone and soft tissue lesions. 3. Accelerated bone remodeling can be seen at MRI as a marrow area with a moderate increase in signal intensity on fat-saturated fluid-sensitive images with limited or no signal changes on fat-sensitive images. 4. Signal changes patterns in accelerated bone remodeling can be linear subcortical, patchy or diffuse. 5. Knowledge of these marrow patterns at MRI is important to increase our understanding of bone pathophysiology and avoid confusion with more destructive bone lesions.

#### TABLE OF CONTENTS/OUTLINE

A/ Bone remodeling in normal and abnormal situations B/ The « regional acceleratory phenomenon » concept developed by H. Frost  
C/ MRI of accelerated bone remodeling Signal patterns Signal distribution D/ Correlations with pathological, radionuclide and radiological findings E/ Limitations and perspectives

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## Abstract Archives of the RSNA, 2023

MKEE-17

### Uncovering Common Lesions in the Sternoclavicular Joint and Costal Cartilages: A Diagnostic Guide

#### Participants

Giancarlo Domingues, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this study is: • To provide a comprehensive review of the normal anatomy and imaging appearance of the sternoclavicular joint and costal cartilages. • To improve understanding and diagnostic accuracy of the pathologies by didactically categorizing them into five distinct groups: degenerative, inflammatory, metabolic, traumatic, and infection.

#### TABLE OF CONTENTS/OUTLINE

The sternoclavicular joint is a critical structure that connects the axial skeleton and upper extremities and enables the movement of the upper limbs. This synovial joint can undergo degenerative alterations, with osteoarthritis being the most prevalent pathology. Additionally, degenerative calcifications in the costal cartilages are frequently observed. Inflammatory conditions, such as costochondritis, SAPHO syndrome, rheumatoid arthritis and spondyloarthritis also affect these structures. Differentiating between metabolic and inflammatory disorders often requires a detailed clinical history. Infections usually occur in immunosuppressed patients and spread hematogenously. Traumatic injuries are often misdiagnosed, leading to persistent chronic pain. Although rare, posterior sternoclavicular dislocation is potentially dangerous as it can compress vital structures.

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## Abstract Archives of the RSNA, 2023

MKEE-18

### Opportunistic Imaging in Musculoskeletal Radiology

#### Participants

Vivek Kalia, MD, MPH, Frisco, TX (*Presenter*) Research Consultant, Hyalex Orthopaedics, Inc

#### TEACHING POINTS

1. Opportunistic imaging is leveraging existing imaging data, commonly in the form of DICOM-format CT images, to extract potentially useful clinical information unrelated to the examination's original indication. 2. Opportunistic imaging, currently employed for a fairly narrow list of indications such as osteoporosis screening, is poised to enable large-scale population-based screening in the very near future. 3. At-scale deployment of opportunistic imaging creates opportunities and challenges in MSK radiology.

#### TABLE OF CONTENTS/OUTLINE

1. Definition and technical requirements a. Artificial intelligence (AI)/machine learning (ML) algorithms 2. Areas of Current Use a. Osteoporosis screening to predict fractures i. Bone mineral density (BMD) assessment ii. Finite element analysis for bone strength assessment b. Body composition analysis to predict cardiometabolic risk and mortality i. Muscle mass (sarcopenia) and quality (fatty infiltration) ii. Visceral adiposity iii. Hepatic steatosis iv. Atherosclerotic calcifications 3. Opportunities / Areas of Potential Use in the Future a. Individual risk stratification and customization of therapy b. Large-scale population screening c. Integration into electronic health records 4. Ongoing Challenges Considerations a. Potentially important and/or confounding information will be revealed by opportunistic imaging b. Potential for overdiagnosis and patient anxiety c. Potential for increased costs of care to healthcare system and/or individual patient

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## Abstract Archives of the RSNA, 2023

MKEE-19

### Scapulothoracic Disorders: Anatomy, Kinematics and Imaging Approach

#### Participants

Marília Da Cruz Fagundes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The scapulothoracic is a functional joint and an important part of the shoulder kinematic chain, supporting the center of the humeral head correctly aligned with the glenoid fossa during arm elevation and increasing the range of motion and strength of the rotator cuff muscles. Scapulothoracic disorders usually result in abnormal contact between scapula and chest wall. Pathophysiology includes structural abnormalities (such as scapula anatomic variants and bone and soft tissue expansive lesions), scapular dyskinesia (caused by denervation injuries or imbalance in muscle strength) and microtrauma (associated with overuse). Rarely, the joint may experience acute trauma leading to scapulothoracic dissociation. Primary pathologies are more frequent in young athletes, especially in throwing sports. Due to its functional nature, the identification of disorders related to scapulothoracic joint can be a diagnostic challenge for radiologists. Radiography and Computed Tomography allows the assessment of bone anatomy and anomalies, while Magnetic Resonance Imaging provides information on soft tissue causes and consequences of these disorders. Finally, imaging plays an important role in guiding treatment, whether clinical, including physiotherapy and other conservative measures, or surgical if necessary.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. Anatomy and Kinematics; 3. Pathophysiology: a. Morphological causes; b. Functional causes; 4. Imaging Assessment; 5. Management.

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## Abstract Archives of the RSNA, 2023

MKEE-2

### Beyond the Surface: The Power of Ultrasound in Diagnosing Epidermal Inclusion Cysts

#### Participants

Elena Julian Gomez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To know the typical sonographic features of the epidermal inclusion cyst. - To describe the different complications of epidermal inclusion cysts and their characteristic sonographic findings. - To review other cysts and tumors that, given their location, are part of the differential diagnosis of the epidermal inclusion cyst, as well as the sonographic features that allow us to suspect them.

#### TABLE OF CONTENTS/OUTLINE

Epidermal inclusion cysts are very frequent lesions, and their ultrasound evaluation is a daily request. As radiologists, we must be able to recognize their representative characteristics, as well as other atypical findings that should make us think of other lesions of the same location. Our work is organized as follows: 1. The epidermal inclusion cyst: brief review of its definition, etiopathogenesis, clinical presentation and histopathology. 2. Ultrasonographic features of the epidermal inclusion cyst: everything we should take into account. - Location/relation to the dermis. - Morphology. - Echostructure. - Relation with adjacent tissues. - Vascularization. - Elastography. 3. Ultrasonographic features of the different complications of the epidermal inclusion cyst, including: - Rupture. - Inflammation and infection. - Degeneration in giant cysts. 4. Differential diagnosis of the epidermal inclusion cyst: when to suspect other lesions? - Cystic lesions of adnexal origin. - True dermal and hair follicle sweat gland derived tumors. - Differential diagnosis of complicated inclusion cysts.

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## Abstract Archives of the RSNA, 2023

MKEE-20

### The Weight of the Neck: Understanding Subaxial Cervical Spine Injuries

#### Participants

Francis Ceden Rodriguez, Caguas, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Subaxial cervical spine injuries occur in the lower part of the neck (C3-C7) due to trauma and can range from mild to life-threatening. 2. Compression fractures are the most common, these fractures consist of a collapse of the vertebral body height due to trauma. Burst fractures involve posterior vertebral body wall fracture and can compromise the spinal canal. 3. Flexion and extension teardrop fractures present with typical corner fractures at typical locations. 4. Translation injuries are seen in high energy trauma mechanisms with severe flexion distraction and often associated with severe neurological sequelae. 5. Unilateral and bilateral facet dislocation result from rotational and/or flexion distraction injuries.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction  
A. Overview of Subaxial Cervical Spine Injuries  
B. Review of AO Spine Subaxial Cervical Spine Classification  
II. Radiologic Review of Types of Fractures  
A. Compression Fracture (CF)  
B. Burst Fracture (BF)  
C. Flexion Teardrop Fracture versus Linear Nondisplaced Anterior Inferior Corner Fracture  
D. Extension Teardrop Fracture (ETF)  
III. Rotation and Translation Injuries  
A. Facet Subluxation  
B. Facet Dislocation  
C. Vertebral Translation  
IV. Complications of Cervical Spine Injury  
A. Vascular Injury  
B. Spinal Cord and/or Exiting Nerve Injury  
C. Hematomas (Epidural / Prevertebral)  
D. Ligament Injury  
E. Disc Injury  
V. Conclusion  
VI. Self Assessment

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## Abstract Archives of the RSNA, 2023

MKEE-21

### Flying High and Falling Hard: A Radiological Review of Ultimate Frisbee Injury Patterns

#### Participants

Shaun Johnson, BS, Cleveland Heights, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Understand the game of ultimate frisbee Learn how injuries commonly occur in this sport Understand commonly reported injuries from previous literature Review imaging findings in these patients

#### TABLE OF CONTENTS/OUTLINE

Introduction to ultimate frisbee Defining terminology and gameplay Discussion of rules Common maneuvers Prior reports of common injuries, epidemiology Literature review of common ultimate frisbee related injuries Fajardo Pulido et al 2020 Demonstrated a high lifetime prevalence of injury with injury to the knee, thigh, ankle, and shoulder being most common Akinbola et al 2015 Ultimate frisbee accounts for a high percentage of collegiate athlete injuries with similar trends to other sports Imaging review of patients with ultimate frisbee related injuries Discussion of diagnosis, mechanism injury, correlation with activity, and management strategies, from most common to least common Knee Ligament, meniscal, tendon pathologies Overuse injuries Foot/Ankle Ankle sprains Overuse injuries Shoulder Glenohumeral dislocation Acromioclavicular joint injuries Clavicular fractures Head Concussion Wrist Injuries related to fall on outstretched hand Chest Contusions Thigh Muscle strains Elbow Conclusion Discuss similarities and differences with various sports and known injury patterns such as soccer (football), American football, rugby.

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## Abstract Archives of the RSNA, 2023

MKEE-22

### Did You Know that Your Slot-Scan Radiograph for Scoliosis can Artefactually Cause a Worsening Spinal Curvature? Plus Other Stories of Artifacts Associated with Digital Slot-Scanning Radiography

#### Participants

Sean Schoeman, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Biplanar digital slot-scanning technology is a stereoradiography imaging (SRI) system that reduces radiation exposure for patients requiring serial imaging for chronic and progressive skeletal conditions (1). This has become preferred to standard x-ray additionally because of the ability to image full length spine and lower limbs for follow-up of children with scoliosis and leg-length discrepancy - images are interpreted by pediatric radiologists and orthopedic surgeons. Here we use our experience reviewing multiple images of patients at different time points to demonstrate distinct types of imaging artifact with this imaging modality. Reviewing physicians should be aware of such artifacts so as not to confuse artifacts with pathology which may lead to misdiagnosis or unnecessary management. The purpose of this educational abstract is to demonstrate common artifacts found at our institution.1. Melhem E, Assi A, El Rachkidi R, Ghanem I. EOS(®) biplanar X-ray imaging: concept, developments, benefits, and limitations. J Child Orthop. 2016 Feb 16;10(1):1-14.

#### TABLE OF CONTENTS/OUTLINE

1. Image acquisition technique for slot-scanning and resultant artifacts 2. Incorrect image centering artifact - causing change in Cobb angle and mimicking worsening scoliosis 3. Movement artifacts a. Wavy cardiac margin b. Wavy bones c. Wavy hardware 4. Edge enhancement artifacts a. Halo around hardware b. Pseudo-pneumomediastinum c. Lucency above diaphragm

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## Abstract Archives of the RSNA, 2023

MKEE-23

### Improving Bone Tissue Characterization on MRI Using Gradient-echo: The Role of Simulated CT (sCT) Sequences

#### Participants

Felipe Correa, MD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

.Conventional MRI has limited ability to assess trabecular and cortical bone due to low proton density and markedly reduced T2 decay time..The FRACTURE sequence (Fast field echo Resembling A CT Using Restricted Echo-spacing) aims to improve the visualization of trabecular and cortical bone on MRI by simulating CT tissue contrast..In FRACTURE multiple echoes are acquired at a precise echo-spacing that corresponds to in-phase TEs. Following acquisition, the first post-processing step consists of a magnitude summation of all echoes. After summation, the images from the last echo are subtracted from the summated images to invert the grayscale and give bone a CT-like contrast..Simulated CT contrast sequences have great potential to assist in the diagnosis of inflammatory diseases, neoplasms, trauma, and normal variants. These sequences are useful for demonstrating bone fragmentation, resorption, and bone reaction, which facilitates the identification and understanding of deformities and complex bone remodeling..The great advantages of the FRACTURE sequence are the possibility of using gradient sequences available in all MRI devices and simple post-processing steps.

#### TABLE OF CONTENTS/OUTLINE

.How sCT sequence acquisition and post-processing are performed..Role of the sCT sequence to evaluate the trabecular and cortical bone in routine examinations..Cases of clinical practice in which the sCT sequence turned out to be superior to conventional MRI for trabecular and cortical bone abnormalities.

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## Abstract Archives of the RSNA, 2023

MKEE-24

### Shouldering the Load: Bridging the Gap of Rotator Cuff Tears with Patch Augmentation

#### Participants

Sirui Jiang, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Anatomy of the rotator cuff  
2. Common patterns of rotator cuff tears  
3. Standard of practice for surgical repair  
4. Emerging treatments in graft augmentation  
5. Advanced imaging characteristics of graft-augmented versus conventional repairs

#### TABLE OF CONTENTS/OUTLINE

1. Review of rotator cuff anatomy,  
2. Clinical presentations of rotator cuff tears  
3. Spectrum of rotator cuff disease  
3a. Prevalence of tears and common tear patterns,  
3a.i. Acute versus chronic tear presentations and diagnosis,  
3a.ii. MRI findings and Goutallier classification,  
3a.iii. Ellman classification of partial-thickness rotator cuff tears,  
3a. iv. Massive rotator cuff tears,  
4. Arthroscopic Repair Techniques,  
4a. Single versus double row repair,  
4b. MRI findings after conventional arthroscopic repair,  
4b.i. Failure findings,  
4b.ii. Assessment of repaired tendon quality (Sugaya Classification),  
5. Patch augmentation,  
5a. Indications for patch augmentation,  
5b. Benefits and complications of patch augmentation,  
5b.i. Reduction in retear rate and improvement in tendon thickness/quality,  
5b.ii. Complications with xenografts,  
5c. Types of patch augments,  
5c.i. Collagen Scaffold (Regeneten),  
5c.i.a. Clinical outcomes and MRI features of healed Regeneten patch,  
5c.ii. Acellular dermal allograft (Dermis-on-demand),  
5c.ii.a. Clinical outcomes and MRI features of healed Dermis-on-demand,  
6. Future directions,  
6a. Anticipated advancements,  
6b. Biologic injections (PRP, stem cells) with concomitant patch augmentation

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## Abstract Archives of the RSNA, 2023

MKEE-25

### Checkmate to Chest Wall Tumors: A Strategic Approach to Diagnosis

#### Participants

Rebeca Francelino, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Although chest wall tumors and tumor-like lesions are rare, familiarity with the main diagnostic entities is important. There is a large 'overlap' between the different etiologies, with many non-specific features between benign and malignant tumors. In the absence of other auxiliary tests, such knowledge allows narrowing the differential diagnoses, in addition to facilitating the decision to recommend further investigation when necessary. The purpose of this exhibit is: 1. To review the most common tumors and their characteristic imaging findings. 2. To discuss the diagnosis and management of benign and malignant tumors. 3. To correlate the imaging findings and clinical clues on a systematic approach to help narrowing the differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1- Institutional Protocol to evaluate the chest wall; 2- Epidemiological assessment of the main lesions and best imaging modality 3- Benign bone and cartilaginous tumors Osteochondroma Fibrous dysplasia Aneurysmal bone cyst (ABC) Giant cell tumor (GCT) Ossifying fibromyxoid tumor Chondromyxoid fibroma 4- Malignant bone and cartilaginous tumors Chondrosarcoma Multiple Myeloma Metastasis Osteosarcoma 5- Benign soft tissue lesions Hemangioma Elastofibroma dorsi Fibrous Hamartoma of Infancy Lipoma Schwannoma Desmoid Tumor Neurofibroma Ganglioneuroma Paraganglioma Hemangiopericytoma 6- Malignant soft tissue lesions Ewing sarcoma Rhabdomyosarcoma Synovial sarcoma Pleomorphic sarcoma Ganglioneuroblastoma Neuroblastoma Angiosarcoma Leiomyosarcoma Malignant fibrous histiocytoma (MFH) Malignant peripheral nerve sheath tumor Dermatofibrosarcoma protuberans 7- Miscellaneous Brown Tumor

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## Abstract Archives of the RSNA, 2023

MKEE-26

### Navigating the Lumbosacral Plexus: A Guide to Understanding its Normal Anatomy and Injuries.

#### TEACHING POINTS

The aim of this study is: 1. Review with didactic illustrations the anatomy of the lumbosacral plexus, including how to recognize it on MRI. 2. Demonstrate how various lumbosacral plex injuries manifest clinically and on imaging studies. 3. Present didactic cases of lumbosacral plexus injuries, highlighting the main findings that the radiologist should expect.

#### TABLE OF CONTENTS/OUTLINE

- Introduction and review of lumbosacral brachial anatomy, with didactic illustration.
- Review normal anatomy without MRI, highlighting anatomical landmarks.
- Overview of the main lumbosacral plexus injuries, their clinical and epidemiological manifestations and their imaging findings.
- Demonstrate with challenging clinical cases traumatic and non-traumatic pathologies, such as inflammatory polyneuropathy, other neuropathies, and associated alterations such as piriformis syndrome.
- Present a case series of lumbosacral plexus injuries and what you should actively look for depending on the clinical history.
- Propose a diagnostic checklist for evaluating lumbosacral plexus injuries, simplifying the reading of these challenging exams.
- Summary.

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## Abstract Archives of the RSNA, 2023

MKEE-27

### Crystal Spine: Findings of Spinal Crystal Deposition Disease on CT and MRI

#### Participants

Andrea S. Costacurta, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Crystal Deposition Disease must be considered in the differential of spinal pain. 2- Findings are often located outside the spinal canal, in the soft tissues, and can be overlooked. 3- MRI has a high sensitivity in detecting inflammation but poorly detects calcification. CT on the other hand has high sensitivity to calcification however the amount of associated inflammation is often underestimated. Awareness of the disease may help in the diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Definition and clinical aspects of Crystal Deposition Disease. 2. Classification. 3. Brief review of pathophysiology. 4. Description of the main imaging findings in the spine: longus colli tendinitis, crowned dens syndrome, aseptic spondylodiscitis, disc, ligament or dural calcifications, facet joint arthropathy. 5. Discussion of the differential diagnosis.

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## Abstract Archives of the RSNA, 2023

MKEE-29

### Back to the Future: Automatic Deep Learning Approaches to Opportunistically Assess Spine Health

#### TEACHING POINTS

Complications from spine diseases are highly prevalent across the world. For example, over 1.5 million individuals suffer from back pain due to vertebral fractures and millions more are afflicted with neurogenic back pain. One way to prevent these diseases from developing is to opportunistically assess imaging studies for overall spine health by trending changes in quantitative spine metrics. However, the process of making measurements necessary to diagnose such pathologies is time-consuming, resulting in high underreporting rates for some of the aforementioned conditions (as high as 85%). This exhibit will focus on explaining how deep learning algorithms can be used for detecting vertebral body and disc deformities, trending Cobb angle, assessing paraspinal muscle fat content, and quantifying spinal cord/foramen compression.

#### TABLE OF CONTENTS/OUTLINE

At the end of this presentation the learner should have knowledge about the following:1. Overview of the prevalence of vertebral fractures, disc herniation, spinal cord compression, scoliosis and current manual methods used to quantify severity of these pathologies.2. How neural networks can be used for anatomic object detection across multiple modalities using novel visual transformer and deep convolutional neural networks.3. How keypoint detection networks can be used for automated quantitative vertebral deformity diagnoses.4. How segmentation networks can be used to extract vertebral bodies, intervertebral discs, paraspinal muscles, spinal canal/cord/foramina using 2D and 3D UNets and Swin3D transformer networks.5. A framework for how these measurements can be used for comprehensive spine health assessment in an opportunistic manner.

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## Abstract Archives of the RSNA, 2023

MKEE-3

### Imaging of Meniscal Root Tears: A Practical Review

#### Participants

Bruno Watabe, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: •Review and illustrate the anatomy of the meniscal roots and their specific characteristics. •Illustrate and discuss patterns and classifications of injuries involving these structures, along with their clinical relevance. •Illustrate and discuss various surgical treatments, arthroscopic correlation, and postoperative imaging findings of meniscectomy and repair with suture techniques.

#### TABLE OF CONTENTS/OUTLINE

The meniscal roots and supporting structures anchor the menisci to the tibial plateau, resisting hoop stress and preventing radial displacement of the menisci and subsequent degeneration of the tibiofemoral compartment. Imaging helps determine the type and location of lesions, guiding treatment decisions. An accurate description of lesions and associated imaging findings helps orthopedic surgeons determine the best surgical technique and improve patient outcomes. • Anatomy: Illustration and imaging of the tibial plateau and sites of meniscal root fixation, highlighting their specific characteristics. • Pathological Conditions: Recognition of degenerative changes and various types of traumatic tears in the meniscal roots, along with commonly associated findings, can aid in treatment decisions and potentially delay the onset of secondary osteoarthritis due to meniscal lesions. • Surgical Treatment and Postoperative Imaging: Illustration of different surgical techniques, including partial meniscectomy and meniscus repair, along with their indications and contraindications. Arthroscopic correlation and postoperative images showing follow-up within a certain time interval and potential outcomes.

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## Abstract Archives of the RSNA, 2023

MKEE-30

### Hip Instability Beyond Dislocation: An Overview of New Concepts and Current Radiological Approaches

#### Participants

Julio Guimaraes, MD, Sorocaba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Hip instability is conceptually divided into traumatic and atraumatic causes, eventually leading to long-term complications, such as osteoarthritis. Hip dislocation and subluxation are well-established entities associated with high and low-energy trauma. Conversely, microinstability is a developing concept, mainly atraumatic, characterized by the inability to keep the femoral head centered within the acetabular fossa in extra physiological movements, which diagnosis involves detailed anamnesis and physical examination, as well as imaging approach. Bone markers for instability are classified into acetabular and femoral subgroups, which can be evaluated by radiographs and CT scans. Acetabular coverage and orientation are assessed to diagnose developmental hip dysplasia. In patients with borderline acetabular coverage, the concomitant evaluation of the Shenton line and femoral physeal scar orientation can determine microinstability diagnosis. The femoral head is assessed for bone morphology, CAM deformity, femoral torsion and neck-shaft angle. Connective tissue disorders are best depicted with MRI, related to capsular laxity, thinning or redundancy. Iatrogenic causes are related to capsular disruption due to intra-articular assessment during hip procedures. MRI can also reveal specific secondary chondral and labral lesions resulting from those structural abnormalities.

#### TABLE OF CONTENTS/OUTLINE

1. Definition; 2. Anatomy; 3. Pathophysiology: a. Traumatic: i. Dislocation and subluxation; b. Microinstability (atraumatic): i. Bone insufficiency; ii. Soft tissue insufficiency; iii. Post-surgical; 4. Imaging Assessment; 5. Management.

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## Abstract Archives of the RSNA, 2023

MKEE-31

### Imaging Spectrum of Foot Infections: A Practical Guide to Radiologists

#### Participants

Carlos Francisco Kallas Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The differentiation between foot infection imaging patterns is a common challenge for radiologists. Imaging methods provide detailed anatomical information in the assessment of infections, thus helping clinicians to reach the most accurate diagnosis. CT scans play a key role in providing multi planar reconstructions for bone evaluations, whereas MRI is highly sensitive for detecting osteomyelitis in initial stages and can help particularly in looking for soft tissues' complications. In this evaluation it is also important to understand the particularities of each etiological agent. Bacteria is the most common cause of infection, frequently associated with synovitis and osteomyelitis. Tuberculosis can also be related to tenosynovitis and osteomyelitis, especially in immunocompromised patients. Fungal infections have been described to have the classic "dot in a circle" sign on T2 weighted images. It is also important to remember foreign bodies related infections, to avoid misdiagnosis. The diabetic foot is another condition that requires special attention by radiologists. Neuropathic arthropathy predisposes to a greater risk of infection, mostly due to the loss of sensitivity, repetitive trauma and poor healing. Osteomyelitis and Charcot arthropathy frequently coexists, therefore, it is essential radiologists to understand the particular imaging features of these conditions and how they affect the foot compartments, to aid in diagnosis and proper management.

#### TABLE OF CONTENTS/OUTLINE

Background/epidemiology Anatomy, vascularity and foot compartments Etiological agents Diabetic foot Imaging techniques Diagnostic approach: what to report? Differential diagnosis Take-home Points

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## Abstract Archives of the RSNA, 2023

MKEE-32

### **MRI and US Evaluation of the Carpal Tunnel and Guyon ´s Canal: Normal Anatomy, Pathological and Postoperative Findings**

#### **Participants**

Diego dos Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Report general information about the carpal tunnel and Guyon ´s canal.- Review the normal anatomy of these canals and their main anatomical variations.- Describe its pathological involvement and its imaging patterns and postoperative evaluation on ultrasonography (US) and magnetic resonance imaging (MRI), through clinical cases from our service.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction:- General information about the carpal tunnel and Guyon ´s canal.Normal anatomy of carpal tunnel and Guyon ´s canal.Clinical cases of pathological and postoperative findings and its imaging patterns on US and MRI:\* Carpal Tunnel:- Carpal tunnel syndrome- Anatomical variation of carpal bones with tunnel reduction- Accessory tendon of the superficial flexor muscle- Arthrosynovial cyst determining median nerve neuropathy- Calcium deposit in the carpal tunnel- Thrombosis of the ulnar tributary artery\* Guyon ´s canal:- Arthrosynovial cyst in Guyon's canal- Thrombosis of the ulnar artery\* Other structures:- Neuropathy of the palmar cutaneous branch of the median nerve\* Postoperative findings:- Postoperative changes from carpal tunnel decompression / median nerve injury- Postoperative median nerve neuroma\* Other cases

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## Abstract Archives of the RSNA, 2023

MKEE-33

### Plain Film Evaluation of the Traumatic Knee: A Case-Based Primer

#### TEACHING POINTS

The knee is a commonly injured joint in both children and adults. Plain film evaluation is often first line and familiarity with knee anatomy on plain films is critical for appropriate imaging evaluation. This exhibit reviews normal anatomy of the knee on plain films and illustrates the utility and limitations of plain films in evaluation of the knee joint in the setting of trauma. Utilizing a case-based approach, it reviews common and uncommon knee injuries, their mechanisms, and offers pearls and pitfalls to aid the radiologist in comprehensive radiographic assessment.

#### TABLE OF CONTENTS/OUTLINE

Anatomy Intercondylar Fractures Tibial Plateau Fractures Patellar Fractures Patellar Dislocation Avulsion Injuries Physeal Injuries Stress Fractures Knee Dislocation

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## Abstract Archives of the RSNA, 2023

MKEE-34

### Avoiding the Iceberg and the Ring of Fire: Thermal Protection on Musculoskeletal Ablations

#### TEACHING POINTS

1 - Review and explain the methods that can be used to protect the tissues surrounding thermoablation areas. 2 - Discuss the monitoring methods and devices to evaluate sensitive structures near procedure sites. 3 - Didactic clinical cases with images of musculoskeletal ablations, each kind of protecting measures and potential complications.

#### TABLE OF CONTENTS/OUTLINE

1 - Types of musculoskeletal ablations; 2 - Radiofrequency; 3 - Cryoablation; 4 - Microwave; 5 - Interstitial laser; 6 - Complications; 7 - Safety measures on ablations; 8 - Preparation and monitoring; 9 - Thermal protection types; 10 - Hydrodissection; 11 - Pneumodissection; 12 - Mechanical manipulation; 13 - Skin temperature control.

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## Abstract Archives of the RSNA, 2023

MKEE-35

### Anterior Glenohumeral Instability: Biomechanics, Preoperative and Postoperative Evaluations

#### Participants

Thais Kuwazuru, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose  
Renata Leao, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Traumatic dislocation of the shoulder leads to labral detachment and elongation of the capsular ligamentous restraints, as well as bone loss on the glenoid, humerus or both.-Characterization of the bone loss, with glenoid track, allows an accurate treatment choice.-Most common procedures: Labral repair, glenoid augmentation and humeral reconstruction.-Labral retear: 1.fluid insinuation between the labrum and the glenoid bone margin; 2. Fluid insinuation within the labrum; 3. Morphologic abnormality greater than expected; 4. Anchor detachment.-Latarjet: 1.Graft complications: non-union, dislocation, mispositioning; 2.Hardware complications: loosening, fracture, dislocation; 3.Others: glenohumeral arthritis, neurovascular injuries, subscapularis muscle injury.-Remplissage: indications and normal/abnormal postoperative findings.

#### TABLE OF CONTENTS/OUTLINE

1.Glenohumeral biomechanics and anterior instability2.Anterior glenohumeral dislocation and associated injures3.Glenoid labrum tears4.Bone compression and bone loss - glenoid - humerus and bipolar bone loss5.Labral repair procedure: indications, normal and abnormal postoperative imaging6.Glenoid reconstruction techniques: indications, Latarjet/Bristow and others7.Normal and abnormal imaging findings in glenoid reconstruction techniques8.Humeral head reconstruction: indications, normal and abnormal findings9.Conclusion: the correct assessment of glenohumeral instability is important for the surgical decision. It is essential to know the expected imaging patterns of each surgical technique and the corresponding pathological findings to properly manage potential complications in patients.

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## Abstract Archives of the RSNA, 2023

MKEE-36

### Giant Cell Tumor of Bone: Atypical Imaging Features, Treatment and Complications

#### Participants

Adriano Silveira Moreira Novaes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. Briefly review of the most important features suggesting the diagnosis of the giant cell tumors (GCT) of bone. 2. Demonstrate the unusual locations of the GCT. 3. Review de atypical imaging findings of the GCT and complications in follow-up.

#### TABLE OF CONTENTS/OUTLINE

Giant cell tumor (GCT) of the bone is a generally benign tumor that has recently been reclassified as osteoclastic giant cell-rich tumors according to WHO 2020 classification. It is typically diagnosed through conventional radiographs that show a lytic lesion with a well-defined, non-sclerotic margin, eccentric location, extension to the subchondral bone, and centered in the metaepiphysis of mature long bones. Fluid-fluid levels are seen in 15% of cases, consistent with secondary formation of aneurysmal bone cyst. GCT commonly develops in long bones, particularly around the knee, but can occur in atypical locations with less characteristic radiographic features. Pediatric patients with open epiphyseal growth plates are infrequently affected. Lung metastases are rare, occurring in 1-6% of cases. Recurrence after curettage with cement placement is a possible complication, but this has become less common with the use of adjuvant therapies such as Denosumab.

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## Abstract Archives of the RSNA, 2023

MKEE-37

### **Congenital Hand Malformations: A Review in the Palm of Your Hand**

#### **Participants**

Karla Ortega Rivera, MD, Queretaro, Mexico (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Congenital hand malformations can have a significant impact on hand function and aesthetics, and thus, management should be multidisciplinary and involve specialists in plastic surgery, orthopedics, radiology, and psychology. 2. Radiographic imaging allows for visualization of bone structures, assessment of alignment, and morphology of the hand. 3. Radiographic evaluation is a crucial tool in the assessment of congenital hand malformations. Radiographic findings can help determine the type and severity of the malformation, which can be useful in treatment planning. 4. The aim is to provide a review of the most common congenital hand malformations, their radiographic findings, classifications, and therapeutic approaches, along with illustrative cases both pre- and post-surgery.

#### **TABLE OF CONTENTS/OUTLINE**

I. Introduction  
II. Embryology  
III. Classification  
IV. Specific types of congenital hand malformations and radiographic evaluation  
Polydactyly, syndactyly, camptodactyly, brachydactyly, clinodactyly, constriction ring syndrome  
V. Management of congenital hand malformations  
VI. Cases

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## Abstract Archives of the RSNA, 2023

MKEE-38

### The Muscle Fascia: From Anatomy to Pathological Findings

#### Participants

Diego dos Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Report some concepts related to the muscle fascia, clarifying its definition.- Review the normal anatomy of the muscle fascia through illustrative schemes and correlation with imaging methods - magnetic resonance imaging (MRI) and ultrasonography (US).- Describe its pathological findings and its imaging patterns, through clinical cases gathered in our service.

#### TABLE OF CONTENTS/OUTLINE

Introduction:- Definition and general information about the muscle fascia: fascia superficialis, deep peripheral fascia and deep intermuscular fascia  
Normal anatomy of the muscle fascia and correlation with MRI and US.  
Clinical cases of pathological findings and its imaging patterns on US and MRI:  
\* Traumatic:- Morel-Lavallée lesion- Plantar fascia injury- Muscle hernia / Myo-aponeurotic injuries\* Inflammatory:- Post viral inflammatory fasciitis- Nodular fasciitis- Plantar fasciitis\* Infectious:- Necrotizing and non-necrotizing cellulitis and fasciitis\* Autoimmune: - Eosinophilic fasciitis- Systemic lupus erythematosus- Polymyalgia rheumatica\* Neoplastic:- Superficial fibromatosis- Desmoid tumor / Hibernoma- Sarcoma\* Postoperative:- Assessment of muscle fascia after fasciotomy\* Other:- Compartment syndromes- Granulomatous disease\* Other cases

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## Abstract Archives of the RSNA, 2023

MKEE-39

### The Resident's Thriller: A Pictorial Essay on Benign Bone Tumors

#### Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This essay aims to review the main benign bone tumors and its multimodality radiological features. Although many tumors' diagnoses are histopathological, radiologists and radiology residents must be able to identify several entities, especially those whose correct identification are imaging-made.

#### TABLE OF CONTENTS/OUTLINE

Bone cysts. Chondroblastoma. Chondromyxoid fibroma. Enchondroma. Eosinophilic granuloma. Fibrous dysplasia. Giant cell tumor. Intraosseous hemangioma. Lipoma of the bone. Non-ossifying fibroma. Osteochondroma. Osteoid osteoma.

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## Abstract Archives of the RSNA, 2023

MKEE-4

### Glenohumeral Osteoarthritis: Overview, Imaging Approach and Preoperative Assessment

#### Participants

Marco Aurelio Soato Ratti, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Glenohumeral osteoarthritis (GHOA) has a prevalence as high as 20% in the middle-age and elderly population, predominantly observed as the primary form (no specific risk factors). Conversely, secondary GHOA is associated with diverse causes, including rotator cuff tear, post-traumatic degeneration, gleno-humeral morphology (retroversion and glenoid dysplasia), shoulder instability, inflammatory arthropathies and microcrystal deposition. Imaging plays a pivotal role for GHOA diagnosis, investigation of underlying predisposing factors, evaluation of the extent of degeneration and of local complications. Since surgery can be considered in symptomatic patients with moderate to severe degenerative changes, unresponsive to conservative treatment, preoperative assessment by imaging is fundamental. A multimodality approach including radiographic images, computed tomography and magnetic resonance imaging helps the surgeon to choose the ideal technique for better outcomes. Pathologic glenoid version, bone loss and rotator cuff atrophy, as examples, have established association with poor clinical outcomes and hardware complications following arthroplasty. Thus, complete preoperative assessment of glenohumeral joint includes the following aspects: evaluation of bone stock, glenoid version, glenoid tilt, assessment of the rotator cuff with Goutallier classification and Walch classification.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. Epidemiology; 3. Definition and pathophysiology; 4. Etiology, a. Primary form (or non-specific risk factors), b. Secondary form (or specific risk factors); 5. Multimodality imaging evaluation; 6. Preoperative imaging assessment: what to report.

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## Abstract Archives of the RSNA, 2023

MKEE-40

### CT Myelography and Blood Patches in Intracranial Hypotension: A Primer

#### TEACHING POINTS

1 - Review and explain the intracranial hypotension syndrome, its image manifestations, causes and treatments. 2 - Present didactic clinical cases with images of cerebrospinal fluid (CSF) leaks and fistulas. 3 - Discuss CT myelography technique and interpretation. 4- Show the treatment options for CSF leaks and fistulas. 5 - Demonstrate guided epidural blood patch treatment with real cases images.

#### TABLE OF CONTENTS/OUTLINE

1 - Intracranial hypotension syndrome; 2 - Etiologies; 3 - Diagnostic criteria; 4 - Most common image manifestations; 5 - Imaging methods for etiology investigation. 6 - Spine MRI; 7 - CT myelography; 8 - CSF leaks; 9 - CSF-venous fistulas; 10 - Conservative, interventional and surgical treatments. 11 - Epidural blood patch: how to.

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## Abstract Archives of the RSNA, 2023

MKEE-41

### Distal Tibiofibular Syndesmosis: Stabilize Your Knowledge and Leave the Instability to the Injuries

#### Participants

Izabel Karam, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: To review the anatomy and biomechanics of the distal tibiofibular syndesmosis; Discuss the role of each imaging method, including indications, advantages and disadvantages of each modality; To illustrate the main acute and chronic alterations in radiological and orthopedic practice, through didactic cases illustrating our institution through a multimodality approach; Discuss surgical indications and the importance of the findings for the orthopaedic surgeon, according to the imaging methods.

#### TABLE OF CONTENTS/OUTLINE

Anatomy. Biomechanics. Indication for requesting imaging exams in general. Role of radiography, main views and how to evaluate. Role of ultrasonography. Role of CT in neutral. Role of CT with stress maneuvers. Role of Weight-bearing CT. Role of MRI. Surgical indications, importance of radiological findings, and radiological and surgical correlation. Summary and proposed evaluation and test request flowchart. Future perspectives.

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## Abstract Archives of the RSNA, 2023

MKEE-42

### Capturing Psoriatic Arthritis on Film: A Comprehensive Guide to Radiographic Assessment

#### TEACHING POINTS

- Provide an overview of psoriatic arthritis.
- Emphasize the indications, limitations, and benefits of radiography in psoriatic arthritis.
- Compare different imaging techniques for psoriatic arthritis.
- Discuss the normal anatomy of the hand on plain film radiography.
- Emphasize the importance of a systematic approach to hand radiography.
- Become familiar with descriptive terms for common bone and soft tissue abnormalities seen in psoriatic arthritis.
- Provide case studies to illustrate the practical application of theoretical concepts.
- Analyze differential diagnostics, tips, and tricks.

#### TABLE OF CONTENTS/OUTLINE

Overview of psoriatic arthritis: definition, epidemiology, pathogenesis, and clinical manifestations. Radiography in psoriatic arthritis: indications, limitations, and benefits. Comparison of imaging techniques for psoriatic arthritis: radiography, ultrasound, and MRI. Normal anatomy and systematic approach to the hand on plain film radiography. X-rays and psoriatic arthritis: descriptive terms for common bone and soft tissue abnormalities. Case studies: practical application of theoretical concepts. Differential diagnostics: osteoarthritis, gout, and rheumatoid arthritis. Tips and tricks for improving radiology reports. Conclusions: What rheumatologists want to know?

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## Abstract Archives of the RSNA, 2023

MKEE-43

### Bad to the Bone! Understanding and Applying Bone-RADS: A Standardized Scoring System for Bone Lesions

#### Participants

Ellis Mejias Febres, BS, Carolina, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review pathology of bone anatomy-Bone-RADS provides an algorithmic-type approach to assessing differential diagnosis of bone tumors -Each Bone-RADS score is determined by certain criteria that includes the clinical implications for each -Provision of case examples on conventional radiography and computed tomography (CT) to better understand Bone-RADSIn this educational exhibit, we will review the standardized scoring system Bone-RADS, as well as provide radiologists and other health professionals with an understanding of Bone-RADS. the scoring system itself will be explained, supported by imaging from real cases. Finally, we will explain the implications every score has on the management of individual cases based on the Bone-RADS score assigned.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction-Review of bony anatomyCreation of Bone-RADSII. Overview of the criteria used in Bone-RADSIII. Clinical implications/management of bone tumors based on Bone Rads-How Bone-RADS serves as a guide to assessing bone lesions.IV. Imaging examples-Case by case analysis of how Bone-RADS scores are determined.V. Conclusion-Recap of teaching points.

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## Abstract Archives of the RSNA, 2023

MKEE-44

### Anterior Cruciate Ligament Reconstruction: Imaging Evaluation of the Techniques, Normal Appearance and Complications

#### Participants

Andre Y. Aihara, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Anterior cruciate ligament (ACL) reconstruction aims to restore knee stability. The surgical techniques for ACL reconstruction include single and double bundle, while the most frequently used autografts are bone-patellar tendon-bone and hamstring tendons. CT is the gold standard for evaluating tunnel placement, while MRI is best for assessing graft continuity and soft tissue complications. MRI signal intensity of the graft changes over time, with low signal immediately after surgery, increased signal in the first year due to remodeling, and low signal at 18 months. The objectives of this exhibit are: 1. To review ACL reconstruction techniques 2. Discuss imaging findings of normal postoperative ACL 3. Illustrate post-operative complications according to the potential sources: graft, technical and hardware complications, and soft tissues.

#### TABLE OF CONTENTS/OUTLINE

ACL reconstruction Techniques Normal postoperative Imaging • Femoral and tibial tunnels: position and size • Signal intensity of the graft over time • Harvest sites • Radiographic findings • CT findings • MRI findings Complications • Graft Partial tear Complete tear Porto-Knee Testing Device • Technical and hardware complications Anterior tibial tunnel with impingement Anterior femoral tunnel Tunnel widening Hardware migration Hardware fracture • Soft tissues Arthrofibrosis Infection Adventitious Bursitis

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## Abstract Archives of the RSNA, 2023

MKEE-45

### Imaging Evaluation of the Patella as the Largest Sesamoid Bone

#### Participants

Andre Rosenfeld, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The patella is the largest sesamoid bone in the human body, developing within the quadriceps tendon and becoming a part of the knee's extensor mechanism. Ossification centers can be associated with congenital disorders. Forceful contraction of the extensor mechanism can lead to chronic apophysitis or acute avulsion fractures. Although rare, tumors of the patella can occur, with the majority being benign. Additionally, crystal arthropathies such as gout and CPPD can affect the patella through the deposit of crystals in the tendons or cartilage. Certain diseases are associated with typical patellar morphologies. For example, multiple epiphyseal dysplasia is characterized by a double-layered patella, Cryopyrin-Associated periodic syndromes result in a disproportionately diffuse increase in size, and CPPD deposits cause a gear-like morphology. The purpose of this study is to review the normal development and anatomy of the patella. Discuss and illustrate the imaging findings of pathologies of the patella, which can be didactically divided into congenital disorders, mechanical/trauma, tumors, and crystal arthropathies. For this purpose, radiographs, CT scans, and MR images will be used. Highlight the typical patellar morphologies associated with various diseases. Elucidate how to differentiate normal variants from pathological conditions.

#### TABLE OF CONTENTS/OUTLINE

Normal development of the patella and anatomy Pathologies • Congenital: Bipartite, tripartite, double-layered patella, absence of the patella • Mechanical/trauma: Fracture, sleeve avulsion, Sinding-Larsen-Johansson • Tumors: benign and malign • Cryopyrin-Associated periodic syndromes • Crystal arthropathies: gout and CPPD

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## Abstract Archives of the RSNA, 2023

MKEE-46

### 3D Printing and Metaverse in Musculoskeletal Tumors - A New Assessment Tool

#### Participants

Flavia M. Costa, MD, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 3D printing preoperative planning for the treatment of MSK tumors ( soft tissue and bone tumors).a. Segmentation. Virtual modeling. Build preparations. Quality assessment• Patient-specific devices - Personal surgical instruments ( PSIs);• Identify what sequences should be used for Preoperative planning in many oncological patients with computed tomography (CT) ( maximum slice thickness of 1 mm) and contrast-enhanced magnetic resonance (MR- 3 Tesla -Siemens) and multiplanar reconstruction;• Mixed Reality (MR) is a technology of real and virtual worlds to enhance visualizations, where physical and digital objects coexist and allow users to interact with both in real-time• Special considerations and Pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1) The value of the combination of 3D printing and metaverse in surgical planning procedures in soft tissue and bone tumors;2) These techniques promise improvements and outcomes for complex bone tumor resection2) Case discussion:• Osteosarcomas resection and prosthesis manufacture• Pleomorphic liposarcomas recidive assessment• Schwannomas• Condrossarcomas• Bone marrow metastasis3) To demonstrate many indirect effects of 3D printing on surgical procedures: • reduced surgery time;• to a reduced complication rate of wound infections and wound healing disorders and therefore enable earlier adjuvant therapy initiation 4) Common pitfalls 5) Conclusion Surgical planning using 3D printing and metaverse/ may result in negative tumor resection margins that reduce the risk of local recurrence and adversely affect patients' survival. Computer navigation and 3D-printed resection guides have been reported to be surgical accurate.

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## Abstract Archives of the RSNA, 2023

MKEE-47

### What, Where, and Why - A Primer on Sonographic Evaluation of Traumatic Injuries to the Tendons of the Wrist and Hand

#### Participants

Kevin Sweetwood, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Ultrasound of the tendons of the wrist and hand can provide a high spatial resolution evaluation of tendon pathology which is augmented by the ability to perform dynamic maneuvers that are unavailable with MRI studies. 2. Knowledge of the sonographic appearance and anatomy of these tendons and their associated structures is essential in correctly identifying pathology, providing relevant information to the referring physicians to guide appropriate management, and avoiding pitfalls leading to misdiagnosis. 3. Review of common injuries to the tendons of the wrist and hand focusing on relevant anatomy, sonographic findings, mechanisms of injury, and associated complications and classification schema that are significant for surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. What - Different traumatic pathologies of the tendons with review of terminology, sonographic appearance, and image acquisition techniques. a. Partial versus complete tendon tears, tendon stump separation and retraction. b. Pulley injuries. c. Sagittal band injuries. 2. Where - Review of relevant anatomy, sonographic landmarks, and surgical classification. a. Appearance and relationships of the flexor digitorum profundus tendon, flexor digitorum superficialis tendon slips, and pulleys. b. Identification of flexor tendon zones utilizing landmarks. c. Appearance and relationships of the extensor tendons and sagittal bands. 3. Why - Isolated tendon injury versus secondary post-traumatic injuries and significance of findings for surgical approach. a. Distal radius fractures. b. Hardware complications. c. Surgical management.

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## Abstract Archives of the RSNA, 2023

MKEE-48

### Solving the Puzzle: Trying to Simplify Postsurgical Shoulder Images

#### TEACHING POINTS

To explain the main surgical shoulder techniques performed for the treatment of the rotator cuff lesions, long biceps tendon injuries and shoulder instability. Characterize the normal findings frequently seen in post surgery images, and differentiate them from potential pitfalls. Analyze the most common post surgical complications and describe the most frequent lesion recurrences.

#### TABLE OF CONTENTS/OUTLINE

Postsurgical evaluation of the shoulder can be challenging for radiologists due to the complexity of the shoulder's anatomy and the variety of surgical techniques. The main surgeries involve repairing the rotator cuff and or long head of the biceps tendon injuries, and treating glenohumeral instability. Imaging methods play a fundamental role, particularly in cases where there are suspected surgical complications or reinjuries. They have precise indications, and sometimes, they need to be used in combination for the best accuracy. Misinterpretation of expected findings in postsurgical imaging studies is common due to changes in the anatomy and a lack of knowledge about surgical techniques. This can lead to incorrect reports, unnecessary reinterventions, and even legal issues to the surgeon. This work aims to provide a practical and organized overview of the different surgical techniques, normal postsurgical anatomical changes, common complications, and reinjuries on the operated shoulder, so as to allow the radiologist to perform an adequate interpretation of the images.

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## Abstract Archives of the RSNA, 2023

MKEE-49

### Carpal Instability: Current Concepts and Diagnostic Approach

#### TEACHING POINTS

To show the complex anatomy of the wrist ligaments and its assess in imaging studies. Describe the different types of carpal instability, its pathomechanism, clinical prognosis and treatment implications .Review the different stages of nondissociative carpal instability, integrating images into the pathological process and clinical stages.

#### TABLE OF CONTENTS/OUTLINE

Carpal instability refers to a group of ligament injuries that are responsible for a considerable degree of wrist pain and dysfunction, interfering with sports and daily life activities. Scapholunate and lunotriquetral ligament injuries are the most frequent cause of carpal instability. Depending on the type of injury, these ligaments may be the harbinger of a relentless progression to abnormal joint mechanics, cartilage wear, and degenerative changes. Imaging methods play a crucial role in the diagnosis and staging of this type of injuries which, if not treated, can lead to wrist osteoarthritis

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## Abstract Archives of the RSNA, 2023

MKEE-5

### Diagnostic Evaluation of Very Small Peripheral Nerves: When Ultrasonography Made the Difference

#### Participants

Marcos Felipe Correa, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the role of the high frequency ultrasound (US) in the assessment of very small peripheral nerves and its comparison with magnetic resonance imaging (MRI). Review the sonoanatomy and the topographic anatomy of the reported nerves and its correlation with MRI. Report selected clinical cases from our service, highlighting pathological involvement of very small peripheral nerves on US and its correlation with MRI, through illustrative images and videos.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
The role of the high frequency US in the assessment of the very small peripheral nerves  
Clinical cases of pathological involvement of very small peripheral nerves on US and its correlation with MRI:  
Palmar cutaneous neuropathy  
Posterior interosseous nerve syndrome  
Digital palmar proper nerve injury (stump neuroma neurotmesis)  
Lateral femoral cutaneous neuropathy (meralgia paresthetica)  
Postoperative radial nerve neuropathy  
Postoperative sural nerve (stump neuroma neurotmesis)

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## Abstract Archives of the RSNA, 2023

MKEE-50

### An Ounce of Prevention is Worth a Pound of Cure

#### TEACHING POINTS

The purpose of this exhibit is: A. Discuss the classic concepts of instability and the relatively new concepts of microinstability of the spine; B. Demonstrate the cascade of degenerative instability going through three stages: (1) temporary dysfunction, (2) unstable dysfunction and a (3) final phase of restabilization; C. Correlate the phases of spinal instability and radiological findings in a multimodality approach; D. To review the main therapeutic options in the context of chronic spinal pain, microinstability and instability.

#### TABLE OF CONTENTS/OUTLINE

A. Spine anatomy and biomechanics of spinal pain; B. Classic spinal instability concepts and degenerative stages; C. Concepts of microinstability and imaging findings in a multimodality approach; D. Discussion of the therapy decision, including conservative treatment measures, surgical indications and modalities of intervention.

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## Abstract Archives of the RSNA, 2023

MKEE-51

### MR Neurography of the Lumbosacral Plexus- Tips on Technique and Injury Patterns

#### TEACHING POINTS

Pelvic and lower extremity sensorimotor disturbances frequently present a diagnostic challenge for referring clinicians and radiologists. Complex anatomy of the lumbosacral plexus in addition to varied clinical presentations make it difficult to pinpoint the site of pathology accounting for patients' symptoms. MR Neurography is a useful modality for evaluation of the nerves in the lumbosacral plexus and can serve as an adjunct to conventional MRI lumbar spine.<sup>1-5</sup> Significant improvements in signal to noise ratio and spatial resolution, particularly with 3D isotropic sequences, and emerging techniques such as deep learning reconstruction facilitate improved nerve visualization. When performing MR neurography, it is important for the radiologist to understand the anatomy of the lumbosacral plexus and to be aware of technical considerations in the pelvis.

#### TABLE OF CONTENTS/OUTLINE

Background Anatomy Overview; Technical Considerations; Protocol/Sequences: high field strength, heavily T2W FS images perpendicular to nerve, 2D/3D; Fat suppression: STIR, DIXON; Vascular suppression: DESS/MENSA; Motion reduction; Contrast-Gadolinium, Ferrumoxytol; Imaging around Metal; Deep learning reconstruction; Imaging features; Normal Injury Patterns; Case examples Iatrogenic, Traumatic

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## Abstract Archives of the RSNA, 2023

MKEE-52

### Whole Body of MRI of Castration-Resistant Prostate Bone Metastasis: How and When

#### Participants

Javier Hernandez Ganan, Hospitalet, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To explain Whole-Body MRI protocol focusing on Dixon and Dwi sequences. 2. To discuss main indications. 3. To select target lesion to biopsy. Whole-body MRI is becoming increasingly important in patients diagnosed with disseminated prostate neoplasia, not only in clinical trials but also in daily practice. Specifically in patients with biochemical progression with bone disease, where more scenarios open up for adequate therapeutic guidance.

#### TABLE OF CONTENTS/OUTLINE

Natural history of prostate cancer. WB MRI protocol: MET RADS. Role of Dixon and DWI sequences. Indications 1. Before starting a new treatment. 2. Follow-up. 3. Select viable lesion to perform percutaneous biopsy. Current developments 1. WB MRI at diagnosis in patients at high risk for prostate cancer: 'all in one' study. 2. PET MRI future indications.

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## Abstract Archives of the RSNA, 2023

MKEE-53

### Hematopoietic Tumors of Bone - Growing Your Knowledge

#### Participants

Bruno Cardoso, MD, Barbacena, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Obtaining a differential diagnosis for hematopoietic bone tumors is often challenging due to their varied features. Hematopoietic bone tumors encompass a wide spectrum, including multiple myeloma, lymphoma, histiocytosis, Erdheim-Chester disease, and Rosai-Dorfman disease. In some cases, these pathologies can mimic osteomyelitis or bone metastasis, making an accurate diagnosis crucial prior to treatment. X-rays are often the initial imaging study used to evaluate hematopoietic bone tumors, but they have limited sensitivity and specificity in some cases. CT scans, which provide detailed images of the spine and pelvis, are particularly useful for evaluating bony structures while avoiding the effects of overlapping structures. On the other hand, MRI provides better soft tissue contrast, aiding in the differentiation of benign and malignant conditions. Overall, the DWI technique can provide information about tumor cellularity and aggressiveness, potentially improving the accuracy and efficiency of MRI and enhancing patient care.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction, II. Imaging Modalities, III. Multiple myeloma, IV. Lymphoma, V. Langerhans cell histiocytosis, VI. Erdheim-Chester disease, VII. Rosai-Dorfman disease, IX. Differential diagnosis, X. Conclusion.

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## Abstract Archives of the RSNA, 2023

MKEE-54

### Measurement of Bone Mineral Density in CT: Current Status and Future Perspectives

#### TEACHING POINTS

Screening bone mineral density at opportunistic CT is under active research to be adopted in daily practice. The major teaching points of this exhibit are 1) the history of measuring bone mineral density at CT, 2) the pros and cons of measuring bone mineral density at CT in comparison with DEXA, 3) technical considerations of measuring bone mineral density at CT, and 4) future perspectives of measuring bone mineral density at CT including deep learning technique.

#### TABLE OF CONTENTS/OUTLINE

1. History of measuring bone mineral density using CT: QCT and opportunistic CT  
2. Pros and cons of measuring bone mineral density at CT in comparison with DEXA  
3. Technical considerations when measuring bone mineral density at CT  
4. Future perspectives of measuring bone mineral density at CT: deep learning technique and finite element analysis  
5. References

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## Abstract Archives of the RSNA, 2023

MKEE-55

### Inside the Spinal Canal: A Journey Through Intraspinial Pathologies

#### Participants

Alan Strapasson, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Lesions within the spinal canal can range from benign to highly malignant, with only 20% of these lesions being intramedullary. Other possible origins include nerves, meninges, and vessels. The main objective of this exhibit are: 1. Review the anatomy, imaging protocols, and main pathologies affecting the medullary canal of the lumbar spine or the thoracolumbar transition. 2. Create a diagnostic flowchart for main intraspinal lesions based on age and comorbidities. 3. Describe the main imaging characteristics used to narrow down differentials. 4. Provide an updated classification of intramedullary lesions according to the World Health Organization's 5th edition.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to lumbar spine anatomy, including transitional vertebra classification. 2. MRI protocols for the lumbar spine. 3. Diagnostic flowchart for lesions categorized by age and comorbidities. 4. Discussion of main imaging findings for various conditions such as Mixopapillary ependymoma, Intradural spinal lipoma, Schwannoma, Lipoma of the filum terminale, Plexiform neurofibroma, Metastases, Vertebral body hemangioma with epidural component, Chordoma, Dermoid cyst, and Epidermoid cyst, using illustrative cases. 5. Highlighting the main clinical and imaging aspects that differentiate lesions within the vertebral canal, to aid in prompt diagnosis and proper treatment. Overall, this exhibit provides a comprehensive overview of intraspinal lesions and their characteristics, contributing to accurate diagnosis and treatment planning.

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## Abstract Archives of the RSNA, 2023

MKEE-56

### So, You Have a Trained AI Model, Now What? Step-by-step Guide to Deploying a Prototype Interface Using Open-source Python Tools to Test Newly Developed Internal MSK AI Tools

#### Participants

Brendan Franz, MD, Detroit, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A brief overview of the initial process of training, and validation of an AI model. 2. Overview of open-source tools in python which can be used to deploy a test of an AI solution. 3. Walkthrough of implementation of tools to create a platform to internally test custom AI tools.

#### TABLE OF CONTENTS/OUTLINE

-A brief overview of the initial process of training, and validation of an AI model.--Expected output of a training/validation process during AI model creation.-Walkthrough of open-source tools to deploy a test of an AI solution--Anaconda / Python Flask--Flask--Streamlit-Walkthrough of implementation of a web-based interface to test internally create AI tools--Conda installation--Installation of Flask, Streamlit and other related dependencies--Creating a simple HTML website to take an MSK radiograph and predict the image projection using a custom model file--Using Streamlit to visualize imaging data, masks and output.-Review of the utility of open-source software in healthcare-Conclusion/Summary

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## Abstract Archives of the RSNA, 2023

MKEE-57

### MR Arthrograms: Expecting the Unexpected

#### TEACHING POINTS

After reviewing this education exhibit, the reader will understand: 1. Technique of normal arthrograms discussing the major large and medium joints with brief overview of normal post direct arthrogram anatomy. 2. Pitfalls and imaging findings related to common errors or unexpected findings in MR arthrography of larger and medium joints with focus on shoulder and knee. 3. Genesis of common errors and general procedural techniques to avoid these.

#### TABLE OF CONTENTS/OUTLINE

1. Basic technique of fluoroscopic guided direct MR arthrogram for major joints. 2. Overview of normal appearance of common joint spaces post direct arthrogram 3. Unexpected findings or errors related to: a. Contrast media preparation -Over dilution -Increased concentration b. Injection technique -Over distention and contrast extravasation -Extra-articular injection -Intra-articular gas -Extra-articular local anesthetic c. Soft tissue injury d. Unexpected findings related to -Enhancing lesions e.g. fracture, vascular malformation -Anatomic variants e. Scanning -Timing -Incorrect sequence

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## Abstract Archives of the RSNA, 2023

MKEE-58

### **Cervical and Lumbar Spinal Fusion and Arthroplasty Beyond the Basics: From Surgical Techniques to Postoperative Imaging**

#### **Participants**

Gabriel Miranda, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

I) Discuss the role of each imaging method in postoperative evaluation of patients who have undergone cervical/lumbar spinal fusion or total disc replacement/disc arthroplasty. II) Review the different techniques of cervical and lumbar spinal surgery (indications, advantages and limitations), and describe the various surgical instrumentations/devices used in spinal fusion and total disc replacement (TDR)/disc arthroplasty procedures. III) Discuss a basic primer/checklist for radiological evaluation after cervical and lumbar spinal fusion or total disc replacement/disc arthroplasty, to help identify normal and abnormal postoperative findings on the various imaging modalities. IV) List the main early and late postoperative complications.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction: The importance of imaging in the evaluation after cervical/lumbar spinal fusion or disc arthroplasty. The main uses of each imaging modalities  
Spinal instrumentation nomenclature: Spinal fusion instrumentation: screws, plates, rods, interbody cages, bone grafts. Disc arthroplasty devices: disc prosthesis and its various models. Surgery techniques: Cervical spine: anterior cervical corpectomy and fusion, anterior cervical discectomy and fusion, posterior laminoforaminotomy, cervical disc arthroplasty. Lumbar spine: anterior lumbar interbody fusion, oblique lumbar interbody fusion, lateral/extreme/direct lumbar interbody fusion, transforaminal lumbar interbody fusion, posterior lumbar interbody fusion, and lumbar disc arthroplasty. Checklist for radiological postoperative evaluation: Normal postoperative findings. Early and late postoperative complications.

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## Abstract Archives of the RSNA, 2023

MKEE-59

### **Blossom with Artificial Intelligence: Hidden MSK Imaging Biomarkers for Cardiothoracic Diseases from Conventional Chest CT Examination**

#### **TEACHING POINTS**

\*Definition and benefits: Opportunistic CT imaging means analyzing CT scans initially taken for other purposes but with potential to contribute to medical screening levels (primary, secondary, and tertiary screening), and identify incidental pathologies at zero additional costs or radiation exposure. \*Extraction of important musculoskeletal biomarkers is now feasible from conventional CT scans as predictors of cardiothoracic diseases, such as: -Bone density, osteoporosis and osteopenia, using phantomless measures of bone density- Thoracic spine degeneration, using modified Pfirrmann grading- Detailed pectoralis muscle composition measures loss (subcutaneous adipose tissue, intermuscular and perimuscular adipose tissue, extramyocellular lipids), sarcopenia, and prevention of adverse outcomes- Measures of costochondral and tracheal calcification as a marker for extraosseous calcium deposition  
\*Implementation of artificial intelligence (AI): AI algorithms hold promise for enhancing the precision and speed of the opportunistic CT imaging and can generate robust, reliable, and fast quantitative measurements that may not be readily apparent to the human eye.

#### **TABLE OF CONTENTS/OUTLINE**

-Introduction-Methodology: Development of deep-learning algorithm -Clinical application: Current evidences for predictive values for various common cardiothoracic disease-Future directions: AI role for efficient implementation in routine clinical practice

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## Abstract Archives of the RSNA, 2023

MKEE-6

### All Grown Up: Pictorial Review of Premalignant Bone and Soft Tissue Lesions

#### TEACHING POINTS

- There are several bones and soft tissue lesions that can undergo malignant transformation.
- It is important to understand the characteristic imaging appearance and pitfalls of these lesions.
- Radiologists should be familiar with the clinical and imaging management of these premalignant lesions to prevent misdiagnosis.

#### TABLE OF CONTENTS/OUTLINE

Several bones and soft tissue lesions can undergo malignant transformation. This includes premalignant benign tumors and non-neoplastic conditions that injure bone and soft tissue. Both groups require an understanding of key clinical and imaging features to arrive at the correct diagnosis. Enlargement, new pain, or aggressive imaging features can raise suspicion for malignant transformation. This exhibit will discuss 3 main categories of premalignant musculoskeletal lesions:

- Benign tumors
  - Osteochondroma/multiple hereditary exostoses (MHE) ? chondrosarcoma
  - Enchondroma (Maffucci, Olliers) ? chondrosarcoma
  - Fibrous dysplasia? osteosarcoma
  - Giant cell tumor of bone? malignant giant cell tumor
  - Prior bone injury (non-neoplastic)
  - Osteomyelitis ? squamous cell carcinoma, osteosarcoma
  - Radiation ? osteosarcomas, soft tissue sarcomas
  - Bone infarct ? secondary osteosarcoma
  - Paget disease ? osteosarcomas, chondrosarcomas, or fibrosarcoma
- Soft tissue lesions
  - Burns/scars ? squamous cell carcinoma, basal cell carcinoma
  - Synovial Chondromatosis ? chondrosarcoma
  - Neurofibroma ? Malignant peripheral nerve sheath tumor
  - Atypical lipomatous tumor (ALT) ? dedifferentiated Liposarcoma

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## Abstract Archives of the RSNA, 2023

MKEE-60

### Unraveling Wrist Radiographs: A Review of Traumatic Wrist Injuries Focusing on Radiographic Imaging

#### TEACHING POINTS

?? After reviewing this education exhibit, the reader will:? 1. Understand how various views of the wrist are obtained and the indications of different special views. 2. Understand normal anatomy and imaging appearance of the wrist on radiographs. 3. Understand the imaging appearance and clinical context of common and uncommon traumatic carpal injuries and carpal joint disruptions.?

#### TABLE OF CONTENTS/OUTLINE

1. Wrist radiographs - indications of various views (including standard views and less common views such as carpal tunnel) and optimal patient positioning.? 2. Normal wrist anatomy on standard radiographs. 3. Approach to interpretation?? 4. Relevant anatomy, mechanism of injury/ pathogenesis, imaging examples, brief review of clinical presentation and implications, and management of:? a. Different carpal bone fractures b. Different types of carpal dislocations c. Carpo-metacarpal joint fracture-dislocations? ??

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## Abstract Archives of the RSNA, 2023

MKEE-61

### Microinstability and MRI: Unveiling the Invisible

#### Participants

Natan Ribeiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Introduce microinstability as a disorder with subtle joint instability- Understand the significance of MRI in diagnosing microinstability- Explore the application of MRI in various joints affected by microinstability- Discuss advanced MRI techniques for accurate detection and staging of joint lesions- Review the evolving relationship between MRI and arthroscopy for microinstability diagnosis and treatment

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Microinstability and MRI  
2. The Role of MRI in the Diagnosis and Management of Joint Microinstability  
3. Comprehensive Imaging Evaluation of Microinstability in Various Joints  
4. Dynamic MRI for Detection of Functional Causes of Joint Instability  
5. Quantitative MRI Techniques for Objective Evaluation of Cartilage Health  
6. The Benefits of Functional MRI in Understanding Joint Microinstability  
7. Advanced MRI Techniques for Accurate Detection and Staging of Joint Lesions  
8. The Evolving Relationship Between MRI and Arthroscopy for Microinstability Diagnosis and Treatment  
9. The Pivotal Role of Radiologists in Microinstability Diagnosis and Management  
10. Imaging Findings in Anterior Shoulder Microinstability: An MRI-Based Approach  
11. MRI Findings Suggestive of Knee Microinstability: A Comprehensive Review  
12. Management of Microinstability in Different Joints: An Evidence-Based Approach  
13. Role of MRI in Guiding Surgical Intervention for Joint Microinstability  
14. Understanding the Pathophysiology and Anatomy of Joint Microinstability for Accurate MRI Interpretation  
15. Advancements in MR Imaging Technology for Improved Detection and Characterization of Microinstability

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## Abstract Archives of the RSNA, 2023

MKEE-62

### Lateral Meniscus Instability: Understanding Its Anatomy and Unraveling Posterior Attachment Lesions

#### Participants

Carlos H. Longo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The lateral meniscus is more mobile than the medial meniscus due to its less extensive attachments, and its posterior attachment anatomy has been less studied than the medial meniscus. The posterior root attachment and meniscotibial (coronary) ligaments serve as important static stabilizers, but it is the thin popliteomeniscal fascicles (PMF) that play an important role in the dynamic stabilization of the lateral meniscus during knee flexion. The anterior (Humphrey) and posterior (Wrisberg) meniscomfemoral ligaments also contribute to stabilization. The absence of popliteomeniscal ligaments (congenital or traumatic origin) allows an anterior displacement of the posterior horn of the lateral meniscus during the flexion of the knee (hypermobile meniscus). It can cause symptoms, including pain, blockage and snapping ("snapping knee syndrome"). Peripheric tears of the posterior horn can be associated with buckle-handle tears and meniscal flap dislocation. Posterior root tear is less common in the lateral meniscus than the medial meniscus. The purpose of this study is to:- Review the normal anatomy of the posterior horn of the lateral meniscus and its attachments.- Discuss and illustrate cases of hypermobile meniscus associated with absence of the PMF on MRI.- Illustrate cases of posterior attachments tear on MRI

#### TABLE OF CONTENTS/OUTLINE

Normal anatomy of the posterior attachments of the lateral meniscus and its normal appearance on MRI  
Hypermobile meniscus associated with tear of the PMF  
Buckle-handle tear  
Posterior root tear  
Meniscomfemoral ligaments tear

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## Abstract Archives of the RSNA, 2023

MKEE-63

### Geographic Superficial Soft Tissue Masses: A Guide for Ill-defined Masses

#### Participants

Rachel Bass, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Masses in the superficial soft tissues often have ill-defined borders, and are often benign. Framing the differential into dermal, lipomatous, fibrous, lymphatic and vascular categories may be helpful. 2. Skin thickening with ill-defined underlying edema without enhancement suggests lymphatic origin. This may be localized, and correspond to a pedunculated mass in the morbidly obese, known as a "pseudosarcoma". 3. Ill-defined mass with a fascial tail suggests fibromatosis, which may be desmoid type or superficial. Degree of hyperintensity of fluid weighted sequences corresponds to immature collagen and active tumor. 4. Diffuse fibromatosis is a unique form of neurofibroma that is uncommonly associated with NF-1, and presents with geographic skin thickening with ill-defined subcutaneous edema, nodularity and enhancement. 5. Superficial angiosarcoma will be a nodular, vascular tumor with enhancement and increased activity hot on PET. Often metastatic at presentation.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Lymphatic: Massive localized lymphedema, papillomatosis cutis lymphocystica, Proteus syndrome, cutaneous lymphoma 3. Vascular: Vascular malformation, angiosarcoma 4. Lipomatous: Fat necrosis, adiposis delorosa 5. Fibrous: Desmoid type fibromatosis, superficial fibromatosis, fibrosarcoma 6. Neurogenic: Diffuse neurofibroma 6. Dermal: Squamous cell carcinoma

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## Abstract Archives of the RSNA, 2023

MKEE-64

### "Thinking On Your Feet" - A Step Forward on the Evaluation and Treatment of Morton Neuromas

#### Participants

Mary Creedon, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Overview of Morton neuromas and relevant anatomy
2. Review of the sonographic evaluation of Morton neuromas including patient position, transducer position, and dynamic maneuvers
3. Review of the MRI protocol and findings related to Morton neuromas
4. Differential diagnoses and pitfalls
5. Treatment overview including ultrasound-guided procedure indications, required materials, and technique for steroid, anesthetic, and alcohol Morton neuroma injections

#### TABLE OF CONTENTS/OUTLINE

Introduction and overview Pathophysiology and types of traumatic neuromas Nomenclature Epidemiology Clinical Findings Most common locations Ultrasound evaluation Transducer selection and settings Patient and transducer position (dorsal versus plantar imaging) Dynamic maneuvers Sonographic findings Differential diagnoses (including plantar plate tears and intermetatarsal bursitis) and ways to differentiate sonographically MRI evaluation MRI protocol and the use of intravenous gadolinium contrast Literature favoring prone vs supine patient position for MRI and US Differential diagnoses and pitfalls Treatment options Non-operative, non-invasive treatments Ultrasound-guided procedures: a. Indications, risks, and precautions, b. Required materials for steroid, anesthetic, and alcohol injections, c. Technique details Surgical excision Summary

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## Abstract Archives of the RSNA, 2023

MKEE-65

### Post-operative Fluid Collections Following Lumbar Spine Surgery: Differential Diagnosis and Surgical Considerations

#### TEACHING POINTS

Post-operative fluid collections represent a common imaging finding in patients who have undergone recent lumbar spine surgery. Radiologists must be familiar with different types of post-operative fluid collections that can occur following lumbar spine surgery and their salient imaging findings to guide patient management. 1) Recognize different types of lumbar spine surgical techniques including posterior spinal, transforaminal, anterior, extreme lateral, and oblique lateral interbody fusions 2) Review different types of lumbar spine post-operative fluid collections, including cerebrospinal fluid leak (CSF) and pseudomeningocele, lymphocele, bone morphogenetic protein (BMP)-related fluid collection, hematoma, abscess, and urinoma 3) Identify which types of surgical techniques are associated with different post-operative lumbar fluid collections 4) Review treatment considerations for different types of post-operative lumbar spine fluid collections

#### TABLE OF CONTENTS/OUTLINE

Review anterior and posterior approach lumbar spine fusion techniques, relevant anatomy, and post-operative imaging appearance  
Anterior approach- Anterior lumbar interbody fusion (ALIF)- Oblique lateral interbody fusion (OLIF)- Extreme lateral lumbar interbody fusion (XLIF)  
Posterior approach- Posterior lumbar interbody fusion (PLIF)- Transforaminal lumbar interbody fusion (TLIF)  
Review the imaging appearance and management, of different types of post-operative fluid collections after lumbar spine fusion- Pseudomeningocele/CSF leak- Bone morphogenetic protein (BMP)-related fluid collections- Lymphocele- Hematoma- Abscess with discitis/osteomyelitis- Urinoma

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## Abstract Archives of the RSNA, 2023

MKEE-66

### MRI Evaluation of Oblique Injuries: Introduction of the Deadrise Sign

#### TEACHING POINTS

Importance of oblique injuries in sports imaging  
Primary muscle involved and location of injuries  
Common MRI findings  
Basic MRI protocol and treatment algorithm

#### TABLE OF CONTENTS/OUTLINE

Epidemiology of oblique injuries - Target population - Mechanism of injury - Value of MRI  
Anatomy of the lateral abdominal wall - Muscle layers, fiber orientation, and important attachments - Normal variations in the lower "floating" ribs  
Single institution retrospective cohort of 29 unique injuries in 23 patients - Primary muscle involved - Surrounding injury - Location - Average length of injury  
Common MRI findings and pitfalls - Introduction of the "deadrise" imaging sign - Severity grading considerations  
Case examples - Low grade strain (muscle edema only; no macroscopic tear) - Tears at the lower rib insertions (deadrise sign) - Tears at the iliac attachment (less common) - Differential diagnosis  
MRI protocol considerations - Sequences, scanning time, and short and long-axis views of the rib/cartilage at the site of injury - Common MRI artifacts - Rib level identification  
Treatment algorithm - Collaboration with orthopedic surgery

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## Abstract Archives of the RSNA, 2023

MKEE-67

### The Musculoskeletal Manifestations of Aging: What the Radiologist Needs to Know in Caring for Our Growing Elderly Population

#### TEACHING POINTS

1. Briefly discuss the multifactorial biochemical processes that contribute to normal aging of the musculoskeletal system.2. Familiarize the radiologist with the normal radiologic manifestations seen in the musculoskeletal system that arise from aging.3. Review the radiologic manifestations of the most common musculoskeletal pathologies that occur in the elderly population resulting from normal aging.

#### TABLE OF CONTENTS/OUTLINE

A. Brief review of the biochemical processes that contribute to normal aging in the context of musculoskeletal manifestations.B. Illustrate normal and pathologic radiologic manifestations of aging in the musculoskeletal system a) Changes in bone homeostasis i. Osteopenia/osteoporosis, Paget's disease ii. Insufficiency fractures iii. Fragility fractures b) Architectural changes in skeletal muscle composition i. Sarcopenia c) Architectural changes in articular cartilage composition i. Osteoarthritis d) Architectural changes in tendon composition decreased cellular response to injury i. Tendinopathy and tendon tears e) Metabolic derangement and predisposing co-morbidities seen in the elderly population i. Diffuse idiopathic skeletal hyperostosis ii. Crystal deposition disease f) Genomic instability from accumulated oxidative damage and decreased repair mechanisms i. Multiple myeloma ii. Metastatic disease

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## Abstract Archives of the RSNA, 2023

MKEE-68

### Where is the Contrast? Patterns to Recognize and Pitfalls to Avoid for Successful MSK Arthrography

#### Participants

Maxine Kresse, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review of arthrogram techniques of the major joints to include range of normal appearances and demonstrate pathology with successful injection-Recognition of extra-articular injection, with cross-sectional correlates-How to avoid and correct for common pitfalls

#### TABLE OF CONTENTS/OUTLINE

-Brief introduction to fluoroscopy guided arthrograms of the major joints (including shoulder, elbow, wrist, hip, knee, and ankle)-For each of the major joints: a. Normal arthrogram appearance, including normal bursa/recess communications with the joint; b. Successful intra-articular injection with pathology diagnosed by the arthrogram fluoroscopy images (i.e. full thickness rotator cuff tear); c. Numerous examples of extra-articular injections, with cross sectional correlates on the location of the contrast; d. Tips to avoid common pitfalls and ways to adjust to achieve an intra-articular injection-Summarize pearls and pitfalls to aid in troubleshooting to avoid compromised cross-sectional exams

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## Abstract Archives of the RSNA, 2023

MKEE-69

### "Untangling the Nerves" - Sonographic Findings of Upper Extremity Nerve Entrapments and Injuries with MRI Correlation

#### Participants

Preethi Kesavan, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Benefits in the use of ultrasound with technique details  
2. Classification and sonographic imaging of peripheral nerve injuries with MRI correlation  
3. Ultrasound of nerve entrapment syndromes of the upper extremity with MRI correlation  
4. Ultrasound-guided peripheral nerve interventions

#### TABLE OF CONTENTS/OUTLINE

Why ultrasound and how? Benefits and advantages in the use of ultrasound  
Technique details, including transducer selection and machine settings  
Dynamic imaging and the use of Doppler (including newer microvascular imaging techniques)  
Sonographic findings including normal reference cross-sectional measurements  
Types of peripheral nerve injuries  
Classification and types of peripheral nerve injuries  
Sonographic findings of normal versus abnormal peripheral nerves  
MRI correlative imaging  
Ultrasound imaging of upper extremity nerve entrapment syndromes  
Sites of entrapment, relevant anatomy, and associated pathophysiology  
Sonographic imaging findings with MRI correlation  
Secondary imaging findings including muscle denervation edema, atrophy, and myosteatosis  
Ultrasound-guided peripheral nerve interventions  
Indications, risks, precautions, and benefits of ultrasound. Required materials including what to inject (e.g., nonparticulate versus particulate corticosteroids)  
Ultrasound-guided diagnostic and therapeutic injections including hydrodissection and alcohol/ethanol neurolysis  
Ultrasound-guided cyst aspiration/decompression to relieve nerve compression  
Summary

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## Abstract Archives of the RSNA, 2023

MKEE-7

### Tibial Plateau Fractures: Common Classification Systems and Clinical Considerations

#### Participants

Rachel Bass, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The Schatzker classification of tibial plateau fractures is commonly used but lacks description for coronally oriented fractures. The three column approach highlights the importance of the posterior tibial plateau. 2. The Kfuri (modified Schatzker) classification system was introduced in 2018, and marries the Schatzker classification with anterior and posterior modifiers, and is accepted among orthopedic surgeons. 3. Involvement of the posterior column affects surgical approach and technique, and stabilization of the posterior medial column and tibial rim is critical for good functional outcome. 4. Preoperative CT provides critical information regarding fracture orientation, depression, and vascular injury. 5. Preoperative MRI following external fixation may provide critical information to the orthopedic surgeon regarding meniscus and ligamentous injury that will be addressed at the time of definitive internal fixation.

#### TABLE OF CONTENTS/OUTLINE

1. Tibial Plateau Classification systems: AO/OTA, Schatzker, Three Column, Kfuri (Modified Schatzker) 2. Surgical Approach and clinical importance: Buttress fixation, posterior column fixation, graft placement 3. Soft tissue injury: Open fracture, vascular injury, meniscal tear, cruciate ligament tear, compartment syndrome 4. Long term outcomes: Expected healing, postoperative osteoarthritis leading to arthroplasty.

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## Abstract Archives of the RSNA, 2023

MKEE-70

### Don't Miss a Step: Ligament Injury in Midtarsal Sprain

#### TEACHING POINTS

Review anatomy of themidtarsal (Chopart) joint complexDescribe variant anatomy and common pitfallsProvide recommendations for best visualization of ligaments ofmidtarsal joint complex in MRI-scansDiscuss trauma mechanisms ofmidtarsal sprain and deduce possible injury patternsProvide imaging examples ofmidtarsal sprains (MRI and X-ray)Discuss treatment

#### TABLE OF CONTENTS/OUTLINE

Background: • Epidemiology• Role of imagingLigament anatomy visualized by 3D-renderings and MRI-imaging examples (with common variant appearances):Talocalcaneonavicular joint • Dorsal talonavicular ligament• Calcaneonavicular portion of bifurcate ligament• Spring ligament complexCalcaneocuboid joint• Dorsal calcaneocuboid ligament• Calcaneocuboid portion of bifurcate ligament• Short and long plantar ligamentsPathomechanisms ofmidtarsal sprain:• Inversion-type trauma (most common): lateral and possible dorsal distraction with medial compression• Eversion-type trauma: medial distraction with lateral compressionImaging examples ofmidtarsal ligament injuries:• Ligament tear and sprain• Common findings accompanying ligament injuriesTreatment

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MKEE-71

### Keeping Cool: Thermoprotection Strategies for Musculoskeletal Ablations

#### TEACHING POINTS

Basic principles of how to ablate targeted tissues and minimize damage to surrounding structures.-Review passive monitoring and active protection techniques during thermoablation.

#### TABLE OF CONTENTS/OUTLINE

Percutaneous thermal ablation is being increasingly performed for oncologic treatment within bone and non-visceral soft tissue.- Certain risks are of interest during musculoskeletal ablation, namely skin and neurovascular bundle injury when compared to other deep organ ablations. Given this, concurrent multi-modal thermoprotective measures should be used to prevent non-target destruction of overlying skin and adjacent structures. Both active and passive protective measures are outlined in our presentation.-Passive techniques are utilised to monitor the patient and can include clinical monitoring and real-time intra-procedural imaging. Direct patient interaction and instruction, such as asking the patient to move intermittently or report altered sensation is a subjective method of clinical monitoring in order to detect neural injury. In contrast, intra-procedural imaging is more objective, whereby the radiologist can view the ablation zone in real-time, allowing confident treatment of the target lesion while avoiding non-target structures.-By comparison, active techniques are utilised to protect non-target structures and can be subdivided into temperature modulation and displacement techniques. Temperature modulation can be achieved with warmed/cooled saline gloves on the skin or subcutaneous fluid injection to dissipate temperature. Displacement of non-target adjacent structures is usually achieved with hydrodisplacement or pneumodisplacement.

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## Abstract Archives of the RSNA, 2023

MKEE-72

### Dual Energy X-ray Absorptiometry (DXA): Principles and Tips in Classic and New Applications

#### TEACHING POINTS

- To review the basics of dual energy x-ray absorptiometry (DXA)
- To discuss the use of DXA in the assessment of bone density, also reviewing the contribution of new developments such as trabecular bone score (TBS) in the diagnosis of osteoporosis.
- To analyze the evolving role of DXA in the evaluation of soft tissues especially for body composition such as quantification of fat and estimation of skeletal muscle mass in sarcopenia.
- To emphasize pitfalls, diagnostic difficulties, and provide clue points in order to improve performance in DXA exams.

#### TABLE OF CONTENTS/OUTLINE

DXA is the 'gold-standard' in quantitative assessment of bone mineral density in the diagnosis of osteoporosis. The use of DXA has been also recommended in sarcopenia, to assess lean mass as an estimation of all non-fat/non-bone tissues, fat mass and bone mineral content. We review: 1. Basics and technique of DXA. DXA principle is based on attenuation coefficient of different tissues with low energy X-ray beams. 2. Uses of DXA. BMD study. Body composition and sarcopenia studies 3. BMD study. DXA performance. Causes of mistakes in different steps of DXA study: 3.1 Before the study: technologist training and competence, daily calibration, anthropometric data, regions to scan. 3.2 During the study: Patient positioning, Image acquisition: regions of interest. 4. Osteoporosis diagnosis. Image interpretation: Parameters. Adequate use of T-score and Z-score; Report. Detection of vertebral fractures or bone diseases (osteoarthritis, metastases, Paget's disease), soft tissue lesions, detection of artifacts-foreign bodies. New developments: TBS. 5. Body composition. Sarcopenia. DXA software analysis. Comparison with different techniques.

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## Abstract Archives of the RSNA, 2023

MKEE-73

### A Radiological Overview of Elbow Arthroplasty: Practical Keys in the Assessment of Elbow Replacement

#### Participants

Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To know the different types of elbow replacement. -To review the role of imaging techniques (plain radiograph, CT, MR, US, scintigraphy) in the evaluation of elbow replacements. -To understand usefulness and limitations of plain radiographs and CT in the evaluation of elbow replacements, emphasizing useful parameters and illustrating image analysis and interpretation. -To become familiar with normal and abnormal postoperative imaging findings and signs of complications

#### TABLE OF CONTENTS/OUTLINE

We review imaging of elbow replacement, highlighting key concepts perceived as important variables by the surgeon and correlating images with clinical considerations and functional outcomes. We present: 1. A review of types of replacement. 2. Surgery. Aims. 3. Imaging. Plain radiographs: -Technique and views. Standard image acquisition: beam and anatomical landmarks -Parameters that should be evaluated: description of the components, alignment relative to normal anatomic alignment. 4. Imaging. CT: -Technique. -Parameters that should be evaluated. -Imaging of complications: Aseptic loosening, infections, ulnar nerve complications, instability, disassembly, dislocation, subluxation, intraoperative fractures, mechanical failure of prosthetic components, and ectopic bone formation 5. Role of MRI, US and scintigraphy. .

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## Abstract Archives of the RSNA, 2023

MKEE-74

### **Beyond the Surface: Exploring Extradigital Glomus Tumors - A Comprehensive Review of 64 Cases with Radiologic-Pathologic Correlation**

#### **Participants**

Gabriela Serra Del Carpio, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- In our study males outnumbered females with a male-female ratio of 2.1:1. - The mean age at the time of diagnosis was 55,8 years. - The tumors had a mean size of 1 cm and were located in the lower limbs in most cases (38/64).- In 17 cases (27%) a diagnostic imaging test was performed (US, MRI or both). - The radiological appearance of a glomus tumor on ultrasound was in most cases as a circumscribed hypoechoic oval nodule located in the subcutaneous layer and horizontally oriented. - Spectral Doppler can demonstrate both venous and arterial intralesional flow and in some cases a "Vascular stalk sign". - Images obtained by ultrasound are not specific but they play an important role in early diagnosis, give precise information on location, and provide guidance for excision of glomus tumors.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction  
Materials and Methods  
1. Results- Clinical findings - Radiological findings- Histological, cytological and immunohistochemical features- Differential diagnosis- Discussion  
2. Conclusions

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## Abstract Archives of the RSNA, 2023

MKEE-75

### Weight-Bearing MRI: A New Technology for Changing the Approach to Pathology from Diagnosis to Therapy

#### Participants

Joan C. Vilanova, MD, PhD, Girona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Learn the technical methodology to perform a weight bearing MRI (WB) for the different areas of the body/joints
- Show the proper analysis of the weight bearing examination to distinguish physiological changes from pathology on a clinical-radiological correlation
- Know the most common and appropriate indications for weight bearing MRI from the different areas/joints of the body

#### TABLE OF CONTENTS/OUTLINE

•Introduction • WB MRI equipment characteristics • WB MRI technique of different areas/joints, procedure to perform the upright examination: craniocervical junction (CVJ), spine, shoulder, knee, hip, ankle, foot, temporomandibular joint (TMJ); showing dynamic MRI evaluation • WB postprocessing: quantification of the changes from non-WB to the WB examination • Indications: CVJ: instability; Spine: instability, postural alignments changes, discopathy, lateral recess - foramen - central canal, postsurgical evaluation; Shoulder: instability, impingement; Knee: meniscal-ligamentous instability, patellar shift, Impingement; Hip: impingement, microinstability; Ankle: ligamentous instability, impingement, plantar fascia; Foot: metatarsalgia evaluation; TMJ: internal joint disorders • Benefits and limitations • Conclusions

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## Abstract Archives of the RSNA, 2023

MKEE-76

### Radiologic Stranger Thing: Phosphaturic Mesenchymal Tumor (PMT) and Pitfalls

#### Participants

Jacobo Porto Alvarez, MD, Viedra, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To describe and understand the physiopathology of PMT. -To learn about the most typical presentation of PMT. -To describe that the diagnosis is based on pathologic and biochemical analysis, but the imaging techniques are crucial in the tumor location for surgery treatment. -To alert about PMT and emphasise the radiologist's role in the management of PMT and when a radiologist can be crucial in raising the suspicion of PMT. -To describe some of the most common radiologic pitfalls.

#### TABLE OF CONTENTS/OUTLINE

-Introduction: Actions of FGF-23, analytic changes and the bone implication. -Location and symptoms of PMT.-Diagnoses and treatment of PMT.-The radiologist's role in the management of PMT.-Pitfalls of PMT.

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## Abstract Archives of the RSNA, 2023

MKEE-77

### Soft Tissue Tumours: Anatomic-Based Approach

#### Participants

Imran Ladak, MD,BSC, London, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the 2020 World Health Organization (WHO) classification of soft tissue tumours. Understand the role of imaging in the diagnosis and management of soft tissue tumours Learn an approach to benign and malignant soft tissue tumours based on characteristic location and imaging appearance.

#### TABLE OF CONTENTS/OUTLINE

Introduction Introduction to soft tissue tumours 2020 World Health Organization classification of soft tissue tumours Role of imaging in soft tissue tumours Soft tissue tumours by location and appearance Common/benign soft tissue tumours Lipoma Venous hemangioma Peripheral nerve sheath tumour Skin Dermatofibrosarcoma protuberans Chest Elastofibroma dorsi Solitary fibrous tumour of the pleura Arm Desmoid-type fibromatosis Nodular fasciitis Trunk Desmoid tumour Leiomyosarcoma Retroperitoneal liposarcoma Hand Fibrolipomatous hamartoma Giant cell tumour of tendon sheath Palmar fibromatosis Thigh Intramuscular myxoma Liposarcoma Undifferentiated pleomorphic sarcoma Leg/foot Synovial sarcoma Palmar fibromatosis

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## Abstract Archives of the RSNA, 2023

MKEE-78

### Breaking Down Bone and Muscle: The Nitty-gritty of MSK Infections

#### Participants

Alba Salgado Parente, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To revise the physiopathology and imaging findings of musculoskeletal infections (soft tissue, bone and joint, spine and periprosthetic infections) with different imaging modalities (conventional radiography, US, CT, MRI, PET)  
2. To discuss the differential entities that can mimic septic arthritis and osteomyelitis, focusing on pearls and potential pitfalls to make a correct diagnosis  
3. To develop a systematic approach for interpreting imaging findings of MSK infections, including evaluation of the extent and severity of infection and potential complications

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Imaging techniques in the evaluation of MSK infections: conventional radiography, ultrasound, CT, MRI and nuclear medicine techniques  
3. MSK infections: Pathophysiology and key concepts  
a. Soft tissue infections: Cellulitis, abscess/phlegmon, myositis/pyomyositis, superficial, deep and necrotizing fasciitis  
b. Bone and joint infections: Septic arthritis, septic bursitis, tenosynovitis, acute osteomyelitis, chronic osteomyelitis, Diabetic foot  
c. Spine infections: Spondylodiscitis, facet joint septic arthritis  
d. Periprosthetic infections: Technical considerations and imaging  
4. Pitfalls and mimics - How to avoid them: Is this septic arthritis?, Is this osteomyelitis?  
5. Systematic approach to MSK infections: What steps to follow  
6. Conclusions  
7. References

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## Abstract Archives of the RSNA, 2023

MKEE-79

### Spotlight on Musculoskeletal Lymphoma: A Radiological Exploration of an Uncommon Entity

#### Participants

Maxine Kresse, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiology plays a central role in the diagnosis of musculoskeletal lymphoma. 2. Musculoskeletal lymphoma can present with different patterns. 3. Lymphoma involving the muscle, skin, and bones can occur at nearly every age and may present with atypical features that can distinguish it from other entities.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction-Overview of musculoskeletal lymphoma-Importance of radiology in diagnosis 2. Imaging modalities for musculoskeletal lymphoma, including Radiography, Ultrasound (US), Computed Tomography (CT), Positron Emission Tomography (PET), and Magnetic Resonance Imaging (MRI) 3. Imaging features and patterns of musculoskeletal lymphoma-Osseous lymphoma: lytic pattern, sclerotic pattern, and "near normal" radiographic findings-Soft tissue lymphoma-Trans-spatial lymphoma 4. Differential diagnosis-Other primary bone and soft tissue neoplasms-Metastatic lesions-Inflammatory and infectious conditions 5. Conclusion: key takeaways from radiologic evaluation of musculoskeletal lymphoma

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## Abstract Archives of the RSNA, 2023

MKEE-8

### Non-Tumoral Spine Bone Lesions: A Pictorial Review of Common and Uncommon Pathologies

#### Participants

Andre Mannato, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The features of non-neoplastic bone lesions in the spine are often similar to those of malignant tumors, and a differential diagnosis is challenging to obtain in some cases. Non-tumoral bone lesions of the spine have a broad spectrum, including mechanical, infectious, inflammatory, vascular, and other causes. The clinical manifestations of ranging from back pain to neurological deficits mimicking myelopathy or radiculopathy. A careful and attentive imaging evaluation can help narrow differential diagnosis and potentially avoid unnecessary biopsy. Therefore, an accurate diagnosis is important prior to treatment. X-rays are often the first imaging study used to evaluate spinal tumors, but they have limited sensitivity and specificity for diagnosing benign tumors. CT scans provide detailed images of the spine and are particularly useful for evaluating the bony structures, such as in the case of vertebral hemangiomas. MRI, on the other hand, provides better soft tissue contrast and can help differentiate between benign and malignant tumors. Overall, the DWI and Dixon techniques offer several advantages in magnetic resonance imaging, including improved detection of diseases, improved visualization of structures, can help distinguish between benign and malignant tumors and provide information about tumor cellularity and aggressiveness. These techniques have the potential to improve the accuracy and efficiency of MRI and enhance patient care.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction; II. Imaging Modalities; III. Mechanical Causes; IV. Infectious Lesions of the Spine; V. Inflammatory Causes; VI. Vascular; VII. Miscellaneous; IX. Conclusion.

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## Abstract Archives of the RSNA, 2023

MKEE-80

### Imaging Review of Knee Ligament Reconstructions Other Than the ACL

#### Participants

Thurl Hugh Cledera, MD, Taguig, Philippines (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Knee ligament injuries are common and operative techniques are continually evolving. Accurate clinical information along with imaging diagnosis aids in selection of the appropriate operative technique. While imaging features of anterior cruciate ligament (ACL) reconstruction are well-described in literature, data on indications, postoperative imaging findings and complications of reconstructions of other ligaments of the knee are limited. In this education exhibit, we discuss the imaging findings and complications of reconstructions of knee ligaments other than the ACL. The objectives of this education exhibit are: 1. Recognize normal radiographic and MR appearance of non-ACL ligament reconstructions 2. Understand the basic operative concepts and techniques for each type of reconstruction including indications and common grafts used 3. Recognize commonly encountered postoperative complications to aid in providing a precise and meaningful radiologic report

#### TABLE OF CONTENTS/OUTLINE

TECHNICAL CONSIDERATIONS • Conventional radiographs • Stress radiographs • Pre and postoperative MRI BASIC INDICATIONS AND NORMAL RADIOGRAPHS AND MRI OF THE FOLLOWING PROCEDURES Posterior cruciate ligament (PCL) reconstruction Posterolateral corner reconstruction • Laprade technique • Andrews technique • Lemaire technique Anterolateral knee reconstruction • Lateral extra-articular tenodesis (LET) • Anterolateral ligament (ALL) reconstruction Posteromedial corner reconstruction Medial patellofemoral ligament (MPFL) reconstruction Multiligament reconstruction COMPLICATIONS • Graft failure • Malpositioned graft • Femoral and/or tibial tunnel widening • Arthrofibrosis • Graft impingement

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## Abstract Archives of the RSNA, 2023

MKEE-81

### Radiographs and MRI of Tendon and Ligament Surgeries: A Resident's Primer

#### Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiodense hardware such as in metallic fixation and arthroplasties are easily evaluated on radiographs by both trainees and nontrainees alike. On the other hand, surgeries that utilize mostly radiolucent or nonmetallic components such as tendon transfer, ligament reconstruction and other soft tissue procedures may be more challenging to assess, especially by trainees. These procedures may manifest with nodular or tubular lucencies that may be mistaken for cysts, infection or tumors. In this education exhibit, we provide a concise review or "pocket guide" of normal and abnormal imaging appearance of commonly encountered soft tissue procedures to aid the radiology resident/trainee in appropriate assessment of non-radiodense operative hardware. The objectives of this education exhibit are: 1. Recognize normal radiographic appearance of commonly encountered non-radiodense operative hardware 2. Understand the basic operative concepts and indications of these soft tissue procedures 3. Recognize radiographic and basic MR appearance of complications of these soft tissue procedures?

#### TABLE OF CONTENTS/OUTLINE

For each procedure, the following will be discussed: PROCEDURE: INDICATIONS: RADIOGRAPHS: MRI: COMPLICATIONS: SHOULDER Rotator cuff repair Biceps tenodesis Anterior stabilization ELBOW UCL reconstruction Distal biceps repair WRIST and HAND Volar oblique ligament reconstruction Thumb UCL reconstruction KNEE ACL reconstruction MPFL reconstruction Patellar tendon transfer ANKLE Tendon transfer procedures Lateral ligament reconstruction

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## Abstract Archives of the RSNA, 2023

MKEE-82

### Utilizing Dual Energy CT for Evaluating Gout: A Review of Imaging Artifacts and Pitfalls for Trainees to Avoid

#### TEACHING POINTS

Discuss the basics of dual-energy CT (DECT) technology and its current clinical application in the detection of gout. Demonstrate typical imaging findings of gout on DECT. Review imaging artifacts commonly seen when utilizing DECT gout protocol, including those related to keratin, metallic objects, and image noise. Explore additional pitfalls for trainees to avoid including the physiologic deposition of monosodium urate in various tissues. Understand techniques to minimize DECT artifacts.

#### TABLE OF CONTENTS/OUTLINE

Epidemiology and clinical presentation of gout, a crystal arthropathy caused by the deposition of monosodium urate (MSU) crystals  
Typical imaging findings of gout on radiography, conventional CT and MRI  
Physics of DECT and its clinical application for the evaluation of gout  
Reviewing artifacts causing misregistration of non-MSU crystals as gout: Keratin: Nailbed keratin and skin callous  
Metallic objects: Foreign bodies, CT table and orthopedic hardware including intervertebral disc spacer material  
Image noise: Quantum mottle causing image noise artifact with incorrectly-labeled submillimeter foci of MSU crystals  
Additional miscellaneous pitfalls for trainees to avoid: Limitations of DECT for evaluating chronic gout  
Physiologic deposition of MSU crystals in non-gout patients  
Troubleshooting and minimizing DECT artifacts  
Physiologic deposition of MSU crystals in non-gout patients  
Troubleshooting and minimizing DECT artifacts

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## Abstract Archives of the RSNA, 2023

MKEE-83

### CUP - A Novel Comprehensive Classification System for Triangular Fibrocartilage Complex Lesions

#### Participants

Jan Grunz, MD, Wuerzburg, Germany (*Presenter*) Research Consultant, Siemens AG

#### TEACHING POINTS

The classifications of Palmer (1989) and Atzei/Luchetti (2011) constitute the current standard to characterize lesions of the triangular fibrocartilage complex (TFCC). However, both systems have substantial drawbacks that limit clinical applicability. The Palmer classification does not discern between the foveal and styloid insertions of the radioulnar ligaments, which is essential for treatment, while differentiating between traumatic and degenerative lesions is often not feasible. In contrast, the Atzei classification focuses exclusively on the ulnar-sided periphery. Several less common lesion types are not included in either system. These limitations motivated us to develop a new comprehensive and clinically-oriented classification for lesions of the TFCC. In the proposed system, the acronym 'CUP' refers to central lesions (C) limited to the articular disc, ulnar lesions (U) affecting the insertions of the radioulnar ligaments, and peripheral lesions (P), which comprise injuries of the ulnocarpal meniscus and ligaments, the dorsal joint capsule, and the extensor carpi ulnaris tendon sheath. Each group is subdivided into three grades of severity with adequate treatment recommendations.

#### TABLE OF CONTENTS/OUTLINE

1. TFCC anatomy 1.1 Biomechanical properties 1.2 Vascularization 2. Imaging 2.1 MRI with and without intravenous contrast enhancement 2.2 CT and MR arthrography 3. Lesion types 3.1 Central lesions 3.2 Ulnar lesions 3.3 Peripheral lesions 3.4 Combinations with fractures and avulsion injuries 4. Therapy 4.1 Surgery versus conservative treatment 4.2 Overview of surgical procedures 5. Discussion

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## Abstract Archives of the RSNA, 2023

MKEE-84

### There's Light at the End of the Carpal Tunnel - But is it a Good Thing

#### Participants

Jan Grunz, MD, Wuerzburg, Germany (*Presenter*) Research Consultant, Siemens AG

#### TEACHING POINTS

Constituting the most common entrapment neuropathy by far, carpal tunnel syndrome (CTS) is caused by compression of the median nerve within a narrow passage on the palmar side of the wrist. The carpal tunnel is located beneath the transverse carpal ligament and extends from the scaphoid and trapezium to the hamate and pisiforme bone. Containing the deep and superficial flexor tendons in addition to the median nerve, entrapment neuropathy can occur in case of mismatches between the tunnel's size and the volume of its contents. CTS patients typically report painful paresthesia of digits I-III with aggravation at night, when provoked by tapping the median nerve at the carpal tunnel entrance (Hoffmann-Tinel sign), and when flexing the wrist (Phalen test). Chronic CTS results in atrophy of the thenar muscles with limited opposition and abduction of the thumb. Among several causes, tenosynovialitis of the flexor tendons is the most frequent. While CTS is usually diagnosed in clinical and electrophysiological examinations, radiologists can provide valuable insights by performing cross-sectional measurements and qualitative assessment of the edematous nerve structure in ultrasound and MRI. Particularly if symptoms persist after carpal tunnel release surgery, both imaging methods are of great importance.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of the carpal tunnel 2. Imaging techniques 2.1 Ultrasound 2.2 MRI with and without i.v. contrast enhancement 3. Pathophysiology of CTS 3.1 Tenosynovialitis 3.2 Congenital anatomical variants 3.2 Bony stenoses 3.4. Tumors 4. Postoperative imaging 5. Discussion

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## Abstract Archives of the RSNA, 2023

MKEE-85

### The Many Faces of Heterotopic Ossification: Pathogenesis, Imaging Features and Differential Diagnosis

#### Participants

Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Three requisites stand out for heterotopic ossification (HO) formation: osteogenic precursor cells, multiple inducing factors and pertinent biochemical signaling pathways, a favorable microenvironment.
- Recent evidence suggests that the initiation of HO particularly necessitates local hypoxia in the microenvironment.
- Heterotopic ossification is a commonly encountered condition on imaging with characteristic—if not pathognomonic—findings involving musculoskeletal soft tissues such as muscles, ligaments, and tendons.
- A host of differential diagnostic possibilities need to be considered when there is concern for heterotopic ossification.

#### TABLE OF CONTENTS/OUTLINE

- Pathophysiologic background of HO.
- Case examples of various manifestations of HO on imaging with pearls and pitfalls (e.g., myositis ossificans [traumatic, neurogenic], periostitis ossificans, arachnoiditis ossificans, panniculitis ossificans, Pellegrini-Stieda lesion [HO of the medial collateral ligament of the knee], HO of the posterior longitudinal ligament [OPLL] or nuchal ligament, Bennett lesion [HO of the posterior band of the inferior glenohumeral ligament], other enthesal ossifications [diffuse idiopathic skeletal hyperostosis], tendon ossifications [Achilles, hip abductors, rotator cuff], fibrodysplasia ossificans progressiva).
- Differential diagnostic considerations for HO on imaging (e.g., calcific tendinitis, calcific peri-arthritis, dystrophic calcifications, extraskeletal bone tumors, synovial sarcoma, calcinosis cutis, calcinosis of chronic renal failure).

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## Abstract Archives of the RSNA, 2023

MKEE-86

### Spectrum of Calcaneal Tumors and Tumor-like Lesions: Imaging Findings with Pathological Correlations

#### TEACHING POINTS

1. Lipomas can be distinguished from simple bone cysts based on central dystrophic calcification, particularly with fat necrosis and cyst formation. 2. An associated primary bone lesion should always be considered in older patients with aneurysmal bone cyst-like changes. The differential diagnosis can be narrowed down using a combination of imaging features (lesion components, location) and clinical information (age). 3. The age for some calcaneal tumors is different from tumors in other locations. This makes it difficult to differentiate between chondroblastomas, characterized by marginal sclerosis and calcifications, and giant cell tumors (GCTs). 4. The tumor matrix pattern should be emphasized. A stippled or ring-like pattern indicates cartilage calcification, cloud-like appearance indicates osteoid mineralization, and a ground-glass density indicates fiber matrix. 5. Age needs to be considered in solid tumors with non-specific imaging features. Enchondromas, chondrosarcomas, metastatic tumors, myelomas, lymphomas, and undifferentiated pleomorphic sarcomas are common in adults, whereas, GCTs, chondroblastomas, osteosarcomas, Ewing sarcomas, and Langerhans cell histiocytosis are more common in young individuals.

#### TABLE OF CONTENTS/OUTLINE

1. Chondroblastoma 2. Chondromyxoid fibroma 3. Secondary peripheral atypical cartilaginous tumor 4. Chondrosarcoma 5. Osteoid osteoma 6. Osteosarcoma 7. Hemangioma 8. Epithelioid hemangioendothelioma 9. Aneurysmal bone cyst 10. Giant cell tumor 11. Simple bone cyst 12. Fibrous dysplasia 13. Lipoma 14. Undifferentiated pleomorphic sarcoma 15. Metastases 16. Myeloma 17. Primary lymphoma 18. Ewing sarcoma

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## Abstract Archives of the RSNA, 2023

MKEE-87

### **Discordance Between Bone Mineral Density and Trabecular Bone Scores for the Lumbar Spine in the Setting of Intra-Abdominal Calcifications and Dense Surgical Materials**

#### **TEACHING POINTS**

Spinal vertebrae contain the most metabolically active components, and they are therefore commonly the first site to manifest the osteoporotic process. Calcifications (i.e., fibroids, vascular calcifications, and degenerative joint disease) and dense surgical material (i.e., vertebroplasty, stents, embolization coils, and IVC filters) within the field of view falsely elevate bone mineral density (BMD) measurements. To mitigate such artifactual elevation of BMD measurements, the International Society of Clinical Densitometry (ISCD) has come up with guidelines for BMD reporting such as excluding affected vertebrae from analysis. Trabecular Bone Score (TBS), on the other hand, is a novel tool for assessing fracture risk by analyzing bone trabecular microarchitecture. Despite being adherent to ISCD guidelines, we have found in clinical practice that many patients with intra-abdominal calcifications and surgical material have normal lumbar spine BMD measurements but low TBS scores. These inconsistencies suggest that the utilization of DXA BMD measurements alone may under-predict fracture risk, especially in patients with calcifications or surgical material, and that TBS may be especially helpful as an adjunct to DXA in this patient population.

#### **TABLE OF CONTENTS/OUTLINE**

1. Fundamentals of DXA. 2. Pathophysiology of osteoporosis. 3. Fundamentals of TBS. 4. Limitations of DXA in the setting of intra-abdominal calcifications and surgical material. 5. Case comparisons of DXA and TBS scores to demonstrate discordances. 6. Conclusion.

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## Abstract Archives of the RSNA, 2023

MKEE-88

### Peripheral Arthropathies: Step by Step

#### Participants

Raquel Acosta Hernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Introduction: Despite the development of CT and MRI, plain radiography stands as the irreplaceable test of first diagnostic approach in peripheral arthropathies. Following a complete diagnostic algorithm helps to emphasize the key points in the differential diagnosis between inflammatory versus osteoarthritis disease. Once joint space narrowing is evaluated, the presence of bone erosions (as a hallmark of joint inflammatory arthritis in ankylosing spondylitis, psoriatic arthritis, and reactive arthritis), osteophytes (typical of degenerative arthritis), and their distribution are basic pillars on guiding an accurate diagnosis. Teaching points Approach the radiographic algorithm evaluation of peripheral arthropathies based on classification into inflammatory or degenerative pattern: joint space narrowing (uniform and non-uniform), bone erosion and distribution pattern. Introduced a systematic reading of hands and feet plain radiographs following the ABCDs acronym: articular, bone, cartilage, distribution and soft tissue. Correlate typical plain radiographic of peripheral arthritis findings with CT and MRI studies.

#### TABLE OF CONTENTS/OUTLINE

- Radiographic algorithm evaluation of peripheral arthropathies based on joint space narrowing and typical examples of articular erosions patterns. - Systematic ABCDs acronym reading: articular (deformity and destruction), bone (erosion, osteopenia, proliferative changes and distal affectation), cartilage, distribution and soft tissue (soft tissue swelling).

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## Abstract Archives of the RSNA, 2023

MKEE-89

### Imaging Findings of Monoclonal Gammopathy of Clinical Significance

#### Participants

Anika Dutta, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Monoclonal Gammopathy of Clinical Significance (MGCS) describes a constellation of diseases involving clonal B cells or plasma cells which produce monoclonal proteins and cause organ damage. MGCSs can be divided into groups based on which organ systems are most affected. Some of these entities have distinct imaging findings that suggest the diagnosis. By the end of this education exhibit, the viewer should be able to identify those findings and clinical symptoms that characterize them. Recognizing these findings may help lead to an expedited and accurate diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction - what is MGCS?
2. MGCS definition and symptom classes
3. Detailed description of syndromes, for example:-POEMS syndrome (polyradiculoneuropathy, organomegaly, endocrinopathy, monoclonal plasma cell disorder, and skin changes): Description, Imaging findings with case example-AL Amyloid: Description, Imaging findings with examples
4. Conclusions
5. References

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## Abstract Archives of the RSNA, 2023

MKEE-9

### Patellofemoral Dysfunction: A Practical Approach and New Radiological Insights

#### Participants

Lucas Bettin, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Patellofemoral dysfunction occurs as a result of an imbalance in the dynamic relationship between the patella and the trochlea during knee flexion, secondary to anatomical or functional abnormalities. Classic risk factors are usually limited to local anatomy, such as trochlear dysplasia, patella alta, patellar tilt and increased TT-GT distance. Recently, new concepts on the functional evaluation of the lower limbs and their relationship with the pelvis have earned more attention, including muscle function. Imaging of the patellofemoral joint includes standard radiographs of the knee to evaluate bone morphology and patellofemoral relationship. MR imaging is important to also assess cartilage, capsule and ligaments. For preoperative planning, computed tomography can assess the knee in different degrees of flexion, besides providing multiplanar reconstructions. The evaluation of the entire mechanical axis of the lower limb is also of fundamental importance. Findings such as the anterior tilt of the pelvis, femoral or tibial torsion abnormalities, increased femorotibial rotation and deviations of the mechanical axis significantly modify the dynamics of the extensor mechanism. Clinical treatment and physiotherapy are typically the first-line approach, taking into account the particularities of the mechanical axis. Surgical intervention is indicated for recurrent dislocations. Therefore, anatomical and functional concepts of the patellofemoral joint and the entire lower limb are necessary to determine the optimal treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. Anatomy biomechanics; 3. Dysfunction vs. instability; 4. Radiological approach; 5. Beyond Dejour; 6. Conclusion.

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## Abstract Archives of the RSNA, 2023

MKEE-90

### What's New and Not So New in Postoperative MRI of Rotator Cuff Tendon Repair: Conventional and New Surgical Techniques, Normal and Abnormal Postoperative Findings

#### Participants

Yeongseo Yoo, MD, Hwaseong, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review conventional techniques for rotator cuff tendon (RCT) repair, including correlation with postoperative MRI findings  
2. To introduce newer techniques of RCT repair with MRI correlation  
3. To diagnose normal and abnormal postoperative MRI findings of RCT repair, including complications and RCT repair failures

#### TABLE OF CONTENTS/OUTLINE

I. Surgical techniques on postoperative MRI of RCT repair  
A. Conventional suture techniques (single, double row, transosseous equivalent suture bridge)  
B. Newer techniques- Augmentation, pectoralis major transfer, biceps transfer, Polyglycolic acid insertion, allograft patch graft (fascia lata, dermis), biceps splinting, Others (biceps tenotomy, deltoidoplasty)  
II. Normal postoperative MRI findings  
1. MR appearance of repaired SST tendon (SI, morphology changes, gap) - thinning, high SI (Sugaya type I, II -Sugaya classification)  
2. Significance of fluid collections: glenohumeral joint, subacromial-subdeltoid bursa, subcoracoid bursa  
3. Susceptibility artifacts (air, anchor, metal from burr)  
4. Suture anchor positions: absorbable vs. non-absorbable  
5. Rotator interval change: arthroscopy portal  
III. Abnormal postoperative MRI findings  
1. Thinning of repaired tendon (Sugaya type III)  
2. Focal defect/minor discontinuity of repaired tendon (Sugaya type IV)  
3. Major discontinuity/full thickness tear with retraction (Sugaya type V)  
4. Displacement of anchors  
5. Infection (arthritis, bursitis, soft tissue infection)  
6. Fracture

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## Abstract Archives of the RSNA, 2023

MKEE-91

### The Key Determinant of Purely Lytic Diaphyseal Lesion Visibility on Radiographs: Exclusively Trabecular Versus Concurrent Endosteal Cortical Involvement

#### Participants

Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Location of a lytic lesion within a long bone (i.e., metaphyseal versus diaphyseal; trabecular versus cortical involvement) is a key determinant of the lesion's conspicuity on conventional radiographs.
- Due to the sparseness of trabeculae at diaphysis, lytic diaphyseal bone lesions without matrix mineralization are visible on radiographs only if they involve the endosteal cortex.
- The oft-repeated statement that "30%-50% of trabecular bone must be removed before radiolucency becomes visible on radiographs" can be misleading: A large diaphyseal trabecular lytic lesion involving 100% of the cancellous bone may not be visible on radiographs, if it is confined to the medullary space and does not also involve at least the endosteal surface of the cortex—constituting a major limitation for conventional radiography.
- This is true for lytic lesions of all Lodwick grades: Moth-eaten or permeative lytic bone lesions that involve the diaphysis are not be visible on radiographs at sites where they spare the cortex.
- Such lytic lesions that are obscure on conventional radiography are readily detected on MRI; when a primary bone tumor is suspected and radiographs are negative, MRI is appropriate.

#### TABLE OF CONTENTS/OUTLINE

- The modified Lodwick classification of lytic bone lesions on conventional radiographs.
- Radiographic/anatomic explanation of the crucial role the location plays in lytic lesion conspicuity on radiography at different sites (i.e., metaphyseal versus diaphyseal; trabecular versus trabecular plus cortical) on anatomic specimens.
- Case examples of lytic lesions that are obscure on conventional radiographs (due to their diaphyseal medullary space involvement) but are visible on CT or MRI.

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## Abstract Archives of the RSNA, 2023

MKEE-92

### Ultrasound of Acute Tendon Tears with Emphasis on Anatomic Landmarks

#### Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ultrasound of acute tendon tears with emphasis on anatomic landmarks Sonography has become an essential imaging tool in musculoskeletal imaging, with precision nearly equal to that of MRI for imaging tendon abnormalities. In emergency setting, the rarity of acute tendon tears compared to overuse tendon abnormalities may result in a challenging scan for trainees, sonographers, emergency and musculoskeletal radiologists. In this education exhibit, we present an approach to sonography of acute tendon tears that may be encountered in the emergency or radiology department. The objectives of this educational exhibit are: Brief review of scanning techniques of the various tendons Recognize the normal appearance of the outlined tendons with MRI correlation and emphasizing important anatomic landmarks Recognize imaging presentation of the various traumatic tendon tears

#### TABLE OF CONTENTS/OUTLINE

For each structure, the following will be discussed:1. US scanning technique2. US anatomy and landmarks with MRI correlate3. Pathology (strains, partial, complete tears)Pectoralis Distal biceps Triceps Quadriceps Hamstrings Achilles tendon and related structures

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## Abstract Archives of the RSNA, 2023

MKEE-93

### A 360-degree Imaging Tour of Sports Injuries in the Elbow

#### Participants

Lauren Pringle, MD, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review of anatomy of the elbow, with detail of the ulnar collateral ligament bundles and bands of the anterior bundle. 2. Phases of throwing mechanism are important in understanding forces applied to different structures of the elbow and how injuries then develop. 3. Pediatric throwers are susceptible to injuries also seen in adults but can experience additional injuries seen only during certain phases of development. 4. Medial elbow injuries are among the most common and well-known in athletes but specific injuries in the posterior elbow, lateral elbow, and anterior elbow are not infrequent and will be described. 5. Illustrative cases of these injuries demonstrate important imaging findings and diagnostic tools to improve detection for learners. 6. Treatment/surgical strategies and the surgeon's perspective will also be reviewed for some of these conditions.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy review 2. Throwing mechanism and stresses 3. Medial elbow injuries a. Ulnar collateral ligament b. Medial epicondylitis c. Medial epicondylar apophysitis d. Ulnar neuritis e. Posteromedial impingement syndrome 4. Posterior elbow injuries a. Olecranon stress fractures b. Triceps i. Tendon ii. Muscle c. Snapping triceps 5. Lateral elbow injuries a. Panner's disease b. Capitellum osteochondral lesion c. Tennis elbow d. Synovial fold 6. Anterior elbow injuries a. Biceps b. Brachialis

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## Abstract Archives of the RSNA, 2023

MKEE-94

### Image-guided Symphyseal and Perisymphyseal Musculoskeletal Interventions: Indications, Challenges and Authors' Experience

#### Participants

Juvel Lee, MD, Richmond, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Image-guided musculoskeletal interventions in and about the symphysis pubis can be technically challenging. The joint and surrounding region are small, resulting in limited ability to maneuver and an often cumbersome procedure. Important neurovascular and visceral structures are present nearby, including the dorsal vessels of the penis in males, pudendal nerve, branches of the ilioinguinal nerve and urinary bladder, necessitating judicious pre-procedure planning. Lastly, most procedures require inguinal or groin exposure thereby making careful draping of the pelvis of paramount importance. The main benefits of image guidance are improved precision of needle placement and simultaneous visualization of the needle and critical neurovascular structures that must be avoided during needle insertion. In this education exhibit, we provide an overview of symphyseal and perisymphyseal interventions including injections, aspirations, percutaneous tendon treatments and biopsies, their indications, risks, and complications, focusing on approaches, tips and tricks to a successful procedure.

#### TABLE OF CONTENTS/OUTLINE

Relevant anatomy of the symphysis and parasymphyseal spaces  
Pre-procedural considerations  
General technical considerations  
For each specific procedure, the following will be outlined: Purpose, patient position, equipment, technique, anatomic considerations (critical structures to avoid)  
Specific procedures:  
Fluoroscopy-guided diagnostic injection  
US and fluoroscopy-guided therapeutic injection  
US and fluoroscopy-guided joint and soft tissue aspiration  
Percutaneous tendon treatments  
US and CT-guided bone biopsies

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## Abstract Archives of the RSNA, 2023

MKEE-95

### Solitary Bone Metastasis: Multimodality Imaging Approach and Ten Years Experience

#### Participants

Fernando Rodado Aranguren, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To analyze the radiological presentation and spectrum of solitary bone metastasis (SBM) through the different techniques: plain x-ray, Computed Tomography (CT), Magnetic Resonance imaging and Positron Emission Tomography/CT (PET/CT).-To present our ten year experience in two centers.

#### TABLE OF CONTENTS/OUTLINE

Metastatic bone disease occurs frequently in malignant tumors, but isolated involvement is unusual and has been proposed as a favorable prognostic factor against multiple bone metastatic involvement. This study aims to analyze the radiological presentation of these unique metastasis. We reviewed all bone metastases diagnosed in the last 10 years in two centers and we included patients with SBM with histological confirmation and no visceral, brain or lymph node metastases (n= 79). The primary tumors, in order of frequency, were lung, breast, prostate and melanoma. In up to 36% of SBM, the primary tumor was unknown at the time of diagnosis. 86% of the lesions were located in the spine, pelvis or femur. The most frequent radiological and clinical presentation was osteolytic lesion without periosteal reaction (75%) causing pain (42%). 68% were treated, mostly with radiotherapy. The detection of these lesions depends on their size, so the methods of choice are MR or PET/CT, with good correlation for the evaluation of the associated soft tissue mass component. In the presence of a solitary bone lesion, metastasis should be included in the differential diagnosis along with primary bone tumors, especially osteolytic lesions in patients older than 40 years with or without cancer disease history. Radiologists should be aware of the characteristics of suspicious malignant lesions that would require biopsy.

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## Abstract Archives of the RSNA, 2023

MKEE-96

### Musculoskeletal Paraneoplastic Syndromes

#### TEACHING POINTS

Early recognition of a paraneoplastic syndrome allows for diagnosis of an occult malignancy, and earlier treatment. This review describes unique imaging findings and clinical associations of musculoskeletal paraneoplastic disorders. 1. Oncogenic osteomalacia is associated with phosphaturic mesenchymal tumors (PMT), which produces FGF23, leading to decreased calcium/phosphate absorption, and consequently insufficiency fractures. 2. Secondary hypertrophic osteoarthropathy, associated with non-small cell lung cancer, manifests with digital clubbing or joint effusions and symmetric long bone periostitis. 3. Cancer-associated myositis, most commonly dermatomyositis, occurs within 3 years of the diagnosis of an underlying malignancy. 4. Palmar fasciitis and polyarthrititis presents with painful hand swelling and palmar skin thickening. It is associated with breast and female genitourinary malignancies. 5. Remitting seronegative symmetric synovitis with pitting edema presents with nonerosive polyarthrititis and is associated with hematopoietic and lung malignancies. 6. Pancreatic panniculitis with polyarthrititis, associated with pancreatic neoplasms, shows osteolytic lesions of the distal extremities with increased periarticular edema and synovitis on MRI. 7. Sweet Syndrome, associated with acute myeloid leukemia, presents with fever and erythematous skin lesions. 8. Eosinophilic fasciitis presents with fascial edema and enhancement, and is associated with hematologic malignancies.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Musculoskeletal Paraneoplastic Syndromes including malignant associations, clinical manifestations, and imaging features.

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## Abstract Archives of the RSNA, 2023

MKEE-97

### Principles, Anatomy and Imaging of Ankle and Foot Tendon Transfers

#### Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goals of any tendon transfer are to create a stable, functioning, and plantigrade foot. Tendon transfers were reported first in the literature as early as 1881; the first case was transfer of peroneal tendons to the Achilles in a young patient who had poliomyelitis. With the eradication of polio in developed countries, experience with a variety of tendon transfers has been lost. Aside from correction of foot deformities, tendon transfer can be performed for tendon dysfunction and tendinopathy and correction of lateral ankle instability. In this education exhibit, we discuss common foot and ankle tendon transfers highlighting principles, anatomy and imaging.

#### TABLE OF CONTENTS/OUTLINE

Anatomy and biomechanics of ankle tendon transfers Principles of tendon transfers Types of ankle tendon transfers: 1. For correction of foot deformity PTT transfer for adult acquired flatfoot deformity Extensor tendon transfer for equinovarus deformity Peroneus longus to peroneus brevis tendon transfer for Charcot-Marie-Tooth disease 2. For reinforcement of a diseased tendon (tendinopathy or tendon tear) FHL transfer for Achilles tendon FHL transfer for peroneal tendons FDL transfer for tibialis posterior tendon 3. For correction of lateral ankle instability Lee procedure Evans procedure Chrisman Snook procedure Ancillary osseous (i.e. calcaneal osteotomy) and soft tissue (i.e. Achilles tendon lengthening) procedures

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## Abstract Archives of the RSNA, 2023

MKEE-98

### Cricket is Coming; Are You Ready to Image

#### TEACHING POINTS

1. Cricket is one of the fastest growing sports in the world, with popularity growth in non-traditional cricketing nations like the United States and continental Europe. 2. Understanding player roles and biomechanics is key to understanding common injury patterns.

#### TABLE OF CONTENTS/OUTLINE

From starting in south east England in the 1600s and traditionally played in the Commonwealth countries, played over 5 days with a rest day to the current 100 ball and 20 over three to four hour formats with night games, entertainment value, advertisement, immigration, universal online access and money spinning leagues have resulted in unprecedented growth in popularity of cricket across the world. In the United States alone, from 30,000 people watching/playing cricket in 2006, there are now more than 200,000 people playing cricket in over 6000 teams. The Indian premier league (IPL) is the most popular league, and had a value of \$10.9 billion in 2022. Specific player roles actions in cricket predispose them to different injury patterns. This exhibit provides a comprehensive overview of common cricketing injuries based on player role actions. The three basic roles in cricket are batting, bowling and fielding, each with sub specializations. Fast/medium pace bowlers are most prone to injuries in the spine (pars/pedicle stress), elbow, ankle (instability, posterior impingement), abdominal wall (side strain) and groin (athletic pubalgia) due to the nature of bowling action. Batsmen and fielders are prone to hamstring and quadriceps strains due to sudden sprints. Acrobatic fielding attempts diving result in shoulder injuries. Contact injuries of the fingers like dislocations fractures are common in the wicketkeeper and fielders.

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## Abstract Archives of the RSNA, 2023

MKEE-99

### Microinstability in the Musculoskeletal System: Biomechanical Concepts to Imaging Interpretation

#### Participants

Aurea Mohana-Borges, MD, MSc, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To introduce joint biomechanics as a guide for imaging interpretation of microinstability, emphasizing its relationship with osseous and soft tissue (capsule, ligaments, and muscles) integrity and the role of imaging [Radiographs (Rx), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI)] in its diagnosis. This guide will highlight anatomic landmarks implicated in joint stability, their relevance in different types of synovial joints, and implications in joint biomechanics. It will compare and contrast normal anatomy with examples of commonly encountered pathologies associated with microinstability.

#### TABLE OF CONTENTS/OUTLINE

Explanation of the concept of microinstability. Demonstration of types of movements in different synovial joints. Demonstration of normal anatomy of joint stabilizers with Rx, CT, and MRI. Examples of microinstability with corresponding commonly encountered pathologies in the osseous structure and soft tissues, with emphasis on the shoulder, hip, knee, and ankle joints.

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## Abstract Archives of the RSNA, 2023

MSEE

### Multisystem Education Exhibits

#### Sub-Events

#### MSEE-1 Rosai-Dorfman Disease- Multimodality Imaging

Participants

Babina Gosangi, MPH, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Rosai-Dorfman disease is a benign proliferative disease characterized by sinus-histiocytosis with massive lymphadenopathy. The mean age of presentation is 21-years with a male preponderance. It is a result of immune dysregulation following a viral infection. Lymphadenopathy is the key finding but extranodal involvement is also seen.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Examples of cases: a. Multistation lymphadenopathy b. Extranodal involvement • Nasal cavity- Pansinusitis • Orbital involvement- cranial nerve thickening • Intracranial lesions- Brain neoplasms, meningitis • Lung lesions- perilymphatic nodules, interstitial thickening, endobronchial nodules, pleural lesions • Renal masses • Mesenteric masses • Lytic lesions in the bone • Soft tissue lesions 3. Conclusion.

#### MSEE-10 Another Great Pretender: Extragenital Endometriosis, A Pictorial Review

#### TEACHING POINTS

Extragenital endometriosis (EE) is a relatively infrequent occurrence with a broad spectrum of clinical and phenotypic presentations, posing significant diagnostic difficulties, particularly outside the pelvic region. Radiologists play a pivotal role in suspecting the presence of EE by identifying its characteristic imaging hallmarks even before the onset of clinical symptoms. As such, they can facilitate timely diagnosis and intervention for better patient outcomes. MRI is the imaging modality of choice for EE evaluation, owing to its high specificity and sensitivity in detecting EE-specific imaging signs.

#### TABLE OF CONTENTS/OUTLINE

a) Introduction: General characteristics of EE, demographics, and imaging features, mostly in CT and MRI. b) Description of the case series: The experience in extragenital endometriosis in two tertiary care centers. A retrospective review of last 5 years cases was performed. c) MRI protocol d) Extragenital endometriosis distribution: Pelvic non gynecological organs, gastrointestinal, genitourinary, musculoskeletal, thoracic, nervous system, miscellaneous e) Conclusions: Endometriosis is a commonly underdiagnosed disease, and the diagnostic challenge is further enhanced by the non-specific clinical and phenotypic features of EE. When radiologists are aware to these complexities, they can be the first physician to suspect and propose this diagnosis, allowing timely intervention and improved patient outcomes. MRI is the backbone of EE diagnosis, thanks to its characteristics.

#### MSEE-11 Didactic Cases of Oncologic Emergencies in Radiology

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To be able to recognize the main urgent pathologies related to oncological diseases and treatments. To be able to distinguish the severity level of these conditions and properly guide the clinician regarding the causative agent. To raise awareness among radiologists about the significant prevalence of these complications in general medical care.

#### TABLE OF CONTENTS/OUTLINE

1. Oncologic diagnosis in the emergency department (not previously known malignancy) 2. Tumor-related complications and emergencies a) Superior vena cava b) Intestinal obstruction c) Obstructive hydrocephalus d) Spinal cord compression e) Hypercoagulability f) Carcinoid syndrome 3. Complications arising from diagnostic procedures and classic treatments a) Surgical (suture dehiscence) b) Chemo-radiotherapy c) Vasculitis d) Fistula e) Esophagitis/esophageal necrosis f) Hemorrhagic complications g) Post-radioembolization cholecystitis h) Leukoencephalopathy due to chemotherapeutics 4. Post-hematopoietic stem cell transplantation (HSCT) a) Pulmonary infections: febrile neutropenia (aspergillus may occur in all time segments) 0-30 days post-HSCT (fungal): Aspergillus 31-100 days post-HSCT (early): CMV and PJ >100 days post-HSCT (late): Bacterial and viral infections (common infections) b) Sinusoidal obstructive syndrome and intestinal graft versus host disease c) Neutropenic colitis (typhlitis) 5. Emergencies related with new therapies and targeted therapies a) Immune-related adverse events and complications b) Pancolitis due to TKI c) Pancolitis secondary to immune-checkpoint inhibitors d) Immune-mediated pancreatitis e) Hyperprogesion f) Cytokine release syndrome (CRS) and immune effector cell-associated neurotoxicity syndrome (ICANS)

#### MSEE-12 ctDNA in the Reading Room: A Guide for Radiologists

#### TEACHING POINTS

? Review applications of circulating tumor DNA (ctDNA) in oncology? Summarize current clinical guidelines for use of ctDNA? Review role of ctDNA in everyday practice

#### TABLE OF CONTENTS/OUTLINE

-Overview of circulating tumor DNA (ctDNA).? What is ctDNA? Lexicon and definitions (tumor microenvironment, liquid biopsy, ctDNA, cell free DNA)? Available techniques and most commonly used platforms for liquid biopsy and ctDNA? ctDNA as a biomarker-ctDNA current oncology guidelines include National Comprehensive Cancer Network, American Society of Clinical Oncology, European Society of Molecular Oncology.-ctDNA in cancer surveillance, prognosis, and treatment response for:? Lung? Breast? Colorectal? Lung? Pancreas? Sarcomas(Detectable targetable mutations, imaging examples, and indications in clinical practice are presented for each tumor)-ctDNA Strengths for imaging interpretation, Limitations in cancer surveillance, prognosis, and treatment-Future Directions and Promising Future Applications? Non-invasive tissue characterization? ctDNA and radiomics? Personalized patient management and therapy selection

#### MSEE-13 When Suspect Nonneoplastic Lymphadenopathy on PET/CT

##### TEACHING POINTS

1. Morphological changes of lymph nodes or their metabolism are not enough to predict tumoral compromise.2. The distribution pattern, relation with a primary tumor and its typical extension, inflammatory or posttreatment changes, and clinical conditions should be considered. 3. Different nonneoplastic pathologies characteristically manifest with lymph node enlargement and are frequently confused with malignancy, such as connective tissue diseases, infections, IgG4-related disease, granulomatous inflammation, non-clonal lymphoproliferative disorders, and others.

#### TABLE OF CONTENTS/OUTLINE

1. Clues to suspect nonneoplastic lymphadenopathy: Morphological characteristics, distribution pattern, relation with the drainage pathways of a primary tumor or inflammatory process, and association with other findings.2. Nonneoplastic diseases related to lymphadenopathies: a) Connective tissue diseases: lupus and rheumatoid arthritis; b) Infections: HIV, tuberculosis, toxoplasmosis, histoplasmosis, Epstein-Barr virus, and Bartonella; c) IgG4-related disease; d) Granulomatous inflammation: sarcoidosis, sarcoid-like reaction, and pneumoconiosis; e) Non-clonal lymphoproliferative disorders: Castleman disease and Amyloidosis; f) Kikuchi and Kimura disease; g) Posttreatment lymphadenopathies: immunotherapy, target therapy, surgical and radiation inflammatory changes; h) COVID-19 vaccine; i) Others: pulmonary edema, interstitial lung disease, emphysema, chronic liver disease, and reactive lymph nodes in young patients3. Conclusions

#### MSEE-14 Potential Pitfalls of Splitting Interpretation of Concurrent Chest and Abdominal CTs

Participants

Eyal Ron, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Simultaneously obtained chest and abdomen/pelvis CTs are sometimes read by separate subspecialized radiologists. This creates the potential for missed, incomplete, and conflicting diagnoses involving the scanned areas that overlap.2. Chest findings can sometimes be more conspicuous on the "abdomen" CT and vice-versa. This can be due to differences in contrast timing and CT reconstruction technique.3. Some processes require synthesizing findings from both the chest and abdomen CT for optimal radiology analysis.

#### TABLE OF CONTENTS/OUTLINE

We provide example cases demonstrating how splitting radiology interpretations either did or potentially could have led to misdiagnoses of abdominal findings seen on chest CT and vice versa. Additionally, we provide guidelines to avoid these potential pitfalls. Examples include:1. Missed pancreatic adenocarcinoma conspicuous only on the chest CT portion.2. Pulmonary embolism poorly visualized on chest CT with contrast but more conspicuous on the arterial phase of the concurrently obtained abdominal CT.3. Area of slow flow seen on chest CT misinterpreted as pulmonary embolism when a concurrently obtained abdominal shows these arteries are adequately opacified. The patient later developed an intra-abdominal bleed related to the anti-coagulation started for the false positive pulmonary embolism call.4. Intrathoracic extent of a metastatic GIST tumor and reactive pericardial effusion, challenging to synthesize without strong collaboration between the chest and abdominal radiologists.

#### MSEE-15 Facial Mapping: High Frequency Ultrasound Step-by-step Approach in Facial Anatomical Evaluation for Aesthetics

Participants

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Facial aesthetic procedures are increasingly being performed. Different aesthetic surgery techniques, injectable materials and technologies aimed at improving skin quality and restoring the redistributed volume of facial layers have been used against the multifactorial process of the facial aging. The correct evaluation and characterization of the facial layers is crucial for safe and effective rejuvenation procedures, specially the minimally invasive, since a wrong manipulation might yield an aesthetically undesirable result and lead to serious complications. In this context, the radiologists may be requested to recognize and evaluate the facial layers, compartments and their contents. To achieve accurate and timely detection and appropriate approach of each case, High frequency ultrasound (HFUS/24-33MHz) is the most effective method since it provides optimal anatomical information of the skin and allows facial layers differentiation as well as aesthetic anti-ageing procedures identification. This study aims to discuss and illustrate the radiologist's role in the evaluation of facial anatomy with HFUS, and purposes: (1)To describe the correct examination technique / HFUS advantages. (2)To illustrate the anatomy of the skin/facial layers. (3)To show a step-by-step approach of the most important facial structures. (4)To discuss the course of the main facial neurovascular structures and its variations.(5)To list and describe the anatomy of the Facial Danger Zones. (6)To highlight the importance of HFUS in pre and post-procedural evaluation.

#### TABLE OF CONTENTS/OUTLINE

1.INTRODUCTION. 2. FACIAL LAYERS. 3.VASCULAR MAPPING. 4. FRESH FROZEN SPECIMEN CORRELATION. 5.CONCLUSION



## **MSEE-16 State of the Heart: A Pictorial Review of Classic and Novel Cardiac Devices**

### Participants

Nikhil Gupta, MD, MS, Boston, MA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Outline the indication, function, and imaging of classic cardiac implant devices. Review commonly encountered complications of classic implanted cardiac devices. Understand the role of novel implanted cardiac devices and their appearance on plain film radiography and computed tomography.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to Classic Implanted Devices in the Chest Chest Ports, Heart Valve Prostheses, Pacemakers/Implanted Defibrillators, Coronary Artery Bypass Stents, Implantable Loop Recorder  
2. Outline complications of Classic Implanted Devices  
3. New Implanted Devices Left Atrial Appendage Closure Devices, Atrial Septal Occlusion Devices, Ventricular Support Devices, ECMO

## **MSEE-17 Imaging in Sexagenarians and Beyond: What Clinicians Want to Know and What Radiologists Need to Know**

### Participants

Sirui Jiang, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. By 2030 approximately 20% of all Americans or about 70 million people will be 65 years or older. This population utilizes about 30% of our imaging resources yearly and is ever increasing.  
2. How to incorporate the geriatric scoring systems to risk stratify and prioritize treatment in the reading room.  
3. Review the common imaging findings in the geriatric population with special emphasis in the emergency/trauma and oncology settings using multimodality images.  
4. Review imaging differences of pathology in a young versus an elderly patient.

### **TABLE OF CONTENTS/OUTLINE**

Background  
History of geriatrics  
Importance of geriatric care and management  
Development of multiple geriatric scoring systems  
Succinctly synthesizing common geriatric imaging findings  
Common Scenarios of Geriatric Population in the Reading Room  
Head and Neck: subdural hematomas, cerebral atrophy, vascular calcifications  
Chest: rib fractures, emphysema, cardiovascular (coronary and valvular calcifications), lung/esophageal primary malignancies, acute/chronic lung infection  
Abdomen: steatosis, chronic renal failure, chronic cystitis, pancreatic issues (malignancy/insufficiency), adrenal issues (insufficiency/hyperplasia/atrophy)  
Pelvis: prostate, diverticulitis  
Musculoskeletal: osteopenia, multiple myeloma, osteoarthritis, steroid associated changes, vertebral compression fractures  
Collaborative Approach for Geriatric Care  
Templates with these common findings to help create a concise report  
Multidisciplinary approach with geriatric subspecialties  
Is it time for a geriatric radiology fellowship/subspecialty?

## **MSEE-18 SBRT and Isolated Metastases: A Primer for Radiologists**

### Participants

Raelyne MacBeth, MD, South Euclid, OH (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review the natural history of stereotactic radiation therapy (SBRT) and how it has progressed to treatment of intra-thoracic and intra-abdominal malignancies. 2. To review the different types of malignancies SBRT is used to treat and the potential toxicities associated with each. 3. To discuss the multimodality appearance and evaluation of tumor burden after SBRT. 4. To discuss the multimodality appearance of SBRT associated toxicities after treatment. 5. To discuss the multimodality appearance of recurrence patterns after SBRT.

### **TABLE OF CONTENTS/OUTLINE**

1. Define stereotactic body radiation therapy (SBRT) and how it differs from other modes of radiation therapy.  
2. Review the pathophysiology of radiation therapy-induced cellular damage.  
3. Review the natural evolution of SBRT and how it has progressed to treatment of malignancies in the chest, abdomen, and pelvis.  
4. Discuss the indications for utilizing SBRT in selected malignancies and their common associated toxicities.  
5. Discuss the typical and atypical response patterns after SBRT and their multimodality appearance.  
6. Discuss the typical and atypical toxicity profiles after SBRT and their multimodality appearance.  
7. Examine the multimodality appearance of local recurrence patterns after SBRT.  
8. Discuss distant recurrence patterns after SBRT and their multimodality appearance.  
9. Discuss the financial toxicities associated with SBRT.

## **MSEE-19 Syphilis: The Re-emerging Great Mimicker - A Case-based Review from Head to Toe**

### Participants

Kano Shintaro, MD, Shinagawa-Ku, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Syphilis, a sexually transmitted disease caused by the spirochete bacterium *T. Pallidum*, is a multisystemic infection that can affect various organs. Recently, the number of syphilitic patients has been rapidly increasing worldwide. Clinical manifestations of syphilis are often inconspicuous and imaging examinations performed for other purposes may lead to potential overlook or misdiagnosis of syphilis, making it challenging for radiologists to diagnose it accurately. Therefore, it is crucial for radiologists to understand the imaging spectrums and differential diagnosis of syphilis to ensure accurate diagnosis and appropriate patient management. The purposes of this exhibit are (1) to review the imaging spectrums of syphilis through case-based studies for the improved ability to identify potential cases of syphilis and (2) to discuss approaches to distinguish syphilis from other diseases that can mimic it.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
1-1. Epidemiology  
1-2. Clinical manifestation therapy  
2. Case presentations: Body imaging  
2-1. head and neck  
2-2. chest  
2-3. cardiovascular  
2-4. abdomen urogenital  
3. Case presentations: Neuroimaging  
3-1. brain  
3-2. spinal cord  
4. Case presentations: Pediatric imaging  
5. Summary

## **MSEE-2 Body MRI Approach Fundamentals: A Guide for Beginners**

Participants

Mark Hoegger, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Body MRI interpretation can be daunting for the inexperienced reader because 1) the relevance of key clinical parameters may be unknown, 2) the importance of certain sequences in diagnosis may be unclear, and 3) a routine search pattern may not be established. To aid those inexperienced in body MRI, this exhibit's purpose is to:- Discuss the general body MRI sequences and their uses.- Identify and explain key clinical factors for the most commonly encountered clinical questions that can be answered with body MRI.- Describe the sequences and their relevance for these common body MRI indications. The intent of this exhibit is not provide an exhaustive overview of body MRI, but to arm a trainee starting on service, or a radiologist in practice who has been called upon to read body MRI exams but may be inexperienced or out of practice, with the tools needed to be successful.

### **TABLE OF CONTENTS/OUTLINE**

- General body MRI sequences and their uses: T1-weighted imaging pre- and post-contrast, chemical shift imaging, T2-weighted imaging, and DWI.- Body MRI search pattern fundamentals: CT versus MR approach, flexibility in body MRI, lesion finding versus lesion characterization, and pitfalls.- Disease-specific clinical parameters and sequences for common indications: liver lesions and hepatocellular carcinoma (LI-RADS), rectal cancer, renal masses, prostate adenocarcinoma (PI-RADS), pancreatic cysts and solid masses, inflammatory bowel disease, biliary disease, and uterine and ovarian masses.

## **MSEE-20 Monitoring the Abdomen: How to Do It - Tumor Surveillance and Follow-up**

### **TEACHING POINTS**

Different imaging modalities are used for follow-up Surveillance increases accuracy compared with clinical follow-up alone Detecting recurrence early allows potentially curative salvage therapy Protocols reflect tumor risk stratification. Guidelines outline imaging follow-up of abdominopelvic tumours Radiomics and liquid biopsies may augment surveillance protocols to identify patients at higher risk of relapse

### **TABLE OF CONTENTS/OUTLINE**

Imaging modality pearls and pitfalls for follow-up CT - role of MPR, MIP, dual-energy MRI - anatomical and functional sequences; merits and practicalities of whole-body MRI Nuclear Medicine - including novel radiotracers System based overview of abdominopelvic cancers, how and where to detect relapse- Practical tips for spotting recurrence early and avoiding mimics Understanding routes of disease spread eg. in peritoneal disease Specific challenges of detecting skeletal disease recurrence Assessing lymph node recurrence - not just size Differentiating expected post treatment changes from recurrent disease Immunotherapy and pseudoprogression Guidelines for imaging surveillance post curative treatment Upper, lower, gynaecological and urological tumors Key similarities and differences in international guidelines for follow up of abdominopelvic cancers, why this matters clinically Role of clinical and laboratory markers to augment radiology Tumor markers Liquid biopsy - a new era in cancer surveillance? AI and radiomics in disease surveillance, hype or reality?

## **MSEE-21 Congenital and Acquired Causes, Mimickers and Treatment of Diaphragmatic Paralysis**

Participants

Achala Donuru, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Phrenic nerves originate from cervical nerves C3-C5. Injury of the phrenic nerve can occur by multiple mechanisms. Due to the long course of the left phrenic nerve in the thorax, left-side diaphragmatic weakness is more common compared to right side. One of the most frequent causes of unilateral diaphragmatic paralysis is iatrogenic. In bilateral diaphragmatic paralysis, one of the most common causes is a motor neuron disease. Most cases of DP are idiopathic (70%), other causes include congenital (birth trauma), tumors, infections, muscular disorders, and iatrogenic (medication induced, from nerve block, post-surgical). The main differentials to consider when an elevated hemidiaphragm is noted on a chest radiograph are diaphragmatic eventration, lobar collapse, subphrenic abscess and subdiaphragmatic mass.

### **TABLE OF CONTENTS/OUTLINE**

On a chest radiograph, the right dome of the diaphragm is higher in position when compared to the left dome. If the left dome of the diaphragm is elevated by more than 2 cm, DP should be suspected. Functional imaging with a sniff test is very useful in diagnosing DP, the affected side demonstrates a paradoxical upward movement. Performance of dynamic MR imaging for evaluation of diaphragmatic function has also been described. Most patients with unilateral DP are detected incidentally and do not require any specific management. Most patients with bilateral DP require permanent ventilator support. Selected patients with persistent respiratory failure can benefit from diaphragmatic plication or phrenic nerve pacing. It is important for the radiologists to recognize diaphragmatic paralysis and look for pathology along the course of the phrenic nerve.

## **MSEE-22 It's Not Always Cancer: A Pictorial Essay on Nonneoplastic Lymphadenopathies with Histopathologic Correlation**

Participants

Brenda N. Lahlou, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. List and compartmentalize the different causes of nonneoplastic lymphadenopathies. 2. Recognize typical radiological aspects of certain etiologies of lymphadenopathies. 3. Improve the approach of differential diagnosis of lymph node enlargement by correlating multimodality imaging and clinical findings. 4. Recognize the most common histopathological patterns found in lymph node enlargement caused by benign conditions.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Overview of normal lymph node anatomy and its radiological and histological aspects 3. Subdivision of various

pathologies that can encompass lymphadenopathy based on etiology 4. Localized lymphadenopathy a. Foreign-body related b. Idiopathic diseases c. Reactive conditions d. Infections 5. Generalized lymphadenopathy a. Autoimmune diseases b. Idiopathic diseases c. Reactive conditions d. Infections 6. A practical diagnostic approach in the presence of lymph node enlargement 7. Take home message

### **MSEE-23 From Brain to Bones: A Radiological Saga Through Multisystemic Tuberos Sclerosis**

Participants

Fernanda Limonge, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To review radiological manifestations of Tuberos Sclerosis To illustrate the imaging findings of the most important features of Tuberos Sclerosis (ultrasound, MRI, CT) Discuss the radiologist's role on establishing clinical diagnosis

#### **TABLE OF CONTENTS/OUTLINE**

Clinical criteria for Tuberos Sclerosis Diagnostic Radiological manifestations of Tuberos Sclerosis- Neurological features- Cardiological features- Thoracic features- Abdominal features- Musculoskeletal features

### **MSEE-24 What on Earth is That: Newer Medical Devices on Chest Radiographs**

Participants

Ashrith Kandula, Wallingford, PA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

There has been a constant influx of newer medical devices as technology veers towards more noninvasive methods of treating diseases. Plethora of new devices are seen on today's plain radiographs. Cardiovascular devices are further divided into- cardiac devices comprising of rhythm monitors such as Pacemakers, Implantable cardioverter defibrillators, Ventricular Assist Devices, Occlusion devices, Valve prosthesis- (Open heart and Trans catheter placement), Loop recorders. Vascular devices range from Central venous catheters, Swan Ganz catheter , remote pulmonary artery pressure monitoring devices, devices used for catheter directed thrombolysis, IABP, ECMO to many more. Non-Cardiovascular devices include- esophageal devices- LINX for reflux, nerve stimulators including Vagal, Trigeminal and Hypoglossal, phrenic nerve stimulators, diaphragmatic pacers.

#### **TABLE OF CONTENTS/OUTLINE**

To review the newer medical devices seen on plain radiographs of the chest. Pictorial review of the optimal location, function and complications of the different devices. Organization: Introduction, classification, pictorial review of device along with in-vitro images, optimal location, function and evaluation of complications associated with the device. Entities discussed: Cardio Microelectromechanical device (CardioMEMS), Pulmonary Artery catheters for thrombolysis , Cordella Pulmonary Artery Pressure Monitor, Mitraclip, Transcatheter Mitral Valve Replacement (TMVR), Transcatheter Pulmonary Valve Replacement (TPVR), LINX - device for reflux management, Endoscopic clips from POEMS, Hypoglossal nerve stimulators, Diaphragmatic pacers.

### **MSEE-25 Nail it: A Guide to Diagnosing Nail Disorders**

Participants

Isabela Ribeiro, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Ultrasonography serves as a valuable tool for assessing the nail unit, providing real-time evaluation of its components, which includes the periungual tissue's appearance and thickness, vascularization via color Doppler application, and possible involvement of underlying bone structures. It is crucial to understand not only the normal anatomy of the nail bed on ultrasonography but also the main points of some pathologies encountered in daily clinical and radiological practice. While nail tumors are rare anomalies, a detailed prior anatomical knowledge allows for their easy identification. In addition, it is important to highlight the ultrasonographic findings of other common conditions, such as retronychia, foreign bodies, and paronychia, in order to better define the appropriate course of action. Given its ability to diagnose, localize, and differentiate various nail disorders, it is not surprising that nail unit assessment through ultrasonography can significantly improve patient outcomes.

#### **TABLE OF CONTENTS/OUTLINE**

Highlight the importance of ultrasonographic assessment for the nail unit. Review the advantages and limitations of high-frequency ultrasound for evaluating the nail compartment. Identify the ultrasonographic characteristics of common nail pathologies.

### **MSEE-26 "To Cyst or Not to Cyst," Imaging Spectrum of Mucinous Neoplasms in the Abdomen and Pelvis**

Participants

Nabih Nakrou, MD, Watertown, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to: • Review imaging features of mucin-producing neoplasms in the abdomen and pelvis with attention to organ-specific involvement. • Discuss worrisome findings that favor malignant potentials over benign tumors. • Demonstrate imaging role in management including pre-surgical planning and imaging follow-ups. • Address misdiagnosis, pitfalls, and mimicking pathologies that may resemble mucinous neoplasms

#### **TABLE OF CONTENTS/OUTLINE**

Present multi-modality imaging review of mucinous neoplasms involving the following organs Pancreas Intrahepatic and extrahepatic biliary tree GI tract (Esophagus, stomach, small bowel, colon, appendix and rectum) GU system (ovaries, epididymis, bladder, kidney, renal collecting system) Peritoneum and serosal involvement List syndromic association and predisposing systemic conditions

## **MSEE-27 Make Every Connection Matter: Multi-modality Imaging Features of Fistulas in the Chest, Abdomen and Pelvis**

Participants

Ayman H. Gaballah, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review the definition, classifications, and types of fistulas 2. Discuss multi-modality imaging features of fistulas in the chest, abdomen, and pelvis 3. Point out the appropriate imaging workup and pitfalls according to the anatomic region 4. Illustrate the long-term complications of chronic and untreated fistulas 5. Highlight some of the management options

### **TABLE OF CONTENTS/OUTLINE**

1- Introduction 2- Etiology and types of fistulas a. Congenital: Congenital fistulae arise from remnants of embryonic ducts that persist (e.g., tracheoesophageal, vitello-intestinal, urachal, etc.) b. Acquired: Acquired fistulae are secondary to variety of causes. i. Traumatic ii. Iatrogenic iii. Inflammatory/infectious iv. Neoplastic v. Post-radiation therapy vi. Vascular vii. Miscellaneous c. Types according to fistula opening i. External opening (e.g., enterocutaneous fistula) ii. Internal opening (e.g., tracheoesophageal, rectovesical, cholecysto-duodenal, perianal, arteriovenous fistula, etc.) 3- Multimodality imaging features of fistulas in different body parts from head to toe with related classifications as applicable 4- Complications of fistulas 5- Case presentation and imaging pitfalls 6- Management options

## **MSEE-28 You'll Float Too: A Guide of Ectopic Gas for the Radiology Resident**

Participants

Sofia Arizaga, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

after the exhibit the reader would be able: To describe the imaging features and differentiate normal air/gas in the different tissues and potential body spaces. To identify the origin and causes of ectopic gas. To analyze abnormal gas location in order to detect situations and diseases that involve high mortality rate.

### **TABLE OF CONTENTS/OUTLINE**

Introduction- Pathways of Ectopic Gas Distribution.- Imaging assessment of abnormal gas.- Etiopathogenesis of ectopic Gas: Iatrogenic, trauma, inflammatory/infectious, ischemic, neoplastic, others.- Recognize alarm signs.- Summary

## **MSEE-29 Alohomora: Opening the Mind and Demystifying Abdominal Tuberculosis Findings**

Participants

Kamila Albuquerque, MD, Vila Velha, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Brazil is one of the countries with the highest incidence of tuberculosis in the world, ranking among the top 22, according to the WHO. Abdominal tuberculosis is considered a great mimic of other abdominal diseases, and can affect the gastrointestinal tract (GIT), peritoneum, lymph nodes and other organs. It often represents a diagnostic challenge due to its nonspecific findings, which may result in diagnostic delay and the development of complications. Imaging tests play an important role in its diagnosis, with an impact on the morbidity and mortality of the disease. This study aims to carry out an iconographic review of the most common abdominal manifestations of the disease, atypical presentations and complications from the perspective of different types of imaging methods, which include tomography and magnetic resonance imaging and even CT / PET.

### **TABLE OF CONTENTS/OUTLINE**

In this educational exhibition, we address the different abdominal radiological manifestations related to tuberculosis bacillus infection, in addition to epidemiological and pathophysiological data, as well as some differential diagnoses and miscellaneous.

## **MSEE-3 Visualizing Beyond the Joints: Imaging the Extra-articular Manifestations of Rheumatoid Arthritis**

Participants

Marco Tsuno, Brasilia, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To understand the prevalence and significance of extra-articular manifestations in rheumatoid arthritis.- To recognize the characteristic imaging features of common extra-articular manifestations in rheumatoid arthritis.- To recognize the role of imaging in monitoring disease progression and detecting new or worsening extra-articular manifestations in rheumatoid arthritis.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Pathophysiology. 3. Diagnostic criteria. 4. Articular manifestations. 4.1. Imaging: articular manifestations (Temporomandibular Joint, Spine, Shoulder, Elbow, Wrist and Hand, Hip, Knee, Ankle and Foot). 5. Extra-articular manifestations. 5.1. Imaging: extra-articular manifestations (Central Nervous System, Pulmonary, Cardiovascular, Rheumatoid Nodules). 6. Conclusion. 7. Bibliographic references.

## **MSEE-30 Beyond Genetics: A Review of Current Renal Cancer Screening Guidelines for Hereditary Renal Cancer Syndromes**

Participants

Shiva Singh, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Hereditary renal cancer syndromes, including von Hippel-Lindau (VHL), Birt-Hogg-Dubé (BHD), Hereditary Leiomyomatosis and Renal Cell Carcinoma (HLRCC), Tuberous Sclerosis Complex (TSC), Succinate Dehydrogenase (SDH)-deficient renal cell carcinoma (RCC),

and BRCA1-associated Protein-1 (BAP1) tumor predisposition syndrome, are associated with an increased risk of developing renal tumors. Early detection of renal cancer in individuals with hereditary renal cancer syndromes is of extreme importance as it facilitates timely intervention and improves the prognosis. Owing to differences in their extra-renal manifestations and age of onset, the screening guidelines for each hereditary renal cancer syndrome are unique. Here, we provide a summary of the current recommendations for screening of renal cancer in each of these hereditary renal cancer syndromes.

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/OutlineI. Introduction: (a) Hereditary renal cancer syndromes: Renal and extra-renal manifestations; (b) Importance of screeningII. Screening guidelines for hereditary renal cancer syndromesIII. CT/MRI images of patients with extra-renal manifestations undergoing renal cancer screening and eventually detecting renal tumor in each syndrome:(a) Von Hippel-Lindau syndrome (vHL); (b) Birt Hogg Dubé syndrome (BHD); (c) Hereditary Leiomyomatosis and Renal Cell Cancer syndrome; (d) Tuberous Sclerosis Complex; (e) Succinate Dehydrogenase-deficient RCC; (f) BAP1 tumor predisposition syndromeIV. Conclusion

#### **MSEE-31 DWI vs 18-FDG PET/CT in Oncology: Which Technique for Which Clinical Scenario**

Participants

Antonio Luna, MD, PhD, Jaen, Spain (*Presenter*) Speaker, General Electric Company

#### **TEACHING POINTS**

Learn how to introduce whole-body diffusion-weighted imaging (WB-DWI) for tumor assessment. Review the technological adjustments including parallel imaging, compressed sensing, and deep learning to optimize WB-DWI protocols. Learn how WB-DWI/MRI is a valid alternative to 18-FDG PET/CT for tumor staging and is particularly advantageous in the assessment of peritoneum, bone marrow, liver, and brain metastases. Analyze the complementary role in tumor detection and staging and therapy monitoring of both techniques, using a head-to-head comparison, defining the most adequate technique for common clinical scenarios in oncology and including their applications in special populations (i.e., pregnant, or pediatric patients). Establish the range of clinical applications of PET/MRI combining DWI and 18-FDG PET acquisitions in oncology.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction.2. Technical adjustments in WB-DWI 3. Tumor staging: 3a. WB-DWI vs 18-FDG PET-CT. 3b. N staging. 3c. M staging. 3d. Specific tumors: NSCLC, breast cancer, prostate cancer, malignant melanoma. colorectal cancer, lymphoma, multiple myeloma and others. 4. Therapy monitoring. 5. Prediction of treatment response. 6. Posttreatment surveillance. 8. Conclusions

#### **MSEE-32 An Easy Approach to Cheson-Lungano Criteria: From Staging to Treatment Response Assessment**

Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-To know how to evaluate a lymphoma staging study and treatment response interpretation according to Cheson-Lungano criteria.- Learning how to manage complex situations where this criteria seems to be unclear and its limitations.- Discussing the differences between Cheson-Lungano criteria and other evaluation systems such as RECIST 1.1

#### **TABLE OF CONTENTS/OUTLINE**

Standard criteria for radiological evaluation lymphoma response allowed to optimise the therapeutic management in a more accurate way in this type of patients.It is based on the selection of target and non-target disease in a first staging study, and the evaluation of their presence and change in size in follow-up studies, allowing a global assessment of treatment response.These criteria can be applied by radiologists by evaluating CT studies (Cheson criteria) or CT and PET together (Cheson-Lungano criteria).It should be noted that although these criteria may be similar to the RECIST 1.1 criteria for the evaluation of other solid tumours, there are important differences in their interpretation (number of target lesions, required diameters, percentage limits to consider response/progression...), as well as the specific assessment of splenic involvement (which is more infrequent in other solid tumours).This paper reviews the importance of a correct use of Cheson-Lungano criteria in: 1) performing an adequate staging study inform; 2) interpretate the treatment response in follo-up studies; 3) other special situations where this criteria is sometimes unclear and are discussed in this article.

#### **MSEE-33 POCUS: Radiology Vs Other Medical Professions Perspectives - Where Do We Stand**

Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Point-of-care ultrasonography (POCUS) refers to a focused ultrasound performed at the patient's bedside by a clinician who both performs the US and interprets the images. The protocols usually answer a specific question that helps guide treatment. Goals: Understand what is point of care US (POCUS), its benefits and applications. Discuss differences in US training pathways among the different specialties vs Radiology. Review current issues of US Quality assurance and reimbursement, image archiving and accountability. Understand areas of potential threats and conflicts, and explore potential areas for collaboration and growth.

#### **TABLE OF CONTENTS/OUTLINE**

Define Point-of-care ultrasonography (POCUS) Review benefits and various applications of POCUS ( cardiovascular, ophthalmology, nervous system assessment, procedures ( line placement, nerve block, FAST) Discuss training pathways for POCUS, their strengths and limitations vs Radiology, review accreditation processs for POCUS vs Radiology. Discuss training in medical school Review available methods of US Quality assurance and reimbursement, provide examples of misinterpretation/misdiagnosis and role of Radiology in detailed evaluation of the POCUS findings. Discuss issues related to image archiving and accountability. Understand areas of potential threats and conflicts among Radiology and other fields of medicine utilizing POCUS. Explore potential areas for collaboration and growth.

## **MSEE-34 Diffusion-weighted Imaging (DWI) in the Era of Abbreviated MRI: How to Make the Most Out of it for Abdominal MRI Applications**

Participants

Claudio Lagos, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Introduce and briefly review abbreviated-MRI concepts. 2. Discuss detectability of lesions through abdominal organs using DWI alone, and review evidence comparing it with other imaging modalities, with emphasis in most and least useful applications. 3. Review DWI utility for characterizing abdominal lesions based on patterns and its correlate with pathology and aggressiveness, with emphasis in liver - pancreas. 4. Review last evidence regarding ADC value as a biomarker and a quantitative parameter in oncology imaging, prognosis and treatment response. 5. Illustrate frequent artifact and how they lead to interpretation pitfalls.

### **TABLE OF CONTENTS/OUTLINE**

- Physics principles of diffusion- DWI image acquisition, ADC value and ADC map. Role of increasing b values in detectability.- Review abbreviated-MRI concept, goals and applicability.- Evidence based review of detectability of different lesions with emphasis in liver and pancreas.- Comparison of diagnostic yield with other techniques (ie. PET-CT, CECT) and other MR sequences, for different organs and frequent lesions, including peritoneal disease.- Practical approach in liver and pancreatic lesions for predicting histology / aggressiveness using a pattern based fashion.- Case based review of high performance situations: Liver mets, LIRADS evaluation, pancreatic nodules, extra - abdominal metastatic disease.- Case based review of low performance situations: Aggressiveness in renal nodules.- Role of quantitative DWI and its evidence, with emphasis in oncology.- Detectability and interpretation pitfalls, and how to avoid them.- Summary.- References.

## **MSEE-35 From Head to Toe Non-Langerhans Cell Histiocytosis (Erdheim-Chester Disease): Understanding a Rare Pathology in the Era of Hybrid Imaging**

Participants

Yumi Kimura Sandoval, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Understand the epidemiology and pathology behind Erdheim- Chester disease, as well as its clinical presentation- Learn the importance of 18F-FDG PET/CT in the diagnosis, detection of disease extent, and severity- Identify the radiological signs with which the disease can manifest- Case-based review of the main radiologic signs and features observed in this rare disease

### **TABLE OF CONTENTS/OUTLINE**

1. Epidemiology 2. Clinical presentation 3. Pathology 4. Radiographic features A) Central Nervous system: - Pituitary Gland - Posterior Fossa B) Orbits C) Thorax - Lung - Mediastinum D) Vasculature - Thoracic and abdominal aorta E) Kidneys and retroperitoneum F) Musculoskeletal system

## **MSEE-36 Imaging in Erdheim Chester disease**

Participants

Yashant Aswani, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Discuss recent updates in classification and pathogenesis of Erdheim-Chester disease 2. Describe role of imaging and clinical and radiologic findings of Erdheim-Chester disease 3. Review new treatment options and therapeutic response evaluation

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Epidemiology 3. Pathology 4. Pathogenesis 5. Newer classification systems (2016 WHO classification of lymphoid neoplasms and 2016 Working group of Histiocytic Society Classification) 6. Mixed histiocytosis: an overlap syndrome 7. Diagnosis 8. Role of Imaging 9. Manifestations of Erdheim-Chester disease 10. Skeletal involvement 11. Retroperitoneal disease 12. CNS involvement 13. Cutaneous disease 14. Pulmonary involvement 15. Cardiothoracic disease 16. Endocrine involvement 17. Orbital disease 18. Miscellaneous: Craniofacial bones and skull base 19. Miscellaneous: Hepatobiliary disease 20. Newer imaging findings 21. Association with non-histiocytic malignancies and autoimmune diseases 22. Markers of prognosis 23. Molecular targets for treatment 24. Treatment approach 25. Therapeutic response evaluation modified PERCIST criteria

## **MSEE-37 Response Assessment in Solid Tumors Criteria: Similarities and Differences**

### **TEACHING POINTS**

To review the history and evolution of solid tumor response criteria; To compare similarities and differences across various response criteria; To describe RECIST, RECIST-related criteria adaptations, and immune-related criteria; To recognize the challenges of applying these criteria; To provide case-based scenarios and identify the response categories with particular emphasis on immune-related criteria.

### **TABLE OF CONTENTS/OUTLINE**

Timeline of Response Assessment in Solid Tumor; Terminology and rules for solid tumor response assessment; Similarities and differences across various response assessment criteria; Case-based scenarios to demonstrate assessment variations in response criteria/categories; Challenges in image metrics assessment using these different criteria; Summary and future directions; References.

## **MSEE-38 Bugs that Suck (Your Blood): Imaging Manifestations of Vector-Borne Diseases**

Participants

Francisco Calle, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• Familiarize the radiologist with the range of pathogens transmitted by arthropod vectors and the diseases they cause. • Discuss

• Familiarize the radiologist with the range of pathogens transmitted by arthropod vectors and the diseases they cause. • Discuss the epidemiology of these diseases, including areas of endemicity, types of arthropod vectors, transmission dynamics, and prior outbreaks. • Discuss the clinical presentations and medical complications associated with vector-borne diseases. • Describe the imaging features associated with infection on ultrasound, CT, and MRI. • Provide a brief overview of management and treatment.

#### TABLE OF CONTENTS/OUTLINE

Introduction to vector-borne diseases, including types of vectors and variety of pathogens, as well as epidemiology and major outbreaks. Role of imaging and imaging features in detecting infection and identifying complications: • Neurologic (e.g., viral encephalitis, Lyme encephalitis, cerebral malaria) • Chest/cardiac (e.g., Chagas dilated cardiomyopathy) • Gastrointestinal (e.g., yellow fever, malaria) • Urogenital (e.g., arbovirus-associated acute kidney injury, acute tubular necrosis, and renal failure) • Musculoskeletal: (e.g., cutaneous and mucocutaneous leishmaniasis, ectoparasites). Brief overview of management and treatment of vector-borne diseases and their complications

#### MSEE-39 Whole-Body MRI in Hereditary Tumor Syndromes: How We Do It

##### TEACHING POINTS

- Whole-body MRI can be helpful for screening, detection, and follow-up of bone and soft tissue tumors in patients with hereditary tumor syndromes - Different tumor syndromes require appropriate MRI acquisition protocols to highlight the different pathological findings - Whole-body fluid and cartilage sensitive MRI sequences are necessary for patients with multiple hereditary exostoses (MHE) and enchondromatosis to reveal the cartilaginous portion of the tumors and the associated bursitis - Post-contrast imaging is critical in patients with familial paragangliomatosis to identify small mediastinal and retroperitoneal paragangliomas - Diffusion-weighted imaging is useful in patients with an increased risk of malignant tumors (for example, in Li-Fraumeni syndrome) or when a malignant degeneration of a benign lesion is suspected

#### TABLE OF CONTENTS/OUTLINE

- Imaging approach in hereditary tumor syndromes - Role of Whole-Body MRI for screening, detection, and follow-up of hereditary multisystem and multisite tumors - MR imaging acquisition protocol and evaluation in MHE, Enchondromatosis, and Maffucci syndrome - MR imaging acquisition and evaluation in familial paragangliomatosis - MR imaging acquisition and evaluation in Neurofibromatosis - MR imaging acquisition and evaluation in Li-Fraumeni syndrome - When to use DW imaging - When to use post-contrast imaging

#### MSEE-4 Getting Started with PCCT: Lessons Learned

Participants

Fides Schwartz, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Photon-counting computed tomography (PCCT) uses energy-resolving detectors whereas conventional CT detectors integrate the entire x-ray signal. Decision trees for protocol selection and scan mode are different from EID and must be defined at scanner setup. Technologists need to learn the use of a new interface. Automatic monoenergetic reconstructions with PCCT need to be optimized by imaging protocol including display window levels. Higher spatial resolution may increase image noise, but can be beneficial for many applications. Detector based spectral information collected, creates the need to set up what reconstructions automatically get sent to PACS. This project is geared toward helping new users in the RSNA imaging community in their decision-making processes when setting up a new clinical photon-counting CT. Patient case examples from the PCCTs installed at three major US institutions are shown to underline benefits of the new scanner system.

#### TABLE OF CONTENTS/OUTLINE

Overview of differences between PCCT and EID scanner systems. New Terminology. What do I need to set up. Setting up your exam cards: scan modes, reconstruction kernels. Reviewing the images: adjusting window level settings, sending thinner slices. Comparison of PCCT and EID images from three major US institutions. Abdominal imaging. Pediatric imaging.

#### MSEE-40 How Multiple Joint CT Scanning Would Benefit from Artificial Intelligence

##### TEACHING POINTS

Teaching Points: 1. Artificial intelligence (AI) diagnosis platforms are playing more and more important role in clinical imaging diagnosis. 2. Multi-part joint CT scanning can highly reduce the radiation dose and contrast injection volume, effectively reduce the scanning time to protect patients and improve diagnosis efficiency while remaining image quality. 3. Taking coronary and carotid-cerebral joint scanning as example, the diagnosis time and mouse click number using AI platform can be reduced to 80% - 90% and 20% - 60% comparing to manual diagnosis. There is more diagnosis time reduction for junior radiologists than senior radiologists. And the diagnosis accuracy is comparable between AI platform and senior manual diagnosis. 4. We assume AI platform can help make the whole-body CT diagnosis more efficient and reduce 70 - 90% diagnosis time with body auto-segmentation and auto-diagnosis. AI platform offers over-sensitive diagnosis results and radiologists only need to double check to screen out wrong results.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: The purpose of this educational exhibit is to: 1. Review the current development and application of AI diagnosis platforms. Review the clinical benefit and outcome of multi-part joint CT scanning. 2. Demonstrate the role of AI platform for coronary and carotid-cerebral atherosclerosis diagnosis using one-step heart-brain CT angiography. 3. Illustrate the potential application value of AI platform for whole-body CT scanning using auto-segmentation and auto-diagnosis.

#### MSEE-41 Imaging-based Response Criteria in Oncologic Clinical Trials: What Radiologists Need to Know

Participants

Guilherme M. Cunha, MD, (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1) Discuss the role of imaging for assessing treatment response as endpoint of oncologic clinical trials. 2) Summarize differences and similarities of treatment response assessment in clinical practice vs for clinical trials. 3) Review the most common imaging-

based treatment response criteria used in oncologic clinical trials. 4) Provide guidance on tumor response interpretation and reporting. 5) Discuss future directions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Relevance of clinical trials for advances in medicine and patient care. b. Oncologic clinical trials: Definitions and practical points. c. The role of imaging in oncologic clinical trials. 2. Assessment of response during oncologic treatment: a. Differences to clinical practice. b. Standardization. c. Blind and independent review. d. Need for objective metrics and endpoints. 3. Imaging-based treatment response criteria: a. Rationale for different criteria. b. Target vs non-target lesions. c. Pictorial review of the most used response criteria. 4. Imaging-based treatment response assessment: a. Image analysis and interpretation. b. Reporting. 5. Future directions: a. Criteria updates. b. Technical Innovations.

#### MSEE-42 Evaluation of Hidradenitis Suppurativa Through Imaging Methods

Participants

Carolina Almeida, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Hidradenitis suppurativa is a chronic inflammatory skin condition with lesions including deep-seated nodules and abscesses, draining tracts, and fibrotic scars. 2) The classification of the severity of hidradenitis suppurativa is done clinically using the Hurley scale. Correct severity classification allows for appropriate treatment. 3) Currently, high-frequency ultrasound has been used to map lesions and proposes a new classification: clinical-sonographic scoring system (SOS-HS). 4) Explain how lesions are classified using ultrasonography and the standardization of nomenclature. 5) Clarify doubts about magnetic resonance imaging protocols in the evaluation of hidradenitis suppurativa and when to use this method. 6) To present 3D reconstruction as a useful tool for the pre-surgical study of lesions. 7) Correlate clinical and ultrasound findings, magnetic resonance imaging and 3D reconstruction.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of hidradenitis suppurativa. 2) Hurley classification. 3) Criteria for diagnosing hidradenitis suppurativa by ultrasonography. 4) Hidradenitis suppurativa 3T MRI protocol. 5) Cases exemplifying the importance of imaging exams in the clinical and surgical management of the disease.

#### MSEE-43 Beyond the Neonatal Intensive Care Unit: Imaging of Long-term Sequel of Prematurity

#### TEACHING POINTS

Radiologists should be aware of the potential for late imaging manifestations in patients with a remote history of prematurity, and carefully evaluate imaging studies to identify these complications. Late common CNS manifestations include white matter injury and post-hemorrhagic hydrocephalus. Both frequently co-exist and may have distinctive features on imaging. Advanced chest imaging techniques, including CT and MRI, can enhance the accurate diagnosis and monitoring of late lung complications of prematurity such as bronchopulmonary dysplasia. Late complications of necrotizing enterocolitis, such as strictures and short bowel syndrome, can be accurately identified and monitored using appropriate abdominal imaging techniques, which should be tailored specifically to the patient.

#### TABLE OF CONTENTS/OUTLINE

Outline. I. Introduction Premature birth rates and associated health risks Role of imaging in the management of premature infants II. Late Imaging Features of Prematurity Brain abnormalities: periventricular leukomalacia, cerebral atrophy, post-hemorrhagic hydrocephalus, etc. Lung abnormalities: bronchopulmonary dysplasia. Gastrointestinal abnormalities: long term sequel of necrotizing enterocolitis Bone abnormalities: osteopenia, fractures, etc. Differentiating late imaging features from other conditions III. Clinical Case Studies and Outcomes VI. Conclusion Recap of key points Future directions for research and clinical practice.

#### MSEE-44 The Perirenal Space: Anatomy and Spectrum of Disease

Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Anatomy of the perirenal space with boundaries, key landmarks and pathways for the spread of disease. 2. Complete revision of pathology that can arise in the perirenal space. Radiologic clues to approach the final diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of the perirenal space: The Inverted Cone 1.1. Perirenal space anatomy with illustrations. 1.2. Key relations. 2. Pathology of the perirenal space 2.1. Masses/Pseudomasses: Pattern based diagnostic approach to perirenal masses and pseudomasses. Renal cell carcinoma. Lymphoma. Leukaemia. Sarcoma and liposarcoma. Myeloma. Lymphangioma. Angiomyolipoma. Extraadrenal myelolipoma. Pancreatic pseudocyst. GIST. 2.2. Collections/Fluid: Infectious: perirenal abscess, xantogranulomatous pyelonephritis, emphysematous pyelonephritis. Perirenal hematoma. Perirenal urinoma. 2.3. Inflammation/Systemic: Retroperitoneal fibrosis. IgG4-related-disease. Erdheim-Chester disease. Castleman disease. Rosai-Dorfman disease. 2.4. Others/Miscellaneous: Extramedullary hematopoiesis. Spilled lithiasis after nephrolithotripsy. Congested kidneys. 2.5. Summary. 3. Take home points

#### MSEE-45 No Worming Your Way Out of This One: Multimodality Imaging of Helminthic Infections

Participants

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize the radiologist with the variety of helminths which infect humans. Discuss the epidemiology, clinical presentation, and medical complications/sequelae of helminthic infections in humans. Describe the imaging features associated with common and uncommon sequelae of helminthic infections across imaging modalities (ultrasound, CT, MRI). Provide an overview of management and treatment of helminthic infections.

#### TABLE OF CONTENTS/OUTLINE



Classification of helminths, helminth lifecycles, and epidemiology. Potential complications of helminthic infection. Role of imaging and imaging features associated with helminthic infections, including: Neurologic (e.g., neurocysticercosis, ocular cysticercosis, ocular toxocariasis); Pulmonary (e.g., paragonimiasis); Cardiac (e.g., filariasis-associated tropical hyper-eosinophilia with Loeffler endocarditis and restrictive cardiomyopathy); Gastrointestinal (e.g., ascariasis, fascioliasis, cystic/alveolar/polycystic echinococcosis); Urogenital (e.g., genital schistosomiasis); Musculoskeletal: (e.g., onchocercomata, filarial elephantiasis, dirofilariasis). Management of helminthic infections and their sequelae.

#### **MSEE-46 Getting Under Your Skin: Multimodality Imaging of Protozoan Infections**

Participants

Jannatun Sikder, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Familiarize the radiologist with the variety of protozoa which infect humans. Discuss the epidemiology, clinical presentation, and medical complications/sequelae of protozoan infections in humans. Describe the imaging features associated with common and uncommon sequelae of protozoan infections across imaging modalities (ultrasound, CT, MRI). Provide an overview of management and treatment of protozoan infections.

##### **TABLE OF CONTENTS/OUTLINE**

Classification of protozoa. Epidemiology of protozoan infections. Role of imaging in diagnosing protozoan infections, including imaging features associated with protozoan infections and their complications: Neurologic (e.g., cerebral malaria, toxoplasmosis); Chest/Cardiac (e.g., pleuropulmonary amoebiasis, acute myopericarditis and chronic fibrosing cardiomyopathy from Chagas disease); Gastrointestinal (e.g., Chagasic megaesophagus and achalasia, amoebic dysentery and hepatic abscess, giardiasis, visceral leishmaniasis); Urogenital (e.g., trichomoniasis resulting in Fitz-Hugh-Curtis syndrome, ureteric dilatation from Chagas disease); Musculoskeletal: (e.g., Giardia synovitis, sarcocystis myositis). Management of protozoan infections and their sequelae.

#### **MSEE-47 The Beauty And The Botched: A Pictorial of Usual, Unusual, and Botched Cosmetic Procedures for the Unsuspecting Radiologist**

Participants

Alexander Sasse, BA, New Haven, CT (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- Familiarize the radiologist with the diversity of implant procedures performed, with particular focus on the sociocultural phenomenon that is cosmetic implant surgery (including historical context and evolution of the practice).
- Describe typical and atypical implant locations of implants, and their appearances on medical imaging studies.
- Describe potential complications of cosmetic implants and imaging findings associated with "botched" implant procedures.
- Discuss management of "botched" and otherwise complicated implants, where applicable.

##### **TABLE OF CONTENTS/OUTLINE**

Discuss history of cosmetic implant procedures and diversity of current practices/implant placements. Discuss complications and appearance of "botched" implants. Discuss the role of imaging and imaging features in visualizing both appropriately placed and "botched" or otherwise complicated implants: • Head and Neck (e.g., chin implant) • Breast (e.g., saline and silicone implants) • Urogenital (e.g., scrotal and penile implants) • Extremities (e.g., muscle-simulating implants) • Soft tissue: (e.g., buttock implants). Discuss the management of botched cosmetic implants and other associated complications.

#### **MSEE-48 Alcohol-use Related Diseases and Disorders: Head to Toe Imaging Findings**

##### **TEACHING POINTS**

Alcohol is a significant contributor to the global burden of diseases. Understand the metabolism of alcohol, and effects of alcohol and its metabolites on various organs. Review imaging findings of alcohol-use related diseases and disorders head to toe.

##### **TABLE OF CONTENTS/OUTLINE**

Metabolism of alcohol and factors affecting metabolism. Pathophysiology of alcohol induced damage to various organs. Imaging findings: Central nervous system: Wernicke-Korsakoff syndrome, hyperammonemic encephalopathy, subacute combined degeneration of the spinal cord, diffuse cerebral atrophy, osmotic demyelination syndrome, Marchiafava-Bignami disease Cardiovascular system: Alcoholic cardiomyopathy Lungs: Aspiration and bacterial pneumonia, acute respiratory distress syndrome Gastrointestinal tract: Fatty liver, acute alcoholic hepatitis, acute and chronic alcoholic steatohepatitis, alcoholic cirrhosis, hepatocellular carcinoma, acute and chronic pancreatitis, GI dysbiosis, Boerhaave syndrome, alcoholic gastritis Genitourinary tract: Renal stones, hypogonadism Musculoskeletal system: Alcohol induced muscle disease, avascular necrosis of the femoral heads, osteoporosis, gout Cancers of the head and neck, esophagus, breast, colon, and rectum Fetus: Fetal alcohol syndrome

#### **MSEE-49 Extrapulmonary Tuberculosis: Imaging Findings Beyond the Chest**

Participants

Irene Diaz, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Extrapulmonary tuberculosis affects the lymph nodes most frequently, but it can affect any other organ of the body. The presence of necrotic lymph nodes and other organ-specific imaging features increases the diagnostic probability of extrapulmonary disease.

##### **TABLE OF CONTENTS/OUTLINE**

Objectives To identify imaging features that are suggestive of extrapulmonary tuberculosis and its differential diagnosis. Findings Extrapulmonary tuberculosis can be challenging to diagnose as it can mimic many other diseases, so a biopsy is often required. An image-based quiz will lead the review of: Cases of central nervous system, head and neck, lymphatic, abdominal, genitourinary, and musculoskeletal tuberculosis; describing some key imaging features and including its main differential diagnosis. Conclusion Extrapulmonary tuberculosis remains a challenge to diagnose. It is essential to know its key imaging features for an early and

successful diagnosis.

## **MSEE-5 Demystifying Mucin in the Abdomen and Pelvis: Tissue Characterization and Spectrum of Disease**

### **TEACHING POINTS**

1. Mucinous neoplasms are a diverse group of benign and malignant tumors arising from mucin-producing epithelial cells. 2. Mucinous neoplasms arise from a wide range of organs including the appendix, ovary, pancreas, colon, and rectum. 3. Mucin has a characteristic imaging appearance at each modality and differs from other types of tumors that have higher cellular density. 4. Pseudomyxoma peritonei is characterized by the spread of mucinous material throughout the peritoneal cavity and has specific imaging findings. 5. Diagnosis and treatment of mucinous tumors requires a multidisciplinary approach that includes imaging, surgery, and systemic therapies, including hyperthermic intraperitoneal chemotherapy in the case of pseudomyxoma peritonei.

### **TABLE OF CONTENTS/OUTLINE**

I. Introductiona. Overview of mucinous neoplasmsII. Imaging features of mucinous neoplasms with case examplesa. Mucinous cystic neoplasms of the pancreasb. Appendiceal mucinous neoplasmsc. Colon and rectal mucinous adenocarcinomad. Ovarian mucinous cystadenoma and cystadenocarcinomae. Miscellaneous (seminal vesicle, primary peritoneal)III. Pseudomyxoma peritoneia. Imaging featuresb. Treatment, including hyperthermic intraperitoneal chemotherapyIV. Conclusiona. Summary of key teaching points

## **MSEE-50 Technical Aspects in Imaging Patients Under Extracorporeal Membrane Oxygenation (ECMO) Support**

Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Review recommendations to perform optimal CT examinations in patients under extracorporeal membrane oxygenation (ECMO) support according to clinical suspicion and within possible clinical scenarios.- Illustrate examples of optimal and suboptimal examinations in this populations.- Describe the key technical aspects to obtain adequate images and avoid errors.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction and physiology during ECMO support 2. Optimizing the technique: protocol recommendations regarding access, contrast dose and rate injection 2.1. General considerations 2.2. Venovenous ECMO 2.3. Venoarterial ECMO 2.3.1. Central nervous system evaluation 2.3.2. Pulmonary embolism 2.3.3. Aorta evaluation 2.3.4. Abdomen and pelvis 3. Summary and conclusions

## **MSEE-51 I CT Dead People: Exploring the Application of Postmortem Imaging to Cause of Death Investigation in a Hospital Setting**

Participants

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• Familiarize the radiologist with the growing field of forensic radiology, primarily as it pertains to postmortem imaging and cause-of-death investigation. • Provide an introduction to postmortem computed tomography (CT), including its benefits and limitations. • Describe the application of and experiences with postmortem CT at an academic teaching hospital.

### **TABLE OF CONTENTS/OUTLINE**

• Introduction to forensic radiology with focus on role in cause-of-death investigation. • Benefits of postmortem CT as a supplement to autopsy. • Common postmortem changes on imaging and how to mitigate them, where applicable. • Application of and experience with postmortem CT at an academic teaching hospital, including: integration with the Autopsy Service; types of cases performed; imaging methods utilized; and correlation with autopsy. • Case image integration throughout, as illustrative examples.

## **MSEE-52 Microvascular Imaging Ultrasound (MVI) in Children: Current Use and Potential Applications**

Participants

Santiago Martinez-Correa, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To overview the current knowledge of MVI in children. 2. To illustrate MVI benefits in specific pediatric conditions. 3. To describe possible clinical applications of MVI in the future.

### **TABLE OF CONTENTS/OUTLINE**

- Disclosures. - Background Current use and advantages of advanced ultrasound techniques. - Microvascular Imaging Ultrasound 1. Technique description Advanced ultrasound technology that allows high-resolution visualization of slow-flow microvasculature by using clutter suppression algorithms. 2. Protocol Acoustic windows and settings adjustment. 3. Advantages and pitfalls: non-invasive tool, can be used at the bedside. Depends on the scan settings and operator. - Clinical use: 1. Brain Evaluation of vascularity in hypoxic-ischemic injury, hydrocephalus, and infections. 2. Thyroid Approach to vasculature architecture, and focal lesions. 3. Liver Characterization of focal lesions. 4. Spleen Use in assessing trauma, infarcts, focal lesions, and infections. 5. Kidney Evaluation of solid and cystic lesions. 6. Reproductive (Ovaries/Testes): Use in gonadal torsion, and infections. 7. Bowel Assessing small bowel infection and/or inflammation. 8. Lymph nodes Blood flow evaluation in benign and malignant nodes. 9. Skin Evaluation of infected subcutaneous nodules. - Potential future use: 1. MVI as an ancillary method in assessing pediatric brain death. 2. Liver and renal post-transplant perfusion follow-up. 3. Diagnostic and prognostic tool during ECMO therapy. - Take Home Points.

## **MSEE-53 Immunotherapy-Related Adverse Events - A Review of the Breadth of Toxicities and Imaging Findings**

### **TEACHING POINTS**

- Blocking of immune checkpoints by immune checkpoint inhibitors (ICIs) can cause novel autoimmune disease or uncover subclinical

- Blocking of immune checkpoints by immune checkpoint inhibitors (ICIs) can cause novel autoimmune disease or uncover subclinical autoimmune disease.- These toxicities are termed immune-related adverse events (irAEs) and can involve any organ.- irAEs can be mistaken for disease progression or non-autoimmune processes.- Incidence of irAEs is 25% with anti-CTLA-4 inhibitors, 10% with anti-PD(L)-1 inhibitors, and 50% for combination therapy.- The lungs and colon are the most common organs affected radiologically, although cutaneous manifestations are the most common overall.- irAEs are graded from 1 (asymptomatic) to 5 (death) and management options include continuing immunotherapy, holding immunotherapy and initiating corticosteroids, and discontinuing immunotherapy permanently.

#### TABLE OF CONTENTS/OUTLINE

- Pneumonitis: o Organizing pneumonia o Nonspecific interstitial pneumonia o Hypersensitivity pneumonitis o Bronchiolitis Acute interstitial pneumonitis/ARDS o Radiation-recall pneumonitis- Sarcoid-like reaction- Enterocolitis- Pancreatitis- Hepatitis- Nephritis- Hypophysitis- Adrenalitis- Thyroiditis- Aortitis- Pericarditis- Serositis: o Pericardial effusion o Pleural effusion o Peritoneal effusion- Sinusoidal obstruction syndrome- Arthritis- Myositis- Polymyalgia rheumatica-like syndrome

#### MSEE-54 Phenotypic Diversity of Germinal Center-Derived Malignancies: Implications on Diagnosis and Management

Participants

Steven Chua, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The germinal center (GC) is a unique and dynamic microenvironment within lymphoid follicles where selection, maturation and antibody production by activated B lymphocytes occur in response to infections. A multitude of unique malignancies arise within the GC that display characteristic histogenesis, genetic abnormalities, tumor pathways, molecular biology and varied clinical behavior. PET/CT is the mainstay for the diagnosis and staging of these tumors and is critical for the assessment of treatment response. Neoplastic B cells within different GC compartments and maturation stages give rise to follicular lymphoma, Burkitt's lymphoma and diffuse large B cell lymphoma that harbor distinctive genetic mutations. While the follicular T cell lymphoma and angioimmunoblastic T cell lymphoma originate from helper T cells, the follicular dendritic cell sarcomas evolve from the follicular dendritic cells of mesenchymal origin. We present salient imaging features of GC-derived malignancies and correlate with histopathology and tumor genetics. We discuss the implications of the diagnosis on tailored therapeutics and prognosis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction, epidemiology, clinical features this group of germinal center-derived tumors. 2. Histopathology, clinical features, molecular biology of these tumors. 3. Multimodality cross-section delineation of imaging features with CT, MR and PET/CT. 4. Prognosis and management. \* Follicular lymphoma.\* Burkitt's lymphoma.\* Diffuse large B cell lymphoma.\* Angioimmunoblastic T-cell lymphoma.\* Follicular T cell lymphoma.\* Peripheral T cell lymphoma with Tfh phenotype.\* Follicular dendritic cell sarcomas.

#### MSEE-55 Diversity of Epstein-Barr Virus-associated Diseases

Participants

Moto Nakaya, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

•Summarize the clinical and radiological findings of Epstein-Barr virus (EBV)-associated diseases caused by various etiologies. •Describe radiological findings in EBV-associated neoplasms in contrast to those observed in uninfected conventional tumors. •Recognize important imaging points that lead to a definitive diagnosis in patients with suspected EBV-associated diseases.

#### TABLE OF CONTENTS/OUTLINE

I. What are EBV-associated diseases? •Pathomechanisms •The role of EBV in tumorigenesis and progression •Recommended workups  
II. Content Infection: infectious mononucleosis, human immunodeficiency virus co-infection Autoimmune: multiple sclerosis, systemic lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease, type 1 diabetes mellitus, juvenile idiopathic arthritis, celiac disease Neoplasm: lymphomas (primary central nervous system lymphoma, natural killer/T-cell lymphoma, diffuse large B-cell lymphoma, lymphomatoid granulomatosis, and post-transplantation lymphoproliferative disorder), solid tumor (gastric cancer, squamous cell carcinoma, EBV-associated smooth muscle tumor, leiomyosarcoma, breast cancer, hepatocellular carcinoma, and follicular dendritic cell sarcoma), others (EBV-associated inflammatory pseudotumor - like follicular/fibroblastic dendritic cell sarcoma) Medication-related EBV infection: methotrexate-related malignant lymphoma Miscellaneous: EBV-positive mucocutaneous ulcer  
III. Summary 1. The entities associated with EBV are diverse. 2. Clinical and radiological findings can be the diagnostic indicators of the etiology. 3. Appropriate workup is necessary for timely diagnosis and management.

#### MSEE-56 Beyond the Skeletal Survey: Multimodality Imaging Manifestations of Plasma Cell Dyscrasias

Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the wide spectrum of plasma cell dyscrasias, including common and rare subtypes, and their pathophysiology. 2. To present the multimodality imaging features seen in the spectrum of plasma cell dyscrasias to aid in accurate diagnosis and staging, as well as subsequent evaluation of post-therapeutic response.

#### TABLE OF CONTENTS/OUTLINE

Plasma cell dyscrasias are a group of hematological disorders that arise from the abnormal proliferation of plasma cells, which are responsible for producing antibodies. These disorders include monoclonal gammopathy of undetermined significance (MGUS), Waldenström macroglobulinemia, multiple myeloma (MM) and its variants, including smoldering myeloma (SMM), plasma cell leukemia (PCL), solitary and extramedullary plasmacytoma, and amyloidosis. Recent advances in treatment with chemotherapy and immunotherapies have led to improved outcomes, with some patients achieving long-term remission. Early detection and diagnosis allow for appropriate initiation of surveillance and treatment, which will improve outcomes as well as preserve organ function. The imaging manifestations of plasma cell dyscrasias can provide crucial information for diagnosis, prognosis, and management of these diseases. This educational exhibit will (1) review the pathophysiology of plasma cell dyscrasias and the wide spectrum of subtypes, and (2) present the multimodality imaging features of the common and rare subtypes of plasma cell dyscrasias.

## **MSEE-57 Practical Imaging Approach to Unraveling the Causes of Non-neoplastic Lymphadenopathy**

Participants

Sota Masuoka, MD, Kashiwa, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Non-neoplastic lymphadenopathy may not have specific histopathologic features within the lymph node itself, but determining its underlying cause is still important. Radiologists play a critical role in identifying the cause of lymphadenopathy in three scenarios: (1) when infection or inflammation is clinically suspected, (2) during initial or follow-up imaging for malignancy, and (3) when abnormal lymph nodes are detected incidentally on imaging. Careful observation of the imaging characteristics and anatomical distribution of the abnormal lymph nodes, along with other ancillary imaging findings and clinical information, can help establish an accurate diagnosis of the etiology of the lymphadenopathy, leading to appropriate treatment and avoiding unnecessary further testing for the patient. This exhibit aims to: 1. Review the diverse underlying conditions that cause non-neoplastic lymphadenopathy and their characteristic imaging findings. 2. Discuss an imaging-based approach for diagnosing the underlying causes of non-neoplastic lymphadenopathy.

### **TABLE OF CONTENTS/OUTLINE**

1. Overview of non-neoplastic lymphadenopathy 2. Imaging approach for non-neoplastic lymphadenopathy: Focus on inferring the underlying cause- Based on the distribution of abnormal lymph nodes- Based on the imaging characteristics of abnormal lymph nodes 3. Case illustrations- (1) Clinically suspected inflammation or infection- (2) Initial/follow-up imaging for malignancies- (3) Incidental detection of abnormal lymph nodes on imaging 4. Summary

## **MSEE-58 Stroma-Derived Neoplasms and Tumor-Like Lesions of the Lymphoid Tissues: 2022 WHO Classification System Updates**

Participants

Steven Chua, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

A new category of mesenchymal neoplasms and tumor-like lesions that involve the lymphatic and reticuloendothelial system has been introduced in the 2022 WHO classification of hematolymphoid tumors. This diverse group of tumors includes mesenchymal dendritic cell tumors like follicular dendritic cell sarcoma (FDCS) and its inflammatory pseudotumor-like variant (EBV positive inflammatory FDCS), Epstein-Barr virus associated smooth muscle tumor, vascular/vascular-stromal tumors and tumor-like lesions including littoral cell angioma (LCA), hemangioma, bacillary angiomatosis, hemangioendothelioma, angiosarcoma and sclerosing angiomatoid nodular transformation (SANT). These tumors vary in biological potential and prognosis from the indolent littoral cell angioma to the aggressive angiosarcoma. Correlating the salient imaging and histopathological features can facilitate proper identification and optimize treatment to improve morbidity and mortality of patients.

### **TABLE OF CONTENTS/OUTLINE**

1. To review the diverse histopathological spectrum of stroma-derived tumors of the lymphoid tissues. 2. To describe epidemiology, tumor genetics, molecular biology and cross-sectional imaging findings of diverse tumors and to correlate them to histopathological features. 3. To discuss the implications of the diagnosis on management and prognostication of these tumors. \* Follicular dendritic cell sarcoma. \* EBV positive inflammatory follicular dendritic cell sarcoma. \* Inflammatory pseudotumor. \* Epstein-Barr associated smooth muscle tumor. \* Littoral Cell Angioma. \* Bacillary angiomatosis. \* Hemangioendothelioma. \* Angiosarcoma. \* Sclerosing angiomatoid nodular transformation.

## **MSEE-59 Imaging Diagnostic Odyssey of Germ Cell Tumors: Illuminating the Path with Insights into Epigenetic Pathogenesis**

Participants

Toshitaka Ishiguro, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Germ cell tumors (GCTs) are neoplasms derived from cells committed to the germ cell lineage, but exhibit diverse histologies, including embryonic and extraembryonic components. GCTs also arise at various sites throughout the body, from neonates to adults, making their imaging diagnosis challenging. However, recent progress in understanding the biology of GCTs has allowed them to be categorized into several types based on the latent developmental potential of their cells of origin with different epigenomic features, facilitating our understanding of their anatomical distribution, age of onset, male-to-female ratio, and possible histologies. This exhibit aims to explain this recent classification of GCT types and apply insights into epigenetic pathogenesis to the imaging diagnosis of GCTs, which will contribute to accurate diagnosis leading to better patient outcomes. The purposes of this exhibit are: 1. To explain the recent classification of GCT types based on epigenetic pathogenesis. 2. To review the imaging findings of each histology of GCTs. 3. To discuss the imaging diagnostic approach for GCTs combined with the knowledge of epigenetic pathogenesis.

### **TABLE OF CONTENTS/OUTLINE**

1. Minimal essentials of epigenetics for radiologists 2. Classification of GCT types based on epigenetic pathogenesis 3. Imaging findings of each histology of GCTs 4. Imaging diagnostic approach for each type of GCTs combined with the knowledge of epigenetic pathogenesis 5. Summary

## **MSEE-6 Multimodality Imaging of Large and Medium Vessel Vasculitis**

Participants

Mitesh Naik, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To outline classification, clinical presentation, pathogenesis and management of large and medium vessel vasculitis
- To define the role of non-invasive imaging in diagnosis and response to therapy
- To describe the range of modalities used and their relative merits
- To review multimodality appearances of large and medium vessel vasculitis

## TABLE OF CONTENTS/OUTLINE

Background • Epidemiology, clinical presentation, pathogenesis and management • Classification of Large vessel vasculitis: Takayasu arteritis, giant cell arteritis of Medium vessel vasculitis: Polyarteritis nodosa, Kawasaki disease of Variable vessel vasculitis: Behçet syndrome of Secondary vasculitis Review of international guidance on utilization and interpretation of imaging • Diagnosis • Response assessment • Surveillance • Imaging parameters • Imaging criteria - e.g. PET vascular activity score (PETVAS) Multimodality appearances including pros and cons • Ultrasound • CT angiography • MR angiography and MR vessel wall imaging • 18F-fluorodeoxyglucose-PET/CT • Adjunctive modalities - e.g. renography Case examples with interpretive pearls and pitfalls; differential diagnoses; and complex scenarios

### MSEE-60 Multimodality Imaging Features of Hepatoid Adenocarcinoma and its Mimics

Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the pathophysiology of hepatoid adenocarcinoma and the common sites involved, including the liver, stomach, pancreas, lung, and ovary. 2. To present, through case-based review, the multimodality imaging features of hepatoid adenocarcinoma, with differential clues to aid in diagnosis.

## TABLE OF CONTENTS/OUTLINE

Hepatoid adenocarcinoma (HAC) is a rare and aggressive type of cancer that has a histologic appearance similar to hepatocellular carcinoma (HCC) through metaplastic transformation to hepatocyte-like cells. HAC can involve various organs, including the liver, stomach, pancreas, lung, and ovary. Imaging features of HAC may overlap with other extrahepatic tumors, including gastric adenocarcinoma, pancreatic adenocarcinoma, primary lung adenocarcinoma, ovarian adenocarcinoma, or lymphoma, making accurate diagnosis challenging. HAC can produce alpha-fetoprotein (AFP) like HCC, which may be useful in differentiating HAC from tumors in extrahepatic organs. However, given its rarity, unfamiliarity, non-specific clinical presentation, and overlapping imaging features, differentiation of HAC remains difficult and is often diagnosed at an advanced stage or with metastases. At this stage, prognosis of HAC is poor with a median survival of less than one year. Early detection and aggressive treatment, including surgical resection and systemic chemotherapy, are crucial for improving the prognosis of patients with HAC. This educational exhibit will (1) review the pathophysiology of HAC and the common sites of involvement, and (2) present the multimodality imaging features of HAC and differentiation from its imaging mimics.

### MSEE-61 Multi-system Imaging Manifestations of Large Vessel Vasculitis

Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Large-vessel vasculitis (LVV) results in inflammation of the aorta and its major branches and is the most common primary vasculitis in adults. LVV comprises two distinct conditions, giant cell arteritis (GCA), and Takayasu arteritis. LVV can have substantial complications including luminal stenosis, arterial thrombosis and infarction of the corresponding organs and structures. Development of pseudoaneurysms and dissections, and rarely arterial ruptures are potentially serious complications in this patient population. 2. Doppler US is a first-line imaging modality utilized for the assessment of the peripheral arterial system, abdominal aorta, and its branches. Review of normal arterial wall anatomy and pathophysiology of waveforms on Doppler ultrasound, with multi-imaging correlation with particular focus on CTA and MRA.

## TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of Takayasu and giant cell arteritis and their multi-system potential complications. 2. Discuss general concepts of the assessment of the peripheral arterial system and aorta using Doppler US, CTA, and MRA with emphasis on technique, protocol, image optimization. 3. Demonstrate key multi-modality imaging features LVV. Review role of various imaging applications in diagnosis and surveillance of complications in this group of patients. 4. Discuss management options with interventional radiology procedures.

### MSEE-62 COVID-associated Mucormycosis - Imaging Spectrum

Participants

Nidhi Goyal, MD, FRCR, Noida, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the spectrum of imaging findings in patients with COVID-associated Mucormycosis. 2. To correlate imaging findings and the clinical-laboratory parameters in patients with COVID-associated Mucormycosis.

## TABLE OF CONTENTS/OUTLINE

1. Overview of Clinical profile of patients with COVID-associated Mucormycosis. 2. The spectrum of imaging findings in patients with COVID-associated Mucormycosis across different organ systems. 3. Correlation of imaging findings and clinical - laboratory parameters in patients with COVID-associated Mucormycosis. 4. Enlist the key imaging findings which helps in early diagnosis and allows prompt treatment in these patients.

### MSEE-63 Role of Imaging in Endocrine Hypertension

Participants

Azfar Siddiqui, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Assess the epidemiology, classification, and etiopathogenesis of the endocrine hypertension. 2. Review the role of imaging in localizing the pathology.

## TABLE OF CONTENTS/OUTLINE

1. Epidemiology and etiopathogenesis of the endocrine hypertension.2. Incidence and risk factors.3. Classification and imaging findings:A. Primary Aldosteronism (Conn's syndrome): Adrenal adenoma, carcinoma, hyperplasiaB. PheochromocytomaC. Congenital adrenal hyperplasiaD. Cushing syndromeE. Adrenal disordersii. ACTH secreting tumor: Pituitary adenoma (Cushing disease), Ectopic production-Small cell cancers of the lung thymus, carcinoid, Pancreatic NET, Ovarian steroid cell tumorsE. HyperthyroidismF. HyperparathyroidismG. Acromegaly

#### **MSEE-64 Spectrum of Imaging Appearances of Perivascular Epithelioid Cell Tumors (PEComas)**

Participants

Lam Tu, DO, Newark, NJ (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. PEComas are very rare mesenchymal tumors of variable malignant potential characterized by smooth muscle and melanocytic differentiation, perivascular distribution and frequent infiltration of small to medium sized vessels.2. Up to 60% of PEComas are associated with Tuberous Sclerosis Complex (TSC) and TSC and TFE3 gene mutations. Angiomyolipomas and lymphangiomyomatosis are the most common PEComa subtypes seen with TSC.3. PEComa - NOS most commonly arise in the retroperitoneum, uterus and kidneys.4. Hypervascularity and vessel encasement are common imaging features of PEComas. Vascular invasion, size greater than 5 cm, necrosis and tumor thrombus suggest malignant subtypes.5. Definitive treatment is surgical resection; massive blood loss may result if extent of vascular invasion is not recognized. TSC-related PEComas may be treated with mTOR inhibitors. The only FDA approved treatment for advanced/metastatic/inoperable PEComa is FYARRO™ (Sirolimus protein-bound particles for injectable suspension).

##### **TABLE OF CONTENTS/OUTLINE**

Introduction - PEComa definition and etiologyBackground: epidemiology, genetics and classificationSpectrum of Imaging Features of:- Various PEComa subtypes;- PEComas in most common locations - Common PEComa mimickers: leiomyosarcoma, GIST, RCC - Invasive/malignant PEComas (size, necrosis, tumor thrombus)- Common metastatic sites: lung, liver and peritoneumTreatment options

#### **MSEE-65 The 'New' 2022 World Health Organization (WHO) Classification of Lymphoid Neoplasms: A Primer for Radiologists**

Participants

Diego Cebrian Chaustre, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- Familiarize radiologists with new 2022 WHO classification of lymphoid neoplasms review major changes
- Discuss pathology, genetics, and imaging findings of tumor-like lesions select updated lymphomas pertinent to radiologists
- Familiarize the audience with clinically significant, and most important aspects of lymphoma imaging, including the role of CT PET-CT for staging response assessment.
- Review potential therapeutic management implications of the new classification system with special emphasis on novel therapies.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction 2022 WHO Classification Tumor-like lesions, new tumors changes in existing tumors B-cell lymphoid proliferations lymphomas IgG4-related disease, Castleman's disease, small lymphocytic, splenic B-cell, marginal zone, follicular, mantle cell, diffuse large B-cell, Burkitt, Immunosuppressed-associated lymphomas Hodgkin lymphoma. T-cell lymphoid proliferations lymphomas Kikuchi disease, primary cutaneous T-cell, intestinal T-cell, anaplastic large cell EBV-positive lymphomas Stromal-derived dendritic cell sarcoma, littoral cell angioma, splenic hamartoma SANT Imaging findings Role of Imaging in Staging Response Assessment-CT PET-CT: Lugano classification Deauville scoring system Management Novel therapies ConclusionThe current WHO classification of lymphoid neoplasms added new tumors reorganized previous categories based on updated molecular/genetic findings that change management decisions. Select lymphomas demonstrate characteristic genetic/pathology imaging findings. Imaging with CT PET/CT plays a pivotal role in staging, response assessment testing the efficacy of novel drugs.

#### **MSEE-66 A Pictorial Review of Extrapulmonary Tuberculosis: From Head to Toe**

Participants

Masatoshi Hotta, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Extrapulmonary tuberculosis (EPTB) is a form of tuberculosis that affects parts of the body other than the lungs and accounts for 10-20% of all TB infections. A diagnosis of EPTB is challenging and can mimic malignancy, often requiring a biopsy. Therefore, radiologists should be familiar with the imaging features of EPTB, even when there is no active pulmonary involvement. This exhibit aims to: 1) review the pathophysiology of EPTB, 2) present characteristic EPTB images of various organ systems, and 3) identify the key imaging findings of EPTB.

##### **TABLE OF CONTENTS/OUTLINE**

1) Introduction; 2) Central Nervous System (tuberculous leptomeningitis, brain TB, spinal TB); 3) Head and Neck (tuberculous uveitis, pharyngeal TB, tuberculous otitis media); 4) Chest (esophageal TB, endobronchial TB, pericostal TB); 5) Abdomen (hepatic TB, splenic TB, adrenal TB, intestinal TB, peritoneal TB); 6) Genitourinary (renal TB, seminal vesicle TB, epididymis/testicular TB); 7) Musculoskeletal (tuberculous spondylitis, tuberculous arthritis, tuberculous osteomyelitis)

#### **MSEE-67 Multisystem Imaging Manifestations of Fibromuscular Dysplasia**

Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Fibromuscular dysplasia (FMD) is an idiopathic segmentary, non-inflammatory, non-atherosclerotic disease that can affect all layers of both small and medium-caliber arteries. Clinical manifestations are primarily dependent on the vessels affected by FMD,

most frequently affecting the renal, carotid, and vertebral arteries.<sup>2</sup> Complications of FMD can include severe stenosis, hypoperfusion, aneurysm, dissection, arterial occlusion, and subarachnoid hemorrhage in the brain.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review pathophysiology of FMD and its multi-system potential complications, and associated disorders.<sup>2</sup> Discuss general concepts of the assessment of the peripheral arterial system and aorta using Doppler US, CTA, and with MRA, with emphasis on technique, protocol, and image optimization.<sup>3</sup> Demonstrate key multi-modality imaging features FMD. Review role of various imaging applications in diagnosis and surveillance of FMD and its potential complications.<sup>4</sup> Discuss management options with review of available interventional radiology procedures.<sup>5</sup> Discuss the shared features and difference between FMD and polyarteritis nodosa, Takayasu, and other mimics.

#### **MSEE-68 Imaging Manifestations and Treatment of Renovascular Hypertension**

Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Renovascular hypertension is a type of secondary hypertension where high blood pressure develops secondary to renal artery disease.<sup>2</sup> Doppler US is a first line imaging modality utilized for the assessment of the renal arterial system. CTA and MRA are useful confirmatory tests in equivocal or nondiagnostic ultrasonographic exams and can be preferred in specific clinical situations.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review pathophysiology of renovascular hypertension and its multisystem complications. Causes include atherosclerotic renal artery stenosis, fibromuscular dysplasia, renal artery dissection, renal infarction, Page kidney, polyarteritis nodosa, post EVAR RAS, etc.<sup>2</sup> Discuss general concepts of the assessment of the renal arterial system and abdominal aorta using Doppler US: technique protocol, image optimization, and common pitfalls in diagnosis.<sup>3</sup> Demonstrate key multimodality imaging features of renovascular hypertension. Review role of various imaging modalities in diagnosis and surveillance of complications in this group of patients.<sup>4</sup> Discuss management options with emphasis on interventional radiology procedures.

#### **MSEE-69 US of the Neck Beyond the Thyroid: Parathyroids**

Participants

Irene Dixe de Oliveira Santo, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Discuss the role of ultrasound in the evaluation of parathyroid gland pathologies;<sup>2</sup> Discuss the advantages of ultrasound including the possibility of evaluation for concurrent nodular thyroid disease which may alter the surgical approach and treatment planning;<sup>3</sup> Review the role and advantages of complementary imaging modalities in the diagnosis and management of parathyroid gland pathologies including SPECT with technetium-99m sestamibi, 4D computed tomography, and venous sampling

#### **TABLE OF CONTENTS/OUTLINE**

1. Embryology, anatomy, and function of the parathyroid glands;<sup>2</sup> Clinical manifestations of hyper- and hypoparathyroidism;<sup>3</sup> Role of ultrasound in the assessment of the parathyroid glands: advantages, limitations, technical considerations;<sup>4</sup> Ultrasound imaging of parathyroid pathologies: parathyroid adenoma(s) involving one or multiple parathyroid glands, parathyroid carcinoma, multiple endocrine neoplasia, Cowden's disease, parathyromatosis, ectopic or intrathyroidal parathyroid glands;<sup>5</sup> Distinguish parathyroid gland pathologies from its mimics such as exophytic thyroid nodules, normal and abnormal lymph nodes, the esophagus, and the longus colli muscle;<sup>6</sup> Role of additional imaging modalities: SPECT with Tc-99m sestamibi, 4D computed tomography, and venous sampling;<sup>7</sup> Treatment options and clinical challenges

#### **MSEE-7 Review of MRI Defecography: Technique, Indication, Diagnosis and Limitations**

Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Pelvic floor disorders are commonly encountered in clinical practice and can significantly affect patient quality of life. MR defecography is a non-invasive exam that provides high spatial resolution, multiplanar capability, and superior soft tissue differentiation for assessing the pelvic floor compartments at rest and during defecation maneuvers. Abdominal radiologists should be able to recognize normal and abnormal anatomy, as well as the most common pelvic floor pathologies.

#### **TABLE OF CONTENTS/OUTLINE**

MRI defecography is a non-invasive diagnostic technique used to evaluate the function of the pelvic floor compartments during rest, squeezing, valsalva and defecation, in patients with obstructed defecation, constipation, pelvic pain, incontinence and pelvic organ prolapse and others, providing a more accurate diagnosis of pelvic floor disorders that can guide treatment and surgical planning. Usual findings include cystocele, uterine prolapse, enteroceles, perineal descent, and rectal intussusception, and the association between these alterations. While MRI defecography is a valuable diagnostic tool for assessing pelvic floor disorders, it does have some limitations, such as cost, availability, interpretation variability, and patient discomfort. Abdominal radiologists should be able to recognize normal and abnormal anatomy, and evaluate the common pathologies that can affect the three pelvic floor compartments, especially those that may appear only through dynamic images of the pelvis.

#### **MSEE-70 Bigger Butt Not Better: A Radiologist's Guide to the Lifecycle of Cosmetic Injectables**

Participants

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Familiarize the radiologist with the composition and use of cosmetic injectables, with a focus on illegal and unregulated substances and practices.
- Describe the appearances of injectables on imaging throughout the body, as well as potential

complications and their associated imaging findings. • Provide guidance to radiologists for how to report findings related to injectables and their complications to best guide surgical management. • Describe how patients with injectables are surgically managed, including post-operative imaging findings and imaging of post-operative complications.

#### TABLE OF CONTENTS/OUTLINE

• Introduction to cosmetic injectables, their composition (legal and illegal substances), and common and uncommon injection locations. • Imaging appearance of injectables throughout the body and associated complications. • Important features to report on (i.e., foreign material migration, intramuscular location). • Approach to surgical management. • Imaging of post-operative findings and common post-operative complications.

#### MSEE-71 Opportunistic Imaging in Musculoskeletal Radiology: The Data Scavengers

Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Each radiologic examination contains robust additional data that can be leveraged for opportunistic screening of disease and risk assessment of future adverse clinical events. 2. With the radiology transition from volume-based to value-based practice the interest in opportunistic imaging is growing. 3. AI models enabling fully automated evaluation of biometric measures provide the opportunity of individualized patient risk assessment and pre-symptomatic diseases detection. 4. Opportunistic imaging in musculoskeletal radiology can be used in: ü Detecting clinically important musculoskeletal findings (e.g., screening for osteoporosis). ü Systematically discovering non-musculoskeletal findings in musculoskeletal studies (e.g., screening for abdominal aorta aneurysm in lumbosacral MRI).

#### TABLE OF CONTENTS/OUTLINE

• Assess opportunistic imaging for detection of sarcopenia in cancer patients and its clinical relevance • Review opportunistic screening for osteoporosis in abdominopelvic or thoracic CT examinations • Review opportunistic screening for abdominal aorta aneurysm in lumbosacral MRI examinations • Discuss the role of radiomic features extracted from imaging specially in oncology imaging as an opportunity to improve diagnosis and prognostication • Explain the capacity of AI models to fully automate assessment of biometric measures for the use in musculoskeletal imaging

#### MSEE-72 Dual-Energy CT: Still Haven't Found What You Are Looking For

Participants

Roberto Garcia Figueiras, PhD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Dual-energy CT (DECT) imaging has broadened the potential of CT imaging by offering multiple postprocessing datasets which are achieved using discrete acquisitions at more than one energy level. DECT shows profound capabilities to improve diagnosis based on its superior material differentiation, but alsoThe aim of this exhibit is:-To review physical concepts of DECT, parameters influencing image quality, postprocessing methods, and daily routine workflow.-To describe the strengths and weaknesses of different DECT platforms.-To discuss advantages and limitations of DECT in different clinical scenarios.-To provide a comprehensive and practical overview of diagnostic pitfalls and possible artifacts that may be encountered at DECT.-To evaluate future perspectives for DECT imaging and photon-counting technology.

#### TABLE OF CONTENTS/OUTLINE

-Basic concepts of DECT: atomic numbers, energy levels, and other physics concepts.-Strengths and weaknesses of different DECT platforms: "one does not fit all".-Understanding the puzzle of the different types of DECT images.-What you can and cannot expect from a DECT scan: opportunities and limitations (that you need to know) of DECT in daily practice.-Pitfalls and artifacts: how to avoid them?-Cutting-edge applications of DECT: iodine concentration and tumor response, advanced material characterization, electron-density maps in radiotherapy, etc.-Future directions: from dual-energy to photon-counting CT.-Conclusions

#### MSEE-73 Multimodality Imaging of Sarcoidosis and Sarcoid-like Reaction

Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• Review the clinical findings, prognosis, management and imaging guidelines for sarcoidosis and associated complications. • Describe the imaging appearance of sarcoidosis across multiple organ systems and modalities. • Discuss the differential diagnoses for imaging findings of for sarcoidosis. • Discuss radiology-pathology correlation as it applies to sarcoidosis.

#### TABLE OF CONTENTS/OUTLINE

Sarcoidosis is a systemic disease but presents most commonly in the lungs. While up to 90% of patients will have an abnormal chest radiograph, less than 20% of patients will exhibit respiratory symptoms. Extrapulmonary manifestations are seen in up to 40% of patients with involvement of central nervous system, circulatory system, abdomen, musculoskeletal system, or skin. In this educational exhibit we describe the imaging appearance and differential diagnosis of the following pulmonary and extrapulmonary manifestations of sarcoidosis: • Pulmonary o Natural history stages of pulmonary sarcoidosis, imaging timeline o Chest radiograph findings and signs o Chest CT findings and signs o FDG and Gallium PET • Cardiac • Intra-abdominal o Hepatic o Splenic o Renal o Peritoneal • Neurosarcoidosis o Leptomeningeal Dural o Pituitary Endocrine o Cranial nerves o Spine: leptomeningeal, myelopathy • Musculoskeletal Cutaneous Sarcoidosis o Bone lesions o Arthropathy o Myopathy o Lofgren syndrome • Pitfalls o Immunotherapy-induced sarcoid-like reaction Finally, we discuss the relevant radiology-pathology relationships in the systemic manifestations of sarcoidosis with a rich complement of histologic images.

#### MSEE-74 Nontraditional Uses of CT Contrast Agents

#### TEACHING POINTS

- This abstract discusses the basics of tomographic technique and anatomy, with a focus on the appropriate choice of imaging



modality for the evaluation of the specific alterations- Assurance of a valid clinical indication for each contrast medium administration. - To compare positive versus neutral oral contrast material for detecting pathological thoracoabdominal conditions. - Recognize appropriate uses of CT in clinical practice.

#### TABLE OF CONTENTS/OUTLINE

CT scanning is fast, painless, noninvasive, and accurate. The CT exam can now be more effectively tailored to the presumed diagnosis. Specifics related to oral and IV contrast protocols in terms of timing and volume regimens will be covered in detail in this presentation. Table of contents: 1- CT pharyngography 2- CT esophagography 3- CT gastrography 4- CT enterography 5- CT fistulography 6- CT urography 7- CT cystography 8- CT angiography. To illustrate the spectrum of MDCT findings based on our series of CT studies performed between 2015 and 2022. Conclusions: - On-site radiologist supervision is essential? These exams are always radiologist-guided. - Optimal performance of CT requires knowledge of anatomy and pathophysiology, familiarity with the basic physics and techniques of CT, and knowledge of radiation safety. - Specifics related to oral and IV contrast protocols in terms of timing and volume regimens will be covered in detail in this presentation. - Radiologists must be familiar with the radiologic findings for both accurate diagnosis and, in many cases, guidance of management planning. - A practical case-based review.

#### MSEE-75 Multimodality Imaging of Systemic and Localized Amyloidosis

Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the etiologies, pathophysiology and clinical findings of systemic and localized amyloidosis
- Describe the imaging appearance of amyloidosis across multiple organ systems and imaging modalities
- Discuss the differential diagnoses for imaging findings of amyloidosis
- Discuss radiology-pathology correlation as it applies to amyloidosis

#### TABLE OF CONTENTS/OUTLINE

Amyloidosis is a condition secondary to a range of pathologic processes resulting in deposition of abnormal protein in tissues (amyloid). Amyloid deposition may be due to neoplastic, infectious, inflammatory, and even congenital processes, leading to marked heterogeneity in clinical and imaging manifestations. In this exhibit, we will discuss the varying etiologies of systemic amyloidosis including AL, AA,  $\beta_2$ -microglobulin, ATTR (transthyretin), and hereditary forms. We will also discuss the etiologies of localized amyloidosis including:  $\beta$ -amyloid (Alzheimer's), AANF (isolated atrial amyloid), and AIAPP (DM2). The focus of our work is the imaging appearance and differential diagnosis for the following organ-specific manifestations of amyloidosis with accompanying clinical images: 1. Pulmonary Amyloidosis o Nodular parenchymal o Diffuse parenchymal o Tracheobronchial laryngeal 2. Cardiac with specific MR and NM findings 3. Intra-abdominal o Hepatosplenic o Renal o Bowel o Bladder 4. Cerebral o Angiopathy o Alzheimer's disease 5. Musculoskeletal o Arthropathy o Myopathy o Carpal tunnel syndrome 6. Amyloidomas Soft Tissue Amyloid Finally, we will describe radiology-pathology relationships that influence imaging findings of amyloidosis.

#### MSEE-76 Characteristic Imaging Features and Screening/Surveillance Recommendations for Hereditary Syndromes

#### TEACHING POINTS

I. Many heritable syndromes have characteristic imaging features. Recognizing common multi-system findings in heritable syndromes allows radiologists to make a unifying diagnosis and guide surveillance strategies. II. Heritable syndromes can have overlapping imaging features. a. Multiple endocrine neoplasia (MEN) type 1, tuberous sclerosis complex (TSC), neurofibromatosis (NF), and von Hippel Lindau (VHL) have characteristic findings in the central nervous system (CNS). b. Lynch, Gardner, and Peutz-Jegher (PJS) syndromes are characterized by gastrointestinal tract malignancies. c. Renal tumors can be seen in Birt-Hogg-Dubé (BHD), TSC, and VHL. d. Pheochromocytomas can be seen in NF type 1, VHL, and MEN type 2. III. While oncologic screening is a critical part of heritable syndrome monitoring, it is equally important to recognize acute pathologies that can result from heritable syndromes. a. CNS tumors can cause acute neurologic problems such as mass effect and obstructive hydrocephalus. b. Small bowel polyps in PJS can lead to intussusceptions and small bowel obstructions. c. Angiomyolipomas, seen in BHD and TSC, can bleed or rupture if large or rapidly growing. This is the second most common cause of morbidity in these patients.

#### TABLE OF CONTENTS/OUTLINE

I. General concepts about hereditary syndromes II. Review of key imaging findings and screening recommendations for the following diagnoses: Lynch syndrome, Gardner syndrome, PJS, MEN, NF, TSC, BHD, VHL, hereditary breast and ovarian cancer syndrome III. Summary of key concepts

#### MSEE-8 Paraganglioma Imaging: Radiology and Nuclear Medicine

Participants

Aurelie Choucair, MD, Villejuif, France (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the different hereditary forms of paragangliomas insisting on Succinate Dehydrogenase Mutations. Review the genetic associations predisposing to paragangliomas including Von Hippel-Lindau, Multiple Endocrine Neoplasia Type 2 NEM2, Neurofibromatosis Type 1 NF1 and Carney Triad. Define the secreting or non-secreting character. Provide a detailed overview of anatomical imaging (CT and MRI) features. Improve knowledge about the different Nuclear Medicine and functional imaging techniques, and the multiple radiopharmaceuticals available for Scintigraphy and PET/CT, according to paraganglioma site and mutational pattern. Analyse the different functional imaging modalities and review the strengths and weaknesses of each modality in detecting lesions depending on their location, secretory function and underlying genetic mutation. Prognosis of paragangliomas, frequent sites of metastasis and therapeutic options.

#### TABLE OF CONTENTS/OUTLINE

Definition of Paraganglioma Epidemiology Succinate Dehydrogenase Mutations Genetic Association: - Von Hippel-Lindau- NEM2- NF1- Carney Triad Characteristics (secreting / non secreting), and clinical presentation Location: - Parasympathetic Paraganglioma: Carotid Body Tumor, Glomus Tympanicum, Jugulotympanicum, Jugulare, and Vagale- Sympathetic Paraganglioma: Adrenal: Pheochromocytoma Extra-adrenal Imaging of Paraganglioma Radiology CT Scan MRI Nuclear Medicine Scintigraphy PET Differential diagnosis Complications Prognosis and Treatment

## MSEE-9 Eponyms in Radiology: The Controversies Worth Re-examining

Participants

Madeleine Sertic, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Eponymous diseases are a long-standing tradition in Western medicine, however, there are numerous arguments against the practice.
  - o Plain-language descriptive names are easier to understand for both patients and health care providers
  - o Eponyms often only recognize individuals, when in reality discoveries are often collaborative
  - o Bias toward recognizing Western, male and non-minority figures
- Eponyms may serve to honor figures that are controversial.
  - o Affiliations with totalitarian regimes
  - o Documented views of intolerance based on race, disability, age, etc.
  - o Professional scandals involving venality, fraud, etc.
- Stigler's Law of Eponymy states that no scientific eponym is named for its original discoverer.

### TABLE OF CONTENTS/OUTLINE

- Introduction
  - o The concept of "controversy"
  - o Holding historical figures to modern standards
- Multi-system overview of controversial eponymous figures
  - o Breast
  - o Cardiothoracic
  - o Emergency
  - o Gastrointestinal and Genitourinary
  - o Musculoskeletal
  - o Neuroradiology
  - o Nuclear Medicine
  - o Pediatrics
  - o Vascular/Interventional
- Stigler's Law of Eponymy
- Conclusion

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## Abstract Archives of the RSNA, 2023

MSEE-1

### Rosai-Dorfman Disease- Multimodality Imaging

#### Participants

Babina Gosangi, MPH, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Rosai-Dorfman disease is a benign proliferative disease characterized by sinus-histiocytosis with massive lymphadenopathy. The mean age of presentation is 21-years with a male preponderance. It is a result of immune dysregulation following a viral infection. Lymphadenopathy is the key finding but extranodal involvement is also seen.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Examples of cases: a. Multistation lymphadenopathy b. Extranodal involvement • Nasal cavity- Pansinusitis • Orbital involvement- cranial nerve thickening • Intracranial lesions- Brain neoplasms, meningitis • Lung lesions- perilymphatic nodules, interstitial thickening, endobronchial nodules, pleural lesions • Renal masses • Mesenteric masses • Lytic lesions in the bone • Soft tissue lesions 3. Conclusion.

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## Abstract Archives of the RSNA, 2023

MSEE-10

### Another Great Pretender: Extragenital Endometriosis, A Pictorial Review

#### TEACHING POINTS

Extragenital endometriosis (EE) is a relatively infrequent occurrence with a broad spectrum of clinical and phenotypic presentations, posing significant diagnostic difficulties, particularly outside the pelvic region. Radiologists play a pivotal role in suspecting the presence of EE by identifying its characteristic imaging hallmarks even before the onset of clinical symptoms. As such, they can facilitate timely diagnosis and intervention for better patient outcomes. MRI is the imaging modality of choice for EE evaluation, owing to its high specificity and sensitivity in detecting EE-specific imaging signs.

#### TABLE OF CONTENTS/OUTLINE

a) Introduction: General characteristics of EE, demographics, and imaging features, mostly in CT and MRI. b) Description of the case series: The experience in extragenital endometriosis in two tertiary care centers. A retrospective review of last 5 years cases was performed. c) MRI protocol d) Extragenital endometriosis distribution: Pelvic non gynecological organs, gastrointestinal, genitourinary, musculoskeletal, thoracic, nervous system, miscellaneous e) Conclusions: Endometriosis is a commonly underdiagnosed disease, and the diagnostic challenge is further enhanced by the non-specific clinical and phenotypic features of EE. When radiologists are aware to these complexities, they can be the first physician to suspect and propose this diagnosis, allowing timely intervention and improved patient outcomes. MRI is the backbone of EE diagnosis, thanks to its characteristics.

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## Abstract Archives of the RSNA, 2023

MSEE-11

### Didactic Cases of Oncologic Emergencies in Radiology

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To be able to recognize the main urgent pathologies related to oncological diseases and treatments. To be able to distinguish the severity level of these conditions and properly guide the clinician regarding the causative agent. To raise awareness among radiologists about the significant prevalence of these complications in general medical care.

#### TABLE OF CONTENTS/OUTLINE

1. Oncologic diagnosis in the emergency department (not previously known malignancy)  
2. Tumor-related complications and emergencies  
a Superior vena cavab Intestinal obstructionc Obstructive hydrocephalusd Spinal cord compressione Hypercoagulabilityf Carcinoid syndrome  
3. Complications arising from diagnostic procedures and classic treatments  
a Surgical (suture dehiscence)  
b Chemo-radiotherapy  
c Vasculitisc Fistulad Esophagitis/esophageal necrosis  
e Hemorrhagic complications  
f Post-radioembolization cholecystitis  
g Leukoencephalopathy due to chemotherapeutics  
4. Post-hematopoietic stem cell transplantation (HSCT)  
a Pulmonary infections: febrile neutropenia (aspergillus may occur in all time segments)  
0-30 days post-HSCT (fungal): Aspergillus  
31-100 days post-HSCT (early): CMV and PJ  
>100 days post-HSCT (late): Bacterial and viral infections (common infections)  
b Sinusoidal obstructive syndrome and intestinal graft versus host disease  
c Neutropenic colitis (typhlitis)  
5. Emergencies related with new therapies and targeted therapies  
a Immune-related adverse events and complications  
Pancolitis due to TKIPancolitis secondary to immune-checkpoint inhibitors  
Immune-mediated pancreatitis  
b Hyperprogresionc Cytokine release syndrome (CRS) and immune effector cell-associated neurotoxicity syndrome (ICANS)

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## Abstract Archives of the RSNA, 2023

MSEE-12

### ctDNA in the Reading Room: A Guide for Radiologists

#### TEACHING POINTS

? Review applications of circulating tumor DNA (ctDNA) in oncology? Summarize current clinical guidelines for use of ctDNA? Review role of ctDNA in everyday practice

#### TABLE OF CONTENTS/OUTLINE

-Overview of circulating tumor DNA (ctDNA).? What is ctDNA? Lexicon and definitions (tumor microenvironment, liquid biopsy, ctDNA, cell free DNA)? Available techniques and most commonly used platforms for liquid biopsy and ctDNA? ctDNA as a biomarker-ctDNA current oncology guidelines include National Comprehensive Cancer Network, American Society of Clinical Oncology, European Society of Molecular Oncology.-ctDNA in cancer surveillance, prognosis, and treatment response for:? Lung? Breast? Colorectal? Lung? Pancreas? Sarcomas(Detectable targetable mutations, imaging examples, and indications in clinical practice are presented for each tumor)-ctDNA Strengths for imaging interpretation, Limitations in cancer surveillance, prognosis, and treatment-Future Directions and Promising Future Applications? Non-invasive tissue characterization? ctDNA and radiomics? Personalized patient management and therapy selection

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## Abstract Archives of the RSNA, 2023

MSEE-13

### When Suspect Nonneoplastic Lymphadenopathy on PET/CT

#### TEACHING POINTS

1. Morphological changes of lymph nodes or their metabolism are not enough to predict tumoral compromise. 2. The distribution pattern, relation with a primary tumor and its typical extension, inflammatory or posttreatment changes, and clinical conditions should be considered. 3. Different nonneoplastic pathologies characteristically manifest with lymph node enlargement and are frequently confused with malignancy, such as connective tissue diseases, infections, IgG4-related disease, granulomatous inflammation, non-clonal lymphoproliferative disorders, and others.

#### TABLE OF CONTENTS/OUTLINE

1. Clues to suspect nonneoplastic lymphadenopathy: Morphological characteristics, distribution pattern, relation with the drainage pathways of a primary tumor or inflammatory process, and association with other findings. 2. Nonneoplastic diseases related to lymphadenopathies: a) Connective tissue diseases: lupus and rheumatoid arthritis; b) Infections: HIV, tuberculosis, toxoplasmosis, histoplasmosis, Epstein-Barr virus, and Bartonella; c) IgG4-related disease; d) Granulomatous inflammation: sarcoidosis, sarcoid-like reaction, and pneumoconiosis; e) Non-clonal lymphoproliferative disorders: Castleman disease and Amyloidosis; f) Kikuchi and Kimura disease; g) Posttreatment lymphadenopathies: immunotherapy, target therapy, surgical and radiation inflammatory changes; h) COVID-19 vaccine; i) Others: pulmonary edema, interstitial lung disease, emphysema, chronic liver disease, and reactive lymph nodes in young patients. 3. Conclusions

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## Abstract Archives of the RSNA, 2023

MSEE-14

### Potential Pitfalls of Splitting Interpretation of Concurrent Chest and Abdominal CTs

#### Participants

Eyal Ron, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Simultaneously obtained chest and abdomen/pelvis CTs are sometimes read by separate subspecialized radiologists. This creates the potential for missed, incomplete, and conflicting diagnoses involving the scanned areas that overlap. 2. Chest findings can sometimes be more conspicuous on the "abdomen" CT and vice-versa. This can be due to differences in contrast timing and CT reconstruction technique. 3. Some processes require synthesizing findings from both the chest and abdomen CT for optimal radiology analysis.

#### TABLE OF CONTENTS/OUTLINE

We provide example cases demonstrating how splitting radiology interpretations either did or potentially could have led to misdiagnoses of abdominal findings seen on chest CT and vice versa. Additionally, we provide guidelines to avoid these potential pitfalls. Examples include: 1. Missed pancreatic adenocarcinoma conspicuous only on the chest CT portion. 2. Pulmonary embolism poorly visualized on chest CT with contrast but more conspicuous on the arterial phase of the concurrently obtained abdominal CT. 3. Area of slow flow seen on chest CT misinterpreted as pulmonary embolism when a concurrently obtained abdominal shows these arteries are adequately opacified. The patient later developed an intra-abdominal bleed related to the anti-coagulation started for the false positive pulmonary embolism call. 4. Intrathoracic extent of a metastatic GIST tumor and reactive pericardial effusion, challenging to synthesize without strong collaboration between the chest and abdominal radiologists.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

MSEE-15

### **Facial Mapping: High Frequency Ultrasound Step-by-step Approach in Facial Anatomical Evaluation for Aesthetics**

#### **Participants**

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Facial aesthetic procedures are increasingly being performed. Different aesthetic surgery techniques, injectable materials and technologies aimed at improving skin quality and restoring the redistributed volume of facial layers have been used against the multifactorial process of the facial aging. The correct evaluation and characterization of the facial layers is crucial for safe and effective rejuvenation procedures, specially the minimally invasive, since a wrong manipulation might yield an aesthetically undesirable result and lead to serious complications. In this context, the radiologists may be requested to recognize and evaluate the facial layers, compartments and their contents. To achieve accurate and timely detection and appropriate approach of each case, High frequency ultrasound (HFUS/24-33MHz) is the most effective method since it provides optimal anatomical information of the skin and allows facial layers differentiation as well as aesthetic anti-ageing procedures identification. This study aims to discuss and illustrate the radiologist's role in the evaluation of facial anatomy with HFUS, and purposes: (1)To describe the correct examination technique / HFUS advantages. (2)To illustrate the anatomy of the skin/facial layers. (3)To show a step-by-step approach of the most important facial structures. (4)To discuss the course of the main facial neurovascular structures and its variations.(5)To list and describe the anatomy of the Facial Danger Zones. (6)To highlight the importance of HFUS in pre and post-procedural evaluation.

#### **TABLE OF CONTENTS/OUTLINE**

1.INTRODUCTION. 2. FACIAL LAYERS. 3.VASCULAR MAPPING. 4. FRESH FROZEN SPECIMEN CORRELATION. 5.CONCLUSION

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MSEE-16

### State of the Heart: A Pictorial Review of Classic and Novel Cardiac Devices

#### Participants

Nikhil Gupta, MD, MS, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Outline the indication, function, and imaging of classic cardiac implant devices. Review commonly encountered complications of classic implanted cardiac devices. Understand the role of novel implanted cardiac devices and their appearance on plain film radiography and computed tomography.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Classic Implanted Devices in the Chest Chest Ports, Heart Valve Prostheses, Pacemakers/Implanted Defibrillators, Coronary Artery Bypass Stents, Implantable Loop Recorder  
2. Outline complications of Classic Implanted Devices  
3. New Implanted Devices Left Atrial Appendage Closure Devices, Atrial Septal Occlusion Devices, Ventricular Support Devices, ECMO

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## Abstract Archives of the RSNA, 2023

MSEE-17

### Imaging in Sexagenarians and Beyond: What Clinicians Want to Know and What Radiologists Need to Know

#### Participants

Sirui Jiang, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. By 2030 approximately 20% of all Americans or about 70 million people will be 65 years or older. This population utilizes about 30% of our imaging resources yearly and is ever increasing. 2. How to incorporate the geriatric scoring systems to risk stratify and prioritize treatment in the reading room. 3. Review the common imaging findings in the geriatric population with special emphasis in the emergency/trauma and oncology settings using multimodality images. 4. Review imaging differences of pathology in a young versus an elderly patient.

#### TABLE OF CONTENTS/OUTLINE

Background  
History of geriatrics  
Importance of geriatric care and management  
Development of multiple geriatric scoring systems  
Succinctly synthesizing common geriatric imaging findings  
Common Scenarios of Geriatric Population in the Reading Room  
Head and Neck: subdural hematomas, cerebral atrophy, vascular calcifications  
Chest: rib fractures, emphysema, cardiovascular (coronary and valvular calcifications), lung/esophageal primary malignancies, acute/chronic lung infection  
Abdomen: steatosis, chronic renal failure, chronic cystitis, pancreatic issues (malignancy/insufficiency), adrenal issues (insufficiency/hyperplasia/atrophy)  
Pelvis: prostate, diverticulitis  
Musculoskeletal: osteopenia, multiple myeloma, osteoarthritis, steroid associated changes, vertebral compression fractures  
Collaborative Approach for Geriatric Care  
Templates with these common findings to help create a concise report  
Multidisciplinary approach with geriatric subspecialties  
Is it time for a geriatric radiology fellowship/subspecialty?

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## Abstract Archives of the RSNA, 2023

MSEE-18

### SBRT and Isolated Metastases: A Primer for Radiologists

#### Participants

Raelynne MacBeth, MD, South Euclid, OH (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the natural history of stereotactic radiation therapy (SBRT) and how it has progressed to treatment of intra-thoracic and intra-abdominal malignancies. 2. To review the different types of malignancies SBRT is used to treat and the potential toxicities associated with each. 3. To discuss the multimodality appearance and evaluation of tumor burden after SBRT. 4. To discuss the multimodality appearance of SBRT associated toxicities after treatment. 5. To discuss the multimodality appearance of recurrence patterns after SBRT.

#### TABLE OF CONTENTS/OUTLINE

1. Define stereotactic body radiation therapy (SBRT) and how it differs from other modes of radiation therapy. 2. Review the pathophysiology of radiation therapy-induced cellular damage. 3. Review the natural evolution of SBRT and how it has progressed to treatment of malignancies in the chest, abdomen, and pelvis. 4. Discuss the indications for utilizing SBRT in selected malignancies and their common associated toxicities. 5. Discuss the typical and atypical response patterns after SBRT and their multimodality appearance. 6. Discuss the typical and atypical toxicity profiles after SBRT and their multimodality appearance. 7. Examine the multimodality appearance of local recurrence patterns after SBRT. 8. Discuss distant recurrence patterns after SBRT and their multimodality appearance. 9. Discuss the financial toxicities associated with SBRT.

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## Abstract Archives of the RSNA, 2023

MSEE-19

### Syphilis: The Re-emerging Great Mimicker - A Case-based Review from Head to Toe

#### Participants

Kano Shintaro, MD, Shinagawa-Ku, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Syphilis, a sexually transmitted disease caused by the spirochete bacterium *T. Pallidum*, is a multisystemic infection that can affect various organs. Recently, the number of syphilitic patients has been rapidly increasing worldwide. Clinical manifestations of syphilis are often inconspicuous and imaging examinations performed for other purposes may lead to potential overlook or misdiagnosis of syphilis, making it challenging for radiologists to diagnose it accurately. Therefore, it is crucial for radiologists to understand the imaging spectrums and differential diagnosis of syphilis to ensure accurate diagnosis and appropriate patient management. The purposes of this exhibit are (1) to review the imaging spectrums of syphilis through case-based studies for the improved ability to identify potential cases of syphilis and (2) to discuss approaches to distinguish syphilis from other diseases that can mimic it.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 1-1.Epidemiology 1-2.Clinical manifestation therapy 2. Case presentations: Body imaging 2-1.head and neck 2-2.chest 2-3.cardiovascular 2-4.abdomen urogenital 3.Case presentations: Neuroimaging 3-1.brain 3-2.spinal cord 4.Case presentations:Pediatric imaging 5. Summary

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## Abstract Archives of the RSNA, 2023

MSEE-2

### Body MRI Approach Fundamentals: A Guide for Beginners

#### Participants

Mark Hoegger, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Body MRI interpretation can be daunting for the inexperienced reader because 1) the relevance of key clinical parameters may be unknown, 2) the importance of certain sequences in diagnosis may be unclear, and 3) a routine search pattern may not be established. To aid those inexperienced in body MRI, this exhibit's purpose is to:- Discuss the general body MRI sequences and their uses.- Identify and explain key clinical factors for the most commonly encountered clinical questions that can be answered with body MRI.- Describe the sequences and their relevance for these common body MRI indications. The intent of this exhibit is not provide an exhaustive overview of body MRI, but to arm a trainee starting on service, or a radiologist in practice who has been called upon to read body MRI exams but may be inexperienced or out of practice, with the tools needed to be successful.

#### TABLE OF CONTENTS/OUTLINE

- General body MRI sequences and their uses: T1-weighted imaging pre- and post-contrast, chemical shift imaging, T2-weighted imaging, and DWI.- Body MRI search pattern fundamentals: CT versus MR approach, flexibility in body MRI, lesion finding versus lesion characterization, and pitfalls.- Disease-specific clinical parameters and sequences for common indications: liver lesions and hepatocellular carcinoma (LI-RADS), rectal cancer, renal masses, prostate adenocarcinoma (PI-RADS), pancreatic cysts and solid masses, inflammatory bowel disease, biliary disease, and uterine and ovarian masses.

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## Abstract Archives of the RSNA, 2023

MSEE-20

### Monitoring the Abdomen: How to Do It - Tumor Surveillance and Follow-up

#### TEACHING POINTS

Different imaging modalities are used for follow-up Surveillance increases accuracy compared with clinical follow-up alone Detecting recurrence early allows potentially curative salvage therapy Protocols reflect tumor risk stratification. Guidelines outline imaging follow-up of abdominopelvic tumours Radiomics and liquid biopsies may augment surveillance protocols to identify patients at higher risk of relapse

#### TABLE OF CONTENTS/OUTLINE

Imaging modality pearls and pitfalls for follow-up CT - role of MPR, MIP, dual-energy MRI - anatomical and functional sequences; merits and practicalities of whole-body MRI Nuclear Medicine - including novel radiotracers System based overview of abdominopelvic cancers, how and where to detect relapse Practical tips for spotting recurrence early and avoiding mimics Understanding routes of disease spread eg. in peritoneal disease Specific challenges of detecting skeletal disease recurrence Assessing lymph node recurrence - not just size Differentiating expected post treatment changes from recurrent disease Immunotherapy and pseudoprogression Guidelines for imaging surveillance post curative treatment Upper, lower, gynaecological and urological tumors Key similarities and differences in international guidelines for follow up of abdominopelvic cancers, why this matters clinically Role of clinical and laboratory markers to augment radiology Tumor markers Liquid biopsy - a new era in cancer surveillance? AI and radiomics in disease surveillance, hype or reality?

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## Abstract Archives of the RSNA, 2023

MSEE-21

### Congenital and Acquired Causes, Mimickers and Treatment of Diaphragmatic Paralysis

#### Participants

Achala Donuru, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Phrenic nerves originate from cervical nerves C3-C5. Injury of the phrenic nerve can occur by multiple mechanisms. Due to the long course of the left phrenic nerve in the thorax, left-side diaphragmatic weakness is more common compared to right side. One of the most frequent causes of unilateral diaphragmatic paralysis is iatrogenic. In bilateral diaphragmatic paralysis, one of the most common causes is a motor neuron disease. Most cases of DP are idiopathic (70%), other causes include congenital (birth trauma), tumors, infections, muscular disorders, and iatrogenic (medication induced, from nerve block, post-surgical). The main differentials to consider when an elevated hemidiaphragm is noted on a chest radiograph are diaphragmatic eventration, lobar collapse, subphrenic abscess and subdiaphragmatic mass.

#### TABLE OF CONTENTS/OUTLINE

On a chest radiograph, the right dome of the diaphragm is higher in position when compared to the left dome. If the left dome of the diaphragm is elevated by more than 2 cm, DP should be suspected. Functional imaging with a sniff test is very useful in diagnosing DP, the affected side demonstrates a paradoxical upward movement. Performance of dynamic MR imaging for evaluation of diaphragmatic function has also been described. Most patients with unilateral DP are detected incidentally and do not require any specific management. Most patients with bilateral DP require permanent ventilator support. Selected patients with persistent respiratory failure can benefit from diaphragmatic plication or phrenic nerve pacing. It is important for the radiologists to recognize diaphragmatic paralysis and look for pathology along the course of the phrenic nerve.

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## Abstract Archives of the RSNA, 2023

MSEE-22

### **It's Not Always Cancer: A Pictorial Essay on Nonneoplastic Lymphadenopathies with Histopathologic Correlation**

#### **Participants**

Brenda N. Lahlou, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. List and compartmentalize the different causes of nonneoplastic lymphadenopathies. 2. Recognize typical radiological aspects of certain etiologies of lymphadenopathies. 3. Improve the approach of differential diagnosis of lymph node enlargement by correlating multimodality imaging and clinical findings. 4. Recognize the most common histopathological patterns found in lymph node enlargement caused by benign conditions.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Overview of normal lymph node anatomy and its radiological and histological aspects 3. Subdivision of various pathologies that can encompass lymphadenopathy based on etiology 4. Localized lymphadenopathy a. Foreign-body related b. Idiopathic diseases c. Reactive conditions d. Infections 5. Generalized lymphadenopathy a. Autoimmune diseases b. Idiopathic diseases c. Reactive conditions d. Infections 6. A practical diagnostic approach in the presence of lymph node enlargement 7. Take home message

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## Abstract Archives of the RSNA, 2023

MSEE-23

### From Brain to Bones: A Radiological Saga Through Multisystemic Tuberous Sclerosis

#### Participants

Fernanda Limonge, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review radiological manifestations of Tuberous Sclerosis To illustrate the imaging findings of the most important features of Tuberous Sclerosis (ultrasound, MRI, CT) Discuss the radiologist's role on establishing clinical diagnosis

#### TABLE OF CONTENTS/OUTLINE

Clinical criteria for Tuberous Sclerosis Diagnostic Radiological manifestations of Tuberous Sclerosis- Neurological features- Cardiological features- Thoracic features- Abdominal features- Musculoskeletal features

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## Abstract Archives of the RSNA, 2023

MSEE-24

### What on Earth is That: Newer Medical Devices on Chest Radiographs

#### Participants

Ashrith Kandula, Wallingford, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

There has been a constant influx of newer medical devices as technology veers towards more noninvasive methods of treating diseases. Plethora of new devices are seen on today's plain radiographs. Cardiovascular devices are further divided into- cardiac devices comprising of rhythm monitors such as Pacemakers, Implantable cardioverter defibrillators, Ventricular Assist Devices, Occlusion devices, Valve prosthesis- (Open heart and Trans catheter placement), Loop recorders. Vascular devices range from Central venous catheters, Swan Ganz catheter , remote pulmonary artery pressure monitoring devices, devices used for catheter directed thrombolysis, IABP, ECMO to many more. Non-Cardiovascular devices include- esophageal devices- LINX for reflux, nerve stimulators including Vagal, Trigeminal and Hypoglossal, phrenic nerve stimulators, diaphragmatic pacers.

#### TABLE OF CONTENTS/OUTLINE

To review the newer medical devices seen on plain radiographs of the chest. Pictorial review of the optimal location, function and complications of the different devices. Organization: Introduction, classification, pictorial review of device along with in-vitro images, optimal location, function and evaluation of complications associated with the device. Entities discussed: Cardio Microelectromechanical device (CardioMEMS), Pulmonary Artery catheters for thrombolysis , Cordella Pulmonary Artery Pressure Monitor, Mitraclip, Transcatheter Mitral Valve Replacement (TMVR), Transcatheter Pulmonary Valve Replacement (TPVR), LINX - device for reflux management, Endoscopic clips from POEMS, Hypoglossal nerve stimulators, Diaphragmatic pacers.

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## Abstract Archives of the RSNA, 2023

MSEE-25

### Nail it: A Guide to Diagnosing Nail Disorders

#### Participants

Isabela Ribeiro, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ultrasonography serves as a valuable tool for assessing the nail unit, providing real-time evaluation of its components, which includes the periungual tissue's appearance and thickness, vascularization via color Doppler application, and possible involvement of underlying bone structures. It is crucial to understand not only the normal anatomy of the nail bed on ultrasonography but also the main points of some pathologies encountered in daily clinical and radiological practice. While nail tumors are rare anomalies, a detailed prior anatomical knowledge allows for their easy identification. In addition, it is important to highlight the ultrasonographic findings of other common conditions, such as retronychia, foreign bodies, and paronychia, in order to better define the appropriate course of action. Given its ability to diagnose, localize, and differentiate various nail disorders, it is not surprising that nail unit assessment through ultrasonography can significantly improve patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

Highlight the importance of ultrasonographic assessment for the nail unit. Review the advantages and limitations of high-frequency ultrasound for evaluating the nail compartment. Identify the ultrasonographic characteristics of common nail pathologies.

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## Abstract Archives of the RSNA, 2023

MSEE-26

### "To Cyst or Not to Cyst," Imaging Spectrum of Mucinous Neoplasms in the Abdomen and Pelvis

#### Participants

Nabih Nakrour, MD, Watertown, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: • Review imaging features of mucin- producing neoplasms in the abdomen and pelvis with attention to organs- specific involvement. • Discuss worrisome findings that favor malignant potentials over benign tumors. • Demonstrate imaging role in management including pre-surgical planning and imaging follow-ups. • Address misdiagnosis, pitfalls, and mimicking pathologies that may resemble mucinous neoplasms

#### TABLE OF CONTENTS/OUTLINE

Present multi-modality imaging review of mucinous neoplasms involving the following organs Pancreas Intrahepatic and extrahepatic biliary tree GI tract (Esophagus, stomach, small bowel, colon, appendix and rectum) GU system (ovaries, epididymis, bladder, kidney, renal collecting system) Peritoneum and serosal involvement List syndromic association and predisposing systemic conditions

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## Abstract Archives of the RSNA, 2023

MSEE-27

### Make Every Connection Matter: Multi-modality Imaging Features of Fistulas in the Chest, Abdomen and Pelvis

#### Participants

Ayman H. Gaballah, MD, FRCR, Columbia, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the definition, classifications, and types of fistulas 2. Discuss multi-modality imaging features of fistulas in the chest, abdomen, and pelvis 3. Point out the appropriate imaging workup and pitfalls according to the anatomic region 4. Illustrate the long-term complications of chronic and untreated fistulas 5. Highlight some of the management options

#### TABLE OF CONTENTS/OUTLINE

1- Introduction 2- Etiology and types of fistulas a. Congenital: Congenital fistulae arise from remnants of embryonic ducts that persist (e.g., tracheoesophageal, vitello-intestinal, urachal, etc.) b. Acquired: Acquired fistulae are secondary to variety of causes. i. Traumatic ii. Iatrogenic iii. Inflammatory/infectious iv. Neoplastic v. Post-radiation therapy vi. Vascular vii. Miscellaneous c. Types according to fistula opening i. External opening (e.g., enterocutaneous fistula) ii. Internal opening (e.g., tracheoesophageal, rectovesical, cholecysto-duodenal, perianal, arteriovenous fistula, etc.) 3- Multimodality imaging features of fistulas in different body parts from head to toe with related classifications as applicable 4- Complications of fistulas 5- Case presentation and imaging pitfalls 6- Management options

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## Abstract Archives of the RSNA, 2023

MSEE-28

### You'll Float Too: A Guide of Ectopic Gas for the Radiology Resident

#### Participants

Sofia Arizaga, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

after the exhibit the reader would be able: To describe the imaging features and differentiate normal air/gas in the different tissues and potential body spaces. To identify the origin and causes of ectopic gas. To analyze abnormal gas location in order to detect situations and diseases that involve high mortality rate.

#### TABLE OF CONTENTS/OUTLINE

Introduction- Pathways of Ectopic Gas Distribution.- Imaging assessment of abnormal gas.- Etiopathogeneses of ectopic Gas: Iatrogenic, trauma, inflammatory/infectious, ischemic, neoplastic, others.- Recognize alarm signs.- Summary

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## Abstract Archives of the RSNA, 2023

MSEE-29

### **Alohomora: Opening the Mind and Demystifying Abdominal Tuberculosis Findings**

#### **Participants**

Kamila Albuquerque, MD, Vila Velha, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Brazil is one of the countries with the highest incidence of tuberculosis in the world, ranking among the top 22, according to the WHO. Abdominal tuberculosis is considered a great mimic of other abdominal diseases, and can affect the gastrointestinal tract (GIT), peritoneum, lymph nodes and other organs. It often represents a diagnostic challenge due to its nonspecific findings, which may result in diagnostic delay and the development of complications. Imaging tests play an important role in its diagnosis, with an impact on the morbidity and mortality of the disease. This study aims to carry out an iconographic review of the most common abdominal manifestations of the disease, atypical presentations and complications from the perspective of different types of imaging methods, which include tomography and magnetic resonance imaging and even CT / PET.

#### **TABLE OF CONTENTS/OUTLINE**

In this educational exhibition, we address the different abdominal radiological manifestations related to tuberculosis bacillus infection, in addition to epidemiological and pathophysiological data, as well as some differential diagnoses and miscellaneous.

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## Abstract Archives of the RSNA, 2023

MSEE-3

### Visualizing Beyond the Joints: Imaging the Extra-articular Manifestations of Rheumatoid Arthritis

#### Participants

Marco Tsuno, Brasilia, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To understand the prevalence and significance of extra-articular manifestations in rheumatoid arthritis.- To recognize the characteristic imaging features of common extra-articular manifestations in rheumatoid arthritis.- To recognize the role of imaging in monitoring disease progression and detecting new or worsening extra-articular manifestations in rheumatoid arthritis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Pathophysiology. 3. Diagnostic criteria. 4. Articular manifestations. 4.1. Imaging: articular manifestations (Temporomandibular Joint, Spine, Shoulder, Elbow, Wrist and Hand, Hip, Knee, Ankle and Foot). 5. Extra-articular manifestations. 5.1. Imaging: extra-articular manifestations (Central Nervous System, Pulmonary, Cardiovascular, Rheumatoid Nodules). 6. Conclusion. 7. Bibliographic references.

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## Abstract Archives of the RSNA, 2023

MSEE-30

### Beyond Genetics: A Review of Current Renal Cancer Screening Guidelines for Hereditary Renal Cancer Syndromes

#### Participants

Shiva Singh, MBBS, Bethesda, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Hereditary renal cancer syndromes, including von Hippel-Lindau (VHL), Birt-Hogg-Dubé (BHD), Hereditary Leiomyomatosis and Renal Cell Carcinoma (HLRCC), Tuberous Sclerosis Complex (TSC), Succinate Dehydrogenase (SDH)-deficient renal cell carcinoma (RCC), and BRCA1-associated Protein-1 (BAP1) tumor predisposition syndrome, are associated with an increased risk of developing renal tumors. Early detection of renal cancer in individuals with hereditary renal cancer syndromes is of extreme importance as it facilitates timely intervention and improves the prognosis. Owing to differences in their extra-renal manifestations and age of onset, the screening guidelines for each hereditary renal cancer syndrome are unique. Here, we provide a summary of the current recommendations for screening of renal cancer in each of these hereditary renal cancer syndromes.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/OutlineI. Introduction: (a) Hereditary renal cancer syndromes: Renal and extra-renal manifestations; (b) Importance of screeningII. Screening guidelines for hereditary renal cancer syndromesIII. CT/MRI images of patients with extra-renal manifestations undergoing renal cancer screening and eventually detecting renal tumor in each syndrome:(a) Von Hippel-Lindau syndrome (vHL); (b) Birt Hogg Dubé syndrome (BHD); (c) Hereditary Leiomyomatosis and Renal Cell Cancer syndrome; (d) Tuberous Sclerosis Complex; (e) Succinate Dehydrogenase-deficient RCC; (f) BAP1 tumor predisposition syndromeIV. Conclusion

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## Abstract Archives of the RSNA, 2023

MSEE-31

### DWI vs 18-FDG PET/CT in Oncology: Which Technique for Which Clinical Scenario

#### Participants

Antonio Luna, MD, PhD, Jaen, Spain (*Presenter*) Speaker, General Electric Company

#### TEACHING POINTS

Learn how to introduce whole-body diffusion-weighted imaging (WB-DWI) for tumor assessment. Review the technological adjustments including parallel imaging, compressed sensing, and deep learning to optimize WB-DWI protocols. Learn how WB-DWI/MRI is a valid alternative to 18-FDG PET/CT for tumor staging and is particularly advantageous in the assessment of peritoneum, bone marrow, liver, and brain metastases. Analyze the complementary role in tumor detection and staging and therapy monitoring of both techniques, using a head-to-head comparison, defining the most adequate technique for common clinical scenarios in oncology and including their applications in special populations (i.e., pregnant, or pediatric patients). Establish the range of clinical applications of PET/MRI combining DWI and 18-FDG PET acquisitions in oncology.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Technical adjustments in WB-DWI 3. Tumor staging: 3a. WB-DWI vs 18-FDG PET-CT. 3b. N staging. 3c. M staging. 3d. Specific tumors: NSCLC, breast cancer, prostate cancer, malignant melanoma, colorectal cancer, lymphoma, multiple myeloma and others. 4. Therapy monitoring. 5. Prediction of treatment response. 6. Posttreatment surveillance. 8. Conclusions

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## Abstract Archives of the RSNA, 2023

MSEE-32

### An Easy Approach to Cheson-Lungano Criteria: From Staging to Treatment Response Assessment

#### Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To know how to evaluate a lymphoma staging study and treatment response interpretation according to Cheson-Lungano criteria.- Learning how to manage complex situations where this criteria seems to be unclear and its limitations.- Discussing the differences between Cheson-Lungano criteria and other evaluation systems such as RECIST 1.1

#### TABLE OF CONTENTS/OUTLINE

Standard criteria for radiological evaluation lymphoma response allowed to optimise the therapeutic management in a more accurate way in this type of patients. It is based on the selection of target and non-target disease in a first staging study, and the evaluation of their presence and change in size in follow-up studies, allowing a global assessment of treatment response. These criteria can be applied by radiologists by evaluating CT studies (Cheson criteria) or CT and PET together (Cheson-Lungano criteria). It should be noted that although these criteria may be similar to the RECIST 1.1 criteria for the evaluation of other solid tumours, there are important differences in their interpretation (number of target lesions, required diameters, percentage limits to consider response/progression...), as well as the specific assessment of splenic involvement (which is more infrequent in other solid tumours). This paper reviews the importance of a correct use of Cheson-Lungano criteria in: 1) performing an adequate staging study inform; 2) interpretate the treatment response in follo-up studies; 3) other special situations where this criteria is sometimes unclear and are discussed in this article.

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## Abstract Archives of the RSNA, 2023

MSEE-33

### POCUS: Radiology Vs Other Medical Professions Perspectives - Where Do We Stand

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Point-of-care ultrasonography (POCUS) refers to a focused ultrasound performed at the patient's bedside by a clinician who both performs the US and interprets the images. The protocols usually answer a specific question that helps guide treatment. Goals: Understand what is point of care US (POCUS), its benefits and applications. Discuss differences in US training pathways among the different specialties vs Radiology. Review current issues of US Quality assurance and reimbursement, image archiving and accountability. Understand areas of potential threats and conflicts, and explore potential areas for collaboration and growth.

#### TABLE OF CONTENTS/OUTLINE

Define Point-of-care ultrasonography (POCUS) Review benefits and various applications of POCUS ( cardiovascular, ophthalmology, nervous system assessment, procedures ( line placement, nerve block, FAST) Discuss training pathways for POCUS, their strengths and limitations vs Radiology, review accreditation processs for POCUS vs Radiology. Discuss training in medical school Review available methods of US Quality assurance and reimbursement, provide examples of misinterpretation/misdiagnosis and role of Radiology in detailed evaluation of the POCUS findings. Discuss issues related to image archiving and accountability. Understand areas of potential threats and conflicts among Radiology and other fields of medicine utilizing POCUS. Explore potential areas for collaboration and growth.

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## Abstract Archives of the RSNA, 2023

MSEE-34

### Diffusion-weighted Imaging (DWI) in the Era of Abbreviated MRI: How to Make the Most Out of it for Abdominal MRI Applications

#### Participants

Claudio Lagos, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Introduce and briefly review abbreviated-MRI concepts. 2. Discuss detectability of lesions through abdominal organs using DWI alone, and review evidence comparing it with other imaging modalities, with emphasis in most and least useful applications. 3. Review DWI utility for characterizing abdominal lesions based on patterns and its correlate with pathology and aggressiveness, with emphasis in liver - pancreas. 4. Review last evidence regarding ADC value as a biomarker and a quantitative parameter in oncology imaging, prognosis and treatment response. 5. Illustrate frequent artifact and how they lead to interpretation pitfalls.

#### TABLE OF CONTENTS/OUTLINE

- Physics principles of diffusion- DWI image acquisition, ADC value and ADC map. Role of increasing b values in detectability.- Review abbreviated-MRI concept, goals and applicability.- Evidence based review of detectability of different lesions with emphasis in liver and pancreas.- Comparison of diagnostic yield with other techniques (ie. PET-CT, CECT) and other MR sequences, for different organs and frequent lesions, including peritoneal disease.- Practical approach in liver and pancreatic lesions for predicting histology / aggressiveness using a pattern based fashion.- Case based review of high performance situations: Liver mets, LIRADS evaluation, pancreatic nodules, extra - abdominal metastatic disease.- Case based review of low performance situations: Aggressiveness in renal nodules.- Role of quantitative DWI and its evidence, with emphasis in oncology.- Detectability and interpretation pitfalls, and how to avoid them.- Summary.- References.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MSEE-35

### From Head to Toe Non-Langerhans Cell Histiocytosis (Erdheim-Chester Disease): Understanding a Rare Pathology in the Era of Hybrid Imaging

#### Participants

Yumi Kimura Sandoval, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Understand the epidemiology and pathology behind Erdheim- Chester disease, as well as its clinical presentation- Learn the importance of 18F-FDG PET/CT in the diagnosis, detection of disease extent, and severity- Identify the radiological signs with which the disease can manifest- Case-based review of the main radiologic signs and features observed in this rare disease

#### TABLE OF CONTENTS/OUTLINE

1. Epidemiology 2. Clinical presentation 3. Pathology 4. Radiographic features  
A) Central Nervous system: - Pituitary Gland - Posterior Fossa  
B) Orbits  
C) Thorax - Lung - Mediastinum  
D) Vasculature - Thoracic and abdominal aorta  
E) Kidneys and retroperitoneum  
F) Musculoskeletal system

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## Abstract Archives of the RSNA, 2023

MSEE-36

### Imaging in Erdheim Chester disease

#### Participants

Yashant Aswani, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss recent updates in classification and pathogenesis of Erdheim-Chester disease  
2. Describe role of imaging and clinical and radiologic findings of Erdheim-Chester disease  
3. Review new treatment options and therapeutic response evaluation

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology 3. Pathology 4. Pathogenesis 5. Newer classification systems (2016 WHO classification of lymphoid neoplasms and 2016 Working group of Histiocytic Society Classification) 6. Mixed histiocytosis: an overlap syndrome 7. Diagnosis 8. Role of Imaging 9. Manifestations of Erdheim-Chester disease 10. Skeletal involvement 11. Retroperitoneal disease 12. CNS involvement 13. Cutaneous disease 14. Pulmonary involvement 15. Cardiothoracic disease 16. Endocrine involvement 17. Orbital disease 18. Miscellaneous: Craniofacial bones and skull base 19. Miscellaneous: Hepatobiliary disease 20. Newer imaging findings 21. Association with non-histiocytic malignancies and autoimmune diseases 22. Markers of prognosis 23. Molecular targets for treatment 24. Treatment approach 25. Therapeutic response evaluation modified PERCIST criteria

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## Abstract Archives of the RSNA, 2023

MSEE-37

### Response Assessment in Solid Tumors Criteria: Similarities and Differences

#### TEACHING POINTS

To review the history and evolution of solid tumor response criteria; To compare similarities and differences across various response criteria; To describe RECIST, RECIST-related criteria adaptations, and immune-related criteria; To recognize the challenges of applying these criteria; To provide case-based scenarios and identify the response categories with particular emphasis on immune-related criteria.

#### TABLE OF CONTENTS/OUTLINE

Timeline of Response Assessment in Solid Tumor; Terminology and rules for solid tumor response assessment; Similarities and differences across various response assessment criteria; Case-based scenarios to demonstrate assessment variations in response criteria/categories; Challenges in image metrics assessment using these different criteria; Summary and future directions; References.

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## Abstract Archives of the RSNA, 2023

MSEE-38

### Bugs that Suck (Your Blood): Imaging Manifestations of Vector-Borne Diseases

#### Participants

Francisco Calle, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Familiarize the radiologist with the range of pathogens transmitted by arthropod vectors and the diseases they cause.
- Discuss the epidemiology of these diseases, including areas of endemicity, types of arthropod vectors, transmission dynamics, and prior outbreaks.
- Discuss the clinical presentations and medical complications associated with vector-borne diseases.
- Describe the imaging features associated with infection on ultrasound, CT, and MRI.
- Provide a brief overview of management and treatment.

#### TABLE OF CONTENTS/OUTLINE

Introduction to vector-borne diseases, including types of vectors and variety of pathogens, as well as epidemiology and major outbreaks. Role of imaging and imaging features in detecting infection and identifying complications: • Neurologic (e.g., viral encephalitis, lyme encephalitis, cerebral malaria) • Chest/cardiac (e.g., Chagas dilated cardiomyopathy) • Gastrointestinal (e.g., yellow fever, malaria) • Urogenital (e.g., arbovirus-associated acute kidney injury, acute tubular necrosis, and renal failure) • Musculoskeletal: (e.g., cutaneous and mucocutaneous leishmaniasis, ectoparasites). Brief overview of management and treatment of vector-borne diseases and their complications

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## Abstract Archives of the RSNA, 2023

MSEE-39

### Whole-Body MRI in Hereditary Tumor Syndromes: How We Do It

#### TEACHING POINTS

- Whole-body MRI can be helpful for screening, detection, and follow-up of bone and soft tissue tumors in patients with hereditary tumor syndromes - Different tumor syndromes require appropriate MRI acquisition protocols to highlight the different pathological findings - Whole-body fluid and cartilage sensitive MRI sequences are necessary for patients with multiple hereditary exostoses (MHE) and enchondromatosis to reveal the cartilaginous portion of the tumors and the associated bursitis - Post-contrast imaging is critical in patients with familiar Paragangliomatosis to identify small mediastinal and retroperitoneal paragangliomas - Diffusion-weighted imaging is useful in patients with an increased risk of malignant tumors (for example, in Li-Fraumeni syndrome) or when a malignant degeneration of a benign lesion is suspected

#### TABLE OF CONTENTS/OUTLINE

- Imaging approach in hereditary tumor syndromes - Role of Whole-Body MRI for screening, detection, and follow-up of hereditary multisystem and multisite tumors - MR imaging acquisition protocol and evaluation in MHE, Enchondromatosis, and Maffucci syndrome - MR imaging acquisition and evaluation in familiar Paragangliomatosis - MR imaging acquisition and evaluation in Neurofibromatosis - MR imaging acquisition and evaluation in Li-Fraumeni syndrome - When to use Dw imaging - When to use post-contrast imaging

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## Abstract Archives of the RSNA, 2023

MSEE-4

### Getting Started with PCCT: Lessons Learned

#### Participants

Fides Schwartz, MD, Durham, NC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Photon-counting computed tomography (PCCT) uses energy-resolving detectors whereas conventional CT detectors integrate the entire x-ray signal. Decision trees for protocol selection and scan mode are different from EID and must be defined at scanner setup. Technologists need to learn the use of a new interface. Automatic monoenergetic reconstructions with PCCT need to be optimized by imaging protocol including display window levels. Higher spatial resolution may increase image noise, but can be beneficial for many applications. Detector based spectral information collected, creates the need to set up what reconstructions automatically get sent to PACS. This project is geared toward helping new users in the RSNA imaging community in their decision-making processes when setting up a new clinical photon-counting CT. Patient case examples from the PCCTs installed at three major US institutions are shown to underline benefits of the new scanner system.

#### TABLE OF CONTENTS/OUTLINE

Overview of differences between PCCT and EID scanner systems  
New Terminology  
What do I need to set up  
Setting up your exam cards: scan modes, reconstruction kernels  
Reviewing the images: adjusting window level settings, sending thinner slices  
Comparison of PCCT and EID images from three major US institutions  
Abdominal imaging  
Pediatric imaging

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## Abstract Archives of the RSNA, 2023

MSEE-40

### How Multiple Joint CT Scanning Would Benefit from Artificial Intelligence

#### TEACHING POINTS

Teaching Points: 1. Artificial intelligence (AI) diagnosis platforms are playing more and more important role in clinical imaging diagnosis. 2. Multi-part joint CT scanning can highly reduce the radiation dose and contrast injection volume, effectively reduce the scanning time to protect patients and improve diagnosis efficiency while remaining image quality. 3. Taking coronary and carotid-cerebral joint scanning as example, the diagnosis time and mouse click number using AI platform can be reduced to 80% - 90% and 20% - 60% comparing to manual diagnosis. There is more diagnosis time reduction for junior radiologists than senior radiologists. And the diagnosis accuracy is comparable between AI platform and senior manual diagnosis. 4. We assume AI platform can help make the whole-body CT diagnosis more efficient and reduce 70 - 90% diagnosis time with body auto-segmentation and auto-diagnosis. AI platform offers over-sensitive diagnosis results and radiologists only need to double check to screen out wrong results.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: The purpose of this educational exhibit is to: 1. Review the current development and application of AI diagnosis platforms. Review the clinical benefit and outcome of multi-part joint CT scanning. 2. Demonstrate the role of AI platform for coronary and carotid-cerebral atherosclerosis diagnosis using one-step heart-brain CT angiography. 3. Illustrate the potential application value of AI platform for whole-body CT scanning using auto-segmentation and auto-diagnosis.

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## Abstract Archives of the RSNA, 2023

MSEE-41

### Imaging-based Response Criteria in Oncologic Clinical Trials: What Radiologists Need to Know

#### Participants

Guilherme M. Cunha, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Discuss the role of imaging for assessing treatment response as endpoint of oncologic clinical trials. 2) Summarize differences and similarities of treatment response assessment in clinical practice vs for clinical trials. 3) Review the most common imaging-based treatment response criteria used in oncologic clinical trials. 4) Provide guidance on tumor response interpretation and reporting. 5) Discuss future directions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Relevance of clinical trials for advances in medicine and patient care. b. Oncologic clinical trials: Definitions and practical points. c. The role of imaging in oncologic clinical trials. 2. Assessment of response during oncologic treatment: a. Differences to clinical practice. b. Standardization. c. Blind and independent review. d. Need for objective metrics and endpoints. 3. Imaging-based treatment response criteria: a. Rationale for different criteria. b. Target vs non-target lesions. c. Pictorial review of the most used response criteria. 4. Imaging-based treatment response assessment: a. Image analysis and interpretation. b. Reporting. 5. Future directions: a. Criteria updates. b. Technical Innovations.

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## Abstract Archives of the RSNA, 2023

MSEE-42

### Evaluation of Hidradenitis Suppurativa Through Imaging Methods

#### Participants

Carolina Almeida, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Hidradenitis suppurativa is a chronic inflammatory skin condition with lesions including deep-seated nodules and abscesses, draining tracts, and fibrotic scars. 2) The classification of the severity of hidradenitis suppurativa is done clinically using the Hurley scale. Correct severity classification allows for appropriate treatment. 3) Currently, high-frequency ultrasound has been used to map lesions and proposes a new classification: clinical-sonographic scoring system (SOS-HS). 4) Explain how lesions are classified using ultrasonography and the standardization of nomenclature. 5) Clarify doubts about magnetic resonance imaging protocols in the evaluation of hidradenitis suppurativa and when to use this method. 6) To present 3D reconstruction as a useful tool for the pre-surgical study of lesions. 7) Correlate clinical and ultrasound findings, magnetic resonance imaging and 3D reconstruction.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of hidradenitis suppurativa. 2) Hurley classification. 3) Criteria for diagnosing hidradenitis suppurativa by ultrasonography. 4) Hidradenitis suppurativa 3T MRI protocol. 5) Cases exemplifying the importance of imaging exams in the clinical and surgical management of the disease.

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## Abstract Archives of the RSNA, 2023

MSEE-43

### Beyond the Neonatal Intensive Care Unit: Imaging of Long-term Sequel of Prematurity

#### TEACHING POINTS

Radiologists should be aware of the potential for late imaging manifestations in patients with a remote history of prematurity, and carefully evaluate imaging studies to identify these complications. Late common CNS manifestations include white matter injury and post-hemorrhagic hydrocephalus. Both frequently co-exist and may have distinctive features on imaging. Advanced chest imaging techniques, including CT and MRI, can enhance the accurate diagnosis and monitoring of late lung complications of prematurity such as bronchopulmonary dysplasia. Late complications of necrotizing enterocolitis, such as strictures and short bowel syndrome, can be accurately identified and monitored using appropriate abdominal imaging techniques, which should be tailored specifically to the patient.

#### TABLE OF CONTENTS/OUTLINE

Outline I. Introduction Premature birth rates and associated health risks Role of imaging in the management of premature infants II. Late Imaging Features of Prematurity Brain abnormalities: periventricular leukomalacia, cerebral atrophy, post-hemorrhagic hydrocephalus, etc. Lung abnormalities: bronchopulmonary dysplasia. Gastrointestinal abnormalities: long term sequel of necrotizing enterocolitis Bone abnormalities: osteopenia, fractures, etc. Differentiating late imaging features from other conditions III. Clinical Case Studies and Outcomes VI. Conclusion Recap of key points Future directions for research and clinical practice.

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## Abstract Archives of the RSNA, 2023

MSEE-44

### The Perirenal Space: Anatomy and Spectrum of Disease

#### Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Anatomy of the perirenal space with boundaries, key landmarks and pathways for the spread of disease. 2. Complete revision of pathology that can arise in the perirenal space. Radiologic clues to approach the final diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of the perirenal space: The Inverted Cone 1.1. Perirenal space anatomy with illustrations. 1.2. Key relations. 2. Pathology of the perirenal space 2.1. Masses/Pseudomasses: Pattern based diagnostic approach to perirenal masses and pseudomasses. Renal cell carcinoma. Lymphoma. Leukaemia. Sarcoma and liposarcoma. Myeloma. Lymphangioma. Angiomyolipoma. Extraadrenal myelolipoma. Pancreatic pseudocyst. GIST. 2.2. Collections/Fluid: Infectious: perirenal abscess, xantogranulomatous pyelonephritis, emphysematous pyelonephritis. Perirenal hematoma. Perirenal urinoma. 2.3. Inflammation/Systemic: Retroperitoneal fibrosis. IgG4-related-disease. Erdheim-Chester disease. Castleman disease. Rosai-Dorfman disease. 2.4. Others/Miscellaneous: Extramedullary hematopoiesis. Spilled lithiasis after nephrolithotripsy. Congested kidneys. 2.5. Summary. 3. Take home points

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## Abstract Archives of the RSNA, 2023

MSEE-45

### No Worming Your Way Out of This One: Multimodality Imaging of Helminthic Infections

#### Participants

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize the radiologist with the variety of helminths which infect humans. Discuss the epidemiology, clinical presentation, and medical complications/sequelae of helminthic infections in humans. Describe the imaging features associated with common and uncommon sequelae of helminthic infections across imaging modalities (ultrasound, CT, MRI). Provide an overview of management and treatment of helminthic infections.

#### TABLE OF CONTENTS/OUTLINE

Classification of helminths, helminth lifecycles, and epidemiology. Potential complications of helminthic infection. Role of imaging and imaging features associated with helminthic infections, including: Neurologic (e.g., neurocysticercosis, ocular cysticercosis, ocular toxocariasis); Pulmonary (e.g., paragonimiasis); Cardiac (e.g., filariasis-associated tropical hyper-eosinophilia with Loeffler endocarditis and restrictive cardiomyopathy); Gastrointestinal (e.g., ascariasis, fascioliasis, cystic/alveolar/polycystic echinococcosis); Urogenital (e.g., genital schistosomiasis); Musculoskeletal: (e.g., onchocercosmata, filarial elephantiasis, dirofilariasis). Management of helminthic infections and their sequelae.

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## Abstract Archives of the RSNA, 2023

MSEE-46

### Getting Under Your Skin: Multimodality Imaging of Protozoan Infections

#### Participants

Jannatun Sikder, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize the radiologist with the variety of protozoa which infect humans. Discuss the epidemiology, clinical presentation, and medical complications/sequelae of protozoan infections in humans. Describe the imaging features associated with common and uncommon sequelae of protozoan infections across imaging modalities (ultrasound, CT, MRI). Provide an overview of management and treatment of protozoan infections.

#### TABLE OF CONTENTS/OUTLINE

Classification of protozoa. Epidemiology of protozoan infections. Role of imaging in diagnosing protozoan infections, including imaging features associated with protozoan infections and their complications: Neurologic (e.g., cerebral malaria, toxoplasmosis); Chest/Cardiac (e.g., pleuropulmonary amoebiasis, acute myopericarditis and chronic fibrosing cardiomyopathy from Chagas disease); Gastrointestinal (e.g., Chagasic megaesophagus and achalasia, amoebic dysentery and hepatic abscess, giardiasis, visceral leishmaniasis); Urogenital (e.g., trichomoniasis resulting in Fitz-Hugh-Curtis syndrome, ureteric dilatation from Chagas disease); Musculoskeletal: (e.g., Giardia synovitis, sarcocystis myositis). Management of protozoan infections and their sequelae.

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## Abstract Archives of the RSNA, 2023

MSEE-47

### **The Beauty And The Botched: A Pictorial of Usual, Unusual, and Botched Cosmetic Procedures for the Unsuspecting Radiologist**

#### **Participants**

Alexander Sasse, BA, New Haven, CT (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Familiarize the radiologist with the diversity of implant procedures performed, with particular focus on the sociocultural phenomenon that is cosmetic implant surgery (including historical context and evolution of the practice).
- Describe typical and atypical implant locations of implants, and their appearances on medical imaging studies.
- Describe potential complications of cosmetic implants and imaging findings associated with “botched” implant procedures.
- Discuss management of “botched” and otherwise complicated implants, where applicable.

#### **TABLE OF CONTENTS/OUTLINE**

Discuss history of cosmetic implant procedures and diversity of current practices/implant placements. Discuss complications and appearance of “botched” implants. Discuss the role of imaging and imaging features in visualizing both appropriately placed and “botched” or otherwise complicated implants: • Head and Neck (e.g., chin implant) • Breast (e.g., saline and silicone implants) • Urogenital (e.g., scrotal and penile implants) • Extremities (e.g., muscle-simulating implants) • Soft tissue: (e.g., buttock implants). Discuss the management of botched cosmetic implants and other associated complications.

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## Abstract Archives of the RSNA, 2023

MSEE-48

### Alcohol-use Related Diseases and Disorders: Head to Toe Imaging Findings

#### TEACHING POINTS

Alcohol is a significant contributor to the global burden of diseases. Understand the metabolism of alcohol, and effects of alcohol and its metabolites on various organs. Review imaging findings of alcohol-use related diseases and disorders head to toe.

#### TABLE OF CONTENTS/OUTLINE

Metabolism of alcohol and factors affecting metabolism. Pathophysiology of alcohol induced damage to various organs. Imaging findings: Central nervous system: Wernicke-Korsakoff syndrome, hyperammonemic encephalopathy, subacute combined degeneration of the spinal cord, diffuse cerebral atrophy, osmotic demyelination syndrome, Marchiafava-Bignami disease Cardiovascular system: Alcoholic cardiomyopathy Lungs: Aspiration and bacterial pneumonia, acute respiratory distress syndrome Gastrointestinal tract: Fatty liver, acute alcoholic hepatitis, acute and chronic alcoholic steatohepatitis, alcoholic cirrhosis, hepatocellular carcinoma, acute and chronic pancreatitis, GI dysbiosis, Boerhaave syndrome, alcoholic gastritis Genitourinary tract: Renal stones, hypogonadism Musculoskeletal system: Alcohol induced muscle disease, avascular necrosis of the femoral heads, osteoporosis, gout Cancers of the head and neck, esophagus, breast, colon, and rectum Fetus: Fetal alcohol syndrome

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## Abstract Archives of the RSNA, 2023

MSEE-49

### Extrapulmonary Tuberculosis: Imaging Findings Beyond the Chest

#### Participants

Irene Diaz, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Extrapulmonary tuberculosis affects the lymph nodes most frequently, but it can affect any other organ of the body. The presence of necrotic lymph nodes and other organ-specific imaging features increases the diagnostic probability of extrapulmonary disease.

#### TABLE OF CONTENTS/OUTLINE

Objectives To identify imaging features that are suggestive of extrapulmonary tuberculosis and its differential diagnosis. Findings Extrapulmonary tuberculosis can be challenging to diagnose as it can mimic many other diseases, so a biopsy is often required. An image-based quiz will lead the review of: Cases of central nervous system, head and neck, lymphatic, abdominal, genitourinary, and musculoskeletal tuberculosis; describing some key imaging features and including its main differential diagnosis. Conclusion Extrapulmonary tuberculosis remains a challenge to diagnose. It is essential to know its key imaging features for an early and successful diagnosis.

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## Abstract Archives of the RSNA, 2023

MSEE-5

### Demystifying Mucin in the Abdomen and Pelvis: Tissue Characterization and Spectrum of Disease

#### TEACHING POINTS

1. Mucinous neoplasms are a diverse group of benign and malignant tumors arising from mucin-producing epithelial cells. 2. Mucinous neoplasms arise from a wide range of organs including the appendix, ovary, pancreas, colon, and rectum. 3. Mucin has a characteristic imaging appearance at each modality and differs from other types of tumors that have higher cellular density. 4. Pseudomyxoma peritonei is characterized by the spread of mucinous material throughout the peritoneal cavity and has specific imaging findings. 5. Diagnosis and treatment of mucinous tumors requires a multidisciplinary approach that includes imaging, surgery, and systemic therapies, including hyperthermic intraperitoneal chemotherapy in the case of pseudomyxoma peritonei.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction  
a. Overview of mucinous neoplasms  
II. Imaging features of mucinous neoplasms with case examples  
a. Mucinous cystic neoplasms of the pancreas  
b. Appendiceal mucinous neoplasms  
c. Colon and rectal mucinous adenocarcinoma  
d. Ovarian mucinous cystadenoma and cystadenocarcinoma  
e. Miscellaneous (seminal vesicle, primary peritoneal)  
III. Pseudomyxoma peritonei  
a. Imaging features  
b. Treatment, including hyperthermic intraperitoneal chemotherapy  
IV. Conclusion  
a. Summary of key teaching points

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## Abstract Archives of the RSNA, 2023

MSEE-50

### Technical Aspects in Imaging Patients Under Extracorporeal Membrane Oxygenation (ECMO) Support

#### Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review recommendations to perform optimal CT examinations in patients under extracorporeal membrane oxygenation (ECMO) support according to clinical suspicion and within possible clinical scenarios.- Illustrate examples of optimal and suboptimal examinations in this populations.- Describe the key technical aspects to obtain adequate images and avoid errors.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction and physiology during ECMO support 2. Optimizing the technique: protocol recommendations regarding access, contrast dose and rate injection 2.1. General considerations 2.2. Venovenous ECMO 2.3. Venoarterial ECMO 2.3.1. Central nervous system evaluation 2.3.2. Pulmonary embolism 2.3.3. Aorta evaluation 2.3.4. Abdomen and pelvis 3. Summary and conclusions

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## Abstract Archives of the RSNA, 2023

MSEE-51

### **I CT Dead People: Exploring the Application of Postmortem Imaging to Cause of Death Investigation in a Hospital Setting**

#### **Participants**

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Familiarize the radiologist with the growing field of forensic radiology, primarily as it pertains to postmortem imaging and cause-of-death investigation.
- Provide an introduction to postmortem computed tomography (CT), including its benefits and limitations.
- Describe the application of and experiences with postmortem CT at an academic teaching hospital.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction to forensic radiology with focus on role in cause-of-death investigation.
- Benefits of postmortem CT as a supplement to autopsy.
- Common postmortem changes on imaging and how to mitigate them, where applicable.
- Application of and experience with postmortem CT at an academic teaching hospital, including: integration with the Autopsy Service; types of cases performed; imaging methods utilized; and correlation with autopsy.
- Case image integration throughout, as illustrative examples.

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## Abstract Archives of the RSNA, 2023

MSEE-52

### Microvascular Imaging Ultrasound (MVI) in Children: Current Use and Potential Applications

#### Participants

Santiago Martinez-Correa, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To overview the current knowledge of MVI in children. 2. To illustrate MVI benefits in specific pediatric conditions. 3. To describe possible clinical applications of MVI in the future.

#### TABLE OF CONTENTS/OUTLINE

- Disclosures. - Background Current use and advantages of advanced ultrasound techniques. - Microvascular Imaging Ultrasound 1. Technique description Advanced ultrasound technology that allows high-resolution visualization of slow-flow microvasculature by using clutter suppression algorithms. 2. Protocol Acoustic windows and settings adjustment. 3. Advantages and pitfalls: non-invasive tool, can be used at the bedside. Depends on the scan settings and operator. - Clinical use: 1. Brain Evaluation of vascularity in hypoxic-ischemic injury, hydrocephalus, and infections. 2. Thyroid Approach to vasculature architecture, and focal lesions. 3. Liver Characterization of focal lesions. 4. Spleen Use in assessing trauma, infarcts, focal lesions, and infections. 5. Kidney Evaluation of solid and cystic lesions. 6. Reproductive (Ovaries/Testes): Use in gonadal torsion, and infections. 7. Bowel Assessing small bowel infection and/or inflammation. 8. Lymph nodes Blood flow evaluation in benign and malignant nodes. 9. Skin Evaluation of infected subcutaneous nodules. - Potential future use: 1. MVI as an ancillary method in assessing pediatric brain death. 2. Liver and renal post-transplant perfusion follow-up. 3. Diagnostic and prognostic tool during ECMO therapy. - Take Home Points.

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## Abstract Archives of the RSNA, 2023

MSEE-53

### Immunotherapy-Related Adverse Events - A Review of the Breadth of Toxicities and Imaging Findings

#### TEACHING POINTS

- Blocking of immune checkpoints by immune checkpoint inhibitors (ICIs) can cause novel autoimmune disease or uncover subclinical autoimmune disease.- These toxicities are termed immune-related adverse events (irAEs) and can involve any organ.- IrAEs can be mistaken for disease progression or non-autoimmune processes.- Incidence of irAEs is 25% with anti-CTLA-4 inhibitors, 10% with anti-PD(L)-1 inhibitors, and 50% for combination therapy.- The lungs and colon are the most common organs affected radiologically, although cutaneous manifestations are the most common overall.- IrAEs are graded from 1 (asymptomatic) to 5 (death) and management options include continuing immunotherapy, holding immunotherapy and initiating corticosteroids, and discontinuing immunotherapy permanently.

#### TABLE OF CONTENTS/OUTLINE

- Pneumonitis: o Organizing pneumonia o Nonspecific interstitial pneumonia o Hypersensitivity pneumonitis o Bronchiolitis o Acute interstitial pneumonitis/ARDS o Radiation-recall pneumonitis- Sarcoid-like reaction- Enterocolitis- Pancreatitis- Hepatitis- Nephritis- Hypophysitis- Adrenalitis- Thyroiditis- Aortitis- Pericarditis- Serositis: o Pericardial effusion o Pleural effusion o Peritoneal effusion- Sinusoidal obstruction syndrome- Arthritis- Myositis- Polymyalgia rheumatica-like syndrome

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## Abstract Archives of the RSNA, 2023

MSEE-54

### Phenotypic Diversity of Germinal Center-Derived Malignancies: Implications on Diagnosis and Management

#### Participants

Steven Chua, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The germinal center (GC) is a unique and dynamic microenvironment within lymphoid follicles where selection, maturation and antibody production by activated B lymphocytes occur in response to infections. A multitude of unique malignancies arise within the GC that display characteristic histogenesis, genetic abnormalities, tumor pathways, molecular biology and varied clinical behavior. PET/CT is the mainstay for the diagnosis and staging of these tumors and is critical for the assessment of treatment response. Neoplastic B cells within different GC compartments and maturation stages give rise to follicular lymphoma, Burkitt's lymphoma and diffuse large B cell lymphoma that harbor distinctive genetic mutations. While the follicular T cell lymphoma and angioimmunoblastic T cell lymphoma originate from helper T cells, the follicular dendritic cell sarcomas evolve from the follicular dendritic cells of mesenchymal origin. We present salient imaging features of GC-derived malignancies and correlate with histopathology and tumor genetics. We discuss the implications of the diagnosis on tailored therapeutics and prognosis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction, epidemiology, clinical features this group of germinal center-derived tumors. 2. Histopathology, clinical features, molecular biology of these tumors. 3. Multimodality cross-section delineation of imaging features with CT, MR and PET/CT. 4. Prognosis and management. \* Follicular lymphoma.\* Burkitt's lymphoma.\* Diffuse large B cell lymphoma.\* Angioimmunoblastic T-cell lymphoma.\* Follicular T cell lymphoma.\* Peripheral T cell lymphoma with Tfh phenotype.\* Follicular dendritic cell sarcomas.

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## Abstract Archives of the RSNA, 2023

MSEE-55

### Diversity of Epstein-Barr Virus-associated Diseases

#### Participants

Moto Nakaya, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Summarize the clinical and radiological findings of Epstein-Barr virus (EBV)-associated diseases caused by various etiologies.
- Describe radiological findings in EBV-associated neoplasms in contrast to those observed in uninfected conventional tumors.
- Recognize important imaging points that lead to a definitive diagnosis in patients with suspected EBV-associated diseases.

#### TABLE OF CONTENTS/OUTLINE

I. What are EBV-associated diseases? • Pathomechanisms • The role of EBV in tumorigenesis and progression • Recommended workups

II. Content

Infection: infectious mononucleosis, human immunodeficiency virus co-infection

Autoimmune: multiple sclerosis, systemic lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease, type 1 diabetes mellitus, juvenile idiopathic arthritis, celiac disease

Neoplasm: lymphomas (primary central nervous system lymphoma, natural killer/T-cell lymphoma, diffuse large B-cell lymphoma, lymphomatoid granulomatosis, and post-transplantation lymphoproliferative disorder), solid tumor (gastric cancer, squamous cell carcinoma, EBV-associated smooth muscle tumor, leiomyosarcoma, breast cancer, hepatocellular carcinoma, and follicular dendritic cell sarcoma), others (EBV-associated inflammatory pseudotumor - like follicular/fibroblastic dendritic cell sarcoma)

Medication-related EBV infection: methotrexate-related malignant lymphoma

Miscellaneous: EBV-positive mucocutaneous ulcer

III. Summary

1. The entities associated with EBV are diverse.
2. Clinical and radiological findings can be the diagnostic indicators of the etiology.
3. Appropriate workup is necessary for timely diagnosis and management.

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## Abstract Archives of the RSNA, 2023

MSEE-56

### Beyond the Skeletal Survey: Multimodality Imaging Manifestations of Plasma Cell Dyscrasias

#### Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the wide spectrum of plasma cell dyscrasias, including common and rare subtypes, and their pathophysiology. 2. To present the multimodality imaging features seen in the spectrum of plasma cell dyscrasias to aid in accurate diagnosis and staging, as well as subsequent evaluation of post-therapeutic response.

#### TABLE OF CONTENTS/OUTLINE

Plasma cell dyscrasias are a group of hematological disorders that arise from the abnormal proliferation of plasma cells, which are responsible for producing antibodies. These disorders include monoclonal gammopathy of undetermined significance (MGUS), Waldenström macroglobulinemia, multiple myeloma (MM) and its variants, including smoldering myeloma (SMM), plasma cell leukemia (PCL), solitary and extramedullary plasmacytoma, and amyloidosis. Recent advances in treatment with chemotherapy and immunotherapies have led to improved outcomes, with some patients achieving long-term remission. Early detection and diagnosis allow for appropriate initiation of surveillance and treatment, which will improve outcomes as well as preserve organ function. The imaging manifestations of plasma cell dyscrasias can provide crucial information for diagnosis, prognosis, and management of these diseases. This educational exhibit will (1) review the pathophysiology of plasma cell dyscrasias and the wide spectrum of subtypes, and (2) present the multimodality imaging features of the common and rare subtypes of plasma cell dyscrasias.

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## Abstract Archives of the RSNA, 2023

MSEE-57

### Practical Imaging Approach to Unraveling the Causes of Non-neoplastic Lymphadenopathy

#### Participants

Sota Masuoka, MD, kashiwa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Non-neoplastic lymphadenopathy may not have specific histopathologic features within the lymph node itself, but determining its underlying cause is still important. Radiologists play a critical role in identifying the cause of lymphadenopathy in three scenarios: (1) when infection or inflammation is clinically suspected, (2) during initial or follow-up imaging for malignancy, and (3) when abnormal lymph nodes are detected incidentally on imaging. Careful observation of the imaging characteristics and anatomical distribution of the abnormal lymph nodes, along with other ancillary imaging findings and clinical information, can help establish an accurate diagnosis of the etiology of the lymphadenopathy, leading to appropriate treatment and avoiding unnecessary further testing for the patient. This exhibit aims to: 1. Review the diverse underlying conditions that cause non-neoplastic lymphadenopathy and their characteristic imaging findings. 2. Discuss an imaging-based approach for diagnosing the underlying causes of non-neoplastic lymphadenopathy.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of non-neoplastic lymphadenopathy  
2. Imaging approach for non-neoplastic lymphadenopathy: Focus on inferring the underlying cause- Based on the distribution of abnormal lymph nodes- Based on the imaging characteristics of abnormal lymph nodes  
3. Case illustrations- (1) Clinically suspected inflammation or infection- (2) Initial/follow-up imaging for malignancies- (3) Incidental detection of abnormal lymph nodes on imaging  
4. Summary

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

MSEE-58

### Stroma-Derived Neoplasms and Tumor-Like Lesions of the Lymphoid Tissues: 2022 WHO Classification System Updates

#### Participants

Steven Chua, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A new category of mesenchymal neoplasms and tumor-like lesions that involve the lymphatic and reticuloendothelial system has been introduced in the 2022 WHO classification of hematolymphoid tumors. This diverse group of tumors include mesenchymal dendritic cell tumors like follicular dendritic cell sarcoma (FDCS) and its inflammatory pseudotumor-like variant (EBV positive inflammatory FDCS), Epstein-Barr virus associated smooth muscle tumor, vascular/vascular-stromal tumors and tumor-like lesions including littoral cell angioma (LCA), hemangioma, bacillary angiomatosis, hemangioendothelioma, angiosarcoma and sclerosing angiomatoid nodular transformation (SANT). These tumors vary in biological potential and prognosis from the indolent littoral cell angioma to the aggressive angiosarcoma. Correlating the salient imaging and histopathological features can facilitate proper identification and optimize treatment to improve morbidity and mortality of patients.

#### TABLE OF CONTENTS/OUTLINE

1. To review the diverse histopathological spectrum of stroma-derived tumors of the lymphoid tissues. 2. To describe epidemiology, tumor genetics, molecular biology and cross-sectional imaging findings of diverse tumors and to correlate them to histopathological features. 3. To discuss the implications of the diagnosis on management and prognostication of these tumors. \* Follicular dendritic cell sarcoma. \* EBV positive inflammatory follicular dendritic cell sarcoma. \* Inflammatory pseudotumor. \* Epstein-Barr associated smooth muscle tumor. \* Littoral Cell Angioma. \* Bacillary angiomatosis. \* Hemangioendothelioma. \* Angiosarcoma. \* Sclerosing angiomatoid nodular transformation.

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## Abstract Archives of the RSNA, 2023

MSEE-59

### Imaging Diagnostic Odyssey of Germ Cell Tumors: Illuminating the Path with Insights into Epigenetic Pathogenesis

#### Participants

Toshitaka Ishiguro, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Germ cell tumors (GCTs) are neoplasms derived from cells committed to the germ cell lineage, but exhibit diverse histologies, including embryonic and extraembryonic components. GCTs also arise at various sites throughout the body, from neonates to adults, making their imaging diagnosis challenging. However, recent progress in understanding the biology of GCTs has allowed them to be categorized into several types based on the latent developmental potential of their cells of origin with different epigenomic features, facilitating our understanding of their anatomical distribution, age of onset, male-to-female ratio, and possible histologies. This exhibit aims to explain this recent classification of GCT types and apply insights into epigenetic pathogenesis to the imaging diagnosis of GCTs, which will contribute to accurate diagnosis leading to better patient outcomes. The purposes of this exhibit are: 1. To explain the recent classification of GCT types based on epigenetic pathogenesis. 2. To review the imaging findings of each histology of GCTs. 3. To discuss the imaging diagnostic approach for GCTs combined with the knowledge of epigenetic pathogenesis.

#### TABLE OF CONTENTS/OUTLINE

1. Minimal essentials of epigenetics for radiologists  
2. Classification of GCT types based on epigenetic pathogenesis  
3. Imaging findings of each histology of GCTs  
4. Imaging diagnostic approach for each type of GCTs combined with the knowledge of epigenetic pathogenesis  
5. Summary

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## Abstract Archives of the RSNA, 2023

MSEE-6

### Multimodality Imaging of Large and Medium Vessel Vasculitis

#### Participants

Mitesh Naik, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To outline classification, clinical presentation, pathogenesis and management of large and medium vessel vasculitis
- To define the role of non-invasive imaging in diagnosis and response to therapy
- To describe the range of modalities used and their relative merits
- To review multimodality appearances of large and medium vessel vasculitis

#### TABLE OF CONTENTS/OUTLINE

Background • Epidemiology, clinical presentation, pathogenesis and management • Classification of Large vessel vasculitis: Takayasu arteritis, giant cell arteritis of Medium vessel vasculitis: Polyarteritis nodosa, Kawasaki disease of Variable vessel vasculitis: Behçet syndrome of Secondary vasculitis Review of international guidance on utilization and interpretation of imaging • Diagnosis • Response assessment • Surveillance • Imaging parameters • Imaging criteria - e.g. PET vascular activity score (PETVAS) Multimodality appearances including pros and cons • Ultrasound • CT angiography • MR angiography and MR vessel wall imaging • 18F-fluorodeoxyglucose-PET/CT • Adjunctive modalities - e.g. renography Case examples with interpretive pearls and pitfalls; differential diagnoses; and complex scenarios

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## Abstract Archives of the RSNA, 2023

MSEE-60

### Multimodality Imaging Features of Hepatoid Adenocarcinoma and its Mimics

#### Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the pathophysiology of hepatoid adenocarcinoma and the common sites involved, including the liver, stomach, pancreas, lung, and ovary. 2. To present, through case-based review, the multimodality imaging features of hepatoid adenocarcinoma, with differential clues to aid in diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Hepatoid adenocarcinoma (HAC) is a rare and aggressive type of cancer that has a histologic appearance similar to hepatocellular carcinoma (HCC) through metaplastic transformation to hepatocyte-like cells. HAC can involve various organs, including the liver, stomach, pancreas, lung, and ovary. Imaging features of HAC may overlap with other extrahepatic tumors, including gastric adenocarcinoma, pancreatic adenocarcinoma, primary lung adenocarcinoma, ovarian adenocarcinoma, or lymphoma, making accurate diagnosis challenging. HAC can produce alpha-fetoprotein (AFP) like HCC, which may be useful in differentiating HAC from tumors in extrahepatic organs. However, given its rarity, unfamiliarity, non-specific clinical presentation, and overlapping imaging features, differentiation of HAC remains difficult and is often diagnosed at an advanced stage or with metastases. At this stage, prognosis of HAC is poor with a median survival of less than one year. Early detection and aggressive treatment, including surgical resection and systemic chemotherapy, are crucial for improving the prognosis of patients with HAC. This educational exhibit will (1) review the pathophysiology of HAC and the common sites of involvement, and (2) present the multimodality imaging features of HAC and differentiation from its imaging mimics.

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## Abstract Archives of the RSNA, 2023

MSEE-61

### Multi-system Imaging Manifestations of Large Vessel Vasculitis

#### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Large-vessel vasculitis (LVV) results in inflammation of the aorta and its major branches and is the most common primary vasculitis in adults. LVV comprises two distinct conditions, giant cell arteritis (GCA), and Takayasu arteritis. LVV can have substantial complications including luminal stenosis, arterial thrombosis and infarction of the corresponding organs and structures. Development of pseudoaneurysms and dissections, and rarely arterial ruptures are potentially serious complications in this patient population. 2. Doppler US is a first-line imaging modality utilized for the assessment of the peripheral arterial system, abdominal aorta, and its branches. Review of normal arterial wall anatomy and pathophysiology of waveforms on Doppler ultrasound, with multi-imaging correlation with particular focus on CTA and MRA.

#### TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of Takayasu and giant cell arteritis and their multi-system potential complications. 2. Discuss general concepts of the assessment of the peripheral arterial system and aorta using Doppler US, CTA, and MRA with emphasis on technique, protocol, image optimization. 3. Demonstrate key multi-modality imaging features LVV. Review role of various imaging applications in diagnosis and surveillance of complications in this group of patients. 4. Discuss management options with interventional radiology procedures.

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## Abstract Archives of the RSNA, 2023

MSEE-62

### COVID-associated Mucormycosis - Imaging Spectrum

#### Participants

Nidhi Goyal, MD, FRCR, Noida, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the spectrum of imaging findings in patients with COVID-associated Mucormycosis. 2. To correlate imaging findings and the clinical-laboratory parameters in patients with COVID-associated Mucormycosis.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of Clinical profile of patients with COVID-associated Mucormycosis. 2. The spectrum of imaging findings in patients with COVID-associated Mucormycosis across different organ systems. 3. Correlation of imaging findings and clinical - laboratory parameters in patients with COVID-associated Mucormycosis. 4. Enlist the key imaging findings which helps in early diagnosis and allows prompt treatment in these patients.

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## Abstract Archives of the RSNA, 2023

MSEE-63

### Role of Imaging in Endocrine Hypertension

#### Participants

Azfar Siddiqui, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Assess the epidemiology, classification, and etiopathogenesis of the endocrine hypertension. 2. Review the role of imaging in localizing the pathology.

#### TABLE OF CONTENTS/OUTLINE

1. Epidemiology and etiopathogenesis of the endocrine hypertension. 2. Incidence and risk factors. 3. Classification and imaging findings: A. Primary Aldosteronism (Conn's syndrome): Adrenal adenoma, carcinoma, hyperplasia B. Pheochromocytoma C. Congenital adrenal hyperplasia D. Cushing syndrome i. Adrenal disorders ii. ACTH secreting tumor: Pituitary adenoma (Cushing disease), Ectopic production - Small cell cancers of the lung thymus, carcinoid, Pancreatic NET, Ovarian steroid cell tumors E. Hyperthyroidism F. Hyperparathyroidism G. Acromegaly

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## Abstract Archives of the RSNA, 2023

MSEE-64

### Spectrum of Imaging Appearances of Perivascular Epithelioid Cell Tumors (PEComas)

#### Participants

Lam Tu, DO, Newark, NJ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. PEComas are very rare mesenchymal tumors of variable malignant potential characterized by smooth muscle and melanocytic differentiation, perivascular distribution and frequent infiltration of small to medium sized vessels. 2. Up to 60% of PEComas are associated with Tuberous Sclerosis Complex (TSC) and TSC and TFE3 gene mutations. Angiomyolipomas and lymphangioleiomyomatosis are the most common PEComa subtypes seen with TSC. 3. PEComa - NOS most commonly arise in the retroperitoneum, uterus and kidneys. 4. Hypervascularity and vessel encasement are common imaging features of PEComas. Vascular invasion, size greater than 5 cm, necrosis and tumor thrombus suggest malignant subtypes. 5. Definitive treatment is surgical resection; massive blood loss may result if extent of vascular invasion is not recognized. TSC-related PEComas may be treated with mTOR inhibitors. The only FDA approved treatment for advanced/metastatic/inoperable PEComa is FYARRO™ (Sirolimus protein-bound particles for injectable suspension).

#### TABLE OF CONTENTS/OUTLINE

Introduction - PEComa definition and etiology  
Background: epidemiology, genetics and classification  
Spectrum of Imaging Features of:  
- Various PEComa subtypes;  
- PEComas in most common locations - Common PEComa mimickers: leiomyosarcoma, GIST, RCC -  
Invasive/malignant PEComas (size, necrosis, tumor thrombus)- Common metastatic sites: lung, liver and peritoneum  
Treatment options

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## Abstract Archives of the RSNA, 2023

MSEE-65

### The 'New' 2022 World Health Organization (WHO) Classification of Lymphoid Neoplasms: A Primer for Radiologists

#### Participants

Diego Cebrian Chaustre, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Familiarize radiologists with new 2022 WHO classification of lymphoid neoplasms review major changes
- Discuss pathology, genetics, and imaging findings of tumor-like lesions select updated lymphomas pertinent to radiologists
- Familiarize the audience with clinically significant, and most important aspects of lymphoma imaging, including the role of CT PET-CT for staging response assessment.
- Review potential therapeutic management implications of the new classification system with special emphasis on novel therapies.

#### TABLE OF CONTENTS/OUTLINE

Introduction 2022 WHO Classification Tumor-like lesions, new tumors changes in existing tumors B-cell lymphoid proliferations lymphomas IgG4-related disease, Castleman's disease, small lymphocytic, splenic B-cell, marginal zone, follicular, mantle cell, diffuse large B-cell, Burkitt, Immunosuppressed-associated lymphomas Hodgkin lymphoma. T-cell lymphoid proliferations lymphomas Kikuchi disease, primary cutaneous T-cell, intestinal T-cell, anaplastic large cell EBV-positive lymphomas Stromal-derived dendritic cell sarcoma, littoral cell angioma, splenic hamartoma SANT Imaging findings Role of Imaging in Staging Response Assessment-CT PET-CT: Lugano classification Deauville scoring system Management Novel therapies ConclusionThe current WHO classification of lymphoid neoplasms added new tumors reorganized previous categories based on updated molecular/genetic findings that change management decisions. Select lymphomas demonstrate characteristic genetic/pathology imaging findings. Imaging with CT PET/CT plays a pivotal role in staging, response assessment testing the efficacy of novel drugs.

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## Abstract Archives of the RSNA, 2023

MSEE-66

### A Pictorial Review of Extrapulmonary Tuberculosis: From Head to Toe

#### Participants

Masatoshi Hotta, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Extrapulmonary tuberculosis (EPTB) is a form of tuberculosis that affects parts of the body other than the lungs and accounts for 10-20% of all TB infections. A diagnosis of EPTB is challenging and can mimic malignancy, often requiring a biopsy. Therefore, radiologists should be familiar with the imaging features of EPTB, even when there is no active pulmonary involvement. This exhibit aims to: 1) review the pathophysiology of EPTB, 2) present characteristic EPTB images of various organ systems, and 3) identify the key imaging findings of EPTB.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction; 2) Central Nervous System (tuberculous leptomeningitis, brain TB, spinal TB); 3) Head and Neck (tuberculous uveitis, pharyngeal TB, tuberculous otitis media); 4) Chest (esophageal TB, endobronchial TB, pericostal TB); 5) Abdomen (hepatic TB, splenic TB, adrenal TB, intestinal TB, peritoneal TB); 6) Genitourinary (renal TB, seminal vesicle TB, epididymis/testicular TB); 7) Musculoskeletal (tuberculous spondylitis, tuberculous arthritis, tuberculous osteomyelitis)

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## Abstract Archives of the RSNA, 2023

MSEE-67

### Multisystem Imaging Manifestations of Fibromuscular Dysplasia

#### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Fibromuscular dysplasia (FMD) is an idiopathic segmentary, non-inflammatory, non-atherosclerotic disease that can affect all layers of both small and medium-caliber arteries. Clinical manifestations are primarily dependent on the vessels affected by FMD, most frequently affecting the renal, carotid, and vertebral arteries. 2. Complications of FMD can include severe stenosis, hypoperfusion, aneurysm, dissection, arterial occlusion, and subarachnoid hemorrhage in the brain.

#### TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of FMD and its multi-system potential complications, and associated disorders. 2. Discuss general concepts of the assessment of the peripheral arterial system and aorta using Doppler US, CTA, and with MRA, with emphasis on technique, protocol, and image optimization. 3. Demonstrate key multi-modality imaging features FMD. Review role of various imaging applications in diagnosis and surveillance of FMD and its potential complications. 4. Discuss management options with review of available interventional radiology procedures. 5. Discuss the shared features and difference between FMD and polyarteritis nodosa, Takayasu, and other mimics.

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## Abstract Archives of the RSNA, 2023

MSEE-68

### Imaging Manifestations and Treatment of Renovascular Hypertension

#### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Renovascular hypertension is a type of secondary hypertension where high blood pressure develops secondary to renal artery disease. 2. Doppler US is a first line imaging modality utilized for the assessment of the renal arterial system. CTA and MRA are useful confirmatory tests in equivocal or nondiagnostic ultrasonographic exams and can be preferred in specific clinical situations.

#### TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology of renovascular hypertension and its multisystem complications. Causes include atherosclerotic renal artery stenosis, fibromuscular dysplasia, renal artery dissection, renal infarction, Page kidney, polyarteritis nodosa, post EVAR RAS, etc. 2. Discuss general concepts of the assessment of the renal arterial system and abdominal aorta using Doppler US: technique protocol, image optimization, and common pitfalls in diagnosis. 3. Demonstrate key multimodality imaging features of renovascular hypertension. Review role of various imaging modalities in diagnosis and surveillance of complications in this group of patients. 4. Discuss management options with emphasis on interventional radiology procedures.

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## Abstract Archives of the RSNA, 2023

MSEE-69

### US of the Neck Beyond the Thyroid: Parathyroids

#### Participants

Irene Dixe de Oliveira Santo, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss the role of ultrasound in the evaluation of parathyroid gland pathologies; 2. Discuss the advantages of ultrasound including the possibility of evaluation for concurrent nodular thyroid disease which may alter the surgical approach and treatment planning; 3. Review the role and advantages of complementary imaging modalities in the diagnosis and management of parathyroid gland pathologies including SPECT with technetium-99m sestamibi, 4D computed tomography, and venous sampling

#### TABLE OF CONTENTS/OUTLINE

1. Embryology, anatomy, and function of the parathyroid glands; 2. Clinical manifestations of hyper- and hypoparathyroidism; 3. Role of ultrasound in the assessment of the parathyroid glands: advantages, limitations, technical considerations; 4. Ultrasound imaging of parathyroid pathologies: parathyroid adenoma(s) involving one or multiple parathyroid glands, parathyroid carcinoma, multiple endocrine neoplasia, Cowden's disease, parathyromatosis, ectopic or intrathyroidal parathyroid glands; 5. Distinguish parathyroid gland pathologies from its mimics such as exophytic thyroid nodules, normal and abnormal lymph nodes, the esophagus, and the longus colli muscle; 6. Role of additional imaging modalities: SPECT with Tc-99m sestamibi, 4D computed tomography, and venous sampling; 7. Treatment options and clinical challenges

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## Abstract Archives of the RSNA, 2023

MSEE-7

### Review of MRI Defecography: Technique, Indication, Diagnosis and Limitations

#### Participants

Alice Schuch, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pelvic floor disorders are commonly encountered in clinical practice and can significantly affect patient quality of life. MR defecography is a non-invasive exam that provides high spatial resolution, multiplanar capability, and superior soft tissue differentiation for assessing the pelvic floor compartments at rest and during defecation maneuvers. Abdominal radiologists should be able to recognize normal and abnormal anatomy, as well as the most common pelvic floor pathologies.

#### TABLE OF CONTENTS/OUTLINE

MRI defecography is a non-invasive diagnostic technique used to evaluate the function of the pelvic floor compartments during rest, squeezing, valsalva and defecation, in patients with obstructed defecation, constipation, pelvic pain, incontinence and pelvic organ prolapse and others, providing a more accurate diagnosis of pelvic floor disorders that can guide treatment and surgical planning. Usual findings include cystocele, uterine prolapse, enteroceles, perineal descent, and rectal intussusception, and the association between these alterations. While MRI defecography is a valuable diagnostic tool for assessing pelvic floor disorders, it does have some limitations, such as cost, availability, interpretation variability, and patient discomfort. Abdominal radiologists should be able to recognize normal and abnormal anatomy, and evaluate the common pathologies that can affect the three pelvic floor compartments, especially those that may appear only through dynamic images of the pelvis.

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## Abstract Archives of the RSNA, 2023

MSEE-70

### Bigger Butt Not Better: A Radiologist's Guide to the Lifecycle of Cosmetic Injectables

#### Participants

Nadia Solomon, MD, MSc, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Familiarize the radiologist with the composition and use of cosmetic injectables, with a focus on illegal and unregulated substances and practices.
- Describe the appearances of injectables on imaging throughout the body, as well as potential complications and their associated imaging findings.
- Provide guidance to radiologists for how to report findings related to injectables and their complications to best guide surgical management.
- Describe how patients with injectables are surgically managed, including post-operative imaging findings and imaging of post-operative complications.

#### TABLE OF CONTENTS/OUTLINE

- Introduction to cosmetic injectables, their composition (legal and illegal substances), and common and uncommon injection locations.
- Imaging appearance of injectables throughout the body and associated complications.
- Important features to report on (i.e., foreign material migration, intramuscular location).
- Approach to surgical management.
- Imaging of post-operative findings and common post-operative complications.

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## Abstract Archives of the RSNA, 2023

MSEE-71

### Opportunistic Imaging in Musculoskeletal Radiology: The Data Scavengers

#### Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Each radiologic examination contains robust additional data that can be leveraged for opportunistic screening of disease and risk assessment of future adverse clinical events. 2. With the radiology transition from volume-based to value-based practice the interest in opportunistic imaging is growing. 3. AI models enabling fully automated evaluation of biometric measures provide the opportunity of individualized patient risk assessment and pre-symptomatic diseases detection. 4. Opportunistic imaging in musculoskeletal radiology can be used in: ü Detecting clinically important musculoskeletal findings (e.g., screening for osteoporosis). ü Systematically discovering non-musculoskeletal findings in musculoskeletal studies (e.g., screening for abdominal aorta aneurysm in lumbosacral MRI).

#### TABLE OF CONTENTS/OUTLINE

- Assess opportunistic imaging for detection of sarcopenia in cancer patients and its clinical relevance
- Review opportunistic screening for osteoporosis in abdominopelvic or thoracic CT examinations
- Review opportunistic screening for abdominal aorta aneurysm in lumbosacral MRI examinations
- Discuss the role of radiomic features extracted from imaging specially in oncology imaging as an opportunity to improve diagnosis and prognostication
- Explain the capacity of AI models to fully automate assessment of biometric measures for the use in musculoskeletal imaging

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## Abstract Archives of the RSNA, 2023

MSEE-72

### Dual-Energy CT: Still Haven't Found What You Are Looking For

#### Participants

Roberto Garcia Figueiras, PhD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Dual-energy CT (DECT) imaging has broadened the potential of CT imaging by offering multiple postprocessing datasets which are achieved using discrete acquisitions at more than one energy level. DECT shows profound capabilities to improve diagnosis based on its superior material differentiation, but alsoThe aim of this exhibit is:-To review physical concepts of DECT, parameters influencing image quality, postprocessing methods, and daily routine workflow.-To describe the strengths and weaknesses of different DECT platforms.-To discuss advantages and limitations of DECT in different clinical scenarios.-To provide a comprehensive and practical overview of diagnostic pitfalls and possible artifacts that may be encountered at DECT.-To evaluate future perspectives for DECT imaging and photon-counting technology.

#### TABLE OF CONTENTS/OUTLINE

-Basic concepts of DECT: atomic numbers, energy levels, and other physics concepts.-Strengths and weaknesses of different DECT platforms: "one does not fit all".-Understanding the puzzle of the different types of DECT images.-What you can and cannot expect from a DECT scan: opportunities and limitations (that you need to know) of DECT in daily practice.-Pitfalls and artifacts: how to avoid them?-Cutting-edge applications of DECT: iodine concentration and tumor response, advanced material characterization, electron-density maps in radiotherapy, etc.-Future directions: from dual-energy to photon-counting CT.-Conclusions

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## Abstract Archives of the RSNA, 2023

MSEE-73

### Multimodality Imaging of Sarcoidosis and Sarcoid-like Reaction

#### Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the clinical findings, prognosis, management and imaging guidelines for sarcoidosis and associated complications.
- Describe the imaging appearance of sarcoidosis across multiple organ systems and modalities.
- Discuss the differential diagnoses for imaging findings of for sarcoidosis.
- Discuss radiology-pathology correlation as it applies to sarcoidosis.

#### TABLE OF CONTENTS/OUTLINE

Sarcoidosis is a systemic disease but presents most commonly in the lungs. While up to 90% of patients will have an abnormal chest radiograph, less than 20% of patients will exhibit respiratory symptoms. Extrapulmonary manifestations are seen in up to 40% of patients with involvement of central nervous system, circulatory system, abdomen, musculoskeletal system, or skin. In this educational exhibit we describe the imaging appearance and differential diagnosis of the following pulmonary and extrapulmonary manifestations of sarcoidosis:

- Pulmonary
  - o Natural history stages of pulmonary sarcoidosis, imaging timeline
  - o Chest radiograph findings and signs
  - o Chest CT findings and signs
  - o FDG and Gallium PET
- Cardiac
- Intra-abdominal
  - o Hepatic
  - o Splenic
  - o Renal
  - o Peritoneal
- Neurosarcoidosis
  - o Leptomeningeal
  - o Dural
  - o Pituitary
  - o Endocrine
  - o Cranial nerves
  - o Spine: leptomeningeal, myelopathy
- Musculoskeletal
  - o Cutaneous Sarcoidosis
  - o Bone lesions
  - o Arthropathy
  - o Myopathy
  - o Lofgren syndrome
- Pitfalls
- o Immunotherapy-induced sarcoid-like reaction

Finally, we discuss the relevant radiology-pathology relationships in the systemic manifestations of sarcoidosis with a rich complement of histologic images.

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## Abstract Archives of the RSNA, 2023

MSEE-74

### Nontraditional Uses of CT Contrast Agents

#### TEACHING POINTS

- This abstract discusses the basics of tomographic technique and anatomy, with a focus on the appropriate choice of imaging modality for the evaluation of the specific alterations- Assurance of a valid clinical indication for each contrast medium administration. - To compare positive versus neutral oral contrast material for detecting pathological thoracoabdominal conditions. - Recognize appropriate uses of CT in clinical practice.

#### TABLE OF CONTENTS/OUTLINE

CT scanning is fast, painless, noninvasive, and accurate. The CT exam can now be more effectively tailored to the presumed diagnosis. Specifics related to oral and IV contrast protocols in terms of timing and volume regimens will be covered in detail in this presentation. Table of contents: 1- CT pharyngography 2- CT esophagography 3- CT gastrography 4- CT enterography 5- CT fistulography 6- CT urography 7- CT cystography 8- CT angiography. To illustrate the spectrum of MDCT findings based on our series of CT studies performed between 2015 and 2022. Conclusions: - On-site radiologist supervision is essential? These exams are always radiologist-guided. - Optimal performance of CT requires knowledge of anatomy and pathophysiology, familiarity with the basic physics and techniques of CT, and knowledge of radiation safety. - Specifics related to oral and IV contrast protocols in terms of timing and volume regimens will be covered in detail in this presentation. - Radiologists must be familiar with the radiologic findings for both accurate diagnosis and, in many cases, guidance of management planning. - A practical case-based review.

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## Abstract Archives of the RSNA, 2023

MSEE-75

### Multimodality Imaging of Systemic and Localized Amyloidosis

#### Participants

Nitin Venugopal, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the etiologies, pathophysiology and clinical findings of systemic and localized amyloidosis
- Describe the imaging appearance of amyloidosis across multiple organ systems and imaging modalities
- Discuss the differential diagnoses for imaging findings of amyloidosis
- Discuss radiology-pathology correlation as it applies to amyloidosis

#### TABLE OF CONTENTS/OUTLINE

Amyloidosis is a condition secondary to a range of pathologic processes resulting in deposition of abnormal protein in tissues (amyloid). Amyloid deposition may be due to neoplastic, infectious, inflammatory, and even congenital processes, leading to marked heterogeneity in clinical and imaging manifestations. In this exhibit, we will discuss the varying etiologies of systemic amyloidosis including AL, AA,  $\beta$ 2- microglobulin, ATTR (transthyretin), and hereditary forms. We will also discuss the etiologies of localized amyloidosis including:  $\beta$ -amyloid (Alzheimer's), AANF (isolated atrial amyloid), and AIAPP (DM2). The focus of our work is the imaging appearance and differential diagnosis for the following organ-specific manifestations of amyloidosis with accompanying clinical images: 1. Pulmonary Amyloidosis o Nodular parenchymal o Diffuse parenchymal o Tracheobronchial laryngeal 2. Cardiac with specific MR and NM findings 3. Intra-abdominal o Hepatosplenic o Renal o Bowel o Bladder 4. Cerebral o Angiopathy o Alzheimer's disease 5. Musculoskeletal o Arthropathy o Myopathy o Carpal tunnel syndrome 6. Amyloidomas Soft Tissue Amyloid Finally, we will describe radiology-pathology relationships that influence imaging findings of amyloidosis.

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## Abstract Archives of the RSNA, 2023

MSEE-76

### Characteristic Imaging Features and Screening/Surveillance Recommendations for Hereditary Syndromes

#### TEACHING POINTS

I. Many heritable syndromes have characteristic imaging features. Recognizing common multi-system findings in heritable syndromes allows radiologists to make a unifying diagnosis and guide surveillance strategies. II. Heritable syndromes can have overlapping imaging features. a. Multiple endocrine neoplasia (MEN) type 1, tuberous sclerosis complex (TSC), neurofibromatosis (NF), and von Hippel Lindau (VHL) have characteristic findings in the central nervous system (CNS). b. Lynch, Gardner, and Peutz-Jegher (PJS) syndromes are characterized by gastrointestinal tract malignancies. c. Renal tumors can be seen in Birt-Hogg-Dubé (BHD), TSC, and VHL. d. Pheochromocytomas can be seen in NF type 1, VHL, and MEN type 2. III. While oncologic screening is a critical part of heritable syndrome monitoring, it is equally important to recognize acute pathologies that can result from heritable syndromes. a. CNS tumors can cause acute neurologic problems such as mass effect and obstructive hydrocephalus. b. Small bowel polyps in PJS can lead to intussusceptions and small bowel obstructions. c. Angiomyolipomas, seen in BHD and TSC, can bleed or rupture if large or rapidly growing. This is the second most common cause of morbidity in these patients.

#### TABLE OF CONTENTS/OUTLINE

I. General concepts about hereditary syndromes II. Review of key imaging findings and screening recommendations for the following diagnoses: Lynch syndrome, Gardner syndrome, PJS, MEN, NF, TSC, BHD, VHL, hereditary breast and ovarian cancer syndrome III. Summary of key concepts

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## Abstract Archives of the RSNA, 2023

MSEE-8

### Paraganglioma Imaging: Radiology and Nuclear Medicine

#### Participants

Aurelie Choucair, MD, Villejuif, France (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the different hereditary forms of paragangliomas insisting on Succinate Dehydrogenase Mutations. Review the genetic associations predisposing to paragangliomas including Von Hippel- Lindau, Multiple Endocrine Neoplasia Type 2 NEM2, Neurofibromatosis Type 1 NF1 and Carney Triad. Define the secreting or non-secreting character. Provide a detailed overview of anatomical imaging (CT and MRI) features. Improve knowledge about the different Nuclear Medicine and functional imaging techniques, and the multiple radiopharmaceuticals available for Scintigraphy and PET/CT, according to paraganglioma site and mutational pattern. Analyse the different functional imaging modalities and review the strengths and weaknesses of each modality in detecting lesions depending on their location, secretory function and underlying genetic mutation. Prognosis of paragangliomas, frequent sites of metastasis and therapeutic options.

#### TABLE OF CONTENTS/OUTLINE

Definition of Paraganglioma  
Epidemiology  
Succinate Dehydrogenase Mutations  
Genetic Association: - Von Hippel-Lindau- NEM2- NF1- Carney Triad  
Characteristics (secreting / non secreting), and clinical presentation  
Location:- Parasympathetic Paraganglioma: Carotid Body Tumor, Glomus Tympanicum, Jugulotympanicum, Jugulare, and Vagale- Sympathetic Paraganglioma: Adrenal: Pheochromocytoma Extra-adrenal  
Imaging of Paraganglioma  
Radiology CT Scan MRI Nuclear Medicine Scintigraphy PET  
Differential diagnosis  
Complications  
Prognosis and Treatment

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## Abstract Archives of the RSNA, 2023

MSEE-9

### Eponyms in Radiology: The Controversies Worth Re-examining

#### Participants

Madeleine Sertic, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Eponymous diseases are a long-standing tradition in Western medicine, however, there are numerous arguments against the practice.
  - o Plain-language descriptive names are easier to understand for both patients and health care providers
  - o Eponyms often only recognize individuals, when in reality discoveries are often collaborative
  - o Bias toward recognizing Western, male and non-minority figures
- Eponyms may serve to honor figures that are controversial.
  - o Affiliations with totalitarian regimes
  - o Documented views of intolerance based on race, disability, age, etc.
  - o Professional scandals involving venality, fraud, etc.
- Stigler's Law of Eponymy states that no scientific eponym is named for its original discoverer.

#### TABLE OF CONTENTS/OUTLINE

- Introduction
  - o The concept of "controversy"
  - o Holding historical figures to modern standards
- Multi-system overview of controversial eponymous figures
  - o Breast
  - o Cardiothoracic
  - o Emergency
  - o Gastrointestinal and Genitourinary
  - o Musculoskeletal
  - o Neuroradiology
  - o Nuclear Medicine
  - o Pediatrics
  - o Vascular/Interventional
- Stigler's Law of Eponymy
- Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE

### Nuclear Medicine & Molecular Imaging Education Exhibits

#### Sub-Events

#### **NMMIEE-1 What Radiologists Need to Know About Immune-related Adverse Events: Clinical Significance of FDG-PET/CT Diagnosis of Immune-related Adverse Events**

##### Participants

Mana Ishibashi, Hiroshima, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Immune-related adverse events (irAE) are common in patients receiving immune checkpoint inhibitors. Frequency varies by molecular target of the agent in use, with irAE of any grade reported approximately 80-90%. Pneumonitis, hypothyroidism, arthralgias, and cutaneous reactions are most often seen with PD-1/PD-L1 inhibitors, and colitis and hypophysitis with CTLA-4 inhibitors. FDG-PET/CT is used to assess the malignancy; it is also able to detect tissue inflammation, one of the hallmarks of irAE. This unique ability sets FDG-PET/CT apart from CT and MRI and potentially enables the early identification and therapeutic intervention in patients with irAE prior to their developing clinical symptoms. Depending on the site, particularly in lymph nodes, an irAE-related uptake may mimic metastases or disease progression.

##### TABLE OF CONTENTS/OUTLINE

1. Basic information about immune checkpoint inhibitors 2. The mechanism of autoimmune-reactions in patients receiving immune checkpoint inhibitors 3. FDG-PET/CT findings of irAE 4. Differential diagnosis of irAE and other pathologies

#### **NMMIEE-10 Imaging of Thyroid Cancer Post-thyroidectomy: Primer for Radiologists**

##### TEACHING POINTS

1. Differentiated thyroid cancer (DTC) arising from thyroid follicular epithelial cells, comprising > 90% of all thyroid cancers. 2. After thyroidectomy, depending on post-operative risk stratification, the primary goal of radioactive iodine (RAI) can include remnant ablation, adjuvant therapy or treatment of known disease. A whole-body scan performed following administration of therapeutic RAI identifies the presence of iodine-avid thyroid tissue, both normal and malignant, allowing staging of the disease. 3. Cervical ultrasound is recommended for surveillance of the thyroid bed and regional lymphadenopathy post-thyroidectomy. 4. Serum Thyroglobulin (Tg) and anti-Tg antibodies are important in the follow-up of these patients; rising levels would warrant further evaluation with RAI imaging. 5. 18F-FDG-PET scanning should be considered in high-risk DTC with elevated serum Tg but negative RAI imaging. Alternatives would include CT imaging of the chest and if negative CT imaging of the abdomen.

##### TABLE OF CONTENTS/OUTLINE

1. Overview of differentiated thyroid cancer 2. Goals of treatment, including the role of radioactive iodine 3. Basics of Thyroglobulin and anti-Thyroglobulin interpretation for monitoring for thyroid cancer recurrence/disease 4. Common sites of disease recurrence and metastasis 5. Role of US and other imaging modalities (RAI, CT, MRI, PET/CT) in the follow-up of thyroid cancer 6. Spectrum of imaging appearances on the various modalities after primary treatment of thyroid cancer 7. Important imaging pitfalls leading to diagnostic errors and misinterpretation

#### **NMMIEE-11 Imaging of Dementias using 18F-FDG PET: Unique and Overlapping Features**

##### Participants

Rita Maria Lahoud, MD, Shelton, CT (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Establishing a specific diagnosis in cases of dementia may be challenging as symptoms and features often overlap. Characteristic metabolic patterns on 18F-FDG PET, in concert with clinical features, aid in reaching an accurate and timely diagnosis.
- Technical considerations and proper patient preparation are necessary to minimize confounders.
- Alzheimer's dementia represents the most common neurodegenerative process encountered on PET/CT and manifests with regional hypometabolism of the posterior temporoparietal regions and cingulate gyrus, although there are variations and overlap with other neurodegenerative processes.
- Reduced radiotracer uptake predominantly involves the frontal and anterior temporal lobes in frontotemporal dementia.
- In Lewy body dementia, the occipital cortex is mainly affected with sparing of the posterior cingulate gyrus, "the cingulate island sign".
- Asymmetric cortical involvement and decreased uptake in the basal ganglia and thalami are characteristic of corticobasal degeneration.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction to Dementias a. Alzheimer's b. Frontotemporal c. Lewy Body d. Posterior Cerebral Atrophy e. Corticobasal Degeneration f. NMDA Encephalitis 2. 18F-FDG PET in the evaluation of dementias a. Rationale for use b. Normal brain metabolic patterns c. Patient preparation and technique 3. Metabolic pattern interpretation: a. Unique and overlapping imaging patterns b. Confounding factors

## **NMMIEE-12 Hybrid Imaging in Infective Endocarditis**

Participants

Antonio Lopez, BA, West Reading, PA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Infective endocarditis (IE) is a serious infection of the heart valves caused by microorganisms, resulting in inflammation and potential complications such as heart failure, stroke, or sepsis. IE is typically diagnosed using the modified Duke criteria, which examines pathologic and clinical criteria; however, due to a variety in presentation and complicating patient factors, I remains a diagnostic challenge. Patients with prosthetic valves (PV) or intracardiac devices (ICD) are at a higher risk for IE, are more difficult to diagnose with IE, and have higher mortality than patients without these cardiac interventions. Combination of cardiac CT and FDG-PET/CT is currently being investigated for adjunct use in I diagnosis in this patient population, which preliminary data shows improve diagnostic accuracy. Here we examine the use of FDG-PET and cardiac CT in diagnosing I in patients with PV and ICD, including a discussion on common cardiac and non-cardiac manifestations of IE on imaging and an examination of its role in future diagnostic algorithms.

### **TABLE OF CONTENTS/OUTLINE**

Describe current diagnostic methods for IE. Examine the use of Cardiac CT and PET/CT in I diagnosis for patients with PV and ICD, including key imaging features. Discuss the future incorporation of hybrid imaging in I diagnosis.

## **NMMIEE-13 Theory into Action: A Step-by-Step Guide to Interpreting Scintigraphy Images for Sentinel Node Assessment**

Participants

Juan Tempra SR, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-Review the basics of the sentinel node and its importance in the diagnosis and staging in cancer.-Describe the technique and methods of optimizing the procedure and the resulting images.-Illustrate different imaging patterns and their clinical significance.-Learn the limitations and pitfalls.

### **TABLE OF CONTENTS/OUTLINE**

-Introduction.-Sentinel lymph node Scintigraphy: principles and technique.-Interpretation of sentinel lymph node mapping images.-Advantages and limitations.-Conclusions.

## **NMMIEE-14 Findings of Primary and Secondary Breast Malignancies on Dotatate PET/CT**

Participants

Lauren Hubbard, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review somatostatin receptor-based PET imaging and normal distribution. Positive radiotracer uptake in the breast on Dotatate PET can be seen with metastatic neuroendocrine tumors. Metastatic neuroendocrine tumors to the breast can result in corresponding mammogram findings indistinguishable from a primary breast malignancy. Primary breast malignancies can also demonstrate positive Dotatate PET uptake due to variable somatostatin receptor expression. Invasive lobular carcinoma can demonstrate low to absent abnormal uptake on FDG-PET/CT, but can demonstrate positive uptake on Dotatate-PET/CT.

### **TABLE OF CONTENTS/OUTLINE**

a. Review of somatostatin receptor-based PET imaging and normal distribution. b. Case presentations of 5 cases of dotatate PET findings of primary and secondary breast malignancies i. A case of biopsy-proven incidentally discovered invasive ductal carcinoma on Dotatate-PET/CT for evaluation of metastatic neuroendocrine tumor. ii. A case of incidentally discovered invasive lobular carcinoma on Dotatate-PET/CT for metastatic neuroendocrine tumor with comparison to FDG- and 18F-Fluoroestradiol-PET/CT. iii. A case of neuroendocrine tumor metastases to the bilateral breasts with corresponding mammographic findings. iv. A case of neuroendocrine tumor metastases to the left breast with additional systemic sites of metastatic disease. v. A case of bilateral dotatate PET avid breast lesions, histologically proven to be atypical carcinoid tumors of the breast. c. Conclusions/Future Directions

## **NMMIEE-15 PET-CT 18F-FES: Selecting Patients Who Will Benefit from Endocrine Therapy**

Participants

Victor Osaki, BMedSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Invasive lobular carcinoma (ILC), the second-most prevalent invasive breast cancer subtype comprising approximately 15% of breast cancers;
- ILC is nearly always (95%) estrogen receptor (ER) positive;
- The determination of ER expression by immunohistochemistry has several limitations;
- PET-CT with 18F-fluoroestradiol (PET-FES) has emerged as a diagnostic method that allows evaluating the ER expression status of breast cancer lesions in a non-invasive way;
- Patients with estrogen receptor positive breast cancer benefit from endocrine therapy by blocking these receptors on tumor cells, preventing tumor progression. Some patients, though, have immunohistochemistry showing positive receptors and PET-CT with 18F-FES with lesions not showing uptake. In these cases we suppose the estrogen receptors are non-functioning ones and, therefore, patient will not benefit from endocrine therapy.

### **TABLE OF CONTENTS/OUTLINE**

- Introduction;
- Objective;
- Discussion;
- Clinical and epidemiologic aspects;
- Show cases that are functioning estrogen receptor positive and non-functioning estrogen receptor;
- Discuss endocrine therapy in non-functioning ER+ cancer;
- Take home messages;
- References.

## **NMMIEE-16 The Value of 18F-FDG-PET-CT in the Management of Head and Neck Tumors**



## TEACHING POINTS

To understand the role of 18F-FDG PET CT in the diagnosis, staging, treatment response assessment and radiotherapy treatment planning in head and neck tumors.

## TABLE OF CONTENTS/OUTLINE

18F-FDG PET-CT is a widely used diagnostic tool in the evaluation of head and neck squamous cell cancers. It is at least as sensitive as MRI or CT in detecting the primary head and neck tumors, but there is no clear evidence of routine use in T staging, due to low spatial resolution and the presence of physiologic uptake on PET. The meta-analysis shows 18F-FDG PET-CT has high sensitivity (79%) and specificity (86%) for N staging, being superior to CT and MRI. For distant spread and second primary cancer detection, 18F-FDG PET-CT may be superior to whole body MRI, while both have high NPV. For the detection of synchronous primary tumor the pooled sensitivity and specificity is above 95%. The meta-analysis of 27 studies shows the high rate of detection of recurrence or residual tumor with 18F-FDG PET-CT (PPV-75 %, NPV-94%). Performed 12 months after therapy for detection of recurrence, the sensitivity and specificity has been reported as high as 100%. The recent response evaluation criteria-so called Hopkins criteria-has high NPV and is characterized by high inter-reader agreement. PET-CT based contouring during radiotherapy treatment planning is more accurate than CT based contouring in terms of gross tumor volume (GTV). Recent advances in hybrid imaging of head and neck tumors include the introduction of integrated PET MRI systems. Studies have shown the intratumoral heterogeneity of FDG uptake, as well as PET-derived volumetric parameters, such as MTV and TLG to be important prognostic factors for disease recurrence, progression and survival.

## NMMIEE-17 PET-CT 18F-FES: The Use in Clinical Practice in One of the Largest Private Health Centers in Brazil

Participants

Victor Osaki, BMedSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- PET-Fluorestradiol (FES) is a type of Positron Emission Tomography (PET) imaging agent used to detect estrogen receptor-positive (ER+) breast cancer. FES is a synthetic form of estrogen that has been radiolabeled with a positron-emitting isotope, the fluorine-18;
- When 18F-FES is injected into the body, it binds to estrogen receptors on breast cancer cells, allowing PET imaging to detect the presence and location of these cancer cells;
- PET-FES imaging can provide valuable information to healthcare professionals about the extent of ER+ breast cancer, as well as guide treatment decisions;
- PET-FES has emerged as a diagnostic method that allows evaluating the ER expression status of breast cancer lesions in a non-invasive way;
- In addition to breast cancer, PET-FES imaging has also been used in research to investigate other estrogen-receptor positive cancers, such as ovarian and endometrial cancer.

## TABLE OF CONTENTS/OUTLINE

- Clinical and epidemiologic aspects;
- Show the possible applications of PET-CT with 18F-FES and show its applicability in clinical practice in our hospital.
- Take home messages;
- References.

## NMMIEE-18 Gallium-68 DOTATATE PET for the Imaging of Non-Gastrointestinal Neoplasm: A Review

Participants

Amar Shah, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Somatostatin-receptor analogue based imaging, including Gallium(Ga)-68 DOTATATE PET/CT, has long played a central role in the evaluation of gastroenteropancreatic neuroendocrine tumor. However, Ga-68 DOTATATE has a variety of clinical applications beyond this, both in oncologic pathologies. In this exhibit, we aim to review Ga-68 DOTATATE physiology and its use beyond gastroenteropancreatic neuroendocrine tumor. 1. Review physiology of Ga68-DOTATATE distribution and uptake. 2. Catalogue non-gastrointestinal uses, both oncologic and nononcologic, of Ga-68 DOTATATE based imaging. 3. Highlight pitfalls of Ga68-DOTATATE imaging.

## TABLE OF CONTENTS/OUTLINE

1. Review normal Ga-68 DOTATATE distribution and mechanism of uptake.
2. Non-gastrointestinal tumoral indications. a. Meningioma b. Medullary thyroid cancer c. Paraganglioma d. Phosphaturic mesenchymal tumor e. Pulmonary carcinoid
3. Pitfalls of Ga-68 DOTATATE PET/CT.

## NMMIEE-19 FDG PET/CT in Evaluation of Cardiac Device Infections: What an Imager Should Know

## TEACHING POINTS

FDG PET/CT is increasingly utilized for the diagnosis and evaluation of cardiac device infections. The objective of this case-based educational exhibit is to 1) review established and emerging applications of FDG PET/CT in the diagnosis of cardiac device infections 2) review protocols and guidelines for integrating FDG PET/CT in the diagnosis of cardiac device infections 3) highlight interpretation criteria, pearls, and pitfalls of FDG PET/CT for cardiac device infections. Implementing this knowledge is important to avoid errors and provide accurate imaging interpretation for cardiac device infection.

## TABLE OF CONTENTS/OUTLINE

The most demonstrative cases of cardiac device infections noted on FDG PET/CT performed at our tertiary care academic institution for evaluation of cardiac device infections were selected to highlight the teaching points for this exhibit, including: 1) cardiac implantable electronic device (CIED) infection 2) left ventricular assist device (LVAD) infection 3) prosthetic valve endocarditis. We will summarize take-home points to facilitate transfer of knowledge.

## NMMIEE-2 Skeletal Muscle Uptake in FDG-PET: Physiology and Pathology, Pearls and Pitfalls

Participants

Jessica Dobson, MD, Halifax, NS (*Presenter*) Nothing to Disclose

## TEACHING POINTS

18F-fluorodeoxyglucose (FDG)-PET is commonly used in oncology, and while key for staging may also reveal nonspecific findings related to any number of neoplastic, infectious, and inflammatory etiologies. Despite the ubiquity of FDG-PET, intense skeletal muscle uptake remains an uncommon and sometimes unexpected finding. Patterns of uptake are often similar between vastly different entities, and the interpreting physician must be familiar with these entities to provide a useful diagnosis or differential. This exhibit will review a series of local cases demonstrating skeletal muscle FDG uptake and discuss the clinical and imaging context leading to the diagnosis, with the goal of conveying an understanding of skeletal muscle uptake on FDG-PET and considerations to provide a relevant differential diagnosis and advise on appropriate next steps.

#### TABLE OF CONTENTS/OUTLINE

1. Overview normal physiologic distribution of FDG; 2. Review the biochemical basis of physiologic and pathologic skeletal muscle FDG uptake; 3. Discuss the differential considerations for skeletal muscle uptake, including physiologic, inflammatory, infectious, and neoplastic etiologies, and possible mimics of skeletal muscle uptake on FDG-PET; 4. Analyze local cases of skeletal muscle uptake with emphasis on imaging patterns and clinical indicators guiding diagnosis.

#### NMMIEE-20 PET-CT Utility in Aortic Disease: Applications and Observations - A Comprehensive Review

##### TEACHING POINTS

PET/CT allows for the non-invasive evaluation of aortic inflammation, wall instability, and clinical symptoms, thereby improving the prediction of individual aneurysm rupture risk. Additionally, PET/CT imaging can aid in determining the age and degree of risk in patients with acute aortic dissection (AAD) and the need for surgery. Stratification of AAD patients based on FDG uptake may predict short- and midterm outcomes. PET/CT imaging has also allowed for preoperative localization of areas with increased risk of rupture correlating with increased FDG uptake within the aneurysm wall in abdominal aortic aneurysm suggesting that FDG-PET/CT imaging may be a novel approach to identifying AAA at risk for rupture. FDG uptake in the aortic wall can also be used as a biomarker for the evaluation of vulnerable atherosclerotic activity. PET/CT can also aid in distinguishing between acute and chronic aortic dissection. In patients with acute dissection, PET/CT imaging showed elevated metabolic activity in fresh lacerated segments of the aortic wall, while stable chronic aortic dissection showed no increased metabolic activity. This differentiation is crucial for appropriate management and predicting outcomes.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction II. PET/CT in the evaluation of aortic disease A. Aortic aneurysms 1. Prediction of individual rupture risk 2. Preoperative localization of areas with increased FDG uptake B. Aortic dissection 1. Determining the need for surgery 2. Distinguishing between acute and chronic dissection 3. Vasculitis/infectious Aortitis III. PET/CT in the evaluation of arterial atherosclerotic activity A. FDG Uptake as an index for atheroma cellular content and vulnerability V. Conclusion

#### NMMIEE-21 PSMA PET/CT and Spectrum of Nonprostatic Disease

Participants  
Qiubai Li, Dallas, TX (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Prostate-specific membrane antigen (PSMA) based radiopharmaceutical 18F-PSMA and 68Ga-PSMA for imaging of prostate cancer.
- PSMA PET/CT plays a key role in diagnosis, staging and evaluation of treatment response of prostate cancer
- PSMA uptake on PET/CT can be divided into prostatic disease and nonprostatic disease. Comparison between cytoplasmic PSMA expression in nonprostatic disease and apical PSMA expression in prostate cancer can help to differentiate these conditions.
- The purpose of this presentation is to introduce of spectrum of nonprostatic disease on PSMA PET/CT which may be interpreted as metastatic disease.
- Recognizing the false positive imaging findings can help narrow the differential diagnosis and triage appropriate patient care

#### TABLE OF CONTENTS/OUTLINE

- PSMA uptake and CNS disease
- PSMA uptake and PNS disease
- PSMA uptake and lacrimal gland disease
- PSMA uptake and thyroid disease
- PSMA uptake and inflammatory/inflammatory disease
- PSMA uptake and lung disease
- PSMA uptake and liver disease
- PSMA uptake and kidney disease
- PSMA uptake and adrenal gland disease
- PSMA uptake and bone disease
- PSMA uptake and chronic lymphocytic leukemia

#### NMMIEE-22 FDG PET: Not Just a One-trick Pony: Non-oncologic Uses of FDG PET Imaging

##### TEACHING POINTS

The purpose of this exhibit is to:- Understand the underlying physiologic mechanism of FDG PET and conventional clinical applications- Discuss non-oncologic pathologies that can be evaluated on FDG PET, including those which may mimic other neoplastic processes.- Examine the pros and cons of utilizing FDG PET versus conventional imaging modalities in non-oncologic applications.

#### TABLE OF CONTENTS/OUTLINE

Mechanism of Action of FDG PET  
Head and Neck applications- Seizures- Dementia/neurocognitive disease- Differentiating CNS lymphoma versus toxoplasmosis  
Chest and Cardiac applications- Sarcoidosis- Evaluating for hibernating myocardium- Cardiac/pericardiac infection myocarditis- Incidental infection/inflammation, including organizing pneumonia  
Abdominal- Infection in polycystic liver or kidney disease- Infection in mucinous peritoneal carcinomatosis- Autoimmune pancreatitis/ IgG4 related disease- Incidental infection/inflammation including: inflammatory bowel disease, hepatitis, pyelonephritis  
Vascular- Aortitis vasculitis- Inflammatory plaques- Incidental findings including: endoleak and deep vein thrombosis  
Musculoskeletal- Chronic recurrent multifocal osteomyelitis (CRMO) synovitis, acne, pustulosis, hyperostosis, and osteitis (SAPHO) syndrome- Non-post-operative spinal infections- Peripheral bone osteomyelitis- Septic arthritis  
Multisystem- Sarcoidosis, tuberculosis, granulomatous infections- Non-Langerhans cell histiocytosis- Fever of unknown origin neoplastic mimics- Sequelae of endocarditis- HIV/Covid reactive adenopathy reactive adenopathy

#### NMMIEE-23 Why PET/MRI in Pediatric Oncology? A Pictorial Review of Advantages and Challenges

##### TEACHING POINTS

- PET/MRI has better soft tissue resolution and lower radiation dose than PET/CT - PET/MRI is a one stop shop that may decrease

• PET/MRI has better soft tissue resolution and lower radiation dose than PET/CT. • PET/MRI is a one-stop-shop that may decrease the number of anesthesia events and patient visits to complete imaging work-up. • PET/MRI provides simultaneous anatomic and functional images, facilitating both initial staging and restaging of various oncologic conditions.

#### TABLE OF CONTENTS/OUTLINE

• Introduction of PET/MRI: an overview of technical aspects and protocol • Case-based approach of oncologic pediatric body PET/MRI: advantages and limitations:- Lymphoma: initial staging and follow up- Sarcoma: soft tissue and osseous sarcoma- Predisposing Conditions: malignant transformation in neurofibromatosis- Congenital hyperinsulinism: focal versus diffuse lesions • Case-based approach of PET/MRI in pediatric neuro-oncology: advantages and limitations- FDG-PET/MRI: is it a helpful tool?- Amino acid PET: in non-enhancing tumor and anti-angiogenic therapy • Current and future role of PET/MRI in theragnostic (diagnosis and therapy) in pediatric oncology • Conclusions

#### NMMIEE-24 Bringing PET/MRI into Practice- Challenges and Considerations

Participants  
Naveen Rajamohan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Developing a PET/MRI program involves planning for optimal physical layout and incorporation of unique safety considerations. 2) Truly simultaneous PET and MRI data acquisition in modern PET/MRI systems minimize the likelihood of image misregistration and provide more robust anatomic co-localization comparison to PET/CT. 3) Identification of appropriate oncologic and non-oncologic clinical indications, education of referring physicians, development of scheduling, protocoling, and image interpretation workflows and dedicated order sets are imperative for successful implementation of a clinical PET/MRI program.

#### TABLE OF CONTENTS/OUTLINE

Safety regulations • Facility guidelines and regulatory requirements • Challenges of working in the PET/MRI environment (governance, safety, technologist training, emergency responses, etc.) • Radiotracers in the PET/MRI environment. PET/MR hardware/data acquisition • Hardware components, data acquisition systems • Technical considerations including attenuation correction and image co-registration Indications, imaging findings, programmatic and workflow considerations • Billing challenges and CPT codes • Protocol development, order sets and education of referring physicians • Clinical workflow including protocoling, scheduling, and image interpretation models. Case-based review of oncologic and non-oncologic clinical indications appropriate for PET/MRI including classic imaging findings and pitfalls

#### NMMIEE-25 Is There a Role for Radium-223 in the Era of 177Lu PSMA?

Participants  
Flavia Lopes, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In cases of prostate bone metastasis, a destructive cycle of bone formation and resorption occurs, making it imperative for treatment to focus on the microenvironment through various mechanisms. This can be achieved through direct targeting of tumor cells, osteoblasts, osteoclasts, inflammatory cells, and bystander effects, which affect non-irradiated cells in the surrounding area by producing cytokines and growth factors. For patients who have previously received Radium-223, it is possible to administer 177LuPSMA and/or chemotherapy as subsequent treatments. Patients with a good medullary reserve who have shown a positive response to initial treatment may receive additional cycles of Radium-223, as it is well-tolerated with minimal toxicity and effectively controls bone progression. For patients with exclusively bone metastatic prostate cancer, Radium-223 may be initiated to control bone progression when first-line therapy fails to achieve optimal control of disease progression. Subsequently, in the treatment sequence, 177Lu-PSMA may be employed as an effective tool in the management of progressive disease involving bone and soft tissue metastases.

#### TABLE OF CONTENTS/OUTLINE

Theranostics in Prostate Cancer: Current Treatment Options Radium-223: Indications and Contraindications Treatment Sequencing: Discussion of Primary Guidelines 177Lu-PSMA and Radium-223: Partners or Competitors?

#### NMMIEE-26 DEXA - It's Not Just About the Numbers

#### TEACHING POINTS

• To describe the classification, clinical presentation, pathogenesis and management of osteopenia and osteoporosis • To outline indications for performing dual-energy x-ray absorptiometry (DEXA) • To review technical aspects of DEXA • To interpret DEXA outputs including quality assurance and recognition of pitfalls

#### TABLE OF CONTENTS/OUTLINE

Background • Epidemiology, clinical presentation, pathogenesis and management of osteopenia and osteoporosis • Classification of bone mineral density • Review of international guidance on DEXA - e.g. American Association of Clinical Endocrinologists consensus statement • Technical aspects of DEXA • Underlying scientific basis • Acquisition parameters • Regions of interest • Outputs including reference standards • Interpretation • Defining Z-scores and T-scores • Monitoring changes in bone mineral density • Fracture risk assessment tool - e.g. FRAX • Clinical application and relevance • Suggested reporting templates • Pearls and pitfalls • Case examples including less typical and challenging scenarios • Summary

#### NMMIEE-27 Utility of FDG PET/CT in Pyrexia of Unknown Origin: A Pictorial Essay

#### TEACHING POINTS

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#### TABLE OF CONTENTS/OUTLINE

Pyrexia of unknown origin (PUO) is defined as fever higher than 38.3 °C/101°F, lasting more than 3 weeks and remaining undiagnosed after 1 week of thorough investigation. Identifying the cause of pyrexia of unknown origin is a clinical challenge. Early identification of source of PUO helps guide further diagnostic invasive procedures and initiation of prompt appropriate treatment.

The current diagnostic approach includes initially first-line procedures such as general examination and various laboratory tests and basic imaging techniques followed by second-line tests like FDG PET/CT and tissue biopsies. Conventional imaging modalities can have limited sensitivity. Understanding imaging patterns of FDG uptake in common and uncommon causes of PUO helps to accurately identify the potential source. Advantages of 18F-FDG PET/CT as first line modality : high sensitivity, whole body imaging can identify pathologic focus at clinically unsuspected sites, high negative predictive value, can identify the source of infection or inflammation before morphological changes on conventional anatomical imaging techniques, no hazardous manipulation of blood for labeling in WBC imaging, no need for complementary bone or bone marrow scan, ability to perform quantitative analysis, cost-effective as first line modality. Images attached of Common and uncommon sites detected on FDG PET/CT in PUO: Fig1) infected aortic stent Fig 2) infected central venous catheters Fig 3) Tuberculous Osteomyelitis Fig 4) Renal Mucormycosis Fig 5) Acute Pyelonephritis in Transplant Kidney Fig 6) Tracheobronchitis

### **NMMIEE-28 How to Master Nuclear CSF Imaging: A Comprehensive Guide to Procedures and Interpretation**

Participants

Megan Mercer, MD, Charleston, SC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

This presentation aims to educate the learner on: 1- Indications and imaging protocol of nuclear CSF imaging (Nuclear cisternography and shuntogram). 2- Patterns of normal and abnormal findings. 3- Complementary role of anatomic imaging (Xray, CT, MRI). 4- Pearls and pitfalls for performing the procedures and imaging interpretation.

#### **TABLE OF CONTENTS/OUTLINE**

1- Nuclear Cisternography: A. Review CSF physiology and the common indications for nuclear cisternography. B. Review Imaging protocol: Patient preparation, radiopharmaceutical, imaging timing, the role of pledgets in cases of CSF leak. C. Review normal and abnormal findings (normal pressure hydrocephalus, spontaneous hypotension, CSF leaks). D. Describe classic signs that are helpful for the interpretation. E. Discuss pitfalls for injection and interpretation and the importance of correlation with anatomic imaging. 2- Nuclear Shuntogram: A. Present a background on hydrocephalus, different types of CSF shunts, and their complications. B. Review multimodality imaging evaluation of shunts with a focus on nuclear shuntogram. C. Present an overview of the nuclear shuntogram procedure (shunt reservoir access, measuring opening pressure, types of radiopharmaceutical, radiopharmaceutical injection, and imaging protocol). D. Review interpretation checklist (opening pressure, T1/2 clearance, flow into the proximal and distal limbs, documentation of free dispersion). E. Present an algorithmic approach for differentiating normal and abnormal drainage patterns (proximal and distal obstruction, shunt over-drainage, CSF pseudocyst, gravity-dependent drainage). F. Review pitfalls of inappropriate injection and falsely elevated pressure.

### **NMMIEE-29 Hybrid DOTATATE PET/MRI Imaging of the Head and Neck**

Participants

Graham Keir, MD, Manhasset, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. The superior soft tissue resolution of MRI improves lesion localization and helps to delineate fine anatomic detail. 2. DOTATATE-PET/MRI detects extent of disease and lesions not detected by MRI alone. 3. DOTATATE-PET may improve surveillance and radiation therapy planning. 4. DOTATATE-PET/MRI may detect more lesions than MRI alone, providing valuable genetic information in cases of multiple paragangliomas. 5. DOTATATE PET is useful for determining lesions that may respond to somatostatin analogue therapy.

#### **TABLE OF CONTENTS/OUTLINE**

1. Overview of Somatostatin Receptor Imaging 2. PET/MRI Fusion Protocols 3. Meningiomas 4. Paragangliomas 5. Olfactor Neuroblastoma (Esthesioneuroblastoma) 6. Pituitary Lesions 7. Conclusion

### **NMMIEE-3 Neo-adjuvant Immune-checkpoint Inhibitors in Lung Cancer - Pearls and Pitfalls in Imaging**

#### **TEACHING POINTS**

1) Neo-adjuvant chemo-immunotherapy results in a high rate of pathologic complete remissions. 2) Residual tumor size and changes (eg., decrease) in tumor size do not necessarily correlate with histopathological response. 3) Metabolic examinations such as [18F]-FDG-PET/CT better assess treatment response compared to morphological changes. 4) Immune mediated increased lymphatic FDG uptake and/or increased lymph node size is called "nodal immune flare".

#### **TABLE OF CONTENTS/OUTLINE**

1) Pathological response patterns in patients with early-stage, non-small cell lung cancer (NSCLC) receiving neo-adjuvant chemo-immune checkpoint inhibitor therapy (ICIT): - Complete pathological response (cPR): no vital tumor cells, - Major pathological response (MPR):  $\geq 10\%$  vital tumor; 2) Radiological response patterns in patients with early-stage NSCLC receiving neo-adjuvant chemo-ICIT: - Radiological response may be consistent or inconsistent with pathological response, - Some patients with partial radiological response show a poor pathological response compared to others who show a cPR, - Nodal immune flare; 3) Current role of imaging in patients with early-stage, NSCLC receiving neo-adjuvant chemo-ICIT: - CT, - [18F]-FDG-PET/CT, - Limitation and pitfalls; 4) Limitations

### **NMMIEE-30 Nuclear Medicine Lymphoscintigraphy: Established and Emerging Applications with Technical Overview**

Participants

Saeed Elojeimy, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The goal of this presentation is to educate the learner on: 1- The clinical approach and role of nuclear scintigraphy in the assessment and management of patients with lymphedema. 2- The imaging protocol for performing nuclear scintigraphy. 3- The imaging patterns of normal and abnormal lymphoscintigraphy. 4- The potential limitations of nuclear medicine examinations for lymphedema assessment. 5- The complementary role of nuclear scintigraphy and MR lymphangiography. 6- The treatment options available for patients with lymphedema.

## TABLE OF CONTENTS/OUTLINE

1- Introduction a. Review the epidemiology and pathophysiology of lymphedema. b. Review the clinical approach to the diagnosis of lymphedema, as well as the role of nuclear lymphoscintigraphy in evaluating these patients. 2- Review Lymphoscintigraphy protocols: a. Patient preparation, radiopharmaceutical, imaging timing, and areas of interest. 3- Review how to evaluate lymphoscintigraphy examinations. a. Provide examples of normal and abnormal lymphoscintigraphy studies (unilateral or bilateral, upper or lower extremity), lymphatic malformations, and lymphatic leak (recurrent chylous ascites or pleural effusions). b. Provide MR lymphangiography correlative features for lymphoscintigraphy to highlight the strengths, limitations, and complementary roles of both modalities. 4- Emerging applications, treatments, and future directions

### NMMIEE-31 PET/MRI: Pictorial Review of Hepatobiliary and Pancreatic Applications

Participants

Malak Itani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

PET/MRI combines physiologic information with superior soft-tissue contrast resolution from MRI, improving assessment of the following hepatopancreaticobiliary diseases:(1) Biliary: assess disease severity, screen for cholangiocarcinoma, delineate local tumor extent and regional spread, and assess treatment response.(2) Hepatic metastases: detecting metastases and evaluating response to treatment.(3) Hepatocellular carcinoma: Y-90 PET/MRI dosimetry, extrahepatic metastases.(4) Pancreatic neoplasms: characterization and local staging, assessing spread to lymph nodes, metastatic disease in the liver, and assessing treatment response.(5) Liver transplant: detecting recurrent HCC, recurrent sclerosing cholangitis, and post-transplant lymphoproliferative disorder.

## TABLE OF CONTENTS/OUTLINE

(1) Hepatobiliary PET/MRI techniques, clinical workflow, and reimbursement issues.(2) Applications:(A) Neoplastic evaluation:(i) Cholangiocarcinoma. (ii) Metastatic liver disease. (iii) Hepatocellular carcinoma. (iv) Pancreatic ductal adenocarcinoma. (v) Pancreatic neuroendocrine neoplasms.(B) Differentiating tumor from non-neoplastic processes:(i) Infectious: Cholangitis, hepatic abscesses. (ii) Inflammatory: Risk-stratifying benign versus malignant biliary strictures. (iii) Post-treatment: Perilesional hemorrhage/necrosis versus residual/recurrent tumor. (iv) Problem solving after locoregional therapy. (v) Follow-up of liver transplant.(3) Emerging tracers and advanced applications.

### NMMIEE-32 Patterns of Response and Progression on Post-treatment SPECT/CT Scans in Patients Treated with Lu-177-PSMA

Participants

Ridvan Demirci, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

With the wider availability of Lu-177-psma therapy, imaging of this population became more important. Post-treatment imaging with SPECT/CT is a helpful tool for response assessment by providing functional and anatomical imaging information. This educational exhibit aims to present certain response and progression patterns in post-treatment SPECT/CT scans.

## TABLE OF CONTENTS/OUTLINE

Non-contrast enhanced CT portion of SPECT/CT needs to be closely reviewed for monitoring of low or no PSMA-expressing disease (defined as lesional uptake equal or less than liver), particularly in the liver, and temporal changes of the osseous disease on CT in relation to intensity of PSMA expression. In addition, patterns of response or progression could be used for clinical decision-making. Below, is the summary of patterns. 1. Response Patterns a. Rapid Response (Rapid decline in disease burden before 4 cycles of treatment) b. Slow Response (Continued response after 4 cycles of treatment) c. Stable Disease 2. Progression Patterns a. Primary Progression (Progression without initial response) i. Increased burden of preexisting disease (bone, soft tissue or both) ii. New lesions (PSMA avid, non or low PSMA avid either in bone or soft tissues) b. Secondary Progression (after initial response) i. Increased burden of preexisting disease (bone, soft tissue or both) ii. New lesions (PSMA avid, non or low PSMA avid either in bone or soft tissues) 3. Mixed Pattern a. Non-uniform response pattern: While being responsive in certain sites/organs, showing progression in other sites/organs.

### NMMIEE-33 Evolving role of PETCT in Systemic Vasculitis

Participants

Vani Vijayakumar, MD, Jackson, MS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learn different Systemic Vasculitides Different PET CT Scoring systems Role of PET CT in Treatment response

## TABLE OF CONTENTS/OUTLINE

Large vessel vasculitis (LVV) and medium-sized vessel vasculitis such as giant cell arteritis (GCA) and Takayasu arteritis (TAK) are three common autoimmune systemic Vasculitides. 18F-FDG PET visual and semiquantitative criteria has been proposed. A standardized 4-point visual grading scale (arterial to liver uptake) is recommended with grade 0, no uptake; grade 1, uptake lower than liver; grade 2, uptake similar to liver; and grade 3, uptake higher than liver. Grade 3 is considered positive for LVV, whereas grade 2 may be indicative of LVV. In addition, a quantitative composite score, based on the visual grading scale of several individual arterial segments (typically between 7 and 15 segments), known as PET vascular activity score (PETVAS). PETVAS provides an overall assessment of disease burden, with little interobserver variability, in evaluating treatment response. 18F-FDG uptake in cranial arteries are scored as 3-point visual grading (0-2), with grade 0 representing uptake not above the surrounding tissue, grade 1 uptake just above the surrounding tissue, and grade 2 uptake significantly above the surrounding tissue. In PMR, The PET CT Leuven score is the best validated one, with sensitivity of 89.6% and specificity of 93.3%. The Leuven score is the summed score of visual 18F-FDG uptake at the cervical and lumbar interspinous bursae, sternoclavicular joints, ischial tuberosities, greater trochanters, hips, and shoulders. 18F-FDG PET/CT plays a role in diagnostic and therapeutic monitoring of patients with vasculitides and PMR.

### NMMIEE-34 Avoid False Positives with Quantitation and Tc 99m Pyrophosphate (Pyp) SPECT with CT Fusion in

## ATTR Cardiac Amyloidosis (ATTR- CA)

### Participants

Vani Vijayakumar, MD, Jackson, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Update on the role of Pyp Imaging cardiac amyloidosis - How to improve Image interpretation with SPECT and CT fusion - Correlate with Anatomic imaging with CT And MRI - Quantitative SPECT Parameters SUV and advanced metrics

### TABLE OF CONTENTS/OUTLINE

Transthyretin (ATTR) cardiac amyloidosis (CA) is a form of heart failure (HF) in the elderly representing approximately 13% to 18% with preserved ejection fraction (HFpEF). Until recently, ATTR-CA was very underdiagnosed. Due to advances in cardiac scintigraphy using the old Bone radiotracer Tc 99m Pyrophosphate single-photon emission computed tomography [SPECT], there is increased awareness to diagnose ATTR -CA. In addition there have been new ATTR stabilizing and silencing medications currently being available for use. Because of these rapid advances in diagnostic and therapeutic approaches, ATTR-CA, once known as a rare and progressive disorder, now can be accurately diagnosed and treated in the elderly with HFpEF. Whole heart SPECT/CT absolute quantification shows strong correlation with the visual Perugini score and high diagnostic performance with SUV<sub>max</sub> cut-off of more than 6.1. Specificity of this approach can be increased to 99% by ruling out elevated monoclonal proteins. 99mTc-DPD and 99mTc-PYP, are the most common cardiac scintigraphy agents used for the diagnosis of ATTR- CA. Planar scintigraphy with SPECT can help with more detailed assessment of the myocardial radiotracer uptake. In addition, Fusion with cardiac CT or MRI improves the correct interpretation avoiding false positives due to blood pool activity. In addition Quantitative measures may help early diagnosis. Risk assessment and therapy response.

### NMMIEE-35 Lymphoscintigraphy of Lymphedema

### Participants

Sara Babapour, MD, Boston, MA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Definition and pathophysiology of lymphedema. 2. Progressive clinical signs in lymphedema and correlating imaging stages. 3. How different lymphoscintigraphic techniques (agents, planar imaging, and SPECT) can be helpful for defining lymphatic function. 4. How to plan treatment based on imaging. 5. Describe post-treatment findings in lymphoscintigraphy.

### TABLE OF CONTENTS/OUTLINE

Introduction to Lymphedema 1.Primary 2.Secondary 3.Treatment options for lymphedema Lymphoscintigraphy Technique 1.Tracer types 2.Imaging protocols 3.Equipment Lymphoscintigraphy signs 1.Normal 2.Early lymphedema 3.Severe lymphedema 4.Correlation with other imaging techniques and clinical measures Post-treatment Lymphoscintigraphy monitoring 1.Lymphovenous bypass 2.Fat debulking 3.Lymph node transplant Current Research and Innovations in Lymphoscintigraphy, Summary

### NMMIEE-36 PET-CT Goes Large: Its Main Role in Large-vessel Vasculitis

### Participants

Javier Collada, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the leading role of PET-CT in large-vessel systemic vasculitis.2. To describe our experience in a tertiary hospital during the last 5 years.

### TABLE OF CONTENTS/OUTLINE

PET-CT is the best imaging technique in large-vessel vasculitis. Metabolic findings may suggest the diagnosis of cranial and large vessel-giant cell arteritis (C-GCA and LV-GCA) or Takayasu arteritis (TAK), the latter often affecting carotid, renal and mesenteric branches. Sensitivity/specificity for them are around 80%.In addition, PET-CT may detect features of polymyalgia rheumatica (PMR) (by means of Leuven score); and helps differentiating perivascular or atherosclerotic inflammation from "true" vasculitis. Metabolic activity (assessed using Meller scale) and extent diminish with treatment response, although it remains challenging to differentiate remission from smoldering mild disease.From 2018 to 2023 we performed 5082 PET-CT, 41 positive for vasculitis in diagnostic or follow-up stage: 71% women, mean age 70; 63% were GCA, the rest of them TAK, aortitis and one Behçet's disease. PET-CT diagnosis was definitive in 61%, only half the cases of GCA needing confirmatory biopsy. MRI was also used. The majority of GCA associated PMR clinical diagnosis, though just 30% had PET-CT signs.During follow-up, 52% had significant response on PET-CT, most of them complete. However, 40% didn't have pre-treatment PET-CT available.In conclusion, regarding our experience and the literature published to date, we deduce that PET-CT stands out as the main technique to assess large-vessel vasculitis, allowing accurate diagnosis, assessment of comorbid disorders and follow-up.

### NMMIEE-37 Radiotheranostics for Prostate Cancer Management: a New and Evolving Standard of Care

### Participants

Moozhan Nikpanah, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiotheranostics, which combines diagnostic and therapeutic capabilities, is changing the clinical management of prostate cancer. Radiopharmaceuticals, specifically prostate-specific membrane antigen (PSMA)-targeting tracers, play a vital role not only in initial diagnosis, staging, and detecting biochemical recurrence of prostate cancer, but also in targeted therapy. Cutting-edge imaging and therapeutic applications of radiotheranostics, such as 177Lu-PSMA-617, are improving patient outcomes. Additionally, there are a number of clinical trials investigating the expanding use of PSMA-based radiopharmaceuticals and other targeted radionuclide therapies. The objective of this educational exhibit is to familiarize radiology and nuclear medicine physicians and trainees with the pivotal role of radiopharmaceuticals in the management of prostate cancer.

### TABLE OF CONTENTS/OUTLINE

1) Overview of prostate cancer (PCa). 2) Concise review of radiotracers used for initial diagnosis, staging, and biochemical

recurrence of PCa, with a focus on PSMA ligands. 3) PSMA PET imaging for PCa: 3a) Application of PSMA PET for treatment guidance and management: implications and considerations. 3b) Pitfalls of PSMA PET imaging. 4) Radioligands and radiopharmaceuticals: advanced imaging and therapeutic applications: 4a) 68Ga-PSMA-11. 4b) 18F-DCFPyL (Piflufolostat F-18). 4c) 177Lu-PSMA-617. 4c-i) Clinical applications and ongoing challenges. 4c-ii) Predictive biomarkers for assessing efficacy of 177Lu-PSMA therapy. 4d) 223Ra-Dichloride. 5) Conclusion and future directions.

### **NMMIEE-38 Multimodality Imaging of Epstein-Barr Virus-Associated Diseases with Emphasis on PET/CT**

Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To review the spectrum of diseases associated with Epstein-Barr virus (EBV), including infectious mononucleosis, lymphoproliferative diseases, malignancies, and systemic autoimmune diseases. To present the multimodality imaging of the EBV-associated disease spectrum, with emphasis on F-18 FDG PET/CT in the initial staging and subsequent evaluation of therapeutic response.

#### **TABLE OF CONTENTS/OUTLINE**

Epstein-Barr virus (EBV) is an oncogenic herpesvirus that infects over 90% of the population worldwide. Although usually asymptomatic, EBV is associated with a wide spectrum of lymphoproliferative diseases and malignancies, especially in patients with immunologic suppression or compromise. EBV has been implicated in the pathogenesis of a variety of diseases, including but not limited to infectious mononucleosis, Burkitt's lymphoma, Hodgkin's and non-Hodgkin's lymphoma, nasopharyngeal carcinoma, gastric carcinoma, post-transplant lymphoproliferative disorders (PTLD), smooth muscle tumors, and autoimmune diseases. While chemotherapy and immunotherapy are therapeutic considerations for many of these diseases, modulation of immunosuppression is considered the first-line management, when applicable, with a regression rate of up to 50%. PET/CT imaging is a critical tool for initial disease staging, assessment of treatment response, and monitoring for disease recurrence. This educational exhibit will (1) review the multimodality imaging features of EBV-associated spectrum of diseases such as infectious mononucleosis, lymphoproliferative diseases, malignancies, and autoimmune diseases and (2) emphasize the role of PET/CT in the detection and surveillance of EBV-associated diseases.

### **NMMIEE-39 Revealing the Hidden Mysteries of the Brain: A Guide to Brain Perfusion Single Photon Emission Computed Tomography (SPECT)**

Participants

Tomoki Imokawa, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Single Photon Emission Computed Tomography (SPECT) is one of the nuclear medicine imaging modalities to evaluate cerebral hemodynamics. Cerebral perfusion studies are important in the diagnosis of a variety of diseases. Sometimes, cerebral perfusion studies are the only diagnostic clue. This presentation introduces the use of SPECT in the diagnosis of epilepsy and dementia. We also present cases in which SPECT played a decisive role in the diagnosis of inflammatory diseases and tumors, as well as cases in which SPECT served as an objective indicator of psychiatric symptoms and treatment efficacy. The results of SPECT research have important implications in clinical practice, and the application of its findings to MR perfusion imaging is also expected.

#### **TABLE OF CONTENTS/OUTLINE**

1. Basics of SPECT 2. Epilepsy 3. Neurodegenerative Diseases 4. Cerebrovascular Diseases 5. Tumor 6. Inflammatory Diseases 7. Psychiatric Disorders 8. Others

### **NMMIEE-4 Feasibility of Performing SPECT/CT Imaging on a CZT Scanner to Monitor Lutetium-177-PSMA-617 Therapy**

#### **TEACHING POINTS**

Lutetium-177-PSMA-617 (Pluvicto) is a novel radioligand therapy for treatment of metastatic prostate cancer. Current time points for PSMA PET/CT include pre- and post- therapy imaging for patient selection and evaluation of treatment response, respectively. To date, there is no clinical imaging available to monitor the treatment progress during cycles of Pluvicto administration. Current Pluvicto treatment monitoring relies on non-imaging clinical tools, such as PSA levels. Sequential imaging (SPECT/CT) during treatment cycles provides imaging direction to monitor Pluvicto treatment targets and perform organ-based dosimetry. Technical challenges, image quality, and sensitivity of Lu SPECT/CT acquisition will be discussed with its implications in the future of image-guided personalized adaptive dosimetry and diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

F-18 PET/CT diagnostic scan for metastatic prostate cancer. Lutetium-177-PSMA-617 (Pluvicto) treatment of metastatic castration resistant prostate cancer. Use of Lu-177 SPECT/CT for sequential monitoring over Pluvicto treatment cycles Acquisition of Lu SPECT/CT at 24 hours post cycle 1 of Pluvicto treatment Evaluation of Pluvicto treatment target with SPECT/CT, avidity for metastatic and primary lesions, sparing of nonaffected essential organs F-18 PET/CT and Lu SPECT/CT imaging qualitative concordance and discordance. Ongoing feasibility study to perform advanced quantification and dosimetry across treatment duration Future possibility to tailor Pluvicto treatment and minimize patient risk across treatment cycles

### **NMMIEE-40 Incremental Value of PET/CT in Identification of Infections Associated with Cardiac Devices**

Participants

Matthew Koh, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The diagnosis and anatomic localization of cardiac device-related infections is a presently challenging and clinically relevant topic. Historically, transthoracic and transesophageal echocardiography has been the gold standard of cardiac imaging, however, they are limited in the evaluation of implantable cardiac devices and prostheses, particularly left ventricular assist devices and prosthetic valves. 18F-fluoro-2-deoxyglucose positron emission tomography with CT (FDG PET/CT) has gained increased attention in recent years for the diagnosis of cardiac infections in these select populations. In this educational exhibit, we intend to provide relevant

background information on this topic, review the essential components of left ventricular devices and prosthetic valves, outline the current standards regarding cardiac device-related infections, and finally provide cases that demonstrate the utility of FDG PET/CT in imaging cardiac device-related infection in both initial diagnosis and follow-up.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction/Relevant background information. Review of essential components of left ventricular assist devices. Review of prosthetic cardiac valves. Current standards regarding imaging of cardiac device-related infections. Case collection of PET/CT in imaging cardiac device-related infections in initial diagnosis and follow-up. Conclusion/Final points.

#### **NMMIEE-41 FDG PET/CT Imaging Pitfalls in Current Era of Immunotherapy: Watch Out for Sarcoid Like Reactions**

##### **TEACHING POINTS**

Recognize the imaging features of sarcoidosis, sarcoid like reaction post immunotherapy on FDG PET/CT. Distinguish between tumor progression vs sarcoid like reaction on FDG PET/CT.

#### **TABLE OF CONTENTS/OUTLINE**

The imaging features of sarcoidosis are diverse and can be shown on a variety of imaging techniques. FDG avidity on PET/CT in patients with sarcoidosis is variable and can mimic malignancies (lymphoma, metastatic disease, post immunotherapy). Sarcoidosis typically demonstrates FDG avid supraclavicular, mediastinal, and bilateral hilar lymph nodes on PET/CT. Biopsy demonstrates non caseating granulomas. Immunologic toxicities in cancer patients are often referred to as immune-related adverse events (irAEs). Among various irAEs, sarcoid-like granulomatous lymphadenopathy occurs in 5% to 7% of patients, and typically presents as asymptomatic mediastinal/hilar lymphadenopathy, sometimes with accompanying multifocal pulmonary nodularity. Resolution or decrease in the original tumor burden on restaging PET/CT, and development of new FDG avid mediastinal/hilar lymphadenopathy in patients receiving immunotherapy indicates probable sarcoid like reaction. Recognition of this pattern of distribution is essential in interpreting the post treatment PET/CT. In equivocal cases, a biopsy or short interval PET scan may be necessary. Using a case based approach, we'll demonstrate PET/CT images of patients with sarcoidosis, evolution of sarcoid like reaction to various immunotherapeutic agents and sarcoid like distribution of metastatic disease.

#### **NMMIEE-42 Boning Up on DXA in Adults: A Radiologist's Guide to Interpretation and Quality Control**

Participants

Saeed Elojeimy, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1- List DXA indications. 2- Recognize appropriate and inappropriate acquisition techniques. 3- Review the pathologic conditions detectable on DXA. 4- Recognize pitfalls that can arise on DXA and how to troubleshoot.

#### **TABLE OF CONTENTS/OUTLINE**

1- Introduction 2- DXA's role in assessing bone mineral density a. Imaging preparation and technique: Patient preparation, imaging technique (describe when to image spine, hip, and forearm and appropriate techniques for ROI placement) b. Interpretation (Comparative databases, T-score, Z-score) c. Review WHO criteria for diagnosing normal bone density, low bone mass, and osteoporosis d. Fracture Risk Assessment (Role of FRAX and Trabecular bone score) e. Pitfalls (improper positioning, artifacts, incidental findings) 3- DXA's emerging role in evaluating and tracking body lean mass and fat composition (review indications, technique, interpretation, available comparison databases, reporting) 4- Summary

#### **NMMIEE-43 18F-FDG PET/CT Focus on Inflammatory-infectious Diseases. Beyond Tumor-related Processes**

Participants

Maria Baladron, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Review the applications and importance of non-oncologic 18F-FDG PET-CT in various infectious and inflammatory cases. Demonstrate the utility of 18F-FDG PET/CT in evaluating fever of unknown origin. Case-based review of common and uncommon inflammatory and infectious pathologies, including sarcoidosis, osteomyelitis, spondylodiscitis, and vasculitis, among others. Demonstrate the utility of 18F-FDG PET/CT in evaluating the extension of the disease and treatment response in some of these pathologies. Be aware that these pathologies sometimes are incidental findings in routine oncology follow up.

#### **TABLE OF CONTENTS/OUTLINE**

A brief theoretical basis of PET-CT imaging and mechanism of 18F-FDG interaction with cells. Fever of unknown origin as a clinical entity that benefits from the sensitivity of FDG uptake. Metabolic findings before morphologic variations challenge conventional imaging. Different potential uses of 18F-FDG PET/CT in infectious and inflammatory cases; assessing active inflammation, disease extent, occult disease, treatment response and sometimes determining the most suitable biopsy site. Display specific FDG uptake patterns in rare conditions like recurrent aseptic osteomyelitis. Illustrate cases of incidental inflammatory-infectious finding during oncologic patient evaluation.

#### **NMMIEE-44 FDG PET/CT Imaging of Systemic Vasculitis: A Pictorial Review**

Participants

Masatoshi Hotta, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Vasculitis can be classified into primary or secondary types based on its etiology or by the size of the affected blood vessels according to the Chapel Hill Consensus Conference criteria. As any size of vessel in any organ may be affected, the imaging findings vary widely. The heterogeneous nature of vasculitis poses a diagnostic challenge. The aims of this review are to: 1) present FDG-PET/CT images of primary and secondary systemic vasculitis affecting vessels of various sizes, including large, medium, small, and variable-sized vessels, 2) describe the FDG-PET/CT features of each systemic vasculitis type and discuss non-vascular findings that can aid in the differential diagnosis, and 3) review the role of FDG-PET/CT in the management of systemic vasculitis.



## TABLE OF CONTENTS/OUTLINE

1. Introduction | 2. Primary vasculitis: a) Large-vessel vasculitis (Takayasu arteritis, giant cell arteritis); b) Medium-vessel vasculitis (polyarteritis nodosa); c) ANCA-associated small-vessel vasculitis (microscopic polyangiitis, granulomatosis with polyangiitis, eosinophilic granulomatosis with polyangiitis); d) Variable-vessel vasculitis (Behçet's disease, Cogan's syndrome). | 3. Secondary vasculitis: a) Vasculitis associated with systemic disease (IgG4-related disease, sarcoidosis, relapsing polychondritis, Erdheim-Chester disease); b) Vasculitis associated with probable etiology (drugs, infection)

### **NMMIEE-45 Transthyretin Cardiac Amyloidosis (ATTR-CM) and Alzheimer's Disease: Is There a Real Correlation or Age-related Specific to Certain Population**

#### TEACHING POINTS

-Review the relationship between cerebral amyloidosis (Alzheimer disease) and Transthyretin cardiac amyloidosis (ATTR-CM). - Review the imaging technique and radiotracer used for cerebral and cardiac amyloidosis. -Illustrate cases with cardiac and cerebral amyloidosis who presented to our institution

## TABLE OF CONTENTS/OUTLINE

The term "cardiac dementia" (ATTR - CM) is referred to heart failure (HF) as a risk factor for Alzheimer disease (AD). It is thought that the correlation between these two entities is through perfusion defects, angiopathy, and inflammation. Some studies suggest that AD is a multiorgan, systemic disease that may contribute to diminished cardiovascular function. Moreover, recent studies have shown common molecular and pathological features in the brain and heart of the patients with AD, including intramyocardial deposits of A $\beta$ . Whether this amount of A $\beta$  deposit can play a role in compromised myocardial function in patients with AD is yet unknown. High A $\beta$  level in the brain is detected on PET imaging. Although the intramyocardial deposits of A $\beta$  are at a much lower concentration than those seen in the brain, cardiac PET imaging with C-PIB, 18F-florbetapir, and 18F-florbetaben can detect light chain and transthyretin amyloidosis and identify cardiac amyloidosis early in the course of the disease. In ATTR-CM, Tc PYP Cardiac SPECT CT improves the differentiation from blood pool and myocardial uptake and decreases false negatives. Alzheimer's disease and heart failure are two common age-related diseases that can coexist. However, whether there is a real correlation between the two is still a subject of debate and more large-scale population studies are being conducted to further investigate this.

### **NMMIEE-46 Preoperative and Postoperative 18F-Choline PET/CT Value in Patients with Primary Hyperparathyroidism**

#### TEACHING POINTS

- To learn about 18F-Choline (FCH) molecule and recognize its physiologic biodistribution, pathological uptake and potential pitfalls.- To understand the acquisition protocol and recognize the importance of early phase PET scan combined with iodine contrast-enhanced CT.- To review current recommendations for the use of FCH PET/CT in patients with primary hyperparathyroidism (PHPT) and related clinical conditions (eg. tertiary hyperparathyroidism, MEN syndromes).

## TABLE OF CONTENTS/OUTLINE

Choline is a chemical precursor for the synthesis of phospholipids that form the cell membrane. Parathyroid (PT) active tissue has a high uptake of FCH due to the upregulation of choline kinase. Hyperparathyroidism causes urinary, bone, neurologic, and gastrointestinal symptoms and complications. Most cases of PHPT are caused by a solitary PT adenoma. Surgery is the appropriate treatment, but the main reasons for surgical failure are ectopic glands and multiple active tissues. Precise preoperative location of PT tissue remains a difficult task with conventional imaging (99Tc-MIBI scan, CT, MRI) and it is more challenging in patients with previous neck surgery. FCH PET/CT has a high sensitivity for preoperative localization of PT adenomas and postoperative search of active PT tissue. FCH PET/CT is becoming a first-line imaging modality for preoperative and postoperative localization of active PT tissue in PHPT patients. Table of Contents- FCH physiologic uptake and normal biodistribution.- Imaging acquisition protocol. - Preoperative and postoperative localization of orthotopic and ectopic active PT tissue. - Recommendations for the use of FCH PET/CT in patients with PHPT. - Illustrative cases.

### **NMMIEE-47 Brain Death: Review of Neuroimaging criteria, Techniques and Pitfalls**

#### TEACHING POINTS

1) Overview of brain death imaging with a focus on the role of radionuclide perfusion scintigraphy for early and accurate determination of brain death. 2) Review brain death physiology, medical standards, clinical and imaging criteria, confounding variables and inconsistencies in the concept of brain death documentation.3) Highlight the imaging indications, patient preparation, techniques/protocols, instrumentation, imaging artifacts and pitfalls.

## TABLE OF CONTENTS/OUTLINE

• Introduction: Review of brain death imaging to assist radiologists in performing, interpreting and appropriate reporting of the results for the confirmation of brain death. Outline • Confirmatory examinations: Includes tests that show absence of brain electrical activity (EEG and somatosensory evoked potentials) and those that evaluate blood flow (radionuclide studies, multivessel angiography, CT/MR angiography). • Methods of evaluating blood flow: Contrast enhanced angiography, Transcranial Doppler ultrasound, Radionuclide brain flow scintigraphy. • Review of radionuclides-Tc-99m HMPAO-Tc-99m ECD-Tc-99 m DTPA-Tc-99 m Glucoheptonate-Tc-99 m TcO $_4$  • Pitfalls of radionuclide scintigraphy -False positive tracer activity due to infection, tumors, scalp hyperemia due to head trauma, CSF shunts, intracranial pressure transducer.-False negative results due to disruptions in the skull and scalp, as well as pressure on the portion of the scalp resting on a hard surface causing photopenic area on the flow study.

### **NMMIEE-48 The Utility of Brain Perfusion Single Photon Emission Computed Tomography (SPECT) in the Assessment of Neurodegenerative Diseases**

Participants  
Tomoki Imokawa, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

SPECT, or Single Photon Emission Computed Tomography, is one of the nuclear medicine imaging modalities to evaluate cerebral hemodynamics. Cerebral perfusion studies contain much information useful for the diagnosis of various diseases, especially neurodegenerative diseases. This presentation will highlight the use of SPECT in the diagnosis of neurodegenerative diseases and

other conditions that cause dementia, such as cerebrovascular disease and idiopathic normal pressure hydrocephalus. The findings of SPECT have important clinical implications, and the application of the knowledge to MR perfusion imaging is also expected.

#### **TABLE OF CONTENTS/OUTLINE**

1. The Basics of SPECT 2. Alzheimer's Disease 3. Dementia with Lewy Bodies 4. Frontotemporal Dementia 5. Corticobasal Syndrome 6. Idiopathic Normal Pressure Hydrocephalus 7. Progressive Supranuclear Palsy 8. Multiple System Atrophy 9. Spinocerebellar Ataxia 10. Cerebrovascular Diseases 11. Creutzfeldt-Jakob Disease 12. Others

#### **NMMIEE-49 Advanced Cancer Imaging with Hyperpolarized<sup>13</sup>C-MRI: Techniques and Applications**

##### **TEACHING POINTS**

1. Hyperpolarized carbon-13 MRI (HP <sup>13</sup>C-MRI) is a promising metabolic imaging for oncology that employs dynamic nuclear polarization to enhance the polarization of solid-state compounds labeled with carbon-13, increasing signal by up to 50,000-fold, and allowing the detection of the probe and its downstream metabolites using a clinical MRI scanner. 2. HP <sup>13</sup>C-MRI using [1-<sup>13</sup>C]pyruvate enables non-invasive and rapid monitoring of the upregulated anaerobic glycolysis in cancer cells. MCT in the cellular membrane enables the uptake of [1-<sup>13</sup>C]pyruvate, which is then converted into [1-<sup>13</sup>C]lactate by LDH or into [1-<sup>13</sup>C]alanine by ALT or into <sup>13</sup>C-bicarbonate by PDH. 3. Hyperpolarization is transient and relaxes back to thermal equilibrium once leaving polarizer, providing an acquisition window of 2-3 minutes. MRI sequences are optimized to utilize the unrecoverable magnetization rapidly and efficiently. 4. Kinetic modeling involves developing a mathematical model that describes the rates at which probes are converted to products, while model-free metrics rely on metabolite ratios. 5. HP <sup>13</sup>C-MRI has been applied to prostate cancer, renal cell carcinoma, brain tumors, and breast cancer, showing its potential to distinguish between benign and malignant tumors, determine tumor aggressiveness, monitor response to therapy, and predict patient outcomes.

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction of HP <sup>13</sup>C-MRI. 2. Technical aspects: (a) <sup>13</sup>C labeled probes; (b) Probe preparation and pharmacy kit assembly; (c) Hyperpolarization, dissolution, and quality control; (d) Patient injection, imaging acquisition, and data analysis. 3. Clinical applications. 4. Conclusions.

#### **NMMIEE-5 Molecular Imaging of Dementia: A Case-Based Review**

##### **TEACHING POINTS**

Introduction: Molecular imaging plays an increasingly important role in the early identification and monitoring of various forms of dementia, as well as in selecting appropriate patients for therapy in these disorders. In this educational exhibit, we aim to review the pathologic basis and salient imaging findings of the most common causes of dementia, drawing on case examples from our institution. Teaching points/ Learning objectives: 1. Understand the basic pathologic processes responsible for the most common neurodegenerative processes as well as their relative prevalence. 2. Learn the normal and abnormal uptake patterns in the brain on various nuclear medicine studies, including FDG PET, amyloid PET, and DaTScan. 3. Learn what further imaging workup would be recommended for indeterminate findings on FDG PET.

##### **TABLE OF CONTENTS/OUTLINE**

Outline: 1. Background of dementia a. Definition b. Review of different neurocognitive domains i. Perceptual-motor function ii. Language iii. Executive function iv. Learning and memory v. Complex attention vi. Social cognition c. Review of the most common causes of dementia and their pathologic basis d. Review of various proteinopathies 2. Review of findings of most common causes of dementia on FDG and amyloid PET as well as DaTScan with associated case examples i. Alzheimer's disease ii. Vascular dementia iii. Mixed dementia iv. Dementia with Lewy Bodies v. Frontotemporal dementia vi. Corticobasal degeneration vii. Creutzfeldt-Jakob disease 3. Imaging using F-18-DOPA in parkinsonism 4. Suggested further workup based on imaging findings 5. Review amyloid and Tau imaging tracers and briefly discuss other functional tracers useful in neurodegenerative diseases

#### **NMMIEE-50 Radiation Safety in Theragnostics: Educational Simulated Real-life Scenarios**

Participants  
Kip Guja, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

##### **TEACHING POINTS**

Theragnostics is a rapidly growing field in nuclear medicine in the era of personalized medicine. Knowledge of radiation safety issues in targeted radionuclide therapies (TRT) is vital for delivering safe and effective patient care, and for maintaining the safety of healthcare workers involved in patient care. The objective of this educational exhibit is to address fundamental issues in radiation safety related to TRT in an engaging way by presenting educational real-life scenarios which may be encountered in a theragnostics clinic.

##### **TABLE OF CONTENTS/OUTLINE**

Educational real-life scenarios to be discussed in this exhibit include: (1) Dose calibrator fails quality control testing, (2) Discrepancy >20% between assayed and prescribed dose, (3) Misadministration of the wrong therapeutic radiopharmaceutical, (4) Preparation of the theragnostics treatment room and restroom, and (5) Patients with nephrostomy tubes referred for Lu-177 therapy, (6) Management of Lu-177 radionuclide spill, (7) Management of radioiodine spill (8) Precautions related to liquid I-131 therapy. The appropriate actions/response to each scenario will be summarized.

#### **NMMIEE-51 Prostate Cancer Theragnostics: Review and Early Insights**

##### **TEACHING POINTS**

1. Review the general characteristics of prostate cancer 2. Explore current treatment options and algorithms for prostate cancer, focusing on the increasing role of PSMA theragnostics 3. Establish a framework for the evaluation and selection of patients who would benefit from PSMA RLT 4. Understand the factors behind successful PSMA RLT therapy; including protocols for treatment, side effects/contraindications and the role of imaging/laboratory monitoring during treatment 5. Identify current ongoing research and unanswered questions in the role of PSMA RLT

##### **TABLE OF CONTENTS/OUTLINE**

I. Overview of prostate cancer. Epidemiology, diagnosis, and progressionb. Localized versus metastatic; Castration sensitive versus resistantII. Overview of current treatmenta. Medical and surgicali. Surgery and radiotherapyii. Androgen basediii. Chemotherapyb. Nuclear medicinei. Radium-223ii. 177Lu-PSMA-617III. Overview of 177Lu-PSMA-617a. Mechanism of actionb. Overview of trial results and evidenceIV. Treatment with 177Lu-PSMA-617a. Patient selectioni. Inclusion criteria and contraindicationsii. Choosing between Ra-223 and PSMA RLtb. Treatment protocolsV. Evaluation and monitoring of 177Lu-PSMA-617 treatment responsea. Adverse effects and managementb. SPECT monitoring between cyclesi. Range of responsesii. Imaging monitoring and adjusting therapyc. Criteria for cessation of therapyd. Case based review and examples.VI. Future directions and unanswered questionsa. Review of ongoing trials

## **NMMIEE-52 Beyond the Glowing Hues: A Comprehensive Review of False Positive Cases on FDG PET/CT**

Participants

Kota Yokoyama, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

FDG PET is one of the most widely used nuclear medicine examination in clinical use today, with high detection capability for malignant tumors and inflammatory diseases. On the other hand, its specificity for tumors is not high, making it difficult to distinguish between inflammation and tumors. In addition, with the recent rise in the price of therapeutic drugs, there are more opportunities to use it for treatment response assessment, and it is important to understand the changes that may be encountered after various types of treatment. This section will provide an overview of the physiologic accumulation of FDG PET/CT and the frequently encountered and somewhat rare false-positive cases (non-neoplastic lesions), presenting a wide range of cases from initial presentation to post-treatment.

### **TABLE OF CONTENTS/OUTLINE**

1. The basics of FDG PET/CT 2. Physiological uptake, Artifacts, reactive change, lipomatous hypertrophy, brown adipose3. Iatrogenic or post-treatment changes: radiation pneumonitis, radiation pulmonary fibrosis, radiation sialadenitis, radiation liver disease, postoperative PPFE, foreign body granuloma, thymic rebound, G-CSF reactive bone marrow, vaccine reactive accumulation, etc.4. Benign lesions: Pituitary adenoma, chronic thyroiditis, hypercellular bone marrow, desmoids, hypercellular bone marrow, etc.5. Inflammatory disease Sarcoidosis/sarcoid-like reaction, vasculitis, IgG4-related disease, Cattleman's disease, TAFRO syndrome, etc.6. Infectious diseases: Tuberculosis, mycosi fungoides, actinomyces/nocardia, echinococcosis, etc.

## **NMMIEE-53 New Era of Imaging of Parkinson's Disease and Atypical Parkinsonian Syndrome**

Participants

Yoshiaki Ota, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Early diagnosis and treatment of movement disorders including Parkinson's disease are highly important to reducing the risk of disease progression and improving the quality of life. 2. Brain MRI, FDG-PET, dopaminergic imaging, cholinergic imaging and 123I cardiac meta-iodobenzylguanidine (MIBG) have been clinically utilized not only for differential diagnosis but also for providing disease prognosis. 3. Novel molecular imaging and brain MRI can aid in deepening the pathophysiology of movement disorders and in treatment development.

### **TABLE OF CONTENTS/OUTLINE**

1. Parkinson's disease and atypical Parkinsonian syndromes: (a) Parkinson's disease, (b) Progressive supranuclear palsy (PSP), (c) Multiple system atrophy (MSA), (d) Corticobasal degeneration (CBD), (e) Dementia with Lewy bodies (DLB) 2. Pathophysiology of Parkinson's disease: (a) Dual-hit hypothesis: a-synuclein pathology arises simultaneously in the olfactory bulb (OB) and dorsal motor nucleus of the vagus (DMV) and in the enteric nervous system (ENS) plexus. (b) Single-hit hypothesis: a-synuclein pathology arises in OB/DMV first or in ENS first. 3. Imaging modalities of Parkinson's disease and atypical Parkinsonian syndrome and common imaging features: (a) Brain MRI, (b) Advanced neuroimaging: Diffusion tensor imaging (DTI) and functional MRI (fMRI), neuromelanin-sensitive MRI (NM-MRI), (c) FDG-PET, (e) Dopaminergic imaging, (f) Cholinergic imaging, (g) Cardiac MIBG 4. Treatment options and imaging assessment of treatment response of Parkinson's disease and atypical Parkinsonian syndromes

## **NMMIEE-54 Nuclear Medicine Imaging in Epilepsy: What the Radiologist Needs to Know**

### **TEACHING POINTS**

1. Nuclear medicine imaging plays an essential role in the evaluation of medically refractory epilepsy patients. For these patients, surgery is effective provided there is a well-delineated epileptogenic focus. 2. Functional imaging methods—SPECT and PET—complement structural imaging, allowing accurate ictal focus localization even in the absence of a structural abnormality. 3. Comparison of ictal and interictal SPECT combined with MRI (SISCOM) increases the sensitivity for epileptogenic focus detection. 4. Interictal F-18 FDG PET helps to lateralize the epileptogenic focus, assess for other abnormalities, and guide further testing in pre-surgical planning. 5. Future endeavors include quantitative analysis improvements, neuroreceptor PET radiotracers, and multimodality imaging integration.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction of medically refractory epilepsy. 2. Overview of surgical options. 3. Description of the pre-surgical evaluation process, focusing on ictal and interictal SPECT and interictal FDG PET. 4. Presentation of radiopharmaceuticals and their characteristics. 5. Review of methodology, imaging protocols, and post-processing techniques. • Ictal and interictal SPECT • Interictal F-18 FDG PET 6. Illustration of SPECT and PET usage in ictal focus localization and pre-surgical guidance through a series of commonly encountered pathologies- temporal and extratemporal epilepsy, cortical dysplasia, arteriovenous malformations, encephalocele, tumors. 7. Review of emerging radiopharmaceutical imaging options.

## **NMMIEE-55 PSMA Radiotheranostics in Prostate Cancer: Principles, Practice, and Future Prospects**

Participants

Laszlo Szidonya, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. 177Lu-PSMA is a safe and effective therapy in metastatic castration-resistant prostate cancer. 2. Eligibility for treatment is

based on the uptake of lesions on PSMA PET.3. The degree of uptake on PSMA and FDG PET offers predictive and prognostic information.4. Post-therapy imaging is important to confirm tumor uptake of the therapeutic agent, monitor response, and identify progressing lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction:a. Clinical overview of prostate cancer and treatment options.b. Concept of radiotheranostics.c. Data from the VISION and TheraP trials.2. Current practice:a. Eligibility for treatment.b. Therapy administration and dosing.c. Toxicity and side effects.3. Added value of imaging:a. Prognostic/predictive PET biomarkers:i. Qualitative parameters:1. Level of PSMA uptake relative to liver/spleen and salivary glands.ii. Quantitative parameters:1. Absolute uptake values (e.g. SUVmax).2. Total tumor burden.iii. PSMA/FDG concordance/discordance.b. Post-therapy imaging:i. SPECT quantification to predict response.ii. Detection of disease progression.4. Future directions:a. Timing, sequencing, and dose optimization.b. Potential role of personalized dosimetry.c. Alternative PSMA targeting molecules.d. PSMA therapy using alpha emitters.e. Combination therapy.

#### NMMIEE-56 Improving the Diagnostic Sensitivity of 13N-Ammonia PET Imaging: Creating Age- and Gender-Matched Normal Databases for Myocardial Flow Reserve Measurements

Participants

Takuji Nanno, Suita, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

13N-Ammonia myocardial perfusion PET imaging (ammonia PET), is a non-invasive, quantitative imaging method that enables the evaluation of myocardial blood flow (MBF) for detecting myocardial ischemia and assessing disease severity. Myocardial flow reserve (MFR) measurements, obtained by comparing stress and rest MBF ratios, provide important diagnostic and prognostic information for ischemic heart disease. However, clinical interpretation of MFR values depends on the normal population values, and the normal database (NDB) for MFR has not been sufficiently evaluated. Since MFR measurements vary, it is desirable to create age- and gender-matched NDBs for individuals under 70 years old as well as NDB for individuals over 70 years old. By comparing MFR values with the appropriate reference NDB, it is possible to evaluate the severity of ischemia in a more detailed and objective manner. This presentation aims to introduce the methods for creating age- and gender-matched NDBs and their usefulness in clinical cases, thereby improving the diagnostic sensitivity in ammonia PET.

#### TABLE OF CONTENTS/OUTLINE

1. Age and Gender Differences in MFR in ammonia PET 2. Creation of age- and gender-matched NDBs for MFR using Syngo MBF software 3. Clinical case 1: Normal perfusion with normal coronary artery 4. Clinical case 2: Mild ischemia with significant stenosis in RCA and D1 5. Clinical case 3: Multi-vessel CAD

#### NMMIEE-57 Nuclear Medicine Lung Perfusion (Q) Imaging: SPECT/CT Indications and Interpretation Pearls and Pitfalls

#### TEACHING POINTS

1. Highlight the PISAPED interpretation criteria for perfusion-only lung scans 2. Understand indications for and utility of SPECT/CT in lung perfusion scans 3. Recognize common pearls and pitfalls in the interpretation of Q scans

#### TABLE OF CONTENTS/OUTLINE

1. Perfusion-only lung imaginga. Historic use of V/Q scansb. COVID pandemic and perfusion-only scansc. 2022 Global contrast shortage crisis 2. Interpretation Criteriaa. PISAPED perfusion-only criteria b. PLOPED perfusion-only criteria 3. SPECT/CT Indicationsa. Non-wedge shaped perfusion defects b. Heterogeneous radiotracer uptake and distribution 4. Case Examplesa. COVID pneumonia with and without pulmonary embolism (PE) b. Emphysema as a mimic of PE c. Bronchopneumonia with and without PE d. CTEPH - missed on CTPA and better seen on Q scan e. PE with pulmonary infarct f. Pleural effusion masking PE on planar images g. Pulmonary masses as a mimic of PE h. Fibrosis as a mimic of PE 5. Teaching Pointsa. Indications and utility of SPECT/CT b. Common pitfalls of interpretation

#### NMMIEE-58 COVID-19 Pandemic and Its Impact on Nuclear Medicine with Teaching Pearls

Participants

Nick Balanda, BSc, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

COVID-19 is a multi-systemic viral disease also known as SARS-CoV-2 or severe acute respiratory syndrome coronavirus 2. Worldwide rapid emergence of the COVID-19 pandemic altered the practice of medicine including nuclear medicine. It is considered to be one of the most massive and chaotic challenges confronting global public health of our times. This educational exhibit aims to: 1. Summarize economic impact of COVID 19 in a tertiary care university teaching hospital. 2. Describe the adaptation to the pandemic by modification of various imaging protocols (for example Myocardial perfusion, V/Q scan, scheduling of PET CT after COVID-19 vaccination), highlighting the importance of CT portion of SPECT CT and PET CT, especially for lung findings. 3. Offer Teaching Pearls and a case-based multi-modality correlation of interesting COVID-19-related findings in nuclear medicine and PET CT imaging with a focus on the impact on patient management.

#### TABLE OF CONTENTS/OUTLINE

We present 15 interesting COVID-19-related findings in nuclear medicine and PET CT imaging with a focus on the impact on patient management. These cases include incidental findings secondary to vaccination and COVID-19 infection as well as modified imaging protocols and highlight important considerations for radiologists interpreting images in the era of COVID-19.

#### NMMIEE-59 Role of 18F FDG PET CT in Patients with Lymphoma Treated with CAR-T Cell Therapy: Current Concepts

Participants

Vanessa Murad, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Understand the principles and biological effects of CAR-T cell therapy. CAR-T cell therapy is a novel cancer treatment based on the genetic modification of the patient-derived T cells by adding synthetic functional chimeric antigen receptors (CARs), which permit the identification of specific tumor antigens. 18F -FDG PET/CT (=PET CT) is the imaging of choice for pre and post CAR-T cell therapy assessment, in patients with metabolically active lymphomas. 2) Recognize the role of PET CT in pre-therapy assessment. Highly metabolically active disease and high tumor burden at baseline PET CT, are predictors of unfavorable patients' outcomes and risk of therapy related toxicities. 3) Define the optimal timing of PET CT in therapy response assessment, as well as its impact on management (with demonstrative cases). PET CT 1-month after the infusion is the preferable timing for therapy response assessment, and may trigger a possible therapeutic intervention. A few cases of pseudo-progression after therapy have been described; however, all have been during the first few days after the infusion, with complete resolution at 1-month PET/CT. 4) Identify the main toxicities associated with CAR-T cell therapy and the role of PET CT in their evaluation.

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction to CAR-T cell therapy, brief history and indications. 2) Role of PET CT in CAR-T cell therapy: 2.1) Pre-therapy considerations. 2.2) Post-therapy response assessment: timing, impact and imaging interpretation including pseudo-progression evaluation. Demonstrative cases. 2.3) Evaluation of toxicities during CAR-T cell therapy: Cytokine release syndrome, immune effector cell-associated neurotoxicity syndrome and infection.

#### **NMMIEE-6 Acute Adverse Events in Theragnostics: Educational Simulated Real-life Scenarios**

Participants

Kip Guja, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Theragnostics is a rapidly growing field in nuclear medicine in the era of personalized medicine. Recognizing and appropriately managing acute adverse events associated with targeted radionuclide therapies (TRT) is vital for delivering safe and effective patient care. The objective of this educational exhibit is to highlight management of acute adverse associated with TRT in an engaging way by presenting simulated real-life scenarios which may be encountered in a theragnostics clinic.

#### **TABLE OF CONTENTS/OUTLINE**

Educational simulated real-life scenarios to be discussed in this exhibit include: (1) Extravasation of 177-Lu radionuclide, (2) Management of potential complications associated with amino acid infusion during Lu-177 DOTATATE therapy, (3) Management of carcinoid crisis after Lu-177 DOTATATE therapy, and (4) Mitigation of flare reaction to TRT (5) Management of acute sialadenitis with Lu-177 PSMA-617 therapy. The appropriate actions/response to each scenario will be summarized.

#### **NMMIEE-60 Pediatric PET/MRI: The How and Why**

Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

#### **TEACHING POINTS**

Since its introduction a decade ago, integrated PET/MRI has been established as a hybrid imaging modality that provides unique diagnostic information. A key application of PET/MRI is pediatric imaging for oncologic, neurologic, inflammatory, and metabolic conditions given its reduced radiation exposure and potential for reduction of administered radiotracer dose. Despite its successful clinical adoption, the availability of PET/MRI for pediatric patients is still limited to larger academic and clinical centers due to high complexity studies which require thorough patient preparation and exam planning, skilled image acquisition and careful image analysis and interpretation. These factors limit the accessibility of PET/MRI not only for imaging specialists in training, but also for experienced radiologists and nuclear medicine physicians. The purpose of this contribution is to provide guidance and the value of pediatric PET/MRI with clinical examples drawn from pediatric PET/MRI programs world-wide.

#### **TABLE OF CONTENTS/OUTLINE**

1. Common clinical indications for PET/MRI in pediatric patients 2. Commonly used PET tracers for these indications 3. PET/MRI instrumentation 4. Patient preparation (patient information, dietary aspects, sedation, anesthesia) 5. Examination planning and protocol definition 6. Examination execution 7. Aspects of image processing 8. Interpretation and reporting 9. Pitfalls and troubleshooting

#### **NMMIEE-61 Role of FDG PET/CT in Therapeutic Decision Making in Lymphoma**

#### **TEACHING POINTS**

1. Therapeutic options for lymphoma include chemotherapy, monoclonal antibody therapy, radiation therapy, stem cell transplant and chimeric antigen receptor therapy (CAR-T). FDG PET/CT plays an integral part in therapeutic decision making. 2. Interim FDG PET/CT allows response-adapted treatment with either reduction in the number of chemotherapy cycles or early use of more aggressive treatment. 3. In patients receiving CAR-T, response assessment on FDG PET/CT should be guided by LYRIC response criteria. 4. Interpretation of interim and post treatment FDG PET/CT can be confounded by thymic hyperplasia, infection/inflammation, immune related adverse events, marrow stimulation by granulocyte colony-stimulating factor (G-CSF). 5. FDG PET/CT plays a role in evaluating disease relapse or transformation and provides guide to biopsy.

#### **TABLE OF CONTENTS/OUTLINE**

1. NCCN treatment guidelines- illustrations of role of FDG PET/CT in therapeutic decision making. 2. Overview of CAR-T3. Illustrate staging by FDG PET/CT 4. Illustrate Lugano and LYRIC treatment response criteria for interim and end of treatment FDG PET/CT 5. Illustrate pitfalls in treatment response assessment- thymic hyperplasia, infection/inflammation, irAEs (immune related adverse events), marrow stimulation by G-CSF 6. Illustrate role of PET/CT in identifying disease relapse or transformation

#### **NMMIEE-62 Functional Imaging of Liver and Spleen Using Tc 99m Sulphur Colloid. A Case Based Multi-modality Pictorial Review with Teaching Pearls**

Participants

Nick Balanda, BSc, Chicago, IL (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Nuclear Medicine Tc-99m Sulphur colloid liver-spleen scan has declined over recent years, however, it is still very useful in certain specific scenarios where it can be virtually diagnostic or confirmatory. Our case-based educational exhibit aims to: 1. Evaluate functional abnormalities of the liver and spleen based on the location and amount of radiotracer uptake. 2. Review specific scenarios for evaluating intra-pancreatic, left hemi abdominal, mediastinal, and left lung masses by liver spleen scan as questioned on conventional anatomic imaging with multi-modality correlation. 3. Evaluate a few specific space-occupying hepatic and splenic masses with multi-modality correlation. 4. Importance of SPECT CT over planar imaging.

## TABLE OF CONTENTS/OUTLINE

Our case-based educational exhibit includes: Assessment for Hypersplenism in patients with thrombocytopenia, evaluating for cirrhosis, evaluating/confirming the presence of accessory/ectopic splenic tissue, evaluating specific intrapancreatic lesions, Hepatic cysts, hepatic hemangiomas, FNH, splenic infarcts, Budd-Chiari syndrome.

## NMMIEE-63 Pictorial Review of MRI Fused with Somatostatin Receptor PET Tracers in Meningiomas: Does the Integration of Molecular and Anatomic Imaging Impact Clinical Management

### TEACHING POINTS

1. Physiologic avidity of somatostatin receptor PET tracers is minimal in the brain parenchyma, providing an excellent tumor background ratio (TBR), unlike FDG PET. 2. Somatostatin receptor PET assists in targeting meningiomas in complex anatomic regions such as the skull base and identifying additional sites. 3. MRI fused somatostatin receptor PET allows for distinguishing enhancing scar tissue from meningiomas. 4. Somatostatin receptor PET impacts clinical and radiation therapy (RT) management leading to changes in the clinical approach and/or modifications in radiation treatment volumes. 5. Somatostatin receptor PET has potential in neurotheranostics to provide diagnostic imaging to guide molecular therapeutic radionuclides, such as <sup>177</sup>Lutetium-DOTATATE.

### TABLE OF CONTENTS/OUTLINE

1. General considerations: § Imaging evaluation of intracranial meningiomas in NM and anatomic modalities § Review the mechanism of Somatostatin Receptor Targeted PET Imaging 2. Integration of PET and imaging guided therapy: Radiotherapy fundamentals. 3. Case-based approach of impact on patient's treatment decisions. 4. Somatostatin receptor PET pitfalls: What you need to know? Summary: Our preliminary experience of MRI fused with somatostatin receptor PET has shown to enhance identification of disease extent compared to MRI only, especially in patients with prior treatments and extracranial components, impacting management decisions and providing information for potential radionuclide targeted therapy.

## NMMIEE-64 Radiotheranostics in Prostate Cancer: Current Practice and Future Outlook

Participants

Daniel Kwon, MD, PhD, Coquitlam, BC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Next generation radiotheranostics are effective in patients with prostate cancer, with studies supporting imaging- and treatment-based on the molecular determinants of patient's disease. 2. Prostate-specific membrane antigen (PSMA)-targeted radiotheranostics represent the frontier of this paradigm, with PSMA-targeted imaging showing superiority compared to conventional imaging for staging and monitoring patients during therapy. 3. <sup>177</sup>Lu-based PSMA-targeted and <sup>223</sup>Ra radioligand therapy are effective in metastatic prostate cancer, and multiple clinical trials are exploring further indications. 4. Dosimetry will personalize doses per patient to maximize therapeutic benefit while minimizing toxicity. 5. Other radioisotopes (e.g. <sup>225</sup>Ac, <sup>161</sup>Tb) and molecular targets (e.g. gastrin-releasing peptide receptor (GRPR)) are being explored for radiotheranostic applications in prostate cancer.

### TABLE OF CONTENTS/OUTLINE

- Overview of prostate cancer: current diagnosis and treatment
- Introduction to radiotheranostics: common theranostic radioisotopes and their selection
- PSMA-targeted imaging and radioligand therapy: recent trial data, indications, clinical pearls, image-guided monitoring, and case examples
- Radium-223: indications, clinical pearls, and case examples in bone metastases in prostate cancer
- Dosimetry: principles and applications for personalized radioligand therapy
- The Future: Ongoing PSMA-targeting radiotheranostic clinical trials, emerging theranostic radioisotopes and radiotheranostic agents (e.g. GRPR)
- Conclusions and Summary

## NMMIEE-65 18F-FDG PET/CT: Least Useful to Most Important Imaging Modality for Evaluation of Prostate Cancer

### TEACHING POINTS

1. Understand the roles and mechanism of PSMA and FDG PET/CT imaging in evaluating prostate cancer at different stages of the disease. 2. When reading PSMA PET/CT scans, interpreters should always correlate with clinical history such as PSA level, disease stage, and prior treatments. If PSMA positive lesions are not in proportion to high PSA level or if lesions are only seen on CT without PSMA avidity, think of transformation of prostatic adenocarcinoma (CRPC-Adeno) to treatment-induced neuroendocrine prostate cancer (t-NEPC). Consider <sup>18</sup>F-FDG PET/CT for further evaluation. In some cases, <sup>68</sup>Ga-DOTATATE PET/CT may be helpful.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Case examples 3. Educational objectives 4. Summary

## NMMIEE-7 Perineural Tumoral Spread- A Search Pattern for PET Scan Readers

### TEACHING POINTS

1. Perineural tumor spread is the macroscopic analogue of perineural tumor invasion. 2. F-18 FDG PET CT is often used in staging and response assessment in head and neck malignancies and has an important role in identification of perineural tumor spread. 3. Familiarity with relevant cranial and peripheral nerve anatomy, pattern of perineural tumor spread and associated PET imaging appearance will lead to improved detection of this important prognosticating factor. 4. FDG uptake resulting from postsurgical and post-radiotherapy inflammation in addition to other infectious and inflammatory causes may lead to false positive cases mimicking perineural tumor spread.

## TABLE OF CONTENTS/OUTLINE

1. Background- what's in a name- perineural tumor spread versus perineural tumor invasion.2. Overview of relevant cranial nerve and peripheral nerve anatomy.3. Pathophysiology of perineural tumor invasion and perineural tumor spread.4. Tumor types, sites, and clinical presentation of perineural tumor spread.5. Case based review of PET patterns of perineural tumor spread in the head and neck.6. Other usual and unusual locations for perineural tumor spread on PET imaging.7. Search pattern for peritumoral spread for PET scan readers.8. Imaging differentials for consideration and false positives. 9. Prognosis and treatment considerations in patients with perineural tumor spread.

### **NMMIEE-8 Imaging Appearances of Large Vessel Vasculitis on 18F-FDG PET/CT: The Dark, the Bright, and the In-between**

Participants

Rita Maria Lahoud, MD, Shelton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 18F- FDG PET/CT can be used in the diagnostic evaluation of vasculitis, to determine the distribution of involvement, the activity status of the disease, and to assess treatment response.
- Where possible, CT angiography should be added to 18F-FDG PET/CT as it not only improves diagnostic accuracy but can identify frequent complications such as aneurysm formation or vascular dissection.
- PET vascular activity score (PETVAS) is a grading system that provides qualitative and quantitative assessment.
- Limitations include superficial cranial vessel involvement, extensive atherosclerosis, and persistent uptake in remission limiting the use of PET/CT for routine follow-up.
- Systemic rheumatologic conditions, including Erdheim Chester and IgG4 Related Disease can have secondary involvement of the large vessels, mimicking a large vessel vasculitis. It is important to recognize their distinguishing features and patterns of involvement on 18F- FDG PET/CT.

## TABLE OF CONTENTS/OUTLINE

1. Introduction to Large Vessel Vasculitis: a. GCA and PMR b. Takaysu's 2. Role of PET/CT in the Evaluation of LVV a. Disease activity b. Extent of involvement c. Biopsy Target d. Response Assessment 3. PET/CT protocol a. General patient preparation b. Impact of glucocorticoids c. Incubation time d. Contemporaneous CT angiogram 4. Common Imaging Appearances of LVV on PET/CT a. GCA pre and post therapy b. Takayasu's c. TIPIC variant of GCA 5. Differential Considerations a. Erdheim Chester b. IgG4 related disease 6. Diagnostic Accuracy of PET/CT

### **NMMIEE-9 Epilepsy Beyond HARNESS-MRI Protocol through Hybrid PET-MRI and Advanced MRI Imaging**

Participants

Piedad Acosta Mora, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To learn the causes of drug-resistant epilepsy and structural alterations in neuroimaging.- To recognize the spectrum of MRI sequences optimized for epilepsy and to implement the use of HARNESS MRI protocol.- To review advanced neuroimaging techniques (functional, metabolic, post-processing.) and to explain the utility in the drug-resistant epilepsy - To evaluate the clinical impact of hybrid FDG -PETMRI in decision-making in drug-resistant epilepsy- To understand how hybrid imaging with PETMRI optimizes the subtle epileptogenic lesions detections and improves postsurgical seizure outcome.

## TABLE OF CONTENTS/OUTLINE

1.Introduction2.Classification of seizure types3.Causes of drug-resistant epilepsy 4.MRI sequences optimized for epilepsy - HARNESS MRI protocol5.Advanced neuroimaging techniques - BOLD- MRI functional - Texture analysis - Spectroscopy - Diffusion tensor imaging (DTI) and fiber tractography 6.Role of hybrid FDG-PETMRI in epilepsy - Indications - Preparation - Technique and recommendations for acquisition - Normal patterns of brain FDG uptake - Cortical analysis 7.Case-based learning 8.Conclusions

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## Abstract Archives of the RSNA, 2023

NMMIEE-1

### What Radiologists Need to Know About Immune-related Adverse Events: Clinical Significance of FDG-PET/CT Diagnosis of Immune-related Adverse Events

#### Participants

Mana Ishibashi, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Immune-related adverse events (irAE) are common in patients receiving immune checkpoint inhibitors. Frequency varies by molecular target of the agent in use, with irAE of any grade reported approximately 80-90%. Pneumonitis, hypothyroidism, arthralgias, and cutaneous reactions are most often seen with PD-1/PD-L1 inhibitors, and colitis and hypophysitis with CTLA-4 inhibitors. FDG-PET/CT is used to assess the malignancy; it is also able to detect tissue inflammation, one of the hallmarks of irAE. This unique ability sets FDG-PET/CT apart from CT and MRI and potentially enables the early identification and therapeutic intervention in patients with irAE prior to their developing clinical symptoms. Depending on the site, particularly in lymph nodes, an irAE-related uptake may mimic metastases or disease progression.

#### TABLE OF CONTENTS/OUTLINE

1. Basic information about immune checkpoint inhibitors  
2. The mechanism of autoimmune-reactions in patients receiving immune checkpoint inhibitors  
3. FDG-PET/CT findings of irAE  
4. Differential diagnosis of irAE and other pathologies

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## Abstract Archives of the RSNA, 2023

NMMIEE-10

### Imaging of Thyroid Cancer Post-thyroidectomy: Primer for Radiologists

#### TEACHING POINTS

1. Differentiated thyroid cancer (DTC) arising from thyroid follicular epithelial cells, comprising > 90% of all thyroid cancers. 2. After thyroidectomy, depending on post-operative risk stratification, the primary goal of radioactive iodine (RAI) can include remnant ablation, adjuvant therapy or treatment of known disease. A whole-body scan performed following administration of therapeutic RAI identifies the presence of iodine-avid thyroid tissue, both normal and malignant, allowing staging of the disease. 3. Cervical ultrasound is recommended for surveillance of the thyroid bed and regional lymphadenopathy post-thyroidectomy. 4. Serum Thyroglobulin (Tg) and anti-Tg antibodies are important in the follow-up of these patients; rising levels would warrant further evaluation with RAI imaging. 5. 18FDG-PET scanning should be considered in high-risk DTC with elevated serum Tg but negative RAI imaging. Alternatives would include CT imaging of the chest and if negative CT imaging of the abdomen.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of differentiated thyroid cancer 2. Goals of treatment, including the role of radioactive iodine 3. Basics of Thyroglobulin and anti-Thyroglobulin interpretation for monitoring for thyroid cancer recurrence/disease 4. Common sites of disease recurrence and metastasis 5. Role of US and other imaging modalities (RAI, CT, MRI, PET/CT) in the follow-up of thyroid cancer 6. Spectrum of imaging appearances on the various modalities after primary treatment of thyroid cancer 7. Important imaging pitfalls leading to diagnostic errors and misinterpretation

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## Abstract Archives of the RSNA, 2023

NMMIEE-11

### Imaging of Dementias using 18F-FDG PET: Unique and Overlapping Features

#### Participants

Rita Maria Lahoud, MD, Shelton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Establishing a specific diagnosis in cases of dementia may be challenging as symptoms and features often overlap. Characteristic metabolic patterns on 18F-FDG PET, in concert with clinical features, aid in reaching an accurate and timely diagnosis.
- Technical considerations and proper patient preparation are necessary to minimize confounders.
- Alzheimer's dementia represents the most common neurodegenerative process encountered on PET/CT and manifests with regional hypometabolism of the posterior temporoparietal regions and cingulate gyrus, although there are variations and overlap with other neurodegenerative processes.
- Reduced radiotracer uptake predominantly involves the frontal and anterior temporal lobes in frontotemporal dementia.
- In Lewy body dementia, the occipital cortex is mainly affected with sparing of the posterior cingulate gyrus, "the cingulate island sign".
- Asymmetric cortical involvement and decreased uptake in the basal ganglia and thalami are characteristic of corticobasal degeneration.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Dementias a. Alzheimer's b. Frontotemporal c. Lewy Body d. Posterior Cerebral Atrophy e. Corticobasal Degeneration f. NMDA Encephalitis  
2. 18F-FDG PET in the evaluation of dementias a. Rationale for use b. Normal brain metabolic patterns c. Patient preparation and technique  
3. Metabolic pattern interpretation: a. Unique and overlapping imaging patterns b. Confounding factors

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## Abstract Archives of the RSNA, 2023

NMMIEE-12

### Hybrid Imaging in Infective Endocarditis

#### Participants

Antonio Lopez, BA, West Reading, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Infective endocarditis (IE) is a serious infection of the heart valves caused by microorganisms, resulting in inflammation and potential complications such as heart failure, stroke, or sepsis. IE is typically diagnosed using the modified Duke criteria, which examines pathologic and clinical criteria; however, due to a variety in presentation and complicating patient factors, I remains a diagnostic challenge. Patients with prosthetic valves (PV) or intracardiac devices (ICD) are at a higher risk for IE, are more difficult to diagnose with IE, and have higher mortality than patients without these cardiac interventions. Combination of cardiac CT and FDG-PET/CT is currently being investigated for adjunct use in I diagnosis in this patient population, which preliminary data shows improve diagnostic accuracy. Here we examine the use of FDG-PET and cardiac CT in diagnosing I in patients with PV and ICD, including a discussion on common cardiac and non-cardiac manifestations of IE on imaging and an examination of its role in future diagnostic algorithms.

#### TABLE OF CONTENTS/OUTLINE

Describe current diagnostic methods for IE. Examine the use of Cardiac CT and PET/CT in I diagnosis for patients with PV and ICD, including key imaging features. Discuss the future incorporation of hybrid imaging in I diagnosis.

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## Abstract Archives of the RSNA, 2023

NMMIEE-13

### Theory into Action: A Step-by-Step Guide to Interpreting Scintigraphy Images for Sentinel Node Assessment

#### Participants

Juan Temptra SR, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review the basics of the sentinel node and its importance in the diagnosis and staging in cancer.-Describe the technique and methods of optimizing the procedure and the resulting images.-Illustrate different imaging patterns and their clinical significance.- Learn the limitations and pitfalls.

#### TABLE OF CONTENTS/OUTLINE

-Introduction.-Sentinel lymph node Scintigraphy: principles and technique.- Interpretation of sentinel lymph node mapping images.- Advantages and limitations.-Conclusions.

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## Abstract Archives of the RSNA, 2023

NMMIEE-14

### Findings of Primary and Secondary Breast Malignancies on Dotatate PET/CT

#### Participants

Lauren Hubbard, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review somatostatin receptor-based PET imaging and normal distribution. Positive radiotracer uptake in the breast on Dotatate PET can be seen with metastatic neuroendocrine tumors. Metastatic neuroendocrine tumors to the breast can result in corresponding mammogram findings indistinguishable from a primary breast malignancy. Primary breast malignancies can also demonstrate positive Dotatate PET uptake due to variable somatostatin receptor expression. Invasive lobular carcinoma can demonstrate low to absent abnormal uptake on FDG-PET/CT, but can demonstrate positive uptake on Dotatate-PET/CT.

#### TABLE OF CONTENTS/OUTLINE

a. Review of somatostatin receptor-based PET imaging and normal distribution. b. Case presentations of 5 cases of dotatate PET findings of primary and secondary breast malignancies i. A case of biopsy-proven incidentally discovered invasive ductal carcinoma on Dotatate-PET/CT for evaluation of metastatic neuroendocrine tumor. ii. A case of incidentally discovered invasive lobular carcinoma on Dotatate-PET/CT for metastatic neuroendocrine tumor with comparison to FDG- and 18F-Fluoroestradiol-PET/CT. iii. A case of neuroendocrine tumor metastases to the bilateral breasts with corresponding mammographic findings. iv. A case of neuroendocrine tumor metastases to the left breast with additional systemic sites of metastatic disease. v. A case of bilateral dotatate PET avid breast lesions, histologically proven to be atypical carcinoid tumors of the breast. c. Conclusions/Future Directions

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## Abstract Archives of the RSNA, 2023

NMMIEE-15

### PET-CT 18F-FES: Selecting Patients Who Will Benefit from Endocrine Therapy

#### Participants

Victor Osaki, BMedSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Invasive lobular carcinoma (ILC), the second-most prevalent invasive breast cancer subtype comprising approximately 15% of breast cancers;
- ILC is nearly always (95%) estrogen receptor (ER) positive;
- The determination of ER expression by immunohistochemistry has several limitations;
- PET-CT with 18F-fluoroestradiol (PET-FES) has emerged as a diagnostic method that allows evaluating the ER expression status of breast cancer lesions in a non-invasive way;
- Patients with estrogen receptor positive breast cancer benefit from endocrine therapy by blocking these receptors on tumor cells, preventing tumor progression. Some patients, though, have immunochemistry showing positive receptors and PET-CT with 18F-FES with lesions not showing uptake. In these cases we suppose the estrogen receptors are non-functioning ones and, therefore, patient will not benefit from endocrine therapy.

#### TABLE OF CONTENTS/OUTLINE

- Introduction;
- Objective;
- Discussion;
- Clinical and epidemiologic aspects;
- Show cases that are functioning estrogen receptor positive and non-functioning estrogen receptor;
- Discuss endocrine therapy in non-functioning ER+ cancer;
- Take home messages;
- References.

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## Abstract Archives of the RSNA, 2023

NMMIEE-16

### The Value of 18F-FDG-PET-CT in the Management of Head and Neck Tumors

#### TEACHING POINTS

To understand the role of 18F-FDG PET CT in the diagnosis, staging, treatment response assessment and radiotherapy treatment planning in head and neck tumors.

#### TABLE OF CONTENTS/OUTLINE

18F-FDG PET-CT is a widely used diagnostic tool in the evaluation of head and neck squamous cell cancers. It is at least as sensitive as MRI or CT in detecting the primary head and neck tumors, but there is no clear evidence of routine use in T staging, due to low spatial resolution and the presence of physiologic uptake on PET. The meta-analysis shows 18F-FDG PET-CT has high sensitivity (79%) and specificity (86%) for N staging, being superior to CT and MRI. For distant spread and second primary cancer detection, 18F-FDG PET-CT may be superior to whole body MRI, while both have high NPV. For the detection of synchronous primary tumor the pooled sensitivity and specificity is above 95%. The meta-analysis of 27 studies shows the high rate of detection of recurrence or residual tumor with 18F-FDG PET-CT (PPV-75 %, NPV-94%). Performed 12 months after therapy for detection of recurrence, the sensitivity and specificity has been reported as high as 100%. The recent response evaluation criteria-so called Hopkins criteria-has high NPV and is characterized by high inter-reader agreement. PET-CT based contouring during radiotherapy treatment planning is more accurate than CT based contouring in terms of gross tumor volume (GTV). Recent advances in hybrid imaging of head and neck tumors include the introduction of integrated PET MRI systems. Studies have shown the intratumoral heterogeneity of FDG uptake, as well as PET-derived volumetric parameters, such as MTV and TLG to be important prognostic factors for disease recurrence, progression and survival.

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## Abstract Archives of the RSNA, 2023

NMMIEE-17

### **PET-CT 18F-FES: The Use in Clinical Practice in One of the Largest Private Health Centers in Brazil**

#### **Participants**

Victor Osaki, BMedSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- PET-Fluorestradiol (FES) is a type of Positron Emission Tomography (PET) imaging agent used to detect estrogen receptor-positive (ER+) breast cancer. FES is a synthetic form of estrogen that has been radiolabeled with a positron-emitting isotope, the fluorine-18;
- When 18F-FES is injected into the body, it binds to estrogen receptors on breast cancer cells, allowing PET imaging to detect the presence and location of these cancer cells;
- PET-FES imaging can provide valuable information to healthcare professionals about the extent of ER+ breast cancer, as well as guide treatment decisions;
- PET-FES has emerged as a diagnostic method that allows evaluating the ER expression status of breast cancer lesions in a non-invasive way;
- In addition to breast cancer, PET-FES imaging has also been used in research to investigate other estrogen-receptor positive cancers, such as ovarian and endometrial cancer.

#### **TABLE OF CONTENTS/OUTLINE**

- Clinical and epidemiologic aspects;
- Show the possible applications of PET-CT with 18F-FES and show its applicability in clinical practice in our hospital.
- Take home messages;
- References.

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## Abstract Archives of the RSNA, 2023

NMMIEE-18

### Gallium-68 DOTATATE PET for the Imaging of Non-Gastrointestinal Neoplasm: A Review

#### Participants

Amar Shah, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Somatostatin-receptor analogue based imaging, including Gallium(Ga)-68 DOTATATE PET/CT, has long played a central role in the evaluation of gastroenteropancreatic neuroendocrine tumor. However, Ga-68 DOTATATE has a variety of clinical applications beyond this, both in oncologic pathologies. In this exhibit, we aim to review Ga-68 DOTATATE physiology and its use beyond gastroenteropancreatic neuroendocrine tumor. 1. Review physiology of Ga68-DOTATATE distribution and uptake. 2. Catalogue non-gastrointestinal uses, both oncologic and nononcologic, of Ga-68 DOTATATE based imaging. 3. Highlight pitfalls of Ga68-DOTATATE imaging.

#### TABLE OF CONTENTS/OUTLINE

1. Review normal Ga-68 DOTATATE distribution and mechanism of uptake. 2. Non-gastrointestinal tumoral indications. a. Meningioma b. Medullary thyroid cancer c. Paraganglioma d. Phosphaturic mesenchymal tumor e. Pulmonary carcinoid 3. Pitfalls of Ga-68 DOTATATE PET/CT.

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## Abstract Archives of the RSNA, 2023

NMMIEE-19

### FDG PET/CT in Evaluation of Cardiac Device Infections: What an Imager Should Know

#### TEACHING POINTS

FDG PET/CT is increasingly utilized for the diagnosis and evaluation of cardiac device infections. The objective of this case-based educational exhibit is to 1) review established and emerging applications of FDG PET/CT in the diagnosis of cardiac device infections 2) review protocols and guidelines for integrating FDG PET/CT in the diagnosis of cardiac device infections 3) highlight interpretation criteria, pearls, and pitfalls of FDG PET/CT for cardiac device infections. Implementing this knowledge is important to avoid errors and provide accurate imaging interpretation for cardiac device infection.

#### TABLE OF CONTENTS/OUTLINE

The most demonstrative cases of cardiac device infections noted on FDG PET/CT performed at our tertiary care academic institution for evaluation of cardiac device infections were selected to highlight the teaching points for this exhibit, including: 1) cardiac implantable electronic device (CIED) infection 2) left ventricular assist device (LVAD) infection 3) prosthetic valve endocarditis. We will summarize take-home points to facilitate transfer of knowledge.

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## Abstract Archives of the RSNA, 2023

NMMIEE-2

### Skeletal Muscle Uptake in FDG-PET: Physiology and Pathology, Pearls and Pitfalls

#### Participants

Jessica Dobson, MD, Halifax, NS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

<sup>18</sup>F-fluorodeoxyglucose (FDG)-PET is commonly used in oncology, and while key for staging may also reveal nonspecific findings related to any number of neoplastic, infectious, and inflammatory etiologies. Despite the ubiquity of FDG-PET, intense skeletal muscle uptake remains an uncommon and sometimes unexpected finding. Patterns of uptake are often similar between vastly different entities, and the interpreting physician must be familiar with these entities to provide a useful diagnosis or differential. This exhibit will review a series of local cases demonstrating skeletal muscle FDG uptake and discuss the clinical and imaging context leading to the diagnosis, with the goal of conveying an understanding of skeletal muscle uptake on FDG-PET and considerations to provide a relevant differential diagnosis and advise on appropriate next steps.

#### TABLE OF CONTENTS/OUTLINE

1. Overview normal physiologic distribution of FDG; 2. Review the biochemical basis of physiologic and pathologic skeletal muscle FDG uptake; 3. Discuss the differential considerations for skeletal muscle uptake, including physiologic, inflammatory, infectious, and neoplastic etiologies, and possible mimics of skeletal muscle uptake on FDG-PET; 4. Analyze local cases of skeletal muscle uptake with emphasis on imaging patterns and clinical indicators guiding diagnosis.

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## Abstract Archives of the RSNA, 2023

NMMIEE-20

### PET-CT Utility in Aortic Disease: Applications and Observations - A Comprehensive Review

#### TEACHING POINTS

PET/CT allows for the non-invasive evaluation of aortic inflammation, wall instability, and clinical symptoms, thereby improving the prediction of individual aneurysm rupture risk. Additionally, PET/CT imaging can aid in determining the age and degree of risk in patients with acute aortic dissection (AAD) and the need for surgery. Stratification of AAD patients based on FDG uptake may predict short- and midterm outcomes. PET/CT imaging has also allowed for preoperative localization of areas with increased risk of rupture correlating with increased FDG uptake within the aneurysm wall in abdominal aortic aneurysm suggesting that FDG-PET/CT imaging may be a novel approach to identifying AAA at risk for rupture. FDG uptake in the aortic wall can also be used as a biomarker for the evaluation of vulnerable atherosclerotic activity. PET/CT can also aid in distinguishing between acute and chronic aortic dissection. In patients with acute dissection, PET/CT imaging showed elevated metabolic activity in fresh lacerated segments of the aortic wall, while stable chronic aortic dissection showed no increased metabolic activity. This differentiation is crucial for appropriate management and predicting outcomes.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction II. PET/CT in the evaluation of aortic disease A. Aortic aneurysms 1. Prediction of individual rupture risk 2. Preoperative localization of areas with increased FDG uptake B. Aortic dissection 1. Determining the need for surgery 2. Distinguishing between acute and chronic dissection 3. Vasculitis/infectious Aortitis III. PET/CT in the evaluation of arterial atherosclerotic activity A. FDG Uptake as an index for atheroma cellular content and vulnerability V. Conclusion

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## Abstract Archives of the RSNA, 2023

NMMIEE-21

### PSMA PET/CT and Spectrum of Nonprostatic Disease

#### Participants

Qiubai Li, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Prostate-specific membrane antigen (PSMA) based radiopharmaceutical 18F-PSMA and 68Ga-PSMA for imaging of prostate cancer.
- PSMA PET/CT plays a key role in diagnosis, staging and evaluation of treatment response of prostate cancer
- PSMA uptake on PET/CT can be divided into prostatic disease and nonprostatic disease. Comparison between cytoplasmic PSMA expression in nonprostatic disease and apical PSMA expression in prostate cancer can help to differentiate these conditions.
- The purpose of this presentation is to introduce of spectrum of nonprostatic disease on PSMA PET/CT which may be interpreted as metastatic disease.
- Recognizing the false positive imaging findings can help narrow the differential diagnosis and triage appropriate patient care

#### TABLE OF CONTENTS/OUTLINE

- PSMA uptake and CNS disease
- PSMA uptake and PNS disease
- PSMA uptake and lacrimal gland disease
- PSMA uptake and thyroid disease
- PSMA uptake and inflammatory/inflammatory disease
- PSMA uptake and lung disease
- PSMA uptake and liver disease
- PSMA uptake and kidney disease
- PSMA uptake and adrenal gland disease
- PSMA uptake and bone disease
- PSMA uptake and chronic lymphocytic leukemia

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## Abstract Archives of the RSNA, 2023

NMMIEE-22

### FDG PET: Not Just a One-trick Pony: Non-oncologic Uses of FDG PET Imaging

#### TEACHING POINTS

The purpose of this exhibit is to:- Understand the underlying physiologic mechanism of FDG PET and conventional clinical applications- Discuss non-oncologic pathologies that can be evaluated on FDG PET, including those which may mimic other neoplastic processes.- Examine the pros and cons of utilizing FDG PET versus conventional imaging modalities in non-oncologic applications.

#### TABLE OF CONTENTS/OUTLINE

Mechanism of Action of FDG PET  
Head and Neck applications- Seizures- Dementia/neurocognitive disease- Differentiating CNS lymphoma versus toxoplasmosis  
Chest and Cardiac applications- Sarcoidosis- Evaluating for hibernating myocardium- Cardiac/pericardiac infection myocarditis- Incidental infection/inflammation, including organizing pneumonia  
Abdominal- Infection in polycystic liver or kidney disease- Infection in mucinous peritoneal carcinomatosis- Autoimmune pancreatitis/ IgG4 related disease- Incidental infection/inflammation including: inflammatory bowel disease, hepatitis, pyelonephritis  
Vascular- Aortitis vasculitis- Inflammatory plaques- Incidental findings including: endoleak and deep vein thrombosis  
Musculoskeletal- Chronic recurrent multifocal osteomyelitis (CRMO) synovitis, acne, pustulosis, hyperostosis, and osteitis (SAPHO) syndrome- Non-post-operative spinal infections- Peripheral bone osteomyelitis- Septic arthritis  
Multisystem- Sarcoidosis, tuberculosis, granulomatous infections- Non-Langerhans cell histiocytosis- Fever of unknown origin neoplastic mimics- Sequelae of endocarditis- HIV/Covid reactive adenopathy reactive adenopathy

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## Abstract Archives of the RSNA, 2023

NMMIEE-23

### Why PET/MRI in Pediatric Oncology? A Pictorial Review of Advantages and Challenges

#### TEACHING POINTS

- PET/MRI has better soft tissue resolution and lower radiation dose than PET/CT.
- PET/MRI is a one-stop-shop that may decrease the number of anesthesia events and patient visits to complete imaging work-up.
- PET/MRI provides simultaneous anatomic and functional images, facilitating both initial staging and restaging of various oncologic conditions.

#### TABLE OF CONTENTS/OUTLINE

- Introduction of PET/MRI: an overview of technical aspects and protocol
- Case-based approach of oncologic pediatric body
- PET/MRI: advantages and limitations:- Lymphoma: initial staging and follow up- Sarcoma: soft tissue and osseous sarcoma-
- Predisposing Conditions: malignant transformation in neurofibromatosis- Congenital hyperinsulinism: focal versus diffuse lesions
- Case-based approach of PET/MRI in pediatric neuro-oncology: advantages and limitations- FDG-PET/MRI: is it a helpful tool?- Amino acid PET: in non-enhancing tumor and anti-angiogenic therapy
- Current and future role of PET/MRI in theragnostic (diagnosis and therapy) in pediatric oncology
- Conclusions

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## Abstract Archives of the RSNA, 2023

NMMIEE-24

### Bringing PET/MRI into Practice- Challenges and Considerations

#### Participants

Naveen Rajamohan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Developing a PET/MRI program involves planning for optimal physical layout and incorporation of unique safety considerations. 2) Truly simultaneous PET and MRI data acquisition in modern PET/MRI systems minimize the likelihood of image misregistration and provide more robust anatomic co-localization comparison to PET/CT. 3) Identification of appropriate oncologic and non-oncologic clinical indications, education of referring physicians, development of scheduling, protocoling and image interpretation workflows and dedicated order sets are imperative for successful implementation of a clinical PET/MRI program.

#### TABLE OF CONTENTS/OUTLINE

Safety regulations • Facility guidelines and regulatory requirements • Challenges of working in the PET/MRI environment (governance, safety, technologist training, emergency responses, etc.) • Radiotracers in the PET/MRI environment. PET/MR hardware/data acquisition • Hardware components, data acquisition systems • Technical considerations including attenuation correction and image co-registration Indications, imaging findings, programmatic and workflow considerations • Billing challenges and CPT codes • Protocol development, order sets and education of referring physicians • Clinical workflow including protocoling, scheduling, and image interpretation models. Case-based review of oncologic and non-oncologic clinical indications appropriate for PET/MRI including classic imaging findings and pitfalls

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## Abstract Archives of the RSNA, 2023

NMMIEE-25

### Is There a Role for Radium-223 in the Era of 177Lu PSMA?

#### Participants

Flavia Lopes, PhD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In cases of prostate bone metastasis, a destructive cycle of bone formation and resorption occurs, making it imperative for treatment to focus on the microenvironment through various mechanisms. This can be achieved through direct targeting of tumor cells, osteoblasts, osteoclasts, inflammatory cells, and bystander effects, which affect non-irradiated cells in the surrounding area by producing cytokines and growth factors. For patients who have previously received Radium-223, it is possible to administer 177LuPSMA and/or chemotherapy as subsequent treatments. Patients with a good medullary reserve who have shown a positive response to initial treatment may receive additional cycles of Radium-223, as it is well-tolerated with minimal toxicity and effectively controls bone progression. For patients with exclusively bone metastatic prostate cancer, Radium-223 may be initiated to control bone progression when first-line therapy fails to achieve optimal control of disease progression. Subsequently, in the treatment sequence, 177Lu-PSMA may be employed as an effective tool in the management of progressive disease involving bone and soft tissue metastases.

#### TABLE OF CONTENTS/OUTLINE

Theranostics in Prostate Cancer: Current Treatment Options Radium-223: Indications and Contraindications Treatment Sequencing: Discussion of Primary Guidelines 177Lu-PSMA and Radium-223: Partners or Competitors?

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## Abstract Archives of the RSNA, 2023

NMMIEE-26

### DEXA - It's Not Just About the Numbers

#### TEACHING POINTS

- To describe the classification, clinical presentation, pathogenesis and management of osteopenia and osteoporosis· To outline indications for performing dual-energy x-ray absorptiometry (DEXA)· To review technical aspects of DEXA· To interpret DEXA outputs including quality assurance and recognition of pitfalls

#### TABLE OF CONTENTS/OUTLINE

Background· Epidemiology, clinical presentation, pathogenesis and management of osteopenia and osteoporosis· Classification of bone mineral density· Review of international guidance on DEXA - e.g. American Association of Clinical Endocrinologists consensus statementTechnical aspects of DEXA· Underlying scientific basis· Acquisition parameters· Regions of interest· Outputs including reference standardsInterpretation· Defining Z-scores and T-scores· Monitoring changes in bone mineral density· Fracture risk assessment tool - e.g. FRAX· Clinical application and relevance· Suggested reporting templates· Pearls and pitfallsCase examples including less typical and challenging scenariosSummary

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## Abstract Archives of the RSNA, 2023

NMMIEE-27

### Utility of FDG PET/CT in Pyrexia of Unknown Origin: A Pictorial Essay

#### TEACHING POINTS

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#### TABLE OF CONTENTS/OUTLINE

Pyrexia of unknown origin (PUO) is defined as fever higher than 38.3 °C/101°F, lasting more than 3 weeks and remaining undiagnosed after 1 week of thorough investigation. Identifying the cause of pyrexia of unknown origin is a clinical challenge. Early identification of source of PUO helps guide further diagnostic invasive procedures and initiation of prompt appropriate treatment. The current diagnostic approach includes initially first-line procedures such as general examination and various laboratory tests and basic imaging techniques followed by second-line tests like FDG PET/CT and tissue biopsies. Conventional imaging modalities can have limited sensitivity. Understanding imaging patterns of FDG uptake in common and uncommon causes of PUO helps to accurately identify the potential source. Advantages of 18F-FDG PET/CT as first line modality : high sensitivity, whole body imaging can identify pathologic focus at clinically unsuspected sites, high negative predictive value, can identify the source of infection or inflammation before morphological changes on conventional anatomical imaging techniques, no hazardous manipulation of blood for labeling in WBC imaging, no need for complementary bone or bone marrow scan, ability to perform quantitative analysis, cost-effective as first line modality. Images attached of Common and uncommon sites detected on FDG PET/CT in PUO: Fig1) infected aortic stent Fig 2) infected central venous catheters Fig 3) Tuberculous Osteomyelitis Fig 4) Renal Mucormycosis Fig 5) Acute Pyelonephritis in Transplant Kidney Fig 6) Tracheobronchitis

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## Abstract Archives of the RSNA, 2023

NMMIEE-28

### How to Master Nuclear CSF Imaging: A Comprehensive Guide to Procedures and Interpretation

#### Participants

Megan Mercer, MD, Charleston, SC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This presentation aims to educate the learner on: 1- Indications and imaging protocol of nuclear CSF imaging (Nuclear cisternography and shuntogram). 2- Patterns of normal and abnormal findings. 3- Complementary role of anatomic imaging (Xray, CT, MRI). 4- Pearls and pitfalls for performing the procedures and imaging interpretation.

#### TABLE OF CONTENTS/OUTLINE

1- Nuclear Cisternography: A. Review CSF physiology and the common indications for nuclear cisternography. B. Review Imaging protocol: Patient preparation, radiopharmaceutical, imaging timing, the role of pledgets in cases of CSF leak. C. Review normal and abnormal findings (normal pressure hydrocephalus, spontaneous hypotension, CSF leaks). D. Describe classic signs that are helpful for the interpretation. E. Discuss pitfalls for injection and interpretation and the importance of correlation with anatomic imaging. 2- Nuclear Shuntogram: A. Present a background on hydrocephalus, different types of CSF shunts, and their complications. B. Review multimodality imaging evaluation of shunts with a focus on nuclear shuntogram. C. Present an overview of the nuclear shuntogram procedure (shunt reservoir access, measuring opening pressure, types of radiopharmaceutical, radiopharmaceutical injection, and imaging protocol). D. Review interpretation checklist (opening pressure, T1/2 clearance, flow into the proximal and distal limbs, documentation of free dispersion). E. Present an algorithmic approach for differentiating normal and abnormal drainage patterns (proximal and distal obstruction, shunt over-drainage, CSF pseudocyst, gravity-dependent drainage). F. Review pitfalls of inappropriate injection and falsely elevated pressure.

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## Abstract Archives of the RSNA, 2023

NMMIEE-29

### Hybrid DOTATATE PET/MRI Imaging of the Head and Neck

#### Participants

Graham Keir, MD, Manhasset, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The superior soft tissue resolution of MRI improves lesion localization and helps to delineate fine anatomic detail. 2. DOTATATE-PET/MRI detects extent of disease and lesions not detected by MRI alone. 3. DOTATATE-PET may improve surveillance and radiation therapy planning. 4. DOTATATE-PET/MRI may detect more lesions than MRI alone, providing valuable genetic information in cases of multiple paragangliomas. 5. DOTATATE PET is useful for determining lesions that may respond to somatostatin analogue therapy.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of Somatostatin Receptor Imaging 2. PET/MRI Fusion Protocols 3. Meningiomas 4. Paragangliomas 5. Olfactor Neuroblastoma (Esthesioneuroblastoma) 6. Pituitary Lesions 7. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-3

### Neo-adjuvant Immune-checkpoint Inhibitors in Lung Cancer - Pearls and Pitfalls in Imaging

#### TEACHING POINTS

1) Neo-adjuvant chemo-immunotherapy results in a high rate of pathologic complete remissions. 2) Residual tumor size and changes (eg., decrease) in tumor size do not necessarily correlate with histopathological response. 3) Metabolic examinations such as [18F]-FDG-PET/CT better assess treatment response compared to morphological changes. 4) Immune mediated increased lymphatic FDG uptake and/or increased lymph node size is called "nodal immune flare".

#### TABLE OF CONTENTS/OUTLINE

1) Pathological response patterns in patients with early-stage, non-small cell lung cancer (NSCLC) receiving neo-adjuvant chemo-immune checkpoint inhibitor therapy (ICIT): - Complete pathological response (cPR): no vital tumor cells, - Major pathological response (MPR): =10% vital tumor; 2) Radiological response patterns in patients with early-stage NSCLC receiving neo-adjuvant chemo-ICIT: - Radiological response may be consistent or inconsistent with pathological response, - Some patients with partial radiological response show a poor pathological response compared to others who show a cPR, - Nodal immune flare; 3) Current role of imaging in patients with early-stage, NSCLC receiving neo-adjuvant chemo-ICIT: - CT, - [18F]-FDG-PET/CT, - Limitation and pitfalls; 4) Limitations

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## Abstract Archives of the RSNA, 2023

NMMIEE-30

### Nuclear Medicine Lymphoscintigraphy: Established and Emerging Applications with Technical Overview

#### Participants

Saeed Elojeimy, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goal of this presentation is to educate the learner on: 1- The clinical approach and role of nuclear scintigraphy in the assessment and management of patients with lymphedema. 2- The imaging protocol for performing nuclear scintigraphy. 3- The imaging patterns of normal and abnormal lymphoscintigraphy. 4- The potential limitations of nuclear medicine examinations for lymphedema assessment. 5- The complementary role of nuclear scintigraphy and MR lymphangiography. 6- The treatment options available for patients with lymphedema.

#### TABLE OF CONTENTS/OUTLINE

1- Introduction a. Review the epidemiology and pathophysiology of lymphedema. b. Review the clinical approach to the diagnosis of lymphedema, as well as the role of nuclear lymphoscintigraphy in evaluating these patients. 2- Review Lymphoscintigraphy protocols: a. Patient preparation, radiopharmaceutical, imaging timing, and areas of interest. 3- Review how to evaluate lymphoscintigraphy examinations. a. Provide examples of normal and abnormal lymphoscintigraphy studies (unilateral or bilateral, upper or lower extremity), lymphatic malformations, and lymphatic leak (recurrent chylous ascites or pleural effusions). b. Provide MR lymphangiography correlative features for lymphoscintigraphy to highlight the strengths, limitations, and complementary roles of both modalities. 4- Emerging applications, treatments, and future directions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-31

### PET/MRI: Pictorial Review of Hepatobiliary and Pancreatic Applications

#### Participants

Malak Itani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

PET/MRI combines physiologic information with superior soft-tissue contrast resolution from MRI, improving assessment of the following hepatopancreaticobiliary diseases:(1) Biliary: assess disease severity, screen for cholangiocarcinoma, delineate local tumor extent and regional spread, and assess treatment response.(2) Hepatic metastases: detecting metastases and evaluating response to treatment.(3) Hepatocellular carcinoma: Y-90 PET/MRI dosimetry, extrahepatic metastases.(4) Pancreatic neoplasms: characterization and local staging, assessing spread to lymph nodes, metastatic disease in the liver, and assessing treatment response.(5) Liver transplant: detecting recurrent HCC, recurrent sclerosing cholangitis, and post-transplant lymphoproliferative disorder.

#### TABLE OF CONTENTS/OUTLINE

(1) Hepatobiliary PET/MRI techniques, clinical workflow, and reimbursement issues.(2) Applications:(A) Neoplastic evaluation:(i) Cholangiocarcinoma. (ii) Metastatic liver disease. (iii) Hepatocellular carcinoma. (iv) Pancreatic ductal adenocarcinoma. (v) Pancreatic neuroendocrine neoplasms.(B) Differentiating tumor from non-neoplastic processes:(i) Infectious: Cholangitis, hepatic abscesses. (ii) Inflammatory: Risk-stratifying benign versus malignant biliary strictures. (iii) Post-treatment: Perilesional hemorrhage/necrosis versus residual/recurrent tumor. (iv) Problem solving after locoregional therapy. (v) Follow-up of liver transplant.(3) Emerging tracers and advanced applications.

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## Abstract Archives of the RSNA, 2023

NMMIEE-32

### Patterns of Response and Progression on Post-treatment SPECT/CT Scans in Patients Treated with Lu-177-PSMA

#### Participants

Ridvan Demirci, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

With the wider availability of Lu-177-psma therapy, imaging of this population became more important. Post-treatment imaging with SPECT/CT is a helpful tool for response assessment by providing functional and anatomical imaging information. This educational exhibit aims to present certain response and progression patterns in post-treatment SPECT/CT scans.

#### TABLE OF CONTENTS/OUTLINE

Non-contrast enhanced CT portion of SPECT/CT needs to be closely reviewed for monitoring of low or no PSMA-expressing disease (defined as lesional uptake equal or less than liver), particularly in the liver, and temporal changes of the osseous disease on CT in relation to intensity of PSMA expression. In addition, patterns of response or progression could be used for clinical decision-making. Below, is the summary of patterns. 1. Response Patterns a. Rapid Response (Rapid decline in disease burden before 4 cycles of treatment) b. Slow Response (Continued response after 4 cycles of treatment) c. Stable Disease 2. Progression Patterns a. Primary Progression (Progression without initial response) i. Increased burden of preexisting disease (bone, soft tissue or both) ii. New lesions (PSMA avid, non or low PSMA avid either in bone or soft tissues) b. Secondary Progression (after initial response) i. Increased burden of preexisting disease (bone, soft tissue or both) ii. New lesions (PSMA avid, non or low PSMA avid either in bone or soft tissues) 3. Mixed Pattern a. Non-uniform response pattern: While being responsive in certain sites/organs, showing progression in other sites/organs.

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## Abstract Archives of the RSNA, 2023

NMMIEE-33

### Evolving role of PETCT in Systemic Vasculitis

#### Participants

Vani Vijayakumar, MD, Jackson, MS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learn different Systemic Vasculitides Different PET CT Scoring systems Role of PET CT in Treatment response

#### TABLE OF CONTENTS/OUTLINE

Large vessel vasculitis (LVV) and medium-sized vessel vasculitis such as giant cell arteritis (GCA) and Takayasu arteritis (TAK) are three common autoimmune systemic Vasculitides. 18F-FDG PET visual and semiquantitative criteria has been proposed. A standardized 4-point visual grading scale (arterial to liver uptake) is recommended with grade 0, no uptake; grade 1, uptake lower than liver; grade 2, uptake similar to liver; and grade 3, uptake higher than liver. Grade 3 is considered positive for LVV, whereas grade 2 may be indicative of LVV. In addition, a quantitative composite score, based on the visual grading scale of several individual arterial segments (typically between 7 and 15 segments), known as PET vascular activity score (PETVAS). PETVAS provides an overall assessment of disease burden, with little interobserver variability, in evaluating treatment response. 18F-FDG uptake in cranial arteries are scored as 3-point visual grading (0-2), with grade 0 representing uptake not above the surrounding tissue, grade 1 uptake just above the surrounding tissue, and grade 2 uptake significantly above the surrounding tissue. In PMR, The PET CT Leuven score is the best validated one, with sensitivity of 89.6% and specificity of 93.3%. The Leuven score is the summed score of visual 18F-FDG uptake at the cervical and lumbar interspinous bursae, sternoclavicular joints, ischial tuberosities, greater trochanters, hips, and shoulders. 18F-FDG PET/CT plays a role in diagnostic and therapeutic monitoring of patients with vasculitides and PMR.

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## Abstract Archives of the RSNA, 2023

NMMIEE-34

### Avoid False Positives with Quantitation and Tc 99m Pyrophosphate (Pyp) SPECT with CT Fusion in ATTR Cardiac Amyloidosis (ATTR- CA)

#### Participants

Vani Vijayakumar, MD, Jackson, MS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Update on the role of Pyp Imaging cardiac amyloidosis - How to improve Image interpretation with SPECT and CT fusion - Correlate with Anatomic imaging with CT And MRI - Quantitative SPECT Parameters SUV and advanced metrics

#### TABLE OF CONTENTS/OUTLINE

Transthyretin (ATTR) cardiac amyloidosis (CA) is a form of heart failure (HF) in the elderly representing approximately 13% to 18% with preserved ejection fraction (HFpEF). Until recently, ATTR-CA was very underdiagnosed. Due to advances in cardiac scintigraphy using the old Bone radiotracer Tc 99m Pyrophosphate single-photon emission computed tomography [SPECT], there is increased awareness to diagnose ATTR -CA. In addition there have been new ATTR stabilizing and silencing medications currently being available for use. Because of these rapid advances in diagnostic and therapeutic approaches, ATTR-CA, once known as a rare and progressive disorder, now can be accurately diagnosed and treated in the elderly with HFpEF. Whole heart SPECT/CT absolute quantification shows strong correlation with the visual Perugini score and high diagnostic performance with SUVmax cut-off of more than 6.1. Specificity of this approach can be increased to 99% by ruling out elevated monoclonal proteins. 99mTc-DPD and 99mTc-PYP, are the most common cardiac scintigraphy agents used for the diagnosis of ATTR- CA. Planar scintigraphy with SPECT can help with more detailed assessment of the myocardial radiotracer uptake. In addition, Fusion with cardiac CT or MRI improves the correct interpretation avoiding false positives due to blood pool activity. In addition Quantitative measures may help early diagnosis. Risk assessment and therapy response.

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## Abstract Archives of the RSNA, 2023

NMMIEE-35

### Lymphoscintigraphy of Lymphedema

#### Participants

Sara Babapour, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Definition and pathophysiology of lymphedema. 2. Progressive clinical signs in lymphedema and correlating imaging stages. 3. How different lymphoscintigraphic techniques (agents, planar imaging, and SPECT) can be helpful for defining lymphatic function. 4. How to plan treatment based on imaging. 5. Describe post-treatment findings in lymphoscintigraphy.

#### TABLE OF CONTENTS/OUTLINE

Introduction to Lymphedema 1.Primary 2.Secondary 3.Treatment options for lymphedema Lymphoscintigraphy Technique 1.Tracer types 2.Imaging protocols 3.Equipment Lymphoscintigraphy signs 1.Normal 2.Early lymphedema 3.Severe lymphedema 4.Correlation with other imaging techniques and clinical measures Post-treatment Lymphoscintigraphy monitoring 1.Lymphovenous bypass 2.Fat debulking 3.Lymph node transplant Current Research and Innovations in Lymphoscintigraphy, Summary

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## Abstract Archives of the RSNA, 2023

NMMIEE-36

### PET-CT Goes Large: Its Main Role in Large-vessel Vasculitis

#### Participants

Javier Collada, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the leading role of PET-CT in large-vessel systemic vasculitis. 2. To describe our experience in a tertiary hospital during the last 5 years.

#### TABLE OF CONTENTS/OUTLINE

PET-CT is the best imaging technique in large-vessel vasculitis. Metabolic findings may suggest the diagnosis of cranial and large vessel-giant cell arteritis (C-GCA and LV-GCA) or Takayasu arteritis (TAK), the latter often affecting carotid, renal and mesenteric branches. Sensitivity/specificity for them are around 80%. In addition, PET-CT may detect features of polymyalgia rheumatica (PMR) (by means of Leuven score); and helps differentiating perivascular or atherosclerotic inflammation from "true" vasculitis. Metabolic activity (assessed using Meller scale) and extent diminish with treatment response, although it remains challenging to differentiate remission from smoldering mild disease. From 2018 to 2023 we performed 5082 PET-CT, 41 positive for vasculitis in diagnostic or follow-up stage: 71% women, mean age 70; 63% were GCA, the rest of them TAK, aortitis and one Behçet's disease. PET-CT diagnosis was definitive in 61%, only half the cases of GCA needing confirmatory biopsy. MRI was also used. The majority of GCA associated PMR clinical diagnosis, though just 30% had PET-CT signs. During follow-up, 52% had significant response on PET-CT, most of them complete. However, 40% didn't have pre-treatment PET-CT available. In conclusion, regarding our experience and the literature published to date, we deduce that PET-CT stands out as the main technique to assess large-vessel vasculitis, allowing accurate diagnosis, assessment of comorbid disorders and follow-up.

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## Abstract Archives of the RSNA, 2023

NMMIEE-37

### Radiotheranostics for Prostate Cancer Management: a New and Evolving Standard of Care

#### Participants

Moozhan Nikpanah, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiotheranostics, which combines diagnostic and therapeutic capabilities, is changing the clinical management of prostate cancer. Radiopharmaceuticals, specifically prostate-specific membrane antigen (PSMA)-targeting tracers, play a vital role not only in initial diagnosis, staging, and detecting biochemical recurrence of prostate cancer, but also in targeted therapy. Cutting-edge imaging and therapeutic applications of radiotheranostics, such as <sup>177</sup>Lu-PSMA-617, are improving patient outcomes. Additionally, there are a number of clinical trials investigating the expanding use of PSMA-based radiopharmaceuticals and other targeted radionuclide therapies. The objective of this educational exhibit is to familiarize radiology and nuclear medicine physicians and trainees with the pivotal role of radiopharmaceuticals in the management of prostate cancer.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of prostate cancer (PCa). 2) Concise review of radiotracers used for initial diagnosis, staging, and biochemical recurrence of PCa, with a focus on PSMA ligands. 3) PSMA PET imaging for PCa: 3a) Application of PSMA PET for treatment guidance and management: implications and considerations. 3b) Pitfalls of PSMA PET imaging. 4) Radioligands and radiopharmaceuticals: advanced imaging and therapeutic applications: 4a) <sup>68</sup>Ga-PSMA-11. 4b) <sup>18</sup>F-DCFPyL (Piflufolastat F-18). 4c) <sup>177</sup>Lu-PSMA-617. 4c-i) Clinical applications and ongoing challenges. 4c-ii) Predictive biomarkers for assessing efficacy of <sup>177</sup>Lu-PSMA therapy. 4d) <sup>223</sup>Ra- Dichloride. 5) Conclusion and future directions.

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## Abstract Archives of the RSNA, 2023

NMMIEE-38

### Multimodality Imaging of Epstein-Barr Virus-Associated Diseases with Emphasis on PET/CT

#### Participants

Kenneth Huynh, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the spectrum of diseases associated with Epstein-Barr virus (EBV), including infectious mononucleosis, lymphoproliferative diseases, malignancies, and systemic autoimmune diseases. To present the multimodality imaging of the EBV-associated disease spectrum, with emphasis on F-18 FDG PET/CT in the initial staging and subsequent evaluation of therapeutic response.

#### TABLE OF CONTENTS/OUTLINE

Epstein-Barr virus (EBV) is an oncogenic herpesvirus that infects over 90% of the population worldwide. Although usually asymptomatic, EBV is associated with a wide spectrum of lymphoproliferative diseases and malignancies, especially in patients with immunologic suppression or compromise. EBV has been implicated in the pathogenesis of a variety of diseases, including but not limited to infectious mononucleosis, Burkitt's lymphoma, Hodgkin's and non-Hodgkin's lymphoma, nasopharyngeal carcinoma, gastric carcinoma, post-transplant lymphoproliferative disorders (PTLD), smooth muscle tumors, and autoimmune diseases. While chemotherapy and immunotherapy are therapeutic considerations for many of these diseases, modulation of immunosuppression is considered the first-line management, when applicable, with a regression rate of up to 50%. PET/CT imaging is a critical tool for initial disease staging, assessment of treatment response, and monitoring for disease recurrence. This educational exhibit will (1) review the multimodality imaging features of EBV-associated spectrum of diseases such as infectious mononucleosis, lymphoproliferative diseases, malignancies, and autoimmune diseases and (2) emphasize the role of PET/CT in the detection and surveillance of EBV-associated diseases.

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## Abstract Archives of the RSNA, 2023

NMMIEE-39

### Revealing the Hidden Mysteries of the Brain: A Guide to Brain Perfusion Single Photon Emission Computed Tomography (SPECT)

#### Participants

Tomoki Imokawa, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Single Photon Emission Computed Tomography (SPECT) is one of the nuclear medicine imaging modalities to evaluate cerebral hemodynamics. Cerebral perfusion studies are important in the diagnosis of a variety of diseases. Sometimes, cerebral perfusion studies are the only diagnostic clue. This presentation introduces the use of SPECT in the diagnosis of epilepsy and dementia. We also present cases in which SPECT played a decisive role in the diagnosis of inflammatory diseases and tumors, as well as cases in which SPECT served as an objective indicator of psychiatric symptoms and treatment efficacy. The results of SPECT research have important implications in clinical practice, and the application of its findings to MR perfusion imaging is also expected.

#### TABLE OF CONTENTS/OUTLINE

1. Basics of SPECT 2. Epilepsy 3. Neurodegenerative Diseases 4. Cerebrovascular Diseases 5. Tumor 6. Inflammatory Diseases 7. Psychiatric Disorders 8. Others

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## Abstract Archives of the RSNA, 2023

NMMIEE-4

### Feasibility of Performing SPECT/CT Imaging on a CZT Scanner to Monitor Lutetium-177-PSMA-617 Therapy

#### TEACHING POINTS

Lutetium-177-PSMA-617 (Pluvicto) is a novel radioligand therapy for treatment of metastatic prostate cancer. Current time points for PSMA PET/CT include pre- and post- therapy imaging for patient selection and evaluation of treatment response, respectively. To date, there is no clinical imaging available to monitor the treatment progress during cycles of Pluvicto administration. Current Pluvicto treatment monitoring relies on non-imaging clinical tools, such as PSA levels. Sequential imaging (SPECT/CT) during treatment cycles provides imaging direction to monitor Pluvicto treatment targets and perform organ-based dosimetry. Technical challenges, image quality, and sensitivity of Lu SPECT/CT acquisition will be discussed with its implications in the future of image-guided personalized adaptive dosimetry and diagnosis.

#### TABLE OF CONTENTS/OUTLINE

F-18 PET/CT diagnostic scan for metastatic prostate cancer. Lutetium-177-PSMA-617 (Pluvicto) treatment of metastatic castration resistant prostate cancer. Use of Lu-177 SPECT/CT for sequential monitoring over Pluvicto treatment cycles. Acquisition of Lu SPECT/CT at 24 hours post cycle 1 of Pluvicto treatment. Evaluation of Pluvicto treatment target with SPECT/CT, avidity for metastatic and primary lesions, sparing of nonaffected essential organs. F-18 PET/CT and Lu SPECT/CT imaging qualitative concordance and discordance. Ongoing feasibility study to perform advanced quantification and dosimetry across treatment duration. Future possibility to tailor Pluvicto treatment and minimize patient risk across treatment cycles.

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## Abstract Archives of the RSNA, 2023

NMMIEE-40

### Incremental Value of PET/CT in Identification of Infections Associated with Cardiac Devices

#### Participants

Matthew Koh, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The diagnosis and anatomic localization of cardiac device-related infections is a presently challenging and clinically relevant topic. Historically, transthoracic and transesophageal echocardiography has been the gold standard of cardiac imaging, however, they are limited in the evaluation of implantable cardiac devices and prostheses, particularly left ventricular assist devices and prosthetic valves. 18F-fluoro-2-deoxyglucose positron emission tomography with CT (FDG PET/CT) has gained increased attention in recent years for the diagnosis of cardiac infections in these select populations. In this educational exhibit, we intend to provide relevant background information on this topic, review the essential components of left ventricular devices and prosthetic valves, outline the current standards regarding cardiac device-related infections, and finally provide cases that demonstrate the utility of FDG PET/CT in imaging cardiac device-related infection in both initial diagnosis and follow-up.

#### TABLE OF CONTENTS/OUTLINE

Introduction/Relevant background information. Review of essential components of left ventricular assist devices. Review of prosthetic cardiac valves. Current standards regarding imaging of cardiac device-related infections. Case collection of PET/CT in imaging cardiac device-related infections in initial diagnosis and follow-up. Conclusion/Final points.

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## Abstract Archives of the RSNA, 2023

NMMIEE-41

### FDG PET/CT Imaging Pitfalls in Current Era of Immunotherapy: Watch Out for Sarcoid Like Reactions

#### TEACHING POINTS

Recognize the imaging features of sarcoidosis, sarcoid like reaction post immunotherapy on FDG PET/CT. Distinguish between tumor progression vs sarcoid like reaction on FDG PET/CT.

#### TABLE OF CONTENTS/OUTLINE

The imaging features of sarcoidosis are diverse and can be shown on a variety of imaging techniques. FDG avidity on PET/CT in patients with sarcoidosis is variable and can mimic malignancies (lymphoma, metastatic disease, post immunotherapy). Sarcoidosis typically demonstrates FDG avid supraclavicular, mediastinal, and bilateral hilar lymph nodes on PET/CT. Biopsy demonstrates non caseating granulomas. Immunologic toxicities in cancer patients are often referred to as immune-related adverse events (irAEs). Among various irAEs, sarcoid-like granulomatous lymphadenopathy occurs in 5% to 7% of patients, and typically presents as asymptomatic mediastinal/hilar lymphadenopathy, sometimes with accompanying multifocal pulmonary nodularity. Resolution or decrease in the original tumor burden on restaging PET/CT, and development of new FDG avid mediastinal/hilar lymphadenopathy in patients receiving immunotherapy indicates probable sarcoid like reaction. Recognition of this pattern of distribution is essential in interpreting the post treatment PET/CT. In equivocal cases, a biopsy or short interval PET scan may be necessary. Using a case based approach, we'll demonstrate PET/CT images of patients with sarcoidosis, evolution of sarcoid like reaction to various immunotherapeutic agents and sarcoid like distribution of metastatic disease.

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## Abstract Archives of the RSNA, 2023

NMMIEE-42

### Boning Up on DXA in Adults: A Radiologist's Guide to Interpretation and Quality Control

#### Participants

Saeed Elojeimy, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- List DXA indications. 2- Recognize appropriate and inappropriate acquisition techniques. 3- Review the pathologic conditions detectable on DXA. 4- Recognize pitfalls that can arise on DXA and how to troubleshoot.

#### TABLE OF CONTENTS/OUTLINE

1- Introduction 2- DXA's role in assessing bone mineral density a. Imaging preparation and technique: Patient preparation, imaging technique (describe when to image spine, hip, and forearm and appropriate techniques for ROI placement) b. Interpretation (Comparative databases, T-score, Z-score) c. Review WHO criteria for diagnosing normal bone density, low bone mass, and osteoporosis d. Fracture Risk Assessment (Role of FRAX and Trabecular bone score) e. Pitfalls (improper positioning, artifacts, incidental findings) 3- DXA's emerging role in evaluating and tracking body lean mass and fat composition (review indications, technique, interpretation, available comparison databases, reporting) 4- Summary

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## Abstract Archives of the RSNA, 2023

NMMIEE-43

### 18F-FDG PET/CT Focus on Inflammatory-infectious Diseases. Beyond Tumor-related Processes

#### Participants

Maria Baladron, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the applications and importance of non-oncologic 18F-FDG PET-CT in various infectious and inflammatory cases. Demonstrate the utility of 18F-FDG PET/CT in evaluating fever of unknown origin. Case-based review of common and uncommon inflammatory and infectious pathologies, including sarcoidosis, osteomyelitis, spondylodiscitis, and vasculitis, among others. Demonstrate the utility of 18F-FDG PET/CT in evaluating the extension of the disease and treatment response in some of these pathologies. Be aware that these pathologies sometimes are incidental findings in routine oncology follow up.

#### TABLE OF CONTENTS/OUTLINE

A brief theoretical basis of PET-CT imaging and mechanism of 18F-FDG interaction with cells. Fever of unknown origin as a clinical entity that benefits from the sensitivity of FDG uptake. Metabolic findings before morphologic variations challenge conventional imaging. Different potential uses of 18F-FDG PET/CT in infectious and inflammatory cases; assessing active inflammation, disease extent, occult disease, treatment response and sometimes determining the most suitable biopsy site. Display specific FDG18 uptake patterns in rare conditions like recurrent aseptic osteomyelitis. Illustrate cases of incidental inflammatory-infectious finding during oncologic patient evaluation.

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## Abstract Archives of the RSNA, 2023

NMMIEE-44

### FDG PET/CT Imaging of Systemic Vasculitis: A Pictorial Review

#### Participants

Masatoshi Hotta, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Vasculitis can be classified into primary or secondary types based on its etiology or by the size of the affected blood vessels according to the Chapel Hill Consensus Conference criteria. As any size of vessel in any organ may be affected, the imaging findings vary widely. The heterogeneous nature of vasculitis poses a diagnostic challenge. The aims of this review are to: 1) present FDG-PET/CT images of primary and secondary systemic vasculitis affecting vessels of various sizes, including large, medium, small, and variable-sized vessels, 2) describe the FDG-PET/CT features of each systemic vasculitis type and discuss non-vascular findings that can aid in the differential diagnosis, and 3) review the role of FDG-PET/CT in the management of systemic vasculitis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction | 2. Primary vasculitis: a) Large-vessel vasculitis (Takayasu arteritis, giant cell arteritis); b) Medium-vessel vasculitis (polyarteritis nodosa); c) ANCA-associated small-vessel vasculitis (microscopic polyangiitis, granulomatosis with polyangiitis, eosinophilic granulomatosis with polyangiitis); d) Variable-vessel vasculitis (Behçet's disease, Cogan's syndrome). | 3. Secondary vasculitis: a) Vasculitis associated with systemic disease (IgG4-related disease, sarcoidosis, relapsing polychondritis, Erdheim-Chester disease); b) Vasculitis associated with probable etiology (drugs, infection)

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## Abstract Archives of the RSNA, 2023

NMMIEE-45

### **Transthyretin Cardiac Amyloidosis (ATTR-CM) and Alzheimer's Disease: Is There a Real Correlation or Age-related Specific to Certain Population**

#### **TEACHING POINTS**

-Review the relationship between cerebral amyloidosis (Alzheimer disease) and Transthyretin cardiac amyloidosis (ATTR-CM). - Review the imaging technique and radiotracer used for cerebral and cardiac amyloidosis. -Illustrate cases with cardiac and cerebral amyloidosis who presented to our institution

#### **TABLE OF CONTENTS/OUTLINE**

The term "cardiac dementia" (ATTR - CM) is referred to heart failure (HF) as a risk factor for Alzheimer disease (AD). It is thought that the correlation between these two entities is through perfusion defects, angiopathy, and inflammation. Some studies suggest that AD is a multiorgan, systemic disease that may contribute to diminished cardiovascular function. Moreover, recent studies have shown common molecular and pathological features in the brain and heart of the patients with AD, including intramyocardial deposits of A $\beta$ . Whether this amount of A $\beta$  deposit can play a role in compromised myocardial function in patients with AD is yet unknown. High A $\beta$  level in the brain is detected on PET imaging. Although the intramyocardial deposits of A $\beta$  are at a much lower concentration than those seen in the brain, cardiac PET imaging with C-PIB, 18F-florbetapir, and 18F-florbetaben can detect light chain and transthyretin amyloidosis and identify cardiac amyloidosis early in the course of the disease. In ATTR-CM, Tc PYP Cardiac SPECT CT improves the differentiation from blood pool and myocardial uptake and decreases false negatives. Alzheimer's disease and heart failure are two common age-related diseases that can coexist. However, whether there is a real correlation between the two is still a subject of debate and more large-scale population studies are being conducted to further investigate this.

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## Abstract Archives of the RSNA, 2023

NMMIEE-46

### Preoperative and Postoperative 18F-Choline PET/CT Value in Patients with Primary Hyperparathyroidism

#### TEACHING POINTS

- To learn about 18F-Choline (FCH) molecule and recognize its physiologic biodistribution, pathological uptake and potential pitfalls.- To understand the acquisition protocol and recognize the importance of early phase PET scan combined with iodine contrast-enhanced CT.- To review current recommendations for the use of FCH PET/CT in patients with primary hyperparathyroidism (PHPT) and related clinical conditions (eg. tertiary hyperparathyroidism, MEN syndromes).

#### TABLE OF CONTENTS/OUTLINE

Choline is a chemical precursor for the synthesis of phospholipids that form the cell membrane. Parathyroid (PT) active tissue has a high uptake of FCH due to the upregulation of choline kinase. Hyperparathyroidism causes urinary, bone, neurologic, and gastrointestinal symptoms and complications. Most cases of PHPT are caused by a solitary PT adenoma. Surgery is the appropriate treatment, but the main reasons for surgical failure are ectopic glands and multiple active tissues. Precise preoperative location of PT tissue remains a difficult task with conventional imaging (99Tc-MIBI scan, CT, MRI) and it is more challenging in patients with previous neck surgery. FCH PET/CT has a high sensitivity for preoperative localization of PT adenomas and postoperative search of active PT tissue. FCH PET/CT is becoming a first-line imaging modality for preoperative and postoperative localization of active PT tissue in PHPT patients. Table of Contents- FCH physiologic uptake and normal biodistribution.- Imaging acquisition protocol. - Preoperative and postoperative localization of orthotopic and ectopic active PT tissue. - Recommendations for the use of FCH PET/CT in patients with PHPT. - Illustrative cases.

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## Abstract Archives of the RSNA, 2023

NMMIEE-47

### Brain Death: Review of Neuroimaging criteria, Techniques and Pitfalls

#### TEACHING POINTS

1) Overview of brain death imaging with a focus on the role of radionuclide perfusion scintigraphy for early and accurate determination of brain death. 2) Review brain death physiology, medical standards, clinical and imaging criteria, confounding variables and inconsistencies in the concept of brain death documentation. 3) Highlight the imaging indications, patient preparation, techniques/protocols, instrumentation, imaging artifacts and pitfalls.

#### TABLE OF CONTENTS/OUTLINE

- Introduction: Review of brain death imaging to assist radiologists in performing, interpreting and appropriate reporting of the results for the confirmation of brain death. Outline
- Confirmatory examinations: Includes tests that show absence of brain electrical activity (EEG and somatosensory evoked potentials) and those that evaluate blood flow (radionuclide studies, multivessel angiography, CT/MR angiography).
- Methods of evaluating blood flow: Contrast enhanced angiography, Transcranial Doppler ultrasound, Radionuclide brain flow scintigraphy.
- Review of radionuclides-Tc-99m HMPAO-Tc-99m ECD-Tc-99 m DTPA-Tc-99 m Glucoheptonate-Tc-99 m TcO<sub>4</sub>
- Pitfalls of radionuclide scintigraphy -False positive tracer activity due to infection, tumors, scalp hyperemia due to head trauma, CSF shunts, intracranial pressure transducer.-False negative results due to disruptions in the skull and scalp, as well as pressure on the portion of the scalp resting on a hard surface causing photopenic area on the flow study.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-48

### **The Utility of Brain Perfusion Single Photon Emission Computed Tomography (SPECT) in the Assessment of Neurodegenerative Diseases**

#### **Participants**

Tomoki Imokawa, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

SPECT, or Single Photon Emission Computed Tomography, is one of the nuclear medicine imaging modalities to evaluate cerebral hemodynamics. Cerebral perfusion studies contain much information useful for the diagnosis of various diseases, especially neurodegenerative diseases. This presentation will highlight the use of SPECT in the diagnosis of neurodegenerative diseases and other conditions that cause dementia, such as cerebrovascular disease and idiopathic normal pressure hydrocephalus. The findings of SPECT have important clinical implications, and the application of the knowledge to MR perfusion imaging is also expected.

#### **TABLE OF CONTENTS/OUTLINE**

1. The Basics of SPECT 2. Alzheimer's Disease 3. Dementia with Lewy Bodies 4. Frontotemporal Dementia 5. Corticobasal Syndrome 6. Idiopathic Normal Pressure Hydrocephalus 7. Progressive Supranuclear Palsy 8. Multiple System Atrophy 9. Spinocerebellar Ataxia 10. Cerebrovascular Diseases 11. Creutzfeldt-Jakob Disease 12. Others

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-49

### Advanced Cancer Imaging with Hyperpolarized<sup>13</sup>C-MRI: Techniques and Applications

#### TEACHING POINTS

1. Hyperpolarized carbon-13 MRI (HP <sup>13</sup>C-MRI) is a promising metabolic imaging for oncology that employs dynamic nuclear polarization to enhance the polarization of solid-state compounds labeled with carbon-13, increasing signal by up to 50,000-fold, and allowing the detection of the probe and its downstream metabolites using a clinical MRI scanner. 2. HP <sup>13</sup>C-MRI using [1-<sup>13</sup>C]pyruvate enables non-invasive and rapid monitoring of the upregulated anaerobic glycolysis in cancer cells. MCT in the cellular membrane enables the uptake of [1-<sup>13</sup>C]pyruvate, which is then converted into [1-<sup>13</sup>C]lactate by LDH or into [1-<sup>13</sup>C]alanine by ALT or into <sup>13</sup>C-bicarbonate by PDH. 3. Hyperpolarization is transient and relaxes back to thermal equilibrium once leaving polarizer, providing an acquisition window of 2-3 minutes. MRI sequences are optimized to utilize the unrecoverable magnetization rapidly and efficiently. 4. Kinetic modeling involves developing a mathematical model that describes the rates at which probes are converted to products, while model-free metrics rely on metabolite ratios. 5. HP <sup>13</sup>C-MRI has been applied to prostate cancer, renal cell carcinoma, brain tumors, and breast cancer, showing its potential to distinguish between benign and malignant tumors, determine tumor aggressiveness, monitor response to therapy, and predict patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of HP <sup>13</sup>C-MRI. 2. Technical aspects: (a) <sup>13</sup>C labeled probes; (b) Probe preparation and pharmacy kit assembly; (c) Hyperpolarization, dissolution, and quality control; (d) Patient injection, imaging acquisition, and data analysis. 3. Clinical applications. 4. Conclusions.

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## Abstract Archives of the RSNA, 2023

NMMIEE-5

### Molecular Imaging of Dementia: A Case-Based Review

#### TEACHING POINTS

Introduction: Molecular imaging plays an increasingly important role in the early identification and monitoring of various forms of dementia, as well as in selecting appropriate patients for therapy in these disorders. In this educational exhibit, we aim to review the pathologic basis and salient imaging findings of the most common causes of dementia, drawing on case examples from our institution. Teaching points/ Learning objectives: 1. Understand the basic pathologic processes responsible for the most common neurodegenerative processes as well as their relative prevalence. 2. Learn the normal and abnormal uptake patterns in the brain on various nuclear medicine studies, including FDG PET, amyloid PET, and DaTScan. 3. Learn what further imaging workup would be recommended for indeterminate findings on FDG PET.

#### TABLE OF CONTENTS/OUTLINE

Outline: 1. Background of dementia a. Definition b. Review of different neurocognitive domains i. Perceptual-motor function ii. Language iii. Executive function iv. Learning and memory v. Complex attention vi. Social cognition c. Review of the most common causes of dementia and their pathologic basis d. Review of various proteinopathies 2. Review of findings of most common causes of dementia on FDG and amyloid PET as well as DaTScan with associated case examples i. Alzheimer's disease ii. Vascular dementia iii. Mixed dementia iv. Dementia with Lewy Bodies v. Frontotemporal dementia vi. Corticobasal degeneration vii. Creutzfeldt-Jakob disease 3. Imaging using F-18-DOPA in parkinsonism 4. Suggested further workup based on imaging findings 5. Review amyloid and Tau imaging tracers and briefly discuss other functional tracers useful in neurodegenerative diseases

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## Abstract Archives of the RSNA, 2023

NMMIEE-50

### Radiation Safety in Theragnostics: Educational Simulated Real-life Scenarios

#### Participants

Kip Guja, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Theragnostics is a rapidly growing field in nuclear medicine in the era of personalized medicine. Knowledge of radiation safety issues in targeted radionuclide therapies (TRT) is vital for delivering safe and effective patient care, and for maintaining the safety of healthcare workers involved in patient care. The objective of this educational exhibit is to address fundamental issues in radiation safety related to TRT in an engaging way by presenting educational real-life scenarios which may be encountered in a theragnostics clinic.

#### TABLE OF CONTENTS/OUTLINE

Educational real-life scenarios to be discussed in this exhibit include: (1) Dose calibrator fails quality control testing, (2) Discrepancy >20% between assayed and prescribed dose, (3) Misadministration of the wrong therapeutic radiopharmaceutical, (4) Preparation of theragnostics treatment room and restroom, and (5) Patients with nephrostomy tubes referred for Lu-177 therapy, (6) Management of Lu-177 radionuclide spill, (7) Management of radioiodine spill (8) Precautions related to liquid I-131 therapy. The appropriate actions/response to each scenario will be summarized.

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## Abstract Archives of the RSNA, 2023

NMMIEE-51

### Prostate Cancer Theragnostics: Review and Early Insights

#### TEACHING POINTS

1. Review the general characteristics of prostate cancer  
2. Explore current treatment options and algorithms for prostate cancer, focusing on the increasing role of PSMA theragnostics  
3. Establish a framework for the evaluation and selection of patients who would benefit from PSMA RLT  
4. Understand the factors behind successful PSMA RLT therapy; including protocols for treatment, side effects/contraindications and the role of imaging/laboratory monitoring during treatment  
5. Identify current ongoing research and unanswered questions in the role of PSMA RLT

#### TABLE OF CONTENTS/OUTLINE

I. Overview of prostate cancer  
a. Epidemiology, diagnosis, and progression  
b. Localized versus metastatic; Castration sensitive versus resistant  
II. Overview of current treatment  
a. Medical and surgical  
i. Surgery and radiotherapy  
ii. Androgen based  
iii. Chemotherapy  
b. Nuclear medicine  
i. Radium-223  
ii. <sup>177</sup>Lu-PSMA-617  
III. Overview of <sup>177</sup>Lu-PSMA-617  
a. Mechanism of action  
b. Overview of trial results and evidence  
IV. Treatment with <sup>177</sup>Lu-PSMA-617  
a. Patient selection  
i. Inclusion criteria and contraindications  
ii. Choosing between Ra-223 and PSMA RLT  
b. Treatment protocols  
V. Evaluation and monitoring of <sup>177</sup>Lu-PSMA-617 treatment response  
a. Adverse effects and management  
b. SPECT monitoring between cycles  
i. Range of responses  
ii. Imaging monitoring and adjusting therapy  
c. Criteria for cessation of therapy  
d. Case based review and examples  
VI. Future directions and unanswered questions  
a. Review of ongoing trials

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## Abstract Archives of the RSNA, 2023

NMMIEE-52

### Beyond the Glowing Hues: A Comprehensive Review of False Positive Cases on FDG PET/CT

#### Participants

Kota Yokoyama, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

FDG PET is one of the most widely used nuclear medicine examination in clinical use today, with high detection capability for malignant tumors and inflammatory diseases. On the other hand, its specificity for tumors is not high, making it difficult to distinguish between inflammation and tumors. In addition, with the recent rise in the price of therapeutic drugs, there are more opportunities to use it for treatment response assessment, and it is important to understand the changes that may be encountered after various types of treatment. This section will provide an overview of the physiologic accumulation of FDG PET/CT and the frequently encountered and somewhat rare false-positive cases (non-neoplastic lesions), presenting a wide range of cases from initial presentation to post-treatment.

#### TABLE OF CONTENTS/OUTLINE

1. The basics of FDG PET/CT 2. Physiological uptake, Artifacts, reactive change, lipomatous hypertrophy, brown adipose3. Iatrogenic or post-treatment changes: radiation pneumonitis, radiation pulmonary fibrosis, radiation sialadenitis, radiation liver disease, postoperative PPFE, foreign body granuloma, thymic rebound, G-CSF reactive bone marrow, vaccine reactive accumulation, etc.4. Benign lesions: Pituitary adenoma, chronic thyroiditis, hypercellular bone marrow, desmoids, hypercellular bone marrow, etc.5. Inflammatory disease Sarcoidosis/sarcoid-like reaction, vasculitis, IgG4-related disease, Cattleman's disease, TAFRO syndrome, etc.6. Infectious diseases: Tuberculosis, mycosi fungoides, actinomycosis/nocardia, echinococcosis, etc.

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## Abstract Archives of the RSNA, 2023

NMMIEE-53

### New Era of Imaging of Parkinson's Disease and Atypical Parkinsonian Syndrome

#### Participants

Yoshiaki Ota, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Early diagnosis and treatment of movement disorders including Parkinson's disease are highly important to reducing the risk of disease progression and improving the quality of life. 2. Brain MRI, FDG-PET, dopaminergic imaging, cholinergic imaging and 123I cardiac meta-iodobenzylguanidine (MIBG) have been clinically utilized not only for differential diagnosis but also for providing disease prognosis. 3. Novel molecular imaging and brain MRI can aid in deepening the pathophysiology of movement disorders and in treatment development.

#### TABLE OF CONTENTS/OUTLINE

1. Parkinson's disease and atypical Parkinsonian syndromes: (a) Parkinson's disease, (b) Progressive supranuclear palsy (PSP), (c) Multiple system atrophy (MSA), (d) Corticobasal degeneration (CBD), (e) Dementia with Lewy bodies (DLB) 2. Pathophysiology of Parkinson's disease: (a) Dual-hit hypothesis: a-synuclein pathology arises simultaneously in the olfactory bulb (OB) and dorsal motor nucleus of the vagus (DMV) and in the enteric nervous system (ENS) plexus. (b) Single-hit hypothesis: a-synuclein pathology arises in OB/DMV first or in ENS first. 3. Imaging modalities of Parkinson's disease and atypical Parkinsonian syndrome and common imaging features: (a) Brain MRI, (b) Advanced neuroimaging: Diffusion tensor imaging (DTI) and functional MRI (fMRI), neuromelanin-sensitive MRI (NM-MRI), (c) FDG-PET, (e) Dopaminergic imaging, (f) Cholinergic imaging, (g) Cardiac MIBG 4. Treatment options and imaging assessment of treatment response of Parkinson's disease and atypical Parkinsonian syndromes

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## Abstract Archives of the RSNA, 2023

NMMIEE-54

### Nuclear Medicine Imaging in Epilepsy: What the Radiologist Needs to Know

#### TEACHING POINTS

1. Nuclear medicine imaging plays an essential role in the evaluation of medically refractory epilepsy patients. For these patients, surgery is effective provided there is a well-delineated epileptogenic focus. 2. Functional imaging methods—SPECT and PET—complement structural imaging, allowing accurate ictal focus localization even in the absence of a structural abnormality. 3. Comparison of ictal and interictal SPECT combined with MRI (SISCOM) increases the sensitivity for epileptogenic focus detection. 4. Interictal F-18 FDG PET helps to lateralize the epileptogenic focus, assess for other abnormalities, and guide further testing in pre-surgical planning. 5. Future endeavors include quantitative analysis improvements, neuroreceptor PET radiotracers, and multimodality imaging integration.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of medically refractory epilepsy. 2. Overview of surgical options. 3. Description of the pre-surgical evaluation process, focusing on ictal and interictal SPECT and interictal FDG PET. 4. Presentation of radiopharmaceuticals and their characteristics. 5. Review of methodology, imaging protocols, and post-processing techniques. • Ictal and interictal SPECT • Interictal F-18 FDG PET 6. Illustration of SPECT and PET usage in ictal focus localization and pre-surgical guidance through a series of commonly encountered pathologies- temporal and extratemporal epilepsy, cortical dysplasia, arteriovenous malformations, encephalocele, tumors. 7. Review of emerging radiopharmaceutical imaging options.

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## Abstract Archives of the RSNA, 2023

NMMIEE-55

### PSMA Radiotheranostics in Prostate Cancer: Principles, Practice, and Future Prospects

#### Participants

Laszlo Szidonya, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. <sup>177</sup>Lu-PSMA is a safe and effective therapy in metastatic castration-resistant prostate cancer. 2. Eligibility for treatment is based on the uptake of lesions on PSMA PET. 3. The degree of uptake on PSMA and FDG PET offers predictive and prognostic information. 4. Post-therapy imaging is important to confirm tumor uptake of the therapeutic agent, monitor response, and identify progressing lesions.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Clinical overview of prostate cancer and treatment options. b. Concept of radiotheranostics. c. Data from the VISION and TheraP trials. 2. Current practice: a. Eligibility for treatment. b. Therapy administration and dosing. c. Toxicity and side effects. 3. Added value of imaging: a. Prognostic/predictive PET biomarkers: i. Qualitative parameters: 1. Level of PSMA uptake relative to liver/spleen and salivary glands. ii. Quantitative parameters: 1. Absolute uptake values (e.g. SUV<sub>max</sub>). 2. Total tumor burden. iii. PSMA/FDG concordance/discordance. b. Post-therapy imaging: i. SPECT quantification to predict response. ii. Detection of disease progression. 4. Future directions: a. Timing, sequencing, and dose optimization. b. Potential role of personalized dosimetry. c. Alternative PSMA targeting molecules. d. PSMA therapy using alpha emitters. e. Combination therapy.

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## Abstract Archives of the RSNA, 2023

NMMIEE-56

### Improving the Diagnostic Sensitivity of <sup>13</sup>N-Ammonia PET Imaging: Creating Age- and Gender-Matched Normal Databases for Myocardial Flow Reserve Measurements

#### Participants

Takuji Nanno, Suita, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

<sup>13</sup>N-Ammonia myocardial perfusion PET imaging (ammonia PET), is a non-invasive, quantitative imaging method that enables the evaluation of myocardial blood flow (MBF) for detecting myocardial ischemia and assessing disease severity. Myocardial flow reserve (MFR) measurements, obtained by comparing stress and rest MBF ratios, provide important diagnostic and prognostic information for ischemic heart disease. However, clinical interpretation of MFR values depends on the normal population values, and the normal database (NDB) for MFR has not been sufficiently evaluated. Since MFR measurements vary, it is desirable to create age- and gender-matched NDBs for individuals under 70 years old as well as NDB for individuals over 70 years old. By comparing MFR values with the appropriate reference NDB, it is possible to evaluate the severity of ischemia in a more detailed and objective manner. This presentation aims to introduce the methods for creating age- and gender-matched NDBs and their usefulness in clinical cases, thereby improving the diagnostic sensitivity in ammonia PET.

#### TABLE OF CONTENTS/OUTLINE

1. Age and Gender Differences in MFR in ammonia PET 2. Creation of age- and gender-matched NDBs for MFR using Syngo MBF software 3. Clinical case 1: Normal perfusion with normal coronary artery 4. Clinical case 2: Mild ischemia with significant stenosis in RCA and D1 5. Clinical case 3: Multi-vessel CAD

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## Abstract Archives of the RSNA, 2023

NMMIEE-57

### Nuclear Medicine Lung Perfusion (Q) Imaging: SPECT/CT Indications and Interpretation Pearls and Pitfalls

#### TEACHING POINTS

1. Highlight the PISAPED interpretation criteria for perfusion-only lung scans  
2. Understand indications for and utility of SPECT/CT in lung perfusion scans  
3. Recognize common pearls and pitfalls in the interpretation of Q scans

#### TABLE OF CONTENTS/OUTLINE

1. Perfusion-only lung imaging  
a. Historic use of V/Q scans  
b. COVID pandemic and perfusion-only scans  
c. 2022 Global contrast shortage crisis  
2. Interpretation Criteria  
a. PISAPED perfusion-only criteria  
b. PIOPED perfusion-only criteria  
3. SPECT/CT Indications  
a. Non-wedge shaped perfusion defects  
b. Heterogeneous radiotracer uptake and distribution  
4. Case Examples  
a. COVID pneumonia with and without pulmonary embolism (PE)  
b. Emphysema as a mimic of PE  
c. Bronchopneumonia with and without PE  
d. CTEPH - missed on CTPA and better seen on Q scan  
e. PE with pulmonary infarct  
f. Pleural effusion masking PE on planar images  
g. Pulmonary masses as a mimic of PE  
h. Fibrosis as a mimic of PE  
5. Teaching Points  
a. Indications and utility of SPECT/CT  
b. Common pitfalls of interpretation

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## Abstract Archives of the RSNA, 2023

NMMIEE-58

### COVID-19 Pandemic and Its Impact on Nuclear Medicine with Teaching Pearls

#### Participants

Nick Balanda, BSc, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

COVID-19 is a multi-systemic viral disease also known as SARS-CoV-2 or severe acute respiratory syndrome coronavirus 2. Worldwide rapid emergence of the COVID-19 pandemic altered the practice of medicine including nuclear medicine. It is considered to be one of the most massive and chaotic challenges confronting global public health of our times. This educational exhibit aims to: 1. Summarize economic impact of COVID 19 in a tertiary care university teaching hospital. 2. Describe the adaptation to the pandemic by modification of various imaging protocols (for example Myocardial perfusion, V/Q scan, scheduling of PET CT after COVID-19 vaccination), highlighting the importance of CT portion of SPECT CT and PET CT, especially for lung findings. 3. Offer Teaching Pearls and a case-based multi-modality correlation of interesting COVID-19-related findings in nuclear medicine and PET CT imaging with a focus on the impact on patient management.

#### TABLE OF CONTENTS/OUTLINE

We present 15 interesting COVID-19-related findings in nuclear medicine and PET CT imaging with a focus on the impact on patient management. These cases include incidental findings secondary to vaccination and COVID-19 infection as well as modified imaging protocols and highlight important considerations for radiologists interpreting images in the era of COVID-19.

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## Abstract Archives of the RSNA, 2023

NMMIEE-59

### Role of 18F FDG PET CT in Patients with Lymphoma Treated with CAR-T Cell Therapy: Current Concepts

#### Participants

Vanessa Murad, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Understand the principles and biological effects of CAR-T cell therapy. CAR-T cell therapy is a novel cancer treatment based on the genetic modification of the patient-derived T cells by adding synthetic functional chimeric antigen receptors (CARs), which permit the identification of specific tumor antigens. 18F -FDG PET/CT (=PET CT) is the imaging of choice for pre and post CAR-T cell therapy assessment, in patients with metabolically active lymphomas. 2) Recognize the role of PET CT in pre-therapy assessment. Highly metabolically active disease and high tumor burden at baseline PET CT, are predictors of unfavorable patients' outcomes and risk of therapy related toxicities. 3) Define the optimal timing of PET CT in therapy response assessment, as well as its impact on management (with demonstrative cases). PET CT 1-month after the infusion is the preferable timing for therapy response assessment, and may trigger a possible therapeutic intervention. A few cases of pseudo-progression after therapy have been described; however, all have been during the first few days after the infusion, with complete resolution at 1-month PET/CT. 4) Identify the main toxicities associated with CAR-T cell therapy and the role of PET CT in their evaluation.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction to CAR-T cell therapy, brief history and indications. 2) Role of PET CT in CAR-T cell therapy: 2.1) Pre-therapy considerations. 2.2) Post-therapy response assessment: timing, impact and imaging interpretation including pseudo-progression evaluation. Demonstrative cases. 2.3) Evaluation of toxicities during CAR-T cell therapy: Cytokine release syndrome, immune effector cell-associated neurotoxicity syndrome and infection.

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## Abstract Archives of the RSNA, 2023

NMMIEE-6

### Acute Adverse Events in Theragnostics: Educational Simulated Real-life Scenarios

#### Participants

Kip Guja, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Theragnostics is a rapidly growing field in nuclear medicine in the era of personalized medicine. Recognizing and appropriately managing acute adverse events associated with targeted radionuclide therapies (TRT) is vital for delivering safe and effective patient care. The objective of this educational exhibit is to highlight management of acute adverse associated with TRT in an engaging way by presenting simulated real-life scenarios which may be encountered in a theragnostics clinic.

#### TABLE OF CONTENTS/OUTLINE

Educational simulated real-life scenarios to be discussed in this exhibit include: (1) Extravasation of 177-Lu radionuclide, (2) Management of potential complications associated with amino acid infusion during Lu-177 DOTATATE therapy, (3) Management of carcinoid crisis after Lu-177 DOTATATE therapy, and (4) Mitigation of flare reaction to TRT (5) Management of acute sialadenitis with Lu-177 PSMA-617 therapy. The appropriate actions/response to each scenario will be summarized.

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## Abstract Archives of the RSNA, 2023

NMMIEE-60

### Pediatric PET/MRI: The How and Why

#### Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

#### TEACHING POINTS

Since its introduction a decade ago, integrated PET/MRI has been established as a hybrid imaging modality that provides unique diagnostic information. A key application of PET/MRI is pediatric imaging for oncologic, neurologic, inflammatory, and metabolic conditions given its reduced radiation exposure and potential for reduction of administered radiotracer dose. Despite its successful clinical adoption, the availability of PET/MRI for pediatric patients is still limited to larger academic and clinical centers due to high complexity studies which require thorough patient preparation and exam planning, skilled image acquisition and careful image analysis and interpretation. These factors limit the accessibility of PET/MRI not only for imaging specialists in training, but also for experienced radiologists and nuclear medicine physicians. The purpose of this contribution is to provide guidance and the value of pediatric PET/MRI with clinical examples drawn from pediatric PET/MRI programs world-wide.

#### TABLE OF CONTENTS/OUTLINE

1. Common clinical indications for PET/MRI in pediatric patients 2. Commonly used PET tracers for these indications 3. PET/MRI instrumentation 4. Patient preparation (patient information, dietary aspects, sedation, anesthesia) 5. Examination planning and protocol definition 6. Examination execution 7. Aspects of image processing 8. Interpretation and reporting 9. Pitfalls and troubleshooting

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## Abstract Archives of the RSNA, 2023

NMMIEE-61

### Role of FDG PET/CT in Therapeutic Decision Making in Lymphoma

#### TEACHING POINTS

1. Therapeutic options for lymphoma include chemotherapy, monoclonal antibody therapy, radiation therapy, stem cell transplant and chimeric antigen receptor therapy (CAR-T). FDG PET/CT plays an integral part in therapeutic decision making. 2. Interim FDG PET/CT allows response-adapted treatment with either reduction in the number of chemotherapy cycles or early use of more aggressive treatment. 3. In patients receiving CAR-T, response assessment on FDG PET/CT should be guided by LYRIC response criteria. 4. Interpretation of interim and post treatment FDG PET/CT can be confounded by thymic hyperplasia, infection/inflammation, immune related adverse events, marrow stimulation by granulocyte colony-stimulating factor (G-CSF). 5. FDG PET/CT plays a role in evaluating disease relapse or transformation and provides guide to biopsy.

#### TABLE OF CONTENTS/OUTLINE

1. NCCN treatment guidelines- illustrations of role of FDG PET/CT in therapeutic decision making. 2. Overview of CAR-T. 3. Illustrate staging by FDG PET/CT. 4. Illustrate Lugano and LYRIC treatment response criteria for interim and end of treatment FDG PET/CT. 5. Illustrate pitfalls in treatment response assessment- thymic hyperplasia, infection/inflammation, irAEs (immune related adverse events), marrow stimulation by G-CSF. 6. Illustrate role of PET/CT in identifying disease relapse or transformation

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## Abstract Archives of the RSNA, 2023

NMMIEE-62

### Functional Imaging of Liver and Spleen Using Tc 99m Sulphur Colloid. A Case Based Multi-modality Pictorial Review with Teaching Pearls

#### Participants

Nick Balanda, BSc, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Nuclear Medicine Tc-99m Sulphur colloid liver-spleen scan has declined over recent years, however, it is still very useful in certain specific scenarios where it can be virtually diagnostic or confirmatory. Our case-based educational exhibit aims to: 1. Evaluate functional abnormalities of the liver and spleen based on the location and amount of radiotracer uptake. 2. Review specific scenarios for evaluating intra-pancreatic, left hemi abdominal, mediastinal, and left lung masses by liver spleen scan as questioned on conventional anatomic imaging with multi-modality correlation. 3. Evaluate a few specific space-occupying hepatic and splenic masses with multi-modality correlation. 4. Importance of SPECT CT over planar imaging.

#### TABLE OF CONTENTS/OUTLINE

Our case-based educational exhibit includes: Assessment for Hypersplenism in patients with thrombocytopenia, evaluating for cirrhosis, evaluating/confirming the presence of accessory/ectopic splenic tissue, evaluating specific intrapancreatic lesions, Hepatic cysts, hepatic hemangiomas, FNH, splenic infarcts, Budd-Chiari syndrome.

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## Abstract Archives of the RSNA, 2023

NMMIEE-63

### **Pictorial Review of MRI Fused with Somatostatin Receptor PET Tracers in Meningiomas: Does the Integration of Molecular and Anatomic Imaging Impact Clinical Management**

#### **TEACHING POINTS**

1. Physiologic avidity of somatostatin receptor PET tracers is minimal in the brain parenchyma, providing an excellent tumor background ratio (TBR), unlike FDG PET. 2. Somatostatin receptor PET assists in targeting meningiomas in complex anatomic regions such as the skull base and identifying additional sites. 3. MRI fused somatostatin receptor PET allows for distinguishing enhancing scar tissue from meningiomas. 4. Somatostatin receptor PET impacts clinical and radiation therapy (RT) management leading to changes in the clinical approach and/or modifications in radiation treatment volumes. 5. Somatostatin receptor PET has potential in neurotheranostics to provide diagnostic imaging to guide molecular therapeutic radionuclides, such as <sup>177</sup>Lutetium-DOTATATE.

#### **TABLE OF CONTENTS/OUTLINE**

1. General considerations: § Imaging evaluation of intracranial meningiomas in NM and anatomic modalities § Review the mechanism of Somatostatin Receptor Targeted PET Imaging 2. Integration of PET and imaging guided therapy: Radiotherapy fundamentals. 3. Case-based approach of impact on patient's treatment decisions. 4. Somatostatin receptor PET pitfalls: What you need to know? Summary: Our preliminary experience of MRI fused with somatostatin receptor PET has shown to enhance identification of disease extent compared to MRI only, especially in patients with prior treatments and extracranial components, impacting management decisions and providing information for potential radionuclide targeted therapy.

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## Abstract Archives of the RSNA, 2023

NMMIEE-64

### Radiotheranostics in Prostate Cancer: Current Practice and Future Outlook

#### Participants

Daniel Kwon, MD, PhD, Coquitlam, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Next generation radiotheranostics are effective in patients with prostate cancer, with studies supporting imaging- and treatment-based on the molecular determinants of patient's disease  
2. Prostate-specific membrane antigen (PSMA)-targeted radiotheranostics represent the frontier of this paradigm, with PSMA-targeted imaging showing superiority compared to conventional imaging for staging and monitoring patients during therapy  
3. <sup>177</sup>Lu-based PSMA-targeted and <sup>223</sup>Ra radioligand therapy are effective in metastatic prostate cancer, and multiple clinical trials are exploring further indications  
4. Dosimetry will personalize doses per patient to maximize therapeutic benefit while minimizing toxicity  
5. Other radioisotopes (e.g. <sup>225</sup>Ac, <sup>161</sup>Tb) and molecular targets (e.g. gastrin-releasing peptide receptor (GRPR)) are being explored for radiotheranostic applications in prostate cancer

#### TABLE OF CONTENTS/OUTLINE

- Overview of prostate cancer: current diagnosis and treatment
- Introduction to radiotheranostics: common theranostic radioisotopes and their selection
- PSMA-targeted imaging and radioligand therapy: recent trial data, indications, clinical pearls, image-guided monitoring, and case examples
- Radium-223: indications, clinical pearls, and case examples in bone metastases in prostate cancer
- Dosimetry: principles and applications for personalized radioligand therapy
- The Future: Ongoing PSMA-targeting radiotheranostic clinical trials, emerging theranostic radioisotopes and radiotheranostic agents (e.g. GRPR)
- Conclusions and Summary

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## Abstract Archives of the RSNA, 2023

NMMIEE-65

### 18F-FDG PET/CT: Least Useful to Most Important Imaging Modality for Evaluation of Prostate Cancer

#### TEACHING POINTS

1. Understand the roles and mechanism of PSMA and FDG PET/CT imaging in evaluating prostate cancer at different stages of the disease. 2. When reading PSMA PET/CT scans, interpreters should always correlate with clinical history such as PSA level, disease stage, and prior treatments. If PSMA positive lesions are not in proportion to high PSA level or if lesions are only seen on CT without PSMA avidity, think of transformation of prostatic adenocarcinoma (CRPC-Adeno) to treatment-induced neuroendocrine prostate cancer (t-NEPC). Consider 18F-FDG PET/CT for further evaluation. In some cases, 68Ga-DOTATATE PET/CT may be helpful.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Case examples 3. Educational objectives 4. Summary

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## Abstract Archives of the RSNA, 2023

NMMIEE-7

### Perineural Tumoral Spread- A Search Pattern for PET Scan Readers

#### TEACHING POINTS

1. Perineural tumor spread is the macroscopic analogue of perineural tumor invasion. 2. F-18 FDG PET CT is often used in staging and response assessment in head and neck malignancies and has an important role in identification of perineural tumor spread.3. Familiarity with relevant cranial and peripheral nerve anatomy, pattern of perineural tumor spread and associated PET imaging appearance will lead to improved detection of this important prognosticating factor.4. FDG uptake resulting from postsurgical and postradiotherapy inflammation in addition to other infectious and inflammatory causes may lead to false positive cases mimicking perineural tumor spread.

#### TABLE OF CONTENTS/OUTLINE

1. Background- what's in a name- perineural tumor spread versus perineural tumor invasion.2. Overview of relevant cranial nerve and peripheral nerve anatomy.3. Pathophysiology of perineural tumor invasion and perineural tumor spread.4. Tumor types, sites, and clinical presentation of perineural tumor spread.5. Case based review of PET patterns of perineural tumor spread in the head and neck.6. Other usual and unusual locations for perineural tumor spread on PET imaging.7. Search pattern for peritumoral spread for PET scan readers.8. Imaging differentials for consideration and false positives. 9. Prognosis and treatment considerations in patients with perineural tumor spread.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-8

### Imaging Appearances of Large Vessel Vasculitis on 18F-FDG PET/CT: The Dark, the Bright, and the In-between

#### Participants

Rita Maria Lahoud, MD, Shelton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 18F- FDG PET/CT can be used in the diagnostic evaluation of vasculitis, to determine the distribution of involvement, the activity status of the disease, and to assess treatment response.
- Where possible, CT angiography should be added to 18F-FDG PET/CT as it not only improves diagnostic accuracy but can identify frequent complications such as aneurysm formation or vascular dissection.
- PET vascular activity score (PETVAS) is a grading system that provides qualitative and quantitative assessment.
- Limitations include superficial cranial vessel involvement, extensive atherosclerosis, and persistent uptake in remission limiting the use of PET/CT for routine follow-up.
- Systemic rheumatologic conditions, including Erdheim Chester and IgG4 Related Disease can have secondary involvement of the large vessels, mimicking a large vessel vasculitis. It is important to recognize their distinguishing features and patterns of involvement on 18F- FDG PET/CT.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Large Vessel Vasculitis: a. GCA and PMR b. Takayasu's
2. Role of PET/CT in the Evaluation of LVV a. Disease activity b. Extent of involvement c. Biopsy Target d. Response Assessment
3. PET/CT protocol a. General patient preparation b. Impact of glucocorticoids c. Incubation time d. Contemporaneous CT angiogram
4. Common Imaging Appearances of LVV on PET/CT a. GCA pre and post therapy b. Takayasu's c. TIPIC variant of GCA
5. Differential Considerations a. Erdheim Chester b. IgG4 related disease
6. Diagnostic Accuracy of PET/CT

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NMMIEE-9

### Epilepsy Beyond HARNESS-MRI Protocol through Hybrid PET-MRI and Advanced MRI Imaging

#### Participants

Piedad Acosta Mora, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To learn the causes of drug-resistant epilepsy and structural alterations in neuroimaging.- To recognize the spectrum of MRI sequences optimized for epilepsy and to implement the use of HARNESS MRI protocol.- To review advanced neuroimaging techniques (functional, metabolic, post-processing.) and to explain the utility in the drug-resistant epilepsy - To evaluate the clinical impact of hybrid FDG -PETMRI in decision-making in drug-resistant epilepsy- To understand how hybrid imaging with PETMRI optimizes the subtle epileptogenic lesions detections and improves postsurgical seizure outcome.

#### TABLE OF CONTENTS/OUTLINE

1.Introduction2.Classification of seizure types3.Causes of drug-resistant epilepsy 4.MRI sequences optimized for epilepsy - HARNESS MRI protocol5.Advanced neuroimaging techniques - BOLD- MRI functional - Texture analysis - Spectroscopy - Diffusion tensor imaging (DTI) and fiber tractography 6.Role of hybrid FDG-PETMRI in epilepsy - Indications - Preparation - Technique and recommendations for acquisition - Normal patterns of brain FDG uptake - Cortical analysis 7.Case-based learning 8.Conclusions

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

NPMEE

### Noninterpretive Skills (Beyond Imaging) Education Exhibits

#### Sub-Events

#### **NPMEE-1 Every Little Bit Helps. How to Reduce Carbon Footprint with a Mobile MR. Experience from the Northwest of Spain.**

##### Participants

Mercedes Arias Gonzalez, MD, PhD, Vigo, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Mobile MRs are able to fill the service void in small to medium-sized hospital without in-house magnets. Delivering care closer to home avoids travel kilometers, highly contributing to an improved carbon footprint. Carbon footprint per MR scan can be even further reduced due to a higher utilization rate, as MR scanners cannot be turned off. Being conscious of radiology contribution to carbon footprint and greenhouse gas emissions can contribute to reduce them, as much as possible.

##### TABLE OF CONTENTS/OUTLINE

Evolution of needs and mobile MR implementation in the public healthcare system in Galicia (a region in the Northwest of Spain) since 2006. Evaluation of kilometers avoided by patients since 2006 and its effect in carbon footprint. Study of utilization rates of each mobile MR scan through the years. Easy explanation of useful concepts concerning carbon footprint and greenhouse gas emissions.

#### **NPMEE-10 Financial Fitness for the Radiology Resident**

##### Participants

Kevin Wu, MD, Tampa, FL (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Radiologists receive little formal instruction on basic concepts related to financial planning. Yet, certain financial decisions and strategies that are best employed during residency can yield as much as hundreds of thousands in savings over the course of a career. Therefore, early financial literacy is one of the most important aspects of career counseling that trainees can receive. Indeed, certain financial maneuvers are only possible during the training years. For those with an average loan burden, income driven repayment (IDR) can be worth >\$400,000 over the course of a career, and is a priority consideration. Other maneuvers, such as electing to contribute to a Roth 403b/401k (if available) rather than a pre-tax 403b/401k during residency, or performing a 403b/401k-to-IRA rollover followed Roth conversion after training, are expected to be worth \$84,000 by retirement. Even greater savings are likely with such maneuvers if marginal income tax rates increase in the future. These and other strategies require only hours to employ, and must not be missed for all who are eligible. In this light, we present an "order of priorities" regarding financial maneuvers that maximize yield with respect to ease of execution. Specifically, we discuss maneuvers such as student loan IDR, value-driven credit card rewards, 403b/401k to Roth IRA rollover, strategies around tax season, and early modifications of the retirement portfolio mix.

##### TABLE OF CONTENTS/OUTLINE

Philosophy/disclaimers, The financial waterfall, Student loan IDR, Credit card optimization, Expense ratios, Pretax purchasing, Roth vs. traditional and conversions, Income tax projections, Portfolio mix, Avoidance of taxation events, Tax season, Subtleties

#### **NPMEE-11 Radiology Dashboards: Applications in Addressing Healthcare Disparities in Image Utilization**

##### TEACHING POINTS

1. Review the role of dashboards in radiology  
2. Examine how healthcare disparities (HCD) in radiology can affect morbidity and mortality  
3. Highlight specific applications of radiology dashboards in addressing HCDs in imaging utilization  
4. Discuss the limitations of radiology dashboards

##### TABLE OF CONTENTS/OUTLINE

1. What is a Radiology Dashboard?  
a. Key Performance Indicators (KPIs)  
i. Patient tracking  
ii. Image utilization  
iii. Turnaround time  
iv. Resource allocation  
v. Quality assurance  
2. Overview of the literature on HCDs in image utilization (e.g. disparities in imaging utilization in the emergency department, disparities in utilization of low dose CT for lung cancer screening, etc.)  
3. Applications of radiology dashboards in addressing HCDs in image utilization  
a. Identifying risk factors for decreased imaging utilization stratified by type of study (e.g. screening mammogram, low dose CT for lung cancer screening) and patient setting (e.g. emergency department)  
i. Zip code of patient residence  
ii. Race and ethnicity  
iii. Age  
iv. Language preference  
b. Developing quality improvement initiatives  
i. Patient education  
ii. Language accessibility  
iii. Cultural competency training and diversification of work force  
iv. Community outreach (e.g. mammogram vans and patient education efforts)  
v. ACR Select  
c. Monitoring response  
i. Before and after studies  
ii. Non-Comparative studies  
iii. Time series  
4. Limitations of radiology dashboards  
5. Conclusions

#### **NPMEE-12 Out of the Darkness and into the Light: Redefining the Role of Radiology in Community Engagement**

Participants

Somiah Almeky, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

•Provide a radiology-focused overview of foundational elements related to community engagement, community-based participatory research, reciprocal innovation, and community needs assessment and outreach •Discuss evidence-based examples of how radiology staff/trainees play a crucial role in delivering equitable care •Explore how community engagement can be leveraged as an effective method to restore purpose in our daily work and prevent burn-out •Review practical examples of community engagement across various settings (ie. rural, urban, global health) •Discuss steps to establish a centralized curriculum that defines the role of radiology in the community, and provides trainees with concrete examples of this work

#### TABLE OF CONTENTS/OUTLINE

1. Interface between Radiology and the Community •Definition of Community Engagement, Community-Based Participatory Research, Reciprocal Innovation •Leveraging institutional resources and community needs assessments to guide outreach efforts c. Evidence-based community engagement startup toolkit for radiology 2. Case-based review of ongoing outreach efforts in various settings •Cancer screening efforts •Resident-driven initiatives •Health equity efforts •Outreach interventions among veteran populations 3. Potential pitfalls and opportunities for growth •Allocation of effort and time in alignment with community needs and departmental workload. •Tips on identifying opportunities to engage diverse communities 4. Empowering the next generation •Establishing a "Community Engagement in Radiology" curriculum •Overview of required competency elements •Facilitators and barriers to dissemination of the curriculum

#### NPMEE-13 Breaking Bad News: What the Radiologist Needs to Know

Participants

Natalia Orthmann, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.To emphasize the importance of breaking bad news in appropriate ways.2.To present the existing and consolidated bad news protocols.3.To elaborate on how the protocols can be applied in the day-to-day practice of radiologists, especially breast radiologists.4.To assist in the training of radiologists in this time of breaking bad news.5.To illustrate the differences between the most frequent protocols for breaking the bad news

#### TABLE OF CONTENTS/OUTLINE

1.Literature review focusing of consolidates bad news protocols.2.To illustrate and discuss how bad news protocols can make the moment less traumatic for physicians and patients.3.Discuss how to apply the protocols in the radiologist's routine.4.Examples cases of how bad news may occur in the radiologist's routine.5.Summary and conclusion.

#### NPMEE-14 Green Teams - an AI Gore-ithm for Addressing Sustainability in Radiology

Participants

Katherine Frederick-Dyer, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

We explain the process of forming a sustainability committee in the Department of Radiology to identify and address the environmental footprint in our academic department.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. What is sustainability and how does addressing it reduce costs and improve human health B. What is design thinking and how do we use it to solve non-linear problems II. Baseline Survey A. Identify attitudes and interest in climate change B. Identify opportunities to reduce carbon footprint and build allies III. First meeting A. Forming the committee - approaches to inclusivity B. Guidance with local climate experts to guide discussion 1. Assess - What is the carbon footprint of the department? 2. Inspire - To what extent do concerns about climate change and support for climate mitigation affect employee morale and patient satisfaction? 3. Model - How do we share our successes to decarbonize our department to guide other departments? C. Design thinking session 1. Actively engage participants to brainstorm ideas using colorful sticky notes 2. Visually organize ideas into the Categories (IIIb) 3. Establish culture of inclusivity, collaboration, transparency, fun, and accountability D. Organize team into subgroups to address each CategoriesIV. Subsequent meetings A. Encourage teams to produce achievable deliverables each meeting B. Assess what expertise and resources are needed C. Delineate team member roles and responsibilities D. Define timeline and metrics for success V. Highlighting early wins and how this contributes to the bigger picture

#### NPMEE-15 Forward Together: Collaboratively Integrating Radiology throughout a Medical School Curriculum

Participants

Matthew Lee, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Integrating radiology throughout a medical school curriculum mirrors the breadth, depth, and impact of radiology in the real world2. Sustainable implementation of radiology throughout a curriculum is a product of thoughtful and strategic partnerships with medical school leadership across disciplines and central governance committees3. Collaboratively working with colleagues across disciplines can expand the footprint and impact of radiology in medical school4. Early consistent exposure to quality radiology education promotes recruitment into radiology and positively impacts learners pursuing other specialties5. Effective student education transcends passive modes of learning through activities that promote increased learner engagement

#### TABLE OF CONTENTS/OUTLINE

1. ForWard - 3-phase model integrating basic, clinical, and public health sciences, 10 integrated "threads"2. Phase 1 - thematic blocks incorporating basic and clinical science and early clinical medicine - incorporating radiology into anatomy, patient-centered education cases3. Phase 2 - clinical rotations integrating clinical care, basic sciences, and thread areas - case-based learning4. Phase 3 - career exploration, intern preparation, "selectives" - novel radiology course development5. Leadership - medical student

directors, block leaders6. Innovative educational content creation and delivery - embracing remote techniques, case-based learning, website development7. Novel course development - Screening in Radiology, Financial Wellness8. Faculty Recruitment - range of faculty, educational RVUs9. Resident Recruitment - radiology interest group10. Lessons learned - staff support for sustainable implementation

## **NPMEE-16 #FOAMrad: A Personal Productivity Curriculum for Radiologists**

Participants

Alice Shieh, MD, Seattle, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Simplify and adopt the "Getting Things Done" methodology for busy radiologists- Understand and incorporate the fundamentals of "Deep Work" for peak performance- Learn how to apply the science of habits based on best-selling book "Atomic Habits"- Demonstrate tried and tested productivity software applications to streamline repetitive tasks (for Mac users)- Review time-saving settings and approaches to combat e-mail overwhelm

### **TABLE OF CONTENTS/OUTLINE**

Getting Things Done framework ?- Delete it, Do it, Delegate it, Deposit it, Defer it ?Deep Work ?- 4 deep work philosophies: monastic, bimodal, rhythmic, journalistic?- 3 steps to rewire your brain: embrace boredom, quit social media, drain the shallows ? Atomic Habits ?- 4 laws of behavior change: cue, craving, response, rewards ?- Creating a new identity to develop new habits ?- Building better systems to achieve goals?Tried and tested productivity software applications to streamline repetitive tasks on a Mac?- Alfred, SetApp, 1Password, Evernote, Notion, Ecamm, Endnote, Backblaze ?E-mail management ?- Understanding e-mail communication principles ?- Time-saving settings for Outlook and Gmail ?Multitasking and prioritization techniques ?- MoSCoW (Must, Should, Could, Would)

## **NPMEE-17 Radiology Management at Your Fingertips: Incorporating Macropads Into the Radiology Workflow**

Participants

Elliot Breshears, MD, Seattle, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-Review the utility of macropads in automating and simplifying repetitive nature of the radiologist's workflow-Learn how to easily assemble, program, and implement macropads into your own radiology practice-Discuss the time-saving features of macropads

### **TABLE OF CONTENTS/OUTLINE**

Macropad device utility- Assign complex repetitive tasks to a single button click, improving efficiency- Ability to bypass IT restrictions and firewalls; eliminates need to install additional software on PACS workstationsResource selection process- Consolidating resources into 15 programmable keys- Implementing input from abdominal imaging faculty ?Assembly- Physical components: front and back plates, keycaps, switches, USB cables- Assembly process- Creating custom key stickers to promote intuitive access of selected resources ?Programming- Utilizing duckyScript and the duckyPad Configurator software- Navigating computing system compatibility issues ?Implementation and impact on radiology workflow- Reduction in mouse clicks needed to access resources- Plug and play with ability to use at different workstations ?Limitations- Cost- Time and effort associated with self-assembly, selecting and organizing incidentaloma guidelines- Minimal scripting required ?Future directions- Implementing Elgato stream deck into PACS stations with software installed after security clearance

## **NPMEE-18 Large Language Models and Natural Language Processing: Overview and Metrics for Radiology Report Simplification**

Participants

Rushabh Doshi, MPH,MSc, Cerritos, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Review the gap in health literacy for radiological reports. 2) Review existing efforts for radiology simplification. 3) Review the role of Natural Language Processing (NLP) and Large Language Models (LLM) models in report simplification. 4) Review the evaluation metrics of NLP and LLM models for report simplification.

### **TABLE OF CONTENTS/OUTLINE**

1) Radiology Report Transparency 2) Patient Interest in Report Simplification 3) Ongoing Simplification Efforts 4) Model Terminology 5) Application of Natural Language Processing and Large Learning Models for Report Simplification 6) Demystifying NLP and LLM models 7) How Models Learn - Training NLP and LLM models 8) Existing LLM Interfaces 9) Prompt Optimization of LLM Interfaces 10) Evaluation Metrics (Readability, Accuracy, Simplicity, etc.) 11) Implementing LLM models 12) Potential reimbursement model for report simplification 13) Future directions of LLM models in report simplification

## **NPMEE-19 Journey to Parenthood in Radiology: Progress, Challenges, and Opportunities**

### **TEACHING POINTS**

1. Delayed childbearing impacts the reproductive outcomes among physicians.2. A better understanding of the options to achieve parenthood allows for comprehensive family planning, flexible practice management, and inclusive dialogues.3. Accurate knowledge of occupational radiation exposure to women physicians may help assuage unrealistic fear and build a stronger pipeline of future radiologists.

### **TABLE OF CONTENTS/OUTLINE**

- To highlight the importance of and obstacles to family planning and childbearing for physicians and physicians-in-training
- To review occupational radiation risks and safety precautions in the radiology work environments and specifically within each radiology subspecialties
- To raise awareness of the various options and processes involved in egg preservation, fertility treatment, surrogacy, adoption, and fostering
- To provide an overview of existing policies and guidelines for family and medical leave in the United States, including the American Board of Radiology updated policies and state and federal laws
- To discuss potential mechanisms to support medical students, radiology trainees, and radiologists on their journey to parenthood and those who are

parents

## **NPMEE-2 Small Nodule, Big Impact: Incidental Findings Module**

### **TEACHING POINTS**

1) Studies have found that as radiographic imaging numbers continue to increase, so has the number of incidental findings. 2) Based on literature and guidelines including the ACR white papers and Fleischner Society recommendations, a new incidental/follow up tab was built into our electronic health record (EHR) to provide simple, fast and streamlined recommendations by radiologists for clinicians. 3) Additional measures are also built in to help achieve the proper patient follow up, such as dedicated nurse navigators to help track down incidental findings and assure proper follow up as well as inbox EHR messages to patients PCP upon discharge. 4) Future directions include expanding the followed-up incidental, education to both ordering providers and patients as well as research for continued evolution of incidental finding guidelines.

### **TABLE OF CONTENTS/OUTLINE**

1) Define the impact of incidental pulmonary findings by radiologists on patient care. 2) Discuss the implemented incidental findings tab within our health network and how it has changed patient care/outcomes. 3) Identify methods to expand this model to include more incidental findings and increase patient follow up. 4) Data collection and interruption for future incidental finding recommendations and guidelines.

## **NPMEE-20 Artificial Intelligence for Pediatric Radiologists: A Gentle Introduction for the Non-enthusiast**

Participants

Marcelo Takahashi, MD, PhD, (*Presenter*) Speaker, Vertex Pharmaceuticals Incorporated

### **TEACHING POINTS**

This presentation is intended for pediatric radiologists with no/little AI experience. We will explain the basic concepts of AI applied to radiology and discuss practical example of usage of AI in pediatric radiology. Main points: 1) Core AI concepts and lexicon 2) Brief history of AI in radiology 3) Basic algorithm creation and operation 4) Applications of AI in radiology 5) Limitations of AI in radiology

### **TABLE OF CONTENTS/OUTLINE**

1 - Disclaimer: • created for pediatric radiologists with no/very little experience in AI. • Essential concepts will be explained in straightforward manner and accessible language. 2 - Introduction: • Core concepts: • What is artificial intelligence, narrow AI and broad AI • Machine Learning and Deep Learning. • Big Data, Data Science, Domain Knowledge 3 - Brief history of AI in radiology: • The early years. • The CAD era • The Machine Learning and Deep Learning era. 5 - Basic Lexicon: • Dataset, model, algorithm, training, testing, generalization, features, classification, segmentation, regression, clustering, prediction, label, supervised learning, unsupervised learning 4 - "Classic Machine Learning" and Deep Learning: • How is a "classic ML" algorithm created? • DL algorithm creation • Main differences, advantages and disadvantages ("classic ML" vs DL). 5 - Where is/can AI be applied in the pediatric radiologist's workflow (with practical examples) • Imaging criteria, scheduling, acquisition (MR acceleration, CT/XR dose reduction), image analysis (segmentation, classification, detection), reporting (NLP), precision medicine. 6 - "Must know" AI limitations: • Algorithm creation vs algorithm implementation • Interpretation errors • Generalization errors 7 - Take home message

## **NPMEE-21 The Potential Applications of ChatGPT in the Field of Medical Imaging**

### **TEACHING POINTS**

This exhibit combines recent literature reviews to explore the application prospects of ChatGPT in the field of medical imaging, including its potential applications in medical service, teaching, and scientific research settings, possible ways to apply ChatGPT, and the attitudes of the academic community towards the application of ChatGPT in the field of medical imaging.

### **TABLE OF CONTENTS/OUTLINE**

1. ChatGPT can be used in the processing of medical document texts such as medical records in the medical imaging workflow, to achieve the structuring and standardization of texts, promoting effective interaction between staff and patients. 2. ChatGPT can also be used to train medical students and resident physicians in image diagnosis by improving teaching efficiency through interactive learning and teaching methods. 3. ChatGPT can assist in the literature retrieval, data collection, statistical analysis, and article writing processes in scientific research. However, researchers should be aware of the risk of ChatGPT taking over as the main tool and control the research process to ensure the authenticity of the research.

## **NPMEE-22 Ways to Improve Patient Satisfaction Analytics in the Modern Era of Radiology: Tips and Tricks from the Patient Satisfaction Officer**

### **TEACHING POINTS**

1. Third party analytics evaluate care directly from patients in a simple, fast, and easy-to-use fashion. 2. The information obtained from analytics offers radiologists and their practices an opportunity to identify patient needs and priorities while recognizing weaknesses and opportunity for improvement. 3. Modifications and implementation of new practices are often minor, requiring little to no infrastructure, cost, or time while having a positive impact on retention, referral, and most importantly patient satisfaction.

### **TABLE OF CONTENTS/OUTLINE**

1. Define the patient experience as it relates to most commonly observed factors. 2. Discuss the role that current-day technology has played in the implementation and innovation of healthcare analytics regarding both acquisition and interpretation. 3. Recognize that personnel, speed, and ease of care are common subjects of both positive and negative patient experiences. 4. Identify methods to respond to feedback that increase patient satisfaction.

## **NPMEE-23 Utilizing 3D Printing and Phantoms to Teach the Basic Principles and Pitfalls of Ultrasound**

Participants

Patricia Garcia, Cork, Ireland (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Ultrasound (US) is an essential diagnostic tool for the radiologist. This teaching module will be a practical, interactive, and

Ultrasound (US) is an operator-dependent imaging technique; thus, teaching this skill is critical to radiology education. Ensuring adequate training is essential to patient safety and quality assurance in clinical practice. Those trained in US are keenly aware of the many pitfalls of US imaging. US physics and related artefacts are covered comprehensively in the Diagnostic Radiology curriculum; however, modern education emphasises alternate approaches to teaching, including hands-on practical sessions. US phantoms are used to teach biopsy techniques, but little literature exists on the use of phantoms to teach US basic principles. To simulate commonly encountered US limitations and artefacts, we created gelatin-based US phantoms with embedded objects made from 3D-printed moulds, allowing trainees to experience them in real-time. The embedded objects demonstrated concepts such as relative echogenicity, the importance of imaging an object in multiple planes, mirror image artefact, increased acoustic through-transmission and shadowing. Representative scans of these phantoms will be presented to confirm their utility in demonstrating these concepts.

#### TABLE OF CONTENTS/OUTLINE

1. Challenges of teaching hands-on ultrasound skills
2. Technical aspects of phantom creation
3. Demonstration of basic principles
4. Demonstration of artefacts

#### NPMEE-24 **Scire Quod Sciendum: Knowledge at the Intersection of Suboptimal Photography and Radiography**

Participants

Emiliano Garza Frias, MD, Monterrey, NL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learning Objectives Using the author-shot photographs and curated suboptimal radiographs, this exhibit will help the audience: 1. Understand the causes and types of suboptimal chest radiographs. 2. Learn about the global frequency of suboptimality in the most frequent radiological procedure - chest radiographs. 3. Understand what errors in photography can teach about suboptimal radiography. 4. Understand how suboptimality in radiography influences the interpretation using photo-radio-graphic examples.

#### TABLE OF CONTENTS/OUTLINE

Content organization 1. What makes a chest radiograph suboptimal? 2. What are the parallels between suboptimal radiography and photography? 3. Use of common causes and examples of suboptimal photographs to educate about suboptimal chest radiographs. 4. Parallel examples of how suboptimal photography and radiography hide or distort key findings

#### NPMEE-25 **RadioGraphics Trainee Editorial Advisory Members Board (RG TEAM)**

Participants

Melina Hosseiny, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-The RadioGraphics Trainee Editorial Advisory Members Board (RG TEAM) was established in December 2020 to involve trainees in shaping the journal's content and direction. -The RG TEAM is a group of radiology trainees from around the world who play a crucial role in developing high-quality educational resources that are specifically tailored to trainees. RG TEAM initiatives include content curation, innovation of creative trainee resources, organization of trainee Top 10 reading lists, creation of trainee-focused editorials, Cases from the Cookie Jar (in-print and social media), and the new official Spanish version on social media (Casos Cookie). -Joining the RG TEAM offers multiple benefits to its members, such as mentorship, networking, career development, experience in academic writing and publishing, and exposure to global radiology education. -Trainees can obtain mentorship through the RG TEAM by collaborating directly with RadioGraphics editorial board members and radiology experts, and gain valuable skills including communication, writing, and critical thinking skills. This relationship extends beyond the one-year term and can last a lifetime. -RG TEAM has an annual call for new applications available in SPRING. Interested trainees can submit their curriculum vitae, statement of interest, and an idea for a trainee-focused RG TEAM initiative. Residents and fellows in diagnostic or interventional radiology, radiation oncology, and nuclear medicine, as well as medical students, are encouraged to join.

#### TABLE OF CONTENTS/OUTLINE

- 1) Introduction to RadioGraphics and RG TEAM
- 2) RG TEAM Initiatives
- 3) Benefits of Joining the RG TEAM and How to Get Involved
- 4) Conclusion

#### NPMEE-26 **Blueprint for Medical Student Exposure to Radiology through Research: GSW and MVC Projects**

#### TEACHING POINTS

Medical students can be given early exposure to radiology through research. Research projects can be initiated using pre-existing data sets like the Trauma Registry maintained at Level I trauma centers. Projects can give residents and medical students leadership opportunities. Projects can give medical students opportunities to present their work at local, regional, and national conferences.

#### TABLE OF CONTENTS/OUTLINE

Purpose: Few opportunities exist for medical students to gain exposure to radiology outside of seeking out electives during clinical years. Methods: IRB approval was obtained to access 10 years of GSW injury data. See Figures 1 and 2. Under trainee guidance, medical students reviewed radiology images and worked to grade injuries by the American Association for the Surgery of Trauma injury grading scales. Once injuries were scored, clinical questions were examined. As part of the expansion to MVC injuries, we are recruiting new students at M1 Orientation and collaborating with other specialties. Results: In year 1, 13 posters were presented at a local conference, Research!Louisville, and 6 at state, regional, and national conferences. See Figures 3 and 4. Data presented at RSNA will include the number and listing of the projects presented at Research!Louisville in September 2023 (planning for 45 posters) and will also include 2 years of survey responses from medical student participants and leaders. Conclusion: Trauma registries provide a robust dataset that can be utilized to increase early exposure to radiology in medical school and facilitates collaborative projects between residents and medical students, that students can further expand on as their research experience grows. .

#### NPMEE-27 **Radiology at the Crossroads: Navigating Patient Safety, Risk Management, and Clinical Ethics in Modern Imaging Practice**

#### TEACHING POINTS

1. Comprehensive overview of medical ethics, patient safety, and risk management in radiology 2. Empowering radiologists and trainees to actively engage in quality improvement 3. Transcending specialties to create a positive impact on patient care

#### TABLE OF CONTENTS/OUTLINE

1) Intro: Radiology, Patient Safety, Ethics2) Radiation Safety, Dose Reduction3) Informed Consent in Procedures4) Communicating Critical/Incidental Findings5) Radiology Research Ethics6) AI, Machine Learning: Safety, Ethics7) Justification/Appropriateness of Imaging8) Optimizing Imaging Protocols9) Pediatric Radiology Safety10) Radiology Workflow, Patient Safety11) Contrast Media Safety, Reactions12) Radiation Exposure in Pregnancy13) Safety/Quality Improvement Initiatives14) Reducing Reporting Errors15) Incident Reporting, Learning from Errors16) Patient-centered Care17) Confidentiality, Data Protection18) Teleradiology Ethics19) Credentialing, Privileging20) Sports Injuries Imaging Ethics21) Cultural Competence, Diversity22) Managing Incidental Findings23) Peer Review, Feedback24) Radiology Education Ethics25) Financial Considerations, Conflicts26) Interprofessional Collaboration27) End-of-Life Care Ethics28) Cognitive/Mental Health Issues29) Radiology in Global Health, Disaster30) Palliative Care Imaging Ethics31) Addressing Healthcare Disparities32) Shared Decision-making33) Public Health Emergencies Ethics34) Access to Radiology Services35) Conclusion, Future Directions

#### **NPMEE-28 Myth Busters: Questioning Standard Radiology Practices for Value-added Care**

##### TEACHING POINTS

This exhibit aims to debunk common myths in radiology practices that are believed to provide value-added care but, in reality, lack sufficient scientific evidence to support their efficacy. By analyzing scientific data and exploring recent research, the article challenges widely accepted practices to promote a more evidence-based approach to radiology.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction, a. Value-added care definition, b. Importance of evidence-based practicesII. Radiology Myths, a. Myths 1-5, b. Myths 6-10III. AUC Reality, a. AUC role in debunking myths, b. AUC examplesIV. Barriers to AUC, a. Resistance to change, b. Financial incentives, c. Technology and trainingV. Overcoming Barriers, a. Education, b. Incentives for evidence-based practices, c. Technology upgradesVI. Measuring Radiology Value, a. Patient outcomes, b. Costs, c. EfficiencyVII. Strategies for Value-Added Care, a. Staying current on evidence-based practices, b. AUC for dispelling myths, c. CommunicationVIII. Conclusion, a. Summary of exhibitIX. References

#### **NPMEE-29 From Detection to Action: A Journey Through Incidental Findings in Radiology**

##### TEACHING POINTS

This educational exhibit aims to provide a comprehensive understanding of incidental findings in radiology, addressing their various aspects including identification, communication, management, legal implications, and patient autonomy. The presentation highlights the importance of awareness and proper handling of incidental findings, balancing patient autonomy with ethical considerations and potential harms. It emphasizes the need for evidence-based management, structured reporting, and effective communication. The evolving role of technology, particularly AI, in detecting and managing incidental findings is also discussed.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Definition and variability among radiologists || Settings where incidental findings may ariseEducation: ACGME and ABR guidelinesPatient autonomy Access to images, understanding reports, imaging preferences, and referralsCommunication of incidental findings: Timing, disclosure, responsibilities, and documentationLegal implications: Civil and criminal lawsuits, protection for radiologistsManagement of incidental findings Evidence-based practices, second opinions, structured reporting, national/international variations, conflicts of interest, guidelines, and low-resource settingsHarms of incidental findings Costs, psychological impact, overcalling and undercalling incidentalsCommon incidental findings: ACR white papers, unclear clinical significance, small focus of ischemiaConclusion Importance of awareness, research, guidelines, and technology in managing incidental findings.

#### **NPMEE-3 International Observerships in Pediatric Radiology: Optimization and Potential Benefits**

Participants  
Hermon Derbew, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

International clinical observership programs can facilitate highly effective academic collaboration, international brand building, information dissemination and recruitment. However, this type of program typically adds bureaucracy, logistics and faculty workload for the hosting institution—as well as many regulatory and financial barriers for interested individuals. Our institution's proactive approach to welcoming observers from diverse backgrounds minimizes the financial burden to applicants and allows collaboration to advance our academic mission. This exhibit explains the process and impact of the program with emphasis on specific steps taken towards improved workflow and increased throughput of observers.

#### TABLE OF CONTENTS/OUTLINE

1. Process, 2. Institutional benefits, 3. Impact

#### **NPMEE-30 A Step-By-Step Approach to Establish and Enhance MRI Site Safety: A Primer for Radiologists**

Participants  
Pradnya Y. Mhatre, MD, (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

MRI Site Safety is important for protection of patients, staff and public. Proactively thinking about MR Safety features while designing an MR suite is key in establishing robust MR safe environment. American College of Radiology has created MR Safety Manual which includes general principles of MR Safety. We describe various components of MR Site Safety that need to be implemented in a systematic manner to create a robust and sustainable program.

#### TABLE OF CONTENTS/OUTLINE

Initial step in establishing site safety is to identify MR Medical Director, MR Safety Officer and MR Safety Committee. We describe

initial step in establishing site safety is to identify MR Medical Director, MR Safety Officer and MR Safety Committee. We describe how to structure MRI zones, including placement of ferrous quarantine, safe storage, patient transfer, mechanical room, and control room. We also discuss marking of equipment with appropriate signage, use of ferromagnetic detection devices, operation of MR conditional devices in Zone IV and infection control. Specific considerations for cryogen safety, cryogen vent pathway and quench scenario are discussed. Important design details during construction and installation are included. Development of key site safety policies and procedures needed and will be discussed including quarterly and yearly site safety checklist and QC program. Lastly, we will discuss emergency plans for various emergencies like fire, water damage, quench, structural damage, establishment of code area, and preparation for emergency resuscitation, which are a key component of site safety.

### **NPMEE-31 Stay Calm and Don't Attract the Magnet: A Comprehensive Review of MRI Safety Precautions**

Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Following completion of this presentation, the reader will be able to: (1) Identify the four zones of MRI facilities (2) Describe the direct effects of MRI on patients (e.g., noise, heat, neurostimulation) (3) Describe the indirect effects of MRI on patients (e.g., interactions with existing devices and equipment) (4) Define specific absorption rate (SAR) and specific energy dose (SED) and their applications to MRI examinations (5) Discuss specific MRI safety considerations for special patient populations (6) Discuss safety profiles of gadolinium-based contrast media

#### **TABLE OF CONTENTS/OUTLINE**

(1) Background: Physical setup and zones, Hardware and parts of MR apparatus (2) Auditory concerns (3) Heating effects (including burns) (4) Peripheral neural stimulation (5) Portable metallic objects and equipment (6) Medical device and hardware compatibility and interactions (7) Contrast agents (8) Personnel and staffing (9) Special populations: pediatric patients, pregnant patients, patients with altered states of consciousness, obese patients, prisoners and detainees

### **NPMEE-32 Common Errors in Neuroradiology**

Participants

Luke Wojdyla, DO, San Diego, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Diagnostic errors in neuroradiology are alarmingly common, with estimates ranging from 1-16% in clinical practice. It is well established that most diagnostic misses, including those which result in malpractice litigation, are due to errors in perception. Despite this, the miss rates of specific neuroradiologic diseases have historically been undefined. Recently, a growing number of studies have quantified and categorized neuroradiologic errors across training levels and in a variety of practice schema, measuring the influence of radiologist experience, specific pathology, and other individual and systematic factors. In this exhibit, the most common diagnostic errors described in emerging neuroradiologic literature will be presented. Briefly, these include errors of cerebrovascular pathology, blind spots on CT head imaging, errors of cerebrovascular pathology, misses of head and neck pathology, and errors of skull-base pathology. Systemic factors affecting performance such as practice volumes, reading speeds, and fatigue will also be presented. Knowledge of these findings can provide insight into understanding why errors occur, and in turn, help develop robust strategies to prevent them. Radiologists should be aware of the common blind spots and missed pathologies in the variety of settings described in this exhibit.

#### **TABLE OF CONTENTS/OUTLINE**

Explore the impact of diagnostic error in neuroradiology. Summarize recent literature quantifying common neuroradiologic errors amongst residents, generalists, and neuroradiologists. Appreciate the risk factors and biases associated with error. Provide case examples of real errors encountered in one department. Discuss strategies to minimize error.

### **NPMEE-33 Microaggression or Cross-Cultural Competence?**

#### **TEACHING POINTS**

The pursuit of cultural competence among an increasingly diverse and interconnected workforce is vital. It requires empathy and perspective taking. It behooves us to successfully distinguish the subtleties that exist between the negative connotation of microaggressions from the positive influence of cultural competence. Microaggressions are subtle indignities, slights or insults whose derogatory nature communicates prejudice, dismissal, denigration, hostility or negativity to a member of a marginalized group. They may appear indirect, casual, innocuous, and insignificant. They are often unconscious and unintentional, arising from underlying: prejudice, discrimination, oppression, or bias. Are microaggressions sometimes confused with a genuine desire to improve one's cross-cultural competence?

#### **TABLE OF CONTENTS/OUTLINE**

1) Introduction 2) Cross-Cultural Competence and Communication 3) Microaggressions 4) "Microaggressions are a real problem" 5) "Microaggressions are much ado about nothing" 6) Conclusions

### **NPMEE-34 RadLinks: Creating an Efficient Reference Webpage for Incidentaloma Management Guidelines and Template Generation**

Participants

Alice Shieh, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Conceptualize and design a webpage (RadLinks) to efficiently reference incidentaloma management guidelines- Discuss webpage design features that streamline incidentaloma management- Provide a seamless workflow so radiologists can provide incidentaloma management recommendations quickly with ease

#### **TABLE OF CONTENTS/OUTLINE**

Barriers to efficiency when managing incidentalomas?- Time consuming and repetitive efforts to look up information?- Lack of

resource consolidation? Benefits of using the RadLinks page? - Minimalist, user-friendly design? - Thoughtfully consolidated resources? - Pre-generated templates and text macros? - Hosted on public domain, with lack of institutional barriers RadLinks user interface features? - Expandable/collapsible navigation menu, ability to enlarge figures/charts in-screen, copy text to clipboard with one-click, mobile device compatibility? Website hosting and building options and tools? - Squarespace, Wix, WordPress? - Flaticon? - HTML/CSS tutorials Copyright issues? - Obtaining permissions to display figures and graphs from published articles Future directions? - Keeping content and guidelines up to date? - Expanding resources beyond incidentaloma management? - Reducing scrolling distance? - Implementing user suggestions and feedback?

### **NPMEE-35 Beauty Beyond a Few Slides Deep: How to Increase Radiology Lecture Engagement**

Participants

Julia Tran, MD, Westminster, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

(1) Engaging lectures can hold the audience's attention, convey information more effectively, and make lessons more memorable. (2) Use graphic design resources (eg. AI art sites, design software, typography sites) to visually enhance your presentation. (3) Include activities that require active participation such as games, polls, and PACS simulators to increase engagement.

#### **TABLE OF CONTENTS/OUTLINE**

Didactics are an integral part of radiology education but creating engaging learning experiences can be challenging. Effective and interactive lectures improve learning outcomes by helping learners retain and apply new information. This educational exhibit will (1) introduce the concepts of graphic design and its role in creating impactful presentations. We will share various graphic design software, AI tools, and web resources useful for creating visually appealing designs. We provide examples of how to format lecture slides to emphasize key learning points and findings. This exhibit also aims to (2) showcase various interactive tools and activities that increase audience engagement. PACS simulators, such as PACSBIN, combine imaging software with educational tools to create case-based quizzes and lesson plans. Gamifying cases into competitions, such as Taboo™ or Pictionary™, motivates learners to strive for mastery. By implementing these strategies, educators can create more effective and engaging learning experiences.

### **NPMEE-36 Sustainability, Climate Change and Radiology: Why We Should Care and What We Can Do**

Participants

Hayley McKee, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

#### **TEACHING POINTS**

Producing, using, and powering medical imaging equipment to provide radiology services are estimated to contribute to 1% of total global greenhouse gas emissions. Achieving sustainability in radiology requires immediate and strategic action. Strategies should focus not only on mitigating radiology's impacts, but also building resiliency to the risks of climate change through adaptation, with action taken at individual, department, and industry levels. Opportunities to reduce radiology's carbon footprint include reducing emissions due to non-productive scanner time and minimizing the use of single-use products and overall waste. Reducing overall emissions in health care and radiology will also require partnerships with both industrial and clinical stakeholders.

#### **TABLE OF CONTENTS/OUTLINE**

The overarching goal of this exhibit is to review the intersection of sustainability, climate change and radiology with a focus on why we should care and steps we can take to reduce waste and greenhouse gas emissions. This will be achieved by: 1. Describing the human health impacts of climate change, with health equity considerations. 2. Discussing diagnostic and interventional radiology's contributions to greenhouse gas emissions and waste. 3. Reviewing sources and classification of emissions related to radiology. 4. Differentiating mitigation (reducing impacts) and adaptation (building resiliency) strategies related to radiology. 5. Exploring strategies to promote sustainable practices at individual, institutional, and industry levels.

### **NPMEE-37 Decolonizing Radiology: Addressing Historical Influences and Promoting Global Equity**

#### **TEACHING POINTS**

It is well established there are worldwide disparities in access to radiology services as well as image guided procedures. While differences in access to care persist in the United States, there are profound disparities in access to care between high income countries (HIC) and low/middle -income countries (LMIC). Socioeconomic differences in patient populations, lack of equipment, career opportunities, and until recently lack of formal training programs have all contributed to differences in global access to radiology services. An additional well known contributing factor in differences to access to care are the historical effects of colonialism. While there have been increasing world-wide efforts to decrease the gaps in access to care and addressing the training gap in radiology, there has been little effort to address the history of colonialism in global health work in the context of radiology. This educational exhibit aims to provide context to the history of colonialism in global health and how this perspective is crucial to provide sustainable solutions for long term global radiology equity and culturally competent global health work.

#### **TABLE OF CONTENTS/OUTLINE**

1. History of Colonial Influence on Radiology 2. Consequences of Colonialism in Radiology 3. Current State of Global Radiology Outreach 4. Strategies for Decolonizing Radiology

### **NPMEE-38 Global Radiology: Building Equitable and Sustainable Partnerships with Low- and Middle-Income Countries (LMICs)**

Participants

Lydia Kwarteng, BS, MPH, San Francisco, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Global radiology partnerships can be leveraged to help address the shortage of radiology professionals in LMICs. Simultaneously, there are efforts to address the legacy of colonization on global health initiatives by highlighting the power asymmetry between High-Income Country (HIC) and LMIC partners. This exhibit reviews the critical need to help establish and scale-up radiology training programs in LMICs, highlights opportunities for reform in global health, and provides examples of best practices to foster



equitable and sustainable global radiology partnerships with LMICs.

#### TABLE OF CONTENTS/OUTLINE

Background- Shortage of radiology professionals in LMICs- Global radiology engagement in LMICs The Decolonize Global Health movement- Origins in global health- Goals and controversies Building equitable global radiology partnerships- Leadership and decision-making- Understanding sociocultural context- Equity in research, education, and capacity-building- Funding practices- Transparency and accountability Examples of successful partnerships in Africa- HIC-LMIC institutional collaborations in global cancer research, subspecialty training, and capacity-building (e.g. in neuroradiology, breast imaging, and interventional radiology).

#### **NPMEE-39 Usefulness of Deep Learning for Improved Image Quality and Noise Reduction in Diffusion Weighted Imaging (DWI)**

##### TEACHING POINTS

Deep learning (DL) has recently experienced explosive growth including many areas of medical research. Recent advances in DL-based image reconstruction in MRI have been reported to achieve improved image quality through noise reduction and super-resolution (SR), but there have been very few reports of its application to diffusion-weighted imaging (DWI). We have scanned various body regions with a DL-based DWI research application for clinical evaluation. These images are presented with clinical findings. In addition, underlying technical details and imaging parameter optimizations are presented. Although the visual impression varies depending on imaging regions or scan parameters, the following advantages in DL-based reconstruction are observed: noise reduction due to DL, reduced distortion due to higher acceleration factor, sharpness improvement due to SR and higher spatial resolution, and better visibility of background normal tissues due to shorter echo time.

#### TABLE OF CONTENTS/OUTLINE

1. To present DWI images with deep learning-based image reconstruction and its findings in various body regions. 2. To understand the mechanism of deep learning-based image reconstruction. 3. To understand scan parameter optimization in DL DWI. 4. To know the clinical feasibility of DL DWI in patients with various diseases.

#### **NPMEE-4 Waste Reduction in Radiology: Educational Case Series**

##### TEACHING POINTS

In the U.S. the healthcare sector is estimated to contribute almost 10% of our nation's carbon emissions. As healthcare professionals, we are committed to improving the well-being of our patients, so we also must focus on decreasing our contribution to climate change. Radiology departments can target both direct and indirect emissions by decreasing energy usage within the workspace, reducing unnecessary imaging, and transitioning to green suppliers for the procurement and disposal of medical equipment. Studies have shown that there is a high rate of imaging overuse. Understanding the environmental impact associated with these practices can help to encourage appropriate usage. There are both external and internal factors that can drive a physician to order unnecessary or inappropriate imaging, including but not limited to defensive medicine, patient expectations, obliviousness to cost and risks, breaks in patient-provider communication, and inadequate knowledge.

#### TABLE OF CONTENTS/OUTLINE

Introduction a. Health care impact on environment b. Radiology energy use c. Avenues for reduction Case examples a. Emissions by scan b. Contrast use Inappropriate imaging examples a. Contributions to inappropriate imaging b. Inpatient cases c. Outpatient cases Advocacy strategies

#### **NPMEE-40 The Second Mountain - Climbing the Challenges of Mid-career Radiology**

Participants

Miltiadis Tembelis, MD, Mineola, NY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The mid-career phase for a radiologist, and many other professions, is a time burdened by career stagnation and high rates of burnout. To spite it being a particularly difficult time in the radiologist career, there is little dedicated mid-career support to help radiologists overcome their woes. The goal of this presentation is to highlight the difficulties faced by the mid-career radiologists as well as provide potential solutions to these problems. A focus on the mid-career female radiologist and their unique challenges will also be presented.

#### TABLE OF CONTENTS/OUTLINE

This review will define the mid-career radiologist and provide an overview of the current radiology workforce. Problems such as burnout, career stagnation, alternative career pursuits, lack of mentorship, sponsorship and career development programs, and gender specific challenges of women will be discussed. Potential solutions to these problems will also be presented.

#### **NPMEE-41 Subspecialty Breast Imaging Education in Tanzania: Clinical, Infrastructure and Logistical Paradigms for Best Practices in the Low- and- Middle Income (LMIC) Setting**

Participants

Toma Omfofoye, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Given the global rise in breast cancer, radiology workforce shortages in sub-Saharan Africa are critical.
- The RSNA-led Global Learning Center (GLC) initiative in Tanzania for sub-specialty breast radiology training is presented as a paradigm for remote/in-person education.
- It is imperative to tailor interventions for the resource-limited LMIC environment.
- Presenting a scalable education program for best practices in the LMIC setting, with goals of improving interdisciplinary breast care through training, infrastructure, and optimization of local resources.
- An example of an transnational alliance to care for underserved populations.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Radiology workforce in Africa b. Breast Cancer in Tanzania 2. Educational Paradigm a. Background/need i. Tanzania medical education, radiology and subspecialty education b. Trainees c. Curriculum i. Goals/objectives ii. Content iii.

Learners iv. Faculty v. Resources and Methods ? Synchronous teaching ? Asynchronous teaching ? Observerships vi. Assessment vii. Governance viii. Continuous improvement 3. Breast Imaging Service a. LMIC modality specific goals b. Reporting c. Interprofessional collaborations 4. Infrastructure a. improving technology and support staff 5. Future directions

#### **NPMEE-42 Radiologists for a Sustainable Future (R4SF): Bridging the Gap Between Radiology Practice and Environmental Responsibility**

Participants

Melina Hosseiny, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

-Radiologists for a sustainable future(R4SF) is an international community of radiologists and trainees, dedicated to promoting environmentally sustainable radiology practice and healthcare delivery.-R4SF advocates for policies that promote environmental sustainability in healthcare.At R4SF, radiologists/radiologists-in-training and leaders in the field unite to promote sustainable practices in radiology through education and awareness initiatives, the promotion of sustainable projects, and the establishment of a supportive network.-The R4SF has teams working together to advocate for sustainable radiology through education, policy, social media, and research. -Education team focuses on expanding the participation of medical students and residents in sustainable practices.-R4SF collaborated with members' ACR chapters to propose and pass a resolution on climate change and sustainability at the 2022 National ACR meeting. -R4SF team is a subgroup of the larger multispecialty Healthcare without Harm physician network and has support, mentorship, and sponsorship from great leaders in the radiology society.-Members of R4SF have delivered talks and shared our aims to the radiology community at various societies, including RSNA, ARRS, SABI, AUR, and others.

##### **TABLE OF CONTENTS/OUTLINE**

1)Introduction to Radiologists for a Sustainable Future (R4SF)2)R4SF Initiatives 3)R4SF Goals and Collaborations4)Benefits of Joining the R4SF and How to Get Involved5)Future Direction

#### **NPMEE-43 Let it Go, Let it Go: An Approach to Assessment and Reporting of Benign or Low-Risk Incidental Findings in the Chest**

Participants

Erin Gomez, MD, Columbia, MD (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Radiologists are expected to provide management recommendations for incidentally detected pulmonary nodules and thyroid nodules. While some are clinically impactful, a majority are benign and inconsequential. Fleischner, Thyroid White Paper and TIRADS consensus recommendations were developed to decrease inappropriate recommendations for further evaluation. In our quest to do no harm, radiologists can help decrease patient anxiety, time spent, medical expenses and potential risks associated with further characterization by using best practices for characterizing and reporting nodules which do not require further evaluation through clear, concise language. We will present examples of nodules inappropriately recommended for follow up and a step by step approach to assessment and reporting. ?

##### **TABLE OF CONTENTS/OUTLINE**

Introduction?Commonly Mischaracterized Incidental Findings on Chest CT:?- Pulmonary nodules?- Mucous plugging?Granulomas?- AVMs?- Thyroid Nodules?Risk statistics for nodules by size?Reporting considerations:?- Morphologic descriptors (shape, density, distribution)?- Measurements - 3 plane review?- Concise, specific language; avoiding vague terms?- Comparison with prior imaging? Patient history?Letting it go: supporting data?Role of Structured Reporting?Pre-Populated Macros: Pros and Cons?Society Recommendations and Indications for Incorporation into Reports?Closed Loop Communication?Conclusion

#### **NPMEE-44 Best Practices for Medical Student Engagement in the Radiology Reading Room**

Participants

Devyn Rigsby, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. There is no standardized approach to engaging medical students in the radiology reading room during radiology electives (1).2. Without intentional incorporation of medical students into the reading room team, students may feel disinterested, excluded, or insufficiently challenged to learn. Negative experiences on radiology electives may dissuade students from pursuing radiology as a career.3. This presentation shares best practices for radiology preceptors to foster a healthy learning environment, maximize educational opportunities, and increase medical student interest in radiology.4. Best practices for engaging medical students in radiology courses can be divided into three parts: preparing for student arrival, starting a learning session, and facilitating case-based instruction.5. These best practices are transferrable to any institution's in-person radiology curriculum for medical students.Reference 1. Darras KE, Spouge R, Kang H, et al. The challenge with clinical radiology electives. *Can Assoc Radiol J*. 2019;70(4):337-343.

##### **TABLE OF CONTENTS/OUTLINE**

1. Problem statement2. Common concerns about the reading room experience raised by students at our institution3. Preparing for student arrival in the reading room a. Introductory information b. Identify near-peer mentor (resident or fellow) c. Student workspace4. Starting a learning session a. Learning objectives b. Transfer of foundational knowledge c. Select cases for student to attempt independently5. Facilitating learning through cases a. Student inclusion in all trainee readouts b. 1:1 student readouts on assigned cases c. Session wrap-up

#### **NPMEE-45 Reducing Inappropriate Screening of Endometrial Cancer in Transgendered Men: Discussion of Best Practices**

##### **TEACHING POINTS**

1. To review the testosterone-induced changes in patients who are assigned female at birth (AFAB)2. To discuss the existing literature on the appropriateness of transvaginal US in evaluating abnormal vaginal bleeding in transgender men on hormone-replacement therapy3. To discuss the costs, financial and psychological, of inappropriate screening4. To recommend new guidelines

for screening endometrial cancer in transgender men

#### TABLE OF CONTENTS/OUTLINE

- Hormone replacement therapy treatment goals for transgender men- Current guidelines for endometrial cancer screening - Guidelines for endometrial cancer screening in transgender men - Recommendations for endometrial cancer screening in transgender men- Costs of inappropriate transvaginal US screening- Patient-centered care principles in treatment and care of transgender men

#### **NPMEE-46 It Takes a Village: Multidisciplinary Breast Subspecialty Telementoring for Low- to- Middle-Income-Countries (LMICs)**

Participants

Toma Omofoye, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Funded by an RSNA International education grant, a method for telementoring is described for breast radiologists, pathologists, oncologists, and surgeons where domestic/foreign, low/high resource, and within/outside subspecialty input is used to adapt best practices to available resources. Breast subspecialist shortages in African Low-Middle-Income Countries (LMICs) call for creative solutions. Many LMICs lack multidisciplinary communication (radiology-pathology or tumor board). While LMIC practitioners have varying levels of breast subspecialty training and resources, they have tailored creative solutions for optimizing resources to address advanced disease. The transnational collaboration (with 200 participants from 3 continents- Africa, North and South America) assists capacity building.

#### TABLE OF CONTENTS/OUTLINE

We describe a model for multidisciplinary telementoring to provide paired subspecialty support for breast health practitioners in LMICs. 1. Introduction: LMIC breast cancer burden and subspecialty workforce gaps 2. Project Extension for Community Healthcare Outcomes (ECHO) ABCD model: a. Amplification of medical knowledge b. Best practices to improve outcomes c. Case based (clinically-relevant) learningd. Database: outcome monitoring 3. Program Formata. Case presentation b. Interprofessional and multidisciplinary inputc. Complementary didactics 4. Case-based examples including: Rad-path concordance, quality, symptom, interesting or difficult cases, and rare disease management

#### **NPMEE-47 Supporting Women in Radiology: Implementing a Multi-institutional Coalition**

#### TEACHING POINTS

Women are underrepresented in radiology. Even though men and women are about equality represented among medical school graduates, only 27% of applicants in radiology are women.<sup>1,2</sup> Furthermore, female radiology leaders make up an even smaller minority, consisting of only 13% of radiology leaders.<sup>3,4</sup> The purpose of this exhibit is to showcase how a women in radiology (WIR) group in a teaching institution can provide role models, mentorship, and promote a culture of diversity and inclusion. Furthermore, the introduction of WIR collaborations with other institutions can promote an institution's inter-institutional alliances and provide career advancement opportunities for its trainees. Training institutes are in a unique position to bring about this change. Trainees who have cultivated gender equality values can have a positive impact on their future practices. Though it takes time and effort to foster a culture of diversity and inclusion, it is necessary to do so in order to create a gender inclusive workplace which will benefit not only radiology departments but also patients.

#### TABLE OF CONTENTS/OUTLINE

A) Mentorship: Implementation of "mentoring up" and "mentoring down". B) Promote career advancement opportunities and promotions: Organize discussion panels with panelists from both private practice and academics with a mix of early, mid, and advanced career radiologists. C) Collaborate with other institutions' WIR committees to create inter-institutional alliances focused on promoting the above. D) Overcome or mitigate bias by organizing upstander workshops as part of the training curriculum.E) Understand the unique needs of women in the field, including pregnancy, parental leave, and lactation.

#### **NPMEE-48 Benefits and Applications of ChatGPT for Radiology Trainees**

#### TEACHING POINTS

1. To provide an overview of ChatGPT from a trainee perspective2. To highlight best practices for using ChatGPT 3. To illustrate how ChatGPT can be used to create relevant radiology review content including practice questions 4. To demonstrate the radiology virtual-advisor capability of ChatGPT 5. To describe how medical students can use ChatGPT to develop a preparation plan for radiology rotations6. To provide an overview of the future of ChatGPT in radiology undergraduate medical education

#### TABLE OF CONTENTS/OUTLINE

- What is ChatGPT? - How are trainees using ChatGPT? - Applications of ChatGPT for radiology learning and best practices- Using ChatGPT to generate radiology practice questions - Using ChatGPT to prepare for radiology rotations- Using ChatGPT as a virtual radiology advisor- Using ChatGPT to assist during core clinical rotations - Using ChatGPT to assist with professional communication - Future of ChatGPT in radiology undergraduate medical education

#### **NPMEE-49 Promoting Health Equity Through Radiology: Practical Tips for Empowering the Next Generation of Trainees**

Participants

Pooja Agrawal, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Medical students and residents in radiology represent the next generation of trainees and have a vital role in fostering sustainable health equity efforts focused on eliminating health disparities in radiology. Three ways trainees can promote health equity in radiology are through research, community outreach, and education.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Review existing health disparities in radiology using findings from a published systematic review; discuss the

importance of trainee involvement in eliminating disparities; describe practical ways how research, community outreach, and education can promote health equityHealth equity research: Introduce tips to identify a mentor; discuss how to select a research topic by identifying gaps in existing research; review opportunities at national meetings to build research networkCommunity outreach: Discuss how to leverage existing community needs assessment to identify emerging opportunities; develop initiatives to educate patients about the importance of screening as a trainee; provide examples of radiology-focused community efforts (mobile mammography/lung cancer screening, RAD-AID)Education in health equity: Participate in the creation of radiology health equity-focused learning materials; collaborate in establishing mentorship programs to promote diverse applicants in radiology; explore how current radiology pillars in quality safety, innovation, and AI can be used as catalysts to bridge existing disparitiesConclusion: Discuss how long-lasting health equity necessitates an understanding of systemic obstacles and a commitment to staying informed on fields such as molecular imaging, social genomics, and AI algorithms

#### **NPMEE-5    Medicolegal Readout: A Malpractice Primer for Radiologists**

Participants

Luke Wojdyla, DO, San Diego, CA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The majority of radiologists will face litigation in their careers. In a 2021 survey, 71% of radiologists said they were sued which is similar to estimates in prior reports. Despite this, dedicated teaching of medicolegal issues is often lacking or incomplete in radiology training programs. Residents are seldom exposed to legal issues that can arise when caring for patients, and attendings themselves may feel unqualified in leading medicolegal discussions. Concerningly, residents may transition to independent practice with an incomplete understanding of the legal environment applicable to their practice. This exhibit will provide background for the legal frameworks relevant to modern radiology practice. A brief historical summary of key court decisions will be presented alongside a discussion of malpractice and radiologic errors. Challenging case scenarios will address nonroutine communication, reporting missed findings on comparison imaging, addressing technical limitations, and admitting mistakes, among others. At the end of the presentation, the reader should understand the legal basis for common radiologic practices, identify challenging situations with increased medicolegal risk, and implement practical strategies to mitigate risk of litigation.

##### **TABLE OF CONTENTS/OUTLINE**

Recognize the magnitude of malpractice within radiology. Understand how fundamental radiology practices have arisen directly from court rulings. Describe the most common causes for malpractice. Identify examples of frequently encountered medicolegal hazards and controversies. Case-based imaging examples will be used to discuss challenging medicolegal issues encountered in radiology.

#### **NPMEE-50    Integration of Clinical Context into Medical School Gross Anatomy Based on CT Imaging of the Students' Dissection Cadavers**

Participants

Peter J. Haar, MD, PhD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Incorporating imaging in medical school gross anatomy courses can provide medical students with early, positive learning experiences with radiology. The teaching points of this exhibit include the following: first, to describe methods to incorporate CT imaging of the students' dissection cadavers into a novel exercise in which dissection cadavers are regarded as medical students' "first patients;" second, to outline roles for radiology attendings and residents in interactive cadaver CT workshops; and third, to explore the potential benefits of the experience in medical education and radiology residency training.

##### **TABLE OF CONTENTS/OUTLINE**

1.) Anatomy Rounds: an exercise for medical students to synthesize clinically relevant cadaver observations. 2.) Methods and resources to acquire and distribute cadaver CT images to medical students. 3.) Involving radiology residents in generating radiology findings on full-body cadaver CT image sets. 4.) Strategies to enhance the learning experience of interactive workshops based on the dissection cadaver CT images. 5.) Potential benefits of interactive radiology experiences early in medical school education. 6.) Feedback from medical students and radiology residents on the value of the learning experience.

#### **NPMEE-51    Designing Interactive Team-Based Learning Experiences with Cadaver CT Images in Medical School Gross Anatomy**

Participants

Peter J. Haar, MD, PhD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Curricula involving CT images of medical school gross anatomy cadavers can provide students with a rewarding educational experience early in medical school. Teaching points of this exhibit include the following: first, to describe the challenges and benefits of teaching simple CT image analysis to enhance and complement gross anatomy instruction; second, to outline a strategy for developing interactive team-based learning modules and assessments; and third, to examine potential pitfalls and solutions in teaching the curriculum.

##### **TABLE OF CONTENTS/OUTLINE**

1.) Teaching gross anatomy and cross-sectional anatomy in parallel. 2.) User-friendly image interaction and teaching foundational concepts of CT imaging. 3.) Designing learning experiences with the intellectual rewards of correctly making real imaging diagnoses. 4.) Interactive group-learning assignments, and assessment of learning. 5.) Advantages and disadvantages of the interactive cadaver CT-based curriculum. 6.) Feedback and student response to the curriculum.

#### **NPMEE-6    A National Plan for the Renewal of Imaging in the EU: A Regional Perspective**

##### **TEACHING POINTS**

With this publication it is intended to disseminate a National Investment Plan and how it was managed and developed from a regional point of view. The main objective of this Plan is to increase overall survival and the quality of life of people through the diagnosis of diseases in early stages, which allow rapid therapeutic intervention. The plan pays special attention to the pathologies

with the greatest impact on the present and future of a National Public Health Service (SNS), such as chronic diseases, oncological diseases, rare diseases and neurological diseases. All this, consolidating equity in access to high technology and improving the quality of care and the safety of patients and professionals. This poster describes the objectives, method and results of a national plan that involves the acquisition of 847 state-of-the-art equipment for the SNS in order to: Reduce the obsolescence of high-tech equipment, guaranteeing the renewal of 100% of equipment that is 12 years old or older in accordance with scientific recommendations. Raise the average density rate of high-tech equipment per 100,000 inhabitants by at least 15%, in order to improve equity in access throughout the national territory, bring the service closer to patients and position the SNS, progressively, in the European average. As a consequence of the application of the Plan in our region, 76 new pieces of equipment are being installed (63 renewals and 13 extensions) and the total amount of the investment is € 67,204,159.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS Context and introduction Objectives of the Plan Methodology Results Discussion and conclusions

#### **NPMEE-7 Guide for Radiologists Leading Multidisciplinary Conference**

Participants

Jody Shen, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiologists play a key role in multidisciplinary conference. This educational exhibit is meant to be a guide for trainees or junior attending radiologists for planning and leading a multidisciplinary conference. Special considerations will be given to leading the conference virtually (e.g. over Zoom) as this has become more commonplace. This guide can help radiologists early in their career add value to patient care and build relationships with referring clinicians.

#### TABLE OF CONTENTS/OUTLINE

A. How to prepare for multidisciplinary conference. B. How to lead multidisciplinary conference and key principles with examples of before revision, better strategy, and rationale: 1) Move it along. 2) Maximize screen real estate. 3) Keep it simple. 4) Keep it clinically relevant. 5) Get feedback. C. Common questions and challenging cases.

#### **NPMEE-8 Being a Radiologist in the Earthquake: Are You Prepared Enough**

Participants

Duygu Ekizalioglu, MD, Izmir, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Raising awareness of earthquakes and other potential disasters The critical role of Radiologists in disaster prevention To overview radiology's role in disaster management Global outreach and education for radiology department disaster preparedness

#### TABLE OF CONTENTS/OUTLINE

What is an earthquake and when does it become a disaster? A recent experience: The impact of the earthquake in Turkiye The critical role of Radiologists in disaster prevention and preparedness Where does Radiology stand in disaster management on hyperacute/acute/subacute/chronic stages: Providing necessary imaging services based on the availability and utility of imaging methods, alternative reporting systems for communication, and teleradiology services The challenges that radiologists faced in the Turkiye earthquake management system; and what is next? A comparison of past experiences in different countries; lessons learned?

#### **NPMEE-9 Using Process Mapping to Identify Targeted Interventions to Reduce Imaging Disparities**

#### TEACHING POINTS

- Process mapping is a quality improvement tool used to depict flow of healthcare processes.
- Components of the imaging process are addressed in order to reduce imaging disparities.
- Pre-imaging interventions include reviewing imaging guidelines, providing culturally dexterous patient educational materials, community outreach, and improving imaging access.
- Imaging interventions include high quality interpretation services, patient-centered communication strategies, and maximizing patient comfort.
- Post-imaging interventions include structured collection of patient feedback and culturally-responsive patient navigation services to ensure adequate follow-up.

#### TABLE OF CONTENTS/OUTLINE

1) Process Mapping Definition a) Published Process Maps b) Apply Health Equity Lens to Published Imaging Process Maps 2) Pre-Imaging a) Review Imaging Guidelines Using Health Equity Lens i) Cancer Screening (breast, lung, colorectal) b) Clinical Decision Support to Reduce Variability in Decision-Making c) Patient and Provider Education d) Maximizing Patient Access i) Evidence-Based Strategies 3) Imaging a) Culturally Dexterous Communication Strategies i) Definition ii) Standardized Communication Strategies to Improve Patient Communication for Diverse Patient Populations (1) Review Evidence-Based Strategies iii) Stigmatizing Language in Medicine (1) Definition (2) Application of Stigmatizing Language in Radiology 1. Physician-patient encounter 2. Radiology Reports 3. Electronic health records (3) Vulnerable groups 1. Patients of color 2. Obese population 3. LGBTQ community 4) Post-Imaging a) Collection of Patient Feedback b) Patient-Navigation Services i) Review Evidence-Based Strategies

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## Abstract Archives of the RSNA, 2023

NPMEE-1

### Every Little Bit Helps. How to Reduce Carbon Footprint with a Mobile MR. Experience from the Northwest of Spain.

#### Participants

Mercedes Arias Gonzalez, MD, PhD, Vigo, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Mobile MRs are able to fill the service void in small to medium-sized hospital without in-house magnets. Delivering care closer to home avoids travel kilometers, highly contributing to an improved carbon footprint. Carbon footprint per MR scan can be even further reduced due to a higher utilization rate, as MR scanners cannot be turned off. Being conscious of radiology contribution to carbon footprint and greenhouse gas emissions can contribute to reduce them, as much as possible.

#### TABLE OF CONTENTS/OUTLINE

Evolution of needs and mobile MR implementation in the public healthcare system in Galicia (a region in the Northwest of Spain) since 2006. Evaluation of kilometers avoided by patients since 2006 and its effect in carbon footprint. Study of utilization rates of each mobile MR scan through the years. Easy explanation of useful concepts concerning carbon footprint and greenhouse gas emissions.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-10

### Financial Fitness for the Radiology Resident

#### Participants

Kevin Wu, MD, Tampa, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiologists receive little formal instruction on basic concepts related to financial planning. Yet, certain financial decisions and strategies that are best employed during residency can yield as much as hundreds of thousands in savings over the course of a career. Therefore, early financial literacy is one of the most important aspects of career counseling that trainees can receive. Indeed, certain financial maneuvers are only possible during the training years. For those with an average loan burden, income driven repayment (IDR) can be worth >\$400,000 over the course of a career, and is a priority consideration. Other maneuvers, such as electing to contribute to a Roth 403b/401k (if available) rather than a pre-tax 403b/401k during residency, or performing a 403b/401k-to-IRA rollover followed Roth conversion after training, are expected to be worth \$84,000 by retirement. Even greater savings are likely with such maneuvers if marginal income tax rates increase in the future. These and other strategies require only hours to employ, and must not be missed for all who are eligible. In this light, we present an "order of priorities" regarding financial maneuvers that maximize yield with respect to ease of execution. Specifically, we discuss maneuvers such as student loan IDR, value-driven credit card rewards, 403b/401k to Roth IRA rollover, strategies around tax season, and early modifications of the retirement portfolio mix.

#### TABLE OF CONTENTS/OUTLINE

Philosophy/disclaimers, The financial waterfall, Student loan IDR, Credit card optimization, Expense ratios, Pretax purchasing, Roth vs. traditional and conversions, Income tax projections, Portfolio mix, Avoidance of taxation events, Tax season, Subtleties

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-11

### Radiology Dashboards: Applications in Addressing Healthcare Disparities in Image Utilization

#### TEACHING POINTS

1. Review the role of dashboards in radiology  
2. Examine how healthcare disparities (HCD) in radiology can affect morbidity and mortality  
3. Highlight specific applications of radiology dashboards in addressing HCDs in imaging utilization  
4. Discuss the limitations of radiology dashboards

#### TABLE OF CONTENTS/OUTLINE

1. What is a Radiology Dashboard?  
a. Key Performance Indicators (KPIs)  
i. Patient tracking  
ii. Image utilization  
iii. Turnaround time  
iv. Resource allocation  
v. Quality assurance  
2. Overview of the literature on HCDs in image utilization (e.g. disparities in imaging utilization in the emergency department, disparities in utilization of low dose CT for lung cancer screening, etc.)  
3. Applications of radiology dashboards in addressing HCDs in image utilization  
a. Identifying risk factors for decreased imaging utilization stratified by type of study (e.g. screening mammogram, low dose CT for lung cancer screening) and patient setting (e.g. emergency department)  
i. Zip code of patient residence  
ii. Race and ethnicity  
iii. Age  
iv. Language preference  
b. Developing quality improvement initiatives  
i. Patient education  
ii. Language accessibility  
iii. Cultural competency training and diversification of work force  
iv. Community outreach (e.g. mammogram vans and patient education efforts)  
v. ACR Select  
c. Monitoring response  
i. Before and after studies  
ii. Non-Comparative studies  
iii. Time series  
4. Limitations of radiology dashboards  
5. Conclusions

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## Abstract Archives of the RSNA, 2023

NPMEE-12

### Out of the Darkness and into the Light: Redefining the Role of Radiology in Community Engagement

#### Participants

Somiah Almeky, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Provide a radiology-focused overview of foundational elements related to community engagement, community-based participatory research, reciprocal innovation, and community needs assessment and outreach
- Discuss evidence-based examples of how radiology staff/trainees play a crucial role in delivering equitable care
- Explore how community engagement can be leveraged as an effective method to restore purpose in our daily work and prevent burn-out
- Review practical examples of community engagement across various settings (ie. rural, urban, global health)
- Discuss steps to establish a centralized curriculum that defines the role of radiology in the community, and provides trainees with concrete examples of this work

#### TABLE OF CONTENTS/OUTLINE

1. Interface between Radiology and the Community
  - Definition of Community Engagement, Community-Based Participatory Research, Reciprocal Innovation
  - Leveraging institutional resources and community needs assessments to guide outreach efforts
  - Evidence-based community engagement startup toolkit for radiology
2. Case-based review of ongoing outreach efforts in various settings
  - Cancer screening efforts
  - Resident-driven initiatives
  - Health equity efforts
  - Outreach interventions among veteran populations
3. Potential pitfalls and opportunities for growth
  - Allocation of effort and time in alignment with community needs and departmental workload.
  - Tips on identifying opportunities to engage diverse communities
4. Empowering the next generation
  - Establishing a "Community Engagement in Radiology" curriculum
  - Overview of required competency elements
  - Facilitators and barriers to dissemination of the curriculum

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## Abstract Archives of the RSNA, 2023

NPMEE-13

### Breaking Bad News: What the Radiologist Needs to Know

#### Participants

Natalia Orthmann, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.To emphasize the importance of breaking bad news in appropriate ways.2.To present the existing and consolidated bad news protocols.3.To elaborate on how the protocols can be applied in the day-to-day practice of radiologists, especially breast radiologists.4.To assist in the training of radiologists in this time of breaking bad news.5.To illustrate the differences between the most frequent protocols for breaking the bad news

#### TABLE OF CONTENTS/OUTLINE

1.Literature review focusing of consolidates bad news protocols.2.To illustrate and discuss how bad news protocols can make the moment less traumatic for physicians and patients.3.Discuss how to apply the protocols in the radiologist's routine.4.Examples cases of how bad news may occur in the radiologist's routine.5.Summary and conclusion.

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## Abstract Archives of the RSNA, 2023

NPMEE-14

### Green Teams - an AI Gore-ithm for Addressing Sustainability in Radiology

#### Participants

Katherine Frederick-Dyer, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

We explain the process of forming a sustainability committee in the Department of Radiology to identify and address the environmental footprint in our academic department.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction A. What is sustainability and how does addressing it reduce costs and improve human health B. What is design thinking and how do we use it to solve non-linear problems II. Baseline Survey A. Identify attitudes and interest in climate change B. Identify opportunities to reduce carbon footprint and build allies III. First meeting A. Forming the committee - approaches to inclusivity B. Guidance with local climate experts to guide discussion 1. Assess - What is the carbon footprint of the department? 2. Inspire - To what extent do concerns about climate change and support for climate mitigation affect employee morale and patient satisfaction? 3. Model - How do we share our successes to decarbonize our department to guide other departments? C. Design thinking session 1. Actively engage participants to brainstorm ideas using colorful sticky notes 2. Visually organize ideas into the Categories (IIIb) 3. Establish culture of inclusivity, collaboration, transparency, fun, and accountability D. Organize team into subgroups to address each CategoriesIV. Subsequent meetings A. Encourage teams to produce achievable deliverables each meeting B. Assess what expertise and resources are needed C. Delineate team member roles and responsibilities D. Define timeline and metrics for success V. Highlighting early wins and how this contributes to the bigger picture

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## Abstract Archives of the RSNA, 2023

NPMEE-15

### Forward Together: Collaboratively Integrating Radiology throughout a Medical School Curriculum

#### Participants

Matthew Lee, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Integrating radiology throughout a medical school curriculum mirrors the breadth, depth, and impact of radiology in the real world  
2. Sustainable implementation of radiology throughout a curriculum is a product of thoughtful and strategic partnerships with medical school leadership across disciplines and central governance committees  
3. Collaboratively working with colleagues across disciplines can expand the footprint and impact of radiology in medical school  
4. Early consistent exposure to quality radiology education promotes recruitment into radiology and positively impacts learners pursuing other specialties  
5. Effective student education transcends passive modes of learning through activities that promote increased learner engagement

#### TABLE OF CONTENTS/OUTLINE

1. ForWard - 3-phase model integrating basic, clinical, and public health sciences, 10 integrated "threads"  
2. Phase 1 - thematic blocks incorporating basic and clinical science and early clinical medicine - incorporating radiology into anatomy, patient-centered education cases  
3. Phase 2 - clinical rotations integrating clinical care, basic sciences, and thread areas - case-based learning  
4. Phase 3 - career exploration, intern preparation, "selectives" - novel radiology course development  
5. Leadership - medical student directors, block leaders  
6. Innovative educational content creation and delivery - embracing remote techniques, case-based learning, website development  
7. Novel course development - Screening in Radiology, Financial Wellness  
8. Faculty Recruitment - range of faculty, educational RVUs  
9. Resident Recruitment - radiology interest group  
10. Lessons learned - staff support for sustainable implementation

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## Abstract Archives of the RSNA, 2023

NPMEE-16

### #FOAMrad: A Personal Productivity Curriculum for Radiologists

#### Participants

Alice Shieh, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Simplify and adopt the "Getting Things Done" methodology for busy radiologists- Understand and incorporate the fundamentals of "Deep Work" for peak performance- Learn how to apply the science of habits based on best-selling book "Atomic Habits"- Demonstrate tried and tested productivity software applications to streamline repetitive tasks (for Mac users)- Review time-saving settings and approaches to combat e-mail overwhelm

#### TABLE OF CONTENTS/OUTLINE

Getting Things Done framework ?- Delete it, Do it, Delegate it, Deposit it, Defer it ?Deep Work ?- 4 deep work philosophies: monastic, bimodal, rhythmic, journalistic?- 3 steps to rewire your brain: embrace boredom, quit social media, drain the shallows ? Atomic Habits ?- 4 laws of behavior change: cue, craving, response, rewards ?- Creating a new identity to develop new habits ?- Building better systems to achieve goals?Tried and tested productivity software applications to streamline repetitive tasks on a Mac?- Alfred, SetApp, 1Password, Evernote, Notion, Ecamm, Endnote, Backblaze ?E-mail management ?- Understanding e-mail communication principles ?- Time-saving settings for Outlook and Gmail ?Multitasking and prioritization techniques ?- MoSCoW (Must, Should, Could, Would)

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## Abstract Archives of the RSNA, 2023

NPMEE-17

### Radiology Management at Your Fingertips: Incorporating Macropads Into the Radiology Workflow

#### Participants

Elliot Breshears, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Review the utility of macropads in automating and simplifying repetitive nature of the radiologist's workflow-Learn how to easily assemble, program, and implement macropads into your own radiology practice-Discuss the time-saving features of macropads

#### TABLE OF CONTENTS/OUTLINE

Macropad device utility- Assign complex repetitive tasks to a single button click, improving efficiency- Ability to bypass IT restrictions and firewalls; eliminates need to install additional software on PACS workstationsResource selection process- Consolidating resources into 15 programmable keys- Implementing input from abdominal imaging faculty ?Assembly- Physical components: front and back plates, keycaps, switches, USB cables- Assembly process- Creating custom key stickers to promote intuitive access of selected resources ?Programming- Utilizing duckyScript and the duckyPad Configurator software- Navigating computing system compatibility issues ?Implementation and impact on radiology workflow- Reduction in mouse clicks needed to access resources- Plug and play with ability to use at different workstations ?Limitations- Cost- Time and effort associated with self-assembly, selecting and organizing incidentaloma guidelines- Minimal scripting required ?Future directions- Implementing Elgato stream deck into PACS stations with software installed after security clearance

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## Abstract Archives of the RSNA, 2023

NPMEE-18

### Large Language Models and Natural Language Processing: Overview and Metrics for Radiology Report Simplification

#### Participants

Rushabh Doshi, MPH, MSc, Cerritos, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Review the gap in health literacy for radiological reports. 2) Review existing efforts for radiology simplification. 3) Review the role of Natural Language Processing (NLP) and Large Language Models (LLM) models in report simplification. 4) Review the evaluation metrics of NLP and LLM models for report simplification.

#### TABLE OF CONTENTS/OUTLINE

1) Radiology Report Transparency 2) Patient Interest in Report Simplification 3) Ongoing Simplification Efforts 4) Model Terminology 5) Application of Natural Language Processing and Large Learning Models for Report Simplification 6) Demystifying NLP and LLM models 7) How Models Learn - Training NLP and LLM models 8) Existing LLM Interfaces 9) Prompt Optimization of LLM Interfaces 10) Evaluation Metrics (Readability, Accuracy, Simplicity, etc.) 11) Implementing LLM models 12) Potential reimbursement model for report simplification 13) Future directions of LLM models in report simplification

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## Abstract Archives of the RSNA, 2023

NPMEE-19

### Journey to Parenthood in Radiology: Progress, Challenges, and Opportunities

#### TEACHING POINTS

1. Delayed childbearing impacts the reproductive outcomes among physicians. 2. A better understanding of the options to achieve parenthood allows for comprehensive family planning, flexible practice management, and inclusive dialogues. 3. Accurate knowledge of occupational radiation exposure to women physicians may help assuage unrealistic fear and build a stronger pipeline of future radiologists.

#### TABLE OF CONTENTS/OUTLINE

- To highlight the importance of and obstacles to family planning and childbearing for physicians and physicians-in-training
- To review occupational radiation risks and safety precautions in the radiology work environments and specifically within each radiology subspecialties
- To raise awareness of the various options and processes involved in egg preservation, fertility treatment, surrogacy, adoption, and fostering
- To provide an overview of existing policies and guidelines for family and medical leave in the United States, including the American Board of Radiology updated policies and state and federal laws
- To discuss potential mechanisms to support medical students, radiology trainees, and radiologists on their journey to parenthood and those who are parents

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## Abstract Archives of the RSNA, 2023

NPMEE-2

### Small Nodule, Big Impact: Incidental Findings Module

#### TEACHING POINTS

1) Studies have found that as radiographic imaging numbers continue to increase, so has the number of incidental findings. 2) Based on literature and guidelines including the ACR white papers and Fleischner Society recommendations, a new incidental/follow up tab was built into our electronic health record (EHR) to provide simple, fast and streamlined recommendations by radiologists for clinicians. 3) Additional measures are also built in to help achieve the proper patient follow up, such as dedicated nurse navigators to help track down incidental findings and assure proper follow up as well as inbox EHR messages to patients PCP upon discharge. 4) Future directions include expanding the followed-up incidental, education to both ordering providers and patients as well as research for continued evolution of incidental finding guidelines.

#### TABLE OF CONTENTS/OUTLINE

1) Define the impact of incidental pulmonary findings by radiologists on patient care. 2) Discuss the implemented incidental findings tab within our health network and how it has changed patient care/outcomes. 3) Identify methods to expand this model to include more incidental findings and increase patient follow up. 4) Data collection and interruption for future incidental finding recommendations and guidelines.

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## Abstract Archives of the RSNA, 2023

NPMEE-20

### Artificial Intelligence for Pediatric Radiologists: A Gentle Introduction for the Non-enthusiast

#### Participants

Marcelo Takahashi, MD, PhD, (*Presenter*) Speaker, Vertex Pharmaceuticals Incorporated

#### TEACHING POINTS

This presentation is intended for pediatric radiologists with no/little AI experience. We will explain the basic concepts of AI applied to radiology and discuss practical example of usage of AI in pediatric radiology. Main points: 1)Core AI concepts and lexicon 2)Brief history of AI in radiology 3)Basic algorithm creation and operation 4)Applications of AI in radiology 5)Limitations of AI in radiology

#### TABLE OF CONTENTS/OUTLINE

1 - Disclaimer: • created for pediatric radiologists with no/very little experience in AI. • Essential concepts will be explained in straightforward manner and accessible language.2 - Introduction: • Core concepts: • What is artificial intelligence, narrow AI and broad AI • Machine Learning and Deep Learning. • Big Data, Data Science, Domain Knowledge3 - Brief history of AI in radiology: • The early years. • The CAD era • The Machine Learning and Deep Learning era.5 - Basic Lexicon: • Dataset, model, algorithm, training, testing, generalization, features, classification, segmentation, regression, clustering, prediction, label, supervised learning, unsupervised learning4 - "Classic Machine Learning" and Deep Learning: • How is a "classic ML" algorithm created? • DL algorithm creation • Main differences, advantages and disadvantages ("classic ML" vs DL).5 - Where is/can AI be applied in the pediatric radiologist's workflow (with practical examples) • Imaging criteria, scheduling, acquisition (MR acceleration, CT/XR dose reduction), image analysis (segmentation, classification, detection), reporting (NLP), precision medicine.6 - "Must know" AI limitations : • Algorithm creation vs algorithm implementation • Interpretation errors • Generalization errors7 - Take home message

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## Abstract Archives of the RSNA, 2023

NPMEE-21

### The Potential Applications of ChatGPT in the Field of Medical Imaging

#### TEACHING POINTS

This exhibit combines recent literature reviews to explore the application prospects of ChatGPT in the field of medical imaging, including its potential applications in medical service, teaching, and scientific research settings, possible ways to apply ChatGPT, and the attitudes of the academic community towards the application of ChatGPT in the field of medical imaging.

#### TABLE OF CONTENTS/OUTLINE

1. ChatGPT can be used in the processing of medical document texts such as medical records in the medical imaging workflow, to achieve the structuring and standardization of texts, promoting effective interaction between staff and patients. 2. ChatGPT can also be used to train medical students and resident physicians in image diagnosis by improving teaching efficiency through interactive learning and teaching methods. 3. ChatGPT can assist in the literature retrieval, data collection, statistical analysis, and article writing processes in scientific research. However, researchers should be aware of the risk of ChatGPT taking over as the main tool and control the research process to ensure the authenticity of the research.

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## Abstract Archives of the RSNA, 2023

NPMEE-22

### Ways to Improve Patient Satisfaction Analytics in the Modern Era of Radiology: Tips and Tricks from the Patient Satisfaction Officer

#### TEACHING POINTS

1. Third party analytics evaluate care directly from patients in a simple, fast, and easy-to-use fashion. 2. The information obtained from analytics offers radiologists and their practices an opportunity to identify patient needs and priorities while recognizing weaknesses and opportunity for improvement. 3. Modifications and implementation of new practices are often minor, requiring little to no infrastructure, cost, or time while having a positive impact on retention, referral, and most importantly patient satisfaction.

#### TABLE OF CONTENTS/OUTLINE

1. Define the patient experience as it relates to most commonly observed factors. 2. Discuss the role that current-day technology has played in the implementation and innovation of healthcare analytics regarding both acquisition and interpretation. 3. Recognize that personnel, speed, and ease of care are common subjects of both positive and negative patient experiences. 4. Identify methods to respond to feedback that increase patient satisfaction.

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## Abstract Archives of the RSNA, 2023

NPMEE-23

### Utilizing 3D Printing and Phantoms to Teach the Basic Principles and Pitfalls of Ultrasound

#### Participants

Patricia Garcia, Cork, Ireland (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ultrasound (US) is an operator-dependent imaging technique; thus, teaching this skill is critical to radiology education. Ensuring adequate training is essential to patient safety and quality assurance in clinical practice. Those trained in US are keenly aware of the many pitfalls of US imaging. US physics and related artefacts are covered comprehensively in the Diagnostic Radiology curriculum; however, modern education emphasises alternate approaches to teaching, including hands-on practical sessions. US phantoms are used to teach biopsy techniques, but little literature exists on the use of phantoms to teach US basic principles. To simulate commonly encountered US limitations and artefacts, we created gelatin-based US phantoms with embedded objects made from 3D-printed moulds, allowing trainees to experience them in real-time. The embedded objects demonstrated concepts such as relative echogenicity, the importance of imaging an object in multiple planes, mirror image artefact, increased acoustic through-transmission and shadowing. Representative scans of these phantoms will be presented to confirm their utility in demonstrating these concepts.

#### TABLE OF CONTENTS/OUTLINE

1. Challenges of teaching hands-on ultrasound skills
2. Technical aspects of phantom creation
3. Demonstration of basic principles
4. Demonstration of artefacts

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## Abstract Archives of the RSNA, 2023

NPMEE-24

### Scire Quod Sciendum: Knowledge at the Intersection of Suboptimal Photography and Radiography

#### Participants

Emiliano Garza Frias, MD, Monterrey, NL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Learning Objectives Using the author-shot photographs and curated suboptimal radiographs, this exhibit will help the audience: 1. Understand the causes and types of suboptimal chest radiographs. 2. Learn about the global frequency of suboptimality in the most frequent radiological procedure - chest radiographs. 3. Understand what errors in photography can teach about suboptimal radiography. 4. Understand how suboptimality in radiography influences the interpretation using photo-radio-graphic examples.

#### TABLE OF CONTENTS/OUTLINE

Content organization 1. What makes a chest radiograph suboptimal? 2. What are the parallels between suboptimal radiography and photography? 3. Use of common causes and examples of suboptimal photographs to educate about suboptimal chest radiographs. 4. Parallel examples of how suboptimal photography and radiography hide or distort key findings

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## Abstract Archives of the RSNA, 2023

NPMEE-25

### RadioGraphics Trainee Editorial Advisory Members Board (RG TEAM)

#### Participants

Melina Hosseiny, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-The RadioGraphics Trainee Editorial Advisory Members Board (RG TEAM) was established in December 2020 to involve trainees in shaping the journal's content and direction. -The RG TEAM is a group of radiology trainees from around the world who play a crucial role in developing high-quality educational resources that are specifically tailored to trainees. RG TEAM initiatives include content curation, innovation of creative trainee resources, organization of trainee Top 10 reading lists, creation of trainee-focused editorials, Cases from the Cooky Jar (in-print and social media), and the new official Spanish version on social media (Casos Cooky). -Joining the RG TEAM offers multiple benefits to its members, such as mentorship, networking, career development, experience in academic writing and publishing, and exposure to global radiology education. -Trainees can obtain mentorship through the RG TEAM by collaborating directly with RadioGraphics editorial board members and radiology experts, and gain valuable skills including communication, writing, and critical thinking skills. This relationship extends beyond the one-year term and can last a lifetime. -RG TEAM has an annual call for new applications available in SPRING. Interested trainees can submit their curriculum vitae, statement of interest, and an idea for a trainee-focused RG TEAM initiative. Residents and fellows in diagnostic or interventional radiology, radiation oncology, and nuclear medicine, as well as medical students, are encouraged to join.

#### TABLE OF CONTENTS/OUTLINE

1)Introduction to RadioGraphics and RG TEAM2)RG TEAM Initiatives3)Benefits of Joining the RG TEAM and How to Get Involved4)Conclusion

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## Abstract Archives of the RSNA, 2023

NPMEE-26

### Blueprint for Medical Student Exposure to Radiology through Research: GSW and MVC Projects

#### TEACHING POINTS

Medical students can be given early exposure to radiology through research. Research projects can be initiated using pre-existing data sets like the Trauma Registry maintained at Level I trauma centers. Projects can give residents and medical students leadership opportunities. Projects can give medical students opportunities to present their work at local, regional, and national conferences.

#### TABLE OF CONTENTS/OUTLINE

Purpose: Few opportunities exist for medical students to gain exposure to radiology outside of seeking out electives during clinical years. Methods: IRB approval was obtained to access 10 years of GSW injury data. See Figures 1 and 2. Under trainee guidance, medical students reviewed radiology images and worked to grade injuries by the American Association for the Surgery of Trauma injury grading scales. Once injuries were scored, clinical questions were examined. As part of the expansion to MVC injuries, we are recruiting new students at M1 Orientation and collaborating with other specialties. Results: In year 1, 13 posters were presented at a local conference, Research!Louisville, and 6 at state, regional, and national conferences. See Figures 3 and 4. Data presented at RSNA will include the number and listing of the projects presented at Research!Louisville in September 2023 (planning for 45 posters) and will also include 2 years of survey responses from medical student participants and leaders. Conclusion: Trauma registries provide a robust dataset that can be utilized to increase early exposure to radiology in medical school and facilitates collaborative projects between residents and medical students, that students can further expand on as their research experience grows. .

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## Abstract Archives of the RSNA, 2023

NPMEE-27

### **Radiology at the Crossroads: Navigating Patient Safety, Risk Management, and Clinical Ethics in Modern Imaging Practice**

#### **TEACHING POINTS**

1. Comprehensive overview of medical ethics, patient safety, and risk management in radiology 2. Empowering radiologists and trainees to actively engage in quality improvement 3. Transcending specialties to create a positive impact on patient care

#### **TABLE OF CONTENTS/OUTLINE**

1) Intro: Radiology, Patient Safety, Ethics2) Radiation Safety, Dose Reduction3) Informed Consent in Procedures4) Communicating Critical/Incidental Findings5) Radiology Research Ethics6) AI, Machine Learning: Safety, Ethics7) Justification/Appropriateness of Imaging8) Optimizing Imaging Protocols9) Pediatric Radiology Safety10) Radiology Workflow, Patient Safety11) Contrast Media Safety, Reactions12) Radiation Exposure in Pregnancy13) Safety/Quality Improvement Initiatives14) Reducing Reporting Errors15) Incident Reporting, Learning from Errors16) Patient-centered Care17) Confidentiality, Data Protection18) Teleradiology Ethics19) Credentialing, Privileging20) Sports Injuries Imaging Ethics21) Cultural Competence, Diversity22) Managing Incidental Findings23) Peer Review, Feedback24) Radiology Education Ethics25) Financial Considerations, Conflicts26) Interprofessional Collaboration27) End-of-Life Care Ethics28) Cognitive/Mental Health Issues29) Radiology in Global Health, Disaster30) Palliative Care Imaging Ethics31) Addressing Healthcare Disparities32) Shared Decision-making33) Public Health Emergencies Ethics34) Access to Radiology Services35) Conclusion, Future Directions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-28

### Myth Busters: Questioning Standard Radiology Practices for Value-added Care

#### TEACHING POINTS

This exhibit aims to debunk common myths in radiology practices that are believed to provide value-added care but, in reality, lack sufficient scientific evidence to support their efficacy. By analyzing scientific data and exploring recent research, the article challenges widely accepted practices to promote a more evidence-based approach to radiology.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction, a. Value-added care definition, b. Importance of evidence-based practices  
II. Radiology Myths, a. Myths 1-5, b. Myths 6-10  
III. AUC Reality, a. AUC role in debunking myths, b. AUC examples  
IV. Barriers to AUC, a. Resistance to change, b. Financial incentives, c. Technology and training  
V. Overcoming Barriers, a. Education, b. Incentives for evidence-based practices, c. Technology upgrades  
VI. Measuring Radiology Value, a. Patient outcomes, b. Costs, c. Efficiency  
VII. Strategies for Value-Added Care, a. Staying current on evidence-based practices, b. AUC for dispelling myths, c. Communication  
VIII. Conclusion, a. Summary of exhibit  
IX. References

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-29

### From Detection to Action: A Journey Through Incidental Findings in Radiology

#### TEACHING POINTS

This educational exhibit aims to provide a comprehensive understanding of incidental findings in radiology, addressing their various aspects including identification, communication, management, legal implications, and patient autonomy. The presentation highlights the importance of awareness and proper handling of incidental findings, balancing patient autonomy with ethical considerations and potential harms. It emphasizes the need for evidence-based management, structured reporting, and effective communication. The evolving role of technology, particularly AI, in detecting and managing incidental findings is also discussed.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Definition and variability among radiologists || Settings where incidental findings may arise  
Education: ACGME and ABR guidelines  
Patient autonomy: Access to images, understanding reports, imaging preferences, and referrals  
Communication of incidental findings: Timing, disclosure, responsibilities, and documentation  
Legal implications: Civil and criminal lawsuits, protection for radiologists  
Management of incidental findings: Evidence-based practices, second opinions, structured reporting, national/international variations, conflicts of interest, guidelines, and low-resource settings  
Harms of incidental findings: Costs, psychological impact, overcalling and undercalling incidentals  
Common incidental findings: ACR white papers, unclear clinical significance, small focus of ischemia  
Conclusion: Importance of awareness, research, guidelines, and technology in managing incidental findings.

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## Abstract Archives of the RSNA, 2023

NPMEE-3

### International Observerships in Pediatric Radiology: Optimization and Potential Benefits

#### Participants

Hermon Derbew, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

International clinical observership programs can facilitate highly effective academic collaboration, international brand building, information dissemination and recruitment. However, this type of program typically adds bureaucracy, logistics and faculty workload for the hosting institution—as well as many regulatory and financial barriers for interested individuals. Our institution's proactive approach to welcoming observers from diverse backgrounds minimizes the financial burden to applicants and allows collaboration to advance our academic mission. This exhibit explains the process and impact of the program with emphasis on specific steps taken towards improved workflow and increased throughput of observers.

#### TABLE OF CONTENTS/OUTLINE

1. Process, 2. Institutional benefits, 3. Impact

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## Abstract Archives of the RSNA, 2023

NPMEE-30

### A Step-By-Step Approach to Establish and Enhance MRI Site Safety: A Primer for Radiologists

#### Participants

Pradnya Y. Mhatre, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

MRI Site Safety is important for protection of patients, staff and public. Proactively thinking about MR Safety features while designing an MR suite is key in establishing robust MR safe environment. American College of Radiology has created MR Safety Manual which includes general principles of MR Safety. We describe various components of MR Site Safety that need to be implemented in a systematic manner to create a robust and sustainable program.

#### TABLE OF CONTENTS/OUTLINE

Initial step in establishing site safety is to identify MR Medical Director , MR Safety Officer and MR Safety Committee. We describe how to structure MRI zones, including placement of ferrous quarantine, safe storage, patient transfer, mechanical room, and control room. We also discuss marking of equipment with appropriate signage, use of ferromagnetic detection devices, operation of MR conditional devices in Zone IV and infection control. Specific considerations for cryogen safety, cryogen vent pathway and quench scenario are discussed. Important design details during construction and installation are included. Development of key site safety policies and procedures needed and will be discussed including quarterly and yearly site safety checklist and QC program. Lastly, we will discuss emergency plans for various emergencies like fire, water damage, quench, structural damage, establishment of code area, and preparation for emergency resuscitation, which are a key component of site safety.

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## Abstract Archives of the RSNA, 2023

NPMEE-31

### Stay Calm and Don't Attract the Magnet: A Comprehensive Review of MRI Safety Precautions

#### Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Following completion of this presentation, the reader will be able to: (1) Identify the four zones of MRI facilities (2) Describe the direct effects of MRI on patients (e.g., noise, heat, neurostimulation) (3) Describe the indirect effects of MRI on patients (e.g., interactions with existing devices and equipment) (4) Define specific absorption rate (SAR) and specific energy dose (SED) and their applications to MRI examinations (5) Discuss specific MRI safety considerations for special patient populations (6) Discuss safety profiles of gadolinium-based contrast media

#### TABLE OF CONTENTS/OUTLINE

(1) Background: Physical setup and zones, Hardware and parts of MR apparatus (2) Auditory concerns (3) Heating effects (including burns) (4) Peripheral neural stimulation (5) Portable metallic objects and equipment (6) Medical device and hardware compatibility and interactions (7) Contrast agents (8) Personnel and staffing (9) Special populations: pediatric patients, pregnant patients, patients with altered states of consciousness, obese patients, prisoners and detainees

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## Abstract Archives of the RSNA, 2023

NPMEE-32

### Common Errors in Neuroradiology

#### Participants

Luke Wojdyla, DO, San Diego, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diagnostic errors in neuroradiology are alarmingly common, with estimates ranging from 1-16% in clinical practice. It is well established that most diagnostic misses, including those which result in malpractice litigation, are due to errors in perception. Despite this, the miss rates of specific neuroradiologic diseases have historically been undefined. Recently, a growing number of studies have quantified and categorized neuroradiologic errors across training levels and in a variety of practice schema, measuring the influence of radiologist experience, specific pathology, and other individual and systematic factors. In this exhibit, the most common diagnostic errors described in emerging neuroradiologic literature will be presented. Briefly, these include errors of cerebrovascular pathology, blind spots on CT head imaging, errors of cerebrovascular pathology, misses of head and neck pathology, and errors of skull-base pathology. Systemic factors affecting performance such as practice volumes, reading speeds, and fatigue will also be presented. Knowledge of these findings can provide insight into understanding why errors occur, and in turn, help develop robust strategies to prevent them. Radiologists should be aware of the common blind spots and missed pathologies in the variety of settings described in this exhibit.

#### TABLE OF CONTENTS/OUTLINE

Explore the impact of diagnostic error in neuroradiology. Summarize recent literature quantifying common neuroradiologic errors amongst residents, generalists, and neuroradiologists. Appreciate the risk factors and biases associated with error. Provide case examples of real errors encountered in one department. Discuss strategies to minimize error.

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## Abstract Archives of the RSNA, 2023

NPMEE-33

### Microaggression or Cross-Cultural Competence?

#### TEACHING POINTS

The pursuit of cultural competence among an increasingly diverse and interconnected workforce is vital. It requires empathy and perspective taking. It behooves us to successfully distinguish the subtleties that exist between the negative connotation of microaggressions from the positive influence of cultural competence. Microaggressions are subtle indignities, slights or insults whose derogatory nature communicates prejudice, dismissal, denigration, hostility or negativity to a member of a marginalized group. They may appear indirect, casual, innocuous, and insignificant. They are often unconscious and unintentional, arising from underlying: prejudice, discrimination, oppression, or bias. Are microaggressions sometimes confused with a genuine desire to improve one's cross-cultural competence?

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Cross-Cultural Competence and Communication 3) Microaggressions 4) "Microaggressions are a real problem" 5) "Microaggressions are much ado about nothing" 6) Conclusions

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## Abstract Archives of the RSNA, 2023

NPMEE-34

### **RadLinks: Creating an Efficient Reference Webpage for Incidentaloma Management Guidelines and Template Generation**

#### **Participants**

Alice Shieh, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Conceptualize and design a webpage (RadLinks) to efficiently reference incidentaloma management guidelines- Discuss webpage design features that streamline incidentaloma management- Provide a seamless workflow so radiologists can provide incidentaloma management recommendations quickly with ease

#### **TABLE OF CONTENTS/OUTLINE**

Barriers to efficiency when managing incidentalomas?- Time consuming and repetitive efforts to look up information?- Lack of resource consolidation?Benefits of using the RadLinks page?- Minimalist, user-friendly design?- Thoughtfully consolidated resources ?- Pre-generated templates and text macros ?- Hosted on public domain, with lack of institutional barriersRadLinks user interface features ?- Expandable/collapsible navigation menu, ability to enlarge figures/charts in-screen, copy text to clipboard with one-click, mobile device compatibility ?Website hosting and building options and tools ?- Squarespace, Wix, WordPress ?- Flaticon ?- HTML/CSS tutorialsCopyright issues ?- Obtaining permissions to display figures and graphs from published articlesFuture directions ?- Keeping content and guidelines up to date?- Expanding resources beyond incidentaloma management?- Reducing scrolling distance ?- Implementing user suggestions and feedback ?

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## Abstract Archives of the RSNA, 2023

NPMEE-35

### Beauty Beyond a Few Slides Deep: How to Increase Radiology Lecture Engagement

#### Participants

Julia Tran, MD, Westminster, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Engaging lectures can hold the audience's attention, convey information more effectively, and make lessons more memorable. (2) Use graphic design resources (eg. AI art sites, design software, typography sites) to visually enhance your presentation. (3) Include activities that require active participation such as games, polls, and PACS simulators to increase engagement.

#### TABLE OF CONTENTS/OUTLINE

Didactics are an integral part of radiology education but creating engaging learning experiences can be challenging. Effective and interactive lectures improve learning outcomes by helping learners retain and apply new information. This educational exhibit will (1) introduce the concepts of graphic design and its role in creating impactful presentations. We will share various graphic design software, AI tools, and web resources useful for creating visually appealing designs. We provide examples of how to format lecture slides to emphasize key learning points and findings. This exhibit also aims to (2) showcase various interactive tools and activities that increase audience engagement. PACS simulators, such as PACSBIN, combine imaging software with educational tools to create case-based quizzes and lesson plans. Gamifying cases into competitions, such as Taboo™ or Pictionary™, motivates learners to strive for mastery. By implementing these strategies, educators can create more effective and engaging learning experiences.

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## Abstract Archives of the RSNA, 2023

NPMEE-36

### Sustainability, Climate Change and Radiology: Why We Should Care and What We Can Do

#### Participants

Hayley McKee, MSc, Toronto, ON (*Presenter*) Nothing to Disclose

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

#### TEACHING POINTS

Producing, using, and powering medical imaging equipment to provide radiology services are estimated to contribute to 1% of total global greenhouse gas emissions. Achieving sustainability in radiology requires immediate and strategic action. Strategies should focus not only on mitigating radiology's impacts, but also building resiliency to the risks of climate change through adaptation, with action taken at individual, department, and industry levels. Opportunities to reduce radiology's carbon footprint include reducing emissions due to non-productive scanner time and minimizing the use of single-use products and overall waste. Reducing overall emissions in health care and radiology will also require partnerships with both industrial and clinical stakeholders.

#### TABLE OF CONTENTS/OUTLINE

The overarching goal of this exhibit is to review the intersection of sustainability, climate change and radiology with a focus on why we should care and steps we can take to reduce waste and greenhouse gas emissions. This will be achieved by: 1. Describing the human health impacts of climate change, with health equity considerations. 2. Discussing diagnostic and interventional radiology's contributions to greenhouse gas emissions and waste. 3. Reviewing sources and classification of emissions related to radiology. 4. Differentiating mitigation (reducing impacts) and adaptation (building resiliency) strategies related to radiology. 5. Exploring strategies to promote sustainable practices at individual, institutional, and industry levels.

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## Abstract Archives of the RSNA, 2023

NPMEE-37

### Decolonizing Radiology: Addressing Historical Influences and Promoting Global Equity

#### TEACHING POINTS

It is well established there are worldwide disparities in access to radiology services as well as image guided procedures. While differences in access to care persist in the United States, there are profound disparities in access to care between high income countries (HIC) and low/middle -income countries (LMIC). Socioeconomic differences in patient populations, lack of equipment, career opportunities, and until recently lack of formal training programs have all contributed to differences in global access to radiology services. An additional well known contributing factor in differences to access to care are the historical effects of colonialism. While there have been increasing world-wide efforts to decrease the gaps in access to care and addressing the training gap in radiology, there has been little effort to address the history of colonialism in global health work in the context of radiology. This educational exhibit aims to provide context to the history of colonialism in global health and how this perspective is crucial to provide sustainable solutions for long term global radiology equity and culturally competent global health work.

#### TABLE OF CONTENTS/OUTLINE

1. History of Colonial Influence on Radiology  
2. Consequences of Colonialism in Radiology  
3. Current State of Global Radiology Outreach  
4. Strategies for Decolonizing Radiology

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## Abstract Archives of the RSNA, 2023

NPMEE-38

### **Global Radiology: Building Equitable and Sustainable Partnerships with Low- and Middle-Income Countries (LMICs)**

#### **Participants**

Lydia Kwarteng, BS, MPH, San Francisco, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Global radiology partnerships can be leveraged to help address the shortage of radiology professionals in LMICs. Simultaneously, there are efforts to address the legacy of colonization on global health initiatives by highlighting the power asymmetry between High-Income Country (HIC) and LMIC partners. This exhibit reviews the critical need to help establish and scale-up radiology training programs in LMICs, highlights opportunities for reform in global health, and provides examples of best practices to foster equitable and sustainable global radiology partnerships with LMICs.

#### **TABLE OF CONTENTS/OUTLINE**

Background- Shortage of radiology professionals in LMICs- Global radiology engagement in LMICs The Decolonize Global Health movement- Origins in global health- Goals and controversies Building equitable global radiology partnerships- Leadership and decision-making- Understanding sociocultural context- Equity in research, education, and capacity-building- Funding practices- Transparency and accountability Examples of successful partnerships in Africa- HIC-LMIC institutional collaborations in global cancer research, subspecialty training, and capacity-building (e.g. in neuroradiology, breast imaging, and interventional radiology).

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## Abstract Archives of the RSNA, 2023

NPMEE-39

### Usefulness of Deep Learning for Improved Image Quality and Noise Reduction in Diffusion Weighted Imaging (DWI)

#### TEACHING POINTS

Deep learning (DL) has recently experienced explosive growth including many areas of medical research. Recent advances in DL-based image reconstruction in MRI have been reported to achieve improved image quality through noise reduction and super-resolution (SR), but there have been very few reports of its application to diffusion-weighted imaging (DWI). We have scanned various body regions with a DL-based DWI research application for clinical evaluation. These images are presented with clinical findings. In addition, underlying technical details and imaging parameter optimizations are presented. Although the visual impression varies depending on imaging regions or scan parameters, the following advantages in DL-based reconstruction are observed: noise reduction due to DL, reduced distortion due to higher acceleration factor, sharpness improvement due to SR and higher spatial resolution, and better visibility of background normal tissues due to shorter echo time.

#### TABLE OF CONTENTS/OUTLINE

1. To present DWI images with deep learning-based image reconstruction and its findings in various body regions. 2. To understand the mechanism of deep learning-based image reconstruction. 3. To understand scan parameter optimization in DL DWI. 4. To know the clinical feasibility of DL DWI in patients with various diseases.

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## Abstract Archives of the RSNA, 2023

NPMEE-4

### Waste Reduction in Radiology: Educational Case Series

#### TEACHING POINTS

In the U.S. the healthcare sector is estimated to contribute almost 10% of our nation's carbon emissions. As healthcare professionals, we are committed to improving the well-being of our patients, so we also must focus on decreasing our contribution to climate change. Radiology departments can target both direct and indirect emissions by decreasing energy usage within the workspace, reducing unnecessary imaging, and transitioning to green suppliers for the procurement and disposal of medical equipment. Studies have shown that there is a high rate of imaging overuse. Understanding the environmental impact associated with these practices can help to encourage appropriate usage. There are both external and internal factors that can drive a physician to order unnecessary or inappropriate imaging, including but not limited to defensive medicine, patient expectations, obliviousness to cost and risks, breaks in patient-provider communication, and inadequate knowledge.

#### TABLE OF CONTENTS/OUTLINE

Introduction a. Health care impact on environment b. Radiology energy use c. Avenues for reduction  
Case examples a. Emissions by scan b. Contrast use  
Inappropriate imaging examples a. Contributions to inappropriate imaging b. Inpatient cases c. Outpatient cases  
Advocacy strategies

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## Abstract Archives of the RSNA, 2023

NPMEE-40

### The Second Mountain - Climbing the Challenges of Mid-career Radiology

#### Participants

Miltiadis Tembelis, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The mid-career phase for a radiologist, and many other professions, is a time burdened by career stagnation and high rates of burnout. To spite it being a particularly difficult time in the radiologist career, there is little dedicated mid-career support to help radiologists overcome their woes. The goal of this presentation is to highlight the difficulties faced by the mid-career radiologists as well as provide potential solutions to these problems. A focus on the mid-career female radiologist and their unique challenges will also be presented.

#### TABLE OF CONTENTS/OUTLINE

This review will define the mid-career radiologist and provide an overview of the current radiology workforce. Problems such as burnout, career stagnation, alternative career pursuits, lack of mentorship, sponsorship and career development programs, and gender specific challenges of women will be discussed. Potential solutions to these problems will also be presented.

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## Abstract Archives of the RSNA, 2023

NPMEE-41

### Subspecialty Breast Imaging Education in Tanzania: Clinical, Infrastructure and Logistical Paradigms for Best Practices in the Low- and- Middle Income (LMIC) Setting

#### Participants

Toma Omofoye, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Given the global rise in breast cancer, radiology workforce shortages in sub-Saharan Africa are critical.
- The RSNA-led Global Learning Center (GLC) initiative in Tanzania for sub-specialty breast radiology training is presented as a paradigm for remote/in-person education.
- It is imperative to tailor interventions for the resource-limited LMIC environment.
- Presenting a scalable education program for best practices in the LMIC setting, with goals of improving interdisciplinary breast care through training, infrastructure, and optimization of local resources.
- An example of an transnational alliance to care for underserved populations.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Radiology workforce in Africa b. Breast Cancer in Tanzania 2. Educational Paradigm a. Background/need i. Tanzania medical education, radiology and subspecialty education b. Trainees c. Curriculum i. Goals/objectives ii. Content iii. Learners iv. Faculty v. Resources and Methods ? Synchronous teaching ? Asynchronous teaching ? Observerships vi. Assessment vii. Governance viii. Continuous improvement 3. Breast Imaging Service a. LMIC modality specific goals b. Reporting c. Interprofessional collaborations 4. Infrastructure a. improving technology and support staff 5. Future directions

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## Abstract Archives of the RSNA, 2023

NPMEE-42

### **Radiologists for a Sustainable Future (R4SF): Bridging the Gap Between Radiology Practice and Environmental Responsibility**

#### **Participants**

Melina Hosseiny, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

-Radiologists for a sustainable future(R4SF) is an international community of radiologists and trainees, dedicated to promoting environmentally sustainable radiology practice and healthcare delivery.-R4SF advocates for policies that promote environmental sustainability in healthcare.At R4SF, radiologists/radiologists-in-training and leaders in the field unite to promote sustainable practices in radiology through education and awareness initiatives, the promotion of sustainable projects, and the establishment of a supportive network.-The R4SF has teams working together to advocate for sustainable radiology through education, policy, social media, and research. -Education team focuses on expanding the participation of medical students and residents in sustainable practices.-R4SF collaborated with members' ACR chapters to propose and pass a resolution on climate change and sustainability at the 2022 National ACR meeting. -R4SF team is a subgroup of the larger multispecialty Healthcare without Harm physician network and has support, mentorship, and sponsorship from great leaders in the radiology society.-Members of R4SF have delivered talks and shared our aims to the radiology community at various societies, including RSNA, ARRS, SABI, AUR, and others.

#### **TABLE OF CONTENTS/OUTLINE**

1)Introduction to Radiologists for a Sustainable Future (R4SF)2)R4SF Initiatives 3)R4SF Goals and Collaborations4)Benefits of Joining the R4SF and How to Get Involved5)Future Direction

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## Abstract Archives of the RSNA, 2023

NPMEE-43

### Let it Go, Let it Go: An Approach to Assessment and Reporting of Benign or Low-Risk Incidental Findings in the Chest

#### Participants

Erin Gomez, MD, Columbia, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiologists are expected to provide management recommendations for incidentally detected pulmonary nodules and thyroid nodules. While some are clinically impactful, a majority are benign and inconsequential. Fleischner, Thyroid White Paper and TIRADS consensus recommendations were developed to decrease inappropriate recommendations for further evaluation. In our quest to do no harm, radiologists can help decrease patient anxiety, time spent, medical expenses and potential risks associated with further characterization by using best practices for characterizing and reporting nodules which do not require further evaluation through clear, concise language. We will present examples of nodules inappropriately recommended for follow up and a step by step approach to assessment and reporting.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Commonly Mischaracterized Incidental Findings on Chest CT:  
- Pulmonary nodules  
- Mucous plugging  
- Granulomas  
- AVMs  
- Thyroid Nodules  
Risk statistics for nodules by size  
Reporting considerations:  
- Morphologic descriptors (shape, density, distribution)  
- Measurements - 3 plane review  
- Concise, specific language; avoiding vague terms  
- Comparison with prior imaging  
Patient history  
Letting it go: supporting data  
Role of Structured Reporting  
Pre-Populated Macros: Pros and Cons  
Society Recommendations and Indications for Incorporation into Reports  
Closed Loop Communication  
Conclusion

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## Abstract Archives of the RSNA, 2023

NPMEE-44

### Best Practices for Medical Student Engagement in the Radiology Reading Room

#### Participants

Devyn Rigsby, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. There is no standardized approach to engaging medical students in the radiology reading room during radiology electives (1).2. Without intentional incorporation of medical students into the reading room team, students may feel disinterested, excluded, or insufficiently challenged to learn. Negative experiences on radiology electives may dissuade students from pursuing radiology as a career.3. This presentation shares best practices for radiology preceptors to foster a healthy learning environment, maximize educational opportunities, and increase medical student interest in radiology.4. Best practices for engaging medical students in radiology courses can be divided into three parts: preparing for student arrival, starting a learning session, and facilitating case-based instruction.5. These best practices are transferrable to any institution's in-person radiology curriculum for medical students.Reference 1. Darras KE, Spouge R, Kang H, et al. The challenge with clinical radiology electives. *Can Assoc Radiol J*. 2019;70(4):337-343.

#### TABLE OF CONTENTS/OUTLINE

1. Problem statement2. Common concerns about the reading room experience raised by students at our institution3. Preparing for student arrival in the reading room a. Introductory information b. Identify near-peer mentor (resident or fellow) c. Student workspace4. Starting a learning session a. Learning objectives b. Transfer of foundational knowledge c. Select cases for student to attempt independently5. Facilitating learning through cases a. Student inclusion in all trainee readouts b. 1:1 student readouts on assigned cases c. Session wrap-up

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## Abstract Archives of the RSNA, 2023

NPMEE-45

### Reducing Inappropriate Screening of Endometrial Cancer in Transgendered Men: Discussion of Best Practices

#### TEACHING POINTS

1. To review the testosterone-induced changes in patients who are assigned female at birth (AFAB)<sup>2</sup>. To discuss the existing literature on the appropriateness of transvaginal US in evaluating abnormal vaginal bleeding in transgender men on hormone-replacement therapy<sup>3</sup>. To discuss the costs, financial and psychological, of inappropriate screening<sup>4</sup>. To recommend new guidelines for screening endometrial cancer in transgender men

#### TABLE OF CONTENTS/OUTLINE

- Hormone replacement therapy treatment goals for transgender men- Current guidelines for endometrial cancer screening - Guidelines for endometrial cancer screening in transgender men - Recommendations for endometrial cancer screening in transgender men- Costs of inappropriate transvaginal US screening- Patient-centered care principles in treatment and care of transgender men

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## Abstract Archives of the RSNA, 2023

NPMEE-46

### **It Takes a Village: Multidisciplinary Breast Subspecialty Telementoring for Low- to- Middle-Income- Countries (LMICs)**

#### **Participants**

Toma Omofoye, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Funded by an RSNA International education grant, a method for telementoring is described for breast radiologists, pathologists, oncologists, and surgeons where domestic/foreign, low/high resource, and within/outside subspecialty input is used to adapt best practices to available resources. Breast subspecialist shortages in African Low-Middle-Income Countries (LMICs) call for creative solutions. Many LMICs lack multidisciplinary communication (radiology-pathology or tumor board). While LMIC practitioners have varying levels of breast subspecialty training and resources, they have tailored creative solutions for optimizing resources to address advanced disease. The transnational collaboration (with 200 participants from 3 continents- Africa, North and South America) assists capacity building.

#### **TABLE OF CONTENTS/OUTLINE**

We describe a model for multidisciplinary telementoring to provide paired subspecialty support for breast health practitioners in LMICs. 1. Introduction: LMIC breast cancer burden and subspecialty workforce gaps 2. Project Extension for Community Healthcare Outcomes (ECHO) ABCD model: a. Amplification of medical knowledge b. Best practices to improve outcomes c. Case based (clinically-relevant) learning d. Database: outcome monitoring 3. Program Formata. Case presentation b. Interprofessional and multidisciplinary input c. Complementary didactics 4. Case-based examples including: Rad-path concordance, quality, symptom, interesting or difficult cases, and rare disease management

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## Abstract Archives of the RSNA, 2023

NPMEE-47

### Supporting Women in Radiology: Implementing a Multi-institutional Coalition

#### TEACHING POINTS

Women are underrepresented in radiology. Even though men and women are about equally represented among medical school graduates, only 27% of applicants in radiology are women.<sup>1,2</sup> Furthermore, female radiology leaders make up an even smaller minority, consisting of only 13% of radiology leaders.<sup>3,4</sup> The purpose of this exhibit is to showcase how a women in radiology (WIR) group in a teaching institution can provide role models, mentorship, and promote a culture of diversity and inclusion. Furthermore, the introduction of WIR collaborations with other institutions can promote an institution's inter-institutional alliances and provide career advancement opportunities for its trainees. Training institutes are in a unique position to bring about this change. Trainees who have cultivated gender equality values can have a positive impact on their future practices. Though it takes time and effort to foster a culture of diversity and inclusion, it is necessary to do so in order to create a gender inclusive workplace which will benefit not only radiology departments but also patients.

#### TABLE OF CONTENTS/OUTLINE

A) Mentorship: Implementation of "mentoring up" and "mentoring down". B) Promote career advancement opportunities and promotions: Organize discussion panels with panelists from both private practice and academics with a mix of early, mid, and advanced career radiologists. C) Collaborate with other institutions' WIR committees to create inter-institutional alliances focused on promoting the above. D) Overcome or mitigate bias by organizing upstander workshops as part of the training curriculum. E) Understand the unique needs of women in the field, including pregnancy, parental leave, and lactation.

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## Abstract Archives of the RSNA, 2023

NPMEE-48

### Benefits and Applications of ChatGPT for Radiology Trainees

#### TEACHING POINTS

1. To provide an overview of ChatGPT from a trainee perspective  
2. To highlight best practices for using ChatGPT  
3. To illustrate how ChatGPT can be used to create relevant radiology review content including practice questions  
4. To demonstrate the radiology virtual-advisor capability of ChatGPT  
5. To describe how medical students can use ChatGPT to develop a preparation plan for radiology rotations  
6. To provide an overview of the future of ChatGPT in radiology undergraduate medical education

#### TABLE OF CONTENTS/OUTLINE

- What is ChatGPT?  
- How are trainees using ChatGPT?  
- Applications of ChatGPT for radiology learning and best practices  
- Using ChatGPT to generate radiology practice questions  
- Using ChatGPT to prepare for radiology rotations  
- Using ChatGPT as a virtual radiology advisor  
- Using ChatGPT to assist during core clinical rotations  
- Using ChatGPT to assist with professional communication  
- Future of ChatGPT in radiology undergraduate medical education

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

NPMEE-49

### Promoting Health Equity Through Radiology: Practical Tips for Empowering the Next Generation of Trainees

#### Participants

Pooja Agrawal, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Medical students and residents in radiology represent the next generation of trainees and have a vital role in fostering sustainable health equity efforts focused on eliminating health disparities in radiology. Three ways trainees can promote health equity in radiology are through research, community outreach, and education.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Review existing health disparities in radiology using findings from a published systematic review; discuss the importance of trainee involvement in eliminating disparities; describe practical ways how research, community outreach, and education can promote health equity  
Health equity research: Introduce tips to identify a mentor; discuss how to select a research topic by identifying gaps in existing research; review opportunities at national meetings to build research network  
Community outreach: Discuss how to leverage existing community needs assessment to identify emerging opportunities; develop initiatives to educate patients about the importance of screening as a trainee; provide examples of radiology-focused community efforts (mobile mammography/lung cancer screening, RAD-AID)  
Education in health equity: Participate in the creation of radiology health equity-focused learning materials; collaborate in establishing mentorship programs to promote diverse applicants in radiology; explore how current radiology pillars in quality safety, innovation, and AI can be used as catalysts to bridge existing disparities  
Conclusion: Discuss how long-lasting health equity necessitates an understanding of systemic obstacles and a commitment to staying informed on fields such as molecular imaging, social genomics, and AI algorithms

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## Abstract Archives of the RSNA, 2023

NPMEE-5

### Medicolegal Readout: A Malpractice Primer for Radiologists

#### Participants

Luke Wojdyla, DO, San Diego, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The majority of radiologists will face litigation in their careers. In a 2021 survey, 71% of radiologists said they were sued which is similar to estimates in prior reports. Despite this, dedicated teaching of medicolegal issues is often lacking or incomplete in radiology training programs. Residents are seldom exposed to legal issues that can arise when caring for patients, and attendings themselves may feel unqualified in leading medicolegal discussions. Concerningly, residents may transition to independent practice with an incomplete understanding of the legal environment applicable to their practice. This exhibit will provide background for the legal frameworks relevant to modern radiology practice. A brief historical summary of key court decisions will be presented alongside a discussion of malpractice and radiologic errors. Challenging case scenarios will address nonroutine communication, reporting missed findings on comparison imaging, addressing technical limitations, and admitting mistakes, among others. At the end of the presentation, the reader should understand the legal basis for common radiologic practices, identify challenging situations with increased medicolegal risk, and implement practical strategies to mitigate risk of litigation.

#### TABLE OF CONTENTS/OUTLINE

Recognize the magnitude of malpractice within radiology. Understand how fundamental radiology practices have arisen directly from court rulings. Describe the most common causes for malpractice. Identify examples of frequently encountered medicolegal hazards and controversies. Case-based imaging examples will be used to discuss challenging medicolegal issues encountered in radiology.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-50

### Integration of Clinical Context into Medical School Gross Anatomy Based on CT Imaging of the Students' Dissection Cadavers

#### Participants

Peter J. Haar, MD, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Incorporating imaging in medical school gross anatomy courses can provide medical students with early, positive learning experiences with radiology. The teaching points of this exhibit include the following: first, to describe methods to incorporate CT imaging of the students' dissection cadavers into a novel exercise in which dissection cadavers are regarded as medical students' "first patients;" second, to outline roles for radiology attendings and residents in interactive cadaver CT workshops; and third, to explore the potential benefits of the experience in medical education and radiology residency training.

#### TABLE OF CONTENTS/OUTLINE

1.) Anatomy Rounds: an exercise for medical students to synthesize clinically relevant cadaver observations. 2.) Methods and resources to acquire and distribute cadaver CT images to medical students. 3.) Involving radiology residents in generating radiology findings on full-body cadaver CT image sets. 4.) Strategies to enhance the learning experience of interactive workshops based on the dissection cadaver CT images. 5.) Potential benefits of interactive radiology experiences early in medical school education. 6.) Feedback from medical students and radiology residents on the value of the learning experience.

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## Abstract Archives of the RSNA, 2023

NPMEE-51

### Designing Interactive Team-Based Learning Experiences with Cadaver CT Images in Medical School Gross Anatomy

#### Participants

Peter J. Haar, MD, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Curricula involving CT images of medical school gross anatomy cadavers can provide students with a rewarding educational experience early in medical school. Teaching points of this exhibit include the following: first, to describe the challenges and benefits of teaching simple CT image analysis to enhance and complement gross anatomy instruction; second, to outline a strategy for developing interactive team-based learning modules and assessments; and third, to examine potential pitfalls and solutions in teaching the curriculum.

#### TABLE OF CONTENTS/OUTLINE

1.) Teaching gross anatomy and cross-sectional anatomy in parallel. 2.) User-friendly image interaction and teaching foundational concepts of CT imaging. 3.) Designing learning experiences with the intellectual rewards of correctly making real imaging diagnoses. 4.) Interactive group-learning assignments, and assessment of learning. 5.) Advantages and disadvantages of the interactive cadaver CT-based curriculum. 6.) Feedback and student response to the curriculum.

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## Abstract Archives of the RSNA, 2023

NPMEE-6

### A National Plan for the Renewal of Imaging in the EU: A Regional Perspective

#### TEACHING POINTS

With this publication it is intended to disseminate a National Investment Plan and how it was managed and developed from a regional point of view. The main objective of this Plan is to increase overall survival and the quality of life of people through the diagnosis of diseases in early stages, which allow rapid therapeutic intervention. The plan pays special attention to the pathologies with the greatest impact on the present and future of a National Public Health Service (SNS), such as chronic diseases, oncological diseases, rare diseases and neurological diseases. All this, consolidating equity in access to high technology and improving the quality of care and the safety of patients and professionals. This poster describes the objectives, method and results of a national plan that involves the acquisition of 847 state-of-the-art equipment for the SNS in order to: Reduce the obsolescence of high-tech equipment, guaranteeing the renewal of 100% of equipment that is 12 years old or older in accordance with scientific recommendations. Raise the average density rate of high-tech equipment per 100,000 inhabitants by at least 15%, in order to improve equity in access throughout the national territory, bring the service closer to patients and position the SNS, progressively, in the European average. As a consequence of the application of the Plan in our region, 76 new pieces of equipment are being installed (63 renewals and 13 extensions) and the total amount of the investment is € 67,204,159.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS Context and introduction Objectives of the Plan Methodology Results Discussion and conclusions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NPMEE-7

### Guide for Radiologists Leading Multidisciplinary Conference

#### Participants

Jody Shen, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Radiologists play a key role in multidisciplinary conference. This educational exhibit is meant to be a guide for trainees or junior attending radiologists for planning and leading a multidisciplinary conference. Special considerations will be given to leading the conference virtually (e.g. over Zoom) as this has become more commonplace. This guide can help radiologists early in their career add value to patient care and build relationships with referring clinicians.

#### TABLE OF CONTENTS/OUTLINE

A. How to prepare for multidisciplinary conference. B. How to lead multidisciplinary conference and key principles with examples of before revision, better strategy, and rationale: 1) Move it along. 2) Maximize screen real estate. 3) Keep it simple. 4) Keep it clinically relevant. 5) Get feedback. C. Common questions and challenging cases.

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## Abstract Archives of the RSNA, 2023

NPMEE-8

### Being a Radiologist in the Earthquake: Are You Prepared Enough

#### Participants

Duygu Ekizalioglu, MD, Izmir, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Raising awareness of earthquakes and other potential disasters The critical role of Radiologists in disaster prevention To overview radiology's role in disaster management Global outreach and education for radiology department disaster preparedness

#### TABLE OF CONTENTS/OUTLINE

What is an earthquake and when does it become a disaster? A recent experience: The impact of the earthquake in Turkiye The critical role of Radiologists in disaster prevention and preparedness Where does Radiology stand in disaster management on hyperacute/acute/subacute/chronic stages: Providing necessary imaging services based on the availability and utility of imaging methods, alternative reporting systems for communication, and teleradiology services The challenges that radiologists faced in the Turkiye earthquake management system; and what is next? A comparison of past experiences in different countries; lessons learned?

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## Abstract Archives of the RSNA, 2023

NPMEE-9

### Using Process Mapping to Identify Targeted Interventions to Reduce Imaging Disparities

#### TEACHING POINTS

- Process mapping is a quality improvement tool used to depict flow of healthcare processes.
- Components of the imaging process are addressed in order to reduce imaging disparities.
- Pre-imaging interventions include reviewing imaging guidelines, providing culturally dexterous patient educational materials, community outreach, and improving imaging access.
- Imaging interventions include high quality interpretation services, patient-centered communication strategies, and maximizing patient comfort.
- Post-imaging interventions include structured collection of patient feedback and culturally-responsive patient navigation services to ensure adequate follow-up.

#### TABLE OF CONTENTS/OUTLINE

1) Process Mapping Definition  
a) Published Process Maps  
b) Apply Health Equity Lens to Published Imaging Process Maps  
2) Pre-Imaging  
a) Review Imaging Guidelines Using Health Equity Lens  
i) Cancer Screening (breast, lung, colorectal)  
b) Clinical Decision Support to Reduce Variability in Decision-Making  
c) Patient and Provider Education  
d) Maximizing Patient Access  
i) Evidence-Based Strategies  
3) Imaging  
a) Culturally Dexterous Communication Strategies  
i) Definition  
ii) Standardized Communication Strategies to Improve Patient Communication for Diverse Patient Populations  
(1) Review Evidence-Based Strategies  
iii) Stigmatizing Language in Medicine  
(1) Definition  
(2) Application of Stigmatizing Language in Radiology  
1. Physician-patient encounter  
2. Radiology Reports  
3. Electronic health records  
(3) Vulnerable groups  
1. Patients of color  
2. Obese population  
3. LGBTQ community  
4) Post-Imaging  
a) Collection of Patient Feedback  
b) Patient-Navigation Services  
i) Review Evidence-Based Strategies

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## Abstract Archives of the RSNA, 2023

NREE

### Neuroradiology Education Exhibits

#### Sub-Events

#### **NREE-1 Variants and Anomalies of Intracranial Cerebral Arteries and Considerations for Neuroendovascular Procedures**

##### TEACHING POINTS

- To describe the embryology of the intracranial cerebral arteries in order to explain the origin of its anatomical variants and anomalies.  
- To review all the variants and anomalies of intracranial cerebral arteries giving examples from cases from our institution.  
- To revise the associated pathology and the implications for endovascular procedures.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Embryology  
3. Intracranial Internal Carotid Artery  
3.1. Variants. Tortuosity.  
3.2. Anomalies  
3.2.1. Aberrant carotid artery  
3.2.2. Persistent estapedial artery  
3.3. Ophthalmic artery  
4. Persistent carotid-basilar communications  
4.1. Trigeminal artery  
4.2. Hypoglossal artery  
4.3. Proatlantal intersegmental artery  
5. Anterior cerebral artery (ACA)  
5.1. Variants  
5.1.1. The anterior communicating artery  
5.2. Anomalies  
5.2.1. Infraoptic origin and persistent olfactory primitive artery  
5.2.2. Accessory, multiple and aberrant ACA  
5.2.3. Bihemispheric and azygos ACA  
6. Middle cerebral artery (MCA)  
6.1. Variants  
6.2. Anomalies  
6.2.1. Accessory, fenestrated and duplicated MCA  
7. The posterior arterial circulation  
7.1. Variants  
7.1.1. Fetal origin  
7.1.2. AICA-PICA  
7.2. Anomalies  
7.2.1. Basilar fenestration

#### **NREE-10 'Incidental' Intracranial Arterial Anatomical Variants: Implications for Diagnosis, Pathology and Treatment**

Participants  
Charlotte Chung, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Variability in intracranial arterial anatomy is well recognized to be the rule, not the exception. For example, the Circle of Willis is incomplete in 75-80% of brain CT/MR angiography. While anatomic variations may be clinically inconsequential in the normal patient, accurate delineation of the involved anatomy may be critical in the setting of pathology. This exhibit employs a systematic vessel-based approach to illustrate common intracranial arterial variants and their potential clinical implications through case-based discussions. Educational objectives of this exhibit are:  
- Outline intracranial arterial development and resultant spectrum of anatomic variations  
- Illustrate common 'incidental' variant configurations of the intracranial arteries on multimodal (CTA, MRA, and DSA) neuroimaging.  
- Highlight implications of anatomical variants in diagnosis, pathology, and treatment of cerebrovascular diseases

##### TABLE OF CONTENTS/OUTLINE

I. Case-based review of anatomical variants in the distal ICA  
II. Case-based review of anatomical variants in the Circle of Willis  
III. Case-based illustration of the continuum of variant MCA and ACA cortical branching pattern  
IV. Case-based review of anatomical variants in the vertebrobasilar circulation  
V. Variants in vessel morphology and caliber mimicking pathology

#### **NREE-100 Frontier Technology in Non-Invasive Vascular Imaging; Arterial Spin Labeling-Based Non-Contrast MR Digital Subtraction Angiography on Cerebral Diseases**

Participants  
Miho Gomyo, Mitaka, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To learn the basic principles of arterial spin labeling-based non-contrast MR digital subtraction angiography (ASL-MRDSA) that can obtain dynamic information of cerebral arteries without using a Gd-based contrast agent.  
2. To learn various scanning methods of ASL-MRDSA.  
3. To learn clinical applications of ASL-MRDSA to evaluate cerebral lesions.  
4. To know some novel techniques of ASL-MRDSA.  
5. To review pitfalls and limitations of ASL-MRDSA.

##### TABLE OF CONTENTS/OUTLINE

1. Basic principles of ASL-MRDSA  
2. Various scanning methods of ASL-MRDSA and their characteristics; 2D-methods, 3D-methods, and ultra-short TE methods  
3. Novel techniques of ASL-MRDSA  
4. Clinical applications of ASL-MRDSA to evaluate the following diseases:  
• intracranial arterial stenosis/occlusion  
• moyamoya disease  
• arteriovenous malformation (AVM)  
• carotid-cavernous fistula (CCF)  
• dural arteriovenous fistula (dAVF)  
• extracranial to intracranial (EC-IC) bypass  
• hypervascular tumors (skull tumor, hemangioblastoma, paraganglioma, and so on)  
• post-operative study of cerebral aneurysms (clipping, coil embolization)  
5. Pitfalls and limitations

#### **NREE-101 Patterns of Abnormal Magnetic Susceptibility in the Brain**

##### TEACHING POINTS

1. Susceptibility-weighted imaging (SWI) is an MRI sequence that uses phase and magnitude information to show subtle

1) Susceptibility weighted imaging (SWI) is an MRI sequence that uses phase and magnitude information to characterize substances that distort the local magnetic field, allowing for identification of hemosiderin, calcification, and iron deposition. 2) Depending on the pathology, abnormal magnetic susceptibility may appear as a single or multiple lesions and can present with varying morphology. 3) SWI lesion locations correlate with the disease mechanism. Understanding physiologic and pathologic reasons for localization is key to formulating the differential diagnosis and diagnosis 4) SWI is instrumental in characterization of vascular abnormalities, masses, and causes of microhemorrhage. 5) SWI is often able to detect changes earlier in a disease process than other sequences.

#### TABLE OF CONTENTS/OUTLINE

Pathology organized by susceptibility patterns: -Single lesion: - Location specific - Basal ganglia: neurodegenerative diseases, hypertensive hemorrhages, toxic/metabolic entities - Midline: desmoid - Sulcal: siderosis - Single vascular: thrombosis of cerebral vein or DVA, calcified embolus in Circle of Willis artery - Linear susceptibility along margins of cerebral mass: pyogenic abscess - Multiple lesions: - Location specific - Grey-white matter junction: hemorrhagic metastases, grade 1 DAI - Lobar: CAA - Diffuse vascular: ferumoxytol - Corpus callosum: grade 2 DAI - Brainstem: grade 3 DAI, kernohan phenomenon -Non-location specific - Diffuse axonal injury - Fat emboli - Microhemorrhage of acute illness, post-cardiac surgery

#### NREE-102 Head On: Facing Central Nervous System Lymphoma

Participants

MARCELO DOS SANTOS BANDEIRA FILHO, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is- To explore the proper terminology and classification of lymphomas based on updates of the fifth edition of the WHO Classification of Tumors of the Central Nervous System (CNS).- List the main clinical and epidemiological characteristics and risk factors associated with the appearance of CNS lymphomas.- To show through a pictorial review the classic imaging findings of various lymphomas of the CNS.- Show atypical cases of lymphomas and develop adequate reasoning for the radiologist to face unusual findings.

#### TABLE OF CONTENTS/OUTLINE

Powerpoint Layout Introduction: 1. Overview of clinical, epidemiological and risk factors. 2. Neuroradiology: 2.1 Terminology of SNC lymphomas. 5th edition of the WHO 2.2 Classification of Tumors: SNC lymphomas. CNS Lymphomas: Primary diffuse large B-cell lymphoma of the CNS. Immunodeficiency-associated CNS lymphoma. Lymphomatoid granulomatosis. Intravascular large B-cell lymphoma. Miscellaneous rare lymphomas in the CNS: MALT lymphoma of the dura. Other low-grade B-cell lymphomas of the CNS. Anaplastic large cell lymphoma (ALK+/ALK-) T-cell and NK/T-cell lymphomas

#### NREE-103 Photon Counting Detector Lateral Decubitus CT Myelography: A Developing Technique for Detection of Cerebrospinal Fluid - Venous Fistulas

Participants

Nikkole Weber, ARRT, RT, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss protocol development and optimization of Photon Counting Detector (PCD) CT Myelography (CTM) 2. Describe features of PCD technology that improve detection of cerebrospinal fluid- venous fistulas (CVFs): spectral, spatial and fast 4D serial acquisitions 3. Demonstrate examples of CVFs found on PCD CTM

#### TABLE OF CONTENTS/OUTLINE

1. Review current imaging modalities for myelography 2. PCD CTM protocol development a. Performed in right and left lateral decubitus Trendelenburg positions b. Lumbar spine localizers c. Spinal needle placement intrathecally d. Bolus tracking to monitor contrast flow within the thecal sac e. Serial paired acquisitions, with multi-energy (ME) and high-resolution (HR)/ME scan modes 3. Unique technologic advantages of PCD that aid in detection of subtle CVF a. Higher spatial resolution i. Spinal anatomy of interest very small ii. HRME (0.2mm), ME (0.4mm) scan mode reconstructions b. Improved radiation dose efficiency compared to energy integrating detector CT scanners—reduced electronic noise, optimal photon weighting, smaller detector pixel size, and removal of septae. Resultant images with thinner slices and sharper kernels can be generated without increasing noise c. Spectral reconstructions to improve contrast enhancement and iodine contrast to noise ratio (CNR) i. Increased iodine CNR due to more optimal energy weighting of PCDs (more weight towards low-energy photons) ii. Subtle CVFs can be very faint. Virtual monoenergetic images (VMI) at low keV (40) increases the conspicuity of iodine d. Fast 4D acquisition: 3D volume + a series of acquisitions at different time points. e. Metal artifact reduction vs high keV VMI reconstructions tested 4. CVF example patient images

#### NREE-104 MR Bone Imaging: Value of Application to Cervical and Intracranial Vessel Wall Imaging

Participants

Kazuhiro Tsuchiya, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn basic concepts and technical aspects of bone imaging like CT by MR imaging. 2. To know basic concepts of vessel wall imaging (VWI) by MR bone imaging with improved visualization between vessel walls and vessel lumen. 3. To know what benefits MR bone imaging offers over conventional cervical and intracranial VWI techniques and some pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Basic issues of MR bone imaging including currently employed scanning sequences and postprocessing methods. 2. MR bone imaging-based VWI: how to improve image quality. 3. MR bone imaging-based VWI: how does it work in the diagnosis of vessel wall abnormalities? 4. Presentation of clinical cases with discussion of implications. Cases will cover carotid calcified plaques, intracranial main trunk plaques, aneurysms, vasculitis, moyamoya disease, and so on. 5. Additional discussion including current limitations and future directions of this technique.

#### NREE-105 Posterior Fossa Ependymomas: Newly Defined Molecular and Genetic Subtypes with Characteristic Imaging Features

Participants

Shan McBurney-Lin, MD, MBA, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Posterior fossa (PF) ependymomas have been newly classified into two distinct subtypes, PFA and PFB, based on molecular and genetic features by the World Health Organization in 2021.2. Each subtype has unique epidemiologic, biologic, prognostic, clinical, and imaging features.3. Imaging plays an important role in differentiating the two subtypes of PF ependymomas and in distinguishing PFA and PFB subtypes from other PF tumors, which benefits surgical planning and tumor recurrence surveillance.4. Upon completion of review of this exhibit, readers will be able to recognize the distinct molecular, genetic, and clinical features of PF ependymomas and become familiar with the characteristic imaging features of each subtype for improved early imaging diagnostic capability.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of PFA and PFB ependymal tumor subtypes, including epidemiology, prognosis and molecular/epigenetic alteration2. Characteristic imaging features of PFA and PFB tumor subtypes3. Radiologic differences between PFA/PFB subtypes and similar entities within the radiologic differential diagnosisa. Medulloblastoma. Atypical teratoid rhabdoid tumorc. Pilocytic astrocytoma4. Summary and quiza. Summary of key radiologic findings of PFA/PFB subtypesb. Quiz to review new knowledge via example cases

#### NREE-106 SWI Brush Sign of Cerebral Parenchymal Veins in CNS Diseases and Conditions

Participants

Seiya Kishi, Tsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

SWI brush sign (BS) represents prominent intracerebral veins in various diseases including ischemic stroke, moyamoya disease, cerebral venous thrombosis (CVT) and Sturge-Weber syndrome (SWS). We aimed to1) learn anatomy of intracerebral veins 2) understand mechanisms of SWI BS in each disease 3) learn clinical significance related to this sign.

#### TABLE OF CONTENTS/OUTLINE

1. What is SWI BS; SWI allows visualization of intracerebral veins (in white matter and occasionally in cortex). BS represents findings of prominent intracerebral veins in some diseases and conditions.2. Diseases that cause the SWI BS; SWI BS is caused by ischemic stroke, moyamoya disease, CVT, and SWS. It may disappear over time with or without treatments.3. Mechanisms of brush sign; Increased deoxyhemoglobin in venous blood (BOLD effect) in ischemic stroke and moyamoya disease Congestion, and partially BOLD effect in CVT and SWS.4. Clinical significance related to SWI BS; indicates severe hemodynamic impairment in ischemic stroke correlates with severity in moyamoya disease and with increased intracranial venous pressure in CVT suggests the diagnosis of cortical vein thrombosis when found in affected cortex may contribute to better clinical outcomes in SWS.

#### NREE-107 How to Improve in Intraoperative Image Quality in Transcranial MR-guided Focused Ultrasound Surgery

#### TEACHING POINTS

The objective of this exhibition is to provide a method for enhancing of intraoperative image quality in transcranial MR-guided focused ultrasound surgery (TcMRgFUS). TcMRgFUS possesses the distinct advantage of allowing expeditious assessment of therapeutic efficacy post each sonication and intraoperative magnetic resonance (MR) imaging for visualization of the lesion. In circumstances which denotes a lack of desired therapeutic effects and the lesion misses the planned target, subsequent ablation targets can be delicately re-aligned based on the intraoperative image. Thus, the acquisition of high-quality intraoperative images, which can accurately confirm the lesion, is imperative. The accuracy of this re-alignment is contingent upon the quality of the intraoperative image. Unfortunately, the current intraoperative image quality obtained from a 3.0T MRI system, is deficient in precisely identifying the lesion. In view of this limitation, we have been developed and substantiated a method for ameliorating the quality of intraoperative images.

#### TABLE OF CONTENTS/OUTLINE

1. TcMRgFUS procedure a. Overview of TcMRgFUS b. Intraoperative T2-weighted image using 3.0T MRI2. Method for improving intraoperative image quality a. Calculating manual transmitter gainb. Acquiring high-quality intraoperative T2-weighted image3. Effectiveness of enhancing intraoperative image quality a. Clinical images resultsb. Contrast between the lesion and thalamus

#### NREE-108 Primary Angiitis of the Central Nervous System (PACNS): Imaging Features and Differential Diagnosis

#### TEACHING POINTS

-To provide a detailed review of the literature of PACNS.-To review the different imaging features of PANCS.-To know the most frequent mimickers of PACNS.

#### TABLE OF CONTENTS/OUTLINE

PACNS is a rare inflammatory vasculopathy (affecting the medium and small vessels) in brain and spinal cord that is frequently difficult to diagnose. The neurological manifestations vary, but they typically include chronic headache, encephalopathy, focal weakness, or stroke. Brain biopsy is the gold standard and only definitive test for PACNS, but has limited sensitivity, is invasive, and is associated with high rates of morbidity. Lumbar puncture is also performed, but has limited specificity for diagnosis. Catheter angiography is the imaging reference standard and is frequently employed, even though it has limited sensitivity and specificity. Neuroimaging is critical in the diagnosis of PACNS. PACNS may present with diffuse or multi-focal white matter abnormalities, hemorrhagic stroke, single or multi-territorial ischemic infarcts, micro-hemorrhages, and pseudotumoral lesions. Vessel wall MRI increases diagnostic accuracy by showing concentric mural thickening and contrast enhancement in brain arteries affected by vasculitis. Reversible cerebral vasoconstriction syndrome, atherosclerosis, Moyamoya disease, CLIPPERS, primary CNS diffuse lymphoma, and secondary cerebral vasculitis are the most common differential diagnoses. In this review, we will illustrate and describe the radiological appearance and differential diagnosis of primary angiitis of the central nervous system (PACNS), and imaging's role in diagnosis.

#### NREE-109 The T2-FLAIR Mismatch Sign in Oncologic Neuroradiology: Imaging Criteria, Current Uses, and Histo-

## Molecular Correlates

Participants

Samir Dagher, MD, BS, Houston, TX (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Detecting the "classic" T2-FLAIR Mismatch sign (T2FMM) requires a strict application of the T2 and FLAIR criteria in adult patients with suspected CNS gliomas. The "classic" T2FMM exhibits near-perfect specificity yet variably low sensitivity for the diagnosis of astrocytoma, IDH-mutant in adults. 2. A less stringent application of the strict criteria allows for the detection of the "partial" T2FMM. Studies suggest it may reliably exclude the diagnosis of glioblastoma, IDH-wildtype while compromising the near-perfect specificity of the "classic" sign. 3. Differences in MRI acquisition parameters may affect the visibility of the T2FMM. 4. The T2FMM has also been reported in pediatric-type CNS tumors, namely dysembryoplastic neuroepithelial tumors and H3K27-altered diffuse midline gliomas. 5. Although limited data suggests significantly larger intercellular spaces, including microcysts, and upregulation of the mTOR pathway in mismatched compared to non-mismatched tumors, this has not yet translated into prognostic implications. 6. Mismatched tumors have significantly higher apparent diffusion coefficient, and lower relative cerebral blood volume on diffusion- and perfusion-weighted imaging, respectively, compared to non-mismatched tumors.

### TABLE OF CONTENTS/OUTLINE

1. Adult-type diffuse gliomas in the 2021 WHO classification of CNS tumors 2. The "classic" T2FMM: imaging criteria, clinical uses and pitfalls 3. The "partial" T2FMM: imaging criteria and clinical uses 4. The T2FMM in pediatric-type tumors 5. Clinical and histomolecular correlates 6. Diffusion- and perfusion-weighted imaging correlates

## NREE-11 Cerebral Small Vessel Disease: Small Size, Big Problems

Participants

Eduardo Freire, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the imaging patterns of cerebral small vessel disease (SVD). Review the classification and subgroups of SVD. Correlate clinical findings and complaints with imaging patterns. Review the subtypes of SVD and their own diagnostic criteria. Review the Boston criteria 2.0 for cerebral amyloid angiopathy (CAA). Review the new markers of Boston criteria 2.0. Discuss the role of the radiologist in the diagnosis of SVD.

### TABLE OF CONTENTS/OUTLINE

Cerebral Small Vessel Disease (SVD) is a high prevalence disease, and a common cause of stroke and dementia. Although SVD can be asymptomatic at the beginning, some imaging findings may suggest its diagnosis. The study "Standards for Reporting Vascular change on neuroimaging (STRIVE)" shows SVD imaging patterns on brain magnetic resonance (MR) that allows considering it as a differential diagnosis. SVD comprises a group of diseases that affect capillaries, arterioles, small veins and venules, and small perforating arteries. Didactically, we can classify SVD according to its pathological and genetic characteristics into sporadic and hereditary (genetically determined). Sporadic subtypes are the most common and represent the two main etiologies of SVD: hypertensive and related to cerebral amyloid angiopathy. Brain MR imaging findings are usually similar for all etiologies. To assist the radiologist, STRIVE compiled imaging findings that represent SVD's indirect signs.

## NREE-110 It's Not All About the Shine: Spotting MS MRI Biomarkers

Participants

Nicole Lambrakos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Briefly describe the multiple sclerosis biomarkers and which techniques have the highest sensitivity and specificity. 2. Discuss the importance of spotting imaging multiple sclerosis biomarkers and their pathology correlation. 3. Expose the role of MR in identifying the main multiple sclerosis biomarkers. 4. Looking for multiple sclerosis biomarkers in doubtful lesions to favor demyelinating etiology.

### TABLE OF CONTENTS/OUTLINE

1. Main multiple sclerosis biomarkers identifiable via MR. 2. Pathophysiology: correlation of imaging and pathology of multiple sclerosis biomarkers. 3. Differential diagnosis: using MR biomarkers to help favor demyelinating etiology.

## NREE-111 Pituitary Insufficiency in Children: Spectrum of MR Imaging Findings

### TEACHING POINTS

1. Hypo-functioning pituitary tissue may appear normal on MRI. 2. Congenital anomalies of hypothalamic-pituitary axis (HPA) often present with pituitary insufficiency in children and are frequently associated with additional CNS anomalies. 3. Normally developed but hypo-functioning pituitary tissue may demonstrate subtle imaging abnormalities such as small size or decreased enhancement. 4. Common infiltrative lesions resulting in pituitary insufficiency in children include germ cell tumors and histiocytosis. 5. Pituitary insufficiency can be seen as a long-term side effect of radiation treatment for pediatric posterior fossa tumors.

### TABLE OF CONTENTS/OUTLINE

1. Background a. Normal embryologic development of the HPA b. Characteristics of normal HPA on MR imaging, including quantitative assessment of pituitary gland enhancement c. Brief clinical overview of hypopituitarism in children 2. Case-based review highlighting the spectrum of abnormalities seen in 85 children with pituitary insufficiency seen at a tertiary care children's hospital over a 5-year period. a. Normal pituitary gland b. Subtle imaging abnormalities in otherwise well-formed HPA c. Congenital abnormalities affecting HPA i. Associated CNS anomalies d. Mass Lesions involving HPA i. Neoplasms ii. Non-neoplastic e. Post-radiation pituitary insufficiency

## NREE-112 Highways to the Danger Zone: Craniofacial to Cerebrovascular Anastomoses

### TEACHING POINTS

1) The etiology of vascular collateralization includes congenital and pathologic connections. 2) Cerebral angiography is the gold

1) The etiology of vascular collateralization includes congenital and pathologic connections. 2) Cerebral angiography is the gold standard for identifying extra- to intra-cranial collateralization. 3) Familiarity with the functional vascular territory schema for extra- to intra-cranial collaterals can help dictate appropriate and safe treatment.

#### TABLE OF CONTENTS/OUTLINE

1) Background a) Review of extra- to intra- cranial anastomosis. i) Developed in the setting of large artery occlusion, vascular agenesis, or high flow shunting due to "sump effect". ii) Small non-visualized collaterals can open in response to acutely increased intra-arterial pressure (e.g., embolization, superselective injection). iii) Anastomotic channels often follow cranial nerves. b) Review of normal cerebrovascular anatomy c) Extra- to intra- cranial anastomotic classification scheme i) Orbital ii) Petrocavernous-Clival iii) Cervical iv) Dural-Pial 2) Interactive case-based review of anastomotic channels organized by functional vascular territories a) Non-invasive imaging b) Cerebral angiography c) Interactive 3D-reconstruction 3) Implications for endovascular therapy a) Complications (e.g., stroke, cranial nerve palsy) b) Common angiographic markers to avoid injury (e.g., choroidal blush) c) Methods to avoid non-target embolization (e.g., balloon occlusion) 4) Summary

#### **NREE-113 Newly Recognized Neurodegenerative Conditions and Adult-onset Leukodystrophies: An Updated Guide in the Genomic Era**

Participants

Amit K. Agarwal, MD, MBBS, Jacksonville, FL (*Presenter*) Stockholder, Gilead Sciences, Inc

#### TEACHING POINTS

Teaching points 1. To discuss the recent updates in molecular markers and genetics for neurodegenerative conditions 2. To discuss radiological pattern recognition of the newly recognized neurodegenerative conditions and adult-onset leukodystrophies

#### TABLE OF CONTENTS/OUTLINE

1. Molecular markers and genetics a. Next generation sequencing b. Neurodegenerative genome panel c. Leukodystrophy genome panel 2. Classification of neurodegenerative conditions [NDD](focus on TDP-43) 3. Recently recognized NDD a. TDP-43 proteinopathies -Limbic-predominant age-related TDP-43 encephalopathy (LATE) - Facial onset sensory and motor neuronopathy (FOSMN) - Cerebral age-related TDP-43 with sclerosis (CARTS)- Multisystem proteinopathy (MSP) - Perry disease (DCTN1 mutations)b. Amyloidoses - Transthyretine-associated cerebral amyloidosis - Neuronal intranuclear hyaline inclusion disease (NIHID)c. Other (miscellaneous) -New brain iron accumulation NDD (BPAN, FAHN)- Chronic traumatic encephalopathy (tauopathy) - EPM1- Unverricht-Lundborg disease -4. Recently recognized adult-onset leukoencephalopathies a. CSF1R-leukoencephalopathy (hereditary diffuse leukoencephalopathy with spheroids) b. AARS2-leukoencephalopathy c. CARASIL (cerebral autosomal recessive arteriopathy) d. CARASAL (cathepsin A-related arteriopathy with strokes) e. COL4A1 and TREX1 associated leukoencephalopathiesf. Leukoencephalopathy with brainstem and cord involvement with elevated lactate (LBSL) g. Late-presenting hypomyelinating disorders (PLP1, GJC2, TUBB4A, POLR3A, POLR3B, CLCN2, NKX6-2)5. Simplified MRI approach for NDD6. Summary/conclusion

#### **NREE-114 Posterior Cranial Fossa Tumors: Tips and Tricks for Diagnosis**

Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the posterior cranial fossa (PCF). - Establish a proper differential diagnosis based on patient age and imaging findings. - Highlight the specific radiological features of the most common posterior cranial fossa tumors (PCFT).

#### TABLE OF CONTENTS/OUTLINE

The PCF is the infratentorial compartment of the cranial vault that houses the cerebellum, brainstem and fourth ventricle. Tumors that settle in this location have serious implications not only because of their potential malignancy but also because they can cause brainstem compression, herniation and hydrocephalus, among other complications. Tumor location and patient demographics, as well as imaging findings on CT or MR must be considered in order to establish a proper differential diagnosis. While cerebellar metastases are the most common PCFT in adults, medulloblastoma is the most common in children. Specific radiologic features have been described to differentiate PCFT, allowing the radiologist to make an accurate diagnosis. In addition, neuroimaging is also useful in surgical planning for these tumors. In this work we review the most common PCFT in patients of all ages, through cases studied in our center highlighting the key radiologic findings that enable us to make a correct diagnosis.

#### **NREE-115 Autoimmune Encephalitis: When Your Immune System Attacks Your Brain and MRI is Your Detective**

Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the pathophysiology and classification of autoimmune encephalitis. 2. Describe and illustrate characteristic MRI findings related to autoimmune encephalitis 3. Discuss the role of neuroradiology in the diagnostic work-up.

#### TABLE OF CONTENTS/OUTLINE

1. Teaching points 2. Introduction 3. Pathophysiology and classification 4. Clinical presentation and radiological findings 4.1 Autoimmune encephalitis with intracellular antigens (group I) 4.2. Autoimmune encephalitis with cell-surface directed antigens (group II) 5. Differential diagnosis 6. Summary and conclusions 7. Bibliography

#### **NREE-116 Insights into Neural Connections: Neuroimaging and Neuromodulation in Parkinson's Disease and Essential Tremor**

Participants

Sonoko Oshima, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Knowledge on neural connections in movement disorders is crucial to understand mechanisms of clinical manifestations, diagnose

the diseases, and maximize benefits and minimize side effects of therapies. The aim of this presentation is to improve radiologists' role in diagnosing and treating Parkinson's disease (PD) and essential tremor (ET) by 1) overviewing neural connections between cortex and deep gray matter and 2) discussing neuromodulation therapies for movement disorders including deep brain stimulation (DBS) and MR-guided focused ultrasound (MRgFUS) from the perspective of neural connections and neuroimaging.

#### TABLE OF CONTENTS/OUTLINE

1) Neural connections related to Parkinson's disease and essential tremor - Histological findings - Imaging findings 2) Neuromodulation therapies: deep brain stimulation (DBS) and MR-guided focused ultrasound (MRgFUS) - Neurophysiological mechanisms - Treatment targets: subthalamic nucleus (STN), globus pallidus interna (Gpi), ventral intermediate nucleus (Vim) of the thalamus - Localization of targets by imaging technique: indirect and direct targeting - Post-operative imaging

#### **NREE-117 Unraveling Dementia Imaging: Challenging Common Misconceptions and Exploring Emerging Conditions**

Participants  
Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Radiologists are generally unfamiliar with clinical and imaging features of common neurodegenerative diseases and wary of suggesting it in their reports. (2) AD, FTLD, PPA and DLB often present with classic, unambiguous appearances on CT, MRI and FDG PET. (3) PCA and CBDS have typical clinical and imaging presentations but are syndromes with multiple potential underlying causes. (4) As the US population ages and lifespans increase, mixed dementia and recently described, more indolent forms of neurodegenerative disease become more prevalent. (5) Newly recognized neurodegenerative diseases (CARTS, LATE and PART) share clinical and imaging features, and may mimic Alzheimer's disease.

#### TABLE OF CONTENTS/OUTLINE

(1) Neurodegenerative disease in everyday radiology (2) Classic clinical, MRI and FDG PET presentations of neurodegenerative diseases: Alzheimer's Disease, Frontotemporal Lobar Degeneration, Primary Progressive Aphasia, Dementia with Lewy Bodies, Vascular cognitive impairment (3) Challenges to neurodegenerative imaging workup: "Normal aging?", Specificity limits of MRI, FDG or Amyloid PET, Mixed dementia is common, Dementia with Lewy bodies (Mimic of both PD and AD, Current imaging limitations, Frequent comorbidity with AD), Confusion in radiology re: clinical-radiology syndromes (Specific diagnosis vs differential for underlying pathology, CBDS [corticobasal degeneration syndrome], PCA [posterior cortical atrophy], PPA [primary progressive aphasia], (4) Newly recognized indolent forms of neurodegeneration: Mimics of AD in patients > 75 years (CARTS, PART, LATE), Are there specific MRI and PET findings?

#### **NREE-118 Quick Diagnosis and Treatment - A Novel AIS Treatment Strategy using Hybrid Emergency Room System**

#### TEACHING POINTS

•A quick diagnosis is important to determine treatment indications for patients who have AIS. •HERS (Hybrid-Emergency Room System) is an all-in-one concept for an Emergency Room. HERS is useful in critical trauma treatment strategies as computed tomography, interventional radiology and surgery are available in one environment. •It is reported that using HERS for AIS, shortened the time to reperfusion. •With my study, we have setup an AIS protocol that allows a Time Based Strategy and Tissue Based Strategy using HERS.

#### TABLE OF CONTENTS/OUTLINE

•We established an AIS treatment strategy (one stop management) using HERS (Angio-CT suite). •HERS can go from diagnostic imaging to treatment without transferring the patient from department to department. •A one-stop stroke protocol with simultaneous CT perfusion and whole body CTA can determine treatment indications, optimize treatment planning, and ensure safety. •This novel protocol is useful for identifying occluded vessels, assessing brain function, and confirming access routes. •Using our approach, a quick diagnosis and quick treatment were possible in cases of acute aortic dissection, aortic aneurysm rupture, carotid artery stenosis, carotid artery dissection in patients suspected with AIS. •A one-stop stroke protocol using HERS can be confirmed to shorten the door-to-image and treatment time and increase the re-canalization rate.

#### **NREE-119 Don't Hold Your Breath: Reproducible Hypercapnic Stimuli for Cerebrovascular Reactivity Mapping with RespirAct**

Participants  
Diana Vera, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the fundamental physiology of hypercapnia and its association with cerebrovascular reactivity (CVR). 2. Explain the mechanisms and advantages of hypercapnic stimuli as generated by the RespirAct instrument as compared to conventional breath-hold techniques for BOLD fMRI-based CVR mapping. 3. Showcase representative examples of patients with cerebrovascular disease and CVR maps produced by RespirAct and BOLD fMRI.

#### TABLE OF CONTENTS/OUTLINE

I. Hypercapnia and its association with cerebrovascular reactivity (CVR) a. Fundamentals of CVR b. Importance of measuring CVR II. Design of the RespirAct device for the production of controlled hypercapnia a. Current established practice b. The RespirAct device description III. Comparison of RespirAct and conventional breath-hold methods of CVR mapping with BOLD fMRI a. A brief review of the origin of the BOLD signal b. RespirAct advantages over conventional breath-hold technique IV. Representative examples of CVR measurements with RespirAct in the context of a. Cerebrovascular steno-occlusive diseases b. Arteriovenous malformations c. Brain tumors V. Summary/Conclusion

#### **NREE-12 Spinal Vascular Malformations: A Systematic Angioarchitecture and Pathophysiology-Based Approach to Classification and Diagnosis**

Participants

Charlotte Chung, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Spinal vascular malformation refers to a spectrum of lesions with abnormal connection between (or morphology of) spinal arteries and veins, all of which differ in angioarchitecture, pathophysiology, and clinical sequelae. Advances in angiographic and non-invasive imaging techniques have improved spinal vasculature visualization, enabling identification of distinctive morphologic and hemodynamic features. This exhibit introduces a comprehensive classification system based on these imaging features to aid diagnosis of well recognized as well as rare/recently identified spinal vascular lesions. The educational objectives of this exhibit are:- Review normal spinal vascular anatomy.- Discuss multimodal imaging techniques for evaluating spinal vascular malformations.- Differentiate spinal vascular malformations based on location, angioarchitecture, pathophysiology, and symptomology.- Illustrate radiographic appearance of spinal vascular malformations including arteriovenous fistulas and malformations, and non-shunting lesions such as aneurysms.

#### TABLE OF CONTENTS/OUTLINE

I. Annotated diagrams of normal spinal arterial and venous anatomy  
II. Imaging techniques for spinal vascular malformation evaluation  
III. Systematic classification of spinal vascular malformations  
IV. Radiographic features of various spinal vascular malformations  
V. Radiographic mimics

#### **NREE-120 Uncovering the Hidden Dangers: Addressing Diagnostic Errors in Brain Emergency Neuroradiology**

Participants

Maria Lucia Brun, MD, OTTAWA, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To explain the importance of accurate and timely diagnosis in brain emergency neuroradiology. - To describe the different types of diagnostic errors in brain emergency neuroradiology. - To identify the potential causes of diagnostic errors and to develop effective strategies for error prevention and mitigation in emergency neuroradiology. - Case-based series examples to highlight different error types and the factors that led to the errors.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Background  
3. Types of errors:- Cognitive errors: biases or heuristics that influence the radiologist's thinking or decision-making (Framing, Anchoring, Alliterative, Satisfaction of search, Availability, Attribution).- Communication errors: Breakdown in communication.- Perception/perceptual errors: Misinterpretation or misperception.- Technical errors: Limitations in the imaging equipment or technique used. - Organizational errors: Factors outside of the radiologist's control (workload, staffing issues, etc)  
4. Consequences of errors- Delayed/missed diagnoses- Incorrect/unnecessary treatments - Patient harm- Legal and financial consequences  
5. Strategies for error prevention and mitigation in emergency neuroradiology- Valuable tools to reduce errors in the imaging evaluation of brain emergencies- Showcase the particular strategies used at our departments.  
6. Case series examples- Provide case examples to further illustrate and explain the statements mentioned above.- Highlight the factors that led to the errors and how they could have been prevented or mitigated in that particular case.  
7. Conclusion

#### **NREE-121 A Game-Changing Approach to Non-Invasive Vascular Imaging: Ultra High-Resolution CT with Novel Deep Learning Reconstruction**

#### TEACHING POINTS

1. To learn the basic principles of ultra high-resolution CT (UHRCT).  
2. To learn the basic principles of the novel reconstruction technology "deep learning reconstruction (DLR)".  
3. To know the differences in image quality between DLR and conventional reconstruction methods on brain CTA using UHRCT.  
4. Clinical applications of brain CTA with DLR using UHRCT and comparison with digital subtraction angiography (DSA).  
5. To know the pitfalls of CTA with DLR and DSA on cerebral diseases.  
6. To present the outlook of brain CTA with DLR using UHRCT in the near future.

#### TABLE OF CONTENTS/OUTLINE

1. Basic principles of UHRCT  
2. Basic principles of the novel imaging reconstruction method "DLR"  
3. The image quality of DLR and conventional reconstruction methods on brain CTA using UHRCT  
4. Clinical applications of brain CTA with DLR using UHRCT and DSA to evaluate the following diseases  
intracranial aneurysms  
moyamoya disease  
arteriovenous malformations (AVMs)  
dural arteriovenous fistulas (dAVFs)  
giant cell arteritis  
tumors (skull tumor, meningioma, schwannoma, glioma, and so on)  
5. Pitfalls of CTA and DSA  
6. The future outlook of brain CTA with DLR using UHRCT

#### **NREE-122 Erdheim-Chester Disease Beyond MSK: Do You Know What to Look for in Brain MRI?**

Participants

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To explain and illustrate the main neuroradiological findings in Erdheim-Chester Disease (ECD), an uncommon type of systemic histiocytosis with almost constant bone involvement. 2. To learn the prognostic implications of certain neuroradiological findings. 3. Much of the literature on this subject focuses on its musculoskeletal findings. However, neuroradiological manifestations are an important source of morbidity and mortality in these patients.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: 1.1. Main systemic manifestations of ECD: establishing a context. 1.2. The BRAF mutation and its (neuro)imaging implications. 2. Neuroradiological findings: 2.1. Introduction: Classification and frequency of neurological manifestations. MRI protocol. 2.2. Intra-axial involvement. Typically infratentorial. 2.3. Hypothalamic-pituitary manifestations. Several patterns. 2.4. Meningeal involvement: Different patterns. Masses often present a diagnostic challenge. 2.5. Orbital involvement. Do not forget the orbits in your systematic search. 3. Conclusions 4. References

#### **NREE-123 Neurocysticercosis: Findings from a Challenge Disease in the Third World**

#### TEACHING POINTS

The purposes of this exhibit are: review and illustrate the imaging findings of neurocysticercosis, the differential diagnoses, and their correlation with pathological images. Describe through illustrative presentations the benefits of the multimodality imaging approach to the diagnosis of neurocysticercosis. Present challenging cases, such as pseudotumoral lesions. Establish the imaging red flags and how they can help the radiologist reach the correct diagnosis.

#### **TABLE OF CONTENTS/OUTLINE**

Neurocysticercosis stages and parasite life cycle. Imaging patterns on MR and CT. Susceptibility weighted imaging (SWI) role on calcified lesions. Diffusion-weighted imaging (DWI) showing the scolex. Spectroscopy as a valuable tool for differential diagnosis. 3D CISS sequence applicability for subarachnoid lesions. Vessel wall imaging sequence showing vasculitis with or without infarction. Pseudotumoral lesions. Differential diagnoses based on a pictorial review using representative cases from a Tertiary University Hospital database. A practical approach for better diagnostic accuracy and avoiding pitfalls. Final remarks.

#### **NREE-124 Evaluation of Head and Spinal CT Angiography with Photon-counting Detector CT: How Close to the Angiographic and Operative Findings**

##### **TEACHING POINTS**

The purpose of this exhibit is: 1) To review imaging of head and spinal CT angiography with photon-counting detector CT 2) To correlate with angiography and intraoperative findings.

#### **TABLE OF CONTENTS/OUTLINE**

Recently, Photon-counting detector (PCD-CT) has been developed and enabling high-resolution imaging at a lower radiation dose. PCD-CT employs a photon-counting detector that can measure the number of incident X-ray photons and their energy. The newly released PCD-CT (NAEOTOM Alpha, Siemens Healthineers, Forchheim, Germany) has been in clinical use at our institution since December 2022. The PCD-CT offers several advantages over current state-of-the-art energy-integrating detector CT (EID-CT). The PCD-CT does not require septa to create a detector channel but does EID-CT. Therefore, it can be seen that downsizing the anode to achieve higher resolution does not affect the dose efficiency of the PCD-CT. The purpose of our exhibit is to present head and spinal cord CT angiographic images acquired with PCD-CT and corresponding images acquired angiographically and intraoperatively to clarify the delineation potential of PCD-CT. In spinal arterio-venous fistula (AVF), feeder, shunted pouch, and drainer are depicted in CTA. In spinal tumor of hemangioblastoma, tumor drainer is recognized in CTA. We would like to provide insight into how close the PCD-CTA findings are to the angiographic and intraoperative findings.

#### **NREE-125 MRI Analysis of Causes and Consequences of Acute Epileptic Seizures from Temporal Lobe Origin**

Participants

Silvana Sarria Estrada I, MD, PhD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

MRI is useful to diagnose the cause and functional changes associated with acute seizures or status epilepticus (SE) from temporal lobe origin. Several MRI abnormalities on diffusion/perfusion-weighted, T2-weighted and contrast-enhanced T1-weighted sequences, observed after acute seizures in chronic conditions, even distant from the temporal lobe, are relevant to detect changes in the evolution. The identification of inflammatory component on MRI after a new onset temporal lobe seizure impacts the prognosis of infectious or autoimmune encephalitis, stroke or malignant tumours. Acute MRI findings in new onset seizures or SE are often subtle or unspecific. Timing of serial follow-up MRIs must be protocolized. Increase of amygdalar enlargements, hippocampal atrophy or autoimmune epilepsies can be detected using time defined follow-up MRI studies. In conclusion, a standardized MRI protocol for acute seizures and SE that analyses structure and function of the temporal lobe can lead to an early diagnosis of severe and chronic disorders. The time intervals between serial follow-up MRIs are relevant to avoid further consequences.

#### **TABLE OF CONTENTS/OUTLINE**

1 Temporal lobe seizures are often associate with ictal MRI abnormalities. 2 Acute MRI can diagnose acute seizures or status epilepticus. 3 Some MRI features, even distant from chronic lesions, may suggest change in evolution. 4 Early MTI features in new onset seizures can lead to the diagnostic of chronic conditions. 5 Time-defined serial MR scans are needed in cases of subtle or unspecific MRI features.

#### **NREE-126 The Haunted Core in Acute Ischemic Stroke**

##### **TEACHING POINTS**

Perfusion-based imaging used in the evaluation of tissue viability is crucial in the management of patients with acute ischemic stroke (AIS), especially in extended time windows. Currently used imaging techniques in AIS cannot accurately differentiate between salvageable and non-salvageable tissue. There is no widespread gold standard definition of ischemic core. Different findings highlighting current challenges and solutions in AIS imaging will be presented through clinical cases.

#### **TABLE OF CONTENTS/OUTLINE**

Perfusion-based CT and MR imaging techniques are used for detection of AIS and evaluation of tissue viability. At present, common available imaging techniques fail to accurately differentiate between salvageable and non-salvageable ischemic tissue. Additionally, a widespread gold standard definition of the ischemic core is lacking. Through clinical cases, image findings highlighting challenges and solutions in the evaluation of tissue viability will be discussed, like limited sensitivity to detect early ischemic changes on non-contrast enhanced CT (NCCT), variation in outcome after successful recanalization, potential reversibility of DWI-lesions, false negative initial DWI, overestimation of ischemic core on perfusion computed tomography and variation in penumbra and core volume calculations. Considering the important role of imaging in the management of patients with AIS, it is crucial with profound knowledge about advantages and limitations of penumbra and core evaluation. The teaching points will be extensively illustrated through clinical imaging examples.

#### **NREE-127 Cavernous Sinus Dural Arteriovenous Fistulas: Relevant Vascular Anatomy, Angioarchitecture and Endovascular Treatments**

Participants

Hiro Kiyosue, MD, (*Presenter*) Research Grant, Koninklijke Philips NV



## TEACHING POINTS

Dural arteriovenous fistulas (DAVFs) frequently involve the cavernous sinus (CS). Although CSDAVFs are usually associated with benign ocular symptoms, they can cause aggressive symptoms such as cerebral hemorrhage. Those symptoms are strongly related to the pattern of venous drainage. Recent advances of imaging and therapeutic technologies allow us to evaluate their angioarchitecture precisely and to treat them effectively by endovascular techniques. However, serious complications such as fetal hemorrhage and infarction can occur during and after embolization mainly due to overlooking of tiny but important vessels relevant to CSDAVFs. This presentation demonstrates imaging anatomy of important vessels relevant to the CS, angioarchitecture of CSDAVF, and tips and tricks for successful endovascular treatments. CS is derived from three different venous systems of prootic sinus, duro-osseous venous plexus, and primitive tentorial sinus. Anatomical variations occur during development of CS. The CSDAVFs are fed by multiple feeders from the internal and external carotid arteries, which converge to form shunted pouches adjacent to the CS. The CSDAVFs are effectively occluded by selective embolization of those shunted pouches. Inadequate embolization of the venous outflow may lead serious complication.

## TABLE OF CONTENTS/OUTLINE

1. Relevant vascular anatomy:1-1. Arterial branches to the CS and their potential anastomoses.1-2. Venous tributary and their variations.2. Angioarchitecture of CSDAVF: common feeders, shunted pouches, and dangerous drainage routes3. Endovascular techniques: various access routes, selective transvenous embolization, and sinus packing

## NREE-128 Understanding Perisylvian Cortical Anatomy: Tips and Tricks

Participants

Sally Choi, MD, BS, San Antonio, TX (*Presenter*) Nothing to Disclose

## TEACHING POINTS

- Perisylvian area serves as a crossroad for important cortical structures with principal functions for example Broca's area is located along the anterior and ascending rami of the sylvian fissure (M sign) o Wernicke area is classically located along the inferior aspect of the posterior ramus of the Sylvian fissure
- Important structures form this area areo Frontal operculum Parietal operculum Temporal operculum Insula
- Knowing these structures is beneficial for a radiologist in describing the anatomical component of a lesion to better understand the physiologic symptoms corresponding to the lesion location with surgical and prognostic importance.

## TABLE OF CONTENTS/OUTLINE

- Briefly discuss the sylvian fissure anatomy
- Discuss the different cortical structures form the perisylvian area such as frontal, parietal and temporal operculum and insula.
- Discuss the MRI anatomy of these structures utilizing some tips and tricks to understand the anatomy such as- M shaped appearance of the inferior frontal gyrus along the anterior and ascending rami of the sylvian fissure
- Discuss the role of these cortical structures in the principal functions of the body.
- Discuss the role of relevance of Functional MRI in these areas

## NREE-129 The Cortico-Limbo-Thalamo-Cortical Circuits: An Update to the Papez Circuit of the Limbic System

Participants

Parnian Shobeiri, MD, MPH, Tehran, (*Presenter*) Nothing to Disclose

## TEACHING POINTS

? The Papez circuit is a circuit believed to control memory and emotion, composed of the cingulate cortex, entorhinal cortex, parahippocampal gyrus, hippocampus, hypothalamus, and thalamus. ? In recent years, multiple additional limbic fiber connectivity has been revealed using diffusion-weighted imaging (DWI) techniques. Some of these fiber tracts include the amygdalofugal tract (AFT), amygdalothalamic tract (ATT), stria terminalis (ST), dorsal thalamo-hypothalamic tract (DTH), cerebello-hypothalamic tracts, and the parieto-occipito-hypothalamic tract (POHT) ? This presentation aims to summarize the anatomy of the limbic system, outline previous updates to the circuit, and elaborate on the anatomical connectivity of the limbic circuits based on recent DWI as an update to the original Papez circuit.

## TABLE OF CONTENTS/OUTLINE

? The original Papez circuit and updates over time ? The Yakovlev model/circuit ? The MacLean's model ? Overview of high spatial resolution diffusion weighted imaging ? Review of previously established Papez circuit (See Figures 1 5 for specific tracts) ? Detailed fiber tract anatomy ? Updates to previously known limbic circuits: the role of additional fibers in creating multiple neuronal loops and circuits

## NREE-13 Mapping the Way: A Road Map for Diagnosing, Treatment and Follow Up of Brain Metastases

Participants

Julia Brunelli, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

This educational exhibition aims to provide a comprehensive overview of the imaging evaluation of patients with suspected brain metastases, emphasizing the prevalence and potential diagnostic challenges associated with these neoplasms. It will highlight specific imaging patterns, differential diagnoses, and potential pitfalls in imaging interpretation. The exhibition will also discuss the clinical and imaging features that suggest the etiology of primary tumors, including a pictorial essay of specific patterns. Additionally, it will review radiological criteria for diagnosing radionecrosis, pseudoprogression, and disease progression in brain metastases patients and emphasize the importance of advanced imaging techniques. Case studies will be used to illustrate radiological challenges and diagnostic considerations in the treatment and follow-up of these patients.

## TABLE OF CONTENTS/OUTLINE

1. Imaging Evaluation of Patients with Suspected Brain Metastases

- Overview of intracranial metastases as the most common adult intracranial neoplasms and their imaging evaluation
- Imaging patterns and differential diagnoses
- Mimickers and pitfalls in imaging interpretation

2. Etiology of the Primary Tumor

- Clinical and imaging features suggestive of the primary tumor
- Pictorial essay of brain metastases with specific patterns

3. Treatment and Follow-up

- Radiological criteria for diagnosing radionecrosis, pseudoprogression, and disease progression
- Case studies illustrating radiological challenges in distinguishing these conditions

## **NREE-130 CNS Imaging of the Immunocompromised - An Opportunistic Review for the Radiologist**

Participants

Luis Colon Flores, MD, Oceanside, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) Review the main imaging findings of the different opportunistic infections. 2) Review and recognize the different HIV/AIDS associated CNS conditions. 3) Discuss the imaging findings of immunodeficiency-associated primary CNS lymphomas.

### **TABLE OF CONTENTS/OUTLINE**

1) Introduction 2) Opportunistic infections (Bacterial, viral, fungal and parasitic) 3) HIV/AIDS CNS associated conditions 4) Immunodeficiency-associated primary CNS lymphoma 5) Conclusion

## **NREE-131 The Ultimate Imaging Companion to Vascular Complications in Cancer Patients: A Comprehensive Review for Radiologists**

Participants

Jessica De Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Vascular complications are a significant cause of morbidity and mortality in cancer patients, with increasing incidence due to improved survival and evolving treatments. Oncologic patients are more prone to vascular complication such as hypercoagulability state, reduction in mobility and aggressive treatments as brain radiation. These complications may occur at disease presentation or be secondary to treatment. Our aim is to review the main imaging findings of vascular complications in a didactic way. We believe this approach may facilitate diagnostic suspicion.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: Review main intracranial vascular complications in oncology patients, with an emphasis on the pathophysiological mechanisms involved. To display a flowchart dividing these complications according to treatment status and treatments applied. To discuss for each vascular complication the risk factors, clinical presentation, main imaging findings and relevant treatments. The discussion will be enriched with illustrative cases, including: Complications before treatment: Hypercoagulability (Trousseau syndrome, cerebral venous thrombosis). Vascular compression/ obstruction by the tumor or Vascular compression/ obstruction due to brain herniation. Intravascular tumor dissemination (oncotic aneurysm and intravascular lymphoma). Complications during treatment: Post-operative ischemia Late complications after treatment: Aneurysm after radiotherapy, SMART, Radiation induced cavernous malformations. To highlight the most relevant clinical and imaging aspects of these vascular complications, essential for prompt diagnosis and treatment.

## **NREE-132 Skull Drip: Algorithmic Multimodality Imaging Approach**

Participants

Pokhraj Suthar, MD, Chicago, IL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Briefly discuss various causes and sites of skull base CSF leak. To learn the diagnostic imaging findings of various modalities including high resolution NECT, CT cisternogram, MRI and radiotracer studies, in identifying the cause and localizing the exact site of skull base CSF leaks. To learn the algorithmic imaging approach and how it is helpful for surgical planning in cases of skull base CSF leak. To diagnose recurrent leaks in post-surgical repair of primary CSF leak

### **TABLE OF CONTENTS/OUTLINE**

Cerebrospinal fluid (CSF) leaks are extracranial leaks of CSF via an osteodural defect in the skull base into the tympanomastoid cavity, paranasal sinus, or rarely in the skull base neck space. There are various etiologies for the same, including accidental trauma, congenital malformation, spontaneous leaks in idiopathic intracranial hypertension and iatrogenic. Accurate localization of the site of the leak and identification of the underlying cause is necessary for surgical planning to avoid associated complications and prevent recurrence. In this educational exhibit, we outline the various interesting cases of skull base defects, their multimodality algorithmic imaging diagnosis approach (CT, MRI, CT/MR/Nuclear medicine radionuclide cisternography), correlation of imaging diagnosed skull base defect with surgical outcome, and imaging diagnosis of recurrent CSF leaks.

## **NREE-133 The Ternary Plot Analysis of Time-sensitive Diffusion Imaging in CNS Pathologies**

Participants

Toshiaki Taoka, MD, PhD, , Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation

### **TEACHING POINTS**

Time-sensitive diffusion imaging provides potentially valuable information on tissue characteristics, with the oscillating gradient spin-echo (OGSE) method enabling short diffusion times compared to the conventional pulsed-field gradient spin-echo (PGSE) method. Comparing the signal on OGSE and PGSE can provide information on tissue compartmentalization. However, comparing different images can make interpretation challenging, and organizing pixel information is necessary. The ternary plot method presents the relationship between diffusivity, compartmentalization, and water content for a single pixel, simplifying the presentation of tissue characteristics obtained from OGSE, PGSE, and  $b=0$  images. This educational exhibit demonstrates the tissue characteristics of various central nervous system pathologies provided by time-sensitive diffusion imaging using the triangulation method of the ternary plot. The ternary plot method has further applications, including the color coding of the pixels according to the tissue characteristics.

### **TABLE OF CONTENTS/OUTLINE**

1. Overview of time dependence of diffusion MRI 2. Methods for displaying time-dependent diffusion-related coefficients. 3. Distribution of the time-dependent diffusion-related coefficients on ternary plot 4. Further application of ternary plot method

## **NREE-134 A Review of Imaging Findings in Neurogenic Ptosis**

## TEACHING POINTS

To understand the anatomy of the neural pathways that innervate the upper eyelid retractor muscles (e.g. oculosympathetic pathway and oculomotor nerve pathway). To describe the normal cross-sectional anatomy of the neural pathways causing neurogenic ptosis. To illustrate the imaging findings of various lesions causing neurogenic ptosis according to a course-based approach.

## TABLE OF CONTENTS/OUTLINE

Introduction and general overview of ptosis / Anatomic review and imaging-based normal cross-sectional anatomy of the neural pathways innervating the upper eyelid retractor muscles (oculosympathetic and oculomotor pathway) / A variety of pathologic conditions causing neurogenic ptosis according to a course-based approach 1. Oculomotor nerve palsy (oculomotor nerve pathway) - Intra-axial segment - Cisternal segment - Cavernous segment - Orbital segment 2. Horner's syndrome (oculosympathetic pathway) - Central neuron - Preganglionic neuron - Postganglionic neuron 3. Neuromuscular junction disorders / Summary and conclusion

## NREE-135 Epilepsy Surgery: Nuts and Bolts for Radiologists

Participants

Jack Yang, Lexington, MA (*Presenter*) Nothing to Disclose

## TEACHING POINTS

A broad range of surgical procedures are available for medically refractory epilepsy from open parenchymal resections to more recent minimally-invasive ablative therapies. In this exhibit, we outline the scope and techniques of these surgical procedures, role of neuroimaging, expected post surgical imaging findings and associated complications. We describe neuroimaging role in subdural or depth electrode placement, an invasive diagnostic surgical procedure for more precise localization of epileptogenic focus. We briefly outline the MRI safety issues in imaging patients with neuromodulation devices.

## TABLE OF CONTENTS/OUTLINE

Table of Contents: I. Epilepsy surgery: Evolution II. Types of surgical procedures: Scope and Techniques A. Surgery for localization of epileptogenic focus: a. Invasive procedure - Subdural grid and strip placement. b. Minimally-invasive procedure - Stereo-EEG B. Surgery for refractory epilepsy a. Invasive procedures: Resection - 1. Hemispherectomy 2. Lobar resection 3. Lesionectomy. Disconnection - 1. Conventional corpus callosotomy 2. Multiple subpial resections. b. Minimally- or less-invasive procedures: Ablative therapies - 1. Laser Interstitial thermal therapy (LITT) 2. MR guided focused US 3. Gamma knife. Neuromodulation procedures - 1. Vagal nerve stimulation (VNS) 2. Deep brain stimulation (DBS) 3. Responsive neurostimulation (RNS) III. MRI safety issues in imaging epilepsy patients with implants and electrodes

## NREE-136 Exploring the FDA Pharmacovigilance Database to Assess the Importance of Symptoms Associated with Gadolinium Exposure (SAGE)

Participants

Eric Lancelot, PhD, Roissy CDG CEDEX, France (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Analysis of FDA pharmacovigilance database to determine safety of gadolinium based contrast media.

## TABLE OF CONTENTS/OUTLINE

**Objective** The aim of this study was to assess the tendency of adverse events representing "symptoms associated with gadolinium exposure" (SAGE) among the bulk of safety experiences reported to health authorities. **Materials and Methods** SAGE symptoms were searched by preferred terms (PTs) in different system organ class (SOC) categories in the FDA Adverse Event Reporting System (FAERS) database over a 5-year period ranging from 2014 to 2019. The numbers of SAGE symptoms per PT, and cumulatively per SOC, were recorded and their weights in the overall spectrum of AEs were determined for 3 linear and 3 macrocyclic GBCAs. **Results:** The analysis of FAERS data revealed a significantly higher SAGE weight for linear GBCAs, namely gadodiamide (23.27%), gadopentetate dimeglumine (22.12%) and gadobenate dimeglumine (19.27%), than for the macrocyclic GBCAs, namely gadoteridol (8.45%), gadobutrol (4.53%) and gadoterate meglumine (3.82%). The SOCs "musculoskeletal and connective tissue disorders", "nervous system disorders", "general disorders and administration site conditions" and "psychiatric disorders" were consistent with this ranking. Moreover, SAGE weights displayed a steady growth of about 5% per year for the linear GBCAs and 1% per year for the macrocyclic agents. **Conclusion** This study showed that SAGE symptoms may be more prevalent with linear than macrocyclic GBCAs, and that SAGE reporting tends to rise significantly more in patients exposed to linear agents. These differences might be explained by the differences in kinetic stability between the GBCAs.

## NREE-137 2022 Updated Diagnostic Criteria of Neurofibromatosis Type 2 and CNS Tumor Manifestations: Imaging Findings, Histological Features, and Assessment of Treatment Effect

Participants

Yoshiaki Ota, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. The diagnostic criteria of NF2 has been revised in 2022 as well as that of schwannomatosis and radiologists should be familiar with the revision. 2. Vestibular schwannomas, meningiomas, other cranial nerve schwannomas, ependymomas, and astrocytomas can be related to NF2. 3. DWI, DSC-MRI, and DCE-MRI can allow for more detailed characterization, tumor differentiation, treatment response assessment, and gene mutation in NF2 patients.

## TABLE OF CONTENTS/OUTLINE

1. 2022 revised diagnostic criteria of NF2A diagnosis of NF2 can be made when an individual has one of the following: a) Bilateral vestibular schwannomas (VS) b) An identical NF2 pathogenic variant in at least 2 anatomically distinct NF2-related tumors (schwannoma, meningioma, and/or ependymoma). c) Either 2 major or 1 major and 2 minor criteria as described in the following: Major criteria: 1) Unilateral VS, 2) First-degree relative other than sibling with NF2-related schwannomatosis, 3) Two or more

meningiomas (Note: single meningioma qualifies as minor criteria). Minor criteria: Can count >1 of a type: Ependymoma, meningioma, schwannoma<sup>2</sup>. Common imaging features and clinical/pathological characteristics of NF2-related CNS tumors: (a) Vestibular schwannoma (b) Trigeminal schwannoma (c) Meningioma (d) Spinal Ependymoma (e) Spinal astrocytoma<sup>3</sup>. Treatment options and imaging assessment of treatment response: (a) Conventional imaging (CT, MRI) (b) Advanced imaging (DWI, DSC-MRI, and DCE-MRI)<sup>4</sup>. Other familial schwannomatosis (SMARCB1 and LZTR1) and meningiomatosis (SMARCB1, SMARCE1, SUFU, and PDGFB)

## **NREE-138 The Radiologist's Guide to Lumbar Spine Pain Procedures: Indications, Techniques and Complications**

### **TEACHING POINTS**

Less than 3 percent of the 4 million annual pain procedures are performed by radiologists, despite having the unique ability to correlate imaging findings with clinical features for targeted pain interventions. This exhibit is aimed at educating the radiologists regarding indications, planning, techniques and challenges of common lumbar pain procedures, with emphasis on 'how to' perform transforaminal and interlaminar epidural spinal injections (ESI). Other technically demanding pain procedures including dorsal transforaminal S1 ESI, synovial cyst rupture and blood patches will be discussed, along with tips and tricks for performing challenging interventions in postoperative, scoliotic and degenerative spine.

### **TABLE OF CONTENTS/OUTLINE**

1. Relevant Lumbar Spine anatomy and fluoroscopic positioning 2. Clinico-radiologic correlation- Clinical examination, patient counselling, selecting the right procedure. 3. Procedure and tray setup 4. Transforaminal ESI- 'how to' approach the target, pre and post contrast injection views. • Supra-neural TFESI • Infra-neural TFESI 5. Interlaminar ESI- • Optimal needle positioning in multiplanar imaging • Recognizing suboptimal needle location 6. Dorsal S1 ESI- recognizing landmarks and optimal views for needle positioning. 7. Other pain relief procedures • Synovial cyst rupture- Direct (IL/TF) and Indirect Techniques • Epidural blood patch 8. Challenging cases and difficult myelograms • Scoliotic and degenerative spine • Postoperative spine 9. Pearls and pitfalls- complications and how to prevent them.

## **NREE-139 From Genes to Emergencies: An Innovative Approach to Imaging Assessment, Genetic Aspects, and Emergency Room Evaluation in CADASIL**

Participants

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

This educational exhibit aims to provide a comprehensive understanding of cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) disease, including: To illustrate the imaging highlights of the cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL). To exhibit the genetic cascade involved in the disease. To explain the imaging approach to the disease within the context of acute stroke in the emergency. To illustrate the differential diagnosis, including cerebral autosomal recessive arteriopathy with subcortical infarcts and leukoencephalopathy (CARASIL) and white matter diseases.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction and revision of CADASIL's epidemiology, clinical presentation, and etiology. 2. MRI highlights in CADASIL. 3. Genetic considerations associated with CADASIL. 4. Differential diagnosis, including CARASIL and other white matter diseases. 5. Imaging assessment in the emergency room. 6. Take-home messages.

## **NREE-14 An Imaging Review of Autoimmune Encephalitis: An Often-Overlooked Diagnosis**

Participants

Miriam Fernandez-Gomez, MD, Almeria, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- To understand the many signs, symptoms, and types of autoimmune encephalitis. - To Review the main antibodies that have been identified, their patterns of CNS involvement, and their typical anatomical distributions due to the relative concentration of target proteins. - To Highlight the characteristic MRI findings associated with autoimmune encephalitis, with specific emphasis on the role of neuroimaging in the diagnostic work-up. - Finally, to describe a case report of anti-LGI1 autoimmune encephalitis associated with SARS-CoV-2 (COVID-19).

### **TABLE OF CONTENTS/OUTLINE**

TABLE OF CONTENTS  
I. Introduction  
Introduce the topic of autoimmune encephalitis  
II. Understanding Autoimmune Encephalitis  
Define autoimmune encephalitis  
Discuss the symptoms of autoimmune encephalitis  
Explain the pathophysiology of autoimmune encephalitis  
Describe the different types of autoimmune encephalitis  
III. MR Imaging Findings Associated with Autoimmune Encephalitis  
Discuss the characteristic MRI findings associated with autoimmune encephalitis  
Emphasize the role of neuroimaging in the diagnostic work-up  
IV. Autoimmune Encephalitis in SARS-CoV-2 Infection (COVID-19): Illustrative Case  
Describe a case report of anti-LGI1 autoimmune encephalitis associated with SARS-CoV-2 (COVID-19)  
V. Conclusion  
Summarize the key points of the paper  
Discuss the importance of recognizing and diagnosing autoimmune encephalitis

## **NREE-140 Predictors of Intracerebral Hemorrhage Expansion on CT**

### **TEACHING POINTS**

1. Review classification of intracranial hemorrhages and define hemorrhage expansion  
2. Importance of identifying intracranial hemorrhage expansion  
3. Describe findings on imaging that can predict hemorrhage expansion  
Intracerebral hemorrhage (ICH) results in 10-20% of all strokes and leaves 60-80% of survivors functionally dependent. Identifying early hematoma expansion (HE), defined as growth >12.5 mL or volume >33%, is crucial for modifying its potential impact. Three accepted HE indicators in non-contrast computed tomography include baseline hematoma volume as measured by the ABC/2 method. Secondly, irregularly hemorrhage shape indicating multiple leaking blood vessels. Radiologically, the satellite sign and island sign are imaging correlates that indicate irregular hemorrhage shape. Lastly, the imaging density heterogeneity of the hematoma can represent active bleeding. Three signs that represent heterogeneity of the hematoma include the swirl, black hole, and blend sign.

### **TABLE OF CONTENTS/OUTLINE**

1. Classification of intracranial hemorrhage. Intra-axial hemorrhage. Extra-axial hemorrhage. 2. Defining hematoma expansion (HE). 3. Importance of identifying intracerebral hemorrhage expansion. a. Relative incidence. b. Prognostic indicator. 4. Clinical aspects that increase risk of hematoma expansion. a. Systolic BP and onset to CT time. b. Prior anticoagulant therapy. c. hyperglycemia. 5. Radiological signs of hemorrhage expansion. a. Hematoma shape/volume/location. b. Perihematomal edema. c. Hematocrit levels. d. Spot sign. e. Satellite sign, Island sign, Swirl sign, Blend sign and Black hole sign

#### **NREE-141 Beyond the Blind Spots: A Comprehensive Approach to Reducing Diagnostic Errors in Neuroradiology in the Emergency Room for Enhanced Patient Safety**

Participants

Heber Colares Costa, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To exhibit a timely and accurate diagnosis of neurological conditions like stroke, brain tumors, and traumatic brain injury, providing effective treatment. To show misdiagnosis or diagnosis delays due to errors in imaging evaluation that can seriously harm the patient, including permanent neurological deficits or death. To prevent unnecessary interventions or treatments, inhibiting inaccurate interpretation of imaging studies and unnecessary surgeries, medications, or other medicines that can harm the patient physically and financially. To avoid significant medicolegal consequences.

##### **TABLE OF CONTENTS/OUTLINE**

1. Revision of epidemiology, pathology, and demographics of neuroradiologic emergencies. 2. Imaging evaluation of the emergency room's crucial and prevalent neuroradiologic diseases. 3. Potential imaging pitfalls in neuroradiologic emergencies and how to avoid them. 4. Potential causes of imaging medical errors, including night periods, fatigue and exhaustion of radiologists, a large volume of examinations, and short evaluation times. 5. The consequences of errors in neuroradiological imaging evaluation in the emergency room, including delays in stroke recanalization therapy, misdiagnoses of intracranial hemorrhages, dural venous sinus thrombosis, and inadequate treatment for these conditions. 6. Highlights on medicolegal issues and reputational damage for healthcare providers and hospitals. 7. How to ensure that hospitals and healthcare providers can reduce the risk of misdiagnosis, unnecessary interventions, and legal consequences, ultimately leading to better patient outcomes. 8. Take-home messages.

#### **NREE-142 The Uncharted Territory of Neurodegeneration: Keeping Pace with the Latest Advances in Imaging Diagnosis and Novel Therapies for Degenerative Diseases**

Participants

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Brain neurodegenerative diseases are a group of disorders characterized by progressive damage and loss of neurons in the brain. These diseases include Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS), among others. Recent advances in imaging diagnosis and novel therapies have shown promising results in improving the diagnosis and treatment of these conditions. The study aims to: To explain the imaging features, genetic cascade, and physiopathology involved in neurodegenerative diseases. To exhibit that advanced imaging techniques have significantly improved the diagnosis of brain neurodegenerative diseases. To explain the imaging approach to the diseases, differential diagnosis, and current therapeutics.

##### **TABLE OF CONTENTS/OUTLINE**

1. Revision of epidemiology, clinical presentation, and etiology of neurodegenerative diseases. 2. Genetical considerations. 3. The role of magnetic resonance imaging (MRI) and functional MRI (fMRI) in identifying structural changes in the brain associated with neurodegeneration. 4. Positron emission tomography (PET) in assessing amyloid plaques and tau protein in the brain, characteristic features of Alzheimer's disease. 5. Novel therapies for neurodegenerative brain diseases, including immunotherapy, gene therapy, stem cell therapy, neuroprotection with drugs, and deep brain stimulation. 6. Differential diagnosis. 7. Take-home messages.

#### **NREE-143 Exploring the Depths of Pediatric Posterior Fossa Tumors: Integrating Molecular Analysis and Magnetic Resonance Imaging for Unprecedented Diagnosis and Prognosis**

Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To illustrate the imaging diversity of these tumors, including a range of histological subtypes, including medulloblastoma, ependymoma, and pilocytic astrocytoma, among others. To demonstrate the importance of pediatric posterior fossa CNS tumors molecular analysis, providing an accurate diagnosis, risk stratification, and personalized treatment. To identify the specific genetic alterations and biomarkers for managing these tumors.

##### **TABLE OF CONTENTS/OUTLINE**

1. Revision of epidemiology, pathology, and pediatric posterior fossa CNS tumor demographics. 2. Imaging features in pediatric posterior fossa CNS tumors, including pilocytic astrocytoma, ependymoma, medulloblastoma, other embryonal tumors, Rosette-forming glioneuronal tumor, diffuse midline gliomas, tectal gliomas including diffuse low-grade MAPK pathway-altered. 3. Most recent updates on pediatric posterior fossa CNS tumors molecular alterations, including WNT, SHH, and non-WNT/non-SHH medulloblastomas, BRAF mutations in pilocytic astrocytoma, EZHIP in group A ependymomas, MAPK pathway-altered in diffuse low-grade tectal gliomas. 4. Imaging strategies to depict the correct diagnosis based on the genetic profile. 5. Flowchart of the changes and last updates based on the neoplastic molecular profile. 6. Take-home messages.

#### **NREE-144 From Conception to Cancer: Exploring the Molecular Signatures of Embryonal Tumors for Precision Medicine**

Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recent advances in molecular biology have led to a better understanding of the types and subtypes of these tumors based on the 2021 World Health Organization of central nervous system tumors. The study aims to: To illustrate that the molecular analysis of Central Nervous System (CNS) embryonal tumors is critical for accurate diagnosis, risk stratification, and targeted therapy. To show that molecular analysis can help identify specific genetic alterations and biomarkers that can provide valuable information for managing these tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Revision of epidemiology, pathology, and demographics of CNS embryonal tumors. 2. Imaging features in CNS embryonal tumors. 3. Most recent updates on CNS embryonal tumors molecular alterations, including WNT-activated medulloblastoma, sonic hedgehog (SHH) activated, and non-WNT/non-SHH medulloblastomas. 4. Recent advances in molecular biology have led to identifying specific genetic alterations and biomarkers in non-medulloblastoma embryonal tumors, including teratoid/rhabdoid tumors (AT/RTs), embryonal tumors with multilayered rosettes (ETMRs), CNS Neuroblastoma, FOXR2-Activated, CNS Tumor with BCOR Internal Tandem Duplication, Cribriform Neuroepithelial Tumor. 5. Specific genetic mutations, amplifications, or deletions associated with tumor progression, recurrence, and response to therapy, including C19MC, DCER1, FOXR2, BCOR-ITD, SMARCB1, SMARCB4, AT/RT (TYR), AT/RT (SHH), AT/RT (MYC). 6. Imaging strategies to depict the correct diagnosis based on the genetic profile. 7. Flowchart of the changes and last updates based on the neoplastic molecular profile. 8. Take-home messages.

#### NREE-145 Neurogenetics and Imaging of Motor Neuron Disease

Participants

Maxwell Wright, BS, Mechanicsburg, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.To discuss the classification and pathogenesis of motor neuron disease (MND). 2.To highlight the neurogenetics, imaging findings, and diagnostic pearls for the specific diagnosis of various upper and lower MNDs.

#### TABLE OF CONTENTS/OUTLINE

We retrospectively reviewed 113 patients from our PACS system with clinical and imaging findings correlating with motor neuron disease (MND). All the patients underwent routine MRIs of the brain and spine. Almost 100% of these patients had CSF examinations, while genetic studies were available in 49% of the patients. All studies were read by two neuroradiologists. Imaging findings were correlated with the clinical examination, CSF, and biochemical results, which were further correlated with the genetic studies when available. For easy understanding, this exhibit is classified under the following categories: 1. Upper MND: Primary lateral sclerosis (PLS), Hereditary Spastic Paraparesis (HSP), Pseudobulbar Palsy 2. Lower MND: a) Chronic onset: Inherited- Spinal Muscular Atrophy (SMA), Progressive Muscular Atrophy (PMA), Distal hereditary motor neuropathy; Acquired- Upper limb dominance (Flail Arm, Hirayama, Segmental MND) Lower limb dominance (PMA, Monomelic Amyotrophy) b) Acute onset: Guillain Barre Syndrome, Polio; and 3. Combination of UMN and LMN: Amyotrophic lateral sclerosis (ALS). Conclusion: 1. Neurogenetics and neuroimaging complement each other in clinching the specific diagnosis of MND. 2. We discuss the neurogenetics, pathogenesis, and imaging appearance of the MND in this exhibit.

#### NREE-146 Imaging Spectrum of Cystic Spinal Lesions

#### TEACHING POINTS

• To illustrate the compartmental spinal anatomy. • To discuss the key imaging findings of cystic spinal lesions and their mimics. • To demonstrate the utility of multimodality imaging in the differential diagnosis of cystic spinal lesions.

#### TABLE OF CONTENTS/OUTLINE

A wide variety of benign and malignant cystic lesions can involve the different compartments of the spine. Although an exact diagnosis may be challenging, different imaging characteristics are used in order to narrow the differential diagnosis and/or establish the exact diagnosis. In addition, spinal cysts can be divided into: intramedullary, intradural extramedullary, or extradural, depending on their location, which is only useful in planning treatment. Magnetic resonance imaging (MRI) is the imaging method of choice to identify and characterize spinal cysts, and ultrasound (US) is often used as the initial imaging modality in pediatric patients. Instead, CT is helpful for evaluating cystic lesions of the vertebral column. In this exhibit, we will review the multimodal imaging features of the most common cystic spinal lesions based on their etiology, including neoplastic, congenital, degenerative, infectious, post-traumatic, and postsurgical disorders. We will also review the main differential diagnoses that should be considered.

#### NREE-147 Pediatric Neurometabolic Diseases: A Pictorial Review of How the Radiologist can Approach Hypomyelinating and Dysmyelinating Disorders

#### TEACHING POINTS

1: Pediatric Neurological metabolic diseases are a group of disorders affecting the brain, mostly related with a specific enzyme deficiency. 2: These disorders traditionally affect the white matter but can also affect the gray matter (both cortex and basal ganglia). 3: Pattern of white matter disease is one of the most helpful clues in the characterizing these conditions on imaging. 4: Pathologically, these disorders can be classified as hypomyelinating (with mild signal changes, with T2 hyperintensity and T1 hypo to isointensity) or other white matter diseases (pronounced T2 hyperintensity and T1 hypointensity) 5: Hypomyelinating disorders can be differentiated based on peripheral neural compromise or not. 5: Other white matter diseases (dysmyelinating) can be characterized based on the pattern of white matter disease (confluent vs multifocal). 6: Confluent white matter disease has an extensive differential, and it is critical to depict where changes are visualized (diffuse, frontal, parieto-occipital, posterior fossa, periventricular or subcortical).

#### TABLE OF CONTENTS/OUTLINE

1: Hypomyelinating disorders (T1 hypointensity and T2 hyperintensity). 1.1: Without typical PNS involvement: Pelizaeus Merzbacher Disease- 1.2: With typical PNS involvement: Cockayne disease 2: Other white matter diseases (mild T1 hypo or isointensity and T2 mild hyperintensity). 2.1: Confluent. 2.1.1: Frontal: Infantile Neuroaxonal Dystrophy. 2.1.2: Parieto-occipital: X-Linked adrenoleukodystrophy. 2.1.3: Posterior Fossa: Leigh syndrome. 2.1.4: Periventricular: Krabbe Disease. 2.1.5: Subcortical: Kearns

Sayre Syndrome. 2.2: Multifocal: Hydroxy glutaric Aciduria.

## **NREE-148 Imaging Approach and Review of Arteriovenous Orbital Fistulae**

### **TEACHING POINTS**

Reinforce the knowledge and correct identification of the vascular structures involved in the orbital-venous arterial fistula. List the imaging findings through contrasted tomography and contrasted MRI, to identify the main aspects to highlight in the diagnosis of orbital arteriovenous fistula. Complications of orbital arteriovenous fistula. Management and prognosis of patients with orbital arteriovenous fistula

### **TABLE OF CONTENTS/OUTLINE**

Definition, Diagnosis and image findings, Clinical findings, Treatment Arteriovenous orbital fistulae is a rare condition that occurs when an abnormal connection forms between an artery and a vein within the orbit; This causes blood to flow directly from the arterial system to the venous system, bypassing the capillary network. As a result, there is a high-pressure gradient in the venous system, leading to congestion and dilation of the veins. Arteriovenous orbital fistulae can be congenital or acquired. The most common cause of acquired arteriovenous orbital fistulae is trauma, such as a blunt or penetrating injury. Symptoms of arteriovenous orbital fistulae include bulging of the eye, proptosis, diplopia), visual disturbance, and in severe cases, loss of vision or even blindness. Diagnosis of arteriovenous orbital fistulae involves a thorough medical history and physical examination, including imaging studies such as ANGIO CT or enhanced MRI. Treatment options depend on the severity of the condition and may include observation, embolization or surgical removal of the abnormal vessels.

## **NREE-149 Intradural Spinal Lesions: A Review of Common and Rare Pathologies**

Participants

Sultan Yahya, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Review normal spinal anatomy and compartments- Approach to intradural spinal pathologies, and distinguishing intra and extramedullary pathologies- Review common and rare intra-medullary neoplasms, including ependymomas, subependymomas, astrocytomas, metastasis, hemangioblastomas and spinal involvement in diffuse leptomeningeal glioneuronal tumors. - Discuss medullary neoplastic mimics, including demyelinating/inflammatory abnormalities, infarctions, and arteriovenous malformations. - Review common and rare extramedullary neoplasms including meningiomas, schwannomas, metastasis, angioliopomas, mature cystic teratomas, paragangliomas, dermoids/epidermoid/lipomas and neuroenteric cysts.

### **TABLE OF CONTENTS/OUTLINE**

- Spinal compartmental anatomy- Approach to intradural pathologies- Intramedullary abnormalities: tumors, differentials of medullary signal abnormalities and neoplastic mimics- Extramedullary lesions: common / rare tumoral entities and cystic lesions

## **NREE-15 Cortically-Based Brain Tumors: Who is Who**

Participants

Irene Diaz, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Cortically-based brain tumors have some features in common. They usually clinically manifest as epilepsy refractory to anti-epileptic drugs and most frequently affect children and young adults. We can also talk about long-term epilepsy-associated tumors (LEAT), and they are usually low-grade tumors. Radiologically, they may be difficult to differentiate, but there are some imaging diagnostic clues that will help us find the correct diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

An image-based quiz will lead the review of different cases of cortically-based brain tumors, with its differential diagnostic clues at imaging. Most of our patients were young adults and clinically presented with focal epilepsy. We are mainly showing low-grade tumors, such as dysembryoplastic neuroepithelial tumor (DNET), ganglioglioma, pleomorphic xanthoastrocytoma, oligodendroglioma, multinodular and vacuolating neuronal tumor (MVNT) or polymorphous low-grade neuroepithelial tumor of the young (PLNTY).

## **NREE-150 Cerebellar Ataxia: Differential Diagnosis Based on Common Imaging Patterns**

### **TEACHING POINTS**

- Ataxia is a physical finding characterized by impaired coordination of voluntary muscle movement, resulting in disequilibrium, vertigo and gait ataxia. - Ataxia can be caused by either impaired vestibular input to the cerebellum or by cerebellum dysfunction itself. - Brain MRI, the imaging modality of choice, has a key role in differentiating the many causes of ataxia. - Ataxia may present with different cerebellum findings: normal, hypoplastic and atrophic morphology. - Regarding clinical findings, ataxia may be further classified as acute / subacute or chronic; traumatic; autoimmune; paraneoplastic or genetic. - Combining imaging and clinical features, differential diagnosis is made.

### **TABLE OF CONTENTS/OUTLINE**

- Defining ataxia. - Clinical findings that are relevant for the diagnosis based on MRI. - Differentiating normal vs hypoplastic vs atrophic cerebellum.- Further exemplifying findings in atrophic cerebellum that lead towards specific diagnosis (e.g.: superficial siderosis, basal ganglia abnormalities, white matter abnormalities). - Further exemplifying findings in hypoplastic cerebellum that lead towards specific diagnosis (e.g.: unilateral hypoplasia, posterior fossa malformations, hemorrhage). - Flowchart to the approach of cerebellar ataxia.

## **NREE-151 Interstitial Fluidopathy: A Concept for Understanding CNS Diseases with Impaired Interstitial Fluid Dynamics**

Participants

Toshiaki Taoka, MD, PhD, , Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation

## TEACHING POINTS

This educational presentation proposes a new concept called "Central Nervous System (CNS) Interstitial Fluidopathy," which encompasses diseases whose pathologies are associated with abnormal interstitial fluid dynamics. The glymphatic system hypothesis proposes that cerebrospinal fluid and interstitial fluid in the brain constitute a mass transport system, including waste clearance. Impairment of these functions results in protein leakage into the interstitium and impaired efflux of waste products, leading to the accumulation of waste products, tissue dysfunction, and conditions such as neuroinflammation. The term "CNS interstitial fluidopathy" describes diseases or conditions in which abnormalities in interstitial fluid dynamics are one of the significant factors in the pathological process. Various diseases, including Alzheimer's disease, Parkinson's disease, traumatic brain injury, multiple sclerosis, and small vessel diseases, develop due to abnormalities in the interstitial fluid dynamics. By categorizing these diseases as CNS interstitial fluidopathies, we can improve our understanding of their disease mechanisms, develop potential imaging methods, clinical methods, and common treatment methods or drugs. The dynamics of interstitial fluid are critical for understanding CNS diseases or disorders, and the proposed concept may promote advancements in disease treatment or prevention.

## TABLE OF CONTENTS/OUTLINE

1. An overview of the dynamics of cerebrospinal fluid and interstitial fluid in the CNS2. The waste clearance system in the CNS.3. Pathologies associated with abnormal interstitial fluid dynamics.4. A summary of the concept of interstitial fluidopathy.

## NREE-152 A Night in the ER: Diagnostic Errors in Emergency Neuroradiology

Participants

George Vilanilam, MBBS, Little Rock, AR (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Introduction: Diagnostic errors in emergency neuroradiology are a major contributor to unnecessary healthcare costs and have been implicated in preventable deaths in the US. Errors are broadly categorized into perceptive and interpretive errors. The most common erroneous studies are CT head (32%), CT cervical spine (18%), and CTA head and neck (24%). Specific teaching points1) Defining and understanding common sources of diagnostic errors in emergency neuroradiology.2) Providing examples of common cognitive biases and perceptual errors.3) Discussing methods to mitigate diagnostic errors in emergency neuroradiology.

## TABLE OF CONTENTS/OUTLINE

Common cognitive biases/interpretive errors1) Truncation of the search and analytical thought processes (premature closure, satisfaction of search, and satisfaction of report).2) Affirming initial diagnosis (anchoring bias and attribution bias).3) Recency (availability and non-availability bias).4) Outcome-related bias (regret bias/defensive reporting, outcome bias).5) Biases stemming from clinical parameters (framing bias, attribution bias).6) Retrospective biases (hindsight bias, self-serving bias). Perceptual errors1) Related to viewing technique (inappropriate windowing and fogging phenomenon). 2) Related to the finding itself (edge of film, first or last slice, bilateral or diffuse findings, subtle or poorly conspicuous). Recommendations to reduce diagnostic and reporting errors

## NREE-16 Nervous System MR Elastography: Current Update

Participants

Safa Hoodeshenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1) How MR elastography of the nervous system is performed; From the generation of the shear waves to obtain qualitative and quantitative parameters2) What MRE can tell us about neural tissue biomechanical properties in physiologic and pathologic conditions

## TABLE OF CONTENTS/OUTLINE

1) Principles of MR elastography technique in the nervous system2) Qualitative and quantitative obtained parameters 3) Role of artificial intelligence in MRE4) Slip interface imaging5) MRE in neurodegenerative disease (Alzheimer's disease, Frontotemporal dementia, Lewy body dementia, Normal pressure hydrocephalus)6) MRE in characterizing and treatment planning of intracranial tumors (tumor subtype and grade, consistency, adhesion to surrounding tissue)7) MRE in traumatic brain injury8) MRE in neuroinflammatory disorders9) Functional MRE10) Pediatric nervous system MRE

## NREE-17 I Only See White Spots: Understanding the Clinical and Radiological Features of CNS Demyelination

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

## TEACHING POINTS

To describe the most typical imaging characteristics of secondary demyelinating processes. To know the basic notions in relation with epidemiology, clinical presentation, pathology, possibility of spinal cord involvement and differential diagnosis. To be able to assist the diagnosis of each etiological group in order to provide better and faster management, taking into account the severity of the findings and prediction of outcome.

## TABLE OF CONTENTS/OUTLINE

1. Autoimmune a. Multiple sclerosisb. Baló (example of tumefactive autoimmune lesions)c. Devic (optic neuromyelitis)2. Infectiousa. HIV encephalopathyb. PML (progressive multifocal leukoencephalopathy)c. Subacute sclerosing encephalomyelitis3. Vasculara. Binswanger (subcortical arteriolesclerotic encephalopathy)b. CADASIL (Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy)c. Post-anoxicd. PRES (posterior reversible encephalopathy)4. Toxic-metabolica. Osmotic demyelinationb. Toxic leukoencephalopathyc. CLOCC (cytotoxic lesions of the corpus callosum)5. Traumatica. Diffuse axonal injury

## NREE-18 Facets of a "Heavy Brain": Exploring Patterns of Iron Metabolism Disturbances

## TEACHING POINTS

Iron accumulation in the brain is common in several neurodegenerative disorders and normal aging. It likely contributes to the



pathophysiology of neurodegenerative changes in these conditions by inducing oxidative stress, inflammation, and cell death. The patterns of iron deposits in the central nervous system vary between different conditions, both at the macroscopic and microscopic level. The role of iron in the pathogenesis and response to iron chelation therapy varies between individual disorders.

#### **TABLE OF CONTENTS/OUTLINE**

This review summarizes the whole brain, cellular, and subcellular patterns of iron accumulation in neurodegenerative diseases of genetic and sporadic origin, and also other associations as neuroinfections. We also provide an update on mechanisms, biomarkers, and effects of brain iron accumulation in these disorders, focusing on recent publications. This pictorial review will also show how we can systematize the role of iron in brain and provide a practical guide to identify the main pathologies.

#### **NREE-19 Don't Take the Long Way: A Diagnostic Shortcut to Longitudinally Extensive Myelopathies**

Participants

Nicole Lambrakos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Outline and describe the types of myelopathies (mechanical and non-mechanical). 2. Explain the pathology and imaging findings of myelopathies. 3. Build a decision making diagnostic flowchart, pointing out the imaging characteristics of myelopathies.

#### **TABLE OF CONTENTS/OUTLINE**

1. Brief review of spinal cord anatomy, tracts and function. 2. Definition of myelopathy and longitudinally extensive spinal cord lesions and their subtypes (mechanical and non-mechanical). 3. Pathology of spondylotic myelopathy. 4. Clinical and imaging findings. 6. Most specific imaging findings. 5. Decision making diagnostic flowchart of myelopathies based on their imaging characteristics.

#### **NREE-2 Variants and Anomalies of Extracranial Cerebral Arteries and Considerations for Neuroendovascular Procedures**

#### **TEACHING POINTS**

- To describe the embryology of the aortic arch in order to explain the origin of its anatomical variants and anomalies. - To review the variants and anomalies of extracranial cerebral arteries giving examples from cases from our institution. - To revise some of the pathology associated with extracranial vascular variants and anomalies and the implications for endovascular procedures.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Embryology. 3. Aortic arch 3.1. Variants 3.1.1. Bovine arch 3.1.2. Elongation and tortuosity 3.2. Anomalies 3.2.1. Right-sided aortic arch 3.2.2. Right aberrant subclavian artery and bicarotid trunk 3.2.3. Double aortic arch 4. Cervical Internal carotid artery 4.1. Variants 4.1.1. Elongation and tortuosity 4.2. Anomalies 4.2.1. Internal carotid artery agenesis 4.2.2. Main branches anomalous origins 5. Cervical vertebral artery 5.1. Variants 5.2. Anomalies 5.2.1. Anomalous origin of the vertebral artery

#### **NREE-20 Beyond the Basic: Advanced MRI Techniques in Neuroimaging**

Participants

Marina Da Cruz, Fernandopolis, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Advanced magnetic resonance imaging (MRI) techniques allow expanding the range of diagnostic tools with the potential to assess functional parameters in neuroimaging, complementary to traditional sequences, that can and should be used by radiologists to aid in the differential diagnosis. The purposes of this submission are: - To review advanced MRI techniques in neuroimaging, such as spectroscopy, perfusion weighted imaging, tractography, nigrosome and neuromelanine evaluation and vessel wall study; - To expose the main indications of each method; - To discuss possible imaging features in some groups of pathologies;

#### **TABLE OF CONTENTS/OUTLINE**

1. Review technique and indications of spectroscopy; 2. Technique and indications of perfusion weighted imaging; 3. Discuss technique, indications and basic interpretation of tractography; 4. Assessment of nigrosome and neuromelanine; 5. Discuss technique, indications and basic interpretation of vessel wall study;

#### **NREE-21 Progressive Multifocal Leukoencephalopathy (PML): A Thorough Overview from Traditional to Contemporary Findings, Including Inflammatory Subtype, IRIS, Drug-associated, and Asymptomatic Cases**

#### **TEACHING POINTS**

1: Discuss PML imaging findings from classical observations to the latest insights. Explain the progression of lesions, taking into account the pathological findings. 2: Contrast-enhanced PML lesions are extremely important in clinical management, and discussing their significance in imaging findings is essential. 3: Address the key points of imaging findings for recently discussed drug-related PML and asymptomatic PML.

#### **TABLE OF CONTENTS/OUTLINE**

1: About progressive multifocal leukoencephalopathy (PML) 1-1: Classification of JCV diseases of the Brain 2: PML progresses through the following 3 steps, reflecting pathological findings 2-1: First step: "Initiation" as a small demyelinating lesion 2-2: Second step: "Expansion" and "Extension" of demyelinating lesions 2-3: Third step: "Fusion" of demyelinating lesions, resulting in axonal destruction! 3: Interpretation of contrast enhancement in PML lesions! 4: New MRI findings related to PML 4-1: low signal intensity on T2\*WI and SWI in U-fibers and deep gray matter adjacent to the lesions 4-2: hyperintense cortical sign (HCS) on T1WI 5: Drug-associated PML 5-1: natalizumab-associated PML 5-2: punctate lesions

## **NREE-22    Neurological Emergencies in Oncologic Patients: Understanding the Importance of Early Imaging Evaluation**

Participants

THARYN Goncalves FRANCO DE GODOY, Sao PAULO, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Neurological emergencies are common and life-threatening conditions, particularly in oncologic patients who are at higher risk due to factors, including immunosuppression, coagulopathy, and treatments such as chemotherapy and radiation therapy. Due to their compromised status, early diagnosis can be challenging, and imaging exams are often required for proper evaluation. Radiologists, especially those working in cancer centers, must be familiar with these emergencies to ensure prompt treatment and reduce morbidity and mortality. Our aim is to review the neurologic emergencies to oncologic patients dividing them into pre and post-treatment, including early and late complications. To increment the discussion, risk factors, clinical presentation, imaging findings and treatment will be in illustrative cases.

### **TABLE OF CONTENTS/OUTLINE**

Introduction: review neurologic emergencies to oncologic patients. To divide the emergencies in two groups: related to cancer itself or its treatment (early and late complications), through a visual flowchart. To discuss, for each condition risk factors, clinical presentation, imaging findings and treatment. Following conditions: Pre-treatment: intracranial hypertension, vasogenic edema, herniations, spinal cord compression, paraneoplastic syndromes, ischemic and hemorrhagic stroke, venous sinus thrombosis. Post-treatment: radiation-induced vasogenic edema and leukoencephalopathy, infections, hemorrhages, radiation necrosis, SMART syndrome, radiation vasculopathy, encephalopathy, PRES, opportunistic infections. To highlight the particular aspects to oncologic patients, discussing the clinical and imaging for early diagnosis and treatment.

## **NREE-23    Beyond the Lumen: Unraveling the Vessel Wall Technique**

Participants

Maria Laura Piassa, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- A method that is here to stay, the vessel wall study, aims to evaluate the vascular wall and characterize the pathologies that compromise it, whether inflammatory, dissection, or atheromatous plaques.- It is a study that requires a high spatial resolution, with homogeneous signal suppression of the intravascular lumen, 2D or 3D multiplanar acquisitions, allowing several acquisitions.- In the evaluation of atherosclerotic diseases, VW-MRI demonstrates parietal thickening that eccentrically involves the circumference of the arterial wall, showing different characteristics on T1 and T2 sequences, depending on its internal content. Active/unstable plaques present a thin fibrous cap, large lipid core, presence of hemorrhage, contrast uptake and vascular remodeling.- Other differential diagnoses of intracranial luminal stenosis would be dissection, vasculitis (primary or secondary), reversible vasoconstriction and Moya-moya. VW-MRI is also used in the evaluation of aneurysms.- Pitfalls are points that deserve full attention, highlighting low flow, in which incomplete suppression can mimic wall thickening and vasa vasorum, mimicking vasculitis.

### **TABLE OF CONTENTS/OUTLINE**

- Raise the importance of the VW-RM, including its techniques and applications.- Assess atherosclerotic disease and its differential diagnoses more precisely, stratifying individual risks, with potential influence on treatment decisions.

## **NREE-24    Help When You're Feeling Low: Intracranial Hypotension and Algorithms for Diagnosis**

Participants

Rahim Ismail, MD, Rochester, NY (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Familiarize radiologists with the pathology and pathophysiology of spinal CSF leaks resulting in spontaneous intracranial hypotension (SIH).
2. Localization of the culprit spinal CSF leak in SIH patients can be difficult. At our institution we use a combination of brain and spinal MRI to guide the type of myelographic imaging and patient positioning for the myelogram to help localize the CSF leak.
3. Role of dynamic CT myelogram (DCM) and digital subtraction myelogram (DSM) in patients demonstrating a spinal longitudinally extensive collection (SLEC) on spinal MRI.
4. Role of lateral decubitus DSM in patients with SLEC negative MRI in evaluating for a CSF venous fistula (CVF) or distal tears of the nerve root sleeve.
5. Role of DSM for precise localization in patients with suspected fast flow CSF leaks, such as dural tears from sharp osteophytes.
6. Role of DCM in patients with suspected CSF leaks from proximal nerve root sleeve tears/perineural cysts.
7. Describe our institutional protocols for performing DCM and DSM including tips for optimizing timing and provocative assessments.

### **TABLE OF CONTENTS/OUTLINE**

The following illustrative examples will be shown: 1. Pathology: Different etiologies of spinal CSF leaks will be shown including: a. Microspurs b. perineural cysts c. CSF venous fistula (CVF) d. distal dural tears. 2. We will describe our institutional algorithm for the work up of these complex subsets of patients.

## **NREE-25    Connecting the Dots: A Step-by-Step Guide of Brain Myelination**

Participants

Afonso Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of this exhibit are: To review the normal appearance of myelination on imaging studies To define a step-by-step analysis algorithm to facilitate the assessment of myelination To display a compendium of cases involving myelination disorders

### **TABLE OF CONTENTS/OUTLINE**

Myelin is a vital component of the nervous system, serving as an insulator for neurons and found in both the central and peripheral nervous systems. It not only insulates but also speeds up action potentials by 10-100 times that of an unmyelinated axon. Moreover, it regulates ion composition and fluid volume around the axon, which is crucial for maintaining its health and integrity. MRI

is the best noninvasive way to assess myelin and myelination in the pediatric brain. Mature myelin usually appears hyperintense to the gray matter cortex on T1 and hypointense to the gray matter cortex on T2. The process of myelination starts during fetal development with the cranial nerves, which are essential for our survival, and continues throughout life. As myelination progresses, it generally follows a pattern of development from bottom to top (caudocranial), back to front (posterior to anterior), and central to peripheral (deep to superficial). In conclusion, myelin is a vital component of the nervous system and plays a critical role in proper functioning. Understanding the process of myelination and the appearance of mature myelin on imaging is essential for the evaluation of many neurological conditions.

## **NREE-26 Nigrosome 1: Anatomy, Variants and Pathologies**

Participants

Danielly Santos SR, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purpose of this exhibit is to help the readers to determine the presence or absence of an abnormality in the N1 and establish diagnostic reasoning in cases of parkinsonism. The objectives of this electronic exhibit are:- to revisit the anatomical definition of the N1 region using schematic illustrations and imaging MRI;- to illustrate the anatomical variants of the N1;- to exhibit parkinsonism diagnostic algorithm;- provide imaging findings of various patients who presented with parkinsonism.

### **TABLE OF CONTENTS/OUTLINE**

Parkinson's disease is a clinically heterogeneous chronic progressive neurodegenerative disease with loss of dopaminergic neurons in Nigrosome 1 (N1). Nigrosomes are small clusters of dopaminergic cells within the substantia nigra. Five nigrosomes have been described with the largest labeled as N1, located in the posterior third of the substantia nigra. The N1 is the key structure in the midbrain that is very important in movement disorders, particularly those associated with parkinsonism. Interpreting the N1 sign can be difficult because it can take many forms but the high-resolution data and clear characterization of the N1 appearance help to make that decision easier.

## **NREE-27 Stroke of Luck: Imaging of Hyperacute Stroke and Selecting Patients Effectively**

### **TEACHING POINTS**

? Stroke management was revolutionized recently by the proven benefit of intervention with a larger time window on selected patients ? Time is brain: CT perfusion helps identifying salvageable brain tissue ? Radiologists play a crucial role on helping the multidisciplinary team select patients who will benefit from intervention based on imaging criteria ? Perfusion studies should be routinely assessed to avoid misinterpretation and excluding patients from therapy

### **TABLE OF CONTENTS/OUTLINE**

Introduction Over the past few years, after publication of the results of the DEFUSE 3, EXTEND and DAWN trials, stroke management has been revolutionized. These studies proved the benefit from intervention with a larger time window based on certain perfusion imaging criteria. This educational exhibit's goal is to review the role of conventional and advanced imaging on hyperacute stroke, ending with a proposed interpretation algorithm for selecting patients effectively. Current treatment options and inclusion criteria Imaging of hyperacute stroke ? Acquisition protocols ? CT ? MR ? Perfusion CT/MR ? ASPECTS ? AI (Rapid, Brainomix) ? Assessing study's quality ? Pitfalls ? Proposed interpretation algorithm

## **NREE-28 Headache, Dizziness, and Leaks. May the Balance be with You. A Pictorial Review of Intracranial Hypo and Hypertension**

Participants

Fernanda Avalos, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Cerebrospinal fluid (CSF) homeostasis is essential to maintain normal intracranial pressure. Even a small imbalance in CSF production, absorption, or flow can lead to altered intracranial pressure. Imaging in increased intracranial pressure (ICP): Although there are no specific imaging findings of idiopathic intracranial hypertension, enlarged arachnoid outpouchings such as an empty sella, enlarged Meckel's cave, or signs in the optic nerve such as vertical tortuosity or flattening of the posterior sclera should raise suspicion, as these signs have been identified in 23-80% of patients. ICP may be due to secondary causes such as disturbances in CSF production and absorption or obstructive hydrocephalus that can result from lesions such as intracranial masses. Imaging in intracranial hypotension: the major radiological features can be summarized with the acronym SPACE (Sagging of the brain, Pituitary enlargement, Angles, Collections, and Enhancement of the pachymeninges). Dural membrane leaks contribute to the majority of causes of intracranial hypotension. Therefore, understanding the imaging methods and findings can guide definitive treatment and improve patient outcomes.

### **TABLE OF CONTENTS/OUTLINE**

1. Understand the physiological mechanism of CSF in the central nervous system. 2. Describe the common symptoms of intracranial hypo- and hypertension, and recall clinical findings during neurological examination. 3. Radiological findings of intracranial hypertension with differential diagnosis. 4. Radiological and clinical evolution of a patient with intracranial hypotension, from the first study with unspecified headache, through spinal leak diagnosis, to control after treatment

## **NREE-29 Meningiomas - Do You Know Their Presentations: Brief Pictorial Review of Intracranial Meningiomas Presentations and Their Radiological Findings. Our Image Experience**

### **TEACHING POINTS**

Remember the definition of meningiomas and its most relevant epidemiological data. Review the current classification of intracranial meningiomas according to the World Health Organization (WHO) and their different imaging characteristics. Overhaul a brief pictorial review with exemplified cases of typical and atypical meningiomas from our institute.

### **TABLE OF CONTENTS/OUTLINE**

Meningiomas are the most common nonglial primary tumors of the Central Nervous System and the most common extraaxial

neoplasms. They may originate in unexpected locations such as the orbit, paranasal sinus, or ventricles or be entirely intraosseous (within the calvaria). The radiologist must be aware of their less frequent and uncharacteristic the imaging features in order to suggest the right diagnoses in cases that are atypical. The present educational exhibit intends to make a brief pictorial review of the main presentations of intracranial meningiomas, their current classification and imaging characteristics, and exemplify them with cases of patients from our institute.

### **NREE-3 Don't be Afraid of Neuroimaging Epilepsy: A Case-based Review of a Myriad of Etiologies and Findings**

#### **TEACHING POINTS**

Epilepsy is seen as a clinical manifestation due to excessive or synchronous abnormal neuronal activity in the brain, defined as recurrent, unprovoked seizures. The prevalence is high, and patients have an increased risk of premature death, injuries, psychosocial dysfunction, and reduced quality of life. The etiologies encompass multiple causes. Neuroimaging studies (particularly magnetic resonance imaging) are essential in evaluating epilepsy, mainly in cases refractory to pharmacotherapy, once the location of the epileptogenic focus is a turning point in a successful neurosurgery approach. The purpose of this exhibit is to present, through illustrative cases, a practical approach to imaging findings within multiple epilepsy etiologies.

#### **TABLE OF CONTENTS/OUTLINE**

Education Exhibit Presentation ? Introduction. ? Clinical and epidemiological aspects. ? A case-based review of original cases from the neuroradiology department of a tertiary hospital showing imaging features of a range of etiological substrates of epilepsy (from the common ones to the rarest), always through the perspective and purpose of a practical approach. Key and ancillary imaging features will be highlighted in each case. ? Take-home messages ? References.

### **NREE-30 Maxillo-mandibular Lesions: Gnawing Through the Differentials**

Participants  
Gilleen Cortes, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To provide an overview and differential diagnosis for maxillo-mandibular lesions encountered during imaging of the head and neck.
2. To present the multimodal radiologic features with case-based review of maxillo-mandibular lesions.
3. To highlight the approach of maxillo-mandibular lesions including diagnosis and management.

#### **TABLE OF CONTENTS/OUTLINE**

Maxillo-mandibular lesions are commonly encountered and usually incidental during head and neck imaging. There is a broad spectrum of lesions, which may be of odontogenic and non-odontogenic origin and can be further classified by cystic, solid, infectious/inflammatory, benign, and malignant processes. Patient characteristics and location of the lesion may be helpful; however, without pathognomonic imaging features, tissue sampling is frequently required. Several key cases presented at our institution will be reviewed such as: periapical cyst, dentigerous cyst, odontogenic keratocyst, non-odontogenic developmental cystic lesions, aneurysmal bone cyst, ameloblastoma, fibrous dysplasia, osteosclerosis, condensing osteitis, cementoblastoma, ossifying fibroma, osteomyelitis, odontogenic carcinoma, invasive squamous cell carcinoma, and osteoradionecrosis. Accurate diagnosis is essential to prevent further complications, as otherwise treatable lesions with destructive potential may be missed.

### **NREE-31 Looking Back: Everything You Need to Know on Infratentorial Malformations**

Participants  
Taisa Guarilha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is:- To review normal anatomy of the posterior fossa- To explain in a simplified way normal embryology and the modifications that result in these malformations- To demonstrate how infratentorial malformations can present themselves- Exemplify with cases- Present a flow chart

#### **TABLE OF CONTENTS/OUTLINE**

1. Normal anatomy
2. Embryology: - Normal- Malformations
3. Cases:
  - 3.a. Cystic malformations: Dandy-Walker continuum, Blake Pouch, Cyst, Mega Cisterna Magna, Arachnoid cyst
  - 3.b. Non-cystic malformations:
    - Predominant cerebellar involvement: Rhombencephalosynapsis- Macrocerbellum- Microcerbellum- Cerebellar Hypoplasia - bilateral, unilateral - Cortical cerebellar malformation- Cobblestone-- Predominant brainstem involvement:- Pontine tegmental cap dysplasia- Horizontal gaze palsy with progressive scoliosis- Möbius Syndrome-- Predominant cerebellar and brainstem involvement:- Molar tooth malformations - including Joubert Syndrome- Pontocerebellar hypoplasia- Walker-Walburg- Lhermitte-Duclos syndrome - Craniocervical junction: Chiari spectrum
    - 3.c. Others- Masiner-Santino Syndrome- Quadrigeminal cistern lipoma
4. Flowchart
5. Take home messages

### **NREE-32 No More Conflict: Imaging of Neurovascular Compression Syndromes, Related Anatomy and Surgical Approach**

#### **TEACHING POINTS**

Neurovascular compression (or conflict) is one of the causes that must be considered in patients presenting with cranial nerve related symptoms. MR imaging is key to rule out differential diagnosis. Knowing the involved anatomy is fundamental to identify possible sites of compression. Communication with the surgeon plays a major role and the reports must include necessary information to surgical planning.

#### **TABLE OF CONTENTS/OUTLINE**

Neurovascular conflict syndromes (NVCS) consist of symptoms related to compression of the V, VII, VIII or XII cranial nerves by vascular structures, usually at the transition zone near the nerve root entry zone. When indicated microsurgical decompression can be done. Trigeminal Nerve NVCS of the V CN usually presents as trigeminal neuralgia and is caused by compression at its REZ of the level of the pons by an elongated superior cerebellar or anterior inferior cerebellar arteries. Facial and Vestibulocochlear Nerves Facial hemispasm (VII CN) / vertigo and tinnitus (VIII CN) may come from compression at the inferior pons level by the AICA.

Glossopharyngeal Nerve IX CN compression at its REZ on the upper medulla by the PICA may cause glossopharyngeal neuralgia.

### **NREE-33 Emergency Neuroradiology Misses: Case Examples and Lessons Learned**

#### **TEACHING POINTS**

Diagnostic errors are the 3rd leading cause of death in the United States. In diagnostic radiology, the rate of errors increases significantly in the emergency setting, this is particularly critical in neuroradiology, where misinterpretation or misidentification may significantly delay treatment and adversely impact patient outcome. In this educational exhibit, readers will be able to: Recognize the two types of thought processing in human decision making, Recognize common diagnostic errors and underlying cognitive biases in image interpretation, See examples of real life missed/misinterpreted cases in emergency neuroradiology and Understand different approaches to reduce diagnostic errors.

#### **TABLE OF CONTENTS/OUTLINE**

1. Background of diagnostic errors in radiology (statistics and common misses in emergency neuroradiology). 2. Type 1 and Type 2 Processing in Clinical Decision Making (heuristic vs analytical approaches). 3. Different Types of Errors During Image Interpretation (cognitive/interpretive biases, perceptual errors). 4. Sample cases to illustrate different types of misses in emergency neuroradiology (perceptual errors - blind spot; cognitive error/lack of knowledge; perceptive error - satisfaction of search; inadequate history). 5. How do we reduce diagnostic errors (strategies from the literature and our institution will be provided such as non-random peer review, double reading, interdisciplinary rounds and tumor boards, reducing interruptions, computer-aided decision making support system)

### **NREE-34 Infarcts, Malformations, and Tumors.. Oh My! A Review of Vascular Pathology In and Around the Spinal Cord**

#### **TEACHING POINTS**

1. To review spinal vascular anatomy with original diagrams. 2. To review International Society for the Study of Vascular Anomalies (ISSVA) and other classification systems. 3. To discuss the clinical presentation and etiologies. 4. To demonstrate common imaging findings.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Infarcts 3. Malformations 4. Tumors 5. Conclusion

### **NREE-35 Teratomas of the Brain, Head and Neck, and Spine: Imaging Appearances**

#### **TEACHING POINTS**

- Illustrate the different imaging appearances of teratomas in the brain, head and neck, and spine.
- Discuss their locations and associated complications.
- Understand the usefulness of CT and MRI in the diagnosis and characterization of teratomas.

#### **TABLE OF CONTENTS/OUTLINE**

Intracranial and spine teratomas, as well as those in the head and neck, are rare tumors that originate from all three embryonic germ layers (ectoderm, mesoderm, endoderm). They can be classified depending on their differentiation as mature, immature, and teratoma with malignant transformation. Clinical manifestations vary according to location and size. Intracranial teratomas are usually located in the midline, generally in the pineal and suprasellar regions, and represent more than two-thirds of brain tumors diagnosed before birth. In the spine, teratomas can occur at any level and compartment (extradural, intradural, or intramedullary). Characteristically, all show distinct components with fat, calcification, and soft-tissue attenuation on CT. Predominantly cystic teratomas also occur. MRI offers better characterization of these tumors and detection of their complications. In this exhibit, we will discuss typical and unusual appearances of teratomas on CT and MRI approaching them by location: • Intracranial: congenital, midline, and off-midline location • Head and Neck • Spine: intramedullary, intradural extramedullary, and extradural/sacroccygeal

### **NREE-36 Radiographic Findings in Hypoxic-Ischemic Brain Injury and the Role of Imaging in Brain Death Determination**

Participants

Min Tae Kim, MD, BSC, Torrance, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to 1. Discuss patterns of hypoxic-ischemic brain injury in pediatric and adult patients 2. Review the utility of imaging in prognostication 3. Review brain death determination using clinical criteria and imaging support 4. Present select cases from our institution

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Patterns of hypoxic-ischemic brain injury in neonates- Normal MRI appearance of the neonatal brain- Patterns of mild, moderate, and severe injury 3. Patterns of hypoxic-ischemic brain injury in infants, young children, and adults- Commonly involved regions of the brain - cortex, deep gray matter, perirolandic cortex, watershed distribution, white matter, cerebellum- Review of radiographic findings on CT- Review of radiographic findings on MR 4. How imaging can assist in determining prognosis 5. Radiographic imaging in the brain death examination- CT angiography- Digital subtraction angiography (DSA) - gold standard- Nuclear medicine 6. Select cases from our institution

### **NREE-37 Don't Get Trapped: Diagnostic Errors in Emergency Neuroradiology**

Participants

Julia Brunelli, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Diagnostic errors in neuroradiology in the emergency department can have serious consequences for patients. The prevalence of errors in diagnostic radiology is around 3-5%. Factors such as less time to prepare the report and discuss the case with peers, the patient's clinical condition evolving rapidly, and dependence on the radiological report to take immediate actions according to the

imaging findings can all contribute to errors. In this educational presentation, we will review a series of cases to address a series of etiologies that are present in a neurological emergency room and provide tips to improve accuracy and patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction• Overview of diagnostic errors• Renfrew Classification (revised by Kim and Mansfield in 2014)2. Case based review• Etiologies that are present in the emergency• Learning with the case: tips about that etiology3. Do it yourself• Cases as a diagnostic challenge for the audience

#### NREE-38 A to Z of Motor Neuron Diseases

Participants

Amit Desai, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review neuroanatomy of the motor system2. Discuss common upper and lower motor neuron diseases3. Provide a multi-disciplinary and radiologic pattern based approach to diagnosis of motor neuron diseases

#### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Neuroanatomy Review3. Classification of Upper and Lower Motor Neuron Diseases. Imaging features, pathophysiology, genetics, clinical symptoms, and management will be reviewed.A. Upper Motor Neuron Involvement Only: i. Primary Lateral Sclerosisii. Hereditary Spastic Paraplegiaiii. Spinal AVM/AVFiv. Radiation MyelitisB. Lower Motor Neuron Involvement Only: i. Progressive Muscular Atrophyii. Flail Arm/Leg Syndromeiii. Post-Polio Syndromeiv. AIDPv. CIDPvi. Motor Neuron Lymphoproliferative DisordersC. Upper and Lower Motor Neuron Involvement: i. Amyotrophic Lateral Sclerosis (ALS)ii. ALS Plus Syndrome, Progressive Bulbar Atrophyiii. Bulbar-onset ALSD. Diseases affecting the Muscle/Neuromuscular Junction: i. Myasthenia Gravisii. Lambert Eatoniii. Inclusion Body Myositis4. Simplified Diagnostic Approach Based Upon Clinical Symptomatology and Radiologic Imaging Pattern5. Conclusion

#### NREE-39 Novel WHO Intra-axial Tumoral Entities: Beyond Gliomas

Participants

Sultan Yahya, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the evolution of CNS tumor classification- Concepts in the WHO 2021 classification of tumors - What's new?- Pertinent Radiomics and Molecular Classification of tumors- Recognize imaging features of relatively Novel CNS tumoral entities- Diffuse Pediatric high grade glioma- High Grade astrocytoma with piloid features (HGAP)- Astroblastoma- Multinodular and Vacuolating neuronal tumor (MVNT)- Multiloculated and Vacuolating Posterior Fossa lesions of Unknown Significance (MV-PLUS)- Diffuse Leptomeningeal Glioneuronal Tumor (DLMGT) - Calcifying Pseudoneoplasm of the Neuroaxis (CAPNON)- Polymorphous Low Grade Neuroepithelial tumor of the Young (PLNTY).

#### TABLE OF CONTENTS/OUTLINE

Review of CNS tumor classification and Novel concepts in the WHO 2021 classificationCased- based review of new CNS tumoral entities: - Diffuse Pediatric high grade glioma- High Grade astrocytoma with piloid features (HGAP)- Astroblastoma- Multinodular and Vacuolating neuronal tumor (MVNT)- Multiloculated and Vacuolating Posterior Fossa lesions of Unknown Significance (MV-PLUS)- Diffuse Leptomeningeal Glioneuronal Tumor (DLMGT) - Calcifying Pseudoneoplasm of the Neuroaxis (CAPNON)- Polymorphous Low Grade Neuroepithelial tumor of the Young (PLNTY).

#### NREE-4 Radiological Approach to Toxic-metabolic Encephalopathies

Participants

Valeria Andrea G. Schonstedt, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To propose a systematic radiologic approach in the evaluation of toxic-metabolic diseases.

#### TABLE OF CONTENTS/OUTLINE

1) When to suspect toxic-metabolic disease in a patient with acute encephalopathy 2) Important differential diagnosis that should be ruled out 3) To establish a topographic approach to suggest an etiologic diagnosis 4) To be aware of rare asymmetric presentations

#### NREE-40 Radiopharmaceutical Therapy for Fibromyalgia: A Promising Treatment Option

Participants

Sriram Paravastu, BA, Lee's Summit, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Despite the availability of several pharmacological and non-pharmacological therapies, the management of fibromyalgia remains challenging.2. Preliminary studies have shown promising results in PET imaging of fibromyalgia.3. Radiopharmaceutical therapy involves the administration of radiopharmaceutical agents that selectively accumulate in specific tissues or organs and may be the next step in treatment of fibromyalgia.

#### TABLE OF CONTENTS/OUTLINE

1. Current challenges in the management of fibromyalgia2. Radiopharmaceutical therapy for fibromyalgiaa. Current radiotracers under investigation3. Preliminary studies on molecular imaging of for fibromyalgiaa. Radiolabeled Substance-P monoclonal antibodyb. Radiolabeled small molecules4. Future directions and challengesa. Theranostics in fibromyalgia and other chronic pain syndromesb. Establishment of objective clinical markers of fibromyalgia

#### NREE-41 Neurovascular Devices and Related Complications: A Case-based Approach

Participants

Victor De Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Showcase the mainly used neurovascular devices, highlighting the preferred imaging modalities and what to avoid in the postoperative evaluation of each device. 2. Review the most relevant complications assessed by imaging related to each neurovascular device : what to look for?

#### TABLE OF CONTENTS/OUTLINE

- Introduction with a brief and illustrative review of the main neurovascular devices used in clinical practice and the modalities of choice for assessment of each device.
- Provide a guide on what to look for when assessing neurovascular devices with the most commonly associated complications.
- Provide didactic cases to illustrate the most important complications related to each neurovascular device and consolidate the acquired knowledge.
- Conclusions.
- Bibliographical references.

#### **NREE-42 Impact of Deep Learning-Based Reconstruction on Neuro MR Imaging: Image Noise Reduction and Super Spatial Resolution**

Participants

Hiroyuki Uetani, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To understand the principle of deep learning-based reconstruction (DLR) for reducing image noise and enhancing spatial resolution of neuro MRI. 2. To illustrate the applications of DLR with/without compressed sensing (CS) and parallel imaging and super spatial resolution-DLR (SR-DLR) for neuro MRI, and discuss the strengths of this techniques. 3. To discuss the pitfalls and limitations of DLR with/without CS and parallel imaging and SR-DLR techniques.

#### TABLE OF CONTENTS/OUTLINE

Introduction: 1) What is DLR with/without CS and parallel imaging, and SR-DLR techniques? 2) The advantages and disadvantages of DLR with/without CS and parallel imaging, and SR-DLR techniques. Clinical application of DLR with/without CS and parallel imaging and SR-DLR in neuro MR imaging: 1) DLR: High signal-to-noise ratio (SNR) images without long acquisition times A) High-resolution 3D T2 weighted imaging (HR-3D T2WI) B) MR angiography 1) Combination of DLR and CS/parallel imaging: High SNR images in a short acquisition time without sacrificing spatial resolution A) 2D-T2WI on the sellar region or spine B) MR angiography C) High-resolution 3D-T2WI 2) SR-DLR: High SNR images with super spatial resolution without long acquisition times A) 2D-T2WI on the hippocampus B) MR angiography C) Double inversion recovery (DIR) imaging D) Contrast-enhanced 3D T1WI E) Bone imaging Pitfalls and limitations of DLR with/without CS and parallel imaging, and SR-DLR in neuro MR imaging.

#### **NREE-43 NODDI vs Traditional dMRI Metrics: Revealing Microstructure Without a Microscope**

#### TEACHING POINTS

Importance of dMRI as a non-invasive medical imaging modality for investigating the white matter integrity in the brain. Different traditional scalar metrics currently used for characterising the diffusion of water molecules - FA, MD, RD and AD and discussing their pitfalls. Introduction to new advanced metrics like NODDI (neurite orientation dispersion and density imaging) for neuroscience clinical research. Clinical relevance of scalar metrics

#### TABLE OF CONTENTS/OUTLINE

Introduction to dMRI Traditional dMRI metrics to reveal microscopic details of tissue architecture (FA, AD, RD, MD) Pitfalls of traditional metrics NODDI- introduction and applications in clinical research (TBI and Epilepsy)

#### **NREE-44 Practical Guide for Young Radiologists: Basic Sequences in Neuroradiology**

Participants

Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the aspects and physical parameters of basic magnetic resonance imaging sequences of the brain. Identify the main evaluation structures and tissue signal patterns in each sequence. Correlate brain diseases with signal changes.

#### TABLE OF CONTENTS/OUTLINE

Different Magnetic Resonance (MRI) imaging sequences are used together for brain evaluation. Knowledge of the physical aspects and signal patterns of basic MR sequences are essential for elucidation of neurological pathologies. Variables such as the number of radiofrequency (RF) pulses, angle, period between excitations (repetition time - TR) and period between excitation to echo (echo time - TE) determine the different signals between tissues on T1, T2 and image density proton weights. Some tissues and contents show different signals in each sequence. In the T1 sequence, fat, lesions with high protein content, some stages of hemoglobin degradation and melanin have high signal. In this sequence, it is important to analyze bone structures, brain parenchyma, flow-void, pineal and pituitary glands. In the T2/FLAIR sequence, most lesions have high signal, is a good sequence to see white lesions. In T2\*/SWI, blood, calcium, air have low signal. Some neoplastic, infectious, and ischemic changes show diffusion restriction on the DWI sequence and characteristic postcontrast enhancement. The correlation of signal patterns from different tissues in the evaluation of basic sequences helps in the recognition of patterns of normality and pathological alterations, being an important knowledge for young radiologists to begin to understand the findings of magnetic resonance imaging of the brain.

#### **NREE-45 The Art of Arteritis: Imaging Primary CNS Vasculitis**

Participants

Eleanor Taylor, MSc, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A practical approach to the investigation of PCNSV covering the diagnostic criteria, presentation, and laboratory tests, but with

1. A practical approach to the investigation of PCNSV, covering the diagnostic criteria, presentation, and laboratory tests, but with a primary focus on imaging. 2. A structured discussion of the radiological manifestations of PCNSV. 3. An awareness of the common mimics and their differentiating clinical and radiological features. 4. Insight into the role of imaging in the process of diagnosis and treatment from a multidisciplinary perspective.

#### TABLE OF CONTENTS/OUTLINE

Primary central nervous system (CNS) vasculitis (PCNSV) is an extremely rare diagnosis but a common clinical concern. The presentation is non-specific; it typically manifests in middle-aged patients with subacute headache, altered cognition, and variable additional neurological features. Cerebrospinal fluid analysis can be normal in up to one third of cases. The radiological phenotype is protean, with no pathognomonic findings and innumerable mimics. Luminal vascular imaging has variable sensitivity and poor specificity. Assessment can be augmented by the use of vessel wall imaging, but this is not a panacea. Definitive diagnosis requires biopsy, not always an attractive prospect, but the risks need to be weighed against those of the disease and its treatment, both of which are considerable. To meet this formidable challenge, we will outline a practical approach to the investigation of suspected PCNSV, review the imaging findings, and explore the common mimics and their differentiating features. This will be illustrated with a series of cases compiled from a neurosciences centre in London.

#### **NREE-46 The Hidden Dangers of Hypothalamic and Hypophysal Lesions: Not Everything is Neoplastic**

Participants  
Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the normal anatomy and embryology of hypothalamic-pituitary axis using schematic illustrations and imaging MRI. Identify the main imaging features to guide differential diagnosis in non-neoplastic hypothalamic-pituitary involvement. To display a compendium of cases of non-neoplastic hypothalamic-pituitary axis.

#### TABLE OF CONTENTS/OUTLINE

The hypothalamic-pituitary axis is responsible to regulate many other endocrine glands through its hormone, and the pituitary being known as the master gland, is divided into two distinct parts: the anterior pituitary (adenohypophysis) and the posterior pituitary (neurohypophysis), differ in embryologic origin and function. There are several diseases that can affect the function and morphology of the hypothalamic-pituitary axis. It is susceptible to involvement by a variety of processes, including congenital, infectious or inflammatory, neoplastic or toxic-metabolic diseases. Imaging plays a key role in determining the most probable diagnosis and the Magnetic resonance (MR) imaging is the modality of choice for evaluating the anatomy and pathologic conditions of the hypothalamic-pituitary axis, helping to distinguish neoplastic and non-neoplastic lesions. The MRI differential diagnosis depends on anatomic recognition and characterization of associated imaging findings such as volumetric changes, stalk thickening, cystic appearance, intensity of signal in T1 and T2-weighted imaging. Therefore, we propose a systematic approach to address non-neoplastic pituitary changes based on the most important imaging patterns.

#### **NREE-47 Uncovering Coverage: Best Cases on Meningeal Pathology**

Participants  
Raissa Marjory Zonta Moreti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review normal meningeal embryology and anatomy. To understand normal behavior of brain meninges. To discuss best MR imaging protocol to evaluate meningeal diseases. To create systematic approach to evaluation of imaging patterns of most relevant meningeal pathology.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Normal embryology  
Anatomy  
Physiological behavior of meninges  
Imaging protocol  
MR imaging patterns  
Anatomic - leptomenigeal, pachymenigeal.  
Morphologic - mass-like, nodular, smooth.  
Meningeal pathology  
Infection  
Pyogenic  
Viral  
Fungal  
Parasite  
Tumors  
Benign  
Malignant - primary and secondary  
Granulomatosis  
Sarcoidosis  
Tuberculosis  
Wegener disease  
Langerhans Cell Disease  
Non Langerhans Cell Disease  
Inflammatory Diseases  
IgG4 related Pseudotumor  
Miscellaneous  
Iatrogenic  
Traumatic

#### **NREE-48 Everything About CNS Infections: A Pictorial Review. Tips and Tricks for General Radiologists**

Participants  
David Castaneda SR, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To highlight the diagnostic pearls to recognize properly CNS infections. - To showcase the differential diagnosis of the main CNS infections. - To point out the importance of the state of the immune system when analyzing these studies. - To provide an extensive pictorial review with the most typical findings of both common and uncommon infections, from bacteria, to viruses, and also fungi and parasites.

#### TABLE OF CONTENTS/OUTLINE

1. Bacterial meningitis. 1.1. Typical imaging features. 1.2. Complications: acute hydrocephalus, extra-axial collections, cranial nerve involvement, arterial and venous strokes, ventriculitis. 2. Brain abscesses and cerebritis. 2.1. Ring enhancing lesions differential diagnosis. 3. Herpes encephalitis. 4. Rhombencephalitis. 5. Acute cerebellitis. 6. Encephalitis with bithalamic lesions. 7. Neurosyphilis. 8. Neurocysticercosis. 9. Hydatidosis. 10. Toxoplasmosis. 11. Cryptococcal meningitis. 12. Progressive multifocal leukoencephalopathy. 13. HIV encephalopathy. 14. Nocardia. 15. Aspergillosis. 16. Mucormycosis. 17. Neuroborreliosis. 18. Rickettsial infections. 19. COVID-19. 20. Creutzfeldt-Jakob.

#### **NREE-49 Cranial Surgical Approaches: What the Radiologist Needs to Know**

Participants  
Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose



## TEACHING POINTS

To correlate the topography of brain lesions with surgical approaches through illustrations and imaging tests. Assist in the identification of surgical accesses through imaging exams. Establish anatomical relationships and correlate with the surgical approaches crania.

## TABLE OF CONTENTS/OUTLINE

In addition to the pre-surgical evaluation for neurosurgeries, the imaging study is extremely important in identifying postoperative findings. Post-surgical changes include repercussions on the brain parenchyma, soft tissues and recognition of the cranial approaches used. The evolution of the location of the pathology helps in the interpretation of the surgical approach. Some topographies favor the use of specific accesses to allow manipulation of certain structures. Access to the skull base, brainstem, supratentorial and intraventricular are well established in the literature and the correct description in the medical report is part of the post-surgical evaluation. Therefore, we proposed to correlate surgical procedures with the location of encephalic pathologies. The demonstration of these aspects is facilitated through schematic illustrations that make it possible to associate these findings with the topography of the lesion in the surgical approach.

## NREE-5 Old but Gold: A Primer of Spine Radiography

Participants

Bianca Bianco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The spine is made up of a complex anatomy and its evaluation could be challenging sometimes. It is a curved structure composed of bony vertebrae that are connected through cartilaginous intervertebral discs. It ensures proper posture, spinal cord protection, communication with the brain, body mobility and sensation through the complex interplay between the bones, ligaments and muscle structures. The radiography is the first method for its evaluation. Although this a simple imaging method, the correct analysis is very important for the clinical management of the patient. A well-performed radiography, with an appropriate position and adequate beam increases the accuracy of the diagnosis, besides the low-cost exam and high availability in the health care system. The purpose of this presentation is to review the normal anatomy of the cervical, thoracic and lumbar spine, to provide a didactic approach about the main characteristics of the evaluation, and to guide young physicians through the analysis of spine radiography.

## TABLE OF CONTENTS/OUTLINE

Didactic review of how to evaluate the spine radiography, including the aspects of the technique, anatomy of the cervical, thoracic and lumbar spine as well as the most common pathologies, based on our service's digital archive.

## NREE-50 Encephalitis and Encephalopathy: Differential Diagnosis of Infectious and Autoimmune Diseases Based on Imaging Patterns and Topography

Participants

Beatriz Prado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

The purpose of this exhibit is: To review and discuss the differential diagnosis and brain MRI imaging patterns of infectious and autoimmune diseases by brain topography. Discuss and illustrate through illustrative cases different imaging patterns and emphasize the key findings that may lead to a specific diagnoses.

## TABLE OF CONTENTS/OUTLINE

Introduction Describe the most common brain MRI imaging features of encephalitis and encephalopathy, including images that illustrate each feature, such as swelling, inflammation, bleeding, among others. Discuss the differential diagnosis of encephalitis and encephalopathy on brain MRI, divided by topography: -Cortical: Anti-NMDAR encephalitis, Herpes simplex encephalitis, Progressive Multifocal Leukoencephalopathy -White matter: Multiple Sclerosis, Susac Syndrome, FLAMES -Basal ganglia and/or thalamus: Auto-immune striatal encephalitis, FLAMES, acute necrotizing encephalitis, Neurocysticercosis -Cerebellum: Paraneoplastic cerebellar degeneration with anti-TR, Paraneoplastic cerebellar degeneration with anti-GAD, Aseptic meningitis with systemic lupus erythematosus, Acute disseminated encephalomyelitis -Brainstem: Progressive Multifocal Leukoencephalopathy, enterovirus rhomboencephalitis, Listeria rhomboencephalitis, NMSOD Key findings and diagnostic tips Diagnostic Approach Final remarks

## NREE-51 Motor Neuron Diseases: Diagnostic Approach, Imaging Findings, and Mimics

Participants

Tatiana Iutaka, BDS, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

## TEACHING POINTS

This panel aims to: Study the diagnostic approach and clinical indications of imaging in motor neuron disease (MND); Review the MRI acquisition protocols, including advanced MRI techniques; Explain and demonstrate through illustrative cases different imaging patterns of MND; Discuss the main MND mimics and their imaging findings

## TABLE OF CONTENTS/OUTLINE

Review of the definition and clinical syndrome of MND Review the clinical indications of imaging in MND Review the main imaging techniques used for the evaluation of MND Standard MRI acquisition protocol MRI signs that might support the diagnosis directly: T2WI, FLAIR, and magnetization transfer hyperintensities in the corticospinal tract (CST) in the brain or sometimes in the spinal cord Atrophy of the precentral gyrus The 'motor dark line' in T2WI and susceptibility sequences The bright tongue sign Illustrative cases of motor neuron diseases: Amyotrophic lateral sclerosis (ALS) Bulbar ALS Primary lateral sclerosis Mills syndrome Imaging findings of the main MND mimics, divided by clinical feature (e.g.: upper motor neuron (UMN) onset, purely UMN, bulbar onset): Ischemia (e.g., stroke) Mass (e.g., tumor, vascular malformation) Radiculopathies (cervical, lumbosacral) Demyelinating disease (e.g., multiple sclerosis) Advanced imaging and respective findings: DWI: Lower mean fractional anisotropy in the CST Volumetric or morphometric analyses of T1WI 3D MRI: Volume changes mainly in classical motor areas Proton (1H) magnetic resonance spectroscopy (MRS): NAA decline over time in the motor cortex Functional MRI: Altered cortical activity in patients with ALS PET and SPECT: Hypometabolism and hypoperfusion are most prominent in the motor cortex

## **NREE-52 The Fascinating Limbic System: Anatomy, Pathology and Involvement Patterns**

Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of this exhibit are:- Review and illustrate the imaging anatomy of the limbic system, correlating with the main imaging methods, emphasizing the potential of each in identifying the structures.- To describe the main imaging patterns of lesions involving the limbic system, including dementia and psychiatric disorders, inflammatory and infectious diseases, temporal lobe epilepsy, neoplasms, Wernicke's encephalopathy, ischemic events, among others, highlighting key points for approaching the diagnosis differential.- Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

### **TABLE OF CONTENTS/OUTLINE**

- Anatomy of the limbic system, emphasizing the functional aspects.- Imaging patterns of diseases that affect the limbic system.- Differential diagnosis based on a pictorial review using representative cases from our institutional database: - Neoplasms - Infection and inflammation- Dementia and neuropsychiatric disorders- Ischemia and Infarction - Metabolic diseases - Developmental malformations- Diagnostic Algorithm- Final remarks

## **NREE-53 Imaging the Sick Neonate: Neurosonogram in Hypoxic Ischemic Injury**

### **TEACHING POINTS**

1. Hypoxic-ischemic injury (HII) of the neonatal brain and resulting encephalopathy sequel remains a significant cause of morbidity and mortality in the neonatal population. 2. Ultrasound of skull (neurosonogram) is a powerful and effective screening tool in the evaluation of sick neonates with clinical hypoxia as it determines the pattern, timing, and extent of injury in HII and differentiates it from other conditions with similar clinical picture. 3. The pattern of injury on brain imaging has crucial implications in therapies and predicted neurodevelopmental outcomes. 4. Major role of neurosonogram is identifying the diagnosis, directing appropriate therapy, monitoring evolution of disease, predicting outcomes and detecting complications of therapy. 5. Addition of Doppler and shear wave elastography (SWE) in determining the difference in brain stiffness in neonates with birth asphyxia can increase the specificity of grey-scale ultrasound.

### **TABLE OF CONTENTS/OUTLINE**

1. Normal neurosonogram appearance and technique in neonates. 2. Pathogenesis, grading and evolution of HII in term and preterm neonates with less profound and severe injury. 3. Patterns of HII in term and preterm neonates with illustration. 4. Role of ultrasound Doppler and SWE in evaluation of HII. 5. Ultrasound illustration of few clinical mimics of HII. 6. Uses and limitations of neurosonography.

## **NREE-54 Errors in the Neuroradiological Emergency: An Escape Room Experience**

Participants

Nathalia Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

TEACHING POINTS The purposes of this exhibit are:- Discuss and illustrate clinical cases of the neuroradiological emergency in a quiz and gamification format, simulating an Escape Room experience.- Highlight the imaging points and red flags to make right diagnoses in the context of emergency. - Describe the most common possible errors in neuroradiological emergency, highlighting tips and challenges in the cases presented.

### **TABLE OF CONTENTS/OUTLINE**

TABLE OF CONTENTS: - Neuroradiological emergency cases in an escape room dynamic:- The most emblematic cases in the context of neuroradiological emergency- Types of errors that can occur while the radiologist is analyzing a case- Series of cases that leads to escape and to finish the call and escape the room- Clinical cases - Quiz format- Ischemic stroke - Early and late signs of stroke- Main trials and treatment windows- Hemorrhagic lesions- Trauma - Fracture and anatomic pitfalls - Pseudofractures in a child skull - Hematic collections- Brain herniations- Headache- Arterial dissection- Metabolic disorders in the emergency- Most common intoxications- Key tips and challenges from the cases demonstrated- Escaping the room: conclusions and lessons learned

## **NREE-55 Temporal Lobe Tumors: A Pattern-based Imaging Approach**

Participants

Afonso Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Review the anatomy of the temporal lobe;2. Group the main primary central nervous system (CNS) tumors that affect the temporal lobe according to imaging characteristics;3. Synthesize the main imaging features of each tumor that help in the differential diagnosis on flashcards for quick reference;4. Show some differential diagnoses that can be confused with temporal lobe tumors

### **TABLE OF CONTENTS/OUTLINE**

Temporal lobe disorders are associated with several conditions, including seizures, dementia, and memory impairment, followed by a spectrum of behavioral disorders. It is noteworthy that about 10% of temporal lobe epilepsies are caused by focal temporal lesions. In this context, this work has as main objectives: In this sense, most primary CNS tumors can potentially occur in the temporal lobe, but entities with a predilection for being diagnosed in this location include: ganglioglioma (40%), DNET (20%), diffuse low-grade astrocytoma (20%) and others (20%). Some of these lesions may present specific imaging characteristics, which allow narrowing the differential diagnosis. Didactically, these lesions can be grouped based on imaging features into solid-cystic, bullous, or solid. Besides any primary CNS tumor can arise from temporal lobe, this location has specific clinical symptoms, and some tumors has a particular predilection for the temporal lobe. The radiologist has a special rule to recognize and narrow the differential diagnosis that will guide the treatment or follow up on each case.

## **NREE-56 Embryonal Tumors - Correlations Between Imaging Findings and Molecular Subtypes**

Participants

Larissa Freitas, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of this exhibit are: • To present the essential embryonal malignancies of the Central Nervous System. • To review the WHO CNS5 classification, considering the new modifications in nomenclature and distribution of embryonal tumors. • To make a parallel between radiophenotypic imaging and genomic features. • To present the essential imaging features correlated to tumor's genetic pattern. • To highlight the importance of recognizing the imaging pattern of embryonal tumors to therapeutics and prognosis.

### **TABLE OF CONTENTS/OUTLINE**

• Introduction - Essential embryonal malignancies of the Central Nervous System. - Review the WHO CNS5 classification making a parallel between radiophenotypic imaging and genomic features. • Medulloblastoma - Medulloblastoma WNT-activated - Medulloblastoma SHH-activated - Medulloblastoma, non-WNT / non-SHH - Group 3 - Group 4 - Other embryonal tumors - Atypical teratoid rhabdoid tumor - Embryonal tumor with multilayered rosettes - CNS Neuroblastoma, FOXR2-activated

## **NREE-57 A Pocket Guide of the Main Side Effects, from Common to Rare, of Radiation Therapy in the Brain**

Participants

Marta Calvo-Imrizaldu, MD, Pamplona, Spain (*Presenter*) Research Grant, Siemens AG

### **TEACHING POINTS**

- To review the different techniques of brain radiation therapy available for primary or metastatic tumors, that radiologists need to know. Basic pathophysiology. Novel approaches and indications.- To recognize the main radiation-related findings on brain studies, from common to unexpected, and its differential diagnosis. Focus on radiation necrosis, radiation induced tumors, and mimics of vascular diseases (SMART syndrome, vasculitis, PRES).

### **TABLE OF CONTENTS/OUTLINE**

1. Background and basics pathophysiology of radiation therapy.i. Clinical relevance statement ii. Basic pathophysiology iii. Risk factors. Benefits and risks iv. Radiation therapy techniques: conventional radiation therapy (external beam radiation therapy), stereotactic radiosurgery, proton therapy. v. Dosimetry2. MRI features and pictorial review of the main radiation-related findings on brain imaging, with differential diagnosis:- Common: a. Atrophy b. Leukoencephalopathy c. Microhemorrhages/cavernomas d. Hypoperfusion e. Mastoiditis- Less common: a. Pseudoprogression b. Radionecrosis c. Intratumoral bleeding d. Radiation-induced vasculitis- Rare: a. Radiation-induced tumors (most commonly meningioma) b. SMART syndrome: stroke-like migraine attack after radiation therapy c. PRES3. Reporting tips4. Conclusion

## **NREE-58 Radiological Evaluation of the Spectrum of Pathologies Involving Medullary Veins in Neonates and Young Children**

Participants

Esther Martin Ramirez, MD, MADRID, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To describe the anatomy and the venous drainage pathways of the intracranial venous system, with emphasis on medullary veins.To review the main pathologies that can cause medullary veins injury in newborns and young children.To explain the pathophysiology of diseases associated with medullary veins injury and their characteristic radiological findings, especially based on magnetic resonance imaging (MRI).To review the guideline-recommended MRI technique for medullary veins evaluation.

### **TABLE OF CONTENTS/OUTLINE**

There are two types of medullary veins: superficial veins (SMV) and deep veins (DMV). SMV drain the subcortical white matter centrifugally into pial veins, whereas DMV drain the deep white and grey matter centripetally into subependymal veins, with a characteristic distribution consisting of a radial pattern with four convergence zones in frontal horns and trigons, and a parallel pattern in bodies and inferior horns of lateral ventricles. The unique disposition of medullary veins allows us to detect their involvement in different pathologies through different imaging techniques, especially on MRI with susceptibility-weighted imaging sequences.The aim of this educational exhibit is to review the most frequent pathologies related to medullary veins seen in neonates and young children, including vascular anomalies, thrombosis, hemorrhage and infectious encephalitis, among others.

## **NREE-59 Fungus on the Mind: There's Much Room for Improvement**

Participants

Karthik Rajendran, MBChB, London, United Kingdom (*Presenter*) Nothing to Disclose

Girija Agarwal, MBBS, Harrow, United Kingdom (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. An overview of the epidemiology, pathophysiology and clinical features of fungal CNS infections.2. A structured review of the imaging features of various fungal CNS infections and their complications.3. An approach to the differentiation of fungal CNS infections from other common infectious and non-infectious mimics, with a focus on clinico-radiologic correlation.

### **TABLE OF CONTENTS/OUTLINE**

Fungal infections of the central nervous system (CNS) typically occur in immunocompromised patients and can be caused by yeasts (e.g. Cryptococcus), molds (e.g. Aspergillus), and dimorphic fungi (e.g. Coccidioides). The prognosis is influenced by the specific organism and patient factors but is frequently poor with mortality generally exceeding >50%.The imaging features, whilst often non-specific with a broad differential in a majority of cases, can also be distinctive and sometimes organism specific. Pathophysiological knowledge of varying fungal infections aids understanding the pathognomonic features to aid in narrowing the differential. Querying fungal etiology, even if the findings are less specific, at an early-stage aids directed laboratory testing and empirical treatment.Prolonged iatrogenic immunosuppression is on the rise, with increasing organ transplantation and cancer

incidence. Old foes like HIV remain common. Radiologists are therefore increasingly likely to encounter fungal CNS infections sporadically and must be familiar with the imaging manifestations to aid early diagnosis and improve clinical outcomes.

## **NREE-6      **Neuroradiologic Complications of Immunotherapy in the Treatment of Cancer****

Participants

John A. Arrington, MD, Tampa, FL (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

• As immune modulation in the treatment of cancer is becoming more common, its complications become more prevalent and the radiologist should be aware of these to aid rapid diagnosis and appropriate therapy. Unlike conventional chemotherapy which typically will cause immune suppression, immune modulation therapy generates an increase in systemic immune response and therefore a different spectrum of complications. This exhibit will explain the nomenclature, mechanism of action, and imaging features of more common complications of immunotherapy in the treatment of neoplasm.

### **TABLE OF CONTENTS/OUTLINE**

• Mechanism of action of Immune Checkpoint Inhibitor (ICI) therapy • Mechanism of action of Chimeric Antigen Receptor T Cell (CAR-T) therapy • Recognizing ICI nomenclature (\*mab) is helpful to know to determine if a patient's therapeutic regimen includes ICI • Neuroimaging examples • Hypophysitis • Pseudoprogression • Myositis • Acute Idiopathic Demyelinating Polyneuropathy (AIDP). • Acute myelitis (CAR-T) • Thyroiditis • CAR-T related infarction

## **NREE-60      **Diffuse High-Grade Gliomas - New Concepts****

Participants

Bruna Carvalho, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of this exhibit are: • To present the current classification of central nervous system tumors and genetic biomarker roles. • To define pediatric-type and adult-type diffuse high-grade gliomas and their molecular pathways. • To present the essential imaging features correlated to the tumor's genetic pattern. • To correlate radiophenotypic imaging and genomic features with prognosis and determination of treatment approaches.

### **TABLE OF CONTENTS/OUTLINE**

• Adult-type diffuse high-grade gliomas - Glioblastoma, IDH wildtype - Astrocytoma, IDH-mutant, grade 4 - Astrocytoma, IDHm, CDKN2A/B homozygous deletion, grade 4 • Pediatric-type diffuse high-grade gliomas - Diffuse midline glioma, H3 K27-altered - Diffuse hemispheric glioma, H3 G34-mutant

## **NREE-61      **Anoxic Brain Injury Patterns. What Can't I miss? Reviewing Patterns and Differential Diagnosis of Anoxic Brain Injury in Newborns, Children and Adults****

Participants

Bernardo Pillar Quadros, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of this exhibit are: - Review and illustrate the imaging findings of the main anoxic brain injuries patterns, classified according to age: newborns, children and adults. - Describe the main imaging patterns of the anoxic brain injuries, including brainstem lesion, thalamic lesion, periventricular leukomalacia, ventrolateral thalamic lesion, posterior putamen lesion, periorlandic cortex lesion, cortical laminar necrosis, delayed post-hypoxic leukoencephalopathy, HACE, diffuse edema, some intoxication hypoxia patterns and some differential diagnosis, highlighting key points to differential diagnosis approach. - Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

### **TABLE OF CONTENTS/OUTLINE**

- Imaging patterns of main anoxic brain injuries in newborns, children and adults. - Preterm newborn patterns lesions - Term newborn patterns lesions - Children/ adults patterns lesions - Intoxication hypoxia patterns lesions - Differential diagnosis based on a pictorial review using representative cases from our institutional database - Hypoglycemia - Creutzfeldt-Jakob disease - Uremic Encephalopathy - Metabolic disorders - Diagnostic Algorithm- Final Remarks

## **NREE-62      **Cerebrovascular Reserve Imaging Evaluation: How Much of a Challenge Can it Be****

### **TEACHING POINTS**

Cerebrovascular reserve imaging with arterial spin labeling (ASL) and acetazolamide challenge is a non-invasive MRI-based technique that evaluates cerebrovascular reactivity. ASL measures cerebral blood flow by magnetically labeling arterial blood water protons, allowing for quantification of regional cerebral blood flow (CBF) without exogenous contrast agents. Acetazolamide (a vasodilator) challenge can be used to estimate cerebrovascular reserve (CVR). ASL with acetazolamide challenge is useful for assessing CVR in neurological conditions such as cerebrovascular disease and neurodegenerative disease.

### **TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Arterial Spin Labeling III. Acetazolamide Challenge IV. Cerebrovascular Reserve Imaging with ASL and Acetazolamide Challenge Protocol, applications and analysis. V. Clinical Utility in Various Neurological Disorders VI. Conclusion

## **NREE-63      **Brainstorming the Brainstem: A Pictorial Review of Challenging Diagnosis****

Participants

Rafael Oliveira, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The goals of this paper are: - Brief anatomy review of the brainstem - Summarize uncommon diseases of the brainstem - Review

imaging presentations of brainstem diseases - Differentiate common and uncommon patterns of known diseases affecting the brainstem

#### TABLE OF CONTENTS/OUTLINE

Powerpoint layout  
1 Midbrain: 1.1 Parkinson 1.2 Wernicke-Korsakoff Syndrome 1.3 Wilson's Disease  
2 Pons: 2.1 Chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroids (CLIPPERS) 2.2 Osmotic Myelinolysis 2.3 Autosomal recessive spastic ataxia of Charlevoix-Saguenay (ARSACS)  
3 Medulla: 3.1 Friedreich Ataxia 3.2 Neuromyelitis optica spectrum disorder (NMOSD) 3.3 Dural Arteriovenous Fistula 3.4 Adult Onset Alexander Disease (AOAD) 3.5 Leukoencephalopathy with brainstem and spinal cord involvement and lactate elevation (LBSL)  
4 Miscellany: 4.1 Neuro-Behçet 4.2 Enterovirus Rombencephalitis 4.3 Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) 4.4 Adrenoleukodystrophy

#### NREE-64 Glioneuronal and Neuronal Tumors: What Can Molecular Pathways Teach Us

Participants

Giovanna Calfi, MD, Sao PAULO, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- List the essential information on various glioneuronal and neuronal tumors according to the 5th Edition of the WHO Classification of Tumors of the Central Nervous System. - Identify the main imaging features and molecular pathway involved in these brain tumors. - Highlight the importance of recognizing those patterns to help neuroradiologists narrow their diagnostic hypotheses, thus saving time and resources.

#### TABLE OF CONTENTS/OUTLINE

- Introduction: Brief review of the inclusion of glioneuronal and neuronal tumors in the 5th edition of the 2021 WHO Classification of Tumors of the Central Nervous System; Presentation of the main common characteristics of glioneuronal and neuronal tumors; Illustration of the MAPK pathway - The radiological, epidemiological and clinical characteristics correlated based on the most known genetic mutations of each tumor, namely: Dysembryoplastic neuroepithelial tumor (DNET); Multinodular and vacuolating neuronal tumor (MVNT); Central neurocytoma; Extraventricular neurocytoma; Ganglioglioma; Rosette-forming glioneuronal tumor; Dysplastic cerebellar gangliocytoma (Lhermitte-Duclos disease); Diffuse leptomeningeal glioneuronal tumor; Desmoplastic infantile astrocytoma; Papillary glioneuronal tumor; Gangliocytoma; Myxoid glioneuronal tumor

#### NREE-65 Practical Guide to Fetal Craniospinal MRI: Essentials for General Neuroradiologists and Trainees

#### TEACHING POINTS

After review of this exhibit, the radiologist should: Be able to recognize the normal fetal anatomy of the craniospinal axis. Be familiar with common indications for fetal MRI and protocol for fetal Neuroimaging Recognize and diagnose a broad range of pathologies that can be assessed with fetal MRI.

#### TABLE OF CONTENTS/OUTLINE

Fetal ultrasound is the primary diagnostic tool used for fetal imaging, but there are limitations to imaging the fetal brain, face and neck, and spinal canal. Fetal MRI is often performed to characterize ultrasound findings and provide better prognostic information for obstetric patients. Common indications for fetal craniospinal MRI include ventriculomegaly, midline anomalies, posterior fossa malformations, fetal intracranial mass, encephaloceles, cleft lip and palate, spinal malformations, and in utero disruptive events. With increased demand for these exams for pre- and post-natal health, more general neuroradiologists will be needed for interpretation. This comprehensive review has the potential to improve patient access to fetal craniospinal MRI by increasing general neuroradiologist's and trainee's comfort with interpretation of these exams. We will review imaging protocols, normal fetal anatomy, common indications, case examples, and postnatal MRI correlates. Case examples will include the Pierre Robin sequence, congenital epulis, Dandy Walker variants, open and closed dysraphism, intrauterine fetal demise with intracranial hemorrhage, orofacial-digital syndrome, and multiple midline abnormalities including alobar holoprosencephaly with synophthalmia.

#### NREE-66 The Hidden Face of Gliomas: Decoding the Pathophysiology and Infiltrative Patterns of Gliomas

Participants

Marta Calvo-Imrizaldu, MD, Pamplona, Spain (*Presenter*) Research Grant, Siemens AG

#### TEACHING POINTS

- To review the current knowledge of the pathophysiology of gliomas and the challenges of their study and management. - To outline different imaging presentations of gliomas and the role of MRI in the presurgical workup of these tumors. Pearls on imaging biomarkers available and potential diagnostic pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Background. Pathophysiological aspects of glioma  
2. Imaging protocol recommended for brain tumors  
3. Pictorial review of the main different infiltrative patterns of gliomas, from isolated hyperintense signal on T2-FLAIR to ring-enhancing necrotic gliomas:  
a. Non-contrast enhancing gliomas  
b. Gliomatosis pattern of gliomas  
c. Non-enhancing with contrast enhancing components gliomas  
d. Homogeneous enhancing gliomas  
e. "Ring enhancing" with necrosis gliomas  
f. Cystic gliomas  
g. Butterfly gliomas  
h. Multifocal gliomas  
With the following information applying for each: clinical issues and pearls on the updated 2021 World Health Organization classification, imaging biomarkers available and potential diagnostic pitfalls.  
4. Reporting tips  
5. Conclusion

#### NREE-67 Myelination and Inborn Errors of Metabolism: Learning That Goes Hand in Hand

Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: - Review and illustrate the classic patterns of myelination, emphasizing the main findings for age delimitation, as well as signs of developmental delay. - To describe the main imaging patterns of Inborn Errors of Metabolism, including hypomyelination and demyelination, exemplifying cases of Pelizaeus disease, Alexander disease, Canavan disease, Krabbe disease, Metachromatic leukodystrophy, among others, highlighting key points for approaching the differential diagnosis. - Determine

an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

#### TABLE OF CONTENTS/OUTLINE

- Imaging patterns of white matter myelination, emphasizing the key findings.- Neuroimaging of Inborn Errors of Metabolism.- Differential diagnosis based on a pictorial review using representative cases from our institutional database:- Organelle-based approach- Imaging pattern approach: white matter predominance versus gray matter predominance; diffuse white matter involvement (vanishing white matter disease), involvement of the basal ganglia (PKAN, MELAS), periventricular predominance (metachromatic leukodystrophy and Krabbe disease), subcortical predominance (L2-hydroxyglutaric aciduria), among other patterns.- Diagnostic Algorithm- Final remarks

#### NREE-68 **Neurovascular Potpourri: Disentangling the Differentials**

Participants

Eugene Shin, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Vascular pathology may be the primary reason for, or an incidental finding on contrast enhanced exams. The goal of this presentation is to provide a broad overview of the range of neurovascular findings one may encounter, from benign congenital variations to neoplasms.

#### TABLE OF CONTENTS/OUTLINE

Neurovascular topics covered include the following:1. Congenital/anatomic variants, including aortic arch and major branches, Circle of Willis and persistent carotid-vertebrobasilar anastomoses, arterial fenestration, and junctional dilatation of the basilar artery tip.2. Review International Society for the Study of Vascular Anomalies characterization of vascular anomalies, primarily discerning vascular malformations from tumors with case examples. Tips will be provided to help discern vascular lesions from similar appearing processes in the head and neck region.3. Examine other vascular disorders including moyamoya disease, fibromuscular dysplasia (including carotid intimal variant), reversible cerebral vasoconstriction syndrome, and amyloid angiopathy.

#### NREE-69 **'To Bleed or Not to Bleed'- The DVA Conundrum**

#### TEACHING POINTS

- Delineate the angioanatomy of developmental venous anomalies. •Classify the various mechanisms that render DVAs symptomatic.
- The following are illustrated with sample cases: •"Flow related" pathomechanisms. •decreased outflow; collector vein thrombosis and DVA thrombosis. •Increased inflow in the form of arterialisation of DVA . •DVAs associated with cavernomas •DVAs with no overt neuroparenchymal signal changes but with resistant epilepsy with metabolic abnormality on PET. •DVAs associated with grey matter abnormalities. •DVAs in tandem with high grade gliomas.

#### TABLE OF CONTENTS/OUTLINE

- Angioanatomy of developmental venous anomalies •Classification of the various pathomechanisms of symptomatic DVAs •The following are illustrated with sample cases: •"Flow related" pathomechanisms (as would be illustrated in our case series) -decreased outflow; collector vein thrombosis and DVA thrombosis. •Collector vein stenosis culminating in outflow restricted DVAs. •Increased inflow in the form of arterialisation of DVA . •DVAs associated with cavernomas •DVAs with no overt neuroparenchymal signal changes but with resistant epilepsy with metabolic abnormality on PET. •DVAs associated with grey matter abnormalities. •DVAs in tandem with high grade gliomas. •Overview of the treatment strategies both endovascular and conservative in the management of these vascular lesions.

#### NREE-7 **Structural and Metabolic Biomarkers in Autism Spectrum Disorder**

Participants

Robert Subtirelu, Ronkonkoma, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Evaluate the utility of structural and metabolic biomarkers in the assessment and diagnosis of patients with autism spectrum disorder (ASD) 2. Discuss possible directions for future studies to expand the application of positron emission tomography (PET) and magnetic resonance imaging (MRI) in ASD

#### TABLE OF CONTENTS/OUTLINE

1) INTRODUCTION 1.1) Methodology 1.2) Results of literature review 1.3) Summary of results 2) MRI IDENTIFIED VOLUMETRIC AND STRUCTURAL DIFFERENCES 2.1) Significance of differences in the context of ASD 2.2) Diagnostic applications 3) FDG PET/CT SHOWS DIFFUSE HYPOMETABOLISM 3.1) Hypometabolism and cognitive changes 3.2) Generalized decrease in metabolism of bilateral temporal lobes 4) ASD RESTING STATE fMRI DATA 4.1) Role of paracentral lobule in ASD symptoms 4.2) Underconnectivity and cognition 5) THE EFFECT OF AGE ON SURFACE BRAIN MEASURES IN AUTISM SPECTRUM DISORDER 5.1) Cortical thickness and cognition 5.2) Effect of surface area increase of right occipital gyrus on ASD symptoms

#### NREE-70 **Easy Come, Easy Go - Transient Brain Findings**

Participants

Samya Alves, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Despite the notability of sequelae left by neurological diseases, many conditions may present as transient abnormalities. Toxic-metabolic encephalopathies comprise one of the groups which classically presents in such manner and is part of the radiologists' daily practice - most of them having a pattern of symmetrical restricted diffusion. Other entities, like some vasculopathies and genetic determined diseases - although instinctively associated with permanent brain damage - might also portray themselves as temporary imaging alterations. In these cases, the follow-up would be critical in determining the diagnosis as it is in differentiating a post-ictal change (typically reversible) from an autoimmune encephalitis (more enduring).- Present a didactic manner for sorting of transient findings and reversible conditions by pathophysiology.- Illustrate transient imaging features in a case-based review.

## TABLE OF CONTENTS/OUTLINE

Suggestion for sorting of reversible imaging findings and conditions  
Toxic-metabolic: exogenous intoxications (medication, recreational drugs), endogenous intoxications, cytotoxic lesions of corpus callosum (CLOC)  
Vascular: PRESS, vasoconstriction syndromes, hemiplegic migraine, transient global amnesia, focal cerebral arteriopathy of childhood  
Genetic determined: phenylketonuria, urea cycle disorders, mitochondrial encephalopathy with lactic acidosis (MELAS).  
Neoplastic: some brain tumors may exhibit temporary post contrast enhancement or cystic changes without meaning tumor progression (e.g., pilocytic astrocytoma).  
Miscellaneous: stroke-like migraine attacks after radiation therapy, benign external hydrocephalus, torcular pseudomass

## NREE-71 Post-operative Spine Imaging: Evolution of Percutaneous and Surgical Devices

### TEACHING POINTS

? Percutaneous devices, such as pedicle screws and vertebral augmentation, are often used in minimally invasive procedures and have lower complication rates. ? Post-operative imaging is essential to assess the success of spine surgery, detect complications, and guide further treatment. ? Radiologists should be familiar with the different surgical approaches and devices used in spinal surgery to accurately describe the post-operative imaging findings and identify any complications that may arise.

## TABLE OF CONTENTS/OUTLINE

Arthrosis Degenerative changes in the lumbar spine are a common source of back pain and disability, affecting millions of people around the world. A great part is discogenic. Degenerative disc changes can take several forms, including disc herniation, spinal stenosis, and osteoarthritis, all of which can cause nerve compression and pain. Surgical approaches ? Anterior lumbar interbody fusion (ALIF) ? Lateral lumbar interbody fusion (LLIF) ? Transforaminal lumbar interbody fusion (TLIF) ? Posterior lumbar interbody fusion (PLIF) Common devices used for arthrodesis How do surgeons decide which approach option? Some challenging cases

## NREE-72 From A to V: Arterial and Venous Intracranial Anatomy, Variants and Malformations

Participants  
Eduardo Valadares, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe the anatomy of arterial and venous intracranial systems  
Exhibit the normal appearance and common variations of the arterial and venous intracranial systems  
Summarize the most common and some rare congenital and acquired intracranial vascular malformations

## TABLE OF CONTENTS/OUTLINE

Anatomy of Intracranial Arteries and Veins  
Normal CT and MRI Appearance  
Common Arterial Variations  
Fenestrations and Duplications  
Internal Carotid Arteries Variants  
Anterior Cerebral Artery Variants  
Middle Cerebral Artery Variants  
Posterior cerebral Artery Variants  
Persistent Carotid-Basilar Artery Anastomoses  
Common Venous Variations  
Hypoplastic Venous Sinus  
Absent Venous Sinus  
Arachnoid Granulations  
Pure Arterial Malformations  
Anterior Cerebral Artery Dolichoectasia  
Associated with Cortical Dysplasia  
CVM with Arteriovenous Shunting  
Arteriovenous Malformation  
Cerebral Proliferative Angiopathy  
Dural AV Fistula  
Carotid-Cavernous Fistula  
Vein of Galen Aneurysmal Malformation  
Fistula without Arteriovenous Shunting  
Developmental Venous Anomaly  
Sinus Pericranii  
Cerebral Cavernous Malformation  
Capillary Telangiectasia  
Vascular Neurocutaneous Syndromes  
Sturge-Weber Syndrome  
PHACE Syndrome  
Wyburn-Mason Syndrome

## NREE-73 A Radiologist Guide to Evaluating White Matter Lesions in Pediatric Patients

Participants  
Roberto Bastos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Review and illustrate the classic imaging patterns of white matter lesions in pediatric patients, with a step-by-step approach.- To describe the main imaging patterns of white matter lesions, including hypomyelination and demyelination diseases, highlighting key points for approaching the differential diagnosis.- Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

## TABLE OF CONTENTS/OUTLINE

Imaging patterns of white matter lesions in pediatric patients  
Differential diagnosis of pediatric conditions that may course with white matter lesions, discussing the main recognizable image patterns:- Terminal myelination- Periventricular leukomalacia- Hypoxic ischemic encephalopathy- Posterior reversible encephalopathy syndrome (PRES)- Hypoglycemic encephalopathy- Adrenoleukodystrophy- Kearns Sayre syndrome- L-2-hydroxyglutaric aciduria- Methotrexate-related leukoencephalopathy- Focal cortical dysplasia- Multiple sclerosis- Acute disseminated encephalomyelitis (ADEM)- Vascular malformation- Ischemic stroke- Hemorrhagic stroke- Perivascular spaces- Other conditions including aggressive and non-aggressive neoplasms, infection of CNS, phacomatosis, autoimmune and neurodegenerative disorders  
Limitations and tips for the correct diagnosis  
Practical Diagnostic Algorithm  
Final remarks

## NREE-74 CNS Tumor on Drugs - Nuts and Bolts of Neuro-oncology Agents for the Radiologist in the Age of Personalized Medicine

### TEACHING POINTS

To introduce both common and newly emerging targeted neuro-oncology agents, typical imaging response patterns, and the imaging manifestation of associated toxicities.  
To highlight targeted agents with actionable molecular markers in primary brain tumors and brain metastasis, focusing on their mechanism of action in oncogenesis.  
To recognize atypical imaging response patterns and describe the crucial role of radiologists in providing crucial input for the management of CNS neoplasms in the age of personalized medicine.

## TABLE OF CONTENTS/OUTLINE

1. Introduce commonly used traditional chemotherapy agents as well as emerging targeted chemotherapy with their mechanism of

actions• Traditional alkylating agents, including Wafer• Anti-metabolites• Targeted chemotherapy i. ALK ii. HER2 iii. EGFR iv. VEGF v. PD-1 vi. CTLA-4 vii. mTOR viii. BRAF ix. MEK x. HIF xi. CAR T-cell therapy xii. IDH inhibitor• Combination therapy• Experimental drugs2. Usual imaging findings of favorable treatment response and/or disease progression.3. Unique atypical response patterns of different neuro-oncology agents and their clinical implications in cancer management.4. Important chemotherapy-related adverse events and corresponding imaging presentation.5. Illustration of imaging manifestations of newly emerging therapies in the era of personalized medicine.

## **NREE-75 A Rose by Any Other Name? Non-Alzheimer Neurodegenerative Conditions**

Participants

Samya Alves, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Alzheimer Disease (AD) is the most common cause of dementia worldwide. However, recent studies continue to demonstrate an overlapping of clinical syndromes among neurodegenerative disorders other than DA, as well as have been presenting new biomarkers for differentiating them. As imaging and nuclear techniques advance, the role of the neuroradiologist becomes more essential to provide at least a narrowing of the differential diagnosis in order to offer the best treatment options as early as possible. - Review neurodegenerative conditions besides DA and their pathophysiology. - Mention newly recognized biomarkers, entities, and classifications. - Summarize imaging and nuclear medicine aspects for the differential diagnosis of the neurodegenerative diseases.

### **TABLE OF CONTENTS/OUTLINE**

- Introduction- Neurodegenerative conditionso Clinical phenotypes and molecular subdivisionso Imaging and nuclear medicine featureso Differential diagnosis - Case-based review

## **NREE-76 ECASS Radiological Classification of Hemorrhagic Transformation of Infarcted Brain Tissue: Don't Miss the Blood**

### **TEACHING POINTS**

Define the characteristics of hemorrhagic transformation of infarcted brain tissue, recognize the pitfalls and mimics of this entity and reproduce the new classification system: ECCAS II. Recall the different possible etiologies and clinical factors for developing this hemorrhagic complication.

### **TABLE OF CONTENTS/OUTLINE**

Introduction The hemorrhagic transformation of the infarcted brain tissue is a frequent complication of acute stroke, because of the extravasation of blood across a disrupted blood brain barrier. There are many risk factors and contributors for this disruption. By the ECASS classification system, the types of hemorrhage can be divided in two: hemorrhagic infarction (HI) and parenchymal hematoma (PH). The recognition and classification of this entity is important because the PH2 is found to be a significant predictor of neurological deterioration with higher mortality rates. Teaching points Illustrate the characteristics of an intracranial hemorrhage, specifically the hemorrhagic transformation of infarcted brain tissue. Employ the ECASS classification for hemorrhagic transformation of infarcted brain tissue. Recognize the patterns and learn how to report the different types of hemorrhagic transformation. Distinguish the pitfalls that can mimic a hemorrhagic transformation of infarcted brain tissue. Describe the possible etiologies and clinical factors for developing an intracranial hemorrhagic transformation of infarcted brain tissue.

## **NREE-77 Vein of Galen Aneurysmal Malformations: A Resident's Approach**

Participants

Sameer Chandra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- What is a Vein of Galen aneurysmal malformations (VGAM), and how does it appear in a CT and MRI scan. - Highlight the differences between Mural and choroidal Vein of Galen aneurysmal malformations (VGAM). - Exemplify the natural evolution of VGAMs, when treated vs left untreated.

### **TABLE OF CONTENTS/OUTLINE**

Vein of Galen aneurysmal malformations (VGAM) are characterized by an embryonic choroidal arteriovenous malformation supplied by the choroidal arteries (ACA, AChoA, PChoA). The venous drainage in VGAMs is towards the median prosencephalic vein. VGAMs are formed between 6th and 11th weeks of embryological development, and corresponds to 30-50% of all vascular malformations in infants. VGAMs can be subdivided into two types Choroidal and Mural. Choroidal VGAMs are characterized by multiple feeders including thalamoperforating, choroidal and pericallosal arteries are located in the subarachnoid space in the choroidal fissure. Choroidal VGAMs converge on a fistula at the anterior aspect of the median prosencephalic vein (MPV); Tend to present earlier (neonates) with more severe shunts. Choroidal VGAMs result in high output cardiac failure because of multiple high flow fistulas with less outflow restriction. Mural VGAMs are characterized by fistulae in the subarachnoid space in the wall of the median prosencephalic vein; supply may be unilateral or bilateral. They are associated with absence or stenosis of Dural sinuses and stenosis at the level of the jugular foramen. Present later (infants) and with hydrocephalus. Mural VGAMs presents with fewer fistulas with high outflow restriction.

## **NREE-78 Review of a HIV-associated Pathology in the Central Nervous System (CNS) Head and Neck**

Participants

Ahmed Abdelhalim, Los Angeles, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To review clinical presentation and imaging manifestations of HIV-associated CNS and head neck pathology, including infectious, inflammatory and neoplastic etiologies2. To discuss differential diagnoses and management considerations3. To present select cases from our institution that highlight these imaging features

### **TABLE OF CONTENTS/OUTLINE**



1. Introduction  
2. Infectious etiologies: presentation, imaging features, differential diagnosis  
a. Virali. HIV encephalopathy  
ii. Progressive multifocal leukoencephalopathy  
iii. Cytomegalovirus  
iv. AIDS encephalopathy and atrophy  
b. Fungali. Cryptococcus  
c. Bacteriali. Tuberculosis  
ii. Neurosyphilis  
d. Parasitici. Toxoplasmosis  
3. Immune reconstitution inflammatory syndrome (IRIS)  
4. CNS Lymphoma  
5. Select head and neck case review: HIV myelopathy, Kaposi sarcoma, lymphadenopathy, lymphoepithelial parotid cysts

## **NREE-79 Anatomy and Congenital Variations of the Sella Turcica, Suprasellar Cistern and Hypothalamus**

Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review the normal embryology and anatomy of the pituitary gland, the suprasellar cistern and the hypothalamus. Summarize the imaging characteristics of the sellar region on CT and MRI. Provide tools to identify anomalies in the sellar region; discuss differential diagnosis and common pitfalls.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Anatomy and embryology review- sella turcica and hypophysis- parasellar region, suprasellar region and hypothalamus  
3. Clinical-radiological correlation of congenital sellar variations  
4. Case-based review of congenital variations and pathology: - osseous - intrasellar - suprasellar - parasellar  
5. Take-home points

## **NREE-8 Beyond Myelopathy: Imaging Findings Associated with Under-recognized Neurologic Manifestations of HTLV-1**

Participants

Jedrej Krawczyk, MD, London, United Kingdom (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Human T-cell lymphotropic virus type-1 (HTLV-1) was first described in the early 1980s. Presently, where testing occurs, HTLV-1 has a prevalence of approximately 10 million (which is likely an underestimate) and is endemic in areas such as southwestern Japan and South America. Whilst in most, the infection is asymptomatic, the infection is lifelong, and there are several, likely under-recognized and potentially devastating neurological complications. The best described is HTLV-1-associated myelopathy (HAM), which typically presents with chronic progressive spastic paraparesis and bladder disturbance, but there are rarer conditions, such as acute myelopathy, encephalopathy, and inflammatory myositis. Raising awareness of these less common presentations is crucial to facilitate prompt diagnosis and treatment, especially as prompt medical intervention may limit and even potentially reverse damage. Here we describe the range of neurological and neuromuscular presentations of HTLV-1, focusing on their imaging findings illustrated by a selection of cases from our tertiary care center.

### **TABLE OF CONTENTS/OUTLINE**

1) To briefly outline clinical and imaging manifestations of HTLV-1-associated myelopathy.  
2) To provide an illustrative review of rarer presentations of HTLV-1-related neurological disorders  
3) To describe the differential diagnoses and their main discriminating imaging features.

## **NREE-80 Detangling the Knots of Pediatric Neurometabolic Disorders, One at a Time**

### **TEACHING POINTS**

- Discuss the pathophysiology of neurometabolic disorders in the pediatric age group.
- Review the imaging findings of common and rare neurometabolic conditions.
- Review the overlap in imaging manifestations and discern subtleties in differentiating various neurometabolic conditions.
- Recognise neurometabolic disorders amenable to treatment with emphasis on current and developing treatment options

### **TABLE OF CONTENTS/OUTLINE**

- Introduction to the pathophysiology with glimpses of the pattern of CNS involvement in pediatric neurometabolic disorders.
- Extensive in depth review of the imaging of various subtypes including : 1. Disorders of amino acid metabolism 2. Organic acidemias 3. Peroxisomal disorders 4. Lysosomal storage disorders 5. Neurodegenerative diseases of childhood 6. Channelopathies
- Imaging overview along with clinical correlation.
- Emphasis on treatment amenable cases.

## **NREE-81 Beware of the Railway Crossing, Neuralgia Awaits You. A Resident's Guide to Neurovascular Conflict**

Participants

Andres Haro Laverde, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Not all vascular conflicts may lead to a clinical condition; therefore, the topographical finding must correlate with the symptoms.  
2. Peripheral nerves have critical segments, where they run without a myelin sheath; this is called the transition zone.  
3. The correct imaging protocol can lead to the diagnosis; nevertheless, the best pulse sequences are prone to artifacts, and it is important to identify them.  
4. Infectious, neoplastic, or inflammatory causes may overlap; therefore, be aware of differentials.

### **TABLE OF CONTENTS/OUTLINE**

1. Anatomical review of the cranial nerves with a hub in the most common trapped roots  
2. Physiopathology of vascular palsy and the common clinical findings.  
3. Types of cranial nerve vascular conflicts and pitfalls.

## **NREE-82 A Comprehensive Guide of Neurovascular Imaging: Discovering Pearls and Overcoming Pitfalls**

Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The aim of this exhibition is to: • Thoroughly review the technical aspects of neurovascular imaging (arterial and venous angiotomography and magnetic resonance angiography) and vessel wall imaging. • Illustrate the role of these imaging methods, overall CT and MRI, highlighting advantages and disadvantages of each modality. • Unify the most important methods in a single article/presentation. • Summarize the pearls of these methods for diagnosis purpose and how to overcome the main pitfalls.

#### TABLE OF CONTENTS/OUTLINE

• INTRODUCTION Importance of neurovascular imaging through the time and where we stand today • IMAGING TECHNIQUE Neurovascular imaging techniques, including: § Protocol: when to choose each method § Sequences: which sequences are preferred for each modality § Imaging acquisition: the physical aspects and time of acquisition. • INTERACTIVE CASE-BASED DIDACTICS Sample cases to illustrate and consolidate the main pearls and pitfalls of neurovascular imaging, separated by imaging method and type of errors • FUTURE DIRECTIONS AND TAKE HOME MESSAGES Where do we need improvement? What is on the horizon for neurovascular imaging?

#### **NREE-83 INTRA-ARTERIAL CHEMOTHERAPY FOR RETINOBLASTOMA: ANATOMICAL HEMODYNAMIC CHALLENGES**

Participants  
Matteo Zanoni, Siena, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- In the hope of salvaging eyes with retinoblastoma (RB) from enucleation, intra-arterial chemotherapy (IAC) has been proposed in 2008. - The main goal of IAC is to deliver a high dose of drugs directly to the tumor while avoiding the side effects and risks of systemic chemotherapy. - In the ideal scenario, an adequate blush is visualized from the internal carotid artery, ophthalmic artery origin is favorable for catheterization and no prominent cutaneous branches from the ophthalmic artery are seen. - IAC is not always as straightforward as expected and some challenges may be seen. - The first scenario is a difficult and unstable catheterization of the OA, in spite of its visualization by selective angiography, usually due to a too angulated origin of the OA. - The second scenario occurs when OA is not visible from ICA injection or the blush is not visible and contrast medium flows back into the ICA when catheterization of the OA is properly achieved. One anastomosis with the external carotid artery could be in place providing alternative pathways for the orbital supply and drug administration. - Distribution volume of the drug, which correlates to effectiveness of the IAC, could increase because of cutaneous branches originating from OA, thus increasing local side effects.

#### TABLE OF CONTENTS/OUTLINE

- Intra-arterial chemotherapy for retinoblastoma- IAC technique and ideal scenario- Anatomical challenges and solutions- Hemodynamic challenges and solutions- Distribution volume understanding

#### **NREE-84 Pictorial Review of the Applications of Dynamic Susceptibility Contrast (DSC) MRI Perfusion in the Characterization of Meningiomas**

Participants  
Theodore Wang, South Pasadena, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Background review on the key characteristics of meningiomas and basics of dynamic susceptibility contrast (DSC) MRI perfusion. 2. Literature and pictorial review of the applications of DSC perfusion in the evaluation of meningioma characteristics, including grade, histologic subtypes, consistency, and vascularity. 3. Future applications of DSC in the evaluation of meningiomas.

#### TABLE OF CONTENTS/OUTLINE

1. Background on meningiomas and DSC MRI perfusion: (a) Brief background on meningiomas, including differences in grade, histologic subtype, consistency, and vascularity. (b) Background on the clinical importance of these different characteristics and current imaging evaluation. (c) Review of the current literature on the application of DSC for meningioma evaluation. 2. Applications of DSC perfusion in meningioma evaluation: (a) Pictorial review of applications of DSC perfusion in meningioma evaluation. (i) Review the differences in perfusion between histologic subtypes of meningiomas, including the correlation of higher perfusion values with higher grade tumors and surrounding brain parenchyma. (ii) Discuss the role of DSC in predicting vascularity and consistency of meningiomas. 3. Discussion of future directions of DSC for meningioma evaluation.

#### **NREE-85 Neuroinfectious Disorders in the Emergency: From Usual to Bizarre**

#### TEACHING POINTS

To depict the pattern of CNS infections in different compartments of the brain. To illustrate characteristic imaging findings attributable to specific pathogens. To be familiar with atypical infectious etiologies in the neuroparenchyma.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to CNS infections 2. CT and MRI imaging protocol of CNS infections: Impact of delayed CT images and Post Gadolinium FLAIR sequences. 3. Infectious involvement of different compartments of brain. 4. Meningitis: Bacterial, Cryptococcal, Viral, Rickettsial/Scrub typhus. 5. Brain Parenchymal involvement in CNS infections Restricted to white matter Both grey and white matter involvement Involvement of basal ganglia/thalami or brainstem. 6. Infectious Mass lesions Fungal abscess Pyogenic abscess Tuberculoma Parasitic infections Fungal granulomatous lesions. 7. Atypical neuroparenchymal infections Neuromyelitis Leptospirosis Scrub typhus Nocardiosis

#### **NREE-86 Arteriovenous Malformations: Practical Application of Spetzler Martin Classification**

#### TEACHING POINTS

Brain arteriovenous malformations are a type of intracranial high flow vascular malformation composed of enlarged feeding arteries, a nidus of vessels closely associated with the brain parenchyma through which arteriovenous shunting occurs, and draining veins. These malformations are characterized by a nidus forming the transition between the feeding artery and draining vein. If this transition is made directly, then it is considered an arteriovenous fistula, which is a separate type of cerebral vascular anomaly.

## TABLE OF CONTENTS/OUTLINE

Definition Clinical findings Location Incidence Associated anomalies Classification Cases

### **NREE-87 Advances in NOWinBRAIN 3D Neuroimage Large Repository: Cortical and Cranial Openings and Neurologic Disorders**

#### TEACHING POINTS

The exhibit: 1) Demonstrates a novel image display and exploration method using sequences of cortical and cranial openings; 2) Enables skull-brain correlation via cranial openings exposing the underlying parcellated and labeled brain (divided into lobes, gyri, and sulci) and intracranial arteries and venous system; 3) Facilitates brain-intracranial arteries correlation by opening 64 gyri and 6 lobules exposing the white matter and the arteries usually hidden deep in the sulci; 4) Provides a correspondence between brain damage (lesion) and the resulting disorder for vascular, cranial nerve and regional anatomy-related synthesized lesions, each lesion labeled with a disorder, signs, symptoms, and/or syndromes; 5) Presents a wide spectrum of over 8,600 3D neuroimages systematically organized, named and grouped into over 630 folders; 6) Is a valuable resource for medical students and residents as well as educators to prepare presentations.

#### TABLE OF CONTENTS/OUTLINE

The NOWinBRAIN repository contains 12 galleries (G1-G12) with 3D neuroimages derived from 3D brain atlases constructed from multiple 3/7 T MR and CT scans of a living brain. Galleries G1-G6 with 5000+ images were earlier presented at RSNA. For RSNA 2023 this repository is extended, enhanced, and two new galleries are created with cortical and cranial openings (G8) and 3D simulated neurologic disorders with outcomes (G11). The NOWinBRAIN repository is web-based and publically available at [www.nowinbrain.org](http://www.nowinbrain.org)

### **NREE-88 Brain Bubbles: Updates on Intracranial Cystic Lesions**

Participants

Azza Reda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the intra- and extra-axial cystic lesions based on the anatomical location.
- To highlight the recently described and updated cystic lesions.
- To provide an algorithmic approach describing incidental lesions elucidating the differential diagnosis with an aim to recognize do not touch lesions, aid in appropriate management, and prevent inadvertent surgical intervention.

#### TABLE OF CONTENTS/OUTLINE

Updated approach to diagnose neoplastic and neoplastic intracranial cystic lesions A. Intra-axial: supra and infratentorial parenchymal lesions. B. Extra-axial: supra and infratentorial; and each divided, into midline, off midline, and intraventricular lesions. Intra-axial cystic lesions • Non neoplastic lesions: Enlarged perivascular spaces (Glymphatic system and tumefactive type), Neuroglial cyst, porencephalic cyst, and ependymal cyst. • Infectious cysts: Cryptococcosis, Neurocysticercosis, and abscess. • Neoplastic lesions: MVNT and MVNT plus, DNET, ganglioglioma, metastasis, glioblastoma and oligodendroglioma, pilocytic astrocytoma, haemangioblastoma, medulloblastoma, pleomorphic xanthoastrocytoma, and rarely ependymoma. Extra-axial cystic lesions • Non neoplastic lesions: Pineal cyst, Rathke's cleft cyst, normal, arachnoid cyst, dermoid, epidermoid cyst, choroid plexus cyst and fissure, colloid cyst, Neurocysticercosis and neuroenteric cyst. • Neoplastic lesions: craniopharyngioma, schwannoma, ependymoma and pituitary apoplexy. Significant emphasis would be on the atypical cystic brain metastatic lesions and don't touch lesions.

### **NREE-89 MR Case-based Review of Cavernous Sinus Lesions**

Participants

Eva Romo, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the anatomy of the cavernous sinuses and normal appearance on MR To make a case-based illustration of the MR imaging features on the main cavernous sinus lesions

#### TABLE OF CONTENTS/OUTLINE

Anatomy of the cavernous sinus MR protocol for suspected cavernous sinus pathology Case-based MR imaging findings of main cavernous sinus lesions Neoplastic Case 1: Pituitary adenoma Case 2: Meningioma Case 3: Giant hemangioma Case 4: Lymphoma Case 5: Chordoma Case 6: Metastatic lesion of skin carcinoma Inflammatory Case 7: Tolosa-Hunt syndrome Vascular Case 8: Cavernous ICAs aneurysms Case 9: ICA occlusion

### **NREE-9 Caught in the Web: Imaging Techniques in Identifying Ischemic Stroke Due to Carotid Web**

Participants

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The carotid web is a rare vascular anomaly that can lead to ischemic stroke. Its diagnosis and management can be challenging due to its limited pathophysiology and presentation understanding. However, advanced diagnostic imaging techniques have greatly enhanced the identification and management of the carotid web. This educational exhibit highlights the importance of early detection, accurate diagnosis, and interdisciplinary approach to carotid web management: To illustrate carotid web radiologic highlights. To explain the complications involved with the finding. To explain the imaging assessment.

#### TABLE OF CONTENTS/OUTLINE

1. Definition of carotid web and revision of epidemiology, clinical presentation, and etiology, including prevalence and incidence of the carotid web, common clinical presentations, and etiological factors contributing to carotid web.
2. CT angiography highlights.
3. Underlying factors contributing to carotid web development, including early detection and management importance.
4. Differential diagnosis of carotid web and the importance of accurate diagnosis for appropriate management.
5. Potential complications associated with carotid web and the importance of identifying and managing complications promptly.
6. Clinical perspective: current

management strategies for carotid web and the importance of an interdisciplinary approach to the patient. 7. Take-home messages.

## **NREE-90 Big Vents: Causes of Hydrocephalus**

### **TEACHING POINTS**

Classification and terminology of hydrocephalus continue to be sources of confusion and debate in the literature. This exhibit provides an overview of the ventricular system and hydrocephalus classification scheme, covering typical pathologies and their imaging findings to enable the reader to approach hydrocephalus confidently. Normal ventricular anatomy consists of four interconnected choroid plexus-lined cavities and two canals. Anatomic variants can mimic hydrocephalus. Hydrocephalus is a disorder of flow, formation, or resorption of cerebrospinal fluid (CSF). Hydrocephalus classification is based on obstruction site and includes high pressure, normal pressure (NPH), and low-pressure subtypes. Intraventricular obstructive hydrocephalus (IVOH) inhibits CSF outflow due to obstruction at or before the 4th ventricle. Extraventricular obstructive hydrocephalus (EVOH) is due to obstruction anywhere from the 4th ventricular outlet foramina to the arachnoid granulations. Overproduction hydrocephalus is frequently caused by choroid plexus papilloma. NPH is diagnosed via a combination of history, neurological examination, and specific imaging findings. Syndrome of Inappropriately Low-Pressure Acute Hydrocephalus (SILPAH) is a rare and unrecognized condition with imaging findings mirroring severe obstructive hydrocephalus.

### **TABLE OF CONTENTS/OUTLINE**

Ventricular Anatomy CSF Production and Circulation Models Normal Variants Hydrocephalus Classification High Pressure subtypes IVOH EVOH Overproduction NPH SILPAH Summary

## **NREE-91 CNS Imaging Correlates of an FDA Cleared Diagnostic Meningitis/Encephalitis Panel**

Participants

Norbert Campeau, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Diagnosis of CNS infections from cerebrospinal fluid collected by lumbar puncture is increasingly performed using comprehensive diagnostic panels. 2. This exhibit serves as a useful imaging reference atlas for the 14 microbial entities of meningitis/encephalitis included on an FDA cleared diagnostic panel which includes 6 bacteria, 7 viruses, and 1 yeast. 3. Knowledge of the imaging findings for these entities is clinically useful to monitor the extent of CSF involvement in known positive cases, or to suggest CSF testing in suspected cases undergoing CNS imaging. 4. The relative merits of CT, MRI and cranial ultrasound imaging modalities and contrast use will be discussed.

### **TABLE OF CONTENTS/OUTLINE**

A. The 14 microbial entities included on the diagnostic panel are: - 6 bacteria (*Haemophilus Influenza*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, *Escherichia coli* K1, *Streptococcus agalactiae*, *Listeria monocytogenes*) - 7 viruses (*Enterovirus*, *Cytomegalovirus*, *Herpes Simplex 1*, *Herpes Simplex 2*, *Human Herpesvirus 6*, *Human parechovirus*, and *Varicella zoster*) - 1 yeast (*Cryptococcus neoformans/C. gattii*) B. The CNS imaging findings for each of the above microbial entities will be presented, including a brief synopsis of the epidemiology and clinical presentation. C. Summary Table of Imaging Findings.

## **NREE-92 Portable Ultralow Field (0.064 Tesla) MRI for Neuroimaging**

Participants

Saurabh Jindal, MD, MBBS, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Bedside magnetic resonance imaging (MRI) performed by an MRI or non-MRI-trained technologist in the presence of clinical staff/family. 2. Clinical utility in neurointensive care units and unstable patients who cannot be transferred to the MRI suite. 3. Standard sequences to diagnose common neurological emergencies, such as stroke, hypoxic-ischemic injury, and empyema. 4. Infarct or Artifact?: When in doubt on the low signal-to-noise ratio (SNR) diffusion-weighted images (DWI), evidence of edema on T2W/FLAIR images can aid in the diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to portable MRI scanner 2. Clinical cases 3. Teaching points 4. References 5. Acknowledgments

## **NREE-93 Radiologist's Guide to Image-guided Spinal Steroid Injections: Anatomy, Procedural Technique, and Potential Pitfalls**

Participants

Jeffrey Ling, MD, Joint Base Lewis-McChord, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Review pertinent spinal anatomy with emphasis on key radiographic landmarks for epidural needle access. Discuss the utility and indications for spinal steroid injections in the setting of neck or back pain. Provide a brief overview of image guided approaches that can be utilized for spinal steroid injections. Understand potential procedural pitfalls and complications.

### **TABLE OF CONTENTS/OUTLINE**

Introduction Epidemiology of painful spine conditions and associated imaging findings. Relevant anatomy of the lumbar and cervical spine. Indications and contraindications of image-guided steroid injections. Choice of corticosteroid and/or local anesthetics. Potential procedural risks and complications. Procedure approach and technique Preprocedural planning: evaluate degenerative disease at the target level, assess epidural target and adjacent structures, anticipate distance to target and optimal needle length; CT versus fluoroscopy technique. Interlaminar epidural steroid injections. Transforaminal epidural steroid injections: supraneural approach, infraneural approach. Complications Common: temporary local discomfort during needle placement; inadvertent dural puncture (CSF leak). Rare, serious: contrast reaction; hemorrhage, epidural hematoma; spinal cord infarct (intravascular injection). Discussion Evaluation of post-procedural improvement in pain. CT versus fluoroscopy. Review of tips and tricks for technical procedural success. Alternative options for pain relief.

## **NREE-94 The Big Picture: A Radiologist's Guide to Unlocking the Intricacies of Pediatric Neurometabolic Diseases**

### **TEACHING POINTS**

1. Brain MRI is the primary imaging modality for assessing neurometabolic disease in children. 2. MR spectroscopy should be considered as a supplemental imaging tool when neurometabolic disease is suspected. 3. Symmetric signal abnormalities involving white matter, basal ganglia, thalami, brainstem, and cerebellum can be major clues on imaging for neurometabolic disease. 4. Narrowing down the differential diagnosis requires further assessment of anatomic distribution, temporal progression, and additional imaging findings such as cysts and calcifications. 5. Age at presentation, particularly neonatal onset, is an important factor to consider when diagnosing devastating metabolic diseases in newborns.

### **TABLE OF CONTENTS/OUTLINE**

Introduction Brief overview of the importance of radiological assessment in pediatric neurometabolic disease Imaging Modalities for Neurometabolic Disease Highlighting brain MRI as the primary imaging modality Discussing the added value of MR spectroscopy Clues on Imaging for Neurometabolic Disease Describing specific patterns and findings on imaging, such as symmetric signal abnormalities involving white matter, basal ganglia, thalami, brainstem, and cerebellum Emphasizing the importance of pattern recognition in identifying potential neurometabolic disease Narrowing Down the Differential Diagnosis Discussing the role of further assessment, including anatomic distribution, temporal progression, and additional imaging findings such as cysts and calcifications Highlighting the significance of age at presentation, particularly neonatal onset Conclusion Summarizing the key take-home messages for radiologists in imaging pediatric neurometabolic disease

## **NREE-95 Multimodality Imaging of Cerebral Vasospasm**

Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To highlight key concepts such as symptomatic vasospasm, radiographic vasospasm and delayed cerebral ischemia, that will help the reader understand cerebral vasospasm and its consequences. 2. To describe different diagnostic methods for detection of cerebral vasospasm, each with their advantages and disadvantages, providing illustrative examples. 3. To propose a practical diagnostic-therapeutic approach of severe SAH and vasospasm.

### **TABLE OF CONTENTS/OUTLINE**

1. Cerebral vasospasm: key concepts 1.1. Definitions: SAH, radiographic vasospasm, symptomatic vasospasm, delayed cerebral ischemia (DCI). 1.2. Etiology: SAH. Risk factors, diagnostic protocol, prognosis. 2. Diagnosis of cerebral vasospasm 2.1. Clinical signs and symptoms and other monitoring tools. 2.2. Transcranial Doppler ultrasound. 2.3. CT (NECT, CT perfusion, CTA) 2.4. DSA 2.5. Diagnostic management - proposed algorithm 3. Treatment: the fight against DCI 3.1. Medical treatment. 3.2. Angiographic/Interventional treatment and its complications. 4. Take home points

## **NREE-96 A Trip Through Gyrfiform Enhancement**

Participants

Adria Roset Altadill, MD, Girona, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Gyrfiform enhancement is mainly secondary to vascular and infectious causes. - Gyrfiform enhancement should be discerned at imaging from leptomeningeal enhancement. - Distinction between the different etiologies of gyrfiform enhancement has to be made based on clinical history, brain distribution and ancillary radiologic findings.

### **TABLE OF CONTENTS/OUTLINE**

Gyrfiform enhancement, also called gyral or cortical enhancement, is an uncommon brain pattern that refers to contrast deposition on the superficial grey matter of the cerebral cortex. The main causes of this enhancement pattern are vascular and infectious. Vascular causes can be related to arterial or venous infarctions, seizures, migraine syndromes, posterior reversible encephalopathy syndrome (PRES) and subarachnoid hemorrhage. Infectious processes include mainly herpes encephalitis, cerebritis and meningitis. Finally, gyral enhancement may also rarely occur in neoplastic diseases or cases of neurotoxicity. Cortical enhancement can be detected by contrast-enhanced head CT or brain MRI, although the latter is much more sensitive due to its higher contrast resolution. It is important to differentiate cortical enhancement from leptomeningeal enhancement, which can demonstrate a similar "serpentine" morphology but affects the subarachnoid space and the pia matter instead. In order to narrow the differential diagnosis between the spectrum of causes of cortical enhancement, a focus should be placed on clinical history, distribution of the gyral enhancement and ancillary radiologic findings.

## **NREE-97 Cerebrovascular Disease in Young Adults: A Case-Based Review**

Participants

Huijuan Wang, MD, Pontiac, MI (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Cerebrovascular disease (CVD) can result from blood vessel narrowing, rupture, or a hypercoagulable state, which may present on imaging as vascular stenosis, hemorrhage, or occlusion, respectively. As an emerging public health issue with debilitating effects on young adults, recognizing the similarities and differences between young adults and elderly patients for the etiologies and prevalence of various types of CVD is imperative for optimal patient outcomes.

### **TABLE OF CONTENTS/OUTLINE**

1. Review the common etiologies and prevalence of cerebrovascular disease (CVD) in young adults and how this compares to elderly patients. 2. Categorize the differential diagnosis based on the general imaging appearance of vascular stenosis, hemorrhage, and occlusion in conjunction with the location of the abnormality. 3. Practice the diagnostic approach previously reviewed with multiple vignette-style young adult CVD cases with questions accompanying each case focused on differential diagnosis, prognosis, and

management.4. Discuss clinical presentation, key imaging findings, differential diagnosis, and management of each presented case.

### **NREE-98 Imaging of Deep Brain Stimulation Systems**

Participants

Alexandre Boutet, MD,MSc, Toronto, ON (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

(1) Deep brain stimulation (DBS) surgery, which is the most common functional neurosurgery treatment, is increasingly being performed worldwide. (2) Its therapeutic effect hinges upon accurate and precise targeting of the intended brain structure—maximizing therapeutic benefits while minimizing spillover onto neighbouring structures that may produce adverse effects. (3) Knowledge of the anatomical relationships of the most common targets including the subthalamic nucleus and pallidum is essential for accurate reporting. (4) Postoperative imaging of DBS patients is subject to strict MRI safety guidelines to prevent heating at the electrode tips, which is the main risk. Knowledge of the factors influencing safety such as specific absorption rate (SAR) is crucial to provide these patients with optimal MRI when it is required. (5) Interpretation of DBS postoperative imaging requires knowledge of the expected appearances and the complications. (6) Functional neurosurgery is a rapidly evolving field with considerable scope for the role of radiologists to grow beyond their current contributions.

#### **TABLE OF CONTENTS/OUTLINE**

(1) Brief background of functional neurosurgery focusing on DBS. (2) Anatomical relationships of the most common targets. (3) Framework on how to safely acquire MRI in postoperative DBS patients. (4) Expected and complicated postoperative imaging appearances of DBS. (5) Future directions and opportunities for radiologists.

### **NREE-99 MRI Characteristics of Chemotherapy Related Central Neurotoxicity: A Pictorial Review**

Participants

Rugaiyah Alkhatib, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Due to the increasing incidence of cancer and advancements in cancer treatment, the prevalence of chemotherapy-related neurotoxicity has also seen an increasing trend. Chemotherapy-related neurotoxicity is a well-recognized complication in oncologic patients, with a wide range of patients, from 19% to more than 85% receiving chemotherapeutic agents experiencing symptoms of neurotoxicity. This may present with a wide range of neurological manifestations, which can pose diagnostic challenges, particularly, in distinguishing it from tumor progression and paraneoplastic syndrome. Therefore, imaging plays a crucial role in the management of these patients. MRI can reveal various imaging patterns of chemotherapy-induced neurotoxicity, including acute-subacute leukoencephalopathy with reversible DWI pattern, commonly observed with methotrexate use, as well as acute cerebellar syndrome and reversible acute cerebellar toxicity patterns, which is most often induced by high-dose cytarabine. Other imaging patterns include posterior reversible encephalopathy syndrome, neurovascular complications pattern, progressive multifocal leukoencephalopathy pattern and spinal cord toxicity. In this pictorial review, we will highlight the MRI characteristics and patterns related to chemotherapy-induced neurotoxicity, as well as provide case-based examples to better illustrate these features.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Types of chemotherapeutic agents and mechanism of action  
3. Characteristics MRI features of chemotherapy-induced central neurotoxicity  
4. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-1

### Variants and Anomalies of Intracranial Cerebral Arteries and Considerations for Neuroendovascular Procedures

#### TEACHING POINTS

- To describe the embryology of the intracranial cerebral arteries in order to explain the origin of its anatomical variants and anomalies.- To review all the variants and anomalies of intracranial cerebral arteries giving examples from cases from our institution.- To revise the associated pathology and the implications for endovascular procedures.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Embryology3. Intracranial Internal Carotid Artery 3.1. Variants. Tortuosity. 3.2. Anomalies 3.2.1. Aberrant carotid artery 3.2.2. Persistent estapedial artery 3.3. Ophthalmic artery4. Persistent carotid-basilar communications4.1. Trigeminal artery 4.2. Hypoglossal artery 4.3. Proatlantal intersegmental artery5. Anterior cerebral artery (ACA) 5.1. Variants 5.1.1. The anterior communicating artery 5.2. Anomalies 5.2.1. Infraoptic origin and persistent olfactory primitive artery 5.2.2. Accessory, multiple and aberrant ACA 5.2.3. Bihemispheric and azygos ACA6. Middle cerebral artery (MCA) 6.1. Variants 6.2. Anomalies 6.2.1. Accessory, fenestrated and duplicated MCA7. The posterior arterial circulation 7.1. Variants 7.1.1. Fetal origin 7.1.2. AICA-PICA 7.2. Anomalies 7.2.1. Basilar fenestration

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## Abstract Archives of the RSNA, 2023

NREE-10

### 'Incidental' Intracranial Arterial Anatomical Variants: Implications for Diagnosis, Pathology and Treatment

#### Participants

Charlotte Chung, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Variability in intracranial arterial anatomy is well recognized to be the rule, not the exception. For example, the Circle of Willis is incomplete in 75-80% of brain CT/MR angiography. While anatomic variations may be clinically inconsequential in the normal patient, accurate delineation of the involved anatomy may be critical in the setting of pathology. This exhibit employs a systematic vessel-based approach to illustrate common intracranial arterial variants and their potential clinical implications through case-based discussions. Educational objectives of this exhibit are:- Outline intracranial arterial development and resultant spectrum of anatomic variations- Illustrate common 'incidental' variant configurations of the intracranial arteries on multimodal (CTA, MRA, and DSA) neuroimaging.- Highlight implications of anatomical variants in diagnosis, pathology, and treatment of cerebrovascular diseases

#### TABLE OF CONTENTS/OUTLINE

I. Case-based review of anatomical variants in the distal ICAII. Case-based review of anatomical variants in the Circle of WillisIII. Case-based illustration of the continuum of variant MCA and ACA cortical branching patternIV. Case-based review of anatomical variants in the vertebrobasilar circulationV. Variants in vessel morphology and caliber mimicking pathology

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## Abstract Archives of the RSNA, 2023

NREE-100

### Frontier Technology in Non-Invasive Vascular Imaging; Arterial Spin Labeling-Based Non-Contrast MR Digital Subtraction Angiography on Cerebral Diseases

#### Participants

Miho Gomyo, Mitaka, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn the basic principles of arterial spin labeling-based non-contrast MR digital subtraction angiography (ASL-MRDSA) that can obtain dynamic information of cerebral arteries without using a Gd-based contrast agent. 2. To learn various scanning methods of ASL-MRDSA. 3. To learn clinical applications of ASL-MRDSA to evaluate cerebral lesions. 4. To know some novel techniques of ASL-MRDSA. 5. To review pitfalls and limitations of ASL-MRDSA.

#### TABLE OF CONTENTS/OUTLINE

1. Basic principles of ASL-MRDSA 2. Various scanning methods of ASL-MRDSA and their characteristics; 2D-methods, 3D-methods, and ultra-short TE methods 3. Novel techniques of ASL-MRDSA 4. Clinical applications of ASL-MRDSA to evaluate the following diseases; • intracranial arterial stenosis/occlusion • moyamoya disease • arteriovenous malformation (AVM) • carotid-cavernous fistula (CCF) • dural arteriovenous fistula (dAVF) • extracranial to intracranial (EC-IC) bypass • hypervascular tumors (skull tumor, hemangioblastoma, paraganglioma, and so on) • post-operative study of cerebral aneurysms (clipping, coil embolization) 5. Pitfalls and limitations

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## Abstract Archives of the RSNA, 2023

NREE-101

### Patterns of Abnormal Magnetic Susceptibility in the Brain

#### TEACHING POINTS

1) Susceptibility weighted imaging (SWI) is an MRI sequence that uses phase and magnitude information to characterize substances that distort the local magnetic field, allowing for identification of hemosiderin, calcification, and iron deposition. 2) Depending on the pathology, abnormal magnetic susceptibility may appear as a single or multiple lesions and can present with varying morphology. 3) SWI lesion locations correlate with the disease mechanism. Understanding physiologic and pathologic reasons for localization is key to formulating the differential diagnosis and diagnosis 4) SWI is instrumental in characterization of vascular abnormalities, masses, and causes of microhemorrhage. 5) SWI is often able to detect changes earlier in a disease process than other sequences.

#### TABLE OF CONTENTS/OUTLINE

Pathology organized by susceptibility patterns: -Single lesion: - Location specific - Basal ganglia: neurodegenerative diseases, hypertensive hemorrhages, toxic/metabolic entities - Midline: desmoid - Sulcal: siderosis - Single vascular: thrombosis of cerebral vein or DVA, calcified embolus in Circle of Willis artery - Linear susceptibility along margins of cerebral mass: pyogenic abscess - Multiple lesions: - Location specific - Grey-white matter junction: hemorrhagic metastases, grade 1 DAI - Lobar: CAA - Diffuse vascular: ferumoxytol - Corpus callosum: grade 2 DAI - Brainstem: grade 3 DAI, kernohan phenomenon -Non-location specific - Diffuse axonal injury - Fat emboli - Microhemorrhage of acute illness, post-cardiac surgery

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## Abstract Archives of the RSNA, 2023

NREE-102

### Head On: Facing Central Nervous System Lymphoma

#### Participants

MARCELO DOS SANTOS BANDEIRA FILHO, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is- To explore the proper terminology and classification of lymphomas based on updates of the fifth edition of the WHO Classification of Tumors of the Central Nervous System (CNS).- List the main clinical and epidemiological characteristics and risk factors associated with the appearance of CNS lymphomas.- To show through a pictorial review the classic imaging findings of various lymphomas of the CNS.- Show atypical cases of lymphomas and develop adequate reasoning for the radiologist to face unusual findings.

#### TABLE OF CONTENTS/OUTLINE

Powerpoint Layout  
Introduction:1. Overview of clinical, epidemiological and risk factors.2. Neuroradiology:2.1 Terminology of SNC lymphomas.5th edition of the WHO 2.2 Classification of Tumors: SNC lymphomas.CNS Lymphomas:Primary diffuse large B-cell lymphoma of the CNS.Immunodeficiency-associated CNS lymphomaLymphomatoid granulomatosisIntravascular large B-cell lymphomaMiscellaneous rare lymphomas in the CNS:MALT lymphoma of the duraOther low-grade B-cell lymphomas of the CNSAnaplastic large cell lymphoma (ALK+/ALK-)T-cell and NK/T-cell lymphomas

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## Abstract Archives of the RSNA, 2023

NREE-103

### Photon Counting Detector Lateral Decubitus CT Myelography: A Developing Technique for Detection of Cerebrospinal Fluid - Venous Fistulas

#### Participants

Nikkole Weber, ARRT, RT, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Discuss protocol development and optimization of Photon Counting Detector (PCD) CT Myelography (CTM) 2. Describe features of PCD technology that improve detection of cerebrospinal fluid- venous fistulas (CVFs): spectral, spatial and fast 4D serial acquisitions 3. Demonstrate examples of CVFs found on PCD CTM

#### TABLE OF CONTENTS/OUTLINE

1. Review current imaging modalities for myelography 2. PCD CTM protocol development a. Performed in right and left lateral decubitus Trendelenburg positions b. Lumbar spine localizers c. Spinal needle placement intrathecally d. Bolus tracking to monitor contrast flow within the thecal sac e. Serial paired acquisitions, with multi-energy (ME) and high-resolution (HR)/ME scan modes 3. Unique technologic advantages of PCD that aide in detection of subtle CVF a. Higher spatial resolution i. Spinal anatomy of interest very small ii. HRME (0.2mm), ME (0.4mm) scan mode reconstructions b. Improved radiation dose efficiency compared to energy integrating detector CT scanners—reduced electronic noise, optimal photon weighting, smaller detector pixel size, and removal of septae. Resultant images with thinner slices and sharper kernels can be generated without increasing noise c. Spectral reconstructions to improve contrast enhancement and iodine contrast to noise ratio (CNR) i. Increased iodine CNR due to more optimal energy weighting of PCDs (more weight towards low-energy photons) ii. Subtle CVFs can be very faint. Virtual monoenergetic images (VMI) at low keV (40) increases the conspicuity of iodine d. Fast 4D acquisition: 3D volume + a series of acquisitions at different time points. e. Metal artifact reduction vs high keV VMI reconstructions tested 4. CVF example patient images

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## Abstract Archives of the RSNA, 2023

NREE-104

### MR Bone Imaging: Value of Application to Cervical and Intracranial Vessel Wall Imaging

#### Participants

Kazuhiro Tsuchiya, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn basic concepts and technical aspects of bone imaging like CT by MR imaging.2. To know basic concepts of vessel wall imaging (VWI) by MR bone imaging with improved visualization between vessel walls and vessel lumen.3. To know what benefits MR bone imaging offers over conventional cervical and intracranial VWI techniques and some pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Basic issues of MR bone imaging including currently employed scanning sequences and postprocessing methods.2. MR bone imaging-based VWI: how to improve image quality.3. MR bone imaging-based VWI: how does it work in the diagnosis of vessel wall abnormalities?4. Presentation of clinical cases with discussion of implications. Cases will cover carotid calcified plaques, intracranial main trunk plaques, aneurysms, vasculitis, moyamoya disease, and so on.5. Additional discussion including current limitations and future directions of this technique.

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## Abstract Archives of the RSNA, 2023

NREE-105

### Posterior Fossa Ependymomas: Newly Defined Molecular and Genetic Subtypes with Characteristic Imaging Features

#### Participants

Shan McBurney-Lin, MD, MBA, San Francisco, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Posterior fossa (PF) ependymomas have been newly classified into two distinct subtypes, PFA and PFB, based on molecular and genetic features by the World Health Organization in 2021.<sup>2</sup> Each subtype has unique epidemiologic, biologic, prognostic, clinical, and imaging features.<sup>3</sup> Imaging plays an important role in differentiating the two subtypes of PF ependymomas and in distinguishing PFA and PFB subtypes from other PF tumors, which benefits surgical planning and tumor recurrence surveillance.<sup>4</sup> Upon completion of review of this exhibit, readers will be able to recognize the distinct molecular, genetic, and clinical features of PF ependymomas and become familiar with the characteristic imaging features of each subtype for improved early imaging diagnostic capability.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of PFA and PFB ependymal tumor subtypes, including epidemiology, prognosis and molecular/epigenetic alteration<sup>2</sup>. Characteristic imaging features of PFA and PFB tumor subtypes<sup>3</sup>. Radiologic differences between PFA/PFB subtypes and similar entities within the radiologic differential diagnosis. Medulloblastoma. Atypical teratoid rhabdoid tumor. Pilocytic astrocytoma<sup>4</sup>. Summary and quiz. Summary of key radiologic findings of PFA/PFB subtypes. Quiz to review new knowledge via example cases

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## Abstract Archives of the RSNA, 2023

NREE-106

### SWI Brush Sign of Cerebral Parenchymal Veins in CNS Diseases and Conditions

#### Participants

Seiya Kishi, Tsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

SWI brush sign (BS) represents prominent intracerebral veins in various diseases including ischemic stroke, moyamoya disease, cerebral venous thrombosis (CVT) and Sturge-Weber syndrome (SWS). We aimed to 1) learn anatomy of intracerebral veins 2) understand mechanisms of SWI BS in each disease 3) learn clinical significance related to this sign.

#### TABLE OF CONTENTS/OUTLINE

1. What is SWI BS; SWI allows visualization of intracerebral veins (in white matter and occasionally in cortex). BS represents findings of prominent intracerebral veins in some diseases and conditions. 2. Diseases that cause the SWI BS; SWI BS is caused by ischemic stroke, moyamoya disease, CVT, and SWS. It may disappear over time with or without treatments. 3. Mechanisms of brush sign; Increased deoxyhemoglobin in venous blood (BOLD effect) in ischemic stroke and moyamoya disease Congestion, and partially BOLD effect in CVT and SWS. 4. Clinical significance related to SWI BS; indicates severe hemodynamic impairment in ischemic stroke correlates with severity in moyamoya disease and with increased intracranial venous pressure in CVT suggests the diagnosis of cortical vein thrombosis when found in affected cortex may contribute to better clinical outcomes in SWS.

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## Abstract Archives of the RSNA, 2023

NREE-107

### How to Improve in Intraoperative Image Quality in Transcranial MR-guided Focused Ultrasound Surgery

#### TEACHING POINTS

The objective of this exhibition is to provide a method for enhancing of intraoperative image quality in transcranial MR-guided focused ultrasound surgery (TcMRgFUS). TcMRgFUS possesses the distinct advantage of allowing expeditious assessment of therapeutic efficacy post each sonication and intraoperative magnetic resonance (MR) imaging for visualization of the lesion. In circumstances which denotes a lack of desired therapeutic effects and the lesion misses the planned target, subsequent ablation targets can be delicately re-aligned based on the intraoperative image. Thus, the acquisition of high-quality intraoperative images, which can accurately confirm the lesion, is imperative. The accuracy of this re-alignment is contingent upon the quality of the intraoperative image. Unfortunately, the current intraoperative image quality obtained from a 3.0T MRI system, is deficient in precisely identifying the lesion. In view of this limitation, we have been developed and substantiated a method for ameliorating the quality of intraoperative images.

#### TABLE OF CONTENTS/OUTLINE

1. TcMRgFUS procedure a. Overview of TcMRgFUS b. Intraoperative T2-weighted image using 3.0T MRI2. Method for improving intraoperative image quality a. Calculating manual transmitter gainb. Acquiring high-quality intraoperative T2-weighted image3. Effectiveness of enhancing intraoperative image quality a. Clinical images resultsb. Contrast between the lesion and thalamus

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

NREE-108

### Primary Angiitis of the Central Nervous System (PACNS): Imaging Features and Differential Diagnosis

#### TEACHING POINTS

-To provide a detailed review of the literature of PACNS.-To review the different imaging features of PANCS.-To know the most frequent mimickers of PACNS.

#### TABLE OF CONTENTS/OUTLINE

PACNS is a rare inflammatory vasculopathy (affecting the medium and small vessels) in brain and spinal cord that is frequently difficult to diagnose. The neurological manifestations vary, but they typically include chronic headache, encephalopathy, focal weakness, or stroke. Brain biopsy is the gold standard and only definitive test for PACNS, but has limited sensitivity, is invasive, and is associated with high rates of morbidity. Lumbar puncture is also performed, but has limited specificity for diagnosis. Catheter angiography is the imaging reference standard and is frequently employed, even though it has limited sensitivity and specificity. Neuroimaging is critical in the diagnosis of PACNS. PACNS may present with diffuse or multi-focal white matter abnormalities, hemorrhagic stroke, single or multi-territorial ischemic infarcts, micro-hemorrhages, and pseudotumoral lesions. Vessel wall MRI increases diagnostic accuracy by showing concentric mural thickening and contrast enhancement in brain arteries affected by vasculitis. Reversible cerebral vasoconstriction syndrome, atherosclerosis, Moyamoya disease, CLIPPERS, primary CNS diffuse lymphoma, and secondary cerebral vasculitis are the most common differential diagnoses. In this review, we will illustrate and describe the radiological appearance and differential diagnosis of primary angiitis of the central nervous system (PACNS), and imaging's role in diagnosis.

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## Abstract Archives of the RSNA, 2023

NREE-109

### The T2-FLAIR Mismatch Sign in Oncologic Neuroradiology: Imaging Criteria, Current Uses, and Histo-Molecular Correlates

#### Participants

Samir Dagher, MD, BS, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Detecting the "classic" T2-FLAIR Mismatch sign (T2FMM) requires a strict application of the T2 and FLAIR criteria in adult patients with suspected CNS gliomas. The "classic" T2FMM exhibits near-perfect specificity yet variably low sensitivity for the diagnosis of astrocytoma, IDH-mutant in adults. 2. A less stringent application of the strict criteria allows for the detection of the "partial" T2FMM. Studies suggest it may reliably exclude the diagnosis of glioblastoma, IDH-wildtype while compromising the near-perfect specificity of the "classic" sign. 3. Differences in MRI acquisition parameters may affect the visibility of the T2FMM. 4. The T2FMM has also been reported in pediatric-type CNS tumors, namely dysembryoplastic neuroepithelial tumors and H3K27-altered diffuse midline gliomas. 5. Although limited data suggests significantly larger intercellular spaces, including microcysts, and upregulation of the mTOR pathway in mismatched compared to non-mismatched tumors, this has not yet translated into prognostic implications. 6. Mismatched tumors have significantly higher apparent diffusion coefficient, and lower relative cerebral blood volume on diffusion- and perfusion-weighted imaging, respectively, compared to non-mismatched tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Adult-type diffuse gliomas in the 2021 WHO classification of CNS tumors. 2. The "classic" T2FMM: imaging criteria, clinical uses and pitfalls. 3. The "partial" T2FMM: imaging criteria and clinical uses. 4. The T2FMM in pediatric-type tumors. 5. Clinical and histo-molecular correlates. 6. Diffusion- and perfusion-weighted imaging correlates.

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## Abstract Archives of the RSNA, 2023

NREE-11

### Cerebral Small Vessel Disease: Small Size, Big Problems

#### Participants

Eduardo Freire, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the imaging patterns of cerebral small vessel disease (SVD). Review the classification and subgroups of SVD. Correlate clinical findings and complaints with imaging patterns. Review the subtypes of SVD and their own diagnostic criteria. Review the Boston criteria 2.0 for cerebral amyloid angiopathy (CAA). Review the new markers of Boston criteria 2.0. Discuss the role of the radiologist in the diagnosis of SVD.

#### TABLE OF CONTENTS/OUTLINE

Cerebral Small Vessel Disease (SVD) is a high prevalence disease, and a common cause of stroke and dementia. Although SVD can be asymptomatic at the beginning, some imaging findings may suggest its diagnosis. The study "Standards for Reporting Vascular change on neuroimaging (STRIVE)" shows SVD imaging patterns on brain magnetic resonance (MR) that allows considering it as a differential diagnosis. SVD comprises a group of diseases that affect capillaries, arterioles, small veins and venules, and small perforating arteries. Didactically, we can classify SVD according to its pathological and genetic characteristics into sporadic and hereditary (genetically determined). Sporadic subtypes are the most common and represent the two main etiologies of SVD: hypertensive and related to cerebral amyloid angiopathy. Brain MR imaging findings are usually similar for all etiologies. To assist the radiologist, STRIVE compiled imaging findings that represent SVD's indirect signs.

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## Abstract Archives of the RSNA, 2023

NREE-110

### It's Not All About the Shine: Spotting MS MRI Biomarkers

#### Participants

Nicole Lambrakos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Briefly describe the multiple sclerosis biomarkers and which techniques have the highest sensitivity and specificity.2. Discuss the importance of spotting imaging multiple sclerosis biomarkers and their pathology correlation.3. Expose the role of MR in identifying the main multiple sclerosis biomarkers.4. Looking for multiple sclerosis biomarkers in doubtful lesions to favor demyelinating etiology.

#### TABLE OF CONTENTS/OUTLINE

1. Main multiple sclerosis biomarkers identifiable via MR.2. Pathophysiology: correlation of imaging and pathology of multiple sclerosis biomarkers.3. Differential diagnosis: using MR biomarkes to help favor demyelinating etiology.

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## Abstract Archives of the RSNA, 2023

NREE-111

### Pituitary Insufficiency in Children: Spectrum of MR Imaging Findings

#### TEACHING POINTS

1. Hypo-functioning pituitary tissue may appear normal on MRI. 2. Congenital anomalies of hypothalamic-pituitary axis (HPA) often present with pituitary insufficiency in children and are frequently associated with additional CNS anomalies. 3. Normally developed but hypo-functioning pituitary tissue may demonstrate subtle imaging abnormalities such as small size or decreased enhancement. 4. Common infiltrative lesions resulting in pituitary insufficiency in children include germ cell tumors and histiocytosis. 5. Pituitary insufficiency can be seen as a long-term side effect of radiation treatment for pediatric posterior fossa tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Background a. Normal embryologic development of the HPA b. Characteristics of normal HPA on MR imaging, including quantitative assessment of pituitary gland enhancement c. Brief clinical overview of hypopituitarism in children 2. Case-based review highlighting the spectrum of abnormalities seen in 85 children with pituitary insufficiency seen at a tertiary care children's hospital over a 5-year period. a. Normal pituitary gland b. Subtle imaging abnormalities in otherwise well-formed HPA c. Congenital abnormalities affecting HPA i. Associated CNS anomalies d. Mass Lesions involving HPA i. Neoplasms ii. Non-neoplastic e. Post-radiation pituitary insufficiency

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## Abstract Archives of the RSNA, 2023

NREE-112

### Highways to the Danger Zone: Craniofacial to Cerebrovascular Anastomoses

#### TEACHING POINTS

1) The etiology of vascular collateralization includes congenital and pathologic connections. 2) Cerebral angiography is the gold standard for identifying extra- to intra-cranial collateralization. 3) Familiarity with the functional vascular territory schema for extra- to intra-cranial collaterals can help dictate appropriate and safe treatment.

#### TABLE OF CONTENTS/OUTLINE

1) Background a) Review of extra- to intra- cranial anastomosis. i) Developed in the setting of large artery occlusion, vascular agenesis, or high flow shunting due to "sump effect". ii) Small non-visualized collaterals can open in response to acutely increased intra-arterial pressure (e.g., embolization, superselective injection). iii) Anastomotic channels often follow cranial nerves. b) Review of normal cerebrovascular anatomy c) Extra- to intra- cranial anastomotic classification scheme i) Orbital ii) Petrocavernous-Clival iii) Cervical iv) Dural-Pial 2) Interactive case-based review of anastomotic channels organized by functional vascular territories a) Non-invasive imaging b) Cerebral angiography c) Interactive 3D-reconstruction 3) Implications for endovascular therapy a) Complications (e.g., stroke, cranial nerve palsy) b) Common angiographic markers to avoid injury (e.g., choroidal blush) c) Methods to avoid non-target embolization (e.g., balloon occlusion) 4) Summary

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## Abstract Archives of the RSNA, 2023

NREE-113

### Newly Recognized Neurodegenerative Conditions and Adult-onset Leukodystrophies: An Updated Guide in the Genomic Era

#### Participants

Amit K. Agarwal, MD, MBBS, Jacksonville, FL (*Presenter*) Stockholder, Gilead Sciences, Inc

#### TEACHING POINTS

Teaching points 1. To discuss the recent updates in molecular markers and genetics for neurodegenerative conditions 2. To discuss radiological pattern recognition of the newly recognized neurodegenerative conditions and adult-onset leukodystrophies

#### TABLE OF CONTENTS/OUTLINE

1. Molecular markers and genetics a. Next generation sequencing b. Neurodegenerative genome panel c. Leukodystrophy genome panel 2. Classification of neurodegenerative conditions [NDD](focus on TDP-43) 3. Recently recognized NDD a. TDP-43 proteinopathies -Limbic-predominant age-related TDP-43 encephalopathy (LATE) - Facial onset sensory and motor neuropathy (FOSMN) - Cerebral age-related TDP-43 with sclerosis (CARTS)- Multisystem proteinopathy (MSP) - Perry disease (DCTN1 mutations)b. Amyloidoses - Transthyretine-associated cerebral amyloidosis - Neuronal intranuclear hyaline inclusion disease (NIHID)c. Other (miscellaneous) -New brain iron accumulation NDD (BPAN, FAHN)- Chronic traumatic encephalopathy (tauopathy) - EPM1- Unverricht-Lundborg disease -4. Recently recognized adult-onset leukoencephalopathies a. CSF1R-leukoencephalopathy (hereditary diffuse leukoencephalopathy with spheroids) b. AARS2-leukoencephalopathy c. CARASIL (cerebral autosomal recessive arteriopathy) d. CARASAL (cathepsin A-related arteriopathy with strokes) e. COL4A1 and TREX1 associated leukoencephalopathiesf. Leukoencephalopathy with brainstem and cord involvement with elevated lactate (LBSL) g. Late-presenting hypomyelinating disorders (PLP1, GJC2, TUBB4A, POLR3A, POLR3B, CLCN2, NKX6-2)5. Simplified MRI approach for NDD6. Summary/conclusion

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## Abstract Archives of the RSNA, 2023

NREE-114

### Posterior Cranial Fossa Tumors: Tips and Tricks for Diagnosis

#### Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomy of the posterior cranial fossa (PCF). - Establish a proper differential diagnosis based on patient age and imaging findings. - Highlight the specific radiological features of the most common posterior cranial fossa tumors (PCFT).

#### TABLE OF CONTENTS/OUTLINE

The PCF is the infratentorial compartment of the cranial vault that houses the cerebellum, brainstem and fourth ventricle. Tumors that settle in this location have serious implications not only because of their potential malignancy but also because they can cause brainstem compression, herniation and hydrocephalus, among other complications. Tumor location and patient demographics, as well as imaging findings on CT or MR must be considered in order to establish a proper differential diagnosis. While cerebellar metastases are the most common PCFT in adults, medulloblastoma is the most common in children. Specific radiologic features have been described to differentiate PCFT, allowing the radiologist to make an accurate diagnosis. In addition, neuroimaging is also useful in surgical planning for these tumors. In this work we review the most common PCFT in patients of all ages, through cases studied in our center highlighting the key radiologic findings that enable us to make a correct diagnosis.

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## Abstract Archives of the RSNA, 2023

NREE-115

### Autoimmune Encephalitis: When Your Immune System Attacks Your Brain and MRI is Your Detective

#### Participants

Fernando Diego Choque Chavez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the pathophysiology and classification of autoimmune encephalitis. 2. Describe and illustrate characteristic MRI findings related to autoimmune encephalitis 3. Discuss the role of neuroradiology in the diagnostic work-up.

#### TABLE OF CONTENTS/OUTLINE

1. Teaching points 2. Introduction 3. Pathophysiology and classification 4. Clinical presentation and radiological findings 4.1 Autoimmune encephalitis with intracellular antigens (group I) 4.2. Autoimmune encephalitis with cell-surface directed antigens (group II) 5. Differential diagnosis 6. Summary and conclusions 7. Bibliography

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## Abstract Archives of the RSNA, 2023

NREE-116

### Insights into Neural Connections: Neuroimaging and Neuromodulation in Parkinson's Disease and Essential Tremor

#### Participants

Sonoko Oshima, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Knowledge on neural connections in movement disorders is crucial to understand mechanisms of clinical manifestations, diagnose the diseases, and maximize benefits and minimize side effects of therapies. The aim of this presentation is to improve radiologists' role in diagnosing and treating Parkinson's disease (PD) and essential tremor (ET) by 1) overviewing neural connections between cortex and deep gray matter and 2) discussing neuromodulation therapies for movement disorders including deep brain stimulation (DBS) and MR-guided focused ultrasound (MRgFUS) from the perspective of neural connections and neuroimaging.

#### TABLE OF CONTENTS/OUTLINE

1) Neural connections related to Parkinson's disease and essential tremor - Histological findings - Imaging findings 2) Neuromodulation therapies: deep brain stimulation (DBS) and MR-guided focused ultrasound (MRgFUS) - Neurophysiological mechanisms - Treatment targets: subthalamic nucleus (STN), globus pallidus interna (GPi), ventral intermediate nucleus (Vim) of the thalamus - Localization of targets by imaging technique: indirect and direct targeting - Post-operative imaging

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## Abstract Archives of the RSNA, 2023

NREE-117

### Unraveling Dementia Imaging: Challenging Common Misconceptions and Exploring Emerging Conditions

#### Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Radiologists are generally unfamiliar with clinical and imaging features of common neurodegenerative diseases and wary of suggesting it in their reports. (2) AD, FTLD, PPA and DLB often present with classic, unambiguous appearances on CT, MRI and FDG PET. (3) PCA and CBDS have typical clinical and imaging presentations but are syndromes with multiple potential underlying causes. (4) As the US population ages and lifespans increase, mixed dementia and recently described, more indolent forms of neurodegenerative disease become more prevalent. (5) Newly recognized neurodegenerative diseases (CARTS, LATE and PART) share clinical and imaging features, and may mimic Alzheimer's disease.

#### TABLE OF CONTENTS/OUTLINE

(1) Neurodegenerative disease in everyday radiology (2) Classic clinical, MRI and FDG PET presentations of neurodegenerative diseases: Alzheimer's Disease, Frontotemporal Lobar Degeneration, Primary Progressive Aphasia, Dementia with Lewy Bodies, Vascular cognitive impairment (3) Challenges to neurodegenerative imaging workup: "Normal aging?", Specificity limits of MRI, FDG or Amyloid PET, Mixed dementia is common, Dementia with Lewy bodies (Mimic of both PD and AD, Current imaging limitations, Frequent comorbidity with AD), Confusion in radiology re: clinical-radiology syndromes (Specific diagnosis vs differential for underlying pathology, CBDS [corticobasal degeneration syndrome], PCA [posterior cortical atrophy], PPA [primary progressive aphasia], (4) Newly recognized indolent forms of neurodegeneration: Mimics of AD in patients > 75 years (CARTS, PART, LATE), Are there specific MRI and PET findings?

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## Abstract Archives of the RSNA, 2023

NREE-118

### Quick Diagnosis and Treatment - A Novel AIS Treatment Strategy using Hybrid Emergency Room System

#### TEACHING POINTS

•A quick diagnosis is important to determine treatment indications for patients who have AIS. •HERS (Hybrid-Emergency Room System) is an all-in-one concept for an Emergency Room. HERS is useful in critical trauma treatment strategies as computed tomography, interventional radiology and surgery are available in one environment. •It is reported that using HERS for AIS, shortened the time to reperfusion. •With my study, we have setup an AIS protocol that allows a Time Based Strategy and Tissue Based Strategy using HERS.

#### TABLE OF CONTENTS/OUTLINE

•We established an AIS treatment strategy (one stop management) using HERS (Angio-CT suite). •HERS can go from diagnostic imaging to treatment without transferring the patient from department to department. •A one-stop stroke protocol with simultaneous CT perfusion and whole body CTA can determine treatment indications, optimize treatment planning, and ensure safety. •This novel protocol is useful for identifying occluded vessels, assessing brain function, and confirming access routes. • Using our approach, a quick diagnosis and quick treatment were possible in cases of acute aortic dissection, aortic aneurysm rupture, carotid artery stenosis, carotid artery dissection in patients suspected with AIS. •A one-stop stroke protocol using HERS can be confirmed to shorten the door-to-image and treatment time and increase the re-canalization rate.

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## Abstract Archives of the RSNA, 2023

NREE-119

### Don't Hold Your Breath: Reproducible Hypercapnic Stimuli for Cerebrovascular Reactivity Mapping with RespirAct

#### Participants

Diana Vera, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the fundamental physiology of hypercapnia and its association with cerebrovascular reactivity (CVR).2. Explain the mechanisms and advantages of hypercapnic stimuli as generated by the RespirAct instrument as compared to conventional breath-hold techniques for BOLD fMRI-based CVR mapping.3. Showcase representative examples of patients with cerebrovascular disease and CVR maps produced by RespirAct and BOLD fMRI.

#### TABLE OF CONTENTS/OUTLINE

I. Hypercapnia and its association with cerebrovascular reactivity (CVR)a. Fundamentals of CVRb. Importance of measuring CVRII. Design of the RespirAct device for the production of controlled hypercapniaa. Current established practiceb. The RespirAct device descriptionIII. Comparison of RespirAct and conventional breath-hold methods of CVR mapping with BOLD fMRIa. A brief review of the origin of the BOLD signalb. RespirAct advantages over conventional breath-hold techniqueIV. Representative examples of CVR measurements with RespirAct in the context of a. Cerebrovascular steno-occlusive diseasesb. Arteriovenous malformationsc. Brain tumorsV. Summary/Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-12

### Spinal Vascular Malformations: A Systematic Angioarchitecture and Pathophysiology-Based Approach to Classification and Diagnosis

#### Participants

Charlotte Chung, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Spinal vascular malformation refers to a spectrum of lesions with abnormal connection between (or morphology of) spinal arteries and veins, all of which differ in angioarchitecture, pathophysiology, and clinical sequelae. Advances in angiographic and non-invasive imaging techniques have improved spinal vasculature visualization, enabling identification of distinctive morphologic and hemodynamic features. This exhibit introduces a comprehensive classification system based on these imaging features to aid diagnosis of well recognized as well as rare/recently identified spinal vascular lesions. The educational objectives of this exhibit are:- Review normal spinal vascular anatomy.- Discuss multimodal imaging techniques for evaluating spinal vascular malformations.- Differentiate spinal vascular malformations based on location, angioarchitecture, pathophysiology, and symptomology.- Illustrate radiographic appearance of spinal vascular malformations including arteriovenous fistulas and malformations, and non-shunting lesions such as aneurysms.

#### TABLE OF CONTENTS/OUTLINE

I. Annotated diagrams of normal spinal arterial and venous anatomy  
II. Imaging techniques for spinal vascular malformation evaluation  
III. Systematic classification of spinal vascular malformations  
IV. Radiographic features of various spinal vascular malformations  
V. Radiographic mimics

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## Abstract Archives of the RSNA, 2023

NREE-120

### Uncovering the Hidden Dangers: Addressing Diagnostic Errors in Brain Emergency Neuroradiology

#### Participants

Maria Lucia Brun, MD, OTTAWA, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To explain the importance of accurate and timely diagnosis in brain emergency neuroradiology. - To describe the different types of diagnostic errors in brain emergency neuroradiology. - To identify the potential causes of diagnostic errors and to develop effective strategies for error prevention and mitigation in emergency neuroradiology. - Case-based series examples to highlight different error types and the factors that led to the errors.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Background  
3. Types of errors:- Cognitive errors: biases or heuristics that influence the radiologist's thinking or decision-making (Framing, Anchoring, Alliterative, Satisfaction of search, Availability, Attribution).- Communication errors: Breakdown in communication.- Perception/perceptual errors: Misinterpretation or misperception.- Technical errors: Limitations in the imaging equipment or technique used. - Organizational errors: Factors outside of the radiologist's control (workload, staffing issues, etc)  
4. Consequences of errors- Delayed/missed diagnoses- Incorrect/unnecessary treatments - Patient harm- Legal and financial consequences  
5. Strategies for error prevention and mitigation in emergency neuroradiology- Valuable tools to reduce errors in the imaging evaluation of brain emergencies- Showcase the particular strategies used at our departments.  
6. Case series examples- Provide case examples to further illustrate and explain the statements mentioned above.- Highlight the factors that led to the errors and how they could have been prevented or mitigated in that particular case.  
7. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-121

### **A Game-Changing Approach to Non-Invasive Vascular Imaging: Ultra High-Resolution CT with Novel Deep Learning Reconstruction**

#### **TEACHING POINTS**

1. To learn the basic principles of ultra high-resolution CT (UHRCT). 2. To learn the basic principles of the novel reconstruction technology "deep learning reconstruction (DLR)". 3. To know the differences in image quality between DLR and conventional reconstruction methods on brain CTA using UHRCT. 4. Clinical applications of brain CTA with DLR using UHRCT and comparison with digital subtraction angiography (DSA). 5. To know the pitfalls of CTA with DLR and DSA on cerebral diseases. 6. To present the outlook of brain CTA with DLR using UHRCT in the near future.

#### **TABLE OF CONTENTS/OUTLINE**

1. Basic principles of UHRCT 2. Basic principles of the novel imaging reconstruction method "DLR" 3. The image quality of DLR and conventional reconstruction methods on brain CTA using UHRCT 4. Clinical applications of brain CTA with DLR using UHRCT and DSA to evaluate the following diseases: intracranial aneurysms, moyamoya disease, arteriovenous malformations (AVMs), dural arteriovenous fistulas (dAVFs), giant cell arteritis, tumors (skull tumor, meningioma, schwannoma, glioma, and so on) 5. Pitfalls of CTA and DSA 6. The future outlook of brain CTA with DLR using UHRCT

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## Abstract Archives of the RSNA, 2023

NREE-122

### Erdheim-Chester Disease Beyond MSK: Do You Know What to Look for in Brain MRI?

#### Participants

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To explain and illustrate the main neuroradiological findings in Erdheim-Chester Disease (ECD), an uncommon type of systemic histiocytosis with almost constant bone involvement. 2. To learn the prognostic implications of certain neuroradiological findings. 3. Much of the literature on this subject focuses on its musculoskeletal findings. However, neuroradiological manifestations are an important source of morbidity and mortality in these patients.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: 1.1. Main systemic manifestations of ECD: establishing a context. 1.2. The BRAF mutation and its (neuro)imaging implications. 2. Neuroradiological findings: 2.1. Introduction: Classification and frequency of neurological manifestations. MRI protocol. 2.2. Intra-axial involvement. Typically infratentorial. 2.3. Hypothalamic-pituitary manifestations. Several patterns. 2.4. Meningeal involvement: Different patterns. Masses often present a diagnostic challenge. 2.5. Orbital involvement. Do not forget the orbits in your systematic search. 3. Conclusions 4. References

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## Abstract Archives of the RSNA, 2023

NREE-123

### Neurocysticercosis: Findings from a Challenge Disease in the Third World

#### TEACHING POINTS

The purposes of this exhibit are: review and illustrate the imaging findings of neurocysticercosis, the differential diagnoses, and their correlation with pathological images. Describe through illustrative presentations the benefits of the multimodality imaging approach to the diagnosis of neurocysticercosis. Present challenging cases, such as pseudotumoral lesions. Establish the imaging red flags and how they can help the radiologist reach the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Neurocysticercosis stages and parasite life cycle. Imaging patterns on MR and CT. Susceptibility weighted imaging (SWI) role on calcified lesions. Diffusion-weighted imaging (DWI) showing the scolex. Spectroscopy as a valuable tool for differential diagnosis. 3D CISS sequence applicability for subarachnoid lesions. Vessel wall imaging sequence showing vasculitis with or without infarction. Pseudotumoral lesions. Differential diagnoses based on a pictorial review using representative cases from a Tertiary University Hospital database. A practical approach for better diagnostic accuracy and avoiding pitfalls. Final remarks.

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## Abstract Archives of the RSNA, 2023

NREE-124

### Evaluation of Head and Spinal CT Angiography with Photon-counting Detector CT: How Close to the Angiographic and Operative Findings

#### TEACHING POINTS

The purpose of this exhibit is: 1) To review imaging of head and spinal CT angiography with photon-counting detector CT 2) To correlate with angiography and intraoperative findings.

#### TABLE OF CONTENTS/OUTLINE

Recently, Photon-counting detector (PCD-CT) has been developed and enabling high-resolution imaging at a lower radiation dose. PCD-CT employs a photon-counting detector that can measure the number of incident X-ray photons and their energy. The newly released PCD-CT (NAEOTOM Alpha, Siemens Healthineers, Forchheim, Germany) has been in clinical use at our institution since December 2022. The PCD-CT offers several advantages over current state-of-the-art energy-integrating detector CT (EID-CT). The PCD-CT does not require septa to create a detector channel but does EID-CT. Therefore, it can be seen that downsizing the anode to achieve higher resolution does not affect the dose efficiency of the PCD-CT. The purpose of our exhibit is to present head and spinal cord CT angiographic images acquired with PCD-CT and corresponding images acquired angiographically and intraoperatively to clarify the delineation potential of PCD-CT. In spinal arterio-venous fistula (AVF), feeder, shunted pouch, and drainer are depicted in CTA. In spinal tumor of hemangioblastoma, tumor drainer is recognized in CTA. We would like to provide insight into how close the PCD-CTA findings are to the angiographic and intraoperative findings.

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## Abstract Archives of the RSNA, 2023

NREE-125

### MRI Analysis of Causes and Consequences of Acute Epileptic Seizures from Temporal Lobe Origin

#### Participants

Silvana Sarria Estrada I, MD, PhD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

MRI is useful to diagnose the cause and functional changes associated with acute seizures or status epilepticus (SE) from temporal lobe origin. Several MRI abnormalities on diffusion/perfusion-weighted, T2-weighted and contrast-enhanced T1-weighted sequences, observed after acute seizures in chronic conditions, even distant from the temporal lobe, are relevant to detect changes in the evolution. The identification of inflammatory component on MRI after a new onset temporal lobe seizure impacts the prognosis of infectious or autoimmune encephalitis, stroke or malignant tumours. Acute MRI findings in new onset seizures or SE are often subtle or unspecific. Timing of serial follow-up MRIs must be protocolized. Increase of amygdalar enlargements, hippocampal atrophy or autoimmune epilepsies can be detected using time defined follow-up MRI studies. In conclusion, a standardized MRI protocol for acute seizures and SE that analyses structure and function of the temporal lobe can lead to an early diagnosis of severe and chronic disorders. The time intervals between serial follow-up MRIs are relevant to avoid further consequences.

#### TABLE OF CONTENTS/OUTLINE

1 Temporal lobe seizures are often associate with ictal MRI abnormalities. 2 Acute MRI can diagnose acute seizures or status epilepticus. 3 Some MRI features, even distant from chronic lesions, may suggest change in evolution. 4 Early MTI features in new onset seizures can lead to the diagnostic of chronic conditions. 5 Time-defined serial MR scans are needed in cases of subtle or unspecific MRI features.

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## Abstract Archives of the RSNA, 2023

NREE-126

### The Haunted Core in Acute Ischemic Stroke

#### TEACHING POINTS

Perfusion-based imaging used in the evaluation of tissue viability is crucial in the management of patients with acute ischemic stroke (AIS), especially in extended time windows. Currently used imaging techniques in AIS cannot accurately differentiate between salvageable and non-salvageable tissue. There is no widespread gold standard definition of ischemic core. Different findings highlighting current challenges and solutions in AIS imaging will be presented through clinical cases.

#### TABLE OF CONTENTS/OUTLINE

Perfusion-based CT and MR imaging techniques are used for detection of AIS and evaluation of tissue viability. At present, common available imaging techniques fail to accurately differentiate between salvageable and non-salvageable ischemic tissue. Additionally, a widespread gold standard definition of the ischemic core is lacking. Through clinical cases, image findings highlighting challenges and solutions in the evaluation of tissue viability will be discussed, like limited sensitivity to detect early ischemic changes on non-contrast enhanced CT (NCCT), variation in outcome after successful recanalization, potential reversibility of DWI-lesions, false negative initial DWI, overestimation of ischemic core on perfusion computed tomography and variation in penumbra and core volume calculations. Considering the important role of imaging in the management of patients with AIS, it is crucial with profound knowledge about advantages and limitations of penumbra and core evaluation. The teaching points will be extensively illustrated through clinical imaging examples.

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## Abstract Archives of the RSNA, 2023

NREE-127

### **Cavernous Sinus Dural Arteriovenous Fistulas: Relevant Vascular Anatomy, Angioarchitecture and Endovascular Treatments**

#### **Participants**

Hiro Kiyosue, MD, (*Presenter*) Research Grant, Koninklijke Philips NV

#### **TEACHING POINTS**

Dural arteriovenous fistulas (DAVFs) frequently involve the cavernous sinus (CS). Although CSDAVFs are usually associated with benign ocular symptoms, they can cause aggressive symptoms such as cerebral hemorrhage. Those symptoms are strongly related to the pattern of venous drainage. Recent advances of imaging and therapeutic technologies allow us to evaluate their angioarchitecture precisely and to treat them effectively by endovascular techniques. However, serious complications such as fetal hemorrhage and infarction can occur during and after embolization mainly due to overlooking of tiny but important vessels relevant to CSDAVFs. This presentation demonstrates imaging anatomy of important vessels relevant to the CS, angioarchitecture of CSDAVF, and tips and tricks for successful endovascular treatments. CS is derived from three different venous systems of prootic sinus, duro-osseous venous plexus, and primitive tentorial sinus. Anatomical variations occur during development of CS. The CSDAVFs are fed by multiple feeders from the internal and external carotid arteries, which converge to form shunted pouches adjacent to the CS. The CSDAVFs are effectively occluded by selective embolization of those shunted pouches. Inadequate embolization of the venous outflow may lead serious complication.

#### **TABLE OF CONTENTS/OUTLINE**

1. Relevant vascular anatomy:1-1. Arterial branches to the CS and their potential anastomoses.1-2. Venous tributary and their variations.2. Angioarchitecture of CSDAVF: common feeders, shunted pouches, and dangerous drainage routes3. Endovascular techniques: various access routes, selective transvenous embolization, and sinus packing

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-128

### Understanding Perisylvian Cortical Anatomy: Tips and Tricks

#### Participants

Sally Choi, MD, BS, San Antonio, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Perisylvian area serves as a crossroad for important cortical structures with principal functions for example Broca's area is located along the anterior and ascending rami of the Sylvian fissure (M sign) o Wernicke area is classically located along the inferior aspect of the posterior ramus of the Sylvian fissure
- Important structures form this area areo Frontal operculum o Parietal operculum o Temporal operculum o Insula
- Knowing these structures is beneficial for a radiologist in describing the anatomical component of a lesion to better understand the physiologic symptoms corresponding to the lesion location with surgical and prognostic importance.

#### TABLE OF CONTENTS/OUTLINE

- Briefly discuss the Sylvian fissure anatomy
- Discuss the different cortical structures form the perisylvian area such as frontal, parietal and temporal operculum and insula.
- Discuss the MRI anatomy of these structures utilizing some tips and tricks to understand the anatomy such as- M shaped appearance of the inferior frontal gyrus along the anterior and ascending rami of the Sylvian fissure
- Discuss the role of these cortical structures in the principal functions of the body.
- Discuss the role of relevance of Functional MRI in these areas

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## Abstract Archives of the RSNA, 2023

NREE-129

### The Cortico-Limbo-Thalamo-Cortical Circuits: An Update to the Papez Circuit of the Limbic System

#### Participants

Parnian Shobeiri, MD, MPH, Tehran, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? The Papez circuit is a circuit believed to control memory and emotion, composed of the cingulate cortex, entorhinal cortex, parahippocampal gyrus, hippocampus, hypothalamus, and thalamus. ? In recent years, multiple additional limbic fiber connectivity has been revealed using diffusion-weighted imaging (DWI) techniques. Some of these fiber tracts include the amygdalofugal tract (AFT), amygdalothalamic tract (ATT), stria terminalis (ST), dorsal thalamo-hypothalamic tract (DTH), cerebello-hypothalamic tracts, and the parieto-occipito-hypothalamic tract (POHT) ? This presentation aims to summarize the anatomy of the limbic system, outline previous updates to the circuit, and elaborate on the anatomical connectivity of the limbic circuits based on recent DWI as an update to the original Papez circuit.

#### TABLE OF CONTENTS/OUTLINE

? The original Papez circuit and updates over time ? The Yakovlev model/circuit ? The MacLean's model ? Overview of high spatial resolution diffusion weighted imaging ? Review of previously established Papez circuit (See Figures 1-5 for specific tracts) ? Detailed fiber tract anatomy ? Updates to previously known limbic circuits: the role of additional fibers in creating multiple neuronal loops and circuits

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## Abstract Archives of the RSNA, 2023

NREE-13

### Mapping the Way: A Road Map for Diagnosing, Treatment and Follow Up of Brain Metastases

#### Participants

Julia Brunelli, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibition aims to provide a comprehensive overview of the imaging evaluation of patients with suspected brain metastases, emphasizing the prevalence and potential diagnostic challenges associated with these neoplasms. It will highlight specific imaging patterns, differential diagnoses, and potential pitfalls in imaging interpretation. The exhibition will also discuss the clinical and imaging features that suggest the etiology of primary tumors, including a pictorial essay of specific patterns. Additionally, it will review radiological criteria for diagnosing radionecrosis, pseudoprogression, and disease progression in brain metastases patients and emphasize the importance of advanced imaging techniques. Case studies will be used to illustrate radiological challenges and diagnostic considerations in the treatment and follow-up of these patients.

#### TABLE OF CONTENTS/OUTLINE

1. Imaging Evaluation of Patients with Suspected Brain Metastases • Overview of intracranial metastases as the most common adult intracranial neoplasms and their imaging evaluation • Imaging patterns and differential diagnoses • Mimickers and pitfalls in imaging interpretation  
2. Etiology of the Primary Tumor • Clinical and imaging features suggestive of the primary tumor • Pictorial essay of brain metastases with specific patterns  
3. Treatment and Follow-up • Radiological criteria for diagnosing radionecrosis, pseudoprogression, and disease progression • Case studies illustrating radiological challenges in distinguishing these conditions

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## Abstract Archives of the RSNA, 2023

NREE-130

### CNS Imaging of the Immunocompromised - An Opportunistic Review for the Radiologist

#### Participants

Luis Colon Flores, MD, Oceanside, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Review the main imaging findings of the different opportunistic infections. 2) Review and recognize the different HIV/AIDS associated CNS conditions. 3) Discuss the imaging findings of immunodeficiency-associated primary CNS lymphomas.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Opportunistic infections (Bacterial, viral, fungal and parasitic) 3) HIVS/AIDS CNS associated conditions 4) Immunodeficiency-associated primary CNS lymphoma 5) Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-131

### The Ultimate Imaging Companion to Vascular Complications in Cancer Patients: A Comprehensive Review for Radiologists

#### Participants

Jessica De Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Vascular complications are a significant cause of morbidity and mortality in cancer patients, with increasing incidence due to improved survival and evolving treatments. Oncologic patients are more prone to vascular complication such as hypercoagulability state, reduction in mobility and aggressive treatments as brain radiation. These complications may occur at disease presentation or be secondary to treatment. Our aim is to review the main imaging findings of vascular complications in a didactic way. We believe this approach may facilitate diagnostic suspicion.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Review main intracranial vascular complications in oncology patients, with an emphasis on the pathophysiological mechanisms involved. To display a flowchart dividing these complications according to treatment status and treatments applied. To discuss for each vascular complication the risk factors, clinical presentation, main imaging findings and relevant treatments. The discussion will be enriched with illustrative cases, including: Complications before treatment: Hypercoagulability (Trousseau syndrome, cerebral venous thrombosis). Vascular compression/ obstruction by the tumor or Vascular compression/ obstruction due to brain herniation. Intravascular tumor dissemination (oncotic aneurysm and intravascular lymphoma). Complications during treatment: Post-operative ischemia Late complications after treatment: Aneurysm after radiotherapy, SMART, Radiation induced cavernous malformations. To highlight the most relevant clinical and imaging aspects of these vascular complications, essential for prompt diagnosis and treatment.

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## Abstract Archives of the RSNA, 2023

NREE-132

### Skull Drip: Algorithmic Multimodality Imaging Approach

#### Participants

Pokhraj Suthar, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Briefly discuss various causes and sites of skull base CSF leak. To learn the diagnostic imaging findings of various modalities including high resolution NECT, CT cisternogram, MRI and radiotracer studies, in identifying the cause and localizing the exact site of skull base CSF leaks. To learn the algorithmic imaging approach and how it is helpful for surgical planning in cases of skull base CSF leak. To diagnose recurrent leaks in post-surgical repair of primary CSF leak

#### TABLE OF CONTENTS/OUTLINE

Cerebrospinal fluid (CSF) leaks are extracranial leaks of CSF via an osteodural defect in the skull base into the tympanomastoid cavity, paranasal sinus, or rarely in the skull base neck space. There are various etiologies for the same, including accidental trauma, congenital malformation, spontaneous leaks in idiopathic intracranial hypertension and iatrogenic. Accurate localization of the site of the leak and identification of the underlying cause is necessary for surgical planning to avoid associated complications and prevent recurrence. In this educational exhibit, we outline the various interesting cases of skull base defects, their multimodality algorithmic imaging diagnosis approach (CT, MRI, CT/MR/Nuclear medicine radionuclide cisternography), correlation of imaging diagnosed skull base defect with surgical outcome, and imaging diagnosis of recurrent CSF leaks.

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## Abstract Archives of the RSNA, 2023

NREE-133

### The Ternary Plot Analysis of Time-sensitive Diffusion Imaging in CNS Pathologies

#### Participants

Toshiaki Taoka, MD, PhD, , Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

Time-sensitive diffusion imaging provides potentially valuable information on tissue characteristics, with the oscillating gradient spin-echo (OGSE) method enabling short diffusion times compared to the conventional pulsed-field gradient spin-echo (PGSE) method. Comparing the signal on OGSE and PGSE can provide information on tissue compartmentalization. However, comparing different images can make interpretation challenging, and organizing pixel information is necessary. The ternary plot method presents the relationship between diffusivity, compartmentalization, and water content for a single pixel, simplifying the presentation of tissue characteristics obtained from OGSE, PGSE, and  $b=0$  images. This educational exhibit demonstrates the tissue characteristics of various central nervous system pathologies provided by time-sensitive diffusion imaging using the triangulation method of the ternary plot. The ternary plot method has further applications, including the color coding of the pixels according to the tissue characteristics.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of time dependence of diffusion MRI2. Methods for displaying time-dependent diffusion-related coefficients.3. Distribution of the time-dependent diffusion-related coefficients on ternary plot4. Further application of ternary plot method

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## Abstract Archives of the RSNA, 2023

NREE-134

### A Review of Imaging Findings in Neurogenic Ptosis

#### TEACHING POINTS

To understand the anatomy of the neural pathways that innervate the upper eyelid retractor muscles (e.g. oculosympathetic pathway and oculomotor nerve pathway). To describe the normal cross-sectional anatomy of the neural pathways causing neurogenic ptosis. To illustrate the imaging findings of various lesions causing neurogenic ptosis according to a course-based approach.

#### TABLE OF CONTENTS/OUTLINE

Introduction and general overview of ptosis / Anatomic review and imaging-based normal cross-sectional anatomy of the neural pathways innervating the upper eyelid retractor muscles (oculosympathetic and oculomotor pathway) / A variety of pathologic conditions causing neurogenic ptosis according to a course-based approach 1. Oculomotor nerve palsy (oculomotor nerve pathway) - Intra-axial segment - Cisternal segment - Cavernous segment - Orbital segment 2. Horner's syndrome (oculosympathetic pathway) - Central neuron - Preganglionic neuron - Postganglionic neuron 3. Neuromuscular junction disorders / Summary and conclusion

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## Abstract Archives of the RSNA, 2023

NREE-135

### Epilepsy Surgery: Nuts and Bolts for Radiologists

#### Participants

Jack Yang, Lexington, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A broad range of surgical procedures are available for medically refractory epilepsy from open parenchymal resections to more recent minimally-invasive ablative therapies. In this exhibit, we outline the scope and techniques of these surgical procedures, role of neuroimaging, expected post surgical imaging findings and associated complications. We describe neuroimaging role in subdural or depth electrode placement, an invasive diagnostic surgical procedure for more precise localization of epileptogenic focus. We briefly outline the MRI safety issues in imaging patients with neuromodulation devices.

#### TABLE OF CONTENTS/OUTLINE

Table of Contents: I. Epilepsy surgery: Evolution II. Types of surgical procedures: Scope and Techniques A. Surgery for localization of epileptogenic focus: a. Invasive procedure - Subdural grid and strip placement. b. Minimally-invasive procedure - Stereo-EEG B. Surgery for refractory epilepsy a. Invasive procedures: Resection - 1. Hemispherectomy 2. Lobar resection 3. Lesionectomy. Disconnection - 1. Conventional corpus callosotomy 2. Multiple subpial resections. b. Minimally- or less-invasive procedures: Ablative therapies - 1. Laser Interstitial thermal therapy (LITT) 2. MR guided focused US 3. Gamma knife. Neuromodulation procedures - 1. Vagal nerve stimulation (VNS) 2. Deep brain stimulation (DBS) 3. Responsive neurostimulation (RNS) III. MRI safety issues in imaging epilepsy patients with implants and electrodes

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## Abstract Archives of the RSNA, 2023

NREE-136

### Exploring the FDA Pharmacovigilance Database to Assess the Importance of Symptoms Associated with Gadolinium Exposure (SAGE)

#### Participants

Eric Lancelot, PhD, Roissy CDG CEDEX, France (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Analysis of FDA pharmacovigilance database to determine safety of gadolinium based contrast media.

#### TABLE OF CONTENTS/OUTLINE

**Objective** The aim of this study was to assess the tendency of adverse events representing "symptoms associated with gadolinium exposure" (SAGE) among the bulk of safety experiences reported to health authorities. **Materials and Methods** SAGE symptoms were searched by preferred terms (PTs) in different system organ class (SOC) categories in the FDA Adverse Event Reporting System (FAERS) database over a 5-year period ranging from 2014 to 2019. The numbers of SAGE symptoms per PT, and cumulatively per SOC, were recorded and their weights in the overall spectrum of AEs were determined for 3 linear and 3 macrocyclic GBCAs. **Results:** The analysis of FAERS data revealed a significantly higher SAGE weight for linear GBCAs, namely gadodiamide (23.27%), gadopentetate dimeglumine (22.12%) and gadobenate dimeglumine (19.27%), than for the macrocyclic GBCAs, namely gadoteridol (8.45%), gadobutrol (4.53%) and gadoterate meglumine (3.82%). The SOCs "musculoskeletal and connective tissue disorders", "nervous system disorders", "general disorders and administration site conditions" and "psychiatric disorders" were consistent with this ranking. Moreover, SAGE weights displayed a steady growth of about 5% per year for the linear GBCAs and 1% per year for the macrocyclic agents. **Conclusion** This study showed that SAGE symptoms may be more prevalent with linear than macrocyclic GBCAs, and that SAGE reporting tends to rise significantly more in patients exposed to linear agents. These differences might be explained by the differences in kinetic stability between the GBCAs.

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## Abstract Archives of the RSNA, 2023

NREE-137

### 2022 Updated Diagnostic Criteria of Neurofibromatosis Type 2 and CNS Tumor Manifestations: Imaging Findings, Histological Features, and Assessment of Treatment Effect

#### Participants

Yoshiaki Ota, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The diagnostic criteria of NF2 has been revised in 2022 as well as that of schwannomatosis and radiologists should be familiar with the revision. 2. Vestibular schwannomas, meningiomas, other cranial nerve schwannomas, ependymomas, and astrocytomas can be related to NF2. 3. DWI, DSC-MRI, and DCE-MRI can allow for more detailed characterization, tumor differentiation, treatment response assessment, and gene mutation in NF2 patients.

#### TABLE OF CONTENTS/OUTLINE

1. 2022 revised diagnostic criteria of NF2A diagnosis of NF2 can be made when an individual has one of the following: a) Bilateral vestibular schwannomas (VS) b) An identical NF2 pathogenic variant in at least 2 anatomically distinct NF2-related tumors (schwannoma, meningioma, and/or ependymoma). c) Either 2 major or 1 major and 2 minor criteria as described in the following: Major criteria: 1) Unilateral VS, 2) First-degree relative other than sibling with NF2-related schwannomatosis, 3) Two or more meningiomas (Note: single meningioma qualifies as minor criteria). Minor criteria: Can count >1 of a type: Ependymoma, meningioma, schwannoma. 2. Common imaging features and clinical/pathological characteristics of NF2-related CNS tumors: (a) Vestibular schwannoma (b) Trigeminal schwannoma (c) Meningioma (d) Spinal Ependymoma (e) Spinal astrocytoma. 3. Treatment options and imaging assessment of treatment response: (a) Conventional imaging (CT, MRI) (b) Advanced imaging (DWI, DSC-MRI, and DCE-MRI). 4. Other familial schwannomatosis (SMARCB1 and LZTR1) and meningiomatosis (SMARCB1, SMARCE1, SUFU, and PDGFB)

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## Abstract Archives of the RSNA, 2023

NREE-138

### The Radiologist's Guide to Lumbar Spine Pain Procedures: Indications, Techniques and Complications

#### TEACHING POINTS

Less than 3 percent of the 4 million annual pain procedures are performed by radiologists, despite having the unique ability to correlate imaging findings with clinical features for targeted pain interventions. This exhibit is aimed at educating the radiologists regarding indications, planning, techniques and challenges of common lumbar pain procedures, with emphasis on 'how to' perform transforaminal and interlaminar epidural spinal injections (ESI). Other technically demanding pain procedures including dorsal transforaminal S1 ESI, synovial cyst rupture and blood patches will be discussed, along with tips and tricks for performing challenging interventions in postoperative, scoliotic and degenerative spine.

#### TABLE OF CONTENTS/OUTLINE

1. Relevant Lumbar Spine anatomy and fluoroscopic positioning 2. Clinico-radiologic correlation- Clinical examination, patient counselling, selecting the right procedure. 3. Procedure and tray setup 4. Transforaminal ESI- 'how to' approach the target, pre and post contrast injection views. • Supra-neural TFESI • Infra-neural TFESI 5. Interlaminar ESI- • Optimal needle positioning in multiplanar imaging • Recognizing suboptimal needle location 6. Dorsal S1 ESI- recognizing landmarks and optimal views for needle positioning. 7. Other pain relief procedures • Synovial cyst rupture- Direct (IL/TF) and Indirect Techniques • Epidural blood patch 8. Challenging cases and difficult myelograms • Scoliotic and degenerative spine • Postoperative spine 9. Pearls and pitfalls- complications and how to prevent them.

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## Abstract Archives of the RSNA, 2023

NREE-139

### **From Genes to Emergencies: An Innovative Approach to Imaging Assessment, Genetic Aspects, and Emergency Room Evaluation in CADASIL**

#### **Participants**

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

This educational exhibit aims to provide a comprehensive understanding of cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) disease, including: To illustrate the imaging highlights of the cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL). To exhibit the genetic cascade involved in the disease. To explain the imaging approach to the disease within the context of acute stroke in the emergency. To illustrate the differential diagnosis, including cerebral autosomal recessive arteriopathy with subcortical infarcts and leukoencephalopathy (CARASIL) and white matter diseases.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction and revision of CADASIL's epidemiology, clinical presentation, and etiology. 2. MRI highlights in CADASIL. 3. Genetic considerations associated with CADASIL. 4. Differential diagnosis, including CARASIL and other white matter diseases. 5. Imaging assessment in the emergency room. 6. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-14

### An Imaging Review of Autoimmune Encephalitis: An Often-Overlooked Diagnosis

#### Participants

Miriam Fernandez-Gomez, MD, Almeria, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To understand the many signs, symptoms, and types of autoimmune encephalitis. - To Review the main antibodies that have been identified, their patterns of CNS involvement, and their typical anatomical distributions due to the relative concentration of target proteins. - To Highlight the characteristic MRI findings associated with autoimmune encephalitis, with specific emphasis on the role of neuroimaging in the diagnostic work-up. - Finally, to describe a case report of anti-LGI1 autoimmune encephalitis associated with SARS-CoV-2 (COVID-19).

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS  
I. Introduction Introduce the topic of autoimmune encephalitis  
II. Understanding Autoimmune Encephalitis Define autoimmune encephalitis Discuss the symptoms of autoimmune encephalitis Explain the pathophysiology of autoimmune encephalitis Describe the different types of autoimmune encephalitis  
III. MR Imaging Findings Associated with Autoimmune Encephalitis Discuss the characteristic MRI findings associated with autoimmune encephalitis Emphasize the role of neuroimaging in the diagnostic work-up  
IV. Autoimmune Encephalitis in SARS-CoV-2 Infection (COVID-19): Illustrative Case Describe a case report of anti-LGI1 autoimmune encephalitis associated with SARS-CoV-2 (COVID-19)  
V. Conclusion Summarize the key points of the paper Discuss the importance of recognizing and diagnosing autoimmune encephalitis

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## Abstract Archives of the RSNA, 2023

NREE-140

### Predictors of Intracerebral Hemorrhage Expansion on CT

#### TEACHING POINTS

1. Review classification of intracranial hemorrhages and define hemorrhage expansion  
2. Importance of identifying intracranial hemorrhage expansion  
3. Describe findings on imaging that can predict hemorrhage expansion  
Intracerebral hemorrhage (ICH) results in 10-20% of all strokes and leaves 60-80% of survivors functionally dependent. Identifying early hematoma expansion (HE), defined as growth >12.5 mL or volume >33%, is crucial for modifying its potential impact. Three accepted HE indicators in non-contrast computed tomography include baseline hematoma volume as measured by the ABC/2 method. Secondly, irregularly hemorrhage shape indicating multiple leaking blood vessels. Radiologically, the satellite sign and island sign are imaging correlates that indicate irregular hemorrhage shape. Lastly, the imaging density heterogeneity of the hematoma can represent active bleeding. Three signs that represent heterogeneity of the hematoma include the swirl, black hole, and blend sign.

#### TABLE OF CONTENTS/OUTLINE

1. Classification of intracranial hemorrhagea. Intra-axial hemorrhageb. Extra-axial hemorrhage  
2. Defining hematoma expansion (HE)  
3. Importance of identifying intracerebral hemorrhage expansion.a. Relative incidenceb. Prognostic indicator  
4. Clinical aspects that increase risk of hematoma expansiona. Systolic BP and onset to CT timeb. Prior anticoagulant therapyc. hyperglycemia  
5. Radiological signs of hemorrhage expansiona. Hematoma shape/volume/locationb. Perihematomal edemac. Hematocrit levelsd. Spot signe. Satellite sign, Island sign, Swirl sign, Blend sign and Black hole sign

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## Abstract Archives of the RSNA, 2023

NREE-141

### **Beyond the Blind Spots: A Comprehensive Approach to Reducing Diagnostic Errors in Neuroradiology in the Emergency Room for Enhanced Patient Safety**

#### **Participants**

Heber Colares Costa, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

To exhibit a timely and accurate diagnosis of neurological conditions like stroke, brain tumors, and traumatic brain injury, providing effective treatment. To show misdiagnosis or diagnosis delays due to errors in imaging evaluation that can seriously harm the patient, including permanent neurological deficits or death. To prevent unnecessary interventions or treatments, inhibiting inaccurate interpretation of imaging studies and unnecessary surgeries, medications, or other medicines that can harm the patient physically and financially. To avoid significant medicolegal consequences.

#### **TABLE OF CONTENTS/OUTLINE**

1. Revision of epidemiology, pathology, and demographics of neuroradiologic emergencies. 2. Imaging evaluation of the emergency room's crucial and prevalent neuroradiologic diseases. 3. Potential imaging pitfalls in neuroradiologic emergencies and how to avoid them. 4. Potential causes of imaging medical errors, including night periods, fatigue and exhaustion of radiologists, a large volume of examinations, and short evaluation times. 5. The consequences of errors in neuroradiological imaging evaluation in the emergency room, including delays in stroke recanalization therapy, misdiagnoses of intracranial hemorrhages, dural venous sinus thrombosis, and inadequate treatment for these conditions. 6. Highlights on medicolegal issues and reputational damage for healthcare providers and hospitals. 7. How to ensure that hospitals and healthcare providers can reduce the risk of misdiagnosis, unnecessary interventions, and legal consequences, ultimately leading to better patient outcomes. 8. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-142

### **The Uncharted Territory of Neurodegeneration: Keeping Pace with the Latest Advances in Imaging Diagnosis and Novel Therapies for Degenerative Diseases**

#### **Participants**

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Brain neurodegenerative diseases are a group of disorders characterized by progressive damage and loss of neurons in the brain. These diseases include Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS), among others. Recent advances in imaging diagnosis and novel therapies have shown promising results in improving the diagnosis and treatment of these conditions. The study aims to: To explain the imaging features, genetic cascade, and physiopathology involved in neurodegenerative diseases. To exhibit that advanced imaging techniques have significantly improved the diagnosis of brain neurodegenerative diseases. To explain the imaging approach to the diseases, differential diagnosis, and current therapeutics.

#### **TABLE OF CONTENTS/OUTLINE**

1. Revision of epidemiology, clinical presentation, and etiology of neurodegenerative diseases. 2. Genetical considerations. 3. The role of magnetic resonance imaging (MRI) and functional MRI (fMRI) in identifying structural changes in the brain associated with neurodegeneration. 4. Positron emission tomography (PET) in assessing amyloid plaques and tau protein in the brain, characteristic features of Alzheimer's disease. 5. Novel therapies for neurodegenerative brain diseases, including immunotherapy, gene therapy, stem cell therapy, neuroprotection with drugs, and deep brain stimulation. 6. Differential diagnosis. 7. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-143

### Exploring the Depths of Pediatric Posterior Fossa Tumors: Integrating Molecular Analysis and Magnetic Resonance Imaging for Unprecedented Diagnosis and Prognosis

#### Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the imaging diversity of these tumors, including a range of histological subtypes, including medulloblastoma, ependymoma, and pilocytic astrocytoma, among others. To demonstrate the importance of pediatric posterior fossa CNS tumors molecular analysis, providing an accurate diagnosis, risk stratification, and personalized treatment. To identify the specific genetic alterations and biomarkers for managing these tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Revision of epidemiology, pathology, and pediatric posterior fossa CNS tumor demographics. 2. Imaging features in pediatric posterior fossa CNS tumors, including pilocytic astrocytoma, ependymoma, medulloblastoma, other embryonal tumors, Rosette-forming glioneuronal tumor, diffuse midline gliomas, tectal gliomas including diffuse low-grade MAPK pathway-altered. 3. Most recent updates on pediatric posterior fossa CNS tumors molecular alterations, including WNT, SHH, and non-WNT/non-SHH medulloblastomas, BRAF mutations in pilocytic astrocytoma, EZHIP in group A ependymomas, MAPK pathway-altered in diffuse low-grade tectal gliomas. 4. Imaging strategies to depict the correct diagnosis based on the genetic profile. 5. Flowchart of the changes and last updates based on the neoplastic molecular profile. 6. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-144

### From Conception to Cancer: Exploring the Molecular Signatures of Embryonal Tumors for Precision Medicine

#### Participants

Laura Magalhaes, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose  
Pedro Castro, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Recent advances in molecular biology have led to a better understanding of the types and subtypes of these tumors based on the 2021 World Health Organization of central nervous system tumors. The study aims to: To illustrate that the molecular analysis of Central Nervous System (CNS) embryonal tumors is critical for accurate diagnosis, risk stratification, and targeted therapy. To show that molecular analysis can help identify specific genetic alterations and biomarkers that can provide valuable information for managing these tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Revision of epidemiology, pathology, and demographics of CNS embryonal tumors.
2. Imaging features in CNS embryonal tumors.
3. Most recent updates on CNS embryonal tumors molecular alterations, including WNT-activated medulloblastoma, sonic hedgehog (SHH) activated, and non-WNT/non-SHH medulloblastomas.
4. Recent advances in molecular biology have led to identifying specific genetic alterations and biomarkers in non-medulloblastoma embryonal tumors, including teratoid/rhabdoid tumors (AT/RTs), embryonal tumors with multilayered rosettes (ETMRs), CNS Neuroblastoma, FOXR2-Activated, CNS Tumor with BCOR Internal Tandem Duplication, Cribriform Neuroepithelial Tumor.
5. Specific genetic mutations, amplifications, or deletions associated with tumor progression, recurrence, and response to therapy, including C19MC, DCER 1, FOXR2, BCOR-ITD, SMARCB1, SMARCB4, AT/RT (TYR), AT/RT (SHH), AT/RT (MYC).
6. Imaging strategies to depict the correct diagnosis based on the genetic profile.
7. Flowchart of the changes and last updates based on the neoplastic molecular profile.
8. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-145

### Neurogenetics and Imaging of Motor Neuron Disease

#### Participants

Maxwell Wright, BS, Mechanicsburg, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1.To discuss the classification and pathogenesis of motor neuron disease (MND). 2.To highlight the neurogenetics, imaging findings, and diagnostic pearls for the specific diagnosis of various upper and lower MNDs.

#### TABLE OF CONTENTS/OUTLINE

We retrospectively reviewed 113 patients from our PACS system with clinical and Imaging findings correlating with motor neuron disease (MND). All the patients underwent routine MRIs of the brain and spine. Almost 100% of these patients had CSF examinations, while genetic studies were available in 49% of the patients. All studies were read by two neuroradiologists. Imaging findings were correlated with the clinical examination, CSF, and biochemical results, which were further correlated with the genetic studies when available. For easy understanding, this exhibit is classified under the following categories: 1. Upper MND: Primary lateral sclerosis (PLS), Hereditary Spastic Paraparesis (HSP), Pseudobulbar Palsy 2. Lower MND: a) Chronic onset: Inherited- Spinal Muscular Atrophy (SMA), Progressive Muscular Atrophy (PMA), Distal hereditary motor neuropathy; Acquired- Upper limb dominance (Flail Arm, Hirayama, Segmental MND) Lower limb dominance (PMA, Monomelic Amyotrophy) b) Acute onset: Guillain Barre Syndrome, Polio; and 3. Combination of UMN and LMN: Amyotrophic lateral sclerosis (ALS). Conclusion: 1. Neurogenetics and neuroimaging complement each other in clinching the specific diagnosis of MND. 2. We discuss the neurogenetics, pathogenesis, and imaging appearance of the MND in this exhibit.

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## Abstract Archives of the RSNA, 2023

NREE-146

### Imaging Spectrum of Cystic Spinal Lesions

#### TEACHING POINTS

- To illustrate the compartmental spinal anatomy.
- To discuss the key imaging findings of cystic spinal lesions and their mimics.
- To demonstrate the utility of multimodality imaging in the differential diagnosis of cystic spinal lesions.

#### TABLE OF CONTENTS/OUTLINE

A wide variety of benign and malignant cystic lesions can involve the different compartments of the spine. Although an exact diagnosis may be challenging, different imaging characteristics are used in order to narrow the differential diagnosis and/or establish the exact diagnosis. In addition, spinal cysts can be divided into: intramedullary, intradural extramedullary, or extradural, depending on their location, which is only useful in planning treatment. Magnetic resonance imaging (MRI) is the imaging method of choice to identify and characterize spinal cysts, and ultrasound (US) is often used as the initial imaging modality in pediatric patients. Instead, CT is helpful for evaluating cystic lesions of the vertebral column. In this exhibit, we will review the multimodal imaging features of the most common cystic spinal lesions based on their etiology, including neoplastic, congenital, degenerative, infectious, post-traumatic, and postsurgical disorders. We will also review the main differential diagnoses that should be considered.

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## Abstract Archives of the RSNA, 2023

NREE-147

### **Pediatric Neurometabolic Diseases: A Pictorial Review of How the Radiologist can Approach Hypomyelinating and Dysmyelinating Disorders**

#### **TEACHING POINTS**

1: Pediatric Neurological metabolic diseases are a group of disorders affecting the brain, mostly related with a specific enzyme deficiency. 2: These disorders traditionally affect the white matter but can also affect the gray matter (both cortex and basal ganglia). 3: Pattern of white matter disease is one of the most helpful clues in the characterizing these conditions on imaging. 4: Pathologically, these disorders can be classified as hypomyelinating (with mild signal changes, with T2 hyperintensity and T1 hypo to isointensity) or other white matter diseases (pronounced T2 hyperintensity and T1 hypointensity) 5: Hypomyelinating disorders can be differentiated based on peripheral neural compromise or not. 5: Other white matter diseases (dysmyelinating) can be characterized based on the pattern of white matter disease (confluent vs multifocal). 6: Confluent white matter disease has an extensive differential, and it is critical to depict where changes are visualized (diffuse, frontal, parieto-occipital, posterior fossa, periventricular or subcortical).

#### **TABLE OF CONTENTS/OUTLINE**

1: Hypomyelinating disorders (T1 hypointensity and T2 hyperintensity). 1.1: Without typical PNS involvement: Pelizaeus Merzbacher Disease- 1.2: With typical PNS involvement: Cockayne disease2: Other white matter diseases (mild T1 hypo or isointensity and T2 mild hyperintensity). 2.1: Confluent. 2.1.1: Frontal: Infantile Neuroaxonal Dystrophy. 2.1.2: Parieto-occipital: X-Linked adrenoleukodystrophy. 2.1.3: Posterior Fossa: Leigh syndrome. 2.1.4: Periventricular: Krabbe Disease. 2.1.5: Subcortical: Kearns Sayre Syndrome. 2.2: Multifocal: Hydroxy glutaric Aciduria.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-148

### Imaging Approach and Review of Arteriovenous Orbital Fistulae

#### TEACHING POINTS

Reinforce the knowledge and correct identification of the vascular structures involved in the orbital-venous arterial fistula. List the imaging findings through contrasted tomography and contrasted MRI, to identify the main aspects to highlight in the diagnosis of orbital arteriovenous fistula. Complications of orbital arteriovenous fistula. Management and prognosis of patients with orbital arteriovenous fistula.

#### TABLE OF CONTENTS/OUTLINE

Definition, Diagnosis and image findings, Clinical findings, Treatment. Arteriovenous orbital fistulae is a rare condition that occurs when an abnormal connection forms between an artery and a vein within the orbit; This causes blood to flow directly from the arterial system to the venous system, bypassing the capillary network. As a result, there is a high-pressure gradient in the venous system, leading to congestion and dilation of the veins. Arteriovenous orbital fistulae can be congenital or acquired. The most common cause of acquired arteriovenous orbital fistulae is trauma, such as a blunt or penetrating injury. Symptoms of arteriovenous orbital fistulae include bulging of the eye, proptosis, diplopia, visual disturbance, and in severe cases, loss of vision or even blindness. Diagnosis of arteriovenous orbital fistulae involves a thorough medical history and physical examination, including imaging studies such as ANGIO CT or enhanced MRI. Treatment options depend on the severity of the condition and may include observation, embolization or surgical removal of the abnormal vessels.

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## Abstract Archives of the RSNA, 2023

NREE-149

### Intradural Spinal Lesions: A Review of Common and Rare Pathologies

#### Participants

Sultan Yahya, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review normal spinal anatomy and compartments- Approach to intradural spinal pathologies, and distinguishing intra and extramedullary pathologies- Review common and rare intra-medullary neoplasms, including ependymomas, subependymomas, astrocytomas, metastasis, hemangioblastomas and spinal involvement in diffuse leptomeningeal glioneuronal tumors. - Discuss medullary neoplastic mimics, including demyelinating/inflammatory abnormalities, infarctions, and arteriovenous malformations. - Review common and rare extramedullary neoplasms including meningiomas, schwannomas, metastasis, angioliipomas, mature cystic teratomas, paragangliomas, dermoids/epidermoid/lipomas and neuroenteric cysts.

#### TABLE OF CONTENTS/OUTLINE

- Spinal compartmental anatomy- Approach to intradural pathologies- Intramedullary abnormalities: tumors, differentials of medullary signal abnormalities and neoplastic mimics- Extramedullary lesions: common / rare tumoral entities and cystic lesions

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## Abstract Archives of the RSNA, 2023

NREE-15

### Cortically-Based Brain Tumors: Who is Who

#### Participants

Irene Diaz, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cortically-based brain tumors have some features in common. They usually clinically manifest as epilepsy refractory to anti-epileptic drugs and most frequently affect children and young adults. We can also talk about long-term epilepsy-associated tumors (LEAT), and they are usually low-grade tumors. Radiologically, they may be difficult to differentiate, but there are some imaging diagnostic clues that will help us find the correct diagnosis.

#### TABLE OF CONTENTS/OUTLINE

An image-based quiz will lead the review of different cases of cortically-based brain tumors, with its differential diagnostic clues at imaging. Most of our patients were young adults and clinically presented with focal epilepsy. We are mainly showing low-grade tumors, such as dysembryoplastic neuroepithelial tumor (DNET), ganglioglioma, pleomorphic xanthoastrocytoma, oligodendroglioma, multinodular and vacuolating neuronal tumor (MVNT) or polymorphous low-grade neuroepithelial tumor of the young (PLNTY).

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## Abstract Archives of the RSNA, 2023

NREE-150

### Cerebellar Ataxia: Differential Diagnosis Based on Common Imaging Patterns

#### TEACHING POINTS

- Ataxia is a physical finding characterized by impaired coordination of voluntary muscle movement, resulting in disequilibrium, vertigo and gait ataxia. - Ataxia can be caused by either impaired vestibular input to the cerebellum or by cerebellum dysfunction itself. - Brain MRI, the imaging modality of choice, has a key role in differentiating the many causes of ataxia. - Ataxia may present with different cerebellum findings: normal, hypoplastic and atrophic morphology. - Regarding clinical findings, ataxia may be further classified as acute / subacute or chronic; traumatic; autoimmune; paraneoplastic or genetic. - Combining imaging and clinical features, differential diagnosis is made.

#### TABLE OF CONTENTS/OUTLINE

- Defining ataxia. - Clinical findings that are relevant for the diagnosis based on MRI. - Differentiating normal vs hypoplastic vs atrophic cerebellum.- Further exemplifying findings in atrophic cerebellum that lead towards specific diagnosis (e.g.: superficial siderosis, basal ganglia abnormalities, white matter abnormalities). - Further exemplifying findings in hypoplastic cerebellum that lead towards specific diagnosis (e.g.: unilateral hypoplasia, posterior fossa malformations, hemorrhage). - Flowchart to the approach of cerebellar ataxia.

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## Abstract Archives of the RSNA, 2023

NREE-151

### Interstitial Fluidopathy: A Concept for Understanding CNS Diseases with Impaired Interstitial Fluid Dynamics

#### Participants

Toshiaki Taoka, MD, PhD, , Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation

#### TEACHING POINTS

This educational presentation proposes a new concept called "Central Nervous System (CNS) Interstitial Fluidopathy," which encompasses diseases whose pathologies are associated with abnormal interstitial fluid dynamics. The glymphatic system hypothesis proposes that cerebrospinal fluid and interstitial fluid in the brain constitute a mass transport system, including waste clearance. Impairment of these functions results in protein leakage into the interstitium and impaired efflux of waste products, leading to the accumulation of waste products, tissue dysfunction, and conditions such as neuroinflammation. The term "CNS interstitial fluidopathy" describes diseases or conditions in which abnormalities in interstitial fluid dynamics are one of the significant factors in the pathological process. Various diseases, including Alzheimer's disease, Parkinson's disease, traumatic brain injury, multiple sclerosis, and small vessel diseases, develop due to abnormalities in the interstitial fluid dynamics. By categorizing these diseases as CNS interstitial fluidopathies, we can improve our understanding of their disease mechanisms, develop potential imaging methods, clinical methods, and common treatment methods or drugs. The dynamics of interstitial fluid are critical for understanding CNS diseases or disorders, and the proposed concept may promote advancements in disease treatment or prevention.

#### TABLE OF CONTENTS/OUTLINE

1. An overview of the dynamics of cerebrospinal fluid and interstitial fluid in the CNS.
2. The waste clearance system in the CNS.
3. Pathologies associated with abnormal interstitial fluid dynamics.
4. A summary of the concept of interstitial fluidopathy.

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## Abstract Archives of the RSNA, 2023

NREE-152

### A Night in the ER: Diagnostic Errors in Emergency Neuroradiology

#### Participants

George Vilanilam, MBBS, Little Rock, AR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Introduction: Diagnostic errors in emergency neuroradiology are a major contributor to unnecessary healthcare costs and have been implicated in preventable deaths in the US. Errors are broadly categorized into perceptive and interpretive errors. The most common erroneous studies are CT head (32%), CT cervical spine (18%), and CTA head and neck (24%). Specific teaching points 1) Defining and understanding common sources of diagnostic errors in emergency neuroradiology. 2) Providing examples of common cognitive biases and perceptual errors. 3) Discussing methods to mitigate diagnostic errors in emergency neuroradiology.

#### TABLE OF CONTENTS/OUTLINE

Common cognitive biases/interpretive errors 1) Truncation of the search and analytical thought processes (premature closure, satisfaction of search, and satisfaction of report). 2) Affirming initial diagnosis (anchoring bias and attribution bias). 3) Recency (availability and non-availability bias). 4) Outcome-related bias (regret bias/defensive reporting, outcome bias). 5) Biases stemming from clinical parameters (framing bias, attribution bias). 6) Retrospective biases (hindsight bias, self-serving bias). Perceptual errors 1) Related to viewing technique (inappropriate windowing and fogging phenomenon). 2) Related to the finding itself (edge of film, first or last slice, bilateral or diffuse findings, subtle or poorly conspicuous). Recommendations to reduce diagnostic and reporting errors

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## Abstract Archives of the RSNA, 2023

NREE-16

### Nervous System MR Elastography: Current Update

#### Participants

Safa Hoodeshenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) How MR elastography of the nervous system is performed; From the generation of the shear waves to obtain qualitative and quantitative parameters  
2) What MRE can tell us about neural tissue biomechanical properties in physiologic and pathologic conditions

#### TABLE OF CONTENTS/OUTLINE

1) Principles of MR elastography technique in the nervous system  
2) Qualitative and quantitative obtained parameters  
3) Role of artificial intelligence in MRE  
4) Slip interface imaging  
5) MRE in neurodegenerative disease (Alzheimer's disease, Frontotemporal dementia, Lewy body dementia, Normal pressure hydrocephalus)  
6) MRE in characterizing and treatment planning of intracranial tumors (tumor subtype and grade, consistency, adhesion to surrounding tissue)  
7) MRE in traumatic brain injury  
8) MRE in neuroinflammatory disorders  
9) Functional MRE  
10) Pediatric nervous system MRE

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## Abstract Archives of the RSNA, 2023

NREE-17

### I Only See White Spots: Understanding the Clinical and Radiological Features of CNS Demyelination

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the most typical imaging characteristics of secondary demyelinating processes. To know the basic notions in relation with epidemiology, clinical presentation, pathology, possibility of spinal cord involvement and differential diagnosis. To be able to assist the diagnosis of each etiological group in order to provide better and faster management, taking into account the severity of the findings and prediction of outcome.

#### TABLE OF CONTENTS/OUTLINE

1. Autoimmune a. Multiple sclerosisb. Baló (example of tumefactive autoimmune lesions)c. Devic (optic neuromyelitis)2. Infectiousa. HIV encephalopathyb. PML (progressive multifocal leukoencephalopathy)c. Subacute sclerosing encephalomyelitis3. Vasculara. Binswanger (subcortical arterioesclerotic encephalopathy)b. CADASIL (Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy)c. Post-anoxicd. PRES (posterior reversible encephalopathy)4. Toxic-metabolica. Osmotic demyelinationb. Toxic leukoencephalopathyc. CLOCC (cytotoxic lesions of the corpus callosum)5. Traumatica. Diffuse axonal injury

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## Abstract Archives of the RSNA, 2023

NREE-18

### Facets of a "Heavy Brain": Exploring Patterns of Iron Metabolism Disturbances

#### TEACHING POINTS

Iron accumulation in the brain is common in several neurodegenerative disorders and normal aging. It likely contributes to the pathophysiology of neurodegenerative changes in these conditions by inducing oxidative stress, inflammation, and cell death. The patterns of iron deposits in the central nervous system vary between different conditions, both at the macroscopic and microscopic level. The role of iron in the pathogenesis and response to iron chelation therapy varies between individual disorders.

#### TABLE OF CONTENTS/OUTLINE

This review summarizes the whole brain, cellular, and subcellular patterns of iron accumulation in neurodegenerative diseases of genetic and sporadic origin, and also other associations as an neuroinfections. We also provide an update on mechanisms, biomarkers, and effects of brain iron accumulation in these disorders, focusing on recent publications. This pictorial review will also show how we can systematize the role of iron in brain and provide a practical guide to identify the main pathologies.

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## Abstract Archives of the RSNA, 2023

NREE-19

### Don't Take the Long Way: A Diagnostic Shortcut to Longitudinally Extensive Myelopathies

#### Participants

Nicole Lambrakos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Outline and describe the types of myelopathies (mechanical and non-mechanical).2. Explain the pathology and imaging findings of myelopathies.3. Build a decision making diagnostic flowchart, pointing out the imaging characteristics of myelopathies.

#### TABLE OF CONTENTS/OUTLINE

1. Brief review of spinal cord anatomy, tracts and function.2. Definition of myelopathy and longitudinally extensive spinal cord lesions and their subtypes (mechanical and non-mechanical).3. Pathology of spondylotic myelopathy.4. Clinical and imaging findings.6. Most specific imaging findings.5. Decision making diagnostic flowchart of myelopathies based on their imaging characteristics.

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## Abstract Archives of the RSNA, 2023

NREE-2

### **Variants and Anomalies of Extracranial Cerebral Arteries and Considerations for Neuroendovascular Procedures**

#### **TEACHING POINTS**

- To describe the embryology of the aortic arch in order to explain the origin of its anatomical variants and anomalies.- To review the variants and anomalies of extracranial cerebral arteries giving examples from cases from our institution.- To revise some of the pathology associated with extracranial vascular variants and anomalies and the implications for endovascular procedures.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Embryology. 3. Aortic arch3.1. Variants 3.1.1. Bovine arch 3.1.2. Elongation and tortuosity 3.2. Anomalies 3.2.1 Right-sided aortic arch 3.2.2. Right aberrant subclavian artery and bicarotid trunk 3.2.3. Double aortic arch4. Cervical Internal carotid artery4.1. Variants 4.1.1. Elongation and tortuosity4.2. Anomalies 4.2.1. Internal carotid artery agenesis 4.2.2. Main branches anomalous origins5. Cervical vertebral artery5.1. Variants5.2. Anomalies 5.2.1. Anomalous origin of the vertebral artery

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## Abstract Archives of the RSNA, 2023

NREE-20

### Beyond the Basic: Advanced MRI Techniques in Neuroimaging

#### Participants

Marina Da Cruz, Fernandopolis, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Advanced magnetic resonance imaging (MRI) techniques allow expanding the range of diagnostic tools with the potential to assess functional parameters in neuroimaging, complementary to traditional sequences, that can and should be used by radiologists to aid in the differential diagnosis. The purposes of this submission are: - To review advanced MRI techniques in neuroimaging, such as spectroscopy, perfusion weighted imaging, tractography, nigrosome and neuromelanine avaiation and vessel wall study; - To expose the main indications of each method; - To discuss possible imaging features in some groups of pathologies;

#### TABLE OF CONTENTS/OUTLINE

1. Review technique and indications of spectroscopy;2. Technique and indications of perfusion weighted imaging;3. Discuss technique, indications and basic interpretation of tractography;4. Assessment of nigrosome and neuromelanine;5. Discuss technique, indications and basic interpretation of vessel wall study;

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## Abstract Archives of the RSNA, 2023

NREE-21

### **Progressive Multifocal Leukoencephalopathy (PML): A Thorough Overview from Traditional to Contemporary Findings, Including Inflammatory Subtype, IRIS, Drug-associated, and Asymptomatic Cases**

#### **TEACHING POINTS**

1: Discuss PML imaging findings from classical observations to the latest insights. Explain the progression of lesions, taking into account the pathological findings. 2: Contrast-enhanced PML lesions are extremely important in clinical management, and discussing their significance in imaging findings is essential. 3: Address the key points of imaging findings for recently discussed drug-related PML and asymptomatic PML.

#### **TABLE OF CONTENTS/OUTLINE**

1: About progressive multifocal leukoencephalopathy (PML) 1-1: Classification of JCV diseases of the Brain! 2: PML progresses through the following 3 steps, reflecting pathological findings 2-1: First step: "Initiation" as a small demyelinating lesion 2-2: Second step: "Expansion" and "Extension" of demyelinating lesions 2-3: Third step: "Fusion" of demyelinating lesions, resulting in axonal destruction! 3: Interpretation of contrast enhancement in PML lesions! 4: New MRI findings related to PML 4-1: low signal intensity on T2\*WI and SWI in U-fibers and deep gray matter adjacent to the lesions 4-2: hyperintense cortical sign (HCS) on T1WI! 5: Drug-associated PML 5-1: natalizumab-associated PML 5-2: punctate lesions

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## Abstract Archives of the RSNA, 2023

NREE-22

### Neurological Emergencies in Oncologic Patients: Understanding the Importance of Early Imaging Evaluation

#### Participants

THARYN Goncalves FRANCO DE GODOY, Sao PAULO, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Neurological emergencies are common and life-threatening conditions, particularly in oncologic patients who are at higher risk due to factors, including immunosuppression, coagulopathy, and treatments such as chemotherapy and radiation therapy. Due to their compromised status, early diagnosis can be challenging, and imaging exams are often required for proper evaluation. Radiologists, especially those working in cancer centers, must be familiar with these emergencies to ensure prompt treatment and reduce morbidity and mortality. Our aim is to review the neurologic emergencies to oncologic patients dividing them into pre and post-treatment, including early and late complications. To increment the discussion, risk factors, clinical presentation, imaging findings and treatment will be in illustrative cases.

#### TABLE OF CONTENTS/OUTLINE

Introduction: review neurologic emergencies to oncologic patients. To divide the emergencies in two groups: related to cancer itself or its treatment (early and late complications), through a visual flowchart. To discuss, for each condition risk factors, clinical presentation, imaging findings and treatment. Following conditions: Pre-treatment: intracranial hypertension, vasogenic edema, herniations, spinal cord compression, paraneoplastic syndromes, ischemic and hemorrhagic stroke, venous sinus thrombosis. Post-treatment: radiation-induced vasogenic edema and leukoencephalopathy, infections, hemorrhages, radiation necrosis, SMART syndrome, radiation vasculopathy, encephalopathy, PRES, opportunistic infections. To highlight the particular aspects to oncologic patients, discussing the clinical and imaging for early diagnosis and treatment.

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## Abstract Archives of the RSNA, 2023

NREE-23

### Beyond the Lumen: Unraveling the Vessel Wall Technique

#### Participants

Maria Laura Piassa, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- A method that is here to stay, the vessel wall study, aims to evaluate the vascular wall and characterize the pathologies that compromise it, whether inflammatory, dissection, or atheromatous plaques.- It is a study that requires a high spatial resolution, with homogeneous signal suppression of the intravascular lumen, 2D or 3D multiplanar acquisitions, allowing several acquisitions.- In the evaluation of atherosclerotic diseases, VW-MRI demonstrates parietal thickening that eccentrically involves the circumference of the arterial wall, showing different characteristics on T1 and T2 sequences, depending on its internal content. Active/unstable plaques present a thin fibrous cap, large lipid core, presence of hemorrhage, contrast uptake and vascular remodeling.- Other differential diagnoses of intracranial luminal stenosis would be dissection, vasculitis (primary or secondary), reversible vasoconstriction and Moya-moya. VW-MRI is also used in the evaluation of aneurysms.- Pitfalls are points that deserve full attention, highlighting low flow, in which incomplete suppression can mimic wall thickening and vasa vasorum, mimicking vasculitis.

#### TABLE OF CONTENTS/OUTLINE

- Raise the importance of the VW-RM, including its techniques and applications.- Assess atherosclerotic disease and its differential diagnoses more precisely, stratifying individual risks, with potential influence on treatment decisions.

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## Abstract Archives of the RSNA, 2023

NREE-24

### Help When You're Feeling Low: Intracranial Hypotension and Algorithms for Diagnosis

#### Participants

Rahim Ismail, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Familiarize radiologists with the pathology and pathophysiology of spinal CSF leaks resulting in spontaneous intracranial hypotension (SIH).2. Localization of the culprit spinal CSF leak in SIH patients can be difficult. At our institution we use a combination of brain and spinal MRI to guide the type of myelographic imaging and patient positioning for the myelogram to help localize the CSF leak.3. Role of dynamic CT myelogram (DCM) and digital subtraction myelogram (DSM) in patients demonstrating a spinal longitudinally extensive collection (SLEC) on spinal MRI4. Role of lateral decubitus DSM in patients with SLEC negative MRI in evaluating for a CSF venous fistula (CVF) or distal tears of the nerve root sleeve.5. Role of DSM for precise localization in patients with suspected fast flow CSF leaks, such as dural tears from sharp osteophytes .6. Role of DCM in patients with suspected CSF leaks from proximal nerve root sleeve tears/perineural cysts.7. Describe our institutional protocols for performing DCM and DSM including tips for optimizing timing and provocative assessments.

#### TABLE OF CONTENTS/OUTLINE

The following illustrative examples will be shown:1. Pathology: Different etiologies of spinal CSF leaks will be shown including:a. Microspurs b. perineural cysts c. CSF venous fistula (CVF) d. distal dural tears.2. We will describe our institutional algorithm for the work up of these complex subsets of patients.

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## Abstract Archives of the RSNA, 2023

NREE-25

### Connecting the Dots: A Step-by-Step Guide of Brain Myelination

#### Participants

Afonso Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: To review the normal appearance of myelination on imaging studies To define a step-by-step analysis algorithm to facilitate the assessment of myelination To display a compendium of cases involving myelination disorders

#### TABLE OF CONTENTS/OUTLINE

Myelin is a vital component of the nervous system, serving as an insulator for neurons and found in both the central and peripheral nervous systems. It not only insulates but also speeds up action potentials by 10-100 times that of an unmyelinated axon. Moreover, it regulates ion composition and fluid volume around the axon, which is crucial for maintaining its health and integrity. MRI is the best noninvasive way to assess myelin and myelination in the pediatric brain. Mature myelin usually appears hyperintense to the gray matter cortex on T1 and hypointense to the gray matter cortex on T2. The process of myelination starts during fetal development with the cranial nerves, which are essential for our survival, and continues throughout life. As myelination progresses, it generally follows a pattern of development from bottom to top (caudocranial), back to front (posterior to anterior), and central to peripheral (deep to superficial). In conclusion, myelin is a vital component of the nervous system and plays a critical role in proper functioning. Understanding the process of myelination and the appearance of mature myelin on imaging is essential for the evaluation of many neurological conditions.

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## Abstract Archives of the RSNA, 2023

NREE-26

### **Nigrosome 1: Anatomy, Variants and Pathologies**

#### **Participants**

Danielly Santos SR, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is to help the readers to determine the presence or absence of an abnormality in the N1 and establish diagnostic reasoning in cases of parkinsonism. The objectives of this electronic exhibit are:- to revisit the anatomical definition of the N1 region using schematic illustrations and imaging MRI;- to illustrate the anatomical variants of the N1;- to exhibit parkinsonism diagnostic algorithm;- provide imaging findings of various patients who presented with parkinsonism.

#### **TABLE OF CONTENTS/OUTLINE**

Parkinson's disease is a clinically heterogeneous chronic progressive neurodegenerative disease with loss of dopaminergic neurons in Nigrosome 1 (N1). Nigrosomes are small clusters of dopaminergic cells within the substance nigra. Five nigrosomes have been described with the largest labeled as N1, located in the posterior third of the substantia nigra. The N1 is the key structure in the midbrain that is very important in movement disorders, particularly those associated with parkinsonism. Interpreting the N1 sign can be difficult because it can take many forms but the high-resolution data and clear characterization of the N1 appearance help to make that decision easier.

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## Abstract Archives of the RSNA, 2023

NREE-27

### Stroke of Luck: Imaging of Hyperacute Stroke and Selecting Patients Effectively

#### TEACHING POINTS

? Stroke management was revolutionized recently by the proven benefit of intervention with a larger time window on selected patients ? Time is brain: CT perfusion helps identifying salvageable brain tissue ? Radiologists play a crucial role on helping the multidisciplinary team select patients who will benefit from intervention based on imaging criteria ? Perfusion studies should be routinely assessed to avoid misinterpretation and excluding patients from therapy

#### TABLE OF CONTENTS/OUTLINE

Introduction Over the past few years, after publication of the results of the DEFUSE 3, EXTEND and DAWN trials, stroke management has been revolutionized. These studies proved the benefit from intervention with a larger time window based on certain perfusion imaging criteria. This educational exhibit's goal is to review the role of conventional and advanced imaging on hyperacute stroke, ending with a proposed interpretation algorithm for selecting patients effectively. Current treatment options and inclusion criteria Imaging of hyperacute stroke ? Acquisition protocols ? CT ? MR ? Perfusion CT/MR ? ASPECTS ? AI (Rapid, Brainomix) ? Assessing study's quality ? Pitfalls ? Proposed interpretation algorithm

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## Abstract Archives of the RSNA, 2023

NREE-28

### Headache, Dizziness, and Leaks. May the Balance be with You. A Pictorial Review of Intracranial Hypo and Hypertension

#### Participants

Fernanda Avalos, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cerebrospinal fluid (CSF) homeostasis is essential to maintain normal intracranial pressure. Even a small imbalance in CSF production, absorption, or flow can lead to altered intracranial pressure. Imaging in increased intracranial pressure (ICP): Although there are no specific imaging findings of idiopathic intracranial hypertension, enlarged arachnoid outpouchings such as an empty sella, enlarged Meckel's cave, or signs in the optic nerve such as vertical tortuosity or flattening of the posterior sclera should raise suspicion, as these signs have been identified in 23-80% of patients. ICP may be due to secondary causes such as disturbances in CSF production and absorption or obstructive hydrocephalus that can result from lesions such as intracranial masses. Imaging in intracranial hypotension: the major radiological features can be summarized with the acronym SPACE (Sagging of the brain, Pituitary enlargement, Angles, Collections, and Enhancement of the pachymeninges). Dural membrane leaks contribute to the majority of causes of intracranial hypotension. Therefore, understanding the imaging methods and findings can guide definitive treatment and improve patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Understand the physiological mechanism of CSF in the central nervous system.
2. Describe the common symptoms of intracranial hypo- and hypertension, and recall clinical findings during neurological examination.
3. Radiological findings of intracranial hypertension with differential diagnosis.
4. Radiological and clinical evolution of a patient with intracranial hypotension, from the first study with unspecified headache, through spinal leak diagnosis, to control after treatment

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## Abstract Archives of the RSNA, 2023

NREE-29

### **Meningiomas - Do You Know Their Presentations: Brief Pictorial Review of Intracranial Meningiomas Presentations and Their Radiological Findings. Our Image Experience**

#### **TEACHING POINTS**

Remember the definition of meningiomas and its most relevant epidemiological data. Review the current classification of intracranial meningiomas according to the World Health Organization (WHO) and their different imaging characteristics. Overhaul a brief pictorial review with exemplified cases of typical and atypical meningiomas from our institute.

#### **TABLE OF CONTENTS/OUTLINE**

Meningiomas are the most common nonglial primary tumors of the Central Nervous System and the most common extraaxial neoplasms. They may originate in unexpected locations such as the orbit, paranasal sinus, or ventricles or be entirely intraosseous (within the calvaria). The radiologist must be aware of their less frequent and uncharacteristic the imaging features in order to suggest the right diagnoses in cases that are atypical. The present educational exhibit intends to make a brief pictorial review of the main presentations of intracranial meningiomas, their current classification and imaging characteristics, and exemplify them with cases of patients from our institute.

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## Abstract Archives of the RSNA, 2023

NREE-3

### Don't be Afraid of Neuroimaging Epilepsy: A Case-based Review of a Myriad of Etiologies and Findings

#### TEACHING POINTS

Epilepsy is seen as a clinical manifestation due to excessive or synchronous abnormal neuronal activity in the brain, defined as recurrent, unprovoked seizures. The prevalence is high, and patients have an increased risk of premature death, injuries, psychosocial dysfunction, and reduced quality of life. The etiologies encompass multiple causes. Neuroimaging studies (particularly magnetic resonance imaging) are essential in evaluating epilepsy, mainly in cases refractory to pharmacotherapy, once the location of the epileptogenic focus is a turning point in a successful neurosurgery approach. The purpose of this exhibit is to present, through illustrative cases, a practical approach to imaging findings within multiple epilepsy etiologies.

#### TABLE OF CONTENTS/OUTLINE

Education Exhibit Presentation ? Introduction. ? Clinical and epidemiological aspects. ? A case-based review of original cases from the neuroradiology department of a tertiary hospital showing imaging features of a range of etiological substrates of epilepsy (from the common ones to the rarest), always through the perspective and purpose of a practical approach. Key and ancillary imaging features will be highlighted in each case. ? Take-home messages ? References.

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## Abstract Archives of the RSNA, 2023

NREE-30

### Maxillo-mandibular Lesions: Gnawing Through the Differentials

#### Participants

Gillean Cortes, DO, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To provide an overview and differential diagnosis for maxillo-mandibular lesions encountered during imaging of the head and neck.
2. To present the multimodal radiologic features with case-based review of maxillo-mandibular lesions.
3. To highlight the approach of maxillo-mandibular lesions including diagnosis and management.

#### TABLE OF CONTENTS/OUTLINE

Maxillo-mandibular lesions are commonly encountered and usually incidental during head and neck imaging. There is a broad spectrum of lesions, which may be of odontogenic and non-odontogenic origin and can be further classified by cystic, solid, infectious/inflammatory, benign, and malignant processes. Patient characteristics and location of the lesion may be helpful; however, without pathognomonic imaging features, tissue sampling is frequently required. Several key cases presented at our institution will be reviewed such as: periapical cyst, dentigerous cyst, odontogenic keratocyst, non-odontogenic developmental cystic lesions, aneurysmal bone cyst, ameloblastoma, fibrous dysplasia, osteosclerosis, condensing osteitis, cementoblastoma, ossifying fibroma, osteomyelitis, odontogenic carcinoma, invasive squamous cell carcinoma, and osteoradionecrosis. Accurate diagnosis is essential to prevent further complications, as otherwise treatable lesions with destructive potential may be missed.

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## Abstract Archives of the RSNA, 2023

NREE-31

### Looking Back: Everything You Need to Know on Infratentorial Malformations

#### Participants

Taisa Guarilha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is:- To review normal anatomy of the posterior fossa- To explain in a simplified way normal embryology and the modifications that result in these malformations- To demonstrate how infratentorial malformations can present themselves- Exemplify with cases- Present a flow chart

#### TABLE OF CONTENTS/OUTLINE

1. Normal anatomy  
2. Embryology: - Normal- Malformations  
3. Cases:  
3.a. Cystic malformations: Dandy-Walker continuum, Blake Pouch, Cyst, Mega Cisterna Magna, Arachnoid cyst  
3.b. Non-cystic malformations:-  
- Predominant cerebellar involvement:- Rhombencephalosynapsis- Macrocerebellum- Microcerebellum- Cerebellar Hypoplasia - bilateral, unilateral - Cortical cerebellar malformation- Cobblestone-  
- Predominant brainstem involvement:- Pontine tegmental cap dysplasia- Horizontal gaze palsy with progressive scoliosis- Möbius Syndrome-  
- Predominant cerebellar and brainstem involvement:- Molar tooth malformations - including Joubert Syndrome- Pontocerebellar hypoplasia- Walker-Walburg- Lhermitte-Duclos syndrome - Craniocervical junction: Chiari spectrum  
3.c. Others- Masiner-Santino Syndrome- Quadrigeminal cistern lipoma  
4. Flowchart  
5. Take home messages

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-32

### **No More Conflict: Imaging of Neurovascular Compression Syndromes, Related Anatomy and Surgical Approach**

#### **TEACHING POINTS**

Neurovascular compression (or conflict) is one of the causes that must be considered in patients presenting with cranial nerve related symptoms. MR imaging is key to rule out differential diagnosis. Knowing the involved anatomy is fundamental to identify possible sites of compression. Communication with the surgeon plays a major role and the reports must include necessary information to surgical planning.

#### **TABLE OF CONTENTS/OUTLINE**

Neurovascular conflict syndromes (NVCS) consist of symptoms related to compression of the V, VII, VIII or XII cranial nerves by vascular structures, usually at the transition zone near the nerve root entry zone. When indicated microsurgical decompression can be done. Trigeminal Nerve NVCS of the V CN usually presents as trigeminal neuralgia and is caused by compression at its REZ at the level of the pons by an elongated superior cerebellar or anterior inferior cerebellar arteries. Facial and Vestibulocochlear Nerves Facial hemispasm (VII CN) / vertigo and tinnitus (VIII CN) may come from compression at the inferior pons level by the AICA. Glossopharyngeal Nerve IX CN compression at its REZ on the upper medulla by the PICA may cause glossopharyngeal neuralgia.

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## Abstract Archives of the RSNA, 2023

NREE-33

### Emergency Neuroradiology Misses: Case Examples and Lessons Learned

#### TEACHING POINTS

Diagnostic errors are the 3rd leading cause of death in the United States. In diagnostic radiology, the rate of errors increases significantly in the emergency setting, this is particularly critical in neuroradiology, where misinterpretation or misidentification may significantly delay treatment and adversely impact patient outcome. In this educational exhibit, readers will be able to: Recognize the two types of thought processing in human decision making, Recognize common diagnostic errors and underlying cognitive biases in image interpretation, See examples of real life missed/misinterpreted cases in emergency neuroradiology and Understand different approaches to reduce diagnostic errors.

#### TABLE OF CONTENTS/OUTLINE

1. Background of diagnostic errors in radiology (statistics and common misses in emergency neuroradiology). 2. Type 1 and Type 2 Processing in Clinical Decision Making (heuristic vs analytical approaches). 3. Different Types of Errors During Image Interpretation (cognitive/interpretive biases, perceptual errors). 4. Sample cases to illustrate different types of misses in emergency neuroradiology (perceptual errors - blind spot; cognitive error/lack of knowledge; perceptive error - satisfaction of search; inadequate history). 5. How do we reduce diagnostic errors (strategies from the literature and our institution will be provided such as non-random peer review, double reading, interdisciplinary rounds and tumor boards, reducing interruptions, computer-aided decision making support system)

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## **Abstract Archives of the RSNA, 2023**

NREE-34

**Infarcts, Malformations, and Tumors.. Oh My! A Review of Vascular Pathology In and Around the Spinal Cord**

### **TEACHING POINTS**

1. To review spinal vascular anatomy with original diagrams. 2. To review International Society for the Study of Vascular Anomalies (ISSVA) and other classification systems. 3. To discuss the clinical presentation and etiologies. 4. To demonstrate common imaging findings.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Infarcts 3. Malformations 4. Tumors 5. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-35

### Teratomas of the Brain, Head and Neck, and Spine: Imaging Appearances

#### TEACHING POINTS

- Illustrate the different imaging appearances of teratomas in the brain, head and neck, and spine.
- Discuss their locations and associated complications.
- Understand the usefulness of CT and MRI in the diagnosis and characterization of teratomas.

#### TABLE OF CONTENTS/OUTLINE

Intracranial and spine teratomas, as well as those in the head and neck, are rare tumors that originate from all three embryonic germ layers (ectoderm, mesoderm, endoderm). They can be classified depending on their differentiation as mature, immature, and teratoma with malignant transformation. Clinical manifestations vary according to location and size. Intracranial teratomas are usually located in the midline, generally in the pineal and suprasellar regions, and represent more than two-thirds of brain tumors diagnosed before birth. In the spine, teratomas can occur at any level and compartment (extradural, intradural, or intramedullary). Characteristically, all show distinct components with fat, calcification, and soft-tissue attenuation on CT. Predominantly cystic teratomas also occur. MRI offers better characterization of these tumors and detection of their complications. In this exhibit, we will discuss typical and unusual appearances of teratomas on CT and MRI approaching them by location:

- Intracranial: congenital, midline, and off-midline location
- Head and Neck
- Spine: intramedullary, intradural extramedullary, and extradural/sacroccygeal

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## Abstract Archives of the RSNA, 2023

NREE-36

### Radiographic Findings in Hypoxic-Ischemic Brain Injury and the Role of Imaging in Brain Death Determination

#### Participants

Min Tae Kim, MD, BSC, Torrance, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to 1. Discuss patterns of hypoxic-ischemic brain injury in pediatric and adult patients 2. Review the utility of imaging in prognostication 3. Review brain death determination using clinical criteria and imaging support 4. Present select cases from our institution

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Patterns of hypoxic-ischemic brain injury in neonates- Normal MRI appearance of the neonatal brain- Patterns of mild, moderate, and severe injury 3. Patterns of hypoxic-ischemic brain injury in infants, young children, and adults- Commonly involved regions of the brain - cortex, deep gray matter, perirolandic cortex, watershed distribution, white matter, cerebellum- Review of radiographic findings on CT- Review of radiographic findings on MR 4. How imaging can assist in determining prognosis 5. Radiographic imaging in the brain death examination- CT angiography- Digital subtraction angiography (DSA) - gold standard- Nuclear medicine 6. Select cases from our institution

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## Abstract Archives of the RSNA, 2023

NREE-37

### Don't Get Trapped: Diagnostic Errors in Emergency Neuroradiology

#### Participants

Julia Brunelli, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diagnostic errors in neuroradiology in the emergency department can have serious consequences for patients. The prevalence of errors in diagnostic radiology is around 3-5%. Factors such as less time to prepare the report and discuss the case with peers, the patient's clinical condition evolving rapidly, and dependence on the radiological report to take immediate actions according to the imaging findings can all contribute to errors. In this educational presentation, we will review a series of cases to address a series of etiologies that are present in a neurological emergency room and provide tips to improve accuracy and patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction• Overview of diagnostic errors• Renfrew Classification (revised by Kim and Mansfield in 2014)2. Case based review• Etiologies that are present in the emergency• Learning with the case: tips about that etiology3. Do it yourself• Cases as a diagnostic challenge for the audience

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## Abstract Archives of the RSNA, 2023

NREE-38

### A to Z of Motor Neuron Diseases

#### Participants

Amit Desai, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review neuroanatomy of the motor system  
2. Discuss common upper and lower motor neuron diseases  
3. Provide a multi-disciplinary and radiologic pattern based approach to diagnosis of motor neuron diseases

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Neuroanatomy Review  
3. Classification of Upper and Lower Motor Neuron Diseases. Imaging features, pathophysiology, genetics, clinical symptoms, and management will be reviewed.  
A. Upper Motor Neuron Involvement Only: i. Primary Lateral Sclerosis  
ii. Hereditary Spastic Paraplegia  
iii. Spinal AVM/AVF  
iv. Radiation Myelitis  
B. Lower Motor Neuron Involvement Only: i. Progressive Muscular Atrophy  
ii. Flail Arm/Leg Syndrome  
iii. Post-Polio Syndrome  
iv. AIDP  
v. CIDP  
vi. Motor Neuron Lymphoproliferative Disorders  
C. Upper and Lower Motor Neuron Involvement: i. Amyotrophic Lateral Sclerosis (ALS)  
ii. ALS Plus Syndrome, Progressive Bulbar Atrophy  
iii. Bulbar-onset ALS  
D. Diseases affecting the Muscle/Neuromuscular Junction: i. Myasthenia Gravis  
ii. Lambert Eaton  
iii. Inclusion Body Myositis  
4. Simplified Diagnostic Approach Based Upon Clinical Symptomatology and Radiologic Imaging Pattern  
5. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-39

### Novel WHO Intra-axial Tumoral Entities: Beyond Gliomas

#### Participants

Sultan Yahya, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the evolution of CNS tumor classification- Concepts in the WHO 2021 classification of tumors - What's new?- Pertinent Radiomics and Molecular Classification of tumors- Recognize imaging features of relatively Novel CNS tumoral entities- Diffuse Pediatric high grade glioma- High Grade astocytoma with piloid features (HGAP)- Astroblastoma- Multinodular and Vacuolating neuronal tumor (MVNT)- Multiloculated and Vacuolating Posterior Fossa lesions of Unknown Significance (MV-PLUS)- Diffuse Leptomeningeal Glioneuronal Tumor (DLMGT) - Calcifying Pseudoneoplasm of the Neuroaxis (CAPNON)- Polymorphous Low Grade Neuroepithelial tumor of the Young (PLNTY).

#### TABLE OF CONTENTS/OUTLINE

Review of CNS tumor classification and Novel concepts in the WHO 2021 classification  
Cased- based review of new CNS tumoral entities: - Diffuse Pediatric high grade glioma- High Grade astocytoma with piloid features (HGAP)- Astroblastoma- Multinodular and Vacuolating neuronal tumor (MVNT)- Multiloculated and Vacuolating Posterior Fossa lesions of Unknown Significance (MV-PLUS)- Diffuse Leptomeningeal Glioneuronal Tumor (DLMGT) - Calcifying Pseudoneoplasm of the Neuroaxis (CAPNON)- Polymorphous Low Grade Neuroepithelial tumor of the Young (PLNTY).

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## Abstract Archives of the RSNA, 2023

NREE-4

### Radiological Approach to Toxic-metabolic Encephalopathies

#### Participants

Valeria Andrea G. Schonstedt, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To propose a systematic radiologic approach in the evaluation of toxic-metabolic diseases.

#### TABLE OF CONTENTS/OUTLINE

1) When to suspect toxic-metabolic disease in a patient with acute encephalopathy 2) Important differential diagnosis that should be ruled out 3) To establish a topographic approach to suggest an etiologic diagnosis 4) To be aware of rare asymmetric presentations

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## Abstract Archives of the RSNA, 2023

NREE-40

### Radiopharmaceutical Therapy for Fibromyalgia: A Promising Treatment Option

#### Participants

Sriram Paravastu, BA, Lee's Summit, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Despite the availability of several pharmacological and non-pharmacological therapies, the management of fibromyalgia remains challenging. 2. Preliminary studies have shown promising results in PET imaging of fibromyalgia. 3. Radiopharmaceutical therapy involves the administration of radiopharmaceutical agents that selectively accumulate in specific tissues or organs and may be the next step in treatment of fibromyalgia.

#### TABLE OF CONTENTS/OUTLINE

1. Current challenges in the management of fibromyalgia 2. Radiopharmaceutical therapy for fibromyalgia a. Current radiotracers under investigation 3. Preliminary studies on molecular imaging of fibromyalgia a. Radiolabeled Substance-P monoclonal antibody b. Radiolabeled small molecules 4. Future directions and challenges a. Theranostics in fibromyalgia and other chronic pain syndromes b. Establishment of objective clinical markers of fibromyalgia

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## Abstract Archives of the RSNA, 2023

NREE-41

### Neurovascular Devices and Related Complications: A Case-based Approach

#### Participants

Victor De Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to: 1. Showcase the mainly used neurovascular devices, highlighting the preferred imaging modalities and what to avoid in the postoperative evaluation of each device. 2. Review the most relevant complications assessed by imaging related to each neurovascular device : what to look for?

#### TABLE OF CONTENTS/OUTLINE

- Introduction with a brief and illustrative review of the main neurovascular devices used in clinical practice and the modalities of choice for assessment of each device.
- Provide a guide on what to look for when assessing neurovascular devices with the most commonly associated complications.
- Provide didactic cases to illustrate the most important complications related to each neurovascular device and consolidate the acquired knowledge.
- Conclusions.
- Bibliographical references.

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## Abstract Archives of the RSNA, 2023

NREE-42

### Impact of Deep Learning-Based Reconstruction on Neuro MR Imaging: Image Noise Reduction and Super Spatial Resolution

#### Participants

Hiroyuki Uetani, Kumamoto, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To understand the principle of deep learning-based reconstruction (DLR) for reducing image noise and enhancing spatial resolution of neuro MRI. 2. To illustrate the applications of DLR with/without compressed sensing (CS) and parallel imaging and super spatial resolution-DLR (SR-DLR) for neuro MRI, and discuss the strengths of this techniques. 3. To discuss the pitfalls and limitations of DLR with/without CS and parallel imaging and SR-DLR techniques.

#### TABLE OF CONTENTS/OUTLINE

Introduction: 1) What is DLR with/without CS and parallel imaging, and SR-DLR techniques? 2) The advantages and disadvantages of DLR with/without CS and parallel imaging, and SR-DLR techniques. Clinical application of DLR with/without CS and parallel imaging and SR-DLR in neuro MR imaging: 1) DLR: High signal-to-noise ratio (SNR) images without long acquisition times A) High-resolution 3D T2 weighted imaging (HR-3D T2WI) B) MR angiography 1) Combination of DLR and CS/parallel imaging: High SNR images in a short acquisition time without sacrificing spatial resolution A) 2D-T2WI on the sellar region or spine B) MR angiography C) High-resolution 3D-T2WI 2) SR-DLR: High SNR images with super spatial resolution without long acquisition times A) 2D-T2WI on the hippocampus B) MR angiography C) Double inversion recovery (DIR) imaging D) Contrast-enhanced 3D T1WI E) Bone imaging Pitfalls and limitations of DLR with/without CS and parallel imaging, and SR-DLR in neuro MR imaging.

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## Abstract Archives of the RSNA, 2023

NREE-43

### **NODDI vs Traditional dMRI Metrics: Revealing Microstructure Without a Microscope**

#### **TEACHING POINTS**

Importance of dMRI as a non-invasive medical imaging modality for investigating the white matter integrity in the brain. Different traditional scalar metrics currently used for characterising the diffusion of water molecules - FA, MD, RD and AD and discussing their pitfalls. Introduction to new advanced metrics like NODDI (neurite orientation dispersion and density imaging) for neuroscience clinical research. Clinical relevance of scalar metrics

#### **TABLE OF CONTENTS/OUTLINE**

Introduction to dMRI Traditional dMRI metrics to reveal microscopic details of tissue architecture (FA, AD, RD, MD) Pitfalls of traditional metrics NODDI- introduction and applications in clinical research (TBI and Epilepsy)

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## Abstract Archives of the RSNA, 2023

NREE-44

### Practical Guide for Young Radiologists: Basic Sequences in Neuroradiology

#### Participants

Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the aspects and physical parameters of basic magnetic resonance imaging sequences of the brain. Identify the main evaluation structures and tissue signal patterns in each sequence. Correlate brain diseases with signal changes.

#### TABLE OF CONTENTS/OUTLINE

Different Magnetic Resonance (MRI) imaging sequences are used together for brain evaluation. Knowledge of the physical aspects and signal patterns of basic MR sequences are essential for elucidation of neurological pathologies. Variables such as the number of radiofrequency (RF) pulses, angle, period between excitations (repetition time - TR) and period between excitation to echo (echo time - TE) determine the different signals between tissues on T1, T2 and image density proton weights. Some tissues and contents show different signals in each sequence. In the T1 sequence, fat, lesions with high protein content, some stages of hemoglobin degradation and melanin have high signal. In this sequence, it is important to analyze bone structures, brain parenchyma, flow-void, pineal and pituitary glands. In the T2/FLAIR sequence, most lesions have high signal, is a good sequence to see white lesions. In T2\*/SWI, blood, calcium, air have low signal. Some neoplastic, infectious, and ischemic changes show diffusion restriction on the DWI sequence and characteristic postcontrast enhancement. The correlation of signal patterns from different tissues in the evaluation of basic sequences helps in the recognition of patterns of normality and pathological alterations, being an important knowledge for young radiologists to begin to understand the findings of magnetic resonance imaging of the brain.

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## Abstract Archives of the RSNA, 2023

NREE-45

### The Art of Arteritis: Imaging Primary CNS Vasculitis

#### Participants

Eleanor Taylor, MSc, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A practical approach to the investigation of PCSNV, covering the diagnostic criteria, presentation, and laboratory tests, but with a primary focus on imaging. 2. A structured discussion of the radiological manifestations of PCNSV. 3. An awareness of the common mimics and their differentiating clinical and radiological features. 4. Insight into the role of imaging in the process of diagnosis and treatment from a multidisciplinary perspective.

#### TABLE OF CONTENTS/OUTLINE

Primary central nervous system (CNS) vasculitis (PCNSV) is an extremely rare diagnosis but a common clinical concern. The presentation is non-specific; it typically manifests in middle-aged patients with subacute headache, altered cognition, and variable additional neurological features. Cerebrospinal fluid analysis can be normal in up to one third of cases. The radiological phenotype is protean, with no pathognomonic findings and innumerable mimics. Luminal vascular imaging has variable sensitivity and poor specificity. Assessment can be augmented by the use of vessel wall imaging, but this is not a panacea. Definitive diagnosis requires biopsy, not always an attractive prospect, but the risks need to be weighed against those of the disease and its treatment, both of which are considerable. To meet this formidable challenge, we will outline a practical approach to the investigation of suspected PCSNV, review the imaging findings, and explore the common mimics and their differentiating features. This will be illustrated with a series of cases compiled from a neurosciences centre in London.

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## Abstract Archives of the RSNA, 2023

NREE-46

### The Hidden Dangers of Hypothalamic and Hypophyseal Lesions: Not Everything is Neoplastic

#### Participants

Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the normal anatomy and embryology of hypothalamic-pituitary axis using schematic illustrations and imaging MRI. Identify the main imaging features to guide differential diagnosis in non-neoplastic hypothalamic-pituitary involvement. To display a compendium of cases of non-neoplastic hypothalamic-pituitary axis.

#### TABLE OF CONTENTS/OUTLINE

The hypothalamic-pituitary axis is responsible to regulate many other endocrine glands through its hormone, and the pituitary being known as the master gland, is divided into two distinct parts: the anterior pituitary (adenohypophysis) and the posterior pituitary (neurohypophysis), differ in embryologic origin and function. There are several diseases that can affect the function and morphology of the hypothalamic-pituitary axis. It is susceptible to involvement by a variety of processes, including congenital, infectious or inflammatory, neoplastic or toxic-metabolic diseases. Imaging plays a key role in determining the most probable diagnosis and the Magnetic resonance (MR) imaging is the modality of choice for evaluating the anatomy and pathologic conditions of the hypothalamic-pituitary axis, helping to distinguish neoplastic and non-neoplastic lesions. The MRI differential diagnosis depends on anatomic recognition and characterization of associated imaging findings such as volumetric changes, stalk thickening, cystic appearance, intensity of signal in T1 and T2-weighted imaging. Therefore, we propose a systematic approach to address non-neoplastic pituitary changes based on the most important imaging patterns.

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## Abstract Archives of the RSNA, 2023

NREE-47

### Uncovering Coverage: Best Cases on Meningeal Pathology

#### Participants

Raissa Marjory Zonta Moreti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review normal meningeal embryology and anatomy. To understand normal behavior of brain meninges. To discuss best MR imaging protocol to evaluate meningeal diseases. To create systematic approach to evaluation of imaging patterns of most relevant meningeal pathology.

#### TABLE OF CONTENTS/OUTLINE

Introduction Normal embryology Anatomy Physiological behavior of meninges Imaging protocol MR imaging patterns Anatomic - leptomeningeal, pachymeningeal. Morphologic - mass-like, nodular, smooth. Meningeal pathology Infection Pyogenic Viral Fungal Parasite Tumors Benign Malignant - primary and secondary Granulomatosis Sarcoidosis Tuberculosis Wegener disease Langerhans Cell Disease Non Langerhans Cell Disease Inflammatory Diseases IgG4 related Pseudotumor Miscellaneous Iatrogenic Traumatic

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## Abstract Archives of the RSNA, 2023

NREE-48

### Everything About CNS Infections: A Pictorial Review. Tips and Tricks for General Radiologists

#### Participants

David Castanedo SR, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To highlight the diagnostic pearls to recognize properly CNS infections. - To showcase the differential diagnosis of the main CNS infections.- To point out the importance of the state of the immune system when analyzing these studies. - To provide an extensive pictorial review with the most typical findings of both common and uncommon infections, from bacteria, to viruses, and also fungi and parasites.

#### TABLE OF CONTENTS/OUTLINE

1. Bacterial meningitis. 1.1. Typical imaging features. 1.2. Complications: acute hydrocephalus, extra-axial collections, cranial nerve involvement, arterial and venous strokes, ventriculitis. 2. Brain abscesses and cerebritis. 2.1. Ring enhancing lesions differential diagnosis. 3. Herpes encephalitis. 4. Rhombencephalitis. 5. Acute cerebellitis. 6. Encephalitis with bithalamic lesions. 7. Neurosyphilis. 8. Neurocysticercosis. 9. Hydatidosis. 10. Toxoplasmosis.11. Cryptococcal meningitis. 12. Progressive multifocal leukoencephalopathy. 13. HIV encephalopathy. 14. Nocardia. 15. Aspergillosis. 16. Mucormycosis. 17. Neuroborreliosis. 18. Rickettsial infections. 19. COVID-19. 20. Creutzfeldt-Jakob.

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## Abstract Archives of the RSNA, 2023

NREE-49

### Cranial Surgical Approaches: What the Radiologist Needs to Know

#### Participants

Taisa Santos, MD, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To correlate the topography of brain lesions with surgical approaches through illustrations and imaging tests. Assist in the identification of surgical accesses through imaging exams. Establish anatomical relationships and correlate with the surgical approaches crania.

#### TABLE OF CONTENTS/OUTLINE

In addition to the pre-surgical evaluation for neurosurgeries, the imaging study is extremely important in identifying postoperative findings. Post-surgical changes include repercussions on the brain parenchyma, soft tissues and recognition of the cranial approaches used. The evolution of the location of the pathology helps in the interpretation of the surgical approach. Some topographies favor the use of specific accesses to allow manipulation of certain structures. Access to the skull base, brainstem, supratentorial and intraventricular are well established in the literature and the correct description in the medical report is part of the post-surgical evaluation. Therefore, we proposed to correlate surgical procedures with the location of encephalic pathologies. The demonstration of these aspects is facilitated through schematic illustrations that make it possible to associate these findings with the topography of the lesion in the surgical approach.

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## Abstract Archives of the RSNA, 2023

NREE-5

### Old but Gold: A Primer of Spine Radiography

#### Participants

Bianca Bianco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The spine is made up of a complex anatomy and its evaluation could be challenging sometimes. It is a curved structure composed of bony vertebrae that are connected through cartilaginous intervertebral discs. It ensures proper posture, spinal cord protection, communication with the brain, body mobility and sensation through the complex interplay between the bones, ligaments and muscle structures. The radiography is the first method for its evaluation. Although this a simple imaging method, the correct analysis is very important for the clinical management of the patient. A well-performed radiography, with an appropriate position and adequate beam increases the accuracy of the diagnosis, besides the low-cost exam and high availability in the health care system. The purpose of this presentation is to review the normal anatomy of the cervical, thoracic and lumbar spine, to provide a didactic approach about the main characteristics of the evaluation, and to guide young physicians through the analysis of spine radiography.

#### TABLE OF CONTENTS/OUTLINE

Didactic review of how to evaluate the spine radiography, including the aspects of the technique, anatomy of the cervical, thoracic and lumbar spine as well as the most common pathologies, based on our service's digital archive.

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## Abstract Archives of the RSNA, 2023

NREE-50

### Encephalitis and Encephalopathy: Differential Diagnosis of Infectious and Autoimmune Diseases Based on Imaging Patterns and Topography

#### Participants

Beatriz Prado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: To review and discuss the differential diagnosis and brain MRI imaging patterns of infectious and autoimmune diseases by brain topography. Discuss and illustrate through illustrative cases different imaging patterns and emphasize the key findings that may lead to a specific diagnosis.

#### TABLE OF CONTENTS/OUTLINE

**Introduction** Describe the most common brain MRI imaging features of encephalitis and encephalopathy, including images that illustrate each feature, such as swelling, inflammation, bleeding, among others. Discuss the differential diagnosis of encephalitis and encephalopathy on brain MRI, divided by topography: -Cortical: Anti-NMDAR encephalitis, Herpes simplex encephalitis, Progressive Multifocal Leukoencephalopathy -White matter: Multiple Sclerosis, Susac Syndrome, FLAMES -Basal ganglia and/or thalamus: Auto-immune striatal encephalitis, FLAMES, acute necrotizing encephalitis, Neurocysticercosis -Cerebellum: Paraneoplastic cerebellar degeneration with anti-TR, Paraneoplastic cerebellar degeneration with anti-GAD, Aseptic meningitis with systemic lupus erythematosus, Acute disseminated encephalomyelitis -Brainstem: Progressive Multifocal Leukoencephalopathy, enterovirus rhomboencephalitis, Listeria rhomboencephalitis, NMSOD Key findings and diagnostic tips Diagnostic Approach Final remarks

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## Abstract Archives of the RSNA, 2023

NREE-51

### Motor Neuron Diseases: Diagnostic Approach, Imaging Findings, and Mimics

#### Participants

Tatiana Iutaka, BDS, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This panel aims to: Study the diagnostic approach and clinical indications of imaging in motor neuron disease (MND); Review the MRI acquisition protocols, including advanced MRI techniques; Explain and demonstrate through illustrative cases different imaging patterns of MND; Discuss the main MND mimics and their imaging findings

#### TABLE OF CONTENTS/OUTLINE

Review of the definition and clinical syndrome of MND  
Review the clinical indications of imaging in MND  
Review the main imaging techniques used for the evaluation of MND  
Standard MRI acquisition protocol  
MRI signs that might support the diagnosis directly: T2WI, FLAIR, and magnetization transfer hyperintensities in the corticospinal tract (CST) in the brain or sometimes in the spinal cord  
Atrophy of the precentral gyrus  
The 'motor dark line' in T2WI and susceptibility sequences  
The bright tongue sign  
Illustrative cases of motor neuron diseases: Amyotrophic lateral sclerosis (ALS) Bulbar ALS Primary lateral sclerosis Mills syndrome  
Imaging findings of the main MND mimics, divided by clinical feature (e.g.: upper motor neuron (UMN) onset, purely UMN, bulbar onset): Ischemia (e.g., stroke) Mass (e.g., tumor, vascular malformation) Radiculopathies (cervical, lumbosacral) Demyelinating disease (e.g., multiple sclerosis) Advanced imaging and respective findings: DWI: Lower mean fractional anisotropy in the CST  
Volumetric or morphometric analyses of T1WI 3D MRI: Volume changes mainly in classical motor areas  
Proton (1H) magnetic resonance spectroscopy (MRS): NAA decline over time in the motor cortex  
Functional MRI: Altered cortical activity in patients with ALS  
PET and SPECT: Hypometabolism and hypoperfusion are most prominent in the motor cortex

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## Abstract Archives of the RSNA, 2023

NREE-52

### The Fascinating Limbic System: Anatomy, Pathology and Involvement Patterns

#### Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are:- Review and illustrate the imaging anatomy of the limbic system, correlating with the main imaging methods, emphasizing the potential of each in identifying the structures.- To describe the main imaging patterns of lesions involving the limbic system, including dementia and psychiatric disorders, inflammatory and infectious diseases, temporal lobe epilepsy, neoplasms, Wernicke's encephalopathy, ischemic events, among others, highlighting key points for approaching the diagnosis differential.- Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

#### TABLE OF CONTENTS/OUTLINE

- Anatomy of the limbic system, emphasizing the functional aspects.- Imaging patterns of diseases that affect the limbic system.- Differential diagnosis based on a pictorial review using representative cases from our institutional database: - Neoplasms - Infection and inflammation- Dementia and neuropsychiatric disorders- Ischemia and Infarction - Metabolic diseases - Developmental malformations- Diagnostic Algorithm- Final remarks

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-53

### Imaging the Sick Neonate: Neurosonogram in Hypoxic Ischemic Injury

#### TEACHING POINTS

1. Hypoxic-ischemic injury (HII) of the neonatal brain and resulting encephalopathy sequel remains a significant cause of morbidity and mortality in the neonatal population. 2. Ultrasound of skull (neurosonogram) is a powerful and effective screening tool in the evaluation of sick neonates with clinical hypoxia as it determines the pattern, timing, and extent of injury in HII and differentiates it from other conditions with similar clinical picture. 3. The pattern of injury on brain imaging has crucial implications in therapies and predicted neurodevelopmental outcomes. 4. Major role of neurosonogram is identifying the diagnosis, directing appropriate therapy, monitoring evolution of disease, predicting outcomes and detecting complications of therapy. 5. Addition of Doppler and shear wave elastography (SWE) in determining the difference in brain stiffness in neonates with birth asphyxia can increase the specificity of grey-scale ultrasound.

#### TABLE OF CONTENTS/OUTLINE

1. Normal neurosonogram appearance and technique in neonates. 2. Pathogenesis, grading and evolution of HII in term and preterm neonates with less profound and severe injury. 3. Patterns of HII in term and preterm neonates with illustration. 4. Role of ultrasound Doppler and SWE in evaluation of HII. 5. Ultrasound illustration of few clinical mimics of HII. 6. Uses and limitations of neurosonography.

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## Abstract Archives of the RSNA, 2023

NREE-54

### Errors in the Neuroradiological Emergency: An Escape Room Experience

#### Participants

Nathalia Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS The purposes of this exhibit are:- Discuss and illustrate clinical cases of the neuroradiological emergency in a quiz and gamification format, simulating an Escape Room experience.- Highlight the imaging points and red flags to make right diagnoses in the context of emergency. - Describe the most common possible errors in neuroradiological emergency, highlighting tips and challenges in the cases presented.

#### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS: - Neuroradiological emergency cases in an escape room dynamic:- The most emblematic cases in the context of neuroradiological emergency- Types of errors that can occur while the radiologist is analyzing a case- Series of cases that leads to escape and to finish the call and escape the room- Clinical cases - Quiz format- Ischemic stroke - Early and late signs of stroke- Main trials and treatment windows- Hemorrhagic lesions- Trauma - Fracture and anatomic pitfalls - Pseudofractures in a child skull - Hematic collections- Brain herniations- Headache- Arterial dissection- Metabolic disorders in the emergency- Most common intoxications- Key tips and challenges from the cases demonstrated- Escaping the room: conclusions and lessons learned

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-55

### Temporal Lobe Tumors: A Pattern-based Imaging Approach

#### Participants

Afonso Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the anatomy of the temporal lobe; 2. Group the main primary central nervous system (CNS) tumors that affect the temporal lobe according to imaging characteristics; 3. Synthesize the main imaging features of each tumor that help in the differential diagnosis on flashcards for quick reference; 4. Show some differential diagnoses that can be confused with temporal lobe tumors

#### TABLE OF CONTENTS/OUTLINE

Temporal lobe disorders are associated with several conditions, including seizures, dementia, and memory impairment, followed by a spectrum of behavioral disorders. It is noteworthy that about 10% of temporal lobe epilepsies are caused by focal temporal lesions. In this context, this work has as main objectives: In this sense, most primary CNS tumors can potentially occur in the temporal lobe, but entities with a predilection for being diagnosed in this location include: ganglioglioma (40%), DNET (20%), diffuse low-grade astrocytoma (20%) and others (20%). Some of these lesions may present specific imaging characteristics, which allow narrowing the differential diagnosis. Didactically, these lesions can be grouped based on imaging features into solid-cystic, bullous, or solid. Besides any primary CNS tumor can arise from temporal lobe, this location has specific clinical symptoms, and some tumors has a particular predilection for the temporal lobe. The radiologist has a special rule to recognize and narrow the differential diagnosis that will guide the treatment or follow up on each case.

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## Abstract Archives of the RSNA, 2023

NREE-56

### Embryonal Tumors - Correlations Between Imaging Findings and Molecular Subtypes

#### Participants

Larissa Freitas, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: • To present the essential embryonal malignancies of the Central Nervous System. • To review the WHO CNS5 classification, considering the new modifications in nomenclature and distribution of embryonal tumors. • To make a parallel between radiophenotypic imaging and genomic features. • To present the essential imaging features correlated to tumor's genetic pattern. • To highlight the importance of recognizing the imaging pattern of embryonal tumors to therapeutics and prognosis.

#### TABLE OF CONTENTS/OUTLINE

• Introduction - Essential embryonal malignancies of the Central Nervous System. - Review the WHO CNS5 classification making a parallel between radiophenotypic imaging and genomic features. • Medulloblastoma - Medulloblastoma WNT-activated - Medulloblastoma SHH-activated - Medulloblastoma, non-WNT / non-SHH - Group 3 - Group 4 - Other embryonal tumors - Atypical teratoid rhabdoid tumor - Embryonal tumor with multilayered rosettes - CNS Neuroblastoma, FOXR2-activated

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## Abstract Archives of the RSNA, 2023

NREE-57

### A Pocket Guide of the Main Side Effects, from Common to Rare, of Radiation Therapy in the Brain

#### Participants

Marta Calvo-Imirizaldu, MD, Pamplona, Spain (*Presenter*) Research Grant, Siemens AG

#### TEACHING POINTS

- To review the different techniques of brain radiation therapy available for primary or metastatic tumors, that radiologists need to know. Basic pathophysiology. Novel approaches and indications.- To recognize the main radiation-related findings on brain studies, from common to unexpected, and its differential diagnosis. Focus on radiation necrosis, radiation induced tumors, and mimics of vascular diseases (SMART syndrome, vasculitis, PRES).

#### TABLE OF CONTENTS/OUTLINE

1. Background and basics pathophysiology of radiation therapy.i. Clinical relevance statement ii. Basic pathophysiology iii. Risk factors. Benefits and risks iv. Radiation therapy techniques: conventional radiation therapy (external beam radiation therapy), stereotactic radiosurgery, proton therapy. v. Dosimetry2. MRI features and pictorial review of the main radiation-related findings on brain imaging, with differential diagnosis:- Common: a. Atrophy b. Leukoencephalopathy c. Microhemorrhages/cavernomas d. Hypoperfusion e. Mastoiditis- Less common: a. Pseudoprogression b. Radionecrosis c. Intratumoral bleeding d. Radiation-induced vasculitis- Rare: a. Radiation-induced tumors (most commonly meningioma) b. SMART syndrome: stroke-like migraine attack after radiation therapyc. PRES3. Reporting tips4. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-58

### Radiological Evaluation of the Spectrum of Pathologies Involving Medullary Veins in Neonates and Young Children

#### Participants

Esther Martin Ramirez, MD, MADRID, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the anatomy and the venous drainage pathways of the intracranial venous system, with emphasis on medullary veins. To review the main pathologies that can cause medullary veins injury in newborns and young children. To explain the pathophysiology of diseases associated with medullary veins injury and their characteristic radiological findings, especially based on magnetic resonance imaging (MRI). To review the guideline-recommended MRI technique for medullary veins evaluation.

#### TABLE OF CONTENTS/OUTLINE

There are two types of medullary veins: superficial veins (SMV) and deep veins (DMV). SMV drain the subcortical white matter centrifugally into pial veins, whereas DMV drain the deep white and grey matter centripetally into subependymal veins, with a characteristic distribution consisting of a radial pattern with four convergence zones in frontal horns and trigons, and a parallel pattern in bodies and inferior horns of lateral ventricles. The unique disposition of medullary veins allows us to detect their involvement in different pathologies through different imaging techniques, especially on MRI with susceptibility-weighted imaging sequences. The aim of this educational exhibit is to review the most frequent pathologies related to medullary veins seen in neonates and young children, including vascular anomalies, thrombosis, hemorrhage and infectious encephalitis, among others.

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## Abstract Archives of the RSNA, 2023

NREE-59

### Fungus on the Mind: There's Much Room for Improvement

#### Participants

Karthik Rajendran, MBChB, London, United Kingdom (*Presenter*) Nothing to Disclose

Girija Agarwal, MBBS, Harrow, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. An overview of the epidemiology, pathophysiology and clinical features of fungal CNS infections. 2. A structured review of the imaging features of various fungal CNS infections and their complications. 3. An approach to the differentiation of fungal CNS infections from other common infectious and non-infectious mimics, with a focus on clinico-radiologic correlation.

#### TABLE OF CONTENTS/OUTLINE

Fungal infections of the central nervous system (CNS) typically occur in immunocompromised patients and can be caused by yeasts (e.g. *Cryptococcus*), molds (e.g. *Aspergillus*), and dimorphic fungi (e.g. *Coccidioides*). The prognosis is influenced by the specific organism and patient factors but is frequently poor with mortality generally exceeding >50%. The imaging features, whilst often non-specific with a broad differential in a majority of cases, can also be distinctive and sometimes organism specific. Pathophysiological knowledge of varying fungal infections aids understanding the pathognomonic features to aid in narrowing the differential. Querying fungal etiology, even if the findings are less specific, at an early-stage aids directed laboratory testing and empirical treatment. Prolonged iatrogenic immunosuppression is on the rise, with increasing organ transplantation and cancer incidence. Old foes like HIV remain common. Radiologists are therefore increasingly likely to encounter fungal CNS infections sporadically and must be familiar with the imaging manifestations to aid early diagnosis and improve clinical outcomes.

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## Abstract Archives of the RSNA, 2023

NREE-6

### Neuroradiologic Complications of Immunotherapy in the Treatment of Cancer

#### Participants

John A. Arrington, MD, Tampa, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• As immune modulation in the treatment of cancer is becoming more common, its complications become more prevalent and the radiologist should be aware of these to aid rapid diagnosis and appropriate therapy. Unlike conventional chemotherapy which typically will cause immune suppression, immune modulation therapy generates an increase in systemic immune response and therefore a different spectrum of complications. This exhibit will explain the nomenclature, mechanism of action, and imaging features of more common complications of immunotherapy in the treatment of neoplasm.

#### TABLE OF CONTENTS/OUTLINE

• Mechanism of action of Immune Checkpoint Inhibitor (ICI) therapy • Mechanism of action of Chimeric Antigen Receptor T Cell (CAR-T) therapy • Recognizing ICI nomenclature (\*mab) is helpful to know to determine if a patient's therapeutic regimen includes ICI • Neuroimaging examples • Hypophysitis • Pseudoprogession • Myositis • Acute Idiopathic Demyelinating Polyneuropathy (AIDP). • Acute myelitis (CAR-T) • Thyoiditis • CAR-T related infarction

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## Abstract Archives of the RSNA, 2023

NREE-60

### Diffuse High-Grade Gliomas - New Concepts

#### Participants

Bruna Carvalho, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: • To present the current classification of central nervous system tumors and genetic biomarker roles. • To define pediatric-type and adult-type diffuse high-grade gliomas and their molecular pathways. • To present the essential imaging features correlated to the tumor's genetic pattern. • To correlate radiophenotypic imaging and genomic features with prognosis and determination of treatment approaches.

#### TABLE OF CONTENTS/OUTLINE

- Adult-type diffuse high-grade gliomas - Glioblastoma, IDH wildtype - Astrocytoma, IDH-mutant, grade 4 - Astrocytoma, IDHm, CDKN2A/B homozygous deletion, grade 4
- Pediatric-type diffuse high-grade gliomas - Diffuse midline glioma, H3 K27-altered - Diffuse hemispheric glioma, H3 G34-mutant

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## Abstract Archives of the RSNA, 2023

NREE-61

### **Anoxic Brain Injury Patterns. What Can't I miss? Reviewing Patterns and Differential Diagnosis of Anoxic Brain Injury in Newborns, Children and Adults**

#### **Participants**

Bernardo Pillar Quadros, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purposes of this exhibit are: - Review and illustrate the imaging findings of the main anoxic brain injuries patterns, classified according to age: newborns, children and adults. - Describe the main imaging patterns of the anoxic brain injuries, including brainstem lesion, thalamic lesion, periventricular leukomalacia, ventrolateral thalamic lesion, posterior putamen lesion, perirolandic cortex lesion, cortical laminar necrosis, delayed post-hypoxic leukoencephalopathy, HACE, diffuse edema, some intoxication hypoxia patterns and some differential diagnosis, highlighting key points to differential diagnosis approach. - Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

#### **TABLE OF CONTENTS/OUTLINE**

- Imaging patterns of main anoxic brain injuries in newborns, children and adults. - Preterm newborn patterns lesions - Term newborn patterns lesions - Children/ adults patterns lesions - Intoxication hypoxia patterns lesions - Differential diagnosis based on a pictorial review using representative cases from our institutional database - Hypoglycemia - Creutzfeldt-Jakob disease - Uremic Encephalopathy - Metabolic disorders - Diagnostic Algorithm- Final Remarks

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## Abstract Archives of the RSNA, 2023

NREE-62

### Cerebrovascular Reserve Imaging Evaluation: How Much of a Challenge Can it Be

#### TEACHING POINTS

Cerebrovascular reserve imaging with arterial spin labeling (ASL) and acetazolamide challenge is a non-invasive MRI-based technique that evaluates cerebrovascular reactivity. ASL measures cerebral blood flow by magnetically labeling arterial blood water protons, allowing for quantification of regional cerebral blood flow (CBF) without exogenous contrast agents. Acetazolamide (a vasodilator) challenge can be used to estimate cerebrovascular reserve (CVR). ASL with acetazolamide challenge is useful for assessing CVR in neurological conditions such as cerebrovascular disease and neurodegenerative disease.

#### TABLE OF CONTENTS/OUTLINE

I. Introduction II. Arterial Spin Labeling III. Acetazolamide Challenge IV. Cerebrovascular Reserve Imaging with ASL and Acetazolamide Challenge Protocol, applications and analysis. V. Clinical Utility in Various Neurological Disorders VI. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-63

### Brainstorming the Brainstem: A Pictorial Review of Challenging Diagnosis

#### Participants

Rafael Oliveira, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The goals of this paper are: - Brief anatomy review of the brainstem - Summarize uncommon diseases of the brainstem - Review imaging presentations of brainstem diseases - Differentiate common and uncommon patterns of known diseases affecting the brainstem

#### TABLE OF CONTENTS/OUTLINE

Powerpoint layout  
1 Midbrain: 1.1 Parkinson 1.2 Wernicke-Korsakoff Syndrome 1.3 Wilson's Disease  
2 Pons: 2.1 Chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroids (CLIPPERS) 2.2 Osmotic Myelinolysis 2.3 Autosomal recessive spastic ataxia of Charlevoix-Saguenay (ARSACS)  
3 Medulla: 3.1 Friedreich Ataxia 3.2 Neuromyelitis optica spectrum disorder (NMOSD) 3.3 Dural Arteriovenous Fistula 3.4 Adult Onset Alexander Disease (AOAD) 3.5 Leukoencephalopathy with brainstem and spinal cord involvement and lactate elevation (LBSL)  
4 Miscellany: 4.1 Neuro-Behçet 4.2 Enterovirus Rombencephalitis 4.3 Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) 4.4 Adrenoleukodystrophy

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## Abstract Archives of the RSNA, 2023

NREE-64

### **Glioneuronal and Neuronal Tumors: What Can Molecular Pathways Teach Us**

#### **Participants**

Giovanna Calfi, MD, Sao PAULO, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- List the essential information on various glioneuronal and neuronal tumors according to the 5th Edition of the WHO Classification of Tumors of the Central Nervous System. - Identify the main imaging features and molecular pathway involved in these brain tumors. - Highlight the importance of recognizing those patterns to help neuroradiologists narrow their diagnostic hypotheses, thus saving time and resources.

#### **TABLE OF CONTENTS/OUTLINE**

- Introduction: Brief review of the inclusion of glioneuronal and neuronal tumors in the 5th edition of the 2021 WHO Classification of Tumors of the Central Nervous System; Presentation of the main common characteristics of glioneuronal and neuronal tumors; Illustration of the MAPK pathway - The radiological, epidemiological and clinical characteristics correlated based on the most known genetic mutations of each tumor, namely: Dysembryoplastic neuroepithelial tumor (DNET); Multinodular and vacuolating neuronal tumor (MVNT); Central neurocytoma; Extraventricular neurocytoma; Ganglioglioma; Rosette-forming glioneuronal tumor; Dysplastic cerebellar gangliocytoma (Lhermitte-Duclos disease); Diffuse leptomeningeal glioneuronal tumor; Desmoplastic infantile astrocytoma; Papillary glioneuronal tumor; Gangliocytoma; Myxoid glioneuronal tumor

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## Abstract Archives of the RSNA, 2023

NREE-65

### Practical Guide to Fetal Craniospinal MRI: Essentials for General Neuroradiologists and Trainees

#### TEACHING POINTS

After review of this exhibit, the radiologist should: Be able to recognize the normal fetal anatomy of the craniospinal axis. Be familiar with common indications for fetal MRI and protocol for fetal Neuroimaging. Recognize and diagnose a broad range of pathologies that can be assessed with fetal MRI.

#### TABLE OF CONTENTS/OUTLINE

Fetal ultrasound is the primary diagnostic tool used for fetal imaging, but there are limitations to imaging the fetal brain, face and neck, and spinal canal. Fetal MRI is often performed to characterize ultrasound findings and provide better prognostic information for obstetric patients. Common indications for fetal craniospinal MRI include ventriculomegaly, midline anomalies, posterior fossa malformations, fetal intracranial mass, encephaloceles, cleft lip and palate, spinal malformations, and in utero disruptive events. With increased demand for these exams for pre- and post-natal health, more general neuroradiologists will be needed for interpretation. This comprehensive review has the potential to improve patient access to fetal craniospinal MRI by increasing general neuroradiologist's and trainee's comfort with interpretation of these exams. We will review imaging protocols, normal fetal anatomy, common indications, case examples, and postnatal MRI correlates. Case examples will include the Pierre Robin sequence, congenital epulis, Dandy Walker variants, open and closed dysraphism, intrauterine fetal demise with intracranial hemorrhage, oro-facial-digital syndrome, and multiple midline abnormalities including alobar holoprosencephaly with synophthalmia.

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## Abstract Archives of the RSNA, 2023

NREE-66

### The Hidden Face of Gliomas: Decoding the Pathophysiology and Infiltrative Patterns of Gliomas

#### Participants

Marta Calvo-Imirizaldu, MD, Pamplona, Spain (*Presenter*) Research Grant, Siemens AG

#### TEACHING POINTS

- To review the current knowledge of the pathophysiology of gliomas and the challenges of their study and management.- To outline different imaging presentations of gliomas and the role of MRI in the presurgical workup of these tumors. Pearls on imaging biomarkers available and potential diagnostic pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Background. Pathophysiological aspects of glioma  
2. Imaging protocol recommended for brain tumors  
3. Pictorial review of the main different infiltrative patterns of gliomas, from isolated hyperintense signal on T2-FLAIR to ring-enhancing necrotic gliomas:  
a. Non-contrast enhancing gliomas  
b. Gliomatosis pattern of gliomas  
c. Non-enhancing with contrast enhancing components gliomas  
d. Homogeneous enhancing gliomas  
e. "Ring enhancing" with necrosis gliomas  
f. Cystic gliomas  
g. Butterfly gliomas  
h. Multifocal gliomas  
With the following information applying for each: clinical issues and pearls on the updated 2021 World Health Organization classification, imaging biomarkers available and potential diagnostic pitfalls.  
4. Reporting tips  
5. Conclusion

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## Abstract Archives of the RSNA, 2023

NREE-67

### Myelination and Inborn Errors of Metabolism: Learning That Goes Hand in Hand

#### Participants

Lucas Souza, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are:- Review and illustrate the classic patterns of myelination, emphasizing the main findings for age delimitation, as well as signs of developmental delay.- To describe the main imaging patterns of Inborn Errors of Metabolism, including hypomyelination and demyelination, exemplifying cases of Pelizaeus disease, Alexander disease, Canavan disease, Krabbe disease, Metachromatic leukodystrophy, among others, highlighting key points for approaching the differential diagnosis.- Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

#### TABLE OF CONTENTS/OUTLINE

- Imaging patterns of white matter myelination, emphasizing the key findings.- Neuroimaging of Inborn Errors of Metabolism.- Differential diagnosis based on a pictorial review using representative cases from our institutional database:- Organelle-based approach- Imaging pattern approach: white matter predominance versus gray matter predominance; diffuse white matter involvement (vanishing white matter disease), involvement of the basal ganglia (PKAN, MELAS), periventricular predominance (metachromatic leukodystrophy and Krabbe disease), subcortical predominance (L2-hydroxyglutaric aciduria), among other patterns.- Diagnostic Algorithm- Final remarks

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## Abstract Archives of the RSNA, 2023

NREE-68

### Neurovascular Potpourri: Disentangling the Differentials

#### Participants

Eugene Shin, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Vascular pathology may be the primary reason for, or an incidental finding on contrast enhanced exams. The goal of this presentation is to provide a broad overview of the range of neurovascular findings one may encounter, from benign congenital variations to neoplasms.

#### TABLE OF CONTENTS/OUTLINE

Neurovascular topics covered include the following:1. Congenital/anatomic variants, including aortic arch and major branches, Circle of Willis and persistent carotid-vertebrobasilar anastomoses, arterial fenestration, and junctional dilatation of the basilar artery tip.2. Review International Society for the Study of Vascular Anomalies characterization of vascular anomalies, primarily discerning vascular malformations from tumors with case examples. Tips will be provided to help discern vascular lesions from similar appearing processes in the head and neck region.3. Examine other vascular disorders including moyamoya disease, fibromuscular dysplasia (including carotid intimal variant), reversible cerebral vasoconstriction syndrome, and amyloid angiopathy.

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## Abstract Archives of the RSNA, 2023

NREE-69

### 'To Bleed or Not to Bleed'- The DVA Conundrum

#### TEACHING POINTS

- Delineate the angioanatomy of developmental venous anomalies.
- Classify the various mechanisms that render DVAs symptomatic.
- The following are illustrated with sample cases: •"Flow related" pathomechanisms. •decreased outflow; collector vein thrombosis and DVA thrombosis.
- Increased inflow in the form of arterialisiation of DVA .
- DVAs associated with cavernomas
- DVAs with no overt neuroparenchymal signal changes but with resistant epilepsy with metabolic abnormality on PET.
- DVAs associated with grey matter abnormalities.
- DVAs in tandem with high grade gliomas.

#### TABLE OF CONTENTS/OUTLINE

- Angioanatomy of developmental venous anomalies
- Classification of the various pathomechanisms of symptomatic DVAs
- The following are illustrated with sample cases: •"Flow related" pathomechanisms (as would be illustrated in our case series) -decreased outflow; collector vein thrombosis and DVA thrombosis.
- Collector vein stenosis culminating in outflow restricted DVAs.
- Increased inflow in the form of arterialisiation of DVA .
- DVAs associated with cavernomas
- DVAs with no overt neuroparenchymal signal changes but with resistant epilepsy with metabolic abnormality on PET.
- DVAs associated with grey matter abnormalities.
- DVAs in tandem with high grade gliomas.
- Overview of the treatment strategies both endovascular and conservative in the management of these vascular lesions.

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## Abstract Archives of the RSNA, 2023

NREE-7

### Structural and Metabolic Biomarkers in Autism Spectrum Disorder

#### Participants

Robert Subtirelu, Ronkonkoma, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Evaluate the utility of structural and metabolic biomarkers in the assessment and diagnosis of patients with autism spectrum disorder (ASD) 2. Discuss possible directions for future studies to expand the application of positron emission tomography (PET) and magnetic resonance imaging (MRI) in ASD

#### TABLE OF CONTENTS/OUTLINE

1) INTRODUCTION 1.1) Methodology 1.2) Results of literature review 1.3) Summary of results 2) MRI IDENTIFIED VOLUMETRIC AND STRUCTURAL DIFFERENCES 2.1) Significance of differences in the context of ASD 2.2) Diagnostic applications 3) FDG PET/CT SHOWS DIFFUSE HYPOMETABOLISM 3.1) Hypometabolism and cognitive changes 3.2) Generalized decrease in metabolism of bilateral temporal lobes 4) ASD RESTING STATE fMRI DATA 4.1) Role of paracentral lobule in ASD symptoms 4.2) Underconnectivity and cognition 5) THE EFFECT OF AGE ON SURFACE BRAIN MEASURES IN AUTISM SPECTRUM DISORDER 5.1) Cortical thickness and cognition 5.2) Effect of surface area increase of right occipital gyrus on ASD symptoms

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## Abstract Archives of the RSNA, 2023

NREE-70

### Easy Come, Easy Go - Transient Brain Findings

#### Participants

Samya Alves, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Despite the notability of sequelae left by neurological diseases, many conditions may present as transient abnormalities. Toxic-metabolic encephalopathies comprise one of the groups which classically presents in such manner and is part of the radiologists' daily practice - most of them having a pattern of symmetrical restricted diffusion. Other entities, like some vasculopathies and genetic determined diseases - although instinctively associated with permanent brain damage - might also portray themselves as temporary imaging alterations. In these cases, the follow-up would be critical in determining the diagnosis as it is in differentiating a post-ictal change (typically reversible) from an autoimmune encephalitis (more enduring).- Present a didactic manner for sorting of transient findings and reversible conditions by pathophysiology.- Illustrate transient imaging features in a case-based review.

#### TABLE OF CONTENTS/OUTLINE

Suggestion for sorting of reversible imaging findings and conditions

- Toxic-metabolic: exogenous intoxications (medication, recreational drugs), endogenous intoxications , cytotoxic lesions of corpus callosum (CLOC)
- Vascular: PRESS, vasoconstriction syndromes, hemiplegic migraine, transient global amnesia, focal cerebral arteriopathy of childhood
- Genetic determined: phenylketonuria, urea cycle disorders, mitochondrial encephalopathy with lactic acidosis (MELAS).
- Neoplastic: some brain tumors may exhibit temporary post contrast enhancement or cystic changes without meaning tumor progression (e.g., pilocytic astrocytoma).
- Miscellaneous: stroke-like migraine attacks after radiation therapy, benign external hydrocephalus, torcular pseudomass

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## Abstract Archives of the RSNA, 2023

NREE-71

### Post-operative Spine Imaging: Evolution of Percutaneous and Surgical Devices

#### TEACHING POINTS

? Percutaneous devices, such as pedicle screws and vertebral augmentation, are often used in minimally invasive procedures and have lower complication rates. ? Post-operative imaging is essential to assess the success of spine surgery, detect complications, and guide further treatment. ? Radiologists should be familiar with the different surgical approaches and devices used in spinal surgery to accurately describe the post-operative imaging findings and identify any complications that may arise.

#### TABLE OF CONTENTS/OUTLINE

Arthrosis Degenerative changes in the lumbar spine are a common source of back pain and disability, affecting millions of people around the world. A great part is discogenic. Degenerative disc changes can take several forms, including disc herniation, spinal stenosis, and osteoarthritis, all of which can cause nerve compression and pain. Surgical approaches ? Anterior lumbar interbody fusion (ALIF) ? Lateral lumbar interbody fusion (LLIF) ? Transforaminal lumbar interbody fusion (TLIF) ? Posterior lumbar interbody fusion (PLIF) Common devices used for arthrodesis How do surgeons decide which approach option? Some challenging cases

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## Abstract Archives of the RSNA, 2023

NREE-72

### From A to V: Arterial and Venous Intracranial Anatomy, Variants and Malformations

#### Participants

Eduardo Valadares, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe the anatomy of arterial and venous intracranial systems  
Exhibit the normal appearance and common variations of the arterial and venous intracranial systems  
Summarize the most common and some rare congenital and acquired intracranial vascular malformations

#### TABLE OF CONTENTS/OUTLINE

Anatomy of Intracranial Arteries and Veins  
Normal CT and MRI Appearance  
Common Arterial Variations  
Fenestrations and Duplications  
Internal Carotid Arteries Variants  
Anterior Cerebral Artery Variants  
Middle Cerebral Artery Variants  
Posterior cerebral Artery Variants  
Persistent Carotid-Basilar Artery Anastomoses  
Common Venous Variations  
Hypoplastic Venous Sinus  
Absent Venous Sinus  
Arachnoid Granulations  
Pure Arterial Malformations  
Anterior Cerebral Artery Dolichoectasia  
Associated with Cortical Dysplasia  
CVM with Arteriovenous Shunting  
Arteriovenous Malformation  
Cerebral Proliferative Angiopathy  
Dural AV Fistula  
Carotid-Cavernous Fistula  
Vein of Galen Aneurysmal Malformation  
CVM without Arteriovenous Shunting  
Developmental Venous Anomaly  
Sinus Pericranii  
Cerebral Cavernous Malformation  
Capillary Telangiectasia  
Vascular Neurocutaneous Syndromes  
Sturge-Weber Syndrome  
PHACE Syndrome  
Wyburn-Mason Syndrome

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## Abstract Archives of the RSNA, 2023

NREE-73

### A Radiologist Guide to Evaluating White Matter Lesions in Pediatric Patients

#### Participants

Roberto Bastos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are:- Review and illustrate the classic imaging patterns of white matter lesions in pediatric patients, with a step-by-step approach.- To describe the main imaging patterns of white matter lesions, including hypomyelination and demyelination diseases, highlighting key points for approaching the differential diagnosis.- Determine an algorithm for the systematic evaluation of differential diagnosis, emphasizing the main clinical features and imaging red flags.

#### TABLE OF CONTENTS/OUTLINE

Imaging patterns of white matter lesions in pediatric patients  
Differential diagnosis of pediatric conditions that may course with white matter lesions, discussing the main recognizable image patterns:- Terminal myelination- Periventricular leukomalacia- Hypoxic ischemic encephalopathy- Posterior reversible encephalopathy syndrome (PRES)- Hypoglycemic encephalopathy- Adrenoleukodystrophy- Kearns Sayre syndrome- L-2-hydroxyglutaric aciduria- Methotrexate-related leukoencephalopathy- Focal cortical dysplasia- Multiple sclerosis- Acute disseminated encephalomyelitis (ADEM)- Vascular malformation- Ischemic stroke- Hemorrhagic stroke- Perivascular spaces- Other conditions including aggressive and non-aggressive neoplasms, infection of CNS, phakomatosis, autoimmune and neurodegenerative disorders  
Limitations and tips for the correct diagnosis  
Practical Diagnostic Algorithm  
Final remarks

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-74

### CNS Tumor on Drugs - Nuts and Bolts of Neuro-oncology Agents for the Radiologist in the Age of Personalized Medicine

#### TEACHING POINTS

To introduce both common and newly emerging targeted neuro-oncology agents, typical imaging response patterns, and the imaging manifestation of associated toxicities. To highlight targeted agents with actionable molecular markers in primary brain tumors and brain metastasis, focusing on their mechanism of action in oncogenesis. To recognize atypical imaging response patterns and describe the crucial role of radiologists in providing crucial input for the management of CNS neoplasms in the age of personalized medicine.

#### TABLE OF CONTENTS/OUTLINE

1. Introduce commonly used traditional chemotherapy agents as well as emerging targeted chemotherapy with their mechanism of actions• Traditional alkylating agents, including Wafer• Anti-metabolites• Targeted chemotherapy i. ALK ii. HER2 iii. EGFR iv. VEGF v. PD-1 vi. CTLA-4 vii. mTOR viii. BRAF ix. MEK x. HIF xi. CAR T-cell therapy xii. IDH inhibitor• Combination therapy• Experimental drugs2. Usual imaging findings of favorable treatment response and/or disease progression.3. Unique atypical response patterns of different neuro-oncology agents and their clinical implications in cancer management.4. Important chemotherapy-related adverse events and corresponding imaging presentation.5. Illustration of imaging manifestations of newly emerging therapies in the era of personalized medicine.

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## Abstract Archives of the RSNA, 2023

NREE-75

### A Rose by Any Other Name? Non-Alzheimer Neurodegenerative Conditions

#### Participants

Samya Alves, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Alzheimer Disease (AD) is the most common cause of dementia worldwide. However, recent studies continue to demonstrate an overlapping of clinical syndromes among neurodegenerative disorders other than DA, as well as have been presenting new biomarkers for differentiating them. As imaging and nuclear techniques advance, the role of the neuroradiologist becomes more essential to provide at least a narrowing of the differential diagnosis in order to offer the best treatment options as early as possible. - Review neurodegenerative conditions besides DA and their pathophysiology. - Mention newly recognized biomarkers, entities, and classifications. - Summarize imaging and nuclear medicine aspects for the differential diagnosis of the neurodegenerative diseases.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Neurodegenerative conditionso Clinical phenotypes and molecular subdivisionso Imaging and nuclear medicine featureso Differential diagnosis - Case-based review

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## Abstract Archives of the RSNA, 2023

NREE-76

### **ECASS Radiological Classification of Hemorrhagic Transformation of Infarcted Brain Tissue: Don't Miss the Blood**

#### **TEACHING POINTS**

Define the characteristics of hemorrhagic transformation of infarcted brain tissue, recognize the pitfalls and mimics of this entity and reproduce the new classification system: ECCAS II. Recall the different possible etiologies and clinical factors for developing this hemorrhagic complication.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction The hemorrhagic transformation of the infarcted brain tissue is a frequent complication of acute stroke, because of the extravasation of blood across a disrupted blood brain barrier. There are many risk factors and contributors for this disruption. By the ECASS classification system, the types of hemorrhage can be divided in two: hemorrhagic infarction (HI) and parenchymal hematoma (PH). The recognition and classification of this entity is important because the PH2 is found to be a significant predictor of neurological deterioration with higher mortality rates. Teaching points Illustrate the characteristics of an intracranial hemorrhage, specifically the hemorrhagic transformation of infarcted brain tissue. Employ the ECASS classification for hemorrhagic transformation of infarcted brain tissue. Recognize the patterns and learn how to report the different types of hemorrhagic transformation. Distinguish the pitfalls that can mimic a hemorrhagic transformation of infarcted brain tissue. Describe the possible etiologies and clinical factors for developing an intracranial hemorrhagic transformation of infarcted brain tissue.

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## Abstract Archives of the RSNA, 2023

NREE-77

### Vein of Galen Aneurysmal Malformations: A Resident's Approach

#### Participants

Sameer Chandra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- What is a Vein of Galen aneurysmal malformations (VGAM), and how does it appear in a CT and MRI scan. - Highlight the differences between Mural and choroidal Vein of Galen aneurysmal malformations (VGAM). - Exemplify the natural evolution of VGAMs, when treated vs left untreated.

#### TABLE OF CONTENTS/OUTLINE

Vein of Galen aneurysmal malformations (VGAM) are characterized by an embryonic choroidal arteriovenous malformation supplied by the choroidal arteries (ACA, AChoA, PChoA). The venous drainage in VGAMs is towards the median prosencephalic vein. VGAMs are formed between 6th and 11th weeks of embryological development, and corresponds to 30-50% of all vascular malformations in infants. VGAMs can be subdivided into two types Choroidal and Mural. Choroidal VGAMs are characterized by multiple feeders including thalamoperforating, choroidal and pericallosal arteries are located in the subarachnoid space in the choroidal fissure. Choroidal VGAMs converge on a fistula at the anterior aspect of the median prosencephalic vein (MPV); Tend to present earlier (neonates) with more severe shunts. Choroidal VGAMs result in high output cardiac failure because of multiple high flow fistulas with less outflow restriction. Mural VGAMs are characterized by fistulae in the subarachnoid space in the wall of the median prosencephalic vein; supply may be unilateral or bilateral. They are associated with absence or stenosis of Dural sinuses and stenosis at the level of the jugular foramen. Present later (infants) and with hydrocephalus. Mural VGAMs presents with fewer fistulas with high outflow restriction.

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## Abstract Archives of the RSNA, 2023

NREE-78

### Review of a HIV-associated Pathology in the Central Nervous System (CNS) Head and Neck

#### Participants

Ahmed Abdelhalim, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review clinical presentation and imaging manifestations of HIV-associated CNS and head neck pathology, including infectious, inflammatory and neoplastic etiologies  
2. To discuss differential diagnoses and management considerations  
3. To present select cases from our institution that highlight these imaging features

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Infectious etiologies: presentation, imaging features, differential diagnosis  
a. Virali. HIV encephalopathy  
ii. Progressive multifocal leukoencephalopathy  
iii. Cytomegalovirus  
iv. AIDS encephalopathy and atrophy  
b. Fungali. Cryptococcus  
c. Bacteriali. Tuberculosis  
ii. Neurosyphilis  
d. Parasitici. Toxoplasmosis  
3. Immune reconstitution inflammatory syndrome (IRIS)  
4. CNS Lymphoma  
5. Select head and neck case review: HIV myelopathy, Kaposi sarcoma, lymphadenopathy, lymphoepithelial parotid cysts

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## Abstract Archives of the RSNA, 2023

NREE-79

### Anatomy and Congenital Variations of the Sella Turcica, Suprasellar Cistern and Hypothalamus

#### Participants

Alex Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the normal embryology and anatomy of the pituitary gland, the suprasellar cistern and the hypothalamus. Summarize the imaging characteristics of the sellar region on CT and MRI. Provide tools to identify anomalies in the sellar region; discuss differential diagnosis and common pitfalls.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Anatomy and embryology review- sella turcica and hypophysis- parasellar region, suprasellar region and hypothalamus  
3. Clinical-radiological correlation of congenital sellar variations  
4. Case-based review of congenital variations and pathology: - osseous - intrasellar - suprasellar - justasellar  
5. Take-home points

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## Abstract Archives of the RSNA, 2023

NREE-8

### Beyond Myelopathy: Imaging Findings Associated with Under-recognized Neurologic Manifestations of HTLV-1

#### Participants

Jedrzey Krawczyk, MD, London, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Human T-cell lymphotropic virus type-1 (HTLV-1) was first described in the early 1980s. Presently, where testing occurs, HTLV-1 has a prevalence of approximately 10 million (which is likely an underestimate) and is endemic in areas such as southwestern Japan and South America. Whilst in most, the infection is asymptomatic, the infection is lifelong, and there are several, likely under-recognized and potentially devastating neurological complications. The best described is HTLV-1-associated myelopathy (HAM), which typically presents with chronic progressive spastic paraparesis and bladder disturbance, but there are rarer conditions, such as acute myelopathy, encephalopathy, and inflammatory myositis. Raising awareness of these less common presentations is crucial to facilitate prompt diagnosis and treatment, especially as prompt medical intervention may limit and even potentially reverse damage. Here we describe the range of neurological and neuromuscular presentations of HTLV-1, focusing on their imaging findings illustrated by a selection of cases from our tertiary care center.

#### TABLE OF CONTENTS/OUTLINE

1) To briefly outline clinical and imaging manifestations of HTLV-1-associated myelopathy. 2) To provide an illustrative review of rarer presentations of HTLV-1-related neurological disorders. 3) To describe the differential diagnoses and their main discriminating imaging features.

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## Abstract Archives of the RSNA, 2023

NREE-80

### Detangling the Knots of Pediatric Neurometabolic Disorders, One at a Time

#### TEACHING POINTS

- Discuss the pathophysiology of neurometabolic disorders in the pediatric age group.
- Review the imaging findings of common and rare neurometabolic conditions.
- Review the overlap in imaging manifestations and discern subtleties in differentiating various neurometabolic conditions.
- Recognise neurometabolic disorders amenable to treatment with emphasis on current and developing treatment options

#### TABLE OF CONTENTS/OUTLINE

- Introduction to the pathophysiology with glimpses of the pattern of CNS involvement in pediatric neurometabolic disorders.
- Extensive in depth review of the imaging of various subtypes including : 1.Disorders of aminoacid metabolism 2.Organic acidemias 3.Peroxisomal disorders 4.Lysosomal storage disorders 5.Neurodegenerative diseases of childhood 6.Channelopathies
- Imaging overview along with clinical correlation.
- Emphasis on treatment amenable cases.

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## Abstract Archives of the RSNA, 2023

NREE-81

### Beware of the Railway Crossing, Neuralgia Awaits You. A Resident's Guide to Neurovascular Conflict

#### Participants

Andres Haro Laverde, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Not all vascular conflicts may lead to a clinical condition; therefore, the topographical finding must correlate with the symptoms.
2. Peripheral nerves have critical segments, where they run without a myelin sheath; this is called the transition zone.
3. The correct imaging protocol can lead to the diagnosis; nevertheless, the best pulse sequences are prone to artifacts, and it is important to identify them.
4. Infectious, neoplastic, or inflammatory causes may overlap; therefore, be aware of differentials.

#### TABLE OF CONTENTS/OUTLINE

1. Anatomical review of the cranial nerves with a hub in the most common trapped roots
2. Physiopathology of vascular palsy and the common clinical findings.
3. Types of cranial nerve vascular conflicts and pitfalls.

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## Abstract Archives of the RSNA, 2023

NREE-82

### A Comprehensive Guide of Neurovascular Imaging: Discovering Pearls and Overcoming Pitfalls

#### Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibition is to:

- Thoroughly review the technical aspects of neurovascular imaging (arterial and venous angiotomography and magnetic resonance angiography) and vessel wall imaging.
- Illustrate the role of these imaging methods, overall CT and MRI, highlighting advantages and disadvantages of each modality.
- Unify the most important methods in a single article/presentation.
- Summarize the pearls of these methods for diagnosis purpose and how to overcome the main pitfalls.

#### TABLE OF CONTENTS/OUTLINE

- **INTRODUCTION**o Importance of neurovascular imaging through the time and where we stand today
- **IMAGING TECHNIQUE**o Neurovascular imaging techniques, including:§ Protocol: when to choose each method§ Sequences: which sequences are preferred for each modality§ Imaging acquisition: the physical aspects and time of acquisition.
- **INTERACTIVE CASE-BASED DIDACTIC**o Sample cases to illustrate and consolidate the main pearls and pitfalls of neurovascular imaging, separated by imaging method and type of errors
- **FUTURE DIRECTIONS AND TAKE HOME MESSAGES**o Where do we need improvement?o What is on the horizon for neurovascular imaging?

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## Abstract Archives of the RSNA, 2023

NREE-83

### INTRA-ARTERIAL CHEMOTHERAPY FOR RETINOBLASTOMA: ANATOMICAL HEMODYNAMIC CHALLENGES

#### Participants

Matteo Zanoni, Siena, Italy (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- In the hope of salvaging eyes with retinoblastoma (RB) from enucleation, intra-arterial chemotherapy (IAC) has been proposed in 2008.- The main goal of IAC is to deliver a high dose of drugs directly to the tumor while avoiding the side effects and risks of systemic chemotherapy.- In the ideal scenario, an adequate blush is visualized from the internal carotid artery, ophthalmic artery origin is favorable for catheterization and no prominent cutaneous branches from the ophthalmic artery are seen.- IAC is not always as straightforward as expected and some challenges may be seen.- The first scenario is a difficult and unstable catheterization of the OA, in spite of its visualization by selective angiography, usually due to a too angulated origin of the OA.- The second scenario occurs when OA is not visible from ICA injection or the blush is not visible and contrast medium flows back into the ICA when catheterization of the OA is properly achieved. One anastomosis with the external carotid artery could be in place providing alternative pathways for the orbital supply and drug administration.- Distribution volume of the drug, which correlates to effectiveness of the IAC, could increase because of cutaneous branches originating from OA, thus increasing local side effects.

#### TABLE OF CONTENTS/OUTLINE

- Intra-arterial chemotherapy for retinoblastoma- IAC technique and ideal scenario- Anatomical challenges and solutions- Hemodynamic challenges and solutions- Distribution volume understanding

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## Abstract Archives of the RSNA, 2023

NREE-84

### **Pictorial Review of the Applications of Dynamic Susceptibility Contrast (DSC) MRI Perfusion in the Characterization of Meningiomas**

#### **Participants**

Theodore Wang, South Pasadena, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Background review on the key characteristics of meningiomas and basics of dynamic susceptibility contrast (DSC) MRI perfusion. 2. Literature and pictorial review of the applications of DSC perfusion in the evaluation of meningioma characteristics, including grade, histologic subtypes, consistency, and vascularity. 3. Future applications of DSC in the evaluation of meningiomas.

#### **TABLE OF CONTENTS/OUTLINE**

1. Background on meningiomas and DSC MRI perfusion: (a) Brief background on meningiomas, including differences in grade, histologic subtype, consistency, and vascularity. (b) Background on the clinical importance of these different characteristics and current imaging evaluation. (c) Review of the current literature on the application of DSC for meningioma evaluation. 2. Applications of DSC perfusion in meningioma evaluation: (a) Pictorial review of applications of DSC perfusion in meningioma evaluation. (i) Review the differences in perfusion between histologic subtypes of meningiomas, including the correlation of higher perfusion values with higher grade tumors and surrounding brain parenchyma. (ii) Discuss the role of DSC in predicting vascularity and consistency of meningiomas. 3. Discussion of future directions of DSC for meningioma evaluation.

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## Abstract Archives of the RSNA, 2023

NREE-85

### Neuroinfectious Disorders in the Emergency: From Usual to Bizarre

#### TEACHING POINTS

To depict the pattern of CNS infections in different compartments of the brain. To illustrate characteristic imaging findings attributable to specific pathogens. To be familiar with atypical infectious etiologies in the neuroparenchyma.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to CNS infections  
2. CT and MRI imaging protocol of CNS infections: Impact of delayed CT images and Post Gadolinium FLAIR sequences.  
3. Infectious involvement of different compartments of brain.  
4. Meningitis: Bacterial, Cryptococcal, Viral, Rickettsial, Scrub typhus  
5. Brain Parenchymal involvement in CNS infections  
Restricted to white matter  
Both grey and white matter involvement  
Involvement of basal ganglia/thalami or brainstem  
6. Infectious Mass lesions  
Fungal abscess  
Pyogenic abscess  
Tuberculoma  
Parasitic infections  
Fungal granulomatous lesions.  
7. Atypical neuroparenchymal infections  
Neurocysticercosis  
Leptospirosis  
Scrub typhus  
Nocardiosis

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## Abstract Archives of the RSNA, 2023

NREE-86

### Arteriovenous Malformations: Practical Application of Spetzler Martin Classification

#### TEACHING POINTS

Brain arteriovenous malformations are a type of intracranial high flow vascular malformation composed of enlarged feeding arteries, a nidus of vessels closely associated with the brain parenchyma through which arteriovenous shunting occurs, and draining veins. These malformations are characterized by a nidus forming the transition between the feeding artery and draining vein. If this transition is made directly, then it is considered an arteriovenous fistula, which is a separate type of cerebral vascular anomaly.

#### TABLE OF CONTENTS/OUTLINE

DefinitionClinical findingsLocationIncidenceAssociated anomaliesClassificationCases

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## Abstract Archives of the RSNA, 2023

NREE-87

### Advances in NOWinBRAIN 3D Neuroimage Large Repository: Cortical and Cranial Openings and Neurologic Disorders

#### TEACHING POINTS

The exhibit: 1) Demonstrates a novel image display and exploration method using sequences of cortical and cranial openings; 2) Enables skull-brain correlation via cranial openings exposing the underlying parcellated and labeled brain (divided into lobes, gyri, and sulci) and intracranial arteries and venous system; 3) Facilitates brain-intracranial arteries correlation by opening 64 gyri and 6 lobules exposing the white matter and the arteries usually hidden deep in the sulci; 4) Provides a correspondence between brain damage (lesion) and the resulting disorder for vascular, cranial nerve and regional anatomy-related synthesized lesions, each lesion labeled with a disorder, signs, symptoms, and/or syndromes; 5) Presents a wide spectrum of over 8,600 3D neuroimages systematically organized, named and grouped into over 630 folders; 6) Is a valuable resource for medical students and residents as well as educators to prepare presentations.

#### TABLE OF CONTENTS/OUTLINE

The NOWinBRAIN repository contains 12 galleries (G1-G12) with 3D neuroimages derived from 3D brain atlases constructed from multiple 3/7 T MR and CT scans of a living brain. Galleries G1-G6 with 5000+ images were earlier presented at RSNA. For RSNA 2023 this repository is extended, enhanced, and two new galleries are created with cortical and cranial openings (G8) and 3D simulated neurologic disorders with outcomes (G11). The NOWinBRAIN repository is web-based and publically available at [www.nowinbrain.org](http://www.nowinbrain.org)

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## Abstract Archives of the RSNA, 2023

NREE-88

### Brain Bubbles: Updates on Intracranial Cystic Lesions

#### Participants

Azza Reda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To describe the intra- and extra-axial cystic lesions based on the anatomical location.
- To highlight the recently described and updated cystic lesions.
- To provide an algorithmic approach describing incidental lesions elucidating the differential diagnosis with an aim to recognize do not touch lesions, aid in appropriate management, and prevent inadvertent surgical intervention.

#### TABLE OF CONTENTS/OUTLINE

Updated approach to diagnose neoplastic and neoplastic intracranial cystic lesions A. Intra-axial: supra and infratentorial parenchymal lesions. B. Extra-axial: supra and infratentorial; and each divided, into midline, off midline, and intraventricular lesions. Intra-axial cystic lesions • Non neoplastic lesions: Enlarged perivascular spaces (Glymphatic system and tumefactive type), Neuroglial cyst, porencephalic cyst, and ependymal cyst. • Infectious cysts: Cryptococcosis, Neurocysticercosis, and abscess. • Neoplastic lesions: MVNT and MVNT plus, DNET, ganglioglioma, metastasis, glioblastoma and oligodendroglioma, pilocytic astrocytoma, haemangioblastoma, medulloblastoma, pleomorphic xanthoastrocytoma, and rarely ependymoma. Extra-axial cystic lesions • Non neoplastic lesions: Pineal cyst, Rathke's cleft cyst, normal, arachnoid cyst, dermoid, epidermoid cyst, choroid plexus cyst and fissure, colloid cyst, Neurocysticercosis and neuroenteric cyst. • Neoplastic lesions: craniopharyngioma, schwannoma, ependymoma and pituitary apoplexy. Significant emphasis would be on the atypical cystic brain metastatic lesions and don't touch lesions.

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## Abstract Archives of the RSNA, 2023

NREE-89

### MR Case-based Review of Cavernous Sinus Lesions

#### Participants

Eva Romo, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To review the anatomy of the cavernous sinuses and normal appearance on MR  
To make a case-based illustration of the MR imaging features on the main cavernous sinus lesions

#### TABLE OF CONTENTS/OUTLINE

Anatomy of the cavernous sinus  
MR protocol for suspected cavernous sinus pathology  
Case-based MR imaging findings of main cavernous sinus lesions  
Neoplastic  
Case 1: Pituitary adenoma  
Case 2: Meningioma  
Case 3: Giant hemangioma  
Case 4: Lymphoma  
Case 5: Chordoma  
Case 6: Metastatic lesion of skin carcinoma  
Inflammatory  
Case 7: Tolosa-Hunt syndrome  
Vascular  
Case 8: Cavernous ICAs aneurysms  
Case 9: ICA occlusion

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## Abstract Archives of the RSNA, 2023

NREE-9

### Caught in the Web: Imaging Techniques in Identifying Ischemic Stroke Due to Carotid Web

#### Participants

Ana Luiza Basilio Franca, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The carotid web is a rare vascular anomaly that can lead to ischemic stroke. Its diagnosis and management can be challenging due to its limited pathophysiology and presentation understanding. However, advanced diagnostic imaging techniques have greatly enhanced the identification and management of the carotid web. This educational exhibit highlights the importance of early detection, accurate diagnosis, and interdisciplinary approach to carotid web management: To illustrate carotid web radiologic highlights. To explain the complications involved with the finding. To explain the imaging assessment.

#### TABLE OF CONTENTS/OUTLINE

1. Definition of carotid web and revision of epidemiology, clinical presentation, and etiology, including prevalence and incidence of the carotid web, common clinical presentations, and etiological factors contributing to carotid web. 2. CT angiography highlights. 3. Underlying factors contributing to carotid web development, including early detection and management importance. 4. Differential diagnosis of carotid web and the importance of accurate diagnosis for appropriate management. 5. Potential complications associated with carotid web and the importance of identifying and managing complications promptly. 6. Clinical perspective: current management strategies for carotid web and the importance of an interdisciplinary approach to the patient. 7. Take-home messages.

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## Abstract Archives of the RSNA, 2023

NREE-90

### Big Vents: Causes of Hydrocephalus

#### TEACHING POINTS

Classification and terminology of hydrocephalus continue to be sources of confusion and debate in the literature. This exhibit provides an overview of the ventricular system and hydrocephalus classification scheme, covering typical pathologies and their imaging findings to enable the reader to approach hydrocephalus confidently. Normal ventricular anatomy consists of four interconnected choroid plexus-lined cavities and two canals. Anatomic variants can mimic hydrocephalus. Hydrocephalus is a disorder of flow, formation, or resorption of cerebrospinal fluid (CSF). Hydrocephalus classification is based on obstruction site and includes high pressure, normal pressure (NPH), and low-pressure subtypes. Intraventricular obstructive hydrocephalus (IVOH) inhibits CSF outflow due to obstruction at or before the 4th ventricle. Extraventricular obstructive hydrocephalus (EVOH) is due to obstruction anywhere from the 4th ventricular outlet foramina to the arachnoid granulations. Overproduction hydrocephalus is frequently caused by choroid plexus papilloma. NPH is diagnosed via a combination of history, neurological examination, and specific imaging findings. Syndrome of Inappropriately Low-Pressure Acute Hydrocephalus (SILPAH) is a rare and unrecognized condition with imaging findings mirroring severe obstructive hydrocephalus.

#### TABLE OF CONTENTS/OUTLINE

Ventricular Anatomy CSF Production and Circulation Models Normal Variants Hydrocephalus Classification High Pressure subtypes IVOH EVOH Overproduction NPH SILPAH Summary

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## Abstract Archives of the RSNA, 2023

NREE-91

### CNS Imaging Correlates of an FDA Cleared Diagnostic Meningitis/Encephalitis Panel

#### Participants

Norbert Campeau, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Diagnosis of CNS infections from cerebrospinal fluid collected by lumbar puncture is increasingly performed using comprehensive diagnostic panels. 2. This exhibit serves as a useful imaging reference atlas for the 14 microbial entities of meningitis/encephalitis included on an FDA cleared diagnostic panel which includes 6 bacteria, 7 viruses, and 1 yeast. 3. Knowledge of the imaging findings for these entities is clinically useful to monitor the extent of CSF involvement in known positive cases, or to suggest CSF testing in suspected cases undergoing CNS imaging. 4. The relative merits of CT, MRI and cranial ultrasound imaging modalities and contrast use will be discussed.

#### TABLE OF CONTENTS/OUTLINE

A. The 14 microbial entities included on the diagnostic panel are: - 6 bacteria (*Haemophilus Influenza*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, *Escherichia coli* K1, *Streptococcus agalactiae*, *Listeria monocytogenes*) - 7 viruses (*Enterovirus*, *Cytomegalovirus*, *Herpes Simplex 1*, *Herpes Simplex 2*, *Human Herpesvirus 6*, *Human parechovirus*, and *Varicella zoster*) - 1 yeast (*Cryptococcus neoformans/C. gattii*) B. The CNS imaging findings for each of the above microbial entities will be presented, including a brief synopsis of the epidemiology and clinical presentation. C. Summary Table of Imaging Findings.

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## Abstract Archives of the RSNA, 2023

NREE-92

### Portable Ultralow Field(0.064 Tesla)MRI for Neuroimaging

#### Participants

Saurabh Jindal, MD, MBBS, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Bedside magnetic resonance imaging (MRI) performed by an MRI or non-MRI-trained technologist in the presence of clinical staff/family. 2. Clinical utility in neurointensive care units and unstable patients who cannot be transferred to the MRI suite. 3. Standard sequences to diagnose common neurological emergencies, such as stroke, hypoxic-ischemic injury, and empyema. 4. Infarct or Artifact?: When in doubt on the low signal-to-noise ratio (SNR) diffusion-weighted images (DWI), evidence of edema on T2W/FLAIR images can aid in the diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to portable MRI scanner 2. Clinical cases 3. Teaching points 4. References 5. Acknowledgments

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## Abstract Archives of the RSNA, 2023

NREE-93

### **Radiologist's Guide to Image-guided Spinal Steroid Injections: Anatomy, Procedural Technique, and Potential Pitfalls**

#### **Participants**

Jeffrey Ling, MD, Joint Base Lewis-McChord, WA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review pertinent spinal anatomy with emphasis on key radiographic landmarks for epidural needle access. Discuss the utility and indications for spinal steroid injections in the setting of neck or back pain. Provide a brief overview of image guided approaches that can be utilized for spinal steroid injections. Understand potential procedural pitfalls and complications.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction Epidemiology of painful spine conditions and associated imaging findings. Relevant anatomy of the lumbar and cervical spine. Indications and contraindications of image-guided steroid injections. Choice of corticosteroid and/or local anesthetics. Potential procedural risks and complications. Procedure approach and technique Preprocedural planning: evaluate degenerative disease at the target level, assess epidural target and adjacent structures, anticipate distance to target and optimal needle length; CT versus fluoroscopy technique. Interlaminar epidural steroid injections. Transforaminal epidural steroid injections: supraneural approach, infraneural approach. Complications Common: temporary local discomfort during needle placement; inadvertent dural puncture (CSF leak). Rare, serious: contrast reaction; hemorrhage, epidural hematoma; spinal cord infarct (intravascular injection). Discussion Evaluation of post-procedural improvement in pain. CT versus fluoroscopy. Review of tips and tricks for technical procedural success. Alternative options for pain relief.

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## Abstract Archives of the RSNA, 2023

NREE-94

### The Big Picture: A Radiologist's Guide to Unlocking the Intricacies of Pediatric Neurometabolic Diseases

#### TEACHING POINTS

1. Brain MRI is the primary imaging modality for assessing neurometabolic disease in children. 2. MR spectroscopy should be considered as a supplemental imaging tool when neurometabolic disease is suspected. 3. Symmetric signal abnormalities involving white matter, basal ganglia, thalami, brainstem, and cerebellum can be major clues on imaging for neurometabolic disease. 4. Narrowing down the differential diagnosis requires further assessment of anatomic distribution, temporal progression, and additional imaging findings such as cysts and calcifications. 5. Age at presentation, particularly neonatal onset, is an important factor to consider when diagnosing devastating metabolic diseases in newborns.

#### TABLE OF CONTENTS/OUTLINE

Introduction Brief overview of the importance of radiological assessment in pediatric neurometabolic disease  
Imaging Modalities for Neurometabolic Disease Highlighting brain MRI as the primary imaging modality  
Discussing the added value of MR spectroscopy  
Clues on Imaging for Neurometabolic Disease Describing specific patterns and findings on imaging, such as symmetric signal abnormalities involving white matter, basal ganglia, thalami, brainstem, and cerebellum  
Emphasizing the importance of pattern recognition in identifying potential neurometabolic disease  
Narrowing Down the Differential Diagnosis Discussing the role of further assessment, including anatomic distribution, temporal progression, and additional imaging findings such as cysts and calcifications  
Highlighting the significance of age at presentation, particularly neonatal onset  
Conclusion Summarizing the key take-home messages for radiologists in imaging pediatric neurometabolic disease

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## Abstract Archives of the RSNA, 2023

NREE-95

### Multimodality Imaging of Cerebral Vasospasm

#### Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To highlight key concepts such as symptomatic vasospasm, radiographic vasospasm and delayed cerebral ischemia, that will help the reader understand cerebral vasospasm and its consequences. 2. To describe different diagnostic methods for detection of cerebral vasospasm, each with their advantages and disadvantages, providing illustrative examples. 3. To propose a practical diagnostic-therapeutic approach of severe SAH and vasospasm.

#### TABLE OF CONTENTS/OUTLINE

1. Cerebral vasospasm: key concepts 1.1. Definitions: SAH, radiographic vasospasm, symptomatic vasospasm, delayed cerebral ischemia (DCI). 1.2. Etiology: SAH. Risk factors, diagnostic protocol, prognosis. 2. Diagnosis of cerebral vasospasm 2.1. Clinical signs and symptoms and other monitoring tools. 2.2. Transcranial Doppler ultrasound. 2.3. CT (NECT, CT perfusion, CTA) 2.4. DSA 2.5. Diagnostic management - proposed algorithm 3. Treatment: the fight against DCI 3.1. Medical treatment. 3.2. Angiographic/Interventional treatment and its complications. 4. Take home points

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-96

### A Trip Through Gyriform Enhancement

#### Participants

Adria Roset Altadill, MD, Girona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Gyriform enhancement is mainly secondary to vascular and infectious causes. - Gyriform enhancement should be discerned at imaging from leptomeningeal enhancement.- Distinction between the different etiologies of gyriform enhancement has to be made based on clinical history, brain distribution and ancillary radiologic findings.

#### TABLE OF CONTENTS/OUTLINE

Gyriform enhancement, also called gyral or cortical enhancement, is an uncommon brain pattern that refers to contrast deposition on the superficial grey matter of the cerebral cortex. The main causes of this enhancement pattern are vascular and infectious. Vascular causes can be related to arterial or venous infarctions, seizures, migraine syndromes, posterior reversible encephalopathy syndrome (PRES) and subarachnoid hemorrhage. Infectious processes include mainly herpes encephalitis, cerebritis and meningitis. Finally, gyral enhancement may also rarely occur in neoplastic diseases or cases of neurotoxicity. Cortical enhancement can be detected by contrast-enhanced head CT or brain MRI, although the latter is much more sensitive due to its higher contrast resolution. It is important to differentiate cortical enhancement from leptomeningeal enhancement, which can demonstrate a similar "serpentine" morphology but affects the subarachnoid space and the pia matter instead. In order to narrow the differential diagnosis between the spectrum of causes of cortical enhancement, a focus should be placed on clinical history, distribution of the gyral enhancement and ancillary radiologic findings.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-97

### Cerebrovascular Disease in Young Adults: A Case-Based Review

#### Participants

Huijuan Wang, MD, Pontiac, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Cerebrovascular disease (CVD) can result from blood vessel narrowing, rupture, or a hypercoagulable state, which may present on imaging as vascular stenosis, hemorrhage, or occlusion, respectively. As an emerging public health issue with debilitating effects on young adults, recognizing the similarities and differences between young adults and elderly patients for the etiologies and prevalence of various types of CVD is imperative for optimal patient outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Review the common etiologies and prevalence of cerebrovascular disease (CVD) in young adults and how this compares to elderly patients.
2. Categorize the differential diagnosis based on the general imaging appearance of vascular stenosis, hemorrhage, and occlusion in conjunction with the location of the abnormality.
3. Practice the diagnostic approach previously reviewed with multiple vignette-style young adult CVD cases with questions accompanying each case focused on differential diagnosis, prognosis, and management.
4. Discuss clinical presentation, key imaging findings, differential diagnosis, and management of each presented case.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-98

### Imaging of Deep Brain Stimulation Systems

#### Participants

Alexandre Boutet, MD,MSc, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Deep brain stimulation (DBS) surgery, which is the most common functional neurosurgery treatment, is increasingly being performed worldwide. (2) Its therapeutic effect hinges upon accurate and precise targeting of the intended brain structure—maximizing therapeutic benefits while minimizing spillover onto neighbouring structures that may produce adverse effects. (3) Knowledge of the anatomical relationships of the most common targets including the subthalamic nucleus and pallidum is essential for accurate reporting. (4) Postoperative imaging of DBS patients is subject to strict MRI safety guidelines to prevent heating at the electrode tips, which is the main risk. Knowledge of the factors influencing safety such as specific absorption rate (SAR) is crucial to provide these patients with optimal MRI when it is required. (5) Interpretation of DBS postoperative imaging requires knowledge of the expected appearances and the complications. (6) Functional neurosurgery is a rapidly evolving field with considerable scope for the role of radiologists to grow beyond their current contributions.

#### TABLE OF CONTENTS/OUTLINE

(1) Brief background of functional neurosurgery focusing on DBS. (2) Anatomical relationships of the most common targets. (3) Framework on how to safely acquire MRI in postoperative DBS patients. (4) Expected and complicated postoperative imaging appearances of DBS. (5) Future directions and opportunities for radiologists.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

NREE-99

### MRI Characteristics of Chemotherapy Related Central Neurotoxicity: A Pictorial Review

#### Participants

Rugaiyah Alkhatib, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Due to the increasing incidence of cancer and advancements in cancer treatment, the prevalence of chemotherapy-related neurotoxicity has also seen an increasing trend. Chemotherapy-related neurotoxicity is a well-recognized complication in oncologic patients, with a wide range of patients, from 19% to more than 85% receiving chemotherapeutic agents experiencing symptoms of neurotoxicity. This may present with a wide range of neurological manifestations, which can pose diagnostic challenges, particularly, in distinguishing it from tumor progression and paraneoplastic syndrome. Therefore, imaging plays a crucial role in the management of these patients. MRI can reveal various imaging patterns of chemotherapy-induced neurotoxicity, including acute-subacute leukoencephalopathy with reversible DWI pattern, commonly observed with methotrexate use, as well as acute cerebellar syndrome and reversible acute cerebellar toxicity patterns, which is most often induced by high-dose cytarabine. Other imaging patterns include posterior reversible encephalopathy syndrome, neurovascular complications pattern, progressive multifocal leukoencephalopathy pattern and spinal cord toxicity. In this pictorial review, we will highlight the MRI characteristics and patterns related to chemotherapy-induced neurotoxicity, as well as provide case-based examples to better illustrate these features.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Types of chemotherapeutic agents and mechanism of action  
3. Characteristics MRI features of chemotherapy-induced central neurotoxicity  
4. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

OBEE

### OB/Gynecology Education Exhibits

#### Sub-Events

#### OBEE-1 Isthmocele: A Simplified Guide

##### Participants

Isabela Ferracini, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Isthmocele may be present in 24-69% of women evaluated with transvaginal ultrasound and may be the cause of several clinical dysfunctions: dysmenorrhea, abnormal uterine bleeding, obstetric complications and perhaps even subfertility. When found in an ultrasound examination, there are several criteria to be considered. Accurate reporting of the description and measurement of this area in ultrasound examinations becomes important not only for research, but also for the clinical approach and planning of surgical treatment and to standardize the language in the documentation of the examination and the performance of reports. The objective of this work is to carry out a didactic review of how to examine an isthmocele in non-pregnant women, based on the first European consensus.

##### TABLE OF CONTENTS/OUTLINE

A literature review was carried out and cases of ultrasound, magnetic resonance imaging and hysterospingography obtained from the digital archive of our institution. We approach a didactic review of the imaging aspects and how to measure them adequately, including teaching points and additional cases.

#### OBEE-10 Diaphragmatic Endometriosis: A Breathtaking Challenge

##### Participants

Nathalie Burger, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1) This study aims to demonstrate MR's feasibility and accuracy in detecting diaphragmatic endometriosis, which can cause long-standing disability and pain, negatively impacting quality of life. 2) Symptomatic diaphragmatic endometriosis is part of thoracic endometriosis syndrome, usually diagnosed later than pelvic endometriosis. The symptoms include chest pain, shortness of breath and coughing, worsening during menses, and associated with pneumothorax and phrenic nerve irradiation. 3) Endometrial cells follow peritoneal circulation through the right paracolic gutter towards the right subdiaphragmatic area, where they can aggregate and form nodules, favored by a preferred stagnation site in the posterior portion of the right side of the diaphragm. 4) MR allows high-sensitivity diagnosis of diaphragmatic endometriosis, offering better characterization of hemorrhagic lesions on fat-suppressed T1-weighted sequences and requiring no radiation exposure. 5) Diaphragmatic lesions present hyperintense nodules on fat-suppressed weighted sequences. Herniation is less frequent and can result from repeated proliferation, bleeding, and necrosis of endometriotic lesions leading to fenestrations and partial or complete diaphragmatic rupture.

##### TABLE OF CONTENTS/OUTLINE

1) Know What You're Dealing With: Anatomy and main symptoms 2) Active Search: MRI Protocol 3) Behold the visual representation of diaphragmatic lesions on magnetic resonance 4) What information should the gynecologist look for in the report? 5) Pearls and pitfalls in the differential diagnosis.

#### OBEE-11 Unfolding Endometriosis Clinical Cases Controls: What to Look For

##### Participants

Brainer Brandao Salomao, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Endometriosis is a chronic disease that impacts women from adolescence to menopause. Treatment options can vary from hormonal suppression to radical surgery and should be individualized and personalized. This educational exhibit presentation aims to: ? Discuss the clinical management of endometriosis including the different drugs available; ? Discuss the imaging methods available for hormonal treatment controls; ? Discuss imaging findings of endometriosis clinical controls.

##### TABLE OF CONTENTS/OUTLINE

? To discuss the available drugs used in the clinical management of endometriosis, including its mechanisms of action and therapeutic efficacy, such as: ? Combined oral contraceptives; ? Selective estrogen receptors modulators; ? Hormonal intrauterine device (IUD); ? Progestins; ? Selective progesterone; ? GnRH agonists; ? Oral GnRH antagonists; ? Aromatase inhibitors; ? Review clinical cases undergoing medical treatment and the correlation between clinical response and imaging findings in different sites such as: ? Retrocervical disease; ? Deep endometriosis with myometrial infiltration; ? Endometriomas; ? Intestinal lesions; ? Diaphragmatic lesions; ? To discuss genetic and immunological aspects that can interfere with clinical response.

## **OBEE-12 Uterine Sarcomas: Update on Pathologic and Imaging Findings**

### **TEACHING POINTS**

Demonstrate the imaging features that favor the diagnosis of uterine sarcomas and the particularities of each subtype; review staging and the role of imaging in monitoring response and suspected recurrence. Recognize their mimickers.

### **TABLE OF CONTENTS/OUTLINE**

Gynecologic sarcomas are rare tumors and usually have an unfavorable prognosis. Magnetic resonance imaging (MRI) is the best method for characterization of these tumors, initial staging and treatment planning. MRI shows features that can be used to try to differentiate between subtypes of uterine sarcomas. Combined DWI and DCE techniques allow more accurate assessment of the degree of myometrial and cervical invasion and characterization of potential metastatic sites. Although several findings increase the suspicion of malignancy in gynecologic tumors (including irregular contouring, intratumoral necrosis/hemorrhage, and low ADC values), some particular features may suggest the diagnosis of sarcoma, such as macroscopic lymphovascular invasion in cases of endometrial stromal sarcomas, the "bag of worms" aspect of low-grade endometrial stromal sarcoma, and the "lattice-like" appearance of adenocarcinomas that result from the mixed composition of solid and cystic multiseptate components. Their diagnosis remains a challenge in the radiologist's practice.

## **OBEE-13 Imaging in Pregnancy: Safe and Sound With Contrast-Enhanced US**

Participants

Stephanie Nguyen, MD, MSc, Calgary, AB (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

(1) Contrast-enhanced US (CEUS) is safe in pregnancy (2) Microbubble contrast agents do not cross the placental barrier (3) CEUS in pregnancy is an effective alternate to CT and MRI when enhanced imaging is required (4) A major indication is in the determination of malignancy when masses anywhere in the abdomen or pelvis are found in a pregnant patient (5) Ability of CEUS to differentiate benign from malignant processes allows prompt diagnosis and management with significant implications on maternal and fetal outcomes (6) CEUS is capable of evaluating more than one organ in any patient

### **TABLE OF CONTENTS/OUTLINE**

(1) Review of the safety record of CEUS in pregnancy (2) CEUS technique in the pregnant patient (3) Case examples (3a) Malignant lesions (3b) Benign diseases (3c) Assessment of acute pain in pregnancy

## **OBEE-14 Beyond the Scar: A Comprehensive Guide to Postoperative Endometriosis Imaging**

Participants

Sofia Maksoud, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Endometriosis affects approximately 176 million women worldwide, with a prevalence of one in ten women during the reproductive period. Treatment can be clinical or surgical. The main surgical indications include clinical failure, lesions in the appendix, small bowel lesions, intrinsic ureter involvement and rectosigmoid (greater than 50% of the circumference). The goals of surgery include radical removal of all lesions and the restoration of normal pelvic anatomy. Postoperative evaluation is the new challenge of imaging studies, as the number of radical surgeries to treat endometriosis has increased enormously. Radiologists must be familiar with the common imaging findings, possible complications and the differentiation between residual disease and fibrotic scar.

### **TABLE OF CONTENTS/OUTLINE**

- Review the common post-surgical findings following surgery for deep endometriosis.- Differentiate residual / recurrence disease and fibrotic scar. - Illustrate didactical cases with pre and post-surgical imaging.- Be familiar with possible complications after surgery.

## **OBEE-15 What Not to Miss in Obstetric Ultrasounds - Multifetal Pregnancies: Chorionicity and Amnionicity**

Participants

Laura Santiago Caobi, Ponce, PR (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Review the embryologic division in multifetal pregnancies and its significance for prenatal care. - Discuss the criteria for the classification of twin pregnancies using ultrasounds. - Provide case examples for classic imaging for each type of multifetal pregnancy. - Use an algorithm to assist in ultrasound monitoring and surveillance of multifetal pregnancies.

### **TABLE OF CONTENTS/OUTLINE**

Multifetal pregnancies pose a significant risk for adverse outcomes compared to singleton pregnancies. Early and accurate diagnosis requires a comprehensive understanding of chorionicity and amnionicity. Ultrasound evaluation of placental number, interposed membranes, fetal genders, amniotic fluid volume, and presence of lambda sign are key for successful assessment of chorionicity and amnionicity. The use of an algorithm for ultrasound monitoring and surveillance of multifetal pregnancies can aid facilitate early interventions that will benefit the health of both, mother and fetus. Outline: (1) Introduction Objectives, (2) Multifetal Pregnancies, (3) Division Timing, (4) Classic Imaging Findings for Each Type of Multifetal Pregnancy, (5) Ultrasound Criteria for Diagnosis of Type of Multifetal Pregnancy, (6) Comparison of Fetal and Infant Mortality Rates, (7) Algorithm for Ultrasound Monitoring and Surveillance, (8) Case Examples, (9) Conclusion

## **OBEE-16 Don't Forget the Bowel: Imaging Techniques, Associations and Treatment Implications of Bowel Endometriosis**

Participants

Haatal Macer, MD, MS, Rolling Hills Estates, CA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**



1. As the GI tract is the most common extragenital organ involved with endometriosis, imagers need to actively look for bowel involvement. Therefore, our exhibit will highlight the associations of bowel endometriosis leading imagers to actively look for bowel implants. 2. Practical tips on Ultrasound and MRI technique of bowel endometriosis imaging and how to improve lesion detection. 3. Discussion of detailed assessment of large and small bowel involvement with implications on management, especially related to pain and fertility, will be highlighted.

#### TABLE OF CONTENTS/OUTLINE

1. Background of GI tract endometriosis. 2. Associations: Incidence and prevalence with ovarian endometriomas; deep pelvic endometriosis especially with posterior compartment (rectovaginal and uterosacral ligament) involvement. 3. Ultrasound Technique: Bowel preparation; transvaginal technique for delineating normal anatomy and pathology; tips on separating bowel layers on ultrasound enabling detection of depth of muscle invasion. 4. MR Enterography: bowel preparation; role of antispasmodics; MR protocol favoring detection of appendiceal, ileocecal junction, small bowel and rectosigmoid deep endometriosis. 5. Detailed anatomic reporting of small and large bowel disease that have implications on management, particularly related to pain and fertility.

#### OBEE-17 Unmasking Atypical Adenomyosis: Imaging Spectrum with Laparoscopic and Pathologic Correlation

Participants

Brainer Brandao Salomao, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Adenomyosis is a prevalent gynecologic condition defined by the presence of endometrial glands and stroma within the myometrium. 2. It remains poorly understood with severe implications on fertility and quality of life. 3. Although there is no agreement on the imaging classification of adenomyosis, the typical features are more discussed and widely known. 4. MUSA statement consensus is an important available tool to recognize and describe the typical forms of adenomyosis on ultrasound. 5. Atypical presentations of adenomyosis are less discussed, remaining a diagnostic challenge. 6. This presentation aims to review imaging findings of atypical adenomyosis, highlighting their potential differential diagnosis, as well as their impact on clinical management and patients outcome.

#### TABLE OF CONTENTS/OUTLINE

- Overview of adenomyosis. - Review imaging-based adenomyosis classification. - Ultrasound and MRI imaging findings of atypical adenomyosis, including: Solid adenomyoma; Cystic adenomyoma; Submucosal adenomyoma; Subserosal adenomyoma; Accessory cavitated uterine mass; Polypoid adenomyoma; Adenomatoid tumor. - Differential diagnosis, such as: Adenosarcoma; Cystic / hemorrhagic degeneration of leiomyoma; Cellular degeneration of leiomyoma; Isthmocele; Unicornuate uterus. - Present clinical cases with laparoscopic and pathological correlation. - Summary of key concepts.

#### OBEE-18 Exploring the Pelvic Floor through MRI - A Comprehensive Trainee's Handbook

Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) This review highlights the benefits and recent updates in defecography, a radiological examination used to evaluate patients with defecatory and pelvic floor dysfunction. This functional anatomical condition affects support structures and is more common in women over 50 years old. 2) MR defecography evaluates multicompartamental dysfunction, etiologies of defecation dysfunction, and postoperative complications and recurrence, providing both anatomical and functional information while allowing simultaneous assessment of the anal sphincters. 3) Most patients present changes in more than one compartment, and the reoperation rate after initial pelvic floor surgery is high. Understanding changes in various compartments can contribute to reducing the need for reapproaches. 4) Examples of pathologies found in defecography include cystocele, urethral hypermobility, uterine and vaginal prolapse, background hernias, and intussusception. This review discusses the implications of these findings for clinical practice.

#### TABLE OF CONTENTS/OUTLINE

1) 1) General Aspects: A Little Bit of Everything; 2) Essential MR Protocol - What you need to remember; 3) Assessing the dynamic study on MR; 4) MR images evaluation - Is defecating three times really necessary?

#### OBEE-19 Adeno-My-Goodness: Comprehensive Review of Adenomyosis

Participants

Paulo Miro, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Adenomyosis is a prevalent condition which may cause symptoms (such as abnormal uterine bleeding and pain), and affect pregnancy outcomes. Ectopic endometrial glandular tissue within the uterine myometrium with associated smooth muscle hypertrophy may have a variety of appearances across the imaging modalities. Imaging findings may be further confounded by hemorrhage or development of myometrial cysts, and changes under the hormonal influence (particularly during pregnancy). Cases may arise when adenomyosis mimics uterine malignancy, and uncommonly, malignancy may arise from the glandular tissue within adenomyosis. This exhibit is a comprehensive review of adenomyosis across multiple imaging modalities with pathologic and graphical correlation.

#### TABLE OF CONTENTS/OUTLINE

Relevant uterine anatomy  
1. Classic Imaging Findings of Adenomyosis  
A) Ultrasound "Adeno"  
• Echogenic striations/buds  
• Myometrial cysts  
• "Myosis"  
• Myometrial thickening (focal or diffuse)  
• Globular uterus  
• Thickened inner myometrium  
• "Venetian blinds" shadowing  
B) MRI "Adeno"  
• T2 hyperintense foci and myometrial cysts  
• T1 hypointense foci  
• "Myosis"  
• T2 hypointense junctional zone thickening  
• Myometrial thickening (focal or diffuse)  
C) CTD  
• Hysterosalpingogram  
2. Atypical findings of adenomyosis  
A) Cystic/hemorrhagic  
B) Pedunculated  
3. Adenomyosis in pregnancy  
4. Clearing up the confusion between focal adenomyosis and adenomyoma (the mixed Mullerian tumor)  
5. Malignancy arising within adenomyosis

## **OBEE-2 Postpartum Woman in the ER? A Surviving Guide for the On-Call Radiologist**

Participants

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To learn what are the main puerperal obstetric complications and their imaging findings. 2. To understand the importance of clinical correlation in the diagnosis of many of these conditions: some can only be diagnosed in the proper clinical setting and a high suspicion is essential. 3. To review the anatomy landmarks necessary to locate certain types of hematomas.

### **TABLE OF CONTENTS/OUTLINE**

1. Normal imaging findings during the puerperium: Vaginal delivery. 2. Normal imaging findings during the puerperium: Cesarean delivery. 3. Surgical technique for Cesarean section and potential complications at each step. 4. Thromboembolic conditions: 4.1. Ovarian vein thrombosis/ thrombophlebitis and their complications. 5. Infectious complications 5.1. Postpartum endometritis. 6. Hemorrhagic complications 6.1. Lower genital tract injury: supra and infralevator hematomas. 6.2. Abnormal placentation: placenta accreta, increta, percreta. 7. Cesarean-related complications 7.1. Wound cellulitis/ abscess 7.2. Uterine dehiscence 7.3. Bladder flap hematoma 7.4. Subfascial hematoma 7.5. Rectus sheath hematoma 7.6. Urinary tract injury

## **OBEE-20 Imaging of Functional Ovarian Tumors and Tumor Like Conditions with Pathological Correlation**

Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Niloofer Karbasian, MD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Describe the ovarian histology and the hormone axes. 2. Discuss clinical features of hormone excess as secondary signs of hormone producing tumors and tumor like conditions. 3. Explain different categories of functional ovarian tumors and tumor like conditions. 4. Illustrate multimodality imaging characteristics of different tumors.

### **TABLE OF CONTENTS/OUTLINE**

1. Ovarian histological anatomy a. Including role of different cell types within the ovary 2. Hypothalamus-Pituitary-Ovary axis a. Introduce sex hormones and their role b. Flowchart demonstrating the hormone pathways 3. Clinical features of hormonal excess. a. Excess androgen and symptoms b. Excess estrogen and symptoms 4. Subtypes of functional ovarian tumors. a. Sex cord-stromal b. Surface epithelial c. Stroma d. Tumor-like lesions and conditions 5. Approach to diagnosing functional ovarian tumors a. Multidisciplinary approach i. Role of imaging. ii. Hormonal analysis in follow up. iii. Tissue sample often needed for diagnosis. b. Imaging direct and indirect signs of hormonal excess. i. Contribution of different modalities: US, MRI, CT. ii. Features of malignancy. iii. Radiologic examples of different functional tumors. c. Pathology correlation 6. Treatment options a. Conservative b. Surgical c. Prognosis

## **OBEE-21 Decoding the Pandora's Box With Fetal MRI: A Comprehensive Pictorial Review of Fetal Abdominal Abnormalities**

Participants

Taruna Yadav, MD, Alwar, India (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. To study indications, advantages and limitations of fetal MRI for antenatal assessment of various abdominal anomalies. 2. To define a standard MRI protocol for assessment of fetal abdominal anomalies. 3. Using a case-based approach, to learn about myriad of common and rare fetal abdominal anomalies including gastrointestinal (bowel atresias, meconium peritonitis), genitourinary (posterior urethral valve, urethral atresia, pelviureteric junction obstruction, cystic renal dysplasia, fetal pyelectasis, ectopic kidney, syndromic associations like Meckel Gruber and Joubert syndrome), ventral wall defects (gastroschisis, omphalocele, limb body wall defects, pentalogy of Cantrell, bladder exstrophy, amniotic band syndrome), pelvic disorders including presacral masses (sacroccygeal teratoma, anterior meningocele) with syndromic associations and follow up (wherever available). 4. To develop an imaging approach to complex fetal abdominal anomalies including ventral abdominal wall defects.

### **TABLE OF CONTENTS/OUTLINE**

1. Role of MRI for assessment of fetal abdomen: indications, advantages and limitations 2. Fetal MR protocol to assess various abdominal anomalies 3. Fetal Abdominal Anomalies (A Case Based Approach): 3A. Gastrointestinal anomalies 3B. Genitourinary anomalies 3C. Ventral wall defects: spectrum of anomalies and simplified imaging approach 3D. Pelvic disorders: presacral masses 3E. Syndromic associations 3F. Miscellaneous 4. Conclusion

## **OBEE-22 Magnetic Resonance Imaging in Obstetric Patients: How Can We Help?**

### **TEACHING POINTS**

? Brief review of indications and protocols of obstetric magnetic resonance imaging (MRI)? Illustrate the characteristics of image in cases of normal anatomy obstetric patients, when appropriate? Review most common pathologies in obstetric cases? Highlight the impact of imaging in the management

### **TABLE OF CONTENTS/OUTLINE**

? MRI indications and protocols? MRI obstetric normal anatomy, when appropriate? MRI aspects of obstetrics patients: pathologies and complications: ? Placenta accreta? Different locations of ectopic pregnancies? Heterotopic pregnancy? Angular pregnancy? Uterine perforation? Per vaginal bleeding in pregnancy? Miscarriage / Retained products of conception? Uterine arteriovenous malformation? Gestational trophoblastic disease? Applications in fetal pathologies or malformations (for example: fetus with cervical mass, congenital diaphragmatic hernia, congenital pulmonary airway malformation and fetal urinary tract anomalies)

## **OBEE-23 Placenta 101: A Pictorial Review of Normal and Pathological Findings by US and MRI**

### **TEACHING POINTS**

To normal thickness of the placenta is 2 to 4 cm, and it must be measured where the umbilical cord is inserted. Placental grading maturity (Grannum classification) is divided into 4 grades by ultrasound and it is based on the extent of calcifications. To differentiate a retroplacental hematoma from a uterine contraction, it is recommended to wait a few minutes for the contraction to disappear. An easy Doppler finding for the differentiation of hematomas from other placental masses is the absence of internal blood flow. Currently, when the placental edge is less than 20 mm away from the internal cervical orifice (ICO) is a low-lying placenta, and when the placenta covers partially or completely the ICO, it is called placenta previa.

#### TABLE OF CONTENTS/OUTLINE

History. Embryology. Normal appearance and grades of maturation. Variations in placental morphology. Placental hematoma. Placenta previa. Placental accretion. Placental tumors. Teaching points. Conclusion. Bibliography.

#### OBEE-24 FOMO, No More - A Comprehensive Guide for Identifying Head to Toe Fetal Anomalies

##### TEACHING POINTS

To highlight the importance of level I scan and develop an algorithmic approach to diagnose structural anomalies at the earliest. To diagnose progressive anomalies on subsequent scans and devise a trimester based checklist to avoid missing abnormalities. To assess the maternal risk factors in conjunction with fetal parameters to be able to assess growth of the fetus as well as restriction. To know the importance of color doppler in all the scans and how it affects further management. Scanning beyond fetus- to diagnose various placental, uterine and adnexal abnormalities for effective management. An obstetric ultrasound plays a pivotal role in each stage of pregnancy in providing a non-invasive diagnostic method, yielding immediate, extensive and accurate results for evaluating the fetus as well as the health of the mother. Protocol based screening reduces the "fear of missing out" an abnormality.

#### TABLE OF CONTENTS/OUTLINE

1. First Trimester Scan A) Early First Trimester: • Ectopic pregnancy • Twin or higher order pregnancy with correct labelling • Adnexal abnormality B) Late First Trimester: Detectable 9 • Anencephaly • Holoprosencephaly • Encephalocele • Omphalocele • Gastroschisis • Iniencephaly • Limb abnormality • Megacystis • Major cardiac defects • First trimester markers for chromosomal abnormalities • Abnormal UAD 2. Second Trimester Scan • Detectable 9 • Cardiac defect • Situs abnormalities • Spinal abnormalities • Placental abnormalities 3. Fetal Echocardiography 4. Third Trimester Scan • Evolving cardiac abnormalities • Placental abnormalities • Abnormal Doppler

#### OBEE-25 Patterns of Ovarian Cancer Recurrence on MDCT: Early Imaging Features

Participants

Sharad Maheshwari, MD, (Presenter) Nothing to Disclose

##### TEACHING POINTS

1. Review of Ovarian ca 2. Review the pattern of recurrence in ovarian ca 3. Review Application of clinical laboratory findings with Imaging 4. Understand the role of imaging, how it can potentially accelerate time to treatment.

#### TABLE OF CONTENTS/OUTLINE

1. General overview of ovarian ca a. Epidemiology recurrence rates b. Pathogenesis how tumour spreads c. Clinical presentation Tumour markers d. quick review of treatment options 2. Multimodality imaging appearance a. Why cross sectional Imaging b. Benefits of MDCT c. Role of MRI PET c. Scanning protocol d. Recurrence sites appearance on Imaging: - Peritoneum - Mesentery - Nodes - Perihepatic and fissural spread - The muscle planes - Urinary bladder surface - Serosal deposits on the bowel surface - Miscellaneous sites e. Review protocol: Region wise f. Examples of early recurrence that would have been missed on routine imaging

#### OBEE-26 See What's Inside: A Look at Pelvic Devices

Participants

Flavia M. Starling, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

##### TEACHING POINTS

The female pelvis has a complex anatomy; thus, it requires deep study and its image can be challenging. Besides the anatomy knowledge, radiologists need to keep up with the daily devices and techniques, used by doctors and by the patients. It is important to be prepared to face unknown figures like foreign bodies, and also to recognize these devices in the pelvis, such as contraceptive methods (vaginal ring and intrauterine devices), tampons, menstrual cups, vaginal pessaries, catheters and slings. Questionnaires are often vague when referring to these devices and most women forget to mention actively whether they have or are using any of them. This study has the objective of reviewing common devices placed in the pelvis, especially in gynecology, urogynecology and its possible complications, helping radiologists to interpret these images. An understanding of the radiological appearance of some of these devices in the many imaging methods such as X-ray, ultrasound, CT and MRI is useful to avoid misinterpreting them, as well as obtaining a diagnosis more quickly and accurately.

#### TABLE OF CONTENTS/OUTLINE

For this education exhibit, we obtained clinical and epidemiological information in literature and selected images of cases that show different findings of women's vaginal and uterine devices, including normal aspects or complications.

#### OBEE-27 This Is Rare, but It Happens: Atypical Presentation of Teratomas

Participants

TATIANA GONCALVES, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose

##### TEACHING POINTS

Teratomas are germ cell tumors composed of multiple tissues derived from two or three germ layers. Mature teratomas are the most common benign ovarian neoplasms. They are easily diagnosed on imaging studies because of their characteristic intratumoral fat and calcification components. However, a minor percentage of teratomas have no visible fat on imaging studies. Malignancy is an uncommon presentation, which may be suspected in the presence of an enhancing, irregularly marginated solid component. Gliomatosis peritonei (GP) is another unusual form, that it is characterized by the implantation of mature glial tissue in the

peritoneum or omentum. Mature teratomas have also an high complication rate compared with other ovarian tumors, however, there is a low rate of spontaneous rupture. The purpose of this presentation is to discuss the various atypical imaging features of teratoma that can be particularly misleading for radiologists.

#### **TABLE OF CONTENTS/OUTLINE**

Index 1. Introduction 2. Mature teratoma 3. Mature teratoma simulating malignant lesion 4. Gliomatosis peritonei 5. Immature teratoma 6. Ruptured teratoma 7. Pre sacral teratoma 8. Pre sacral myelolipoma and dermoid 9. Retrorectal dermoid 10. Cul-de-sac dermoid 11. Currarino syndrome

#### **OBEE-28 Adenomyosis: MRI for Diagnosis and Problem-Solving**

Participants

Lauren F. Alexander, MD, Jacksonville Beach, FL (*Presenter*) Spouse, Stockholder, Abbott Laboratories; Spouse, Stockholder, AbbVie Inc; Spouse, Stockholder, General Electric Company; Spouse, Stockholder, Myriad Genetics, Inc

#### **TEACHING POINTS**

Uterine adenomyosis develops from the abnormal proliferation of heterotopic endometrial glands and stroma in the myometrium. Recognizing the characteristic magnetic resonance imaging (MRI) findings is essential for accurate diagnosis and appropriate patient management, as clinical symptoms such as dysmenorrhea, menorrhagia and pelvic pain overlap with other gynecologic diagnoses. After reviewing this exhibit on adenomyosis, the learner will be able to -- Discuss how to optimize MRI sequences to evaluate for adenomyosis. -- Identify typical and atypical MRI findings of adenomyosis. -- Distinguish other diagnoses which can mimic or have overlapping findings with adenomyosis. -- Describe treatment options for patients with adenomyosis.

#### **TABLE OF CONTENTS/OUTLINE**

(1) Background: Pathophysiology of adenomyosis, Clinical findings, Role of imaging for diagnosis and management. (2) MRI protocol: Key sequences, Tips for optimization. (3) Imaging features on MRI: Normal anatomy, Typical adenomyosis findings, Atypical findings (Polypoid, External adenomyosis, Cystic adenomyosis without with hemorrhage, Pregnancy related changes, Endometrial ablation changes). (4) Differential diagnosis mimics: Deep infiltrating endometriosis, Leiomyoma, Neoplasms (endometrial cancer, Mullerian adenocarcinoma), Accessory and cavitated uterine mass, Pitfalls/Mimics (Uterine contraction, pseudo-thickening of junctional zone). (5) Treatment options: Medical, Procedural (ablation, excision, hysterectomy).

#### **OBEE-29 What Not to Miss in Obstetric Ultrasounds - Fetal Skeletal System Evaluation**

Participants

Oswaldo Guevara Tirado, BS, MS, Coto Laurel, PR (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review the essential components of an ultrasound based fetal skeletal assessment. Discuss common sources of error when evaluating the fetal skeletal system using ultrasound. Analyze case examples of classic images with normal findings that are frequently misinterpreted. Follow a systematic approach to avoid missing significant skeletal defects.

#### **TABLE OF CONTENTS/OUTLINE**

Obstetric ultrasounds play a crucial role in the accurate identification of fetal skeletal abnormalities, allowing physicians to optimize management in order to improve both fetal and maternal outcomes. Fetal skeletal abnormalities can manifest early during embryonic life. Therefore, proper evaluation and identification of developmental anomalies requires a profound understanding of normal fetal development and knowledge about ultrasound imaging techniques. Moreover, it is important to take into consideration the various sources of error that exist when performing a fetal skeletal assessment. Ultrasound is the primary imaging modality used to assess fetal well-being by providing a non-invasive method to precisely identify fetal skeletal abnormalities, amongst other irregularities, and intervene in a timely manner. 1. Introduction Objectives 2. How to Approach the Fetal Skeletal System 3. Skeletal Assessment: Ultrasound Findings 3a. Long Bones 3b. Hands Feet 3c. Fetal Head 3d. Fetal Thorax 3e. Fetal Movement 4. Femur Length Measurement Sources of Error 5. Review of cases in quiz format 6. Conclusion

#### **OBEE-3 Get the Fluoroscopic Vibes: Hysterosalpingography, a Guide for Residents**

#### **TEACHING POINTS**

1. Illustrate the main normal imaging findings and technical procedures of hysterosalpingography including normal variants, non-pathological findings and technical artifacts. 2. Recognize abnormalities of the uterine cavity and fallopian tubes by hysterosalpingographic images and analyze the pathology and its impact on fertility. 3. Emphasize when further imaging modality such as sonohysterogram and magnetic resonance imaging or even hysteroscopic direct visualization is required in order to reach to the final diagnosis. 4. Discuss adequate surgical and non-surgical treatment options and possibilities of pregnancy post-treatment.

#### **TABLE OF CONTENTS/OUTLINE**

1. Review the key points of the female pelvic anatomy, indications and contraindications, technical procedures and normal hysterosalpingographic features. 2. Identify the most common anatomical variants (with and without proven influence on fertility), non-pathological findings and technical artifacts that may simulate causes of infertility. 3. Illustrate the characteristic hysterosalpingographic and other image modalities findings of uterine cavity and Fallopian tubes pathologies by analyzing representative cases and review several treatment options and assess the possibilities of fertility of each case. - Benign and malignant neoplasms - Tubal patency - Hormonal disorders - Post-surgical findings - Miscellaneous

#### **OBEE-30 Incidental Findings of Pelvic Endometriosis in Routine Transvaginal Ultrasound: A Pictorial Essay**

Participants

Alexandre Minoda, MD, Recife, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The aim of this exhibit is: • To conduct a review and illustrate through ultrasound images the female pelvic compartments. • To describe and disseminate the main ultrasound findings suggestive of deep infiltrating endometriosis (DIE) and ovarian endometriomas on transvaginal ultrasounds performed as part of a routine gynecological evaluation. • To demonstrate how the unique capabilities of

ultrasound can help in the diagnosis and management of patients.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION / BACKGROUND• Epidemiology, clinical symptoms and classifications of endometriosisROUTINE TRANSVAGINAL ULTRASOUND AND TRANSVAGINAL ULTRASOUND AFTER BOWEL PREPARATION• International Deep Endometriosis Analysis (IDEA) group consensusPELVIC COMPARTMENTS• Anatomy and normal findings in routine transvaginal ultrasoundINCIDENTAL FINDINGS OF PELVIC ENDOMETRIOSIS IN ROUTINE TRANSVAGINAL ULTRASOUND• Anterior compartment• Middle compartment• Posterior compartment• Other findings that may optimize the diagnosis of endometriosis on routine transvaginal ultrasound

#### OBEE-31 How Far Can We Go With Computed Tomography in the Diagnosis of Endometriosis:- Correlation With MRI and US

Participants

Gabriel Faria Medeiros, Santo Andre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recognize the most common CT findings associated with endometriosis and how to describe them 2. Discuss and highlight the role of CT in aiding endometriosis management, by suggesting the diagnosis and prompting MRI recommendation, accelerating diagnosis and improving patient outcomes. 3. Illustrate cases where CT and MRI were both used in the diagnosis of endometriosis, with emphasis on how the correlation between the two modalities aided in the diagnosis. 4. Identify post-treatment changes and potential pitfalls

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Epidemiology, pathophysiology and clinical aspects of endometriosis Currently available treatment options 2. Role of different imaging techniques in diagnosis and assessment of disease extension (benefits and limitations) Hysterosalpingography Transvaginal ultrasound (with bowel preparation) CT MRI Videolaparoscopy 3. CT findings of endometriosis, with MRI correlation - Case-by-case discussion 4. Post-operative changes and confounding factors Salpingo-oophorectomy Hysterectomy Rectosigmoidectomy Post-radiation therapy Adhesions Inflammatory pelvic disease 5. Summary and take-home messages

#### OBEE-32 Smooth Seas Never Made Skilled Sailors: Navigating the Challenges That Arise After Cervical Cancer Treatments

#### TEACHING POINTS

To review the different radiotherapy modalities and the clinical indications in cervical cancer treatment.To identify the most frequent early and late complications of radiotherapy. To demonstrate that high doses of radiotherapy are associated with a greater risk of complications. To provide key points and radiologic tools in order to differentiate post-actinic changes from residual or recurrent disease.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology and clinical importance -FIGO staging review in cervical cancer -The role of radiotherapy treating cervical cancer. Early and late complications in the uterus, ovaries, intestines, bones, and bladder. Case based approach with radiologic correlation.Imaging findings with histologic and colonoscopy correlation. Conclusion.

#### OBEE-33 Imaging Uterus After Endometrial Ablation

Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Endometrial ablation is a minimally invasive surgical procedures available for the management of patients with abnormal uterine bleeding. Post endometrial ablation expected imaging findings and post procedural complications have a characteristic pattern on imaging and if not readily recognized by the radiologists may lead to misinterpretation and unnecessary follow up imaging and inadequate management. Teaching points The goal of this study is to familiarize radiologists with imaging findings of uterus after endometrial ablation therapy. This will serve to enhance recognition of normal imaging findings and life threatening conditions and help radiologists create a focused differential diagnosis for various complications after the procedure.

#### TABLE OF CONTENTS/OUTLINE

A. Review pathophysiology of dysfunctional uterine bleeding.B. Review of treatment options in management of DUB with emphasis on endometrial ablation C. Discuss imaging options available for the assessment of uterus after ablation: US, CT, MRI and their strengths and weaknesses D. Review key imaging features of the post endometrial ablation 1. Expected post-op changes (early: intracavitary air, intrauterine /cervical hematoma, uterus edema; late: endometrial cavity contracture, endometrial thinning) 2. Complications (immediate: infectious (endometritis, myometritis, salpingitis); cornual hematometra, hematosalpinx; chronic: synechia, infertility from post-ablation tubal sterilization syndrome, ectopic pregnancy, abnormal placentation, endometriosis, malignancy (adenocarcinoma of the uterus)E. Management of the presented post-ablation complications will be reviewed.

#### OBEE-34 Dedicated MR Imaging for Endometriosis: What You Can't Miss in Your Report

#### TEACHING POINTS

MR imaging is an important tool for diagnosis of deep pelvic endometriosis. Understanding and recognizing the MRI manifestations of this disease may be challenging. In this presentation, we will summarize the most important points to include in our reports considering a region-based reading and reporting system

#### TABLE OF CONTENTS/OUTLINE

Anterior compartment: -Differentiating bladder endometriosis from peritoneal endometriosis: bladder endometriosis is diagnosed when the muscular layer of the bladder is involved. If a bladder lesion is identified, informing the location, distance from vesical trigone and distal ureters are mandatory.Middle compartment: Characterization of endometriomas and differentiation with hemorrhagic ovarian cysts- it is a daily point of attention. -Malignant transformation of ovarian endometriosis: it should be

considered if vascular solid tissue is identified with Diffusion imaging and Dynamic post contrast sequences.-Endometriotic tissue infiltrating the uterus: including this information and its differential diagnosis is relevant for treatment planning. Posterior compartment: -Differentiating deep rectal endometriosis from superficial endometriosis: characterization of penetration from endometriotic tissue into muscular layer of rectal wall will be definitive. Location of the lesion (intraabdominal or extraabdominal) will also impact in treatment options. -Superficial endometriosis: this is a challenge in diagnostic imaging. Small deposits of glandular tissue are missed frequently. An indirect sign to look for is the peritoneal pocket sign, defined as a peritoneal defect that collects fluid, frequently identified in posterior cul de sac.

### **OBEE-35 Current Concepts in Imaging of Uterine Adenomyosis: What Radiologists Should Know**

Participants

Alexandre Minoda, MD, Recife, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The aim of this exhibit is:• To discuss the pathophysiology of adenomyosis and how it relates to imaging findings. • To describe the various US and MR imaging manifestations of adenomyosis. • To discuss the classifications of adenomyosis based on US and MR imaging findings. • To provide the diagnostic clues that allow differentiation of adenomyosis from its mimics.

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION• Historical background, epidemiology, pathophysiology, clinical features and phenotypes of adenomyosisTHE UTERINE JUNCTIONAL ZONE• Normal zonal anatomy, physiologic variations and alterations in adenomyosisIMAGING FINDINGS IN ADENOMYOSIS• Direct and indirect sonographic signs of adenomyosis• Direct and indirect MRI signs of adenomyosisCLASSIFICATIONS OF ADENOMYOSIS AND PHENOTYPES IN IMAGING• Atypical presentationsDIFFERENTIAL DIAGNOSIS AND PITFALLS IN DIAGNOSIS OF ADENOMYOSIS

### **OBEE-36 Practical Approach to Ovarian Masses - The ABC's**

Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- To know how to properly identify ovaries and its organ dependency when facing pelvic lesions.- Going over the most common and specific characteristics and radiological features of the different ovarian lesions

#### **TABLE OF CONTENTS/OUTLINE**

The differential diagnosis of ovarian lesions is broad and complex. It is not only a diagnostic challenge due to the existence of multiple tumour lineages, but also to the proper differentiation of their ovarian dependence, which is often unclear. First of all, it is important to properly identify the ovaries by knowing pelvic anatomy, their location and their vascular relations. In the same way, when facing pelvic lesions of possible ovarian origin, there are some radiological signs that can help us to better determine their organ dependence (such as the "phantom organ" or the "beak sign"). Once we have confirmed that the dependence is ovarian, it is important to know the different possible lesions that may exist, and their most common radiological characteristics, both in CT and (mostly) in MRI. According to their T1, T2 signal, and internal component (solid, cystic or mixed), we propose a simple diagnostic algorithm that helps to approximate the diagnosis, based on the most frequent radiological characteristics of ovarian tumours.

### **OBEE-37 First Things First! First Trimester Obstetric Ultrasound From the Basics to the Pearls**

Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The aim of this exhibition is to:• Review the recommendations for screening and diagnostic ultrasound in pregnant women during the first trimester of pregnancy. • Demonstrate how the obstetric ultrasound should be documented in this context. • Discuss how to use ultrasound for risk assessment of common forms of aneuploidies, malformations and gestational diseases/complications, in a practical approach. • Highlight the pearls and pitfalls in that evaluation.

#### **TABLE OF CONTENTS/OUTLINE**

• INTRODUCTIONo Purpose of a first trimester ultrasoundo Standard equipment and protocols o Documentation requirements• GUIDELINE FOR EXAMINATIONo Demonstrate by case-based images the minimum requirements for a 11-14 weeks gestation examination, including:§ Assessment of viability§ Confirmation of intrauterine pregnancy and uterine integrity§ Fetal biometry§ Fetal anatomy§ Risk assessment for common forms of aneuploidy• SCREENINGSo Describe the pretest counseling, biomarkers and ultrasound-based assessment for aneuploidies, malformations and gestational diseases• SUMMARY AND SYSTEMATIC APPROACH• TAKE HOME MESSAGES

### **OBEE-38 A Multimodality Review of Gynecologic Medical Devices in the Pelvis**

Participants

Kaitlin Zaki-Metias, MD, Windsor, ON (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Given the frequency with which gynecologic pelvic devices are encountered on imaging, understanding the imaging characteristics and appropriate positioning on various modalities is important for radiologists to recognize. Positioning and integrity of all pelvic devices should be evaluated on all studies when visualized. Radiologists should be able to confidently communicate pertinent findings of pelvic device malposition to referring clinicians.

#### **TABLE OF CONTENTS/OUTLINE**

Understand the importance and clinical implications of gynecologic medical devices in the pelvis, including intrauterine contraceptive devices (IUCD), pessaries, contraceptive vaginal rings, tubal occlusion and ligation devices, brachytherapy seeds, and menstrual products. Describe the normal appearance and appropriate positioning of gynecologic medical devices in the pelvis and be familiar

with their appearance on various imaging modalities. Describe the strengths and pitfalls of various imaging modalities in the assessment of medical pelvic devices.

### **OBEE-39 Pelvic Venous Congestion Syndrome: The Forgotten Culprit of Chronic Pelvic Pain**

#### **TEACHING POINTS**

1. To raise awareness of pelvic venous congestion syndrome as an underdiagnosed etiology for chronic pelvic pain. 2. Review the clinical and multimodality (CT, MR and Angiography) imaging work-up of diagnosing pelvic venous congestion syndrome. 3. Discuss various differential diagnoses such as Nutcracker Syndrome, May-Thurner Syndrome, and arteriovenous malformation and understand the importance of an accurate diagnosis as there are different treatment methods for each entity.

#### **TABLE OF CONTENTS/OUTLINE**

1. Pelvic Venous Congestion Syndrome (PVCS) - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging (CT, MRA, Angiography) - Treatment/Prognosis 2. Differential Diagnoses a) Nutcracker Syndrome - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis b) May-Thurner Syndrome - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis c) Arteriovenous Malformation (AVM) - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis d) Inferior vena cava (IVC) thrombosis - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis 3. Summary Chart

### **OBEE-4 First-Trimester US and Current Methods of Genetic Screening**

Participants

Ami Gokli, MD, (Presenter) Nothing to Disclose

#### **TEACHING POINTS**

Describe first trimester ultrasound findings including normal, abnormal and indeterminate with imaging correlates, as well as criteria diagnostic for failed pregnancy and pitfalls. Discuss the current methods of genetic screening including carrier testing and all maternal blood tests in conjunction with fetal ultrasound. Review current methods of diagnostic testing in conjunction with fetal ultrasound including common complications, sensitivity/specificity, false neg/pos, how often these occur and why. Review clinical management of the most common diseases and necessary details to include in radiology reports that guide management.

#### **TABLE OF CONTENTS/OUTLINE**

Overview of first trimester US and screening tests - what can be detected in the first trimester, limitations of sonography in the first trimester, and safety issues. First trimester ultrasound imaging findings (pictorial review) of detailed fetal anatomic survey including normal anatomy, standard views. Most common methods of genetic screening and diagnostic testing in conjunction with US. Examples of common pathology encountered with sonographic imaging correlation and management discussion. Case examples with explanations including: Early hydrops, Anencephaly, Body stalk anomaly, Ectopic cordis, omphalocele, gastroschisis, Megacystis. Carrier testing, when and why. 10-13 week blood test with nuchal translucency and intracranial translucency ultrasound. Integrated screening/sequential screening. Cell-free DNA screening. Clinical indications for advanced imaging such as fetal MRI. Clinical management guidance and reporting. Future directions for improving diagnostic capabilities.

### **OBEE-40 MR Imaging of Gynecologic Emergencies in the Pregnant Patient: An Overview of Clinical Indications, Proper Sequence Choice and Not to Miss Emergencies**

#### **TEACHING POINTS**

Describe the clinical indications for MR imaging in pregnancy based upon the risks of fetal harm with ionizing radiation and recommendations from organizations including the American College of Radiology (ACR) and American College of Obstetricians and Gynecologists (ACOG). Outline the sequences included in the protocol for an MRI abdomen/pelvis of a pregnant female with examples of the features best evaluated on each sequence. Review the imaging features of gynecologic emergencies including ovarian torsion, ectopic pregnancy, placenta accreta spectrum and acute uterine rupture based on an understanding of the associated pathophysiology. Understand pertinent positive and negative information that should be conveyed to the primary team and characteristics that may portend prognosis.

#### **TABLE OF CONTENTS/OUTLINE**

Background discussing the difficulty of diagnosing pathology in pregnancy and crucial role of the radiologist. Clinical indications for MR in pregnancy - outline the ACR and ACOG recommendations and reason to avoid gadolinium contrast. Discussion of the risk of fetal harm with ionizing radiation including the difference between stochastic and deterministic effects, absorbed dose of different radiology exams and impact on fetus based on gestational age. List of the sequences included in a typical MR abdomen/pelvis protocol followed by slides with pictures demonstrating the pertinent features evaluated in each sequence. Examples of gynecologic emergencies seen in pregnancy with slides specifically focused on ovarian torsion, ectopic pregnancy (ruptured tubal ectopic, abdominal ectopic and interstitial ectopic), placenta accreta spectrum, and acute uterine rupture.

### **OBEE-41 First Trimester Ultrasound Screening**

Participants

Shannon Navarro, MD, MPH, Sacramento, CA (Presenter) Nothing to Disclose

#### **TEACHING POINTS**

-The importance of the nuchal translucency exam and significance of a widened nuchal translucency -Quality standards - Correlation with blood work for first trimester screen-significance of the ossification of the nasal bone

#### **TABLE OF CONTENTS/OUTLINE**

A. What is the nuchal translucency? Pictorial review of a normal nuchal translucency. B. Pitfalls! the amnion before fusion with the chorion, quality standards for appropriate neck flexion/extension, how the ultrasound should be performed. C. Abnormal nuchal translucencies: the movement from screening to diagnostic exams. A pictorial review of abnormal nuchal translucency screening exams with correlation from diagnostic tests. D. Pictorial review of normal nasal bone ossification. E. Pictorial review of abnormal nasal bone ossification.

## **OBEE-42 Pitfalls in Ovarian Imaging: Limits of the ORAD's System**

### **TEACHING POINTS**

The first step in characterizing a pelvic mass using the ORAD'S system is to determine its ovarian origin. The second step is to avoid misdiagnosing infections and inflammatory conditions. The third step is to identify features of peritoneal carcinomatosis. Finally, the adnexal lesions are analyzed according to the ORADS criteria. Although this system is standardized and clear, care must be taken to avoid the many pitfalls that can occur at each stage of the reasoning.

### **TABLE OF CONTENTS/OUTLINE**

We will report our experience on the pitfalls of the ORAD's system from a series of 3000 MRI's obtained over the past 5 years in a large tertiary institution by : - Presenting a variety of extra-ovarian lesions that mimic ovarian lesions such as exophytic myometrial masses, lymphocele, lymph node and other tumors arising from other structures of the pelvis. - Presenting confusing infections and inflammatory conditions such as complicated endometriosis or actinomycosis - Discussing and illustrating lesions that mimic peritoneal carcinomatosis, such as Demons-Meigs syndrome and functionally hyper-stimulated ovaries - Discussing and illustrating some benign ovarian tumors that mimic malignancy, such as cellular fibromas, sclerosing stromal tumors and necrotic, infected or distorted lesions. - Discussing and illustrating some malignant lesions that mimic benignity, such as calcified tumors (low-grade serous ovarian carcinoma) and serous cystadenofibromas associated with a borderline component.

## **OBEE-43 Serous Tumors in the Female Pelvis: Comprehensive Review of Diagnostic and Therapeutic Strategy**

### **TEACHING POINTS**

1. Serous tumors are common female pelvic neoplasm presenting a variety of clinical and imaging manifestations. Recently, there has been a paradigm shift that most extrauterine pelvic high-grade serous carcinomas (HGSC) are metastases of STIC. While HGSC is the majority of serous carcinomas, but also low-grade serous carcinoma (LGSC) developing through serous borderline tumor (SBT) may be occur. This exhibit provides an overview of diagnostic and treatment strategies including Hereditary Breast and Ovarian Cancer (HBOC) managements. 2. 3D-DCE-MRI and reduced FOV/computed DWI are useful in detecting early-stage HGSC, or small mural nodules of LGSC. Characteristic imaging findings such as black sponge in adenofibroma, papillary architecture with internal branching in SBT, dense calcification in psammocarcinoma, and CT pattern classifications for genomic subtypes estimation of advanced HGSC, and differentiation of invasive/non-invasive peritoneal implants of SBT are demonstrated.

### **TABLE OF CONTENTS/OUTLINE**

Benign: Surface epithelial inclusion /Cystadenoma /Adenofibroma SBT: Exophytic /intra-cystic papillary growth; Micropapillary subtype /Adenofibromatous SBT; Peritoneal implants /LN involvement; Fertility-preserving treatment options LGSC Psammoma body /Psammocarcinoma; HGSC arising from LGSC/SBTHGSC STIC /Tubal /Peritoneal cancers; Advanced MR techniques: SWS, MRS, CEST; Therapeutic strategies for HBOC (BRCA1/2): Risk-reducing surgery /Molecularly targeted drug; Radiomics/Radiogenomics

## **OBEE-44 Pelvic Perspectives: Unveiling the Imaging Findings and Complications of Female Pelvic Devices**

### **TEACHING POINTS**

1. Review normal imaging findings of the female pelvis, including CT, US, and MRI. 2. Review normal and abnormal placement of intrauterine devices (IUDs) and required imaging studies for emergent cases, as in perforation. 3. Review indications for pessary placement and imaging findings for pelvic organ prolapse (POP) and describe their appearance on imaging. 4. Review normal imaging appearance of catheter placement in female patients and discuss potential complications that are visible on imaging. 5. Discuss imaging findings for menstrual devices, including tampons and menstrual cups.

### **TABLE OF CONTENTS/OUTLINE**

1. Review of normal pelvic anatomy and imaging: CT, MRI, Ultrasound 2. Contraceptive devices: Types of IUDs (Copper, hormonal), Intrauterine contraception (NuvaRing), CT, KUB, MRI and safety note, Ultrasound, Malpositioned IUDs 3. Pelvic organ prolapse (POP) and pessaries: Anatomy of POP and imaging before treatment, Pessary types (ring, cube, Gellhorn), CT, MRI, Complications of pessaries (migration, fistulization, forgotten pessary) 4. Catheter placement in female patients: Indications for catheter placement and review of normal placement, CT, MRI, Misplaced catheters and complications (vaginal placement, bladder perforation from traumatic insertion) 5. Menstrual Products: Imaging findings of tampons, menstrual cups, CT, MRI 6. Quick cases with multiple choice questions: Malpositioned IUD, Pessary on CT of patient with POP, Vaginal placement of catheter

## **OBEE-45 Achy Breaky Baby Heart: Guide to Understanding Normal Fetal Cardiac Views**

### **TEACHING POINTS**

1) Fetal cardiac assessment is a key component of the fetal anatomic survey. An understanding of the different cardiac views is crucial to accurate image interpretation during a level 1 fetal anatomic survey. 2) Use of 5 standard scan planes and systematic assessment of the fetal cardiovascular system is the initial step in screening for congenital heart disease. 3) Features at risk for congenital heart disease should be further examined using a detailed echocardiogram, which includes 5 additional views.

### **TABLE OF CONTENTS/OUTLINE**

A. Overview of basic cardiac exam components B. Standardized scan planes, including a graphic schema, US anatomy, CT correlate of the same view, and significance/associated pathologies: 1) Transabdominal (determining fetal situs and cardiac axis) 2) 4 chamber view 3) Left ventricular outflow tract 4) Right ventricular outflow tract 5) 3 vessel and 3 vessel trachea C. Fetal echocardiography planes, including a graphic schema, US anatomy, CT correlate of the same view, and significance/associated pathologies: 6) Bicaval 7) Long axis view of the aortic arch 8) Long axis view of the ductal arch 9) Low short axis view of the ventricles 10) High short axis view of the great arteries D. Pictorial review of common congenital heart diseases detected on fetal cardiac views with key diagnostic findings

## **OBEE-46 Endometrioma - Beyond the Basics: Examining the Nuances and Variations of This Condition**

Participants  
Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (Presenter) Nothing to Disclose

### **TEACHING POINTS**



1) To apprise radiologists of the imaging features of endometrioma/endometriotic cysts. 2) Case-based illustrations of the atypical locations to watch out for in the appropriate clinical context. 3) To illustrate the imaging predictors of malignancy in endometriotic cysts. 4) To outline the common pitfalls encountered on various imaging techniques. 5) To highlight the implications of endometriomas on fertility. 6) To emphasize the important of pain management techniques in patients with endometriotic cysts.

#### TABLE OF CONTENTS/OUTLINE

1) Background 2) Typical/ovarian endometrioma - Introduction - Classic ultrasound findings - Classic MRI findings 3) Atypical locations - a) Peritoneal Endometrioma b) Perihepatic Endometrioma 4) Imaging predictors of malignancy - Locations - Pathology - Imaging - Pitfalls on Imaging 5) Decidualized endometrioma - What is Decidualization? - Ultrasound appearance - MR imaging 6) Complications 7) Associations - Deep infiltrative endometriosis - Extra gynecological organ involvement 8) Implications on fertility 9) Implications on pain management

#### OBEE-47 Don't Miss - Understand: Solving Pitfalls in the Diagnosis of Endometriosis and Adenomyosis

##### TEACHING POINTS

Endometriosis and adenomyosis are prevalent diseases among reproductive age women with a negative impact on their quality of life and reproductive outcomes. Their imaging manifestations may be challenging due to a wide imaging spectrum of both diseases, leading to incorrect interpretations even by experienced radiologists. This presentation aims to demonstrate common imaging pitfalls of endometriosis and adenomyosis, with a comprehensive and instructive problem-solving guide.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of endometriosis and adenomyosis, emphasizing the imaging diagnosis: ultrasound and magnetic resonance. 2) Imaging pitfalls in the diagnosis of endometriosis, including: Posterior compartment: Folds in the sigmoid colon; Vessels in the parametrium and paracolpos; Diverticulitis; Pericolic lymph nodes; Middle compartment: Adenomyosis; Fallopian tubes; Functional ovarian cysts; Pelvic Varices; Anterior compartment: Leiomyomas; Fibrocicatricial changes; Folds in the bladder wall; 3) Imaging pitfalls in the diagnosis of adenomyosis, such as: Myometrial contractions; Physiologic thickening of the junctional zone in the menstrual phase; Deep endometriosis with myometrial infiltration; Leiomyomas with cystic or red degeneration; Unicornuate uterus with functional non-communicating uterine remnant 4) A didactic guide for problem-solving pitfalls.

#### OBEE-48 Magnetic Resonance Imaging (MRI) of Mayer-Rokitansky-Kuster-Hauser Syndrome, Herlyn-Werner-Wunderlich Syndrome and Related Complex Mullerian Duct Anomalies With Special Emphasis on Surgical Reconstruction Management;- What the Radiologist Should Know to Guide the Reconstruction Surgeon

##### TEACHING POINTS

1) Explain Embryology of Mullerian Duct Anomalies (MDA) and Mayer-Rokitansky-Kuster-Hauser Syndrome (MRKHS) and Herlyn-Werner-Wunderlich Syndrome (HWWS) 2) ASRM Classification of MDA with demography 3) Case based introduction to MRKHS, HWWS other complex MDA, associations with Renal, ovarian, spine anomalies 4) Clinico-social aspects of MDA, effect on menarche, fertility pregnancy 5) MRI protocols, Imaging features of MRKHS, HWWS and MDA with sample cases 6) Document MRI findings and dimensions specially for reconstructive surgeon. Detailed analysis of structures - Cervix, Vagina, Plica palmatae, uterine/vaginal septa, uterine buds and extent of uterovaginal aplasia 7) MRI evaluation of Neovagina, other vaginoplasties follow up their complications (with example cases)

#### TABLE OF CONTENTS/OUTLINE

1) Developmental Embryology of MDA genetics 2) Classification of MDA (classes 1-VII) with cases 3) Case based description of MRKHS (type 1II), HWWS and MDA with MRI imaging features imaging pearls, coexistent extragenital genital anomalies, fibroids, endometriosis etc influencing surgical management prognosis 4) Clinical presentations, amenorrhea, subfertility pregnancy complications with sample cases 5) Targeted MRI reporting of MRKHS, HWWS, MDA associated extragenital anomalies. Specific points/dimensions useful for reconstruction, implants, surgery and for assisted reproduction. Describe uterine buds, triangular cord sign etc 6. Introduction to neovagina, vaginoplasty, uterine transplant and other surgical options with MRI features 7. Case based review of MRI of post reconstruction and post treatment follow up their complications (stenosis, fistulae, infections, hernia etc)

#### OBEE-49 Pelvic Endometriosis: Lexicon on Magnetic Resonance Imaging (MRI)

Participants

Claudia Hurtado, Valladolid, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The most common sites of involvement are the vesicouterine space (in the anterior compartment) and the uterosacral ligaments (in the posterior compartment). The "T2 black dot sign" is a specific sign of endometriosis. Malignant transformation should be suspected when a nodule enhances, nodule more than 3 cm, growth or loss of T2 shading.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Objectives- Teaching points- MRI protocol- Gross anatomy- Morphological subtypes- Endometriomas- Structured Report- Conclusions

#### OBEE-5 MRI of Müllerian Duct Anomalies Based on the New ASRM Classification

Participants

Marianna Konidari, MD, London, Greece (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Müllerian duct anomalies (MDAs) consist of a wide spectrum of congenital malformations of the uterus, cervix, fallopian tubes and upper 2/3 of the vagina and are the result of abnormal development, fusion or resorption of the Müllerian ducts.
- The new 2021 American Society of Reproductive Medicine-ASRM (previously, American Fertility Society-AFS) MDAs classification (MAC2021) expands the 1988 classification to include cervical and vaginal anomalies; it classifies MDAs into nine categories using standardized descriptive terminology.
- Imaging is crucial in the diagnostic workup of individuals with suspected MDAs, particularly adolescents

with primary amenorrhea and adults with infertility, since identification of these anomalies and their complications allows tailored clinical management. • MRI is the modality of choice for detailed pelvic anatomy evaluation, accurate MDA classification and preoperative planning.

#### TABLE OF CONTENTS/OUTLINE

• Embryology overview and imaging anatomy of internal female genitalia • MDAs: how do they develop and what are the clinical implications • ASRM Müllerian anomalies classification 2021: overview and differences with the AFS 1988 classification • Imaging evaluation: rationale behind imaging of congenital uterovaginal anomalies, available techniques and the role of MRI • Case-based discussion on MRI appearances, clinical presentation and treatment management of MDAs, according to the new ASRM classification • Diagnostic algorithm for imaging approach of MDAs

#### OBEE-50 Endometriosis Revisited: Current Concept of Pathophysiology, Diagnosis, and Therapeutic Strategy

##### TEACHING POINTS

1. Endometriosis, which significantly impairs women's QOL with chronic pain and reduced fertility, is a benign, common, but controversial disease due to its enigmatic etiopathogenesis and biologic behavior. Recent studies suggest multiple genetic, and environmental factors: endocrinic, inflammatory, immunological, and angiogenetic may affect its onset and development. Genomic analysis revealed the presence of cancer-associated gene mutations, which may reflect the neoplastic aspect of endometriosis. The management has changed dramatically with the development of fertility-preserving, minimally invasive therapies. 2. The appropriate examinations with advanced MR techniques (3D-T2WI, reduced FOV DWI, computed DWI, SWI, DCE-MRI, cine MRI), and careful imaging interpretation are considered useful in evaluating endometriosis and associated lesions, which may be effective for therapeutic strategy with improved patient's outcome.

#### TABLE OF CONTENTS/OUTLINE

Imaging manifestations of endometrioma (shading sign; T2 dark spot; hemosiderin deposition on SWI), deep endometriosis, adenomyosis, less common site and rare site endometriosis, endometriosis-associated tumor-like lesions (polypoid endometriosis; decidualized endometriosis), and malignant transformation, with pathophysiologic conditions, clinical classification, optimal treatment options and clinical outcomes.

#### OBEE-51 Pearls and Pitfalls of First-Trimester US Screening and Prenatal Testing: A Pictorial Review

Participants

Cynthia De la Garza Ramos, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. First trimester ultrasound (US) is key in establishing pregnancy viability, number, and location. 2. Early intrauterine pregnancy (IUP) sonographic milestones, including appearance of a gestational sac, yolk sac, embryo, and cardiac activity, follow a consistent timeline. 3. Prenatal genetic testing and sonographic fetal structural assessment serve as initial screening tools for chromosomal disorders and facilitate detection of patients who may benefit from subsequent amniocentesis, chorionic villous sampling, or fetal intervention. 4. Beta human chorionic gonadotropin ( $\beta$ -hCG) in combination with pelvic US can be used to evaluate early pregnancy complications, but threshold  $\beta$ -hCG values should not be used as a sole decision-making tool.

#### TABLE OF CONTENTS/OUTLINE

1. Review the indications for first trimester US. 2. Recognize the normal appearance of an IUP and identify the sonographic milestones of the first trimester. 3. Illustrate the components of a first trimester fetal anatomy scan. 4. Describe the current prenatal genetic screening recommendations for chromosomal defects and their relationship with US fetal anatomy, including nuchal translucency (NT) measurement. 5. Understand the role of  $\beta$ -hCG and its correlation with US findings in the evaluation of early pregnancy complications. 6. Review the Society of Radiologists in Ultrasound (SRU) consensus statement for diagnosing a nonviable pregnancy in the first trimester. 7. Identify US findings that may be associated with poor pregnancy outcomes and require follow-up. 8. Case Examples.

#### OBEE-52 Nothing Complex about Ovarian Lesions: Expert Guidance from the O-RADS US Committee

Participants

Catherine Phillips, MD, Nashville, TN (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Based on validation studies feedback, the Ovarian-Adnexal Reporting and Data System (O-RADS) US has been updated to address clinical application challenges, improve system specificity, harmonize with other consensus statements and O-RADS MRI. 2. New lexicon terms include bilocular for cystic lesions shadowing for smooth solid lesions, features which favor benignity and may improve specificity by down-scoring lesions. 3. Features of classic benign lesions were further refined to capture their typical appearance and also aim to improve specificity. 4. Updated surveillance and growth parameters optimize management better align with existing consensus statements. 5. Emerging data suggests O-RADS US 3 lesions are at the lower end of the risk of malignancy range (1- <10%); management recommendations have thus been updated to allow short-term US follow-up.

#### TABLE OF CONTENTS/OUTLINE

1. Clarification of updated O-RADS US v2022 governing concepts on applicability criteria, definitions/technique, and rules for system use with diagrammatic depictions illustrative examples. 2. Image rich example cases featuring new lexicon descriptors with an explanation of how their presence alters risk score assessment and management options. 3. Algorithmic approach to assessment and diagnosis using O-RADS US v2022 lexicon terms demonstrating ease use for daily clinical practice.

#### OBEE-53 Unusual Presentations of Common Female Pelvic Lesions

Participants

May Shaaban, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Uterine leiomyomas, uterine adenomyosis, ovarian mature cystic teratomas and endometriomas represent the most common

pathologies in everyday practice. They have characteristic imaging features that allow confident diagnosis. Occasionally these common lesions present with atypical features which makes it more challenging. Teaching points: Describe the classic imaging features of Uterine leiomyomas, uterine adenomyosis, ovarian mature cystic teratomas and endometriomas Describe unusual imaging features of variant or complicated lesions Provide differential possibilities based on the imaging features

#### TABLE OF CONTENTS/OUTLINE

Atypical leiomyomas: I. Degenerated and variant leiomyomas: 1. Cellular leiomyoma 2. Cystic degeneration 3. Myxoid degeneration 4. Red degeneration 5. Lipoleiomyoma II. Infected leiomyoma III. Torsion of leiomyoma IV. Prolapsed leiomyoma Atypical adenomyosis/adenomyomas: Focal adenomyosis (adenomyoma) Cystic adenomyosis Adenomyosis in pregnancy Exophytic adenomyoma Atypical endometriomas: Mural nodules and decidualization Malignant transformation Rupture Atypical presentations of dermoid cysts: Rupture Malignant transformation

#### OBEE-54 Medical Devices of the Female Pelvis: Multimodality Patterns, Pitfalls, and Pearls

##### TEACHING POINTS

Medical devices in the female pelvis are less frequently encountered than those in the chest or abdomen. Nevertheless, radiologist familiarity with these devices is critical for appropriate imaging evaluation. This exhibit reviews normal and abnormal radiologic presentations of medical devices commonly found in the female pelvis on multiple imaging modalities as well as examples of complications that may arise from device placement. Finally, we will present radiologic examples of device mimics that could lead to pitfalls in imaging evaluation.

#### TABLE OF CONTENTS/OUTLINE

Pessaries Pessary Mimic: Menstrual cup Pessary Mimic: NuvaRing Pessary Mimic: Tampon Intrauterine devices (IUDs) Essure devices Tubal ligation clips Embolization coils Ureteral stents Foley catheter Rectal tube

#### OBEE-55 Don't Be Fooled by Uterine Masses: How MRI Can Help You Spot Atypical and Malignant Impostors Among Leiomyomas

##### TEACHING POINTS

Review the specific MRI features of usual leiomyomas. Explain the known and emerging MRI features of atypical leiomyomas and describe how to differentiate them. Describe MRI characteristics of uterine sarcomas and compare them with those of leiomyomas. Develop a systematic image-based approach to recognize these entities.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Uterine anatomy - Clinical relevance - Definitions 2. MRI protocol 3. Usual leiomyomas - MR typical findings - Other RM signs: flow void sign, bridging vascular sign, high signal intensity rim on T2 4. Atypical leiomyomas: MR findings correlation with Histology 4.1. Atypical location- Subserosal - Submucosal 4.2. Degenerated leiomyomas- Hyaline degeneration - Myxoid degeneration - Red degeneration - Cystic degeneration 4.3. Histologic subtypes- Cellular leiomyoma - Lipoleiomyoma - STUMP 5. Uterine sarcomas: MR findings correlation with Histology 5.1. Uterine leiomyosarcoma 5.2. Endometrial stromal sarcoma 6. Differential Diagnosis 7. Conclusion

#### OBEE-56 3D Ultrasound - Troubleshooting in Gynaecological Imaging

Participants  
Sanchita Gupta, MBBS, MD, New Delhi, India (Presenter) Nothing to Disclose

##### TEACHING POINTS

The purpose of this exhibit is to -1) Provide information about system requirements and scanning techniques to obtain a standard 3D dataset, rendering and image reconstruction. 2) Explore newer techniques and software in 3D USG for improving diagnosis. 3) Know common clinical scenarios where 3D provides additional information over simple 2D USG.

#### TABLE OF CONTENTS/OUTLINE

1) 2D vs 3D ultrasound 2) System requirements for 3D dataset acquisition 3) Rendering and multiplanar reconstructions 4) Transvaginal 3D USG - Importance of the coronal plane 5) Newer techniques and software in 3D USG: - Walk thru mode - Virtual Hysteroscopy - 3D USG with Saline infusion sonography (SIS) - Translabial 3D USG - 3D Power Doppler - Endometrial volume calculation using VOCAL (Virtual Organ Computer-Aided Analysis) - Sono AVC (Automated volume calculation) 6) Common clinical scenarios where 3D imaging can help provide a diagnosis - Evaluation of the external and internal uterine contour 1) Congenital uterine anomalies 2) Subserosal and pedunculated fibroids deforming external contour 3) Submucosal fibroids deforming internal contour - Pathologies of the endometrial cavity 1) Identifying intrauterine adhesions 2) Locating polyps and Retained products of conception 3) Placement of Intra-uterine contraceptive devices - Assessment of endo-myometrial junction in adenomyosis and carcinoma endometrium

#### OBEE-57 How to Handle Hydrops

Participants  
April Griffith, MD, Salt Lake City, UT (Presenter) Nothing to Disclose

##### TEACHING POINTS

1: Hydrops fetalis is defined as the presence of fluid in two spaces - skin, pericardium, pleural space, peritoneal cavity. 2: The prognosis is generally poor due to lack of treatment options. 3: Fetal tachycardia and fetal anemia are treatable causes. Middle cerebral artery (MCA) Doppler is a non-invasive method to screen for fetal anemia which can be treated by intrauterine transfusion. 4: Fetal intervention may be lifesaving - shunt placement in large cysts in a lung mass, laser ablation for twin twin transfusion syndrome, radiofrequency ablation for twin reversed arterial perfusion sequence. 5: For some tumors (e.g., sacrococcygeal teratoma) elective preterm delivery with immediate resection is preferable to expectant management. The decision to deliver in such cases is based on multiple factors including the combined cardiac output calculated by echocardiography. 6: Some causes of hydrops can recur. Correct diagnosis of the cause is essential for management of current and future pregnancies.

#### TABLE OF CONTENTS/OUTLINE

1: Pitfalls in diagnosis of abnormal fluid locations. 2: Immune vs Non immune hydrops: Antibody screening, MCA Doppler velocimetry. 3: Cardiac - rhythm disturbance more likely than structural defects. 4: Genetic - Aneuploidy, syndromic. 5: Infection - Serology, growth restriction, hepatosplenomegaly, intracranial and abdominal calcifications. 6: High output states - Vascular malformation, vascular tumor, chorangioma. 7: Mechanical compression - Large lung mass, mediastinal mass. 8: Multiple gestations - Twin twin transfusion, monochorionic twin demise, twin reversed arterial perfusion. 9: Metabolic - Lysosomal storage disorders, gestational alloimmune liver disease.

#### **OBEE-58 A Headache Free Approach to Hydrocephalus**

Participants

April Griffith, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1: The prognosis for fetal ventriculomegaly depends on the underlying etiology thus a systematic approach is recommended. 2: Scan technique is critical to ensure correct measurements for grading (mild, moderate, severe) and tracking for progression over time. 3: Accurate diagnosis is essential for pregnancy management and delivery planning. 4: Some conditions with ventriculomegaly can recur in future pregnancies (e.g., autosomal recessive Walker Warburg syndrome). 5: Fetal MRI plays an essential role in characterizing the underlying pathology. 6: Isolated mild ventriculomegaly is a diagnosis of exclusion, generally associated with good intellectual outcome. It may be unilateral (usually left), in males.

##### **TABLE OF CONTENTS/OUTLINE**

A: Technique to measure ventricles - US and MRIB: Evaluate the posterior fossa: Exclude Chiari malformation, Dandy Walker syndrome, aqueductal stenosis, rhombencephalosynapsis C: Systematic assessment of the supratentorial brain: Midline: Is the falx present, is the cavum septi pellucidi normal? Cortical mantle: Gyral and sulcal development, thickness, symmetry, defects? Ventricles: Shape, lining, contents? D: Is there a mass? E: Is there a vascular malformation? F: Are there cystic areas? G: Perform a detailed anatomy scan to look for signs of syndromes, infection, aneuploidy, growth restriction and complications of monochorionic twinning.

#### **OBEE-59 Medical Devices in Female Genital System: What Radiologists Need to Know**

Participants

Guan Guan, MD, PhD, Guangzhou, China (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. To review the classification and function of medical devices in female genital system (uterus, vagina and adnexa). 2. To realize the normal, abnormal and special imaging findings of medical devices in female genital system. 3. To introduce complications related to medical devices in female genital system (including imaging appearance, diagnosis and differential diagnosis). 4. To learn assistance in imaging diagnosis of medical devices in female genital system.

##### **TABLE OF CONTENTS/OUTLINE**

1. Classifications of medical devices in female genital system (1) Medical devices of the uterus (IUDs, uterine suspension mesh, etc.); (2) Medical devices of the vagina (pessary, vaginal occluder, vaginal tamponade, etc.); (3) Medical devices of the ovary and adnexa (tubal ligation clips, ovarian suspension clips, etc.). 2. Medical devices of the uterus (1) Function and normal imaging appearance; (2) Abnormal imaging appearance and related complications; (3) Assistance in imaging diagnosis. 3. Medical devices of the vagina (1) Function and normal imaging appearance; (2) Abnormal imaging appearance and related complications; (3) Assistance in imaging diagnosis. 4. Medical devices of the ovary and adnexa (1) Function and normal imaging appearance; (2) Differential diagnosis of post-ovarian suspension findings (e.g. ovarian maldescent, supernumerary ovary); (3) Abnormal imaging appearance and related complications; (4) Assistance in imaging diagnosis.

#### **OBEE-6 Role of Fetal MRI in Antenatal Assessment of Central Nervous System Anomalies: What a Radiologist Should Know**

Participants

Smily Sharma, MD, MBBS, Jodhpur, India (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. To study the role of fetal MRI for antenatal assessment of various central nervous system anomalies including indications, added advantage over obstetric ultrasound as well as certain limitations. 2. To define a fetal MRI protocol for central nervous system assessment. 3. To learn about normal appearances of sulcation and gyration of brain at various periods of gestation and beware of MR pitfalls in fetal CNS imaging. 4. Using state of the art cases, to learn about myriad of CNS anomalies that can be detected in fetus, their syndromic and non-syndromic associations and their antenatal or postnatal follow up (wherever available).

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to fetal MR for antenatal central nervous system anomalies: Indications, advantages/ disadvantages and comparison with obstetric ultrasound 2. MR protocol to assess various central nervous system anomalies in fetus 3. MRI appearances of fetal brain at different periods of gestation (Pearls and Pitfalls) 4. Various CNS anomalies on fetal MRI with postnatal follow up wherever available: 4A. Fetal Ventriculomegaly 4B. Malformations of cortical development and midline brain anomalies 4C. Corpus Callosal Agenesis/ Dysgenesis and associations 4D. Posterior Fossa Malformations 4E. Neural Tube defects and Spinal Dysraphism 4F. Vascular anomalies 4G. Syndromic associations 4H. Miscellaneous CNS Disorders including ischemic insults, germinal matrix and intraventricular hemorrhage in fetus 5. Conclusion

#### **OBEE-60 Once in a Lifetime Gynecological Cases: Seen One, Seen Them All**

Participants

Ana Villanueva, MD, Toronto, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. To illustrate and review unusual gynecological cases, some of them with classic appearance as well as common gynecological

cases with rare presentation.2. Role of radiologist in evaluation of challenging gynecological cases.

#### TABLE OF CONTENTS/OUTLINE

1. Background How do abdominal radiologists like to report gynecological cases? And what about general radiologists? Many colleagues say that they find themselves in trouble when reporting these cases. And why is that? Probably it is a combination of lack of knowledge or experience; not familiar reporting different techniques TV US, CT and MRI; etc. We as radiologist look for entities that we know. If we do not know about a disease, we will not think about it and therefore we will not reach a correct diagnosis. However, there are certain entities that even they are challenging because they are uncommon, they have a classic appearance (for example malignant adenoma of the cervix). Once you see one case, you will not forget. Also, common gynecological diseases can present in a very unusual way (for example ileal and appendiceal endometriosis without pelvic endometriotic findings). 2. Identification of characteristic imaging features • Different imaging techniques will be shown: Transvaginal US, CT, MRI • To propose key points to accurately reach the diagnosis • Algorithm of differential diagnosis based on imaging features along with relevant clinical and analytical information 3. Understand the clinical and treatment implications of diseases with characteristic radiologic appearance 4. Radiologic- pathologic correlation will be shown for most of the cases 5. Conclusion 6. References

#### OBEE-61 First Trimester Ultrasound (FTUS): Screening Techniques

##### TEACHING POINTS

Increased nuchal translucency (NT) remains an internationally recognized indication for invasive testing (amniocentesis or CVS). By the end of this educational exhibit, the reader/listener would be able to: 1. Understand the various screening policies for chromosomal abnormalities utilized in the first trimester (Combined screening vs Contingent screening policies). 2. Learn about the importance and technique of measuring NT in the first trimester. 3. Learn about new ultrasound markers utilized in first-trimester screening. 4. Identify important fetal structural abnormalities and their significance system-wise. 5. Algorithmically co-relate first-trimester ultrasound findings to the next steps in the screening process.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to FTUS 2. Combined screening vs Contingent screening for chromosomal abnormalities 3. Nuchal translucency (NT) i. Significance and efficiency ii. The technique of measuring NT 4. New FTUS markers i. Nasal bone ii. Tricuspid flow iii. Ductus Venosus flow 5. Cell-free DNA (cfDNA) i. The utility of cfDNA in relation to FTUS- When to use and when NOT to use? ii. Advantages and limitations of cfDNA compared to FTUS 6. Fetal structural abnormalities NOT to miss in FTUS i. CNS abnormalities ii. GI and GU abnormalities iii. Skeletal abnormalities iv. Cardiac abnormalities 7. Summary

#### OBEE-62 The Hidden Enemy: A Visual Journey Through Ovarian Tumor Imaging

Participants

Sofia Maksoud, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Ovarian tumors are classified according to their origin: epithelial cell tumors, germ cell tumors, sex cord-stromal tumors and metastatic tumors. Among them, epithelial tumors are the most common, with a higher prevalence between 60 and 70 years of age. Imaging exams have the capability to predict the risk of malignancy: mural nodules, papillary projections, solid components, thickened walls and septa (greater than 3.0 mm) with associated vascularization are some aspects that suggest malignancy, while of fat components suggests benignity. Pelvic ultrasound is commonly the first exam to be performed due to its high availability and low cost. However, for adequate characterization of the ovarian mass, additional tests such as magnetic resonance imaging may be requested, with the aim of helping to distinguish between benign and malignant tumors and, mainly, in staging and surgical planning. The results of radiological examinations associated with the clinical features, family history and laboratory tests allow the diagnosis of ovarian lesions. A thorough evaluation provides part of data that may be associated with the histology of these tumors. This information plays a fundamental role in choosing the appropriate therapy.

#### TABLE OF CONTENTS/OUTLINE

To demonstrate cases of malignant and benign ovarian tumors and to review their presentations in different imaging modalities, including pelvic ultrasonography and magnetic resonance imaging, correlating with anatomopathological results and surgical specimens.

#### OBEE-63 Placenta Accreta Spectrum and the Emergence of MRI

Participants

Leslie Nelson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Placenta Accreta Spectrum (PAS) refers to abnormal placental adherence and/or invasion into the uterine wall due to a defective decidualization process. Difficult placental separation can cause life threatening peripartum hemorrhage if not diagnosed prenatally. 2. The prevalence of PAS has increased 10-fold over the last 4 decades and has been linked to increased rate of cesarean deliveries. 3. Ultrasound is the first line modality for placenta imaging, however, MRI is an emerging modality that provides superior soft tissue contrast and is vital for surgical planning in Placenta percreta. 4. In 2020, SAR and ESUR published a joint consensus statement to standardize MRI acquisition, interpretation and reporting of PAS. 5. This educational exhibit will help the learner understand and identify the described MRI signs associated with PAS and their pathophysiologic subcategories.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of PAS 2. Compare and contrast use of ultrasound versus MRI 3. Normal MRI appearance of the placenta 4. Review of the MRI features described by SAR and ESUR joint consensus statement 5. Review the three pathophysiological oriented classifications (gross morphologic signs, interface signs and tissue architecture signs) 6. Review pathology proven cases (accreta, increta and percreta)

#### OBEE-64 CT Imaging of the IUD: Expected Findings, Unexpected Findings, and Complications

Participants

Grace Zhu, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

After viewing this exhibit, the reader will be able to: 1. Understand the approach in evaluating the CT appearance of an intrauterine device and recognize a normally positioned intrauterine device. 2. Recognize the CT imaging appearance of wide spectrum of complications involving the intrauterine device.

#### TABLE OF CONTENTS/OUTLINE

Outline: 1. Introductiona. Types of IUDsb. Approach to evaluating IUDs on CTc. Normal Imaging appearance of an appropriately positioned IUD2. Complicated IUDsa. Malpositioned IUDi. Low lying IUDii. Intracervical IUDiii. Rotated IUD/Upside Down IUDb. Embedded IUDc. Extrauterine IUDd. Fragmented IUDE. Pregnancy and IUDi. Ectopic pregnancyii. Intrauterine pregnancyf. Miscellaneousi. Actinomycoses and IUDsii. Fibroids and IUDSiii. Mullerian abnormalities and IUDs

#### OBEE-65 To Treat, or Not to Treat, That is the Question: Multimodality Approach to Secondary Post Pregnancy Hemorrhage

#### TEACHING POINTS

- Secondary post pregnancy hemorrhage occurs 24 hours to 12 weeks following delivery. Etiologies include retained products of conception (RPOC), subinvolution of the placental site (SIPS), arteriovenous malformation/arteriovenous fistula (AVM/AVF) spectrum.- Ultrasound is often a first line imaging modality in the identification of causes of secondary post pregnancy hemorrhage. However, CT and MRI may also be used in the imaging work up. Recognizing key features of each etiology is essential to timely diagnosis and clinical management.- Certain pathology may mimic causes of secondary post pregnancy hemorrhage such as endometritis and gestational trophoblastic disease.

#### TABLE OF CONTENTS/OUTLINE

- Explanation of causes, pathophysiology, and management of secondary post pregnancy hemorrhage including RPOC, SIPS, and AVM/AVF- Case-based, multimodality imaging review of secondary post pregnancy hemorrhage including US, CT, and MRI with discussion of management options- Imaging review of mimics of retained products of conception including endometritis and gestational trophoblastic disease- Proposed algorithmic approach to management of secondary post pregnancy hemorrhage based on imaging findings and how to differentiate from mimickers

#### OBEE-66 Malignant Transformation of Endometriosis and Its Mimics

Participants

Cesar Resino Sanchez, PhD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the types of malignant transformation of endometriosis, taking into account the typical and atypical locations. 2. To recognize the usefulness of magnetic resonance imaging (MRI) in the early diagnosis of malignant transformation of endometriosis. 3. To describe forms of presentation of endometriosis that can simulate malignant transformation.

#### TABLE OF CONTENTS/OUTLINE

Definition, types and typical and atypical locations of endometriosis. Pathological mechanisms of malignant transformation: genomic alterations, oxidative stress, inflammation, and hormonal influences. Types of ovarian tumors in endometriosis (endometrioid adenocarcinoma and clear cell carcinoma as the most frequent). Optimal protocol and MRI findings suggestive of malignancy: appearance of enhancing intramural nodules, enlargement of the endometrioma and disappearance of shading sign on T2-weighted images. Imaging findings in cancers arising from extraovarian endometriosis. Malignancy simulators: decidualization during pregnancy, polypoid endometriosis, extraovarian endometriosis mimicking peritoneal carcinomatosis, etc.

#### OBEE-67 Hysterosalpingography: What's Current and What's Next

Participants

Erica Cruz, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Hysterosalpingography is an exam with consolidated use in medical practice, with well-established indications and contraindications in the literature. The main indications for the exam are: human reproduction (infertility), preoperative uterine fibroids, repeat abortions and reversal of tubal ligation. Although new technologies and imaging methods have been developed in the past years, it currently persists as the method of choice and gold standard for evaluating the thickening of the mucous pleats of the fallopian tube. The objective of this study is to provide a didact review of hysterosalpingography, from the examination technique to its main findings, since the images acquired's quality depends on the correct preparation and technique. We also provide a comparative study of hysterosalpingography with other emerging imaging methods, such as magnetic resonance hysterosalpingography (HSG-MRI) and hysterosonosalpingography, with future perspectives related to these methods.

#### TABLE OF CONTENTS/OUTLINE

Case-based review of hysterosalpingography exams, including the technique, most common findings and pitfalls, with a literature review, teaching points, and references. We also provide correlation with other imaging methods, such as ultrasonography and magnetic resonance imaging (MRI).

#### OBEE-68 Highlighting the Updates in Mid-Trimester Fetal Ultrasound Scan According to the Updated International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) Practice Guideline

#### TEACHING POINTS

The mid-trimester ultrasound scan is performed for anatomic evaluation of the fetus and is accepted as a part of routine prenatal care by many countries. The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) published a guideline for the performance of the routine mid-trimester fetal ultrasound scan in 2011 and updated the guideline in 2022. According to these guidelines, a routine mid-trimester fetal ultrasound examination should include an evaluation of the cardiac activity; fetal number

(and chorionicity and amnionity in cases of multiple pregnancy); gestational age/fetal size; basic fetal anatomy; placental appearance and location. In the updated ISUOG guideline, amniotic fluid volume assessment and measurement of cervical length for prediction and prevention of preterm birth are also recommended. Pregnancies in which the umbilical cord inserts into the amniotic membranes (velamentous cord insertion) or at the edge of the placenta (marginal cord insertion) should be reported. Suggested minimum (and optional) requirements for the fetal anatomic survey were also updated and will be discussed in the exhibition. Technical challenges to obtaining these standard images will also be discussed.

#### TABLE OF CONTENTS/OUTLINE

The suggested basic mid-trimester fetal anatomic survey according to ISUOG is updated in 2022. Knowledge of minimum and optional requirements according to the current guideline is important for the appropriate evaluation of the fetus. This exhibit aims to highlight the updates as well as remaining unchanged requirements with ultrasound images.

#### OBEE-69 Postmenopausal Endometriosis: Clinical Insights and Imaging Considerations

##### TEACHING POINTS

- Postmenopausal endometriosis is estimated to affect around 2-4% of women and is more commonly seen in patients undergoing hormone replacement therapy.
- There is no current guidelines for management of postmenopausal women with endometriosis.
- Transvaginal ultrasound and magnetic resonance imaging are the primary imaging modalities for assessing extent of endometriosis.
- Imaging findings will demonstrate a predominance of the fibrotic component associated with anatomical distortion.

#### TABLE OF CONTENTS/OUTLINE

- To review the clinical presentation of endometriosis in the postmenopausal population
- To understand how hormonal status affects the pathogenesis of endometriosis, including both exogenous and endogenous sources
- To use a case-based approach to illustrate the sonographic and MRI findings of endometriosis in patients undergoing hormonal replacement therapy, as well as in those who are not undergoing hormonal treatment. Laparoscopic correlation will be included, when available.
- To describe the risk of malignant transformation for specific lesions such as endometriomas and deep invasive lesions, while using cases to demonstrate imaging features of neoplasm.
- To explore proposed non-invasive screening imaging methods.

#### OBEE-7 Hysterosalpingography and Infertility: Beyond Tube Obstruction

Participants

Leticia Cardoso Em, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The causes of infertility can be genetic or acquired. When anatomically compartmentalized, it is possible to determine some groups of causes: uterine, tubal, ovarian, and central (pituitary and hypothalamic). Hysterosalpingography (HSG) is a contrast-enhanced examination of the female genital tract that uses serial radiographs to assess uterine and tubal anatomy. It is known to be the first-line test for assessing tubal obstruction, as it can determine the local anatomy in a relatively simple and inexpensive way. There are several other findings that HSG can offer and suggest diagnoses of other causes of infertility, such as endometriosis, adenomyosis, Müllerian duct malformations, and uterine synechiae. By the end of this study, the reader will be able to define the importance of fluoroscopy in the investigation of infertility, understand the methodology of HSG and identify its causes based on imaging findings.

#### TABLE OF CONTENTS/OUTLINE

Define the role of imaging exams in the investigation of infertility; Determine the methodology of HSG and its usefulness; Explain the causes of infertility and illustrate their compatible findings in HSG through image examples.

#### OBEE-70 From the Pathology Lab to the Radiology Suite: Navigating Neuroendocrine Tumors of the Female Reproductive System

Participants

Ana Bavaresco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Mayara Dos Santos Cruz, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

To present a rare subtype of gynecological tumor, the Neuroendocrine gynecological tumors (NEG). To review clinical-pathological features of NEG, highlighting the pathologic differences between NEG and non-NEG cancers. To expose the aggressive clinical behavior of NEG tumors by evolutive imaging examples and well-documented cases, with emphasis on the radiological role for staging and follow-up. To become aware of the different prognostic data between NEG and non-NEG tumors with a brief overview on the suggested treatment.

#### TABLE OF CONTENTS/OUTLINE

Neuroendocrine gynecological tumors can dramatically affect the cervix, ovary, endometrium, vagina, and vulva. As extremely rare tumors, studies on NEG are scarce and most are based on case reports. Although the imaging features are non-specific for diagnosis, imaging is quintessential in staging, treatment response assessment, and surveillance. To demonstrate with clinical cases, imaging exams, and temporal evolution the regional and advanced involvement of NEG. Review in a didactical way the disease-related pathology, and its differentials, based on illustrations, pathology / immunohistochemistry analysis. Case-based discussion and review of the essential information for the radiological report, that will imply the follow-up and treatment of the patient. Discuss the clinical prognosis associated with the disease, and demonstrate briefly the limitations related to the therapies available.

#### OBEE-71 Many Faces of Uterine Fibroids: Imaging Findings of Degenerations, Differential Diagnoses, and Complications

Participants

Shintaro Ichikawa, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Uterine fibroids are benign tumors composed of smooth muscle and are the most common tumors in gynecology. Because uterine fibroids tend to produce different symptoms depending on their site of origin, accurate assessment of the site and size of the fibroids using diagnostic imaging is required. Although typical uterine fibroids are easy to diagnose using imaging, there are a variety of degenerations, and it is important to know the characteristics of each.

#### TABLE OF CONTENTS/OUTLINE

The following typical and degenerated uterine fibroids are discussed along with their key imaging findings: 1. Typical fibroids (intramural, subserosal, submucosal, and cervical) 2. Hyaline degeneration 3. Hydropic degeneration 4. Myxoid degeneration 5. Fatty degeneration 6. Red degeneration The following differential diagnoses and complications are discussed, along with their key imaging findings: 1. Uterine lipoleiomyoma 2. Hypercellular uterine fibroid 3. Uterine leiomyosarcoma 4. Focal adenomyosis 5. Low-grade endometrial stromal sarcoma 6. Submucosal uterine fibroid prolapse into the vagina (vaginal delivery) 7. Uterine intravenous leiomyomatosis 8. Peritoneal leiomyomatosis following uterine fibroid morcellation 9. Rupture of fibroid 10. Torsion of subserosal fibroid 11. Infection of fibroid

#### OBEE-72 Comprehensive Imaging of Pelvic Medical Devices: Beyond IUDs

##### TEACHING POINTS

Recognize the usual appearance of the main pelvic devices in different imaging methods (Radiographic, Ultrasound, CT and MRI): Vaginal tampon Menstrual cup Contraceptive devices (IUDs, Female sterilization device, Vaginal ring) Therapeutic devices (Pessaries, Brachytherapy applicator, etc) Post-surgical devices (Suture artifacts, catheters, etc) How to assess the proper placement of the most common pelvic devices and what points and measurements should be included in the report Recognize the main complications related to Intrauterine contraceptive devices (IUDs) displacement

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION Main pelvic devices and their radiographic features How to assess correct placement of pelvic devices and practical points COMPLICATIONS RELATED TO INTRAUTERINE CONTRACEPTIVE DEVICES DISPLACEMENT. Case based Review of:- Displacement- Embedment- Complete perforation

#### OBEE-73 Piecing Together the Puzzles: Imaging Diagnostic Approach to Genetic Diseases Affecting the Female Reproductive Organs and Beyond

Participants

Tsukasa Saida, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The genetic links to various tumors have become more apparent, and it is crucial for radiologists to understand them in order to make an accurate diagnosis and establish an appropriate testing strategy. This exhibit will describe the genetic diseases associated with neoplastic lesions in gynecology, including the specific characteristics of each tumor and lesions that occur in other regions of the same disease. The teaching points of this exhibit are: 1. Description of the inheritance pattern and characteristics of each genetic disease 2. Presentation of key imaging findings that contribute to the diagnosis of various genetic diseases

#### TABLE OF CONTENTS/OUTLINE

A. Inheritance pattern B. Characteristics of the genetic disease C. Imaging features of gynecologic tumors associated with genetic diseases D. Imaging features of lesions that occur in other regions of the body

#### OBEE-74 Hystero-Salpingography in Current Clinical Practice - Old Flames, Die Hard!

Participants

Nitin P. Ghonge, MD, New Delhi, India (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. To review the clinical status of Hysterosalpingography [HSG] in infertility work-up in the current era of cross-sectional imaging. 2. To revisit the nuances of HSG procedure and image interpretation for better understanding of uterine, tubo-ovarian and peritoneal lesions in these patients. 3. To understand the spectrum of findings on the initial HSG study and impact on the subsequent infertility work-up.

#### TABLE OF CONTENTS/OUTLINE

1. Status of HSG in current clinical practice as an initial first-line investigation for infertility work-up. 2. Procedural nuances in HSG and the image interpretation skills play an important role in diagnostic accuracy of HSG in patients with infertility and the overall utility. 3. Implications of slow continuous injection of contrast with acquisition of standard set of images: early filling phase, late distended phase, peritoneal spillage phase and post-cannula removal phase. 4. Review of basic principles in Radiation hygiene as applicable to HSG. 5. Image interpretation includes evaluation of endometrial cavity in terms of shape, distension and the mucosal surface. Tubal and peritoneal evaluation is not restricted to contrast spillage alone. Apart from tubal patency, evaluation of tubal mucosa is an important component of tubal evaluation. Apart from the tubal opacification and luminal caliber, the course of fallopian tubes should also be carefully evaluated as it provides vital clues about the status of peri-tubal peritoneum and peritubal adhesions.

#### OBEE-75 Hereditary and Non-Hereditary Syndromes with Gynecologic Manifestations: What the Radiologist Needs to Know

Participants

Ekta Maheshwari, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. A number of key hereditary and non-hereditary syndromes are associated with gynecologic manifestations. 2. Awareness of these syndromes and their associations is integral to optimal patient management, facilitating recommendations for ancillary imaging and follow up.



## TABLE OF CONTENTS/OUTLINE

Hereditary Cancer Predisposition Syndromes Some examples of hereditary cancer predisposition syndromes include Lynch syndrome (mismatch repair genes), Cowden Syndrome (PTEN), hereditary breast and ovarian cancer syndrome (BRCA1/ BRCA2), Peutz-Jeghers syndrome (STK 11) and hereditary leiomyomatosis and renal cell cancer syndrome (FH). These syndromes can predispose individuals to distinct uterine and ovarian neoplasms. Congenital Syndromes with Benign associations • Gynecologic manifestations observed in multiple congenital and acquired syndromes can also be associated with benign entities • Congenital malformation of the reproductive tract can be seen in Mayer-Rokitansky-Küster-Hauser syndrome. Familial clustering of these cases suggests a genetic basis of inheritance. Acquired Syndromes Acquired syndromes with gynecologic manifestations include • Meig's syndrome • Ovarian hyperstimulation syndrome • Ovarian remnant syndrome • Fitz-Hugh-Curtis syndrome • Growing teratoma syndrome AIMS • Summarize and illustrate imaging findings observed for key hereditary and non-hereditary syndromes associated with gynecologic manifestations, including features of malignancy and those features overlapping and mimicking malignancy. • Describe the clinical implications, most current imaging recommendations and screening and surveillance guidelines for these syndromes.

### OBEE-8 Quantification in Fetal MRI: Why, When, and How

Participants

Haithuy N. Nguyen, MD, Los Angeles, CA (*Presenter*) Research Grant, Siemens AG

#### TEACHING POINTS

1. Recognize the fetal abnormalities that require a radiologist to use the measuring tool. 2. Understand the impact of measurements on prognostication and/or family counseling. 3. How to correctly perform the measurements and compare to previously published normative values or thresholds.

## TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Why, when, how to measure lung volumes - Congenital diaphragmatic hernia (CDH), congenital lung malformation, giant omphalocele, anhydramnios, skeletal dysplasia, and cervical teratoma. 3. Why, when, how to measure tracheoesophageal displacement index and tumor volume to fetal weight ratio for cervical and sacrococcygeal teratomas, respectively. 4. Why, when, how to measure liver volumes - CDH. 5. Future work - lung signal ratios, estimating CDH defect size, open neural tube myelomeningocele sac size, and amniotic fluid maximum vertical pocket.

### OBEE-9 Imaging Cervical Cancer: Beyond Diagnosis

#### TEACHING POINTS

Abdominal imaging plays an essential role in the contemporary management of cervical cancer. MRI is a key imaging modality due to excellent tissue contrast resolution, enabling superior accuracy for tumor size, parametrial and pelvic sidewall invasion and evaluation of nodal metastases, all of which are key prognostic factors for cervical cancer. 18F-FDG-PETCT is essential in the assessment of advanced stage disease to evaluate for distant metastasis and can also aid in the detection of involved locoregional lymph nodes. Imaging also plays an integral role in brachytherapy treatment planning and execution. Ultrasound, MRI, CT and, on occasionally radiography, are used for guidance of brachytherapy applicator placement and to confirm appropriate implant positioning prior to the delivery of therapeutic radiation. Imaging is integral in the post-treatment surveillance to detect treatment-related complications and identify recurrent disease.

## TABLE OF CONTENTS/OUTLINE

Review the current FIGO staging system of cervical cancer and illustrate the role of imaging as it relates to stage determination and stage-specific treatment options. Demonstrate the role of imaging for brachytherapy treatment planning and execution, including structured reporting recommendations for brachytherapy implant assessment. Illustrate expected post-therapy imaging findings and the role for MRI, PETCT and CT. Show imaging findings of common and uncommon post-therapy complications. Illustrate cases of recurrence vs. expected benign post treatment changes.

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## Abstract Archives of the RSNA, 2023

OBEE-1

### Isthmocele: A Simplified Guide

#### Participants

Isabela Ferracini, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Isthmocele may be present in 24-69% of women evaluated with transvaginal ultrasound and may be the cause of several clinical dysfunctions: dysmenorrhea, abnormal uterine bleeding, obstetric complications and perhaps even subfertility. When found in an ultrasound examination, there are several criteria to be considered. Accurate reporting of the description and measurement of this area in ultrasound examinations becomes important not only for research, but also for the clinical approach and planning of surgical treatment and to standardize the language in the documentation of the examination and the performance of reports. The objective of this work is to carry out a didactic review of how to examine an isthmocele in non-pregnant women, based on the first European consensus.

#### TABLE OF CONTENTS/OUTLINE

A literature review was carried out and cases of ultrasound, magnetic resonance imaging and hysterospingography obtained from the digital archive of our institution. We approach a didact review of the imaging aspects and how to measure them adequately, including teaching points and additional cases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

OBEE-10

### Diaphragmatic Endometriosis: A Breathtaking Challenge

#### Participants

Nathalie Burger, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) This study aims to demonstrate MR's feasibility and accuracy in detecting diaphragmatic endometriosis, which can cause long-standing disability and pain, negatively impacting quality of life. 2) Symptomatic diaphragmatic endometriosis is part of thoracic endometriosis syndrome, usually diagnosed later than pelvic endometriosis. The symptoms include chest pain, shortness of breath and coughing, worsening during menses, and associated with pneumothorax and phrenic nerve irradiation. 3) Endometrial cells follow peritoneal circulation through the right paracolic gutter towards the right subdiaphragmatic area, where they can aggregate and form nodules, favored by a preferred stagnation site in the posterior portion of the right side of the diaphragm. 4) MR allows high-sensitivity diagnosis of diaphragmatic endometriosis, offering better characterization of hemorrhagic lesions on fat-suppressed T1-weighted sequences and requiring no radiation exposure. 5) Diaphragmatic lesions present hyperintense nodules on fat-suppressed weighted sequences. Herniation is less frequent and can result from repeated proliferation, bleeding, and necrosis of endometriotic lesions leading to fenestrations and partial or complete diaphragmatic rupture.

#### TABLE OF CONTENTS/OUTLINE

1) Know What You're Dealing With: Anatomy and main symptoms 2) Active Search: MRI Protocol 3) Behold the visual representation of diaphragmatic lesions on magnetic resonance 4) What information should the gynecologist look for in the report? 5) Pearls and pitfalls in the differential diagnosis.

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## Abstract Archives of the RSNA, 2023

OBEE-11

### Unfolding Endometriosis Clinical Cases Controls: What to Look For

#### Participants

Brainer Brandao Salomao, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Endometriosis is a chronic disease that impacts women from adolescence to menopause. Treatment options can vary from hormonal suppression to radical surgery and should be individualized and personalized. This educational exhibit presentation aims to: Discuss the clinical management of endometriosis including the different drugs available; Discuss the imaging methods available for hormonal treatment controls; Discuss imaging findings of endometriosis clinical controls.

#### TABLE OF CONTENTS/OUTLINE

To discuss the available drugs used in the clinical management of endometriosis, including its mechanisms of action and therapeutic efficacy, such as: Combined oral contraceptives; Selective estrogen receptors modulators; Hormonal intrauterine device (IUD); Progestins; Selective progesterone; GnRH agonists; Oral GnRH antagonists; Aromatase inhibitors; Review clinical cases undergoing medical treatment and the correlation between clinical response and imaging findings in different sites such as: Retrocervical disease; Deep endometriosis with myometrial infiltration; Endometriomas; Intestinal lesions; Diafragmatic lesions; To discuss genetic and immunological aspects that can interfere with clinical response.

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## Abstract Archives of the RSNA, 2023

OBEE-12

### Uterine Sarcomas: Update on Pathologic and Imaging Findings

#### TEACHING POINTS

Demonstrate the imaging features that favor the diagnosis of uterine sarcomas and the particularities of each subtype; review staging and the role of imaging in monitoring response and suspected recurrence. Recognize their mimickers.

#### TABLE OF CONTENTS/OUTLINE

Gynecologic sarcomas are rare tumors and usually have an unfavorable prognosis. Magnetic resonance imaging (MRI) is the best method for characterization of these tumors, initial staging and treatment planning. MRI shows features that can be used to try to differentiate between subtypes of uterine sarcomas. Combined DWI and DCE techniques allow more accurate assessment of the degree of myometrial and cervical invasion and characterization of potential metastatic sites. Although several findings increase the suspicion of malignancy in gynecologic tumors (including irregular contouring, intratumoral necrosis/hemorrhage, and low ADC values), some particular features may suggest the diagnosis of sarcoma, such as macroscopic lymphovascular invasion in cases of endometrial stromal sarcomas, the "bag of worms" aspect of low-grade endometrial stromal sarcoma, and the "lattice-like" appearance of adenosarcomas that result from the mixed composition of solid and cystic multiseptate components. Their diagnosis remains a challenge in the radiologist's practice.

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## Abstract Archives of the RSNA, 2023

OBEE-13

### Imaging in Pregnancy: Safe and Sound With Contrast-Enhanced US

#### Participants

Stephanie Nguyen, MD, MSc, Calgary, AB (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

(1) Contrast-enhanced US (CEUS) is safe in pregnancy (2) Microbubble contrast agents do not cross the placental barrier (3) CEUS in pregnancy is an effective alternate to CT and MRI when enhanced imaging is required (4) A major indication is in the determination of malignancy when masses anywhere in the abdomen or pelvis are found in a pregnant patient (5) Ability of CEUS to differentiate benign from malignant processes allows prompt diagnosis and management with significant implications on maternal and fetal outcomes (6) CEUS is capable of evaluating more than one organ in any patient

#### TABLE OF CONTENTS/OUTLINE

(1) Review of the safety record of CEUS in pregnancy (2) CEUS technique in the pregnant patient (3) Case examples (3a) Malignant lesions (3b) Benign diseases (3c) Assessment of acute pain in pregnancy

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## Abstract Archives of the RSNA, 2023

OBEE-14

### Beyond the Scar: A Comprehensive Guide to Postoperative Endometrioses Imaging

#### Participants

Sofia Maksoud, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Endometriosis affects approximately 176 million women worldwide, with a prevalence of one in ten women during the reproductive period. Treatment can be clinical or surgical. The main surgical indications include clinical failure, lesions in the appendix, small bowel lesions, intrinsic ureter involvement and rectosigmoid (greater than 50% of the circumference). The goals of surgery include radical removal of all lesions and the restoration of normal pelvic anatomy. Postoperative evaluation is the new challenge of imaging studies, as the number of radical surgeries to treat endometriosis has increased enormously. Radiologists must be familiar with the common imaging findings, possible complications and the differentiation between residual disease and fibrotic scar.

#### TABLE OF CONTENTS/OUTLINE

- Review the common post-surgical findings following surgery for deep endometriosis.- Differentiate residual / recurrence disease and fibrotic scar. - Illustrate didactical cases with pre and post-surgical imaging.- Be familiar with possible complications after surgery.

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## Abstract Archives of the RSNA, 2023

OBEE-15

### What Not to Miss in Obstetric Ultrasounds - Multifetal Pregnancies: Chorionicity and Amnionicity

#### Participants

Laura Santiago Caobi, Ponce, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the embryologic division in multifetal pregnancies and its significance for prenatal care. - Discuss the criteria for the classification of twin pregnancies using ultrasounds. - Provide case examples for classic imaging for each type of multifetal pregnancy. - Use an algorithm to assist in ultrasound monitoring and surveillance of multifetal pregnancies.

#### TABLE OF CONTENTS/OUTLINE

Multifetal pregnancies pose a significant risk for adverse outcomes compared to singleton pregnancies. Early and accurate diagnosis requires a comprehensive understanding of chorionicity and amnionicity. Ultrasound evaluation of placental number, interposed membranes, fetal genders, amniotic fluid volume, and presence of lambda sign are key for successful assessment of chorionicity and amnionicity. The use of an algorithm for ultrasound monitoring and surveillance of multifetal pregnancies can aid facilitate early interventions that will benefit the health of both, mother and fetus. Outline: (1) Introduction Objectives, (2) Multifetal Pregnancies, (3) Division Timing, (4) Classic Imaging Findings for Each Type of Multifetal Pregnancy, (5) Ultrasound Criteria for Diagnosis of Type of Multifetal Pregnancy, (6) Comparison of Fetal and Infant Mortality Rates, (7) Algorithm for Ultrasound Monitoring and Surveillance, (8) Case Examples, (9) Conclusion

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## Abstract Archives of the RSNA, 2023

OBEE-16

### Don't Forget the Bowel: Imaging Techniques, Associations and Treatment Implications of Bowel Endometriosis

#### Participants

Haatal Macer, MD, MS, Rolling Hills Estates, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. As the GI tract is the most common extragenital organ involved with endometriosis, imagers need to actively look for bowel involvement. Therefore, our exhibit will highlight the associations of bowel endometriosis leading imagers to actively look for bowel implants. 2. Practical tips on Ultrasound and MRI technique of bowel endometriosis imaging and how to improve lesion detection. 3. Discussion of detailed assessment of large and small bowel involvement with implications on management, especially related to pain and fertility, will be highlighted.

#### TABLE OF CONTENTS/OUTLINE

1. Background of GI tract endometriosis. 2. Associations: Incidence and prevalence with ovarian endometriomas; deep pelvic endometriosis especially with posterior compartment (rectovaginal and uterosacral ligament) involvement. 3. Ultrasound Technique: Bowel preparation; transvaginal technique for delineating normal anatomy and pathology; tips on separating bowel layers on ultrasound enabling detection of depth of muscle invasion. 4. MR Enterography: bowel preparation; role of antispasmodics; MR protocol favoring detection of appendiceal, ileocecal junction, small bowel and rectosigmoid deep endometriosis. 5. Detailed anatomic reporting of small and large bowel disease that have implications on management, particularly related to pain and fertility.

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## Abstract Archives of the RSNA, 2023

OBEE-17

### Unmasking Atypical Adenomyosis: Imaging Spectrum with Laparoscopic and Pathologic Correlation

#### Participants

Brainer Brandao Salomao, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Adenomyosis is a prevalent gynecologic condition defined by the presence of endometrial glands and stroma within the myometrium. 2. It remains poorly understood with severe implications on fertility and quality of life. 3. Although there is no agreement on the imaging classification of adenomyosis, the typical features are more discussed and widely known. 4. MUSA statement consensus is an important available tool to recognize and describe the typical forms of adenomyosis on ultrasound. 5. Atypical presentations of adenomyosis are less discussed, remaining a diagnostic challenge. 6. This presentation aims to review imaging findings of atypical adenomyosis, highlighting their potential differential diagnosis, as well as their impact on clinical management and patients outcome.

#### TABLE OF CONTENTS/OUTLINE

- Overview of adenomyosis. - Review imaging-based adenomyosis classification. - Ultrasound and MRI imaging findings of atypical adenomyosis, including: Solid adenomyoma; Cystic adenomyoma; Submucosal adenomyoma; Subserosal adenomyoma; Accessory cavitated uterine mass; Polypoid adenomyoma; Adenomatoid tumor. - Differential diagnosis, such as: Adenosarcoma; Cystic / hemorrhagic degeneration of leiomyoma; Cellular degeneration of leiomyoma; Isthmocele; Unicornuate uterus. - Present clinical cases with laparoscopic and pathological correlation. - Summary of key concepts.

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## Abstract Archives of the RSNA, 2023

OBEE-18

### Exploring the Pelvic Floor through MRI - A Comprehensive Trainee's Handbook

#### Participants

Jessica A. Marques Silva, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) This review highlights the benefits and recent updates in defecography, a radiological examination used to evaluate patients with defecatory and pelvic floor dysfunction. This functional anatomical condition affects support structures and is more common in women over 50 years old. 2) MR defecography evaluates multicompartamental dysfunction, etiologies of defecation dysfunction, and postoperative complications and recurrence, providing both anatomical and functional information while allowing simultaneous assessment of the anal sphincters. 3) Most patients present changes in more than one compartment, and the reoperation rate after initial pelvic floor surgery is high. Understanding changes in various compartments can contribute to reducing the need for reapproaches. 4) Examples of pathologies found in defecography include cystocele, urethral hypermobility, uterine and vaginal prolapse, background hernias, and intussusception. This review discusses the implications of these findings for clinical practice.

#### TABLE OF CONTENTS/OUTLINE

1) 1) General Aspects: A Little Bit of Everything; 2) Essential MR Protocol - What you need to remember; 3) Assessing the dynamic study on MR; 4) MR images evaluation - Is defecating three times really necessary?

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## Abstract Archives of the RSNA, 2023

OBEE-19

### Adeno-My-Goodness: Comprehensive Review of Adenomyosis

#### Participants

Paulo Miro, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Adenomyosis is a prevalent condition which may cause symptoms (such as abnormal uterine bleeding and pain), and affect pregnancy outcomes. Ectopic endometrial glandular tissue within the uterine myometrium with associated smooth muscle hypertrophy may have a variety of appearances across the imaging modalities. Imaging findings may be further confounded by hemorrhage or development of myometrial cysts, and changes under the hormonal influence (particularly during pregnancy). Cases may arise when adenomyosis mimics uterine malignancy, and uncommonly, malignancy may arise from the glandular tissue within adenomyosis. This exhibit is a comprehensive review of adenomyosis across multiple imaging modalities with pathologic and graphical correlation.

#### TABLE OF CONTENTS/OUTLINE

Relevant uterine anatomy  
1. Classic Imaging Findings of Adenomyosis  
A) Ultrasound "Adeno"  
• Echogenic striations/buds  
• Myometrial cysts  
• "Myosis"  
• Myometrial thickening (focal or diffuse)  
• Globular uterus  
• Thickened inner myometrium  
• "Venetian blinds" shadowing  
B) MRI "Adeno"  
• T2 hyperintense foci and myometrial cysts  
• T1 hypointense foci  
• "Myosis"  
• T2 hypointense junctional zone thickening  
• Myometrial thickening (focal or diffuse)  
C) CTD Hysterosalpingogram  
2. Atypical findings of adenomyosis  
A) Cystic/hemorrhagic  
B) Pedunculated  
3. Adenomyosis in pregnancy  
4. Clearing up the confusion between focal adenomyosis and adenomyoma (the mixed Mullerian tumor)  
5. Malignancy arising within adenomyosis

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## Abstract Archives of the RSNA, 2023

OBEE-2

### Postpartum Woman in the ER? A Surviving Guide for the On-Call Radiologist

#### Participants

Marta Barrios Lopez, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To learn what are the main puerperal obstetric complications and their imaging findings. 2. To understand the importance of clinical correlation in the diagnosis of many of these conditions: some can only be diagnosed in the proper clinical setting and a high suspicion is essential. 3. To review the anatomy landmarks necessary to locate certain types of hematomas.

#### TABLE OF CONTENTS/OUTLINE

1. Normal imaging findings during the puerperium: Vaginal delivery. 2. Normal imaging findings during the puerperium: Cesarean delivery. 3. Surgical technique for Cesarean section and potential complications at each step. 4. Thromboembolic conditions: 4.1. Ovarian vein thrombosis/ thrombophlebitis and their complications. 5. Infectious complications 5.1. Postpartum endometritis. 6. Hemorrhagic complications 6.1. Lower genital tract injury: supra and infralevator hematomas. 6.2. Abnormal placentation: placenta accreta, increta, percreta. 7. Cesarean-related complications 7.1. Wound cellulitis/ abscess 7.2. Uterine dehiscence 7.3. Bladder flap hematoma 7.4. Subfascial hematoma 7.5. Rectus sheath hematoma 7.6. Urinary tract injury

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## Abstract Archives of the RSNA, 2023

OBEE-20

### Imaging of Functional Ovarian Tumors and Tumor Like Conditions with Pathological Correlation

#### Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose  
Niloofer Karbasian, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the ovarian histology and the hormone axes. 2. Discuss clinical features of hormone excess as secondary signs of hormone producing tumors and tumor like conditions. 3. Explain different categories of functional ovarian tumors and tumor like conditions. 4. Illustrate multimodality imaging characteristics of different tumors.

#### TABLE OF CONTENTS/OUTLINE

1. Ovarian histological anatomy a. Including role of different cell types within the ovary 2. Hypothalamus-Pituitary-Ovary axis a. Introduce sex hormones and their role b. Flowchart demonstrating the hormone pathways 3. Clinical features of hormonal excess. a. Excess androgen and symptoms b. Excess estrogen and symptoms 4. Subtypes of functional ovarian tumors. a. Sex cord-stromal b. Surface epithelial c. Stroma d. Tumor-like lesions and conditions 5. Approach to diagnosing functional ovarian tumors a. Multidisciplinary approach i. Role of imaging. ii. Hormonal analysis in follow up. iii. Tissue sample often needed for diagnosis. b. Imaging direct and indirect signs of hormonal excess. i. Contribution of different modalities: US, MRI, CT. ii. Features of malignancy. iii. Radiologic examples of different functional tumors. c. Pathology correlation 6. Treatment options a. Conservative b. Surgical c. Prognosis

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## Abstract Archives of the RSNA, 2023

OBEE-21

### Decoding the Pandora's Box With Fetal MRI: A Comprehensive Pictorial Review of Fetal Abdominal Abnormalities

#### Participants

Taruna Yadav, MD, Alwar, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To study indications, advantages and limitations of fetal MRI for antenatal assessment of various abdominal anomalies. 2. To define a standard MRI protocol for assessment of fetal abdominal anomalies. 3. Using a case-based approach, to learn about myriad of common and rare fetal abdominal anomalies including gastrointestinal (bowel atresias, meconium peritonitis), genitourinary (posterior urethral valve, urethral atresia, pelviureteric junction obstruction, cystic renal dysplasia, fetal pyelectasis, ectopic kidney, syndromic associations like Meckel Gruber and Joubert syndrome), ventral wall defects (gastroschisis, omphalocele, limb body wall defects, pentalogy of Cantrell, bladder exstrophy, amniotic band syndrome), pelvic disorders including presacral masses (sacrococcygeal teratoma, anterior meningocele) with syndromic associations and follow up (wherever available). 4. To develop an imaging approach to complex fetal abdominal anomalies including ventral abdominal wall defects.

#### TABLE OF CONTENTS/OUTLINE

1. Role of MRI for assessment of fetal abdomen: indications, advantages and limitations 2. Fetal MR protocol to assess various abdominal anomalies 3. Fetal Abdominal Anomalies (A Case Based Approach): 3A. Gastrointestinal anomalies 3B. Genitourinary anomalies 3C. Ventral wall defects: spectrum of anomalies and simplified imaging approach 3D. Pelvic disorders: presacral masses 3E. Syndromic associations 3F. Miscellaneous 4. Conclusion

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## Abstract Archives of the RSNA, 2023

OBEE-22

### Magnetic Resonance Imaging in Obstetric Patients: How Can We Help?

#### TEACHING POINTS

? Brief review of indications and protocols of obstetric magnetic resonance imaging (MRI)? Illustrate the characteristics of image in cases of normal anatomy obstetric patients, when appropriate? Review most common pathologies in obstetric cases? Highlight the impact of imaging in the management

#### TABLE OF CONTENTS/OUTLINE

? MRI indications and protocols? MRI obstetric normal anatomy, when appropriate? MRI aspects of obstetrics patients: pathologies and complications:? Placenta accreta? Different locations of ectopic pregnancies? Heterotopic pregnancy? Angular pregnancy? Uterine perforation? Per vaginal bleeding in pregnancy? Miscarriage / Retained products of conception? Uterine arteriovenous malformation? Gestational trophoblastic disease? Applications in fetal pathologies or malformations (for example: fetus with cervical mass, congenital diaphragmatic hernia, congenital pulmonary airway malformation and fetal urinary tract anomalies)

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## Abstract Archives of the RSNA, 2023

OBEE-23

### Placenta 101: A Pictorial Review of Normal and Pathological Findings by US and MRI

#### TEACHING POINTS

To normal thickness of the placenta is 2 to 4 cm, and it must be measured where the umbilical cord is inserted. Placental grading maturity (Grannum classification) is divided into 4 grades by ultrasound and it is based on the extent of calcifications. To differentiate a retroplacental hematoma from a uterine contraction, it is recommended to wait a few minutes for the contraction to disappear. An easy Doppler finding for the differentiation of hematomas from other placental masses is the absence of internal blood flow. Currently, when the placental edge is less than 20 mm away from the internal cervical orifice (ICO) is a low-lying placenta, and when the placenta covers partially or completely the ICO, it is called placenta previa.

#### TABLE OF CONTENTS/OUTLINE

History. Embryology. Normal appearance and grades of maturation. Variations in placental morphology. Placental hematoma. Placenta previa. Placental accretism. Placental tumors. Teaching points. Conclusion. Bibliography.

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## Abstract Archives of the RSNA, 2023

OBEE-24

### FOMO, No More - A Comprehensive Guide for Identifying Head to Toe Fetal Anomalies

#### TEACHING POINTS

To highlight the importance of level I scan and develop an algorithmic approach to diagnose structural anomalies at the earliest. To diagnose progressive anomalies on subsequent scans and devise a trimester based checklist to avoid missing abnormalities. To assess the maternal risk factors in conjunction with fetal parameters to be able to assess growth of the fetus as well as restriction. To know the importance of color doppler in all the scans and how it affects further management. Scanning beyond fetus- to diagnose various placental, uterine and adnexal abnormalities for effective management. An obstetric ultrasound plays a pivotal role in each stage of pregnancy in providing a non-invasive diagnostic method, yielding immediate, extensive and accurate results for evaluating the fetus as well as the health of the mother. Protocol based screening reduces the "fear of missing out" an abnormality.

#### TABLE OF CONTENTS/OUTLINE

1. First Trimester Scan A) Early First Trimester: • Ectopic pregnancy • Twin or higher order pregnancy with correct labelling • Adnexal abnormality B) Late First Trimester: Detectable 9 • Anencephaly • Holoprosencephaly • Encephalocele • Omphalocele • Gastroschisis • Iniencephaly • Limb abnormality • Megacystis • Major cardiac defects • First trimester markers for chromosomal abnormalities • Abnormal UAD 2. Second Trimester Scan • Detectable 9 • Cardiac defect • Situs abnormalities • Spinal abnormalities • Placental abnormalities 3. Fetal Echocardiography 4. Third Trimester Scan • Evolving cardiac abnormalities • Placental abnormalities • Abnormal Doppler

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## Abstract Archives of the RSNA, 2023

OBEE-25

### Patterns of Ovarian Cancer Recurrence on MDCT: Early Imaging Features

#### Participants

Sharad Maheshwari, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. 1. Review of Ovarian ca 2. 2. Review the pattern of recurrence in ovarian ca 3. 3. Review Application of clinical laboratory findings with Imaging 4. 4. Understand the role of imaging, how it can potentially accelerate time to treatment.

#### TABLE OF CONTENTS/OUTLINE

1. 1. General overview of ovarian ca a. Epidemiology recurrence rates b. Pathogenesis how tumour spreads c. Clinical presentation Tumour markers d. quick review of treatment options 2. 2. Multimodality imaging appearance a. Why cross sectional Imaging b. Benefits of MDCT c. Role of MRI PET c. Scanning protocol d. Recurrence sites appearance on Imaging: - Peritoneum - Mesentery - Nodes - Periheptic and fissural spread - The muscle planes - Urinary bladder surface - Serosal deposits on the bowel surface - Miscellaneous sites e. Review protocol: Region wise f. Examples of early recurrence that would have been missed on routine imaging

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## Abstract Archives of the RSNA, 2023

OBEE-26

### See What's Inside: A Look at Pelvic Devices

#### Participants

Flavia M. Starling, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The female pelvis has a complex anatomy; thus, it requires deep study and its image can be challenging. Besides the anatomy knowledge, radiologists need to keep up with the daily devices and techniques, used by doctors and by the patients. It is important to be prepared to face unknown figures like foreign bodies, and also to recognize these devices in the pelvis, such as contraceptive methods (vaginal ring and intrauterine devices), tampons, menstrual cups, vaginal pessaries, catheters and slings. Questionnaires are often vague when referring to these devices and most women forget to mention actively whether they have or are using any of them. This study has the objective of reviewing common devices placed in the pelvis, especially in gynecology, urogynecology and its possible complications, helping radiologists to interpret these images. An understanding of the radiological appearance of some of these devices in the many imaging methods such as X-ray, ultrasound, CT and MRI is useful to avoid misinterpreting them, as well as obtaining a diagnosis more quickly and accurately.

#### TABLE OF CONTENTS/OUTLINE

For this education exhibit, we obtained clinical and epidemiological information in literature and selected images of cases that show different findings of women's vaginal and uterine devices, including normal aspects or complications.

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## Abstract Archives of the RSNA, 2023

OBEE-27

### This Is Rare, but It Happens: Atypical Presentation of Teratomas

#### Participants

TATIANA GONCALVES, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teratomas are germ cell tumors composed of multiple tissues derived from two or three germ layers. Mature teratomas are the most common benign ovarian neoplasms. They are easily diagnosed on imaging studies because of their characteristic intratumoral fat and calcification components. However, a minor percentage of teratomas have no visible fat on imaging studies. Malignancy is an uncommon presentation, which may be suspected in the presence of an enhancing, irregularly marginated solid component. Gliomatosis peritonei (GP) is another unusual form, that it is characterized by the implantation of mature glial tissue in the peritoneum or omentum. Mature teratomas have also an high complication rate compared with other ovarian tumors, however, there is a low rate of spontaneous rupture. The purpose of this presentation is to discuss the various atypical imaging features of teratoma that can be particularly misleading for radiologists.

#### TABLE OF CONTENTS/OUTLINE

Index 1. Introduction 2. Mature teratoma 3. Mature teratoma simulating malignant lesion 4. Gliomatosis peritonei 5. Immature teratoma 6. Ruptured teratoma 7. Pre sacral teratoma 8. Pre sacral myelolipoma and dermoid 9. Retrorectal dermoid 10. Cul-de-sac dermoid 11. Currarino syndrom

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## Abstract Archives of the RSNA, 2023

OBEE-28

### Adenomyosis: MRI for Diagnosis and Problem-Solving

#### Participants

Lauren F. Alexander, MD, Jacksonville Beach, FL (*Presenter*) Spouse, Stockholder, Abbott Laboratories; Spouse, Stockholder, AbbVie Inc; Spouse, Stockholder, General Electric Company; Spouse, Stockholder, Myriad Genetics, Inc

#### TEACHING POINTS

Uterine adenomyosis develops from the abnormal proliferation of heterotopic endometrial glands and stroma in the myometrium. Recognizing the characteristic magnetic resonance imaging (MRI) findings is essential for accurate diagnosis and appropriate patient management, as clinical symptoms such as dysmenorrhea, menorrhagia and pelvic pain overlap with other gynecologic diagnoses. After reviewing this exhibit on adenomyosis, the learner will be able to -- Discuss how to optimize MRI sequences to evaluate for adenomyosis. -- Identify typical and atypical MRI findings of adenomyosis. -- Distinguish other diagnoses which can mimic or have overlapping findings with adenomyosis. -- Describe treatment options for patients with adenomyosis.

#### TABLE OF CONTENTS/OUTLINE

(1) Background: Pathophysiology of adenomyosis, Clinical findings, Role of imaging for diagnosis and management. (2) MRI protocol: Key sequences, Tips for optimization. (3) Imaging features on MRI: Normal anatomy, Typical adenomyosis findings, Atypical findings (Polypoid, External adenomyosis, Cystic adenomyosis without with hemorrhage, Pregnancy related changes, Endometrial ablation changes). (4) Differential diagnosis mimics: Deep infiltrating endometriosis, Leiomyoma, Neoplasms (endometrial cancer, Mullerian adenosarcoma), Accessory and cavitated uterine mass, Pitfalls/Mimics (Uterine contraction, pseudo-thickening of junctional zone). (5) Treatment options: Medical, Procedural (ablation, excision, hysterectomy).

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## Abstract Archives of the RSNA, 2023

OBEE-29

### What Not to Miss in Obstetric Ultrasounds - Fetal Skeletal System Evaluation

#### Participants

Oswaldo Guevara Tirado, BS, MS, Coto Laurel, PR (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the essential components of an ultrasound based fetal skeletal assessment. Discuss common sources of error when evaluating the fetal skeletal system using ultrasound. Analyze case examples of classic images with normal findings that are frequently misinterpreted. Follow a systematic approach to avoid missing significant skeletal defects.

#### TABLE OF CONTENTS/OUTLINE

Obstetric ultrasounds play a crucial role in the accurate identification of fetal skeletal abnormalities, allowing physicians to optimize management in order to improve both fetal and maternal outcomes. Fetal skeletal abnormalities can manifest early during embryonic life. Therefore, proper evaluation and identification of developmental anomalies requires a profound understanding of normal fetal development and knowledge about ultrasound imaging techniques. Moreover, it is important to take into consideration the various sources of error that exist when performing a fetal skeletal assessment. Ultrasound is the primary imaging modality used to assess fetal well-being by providing a non-invasive method to precisely identify fetal skeletal abnormalities, amongst other irregularities, and intervene in a timely manner. 1. Introduction Objectives 2. How to Approach the Fetal Skeletal System 3. Skeletal Assessment: Ultrasound Findings 3a. Long Bones 3b. Hands Feet 3c. Fetal Head 3d. Fetal Thorax 3e. Fetal Movement 4. Femur Length Measurement Sources of Error 5. Review of cases in quiz format 6. Conclusion

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## Abstract Archives of the RSNA, 2023

OBEE-3

### Get the Fluoroscopic Vibes: Hysterosalpingography, a Guide for Residents

#### TEACHING POINTS

1. Illustrate the main normal imaging findings and technical procedures of hysterosalpingography including normal variants, non-pathological findings and technical artifacts. 2. Recognize abnormalities of the uterine cavity and fallopian tubes by hysterosalpingographic images and analyze the pathology and its impact on fertility. 3. Emphasize when further imaging modality such as sonohysterogram and magnetic resonance imaging or even hysteroscopic direct visualization is required in order to reach to the final diagnosis. 4. Discuss adequate surgical and non-surgical treatment options and possibilities of pregnancy post-treatment.

#### TABLE OF CONTENTS/OUTLINE

1. Review the key points of the female pelvic anatomy, indications and contraindications, technical procedures and normal hysterosalpingographic features. 2. Identify the most common anatomical variants (with and without proven influence on fertility), non-pathological findings and technical artifacts that may simulate causes of infertility. 3. Illustrate the characteristic hysterosalpingographic and other image modalities findings of uterine cavity and Fallopian tubes pathologies by analyzing representative cases and review several treatment options and assess the possibilities of fertility of each case. - Benign and malignant neoplasms- Tubal patency- Hormonal disorders- Post-surgical findings - Miscellaneous

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## Abstract Archives of the RSNA, 2023

OBEE-30

### Incidental Findings of Pelvic Endometriosis in Routine Transvaginal Ultrasound: A Pictorial Essay

#### Participants

Alexandre Minoda, MD, Recife, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibit is:• To conduct a review and illustrate through ultrasound images the female pelvic compartments. • To describe and disseminate the main ultrasound findings suggestive of deep infiltrating endometriosis (DIE) and ovarian endometriomas on transvaginal ultrasounds performed as part of a routine gynecological evaluation. • To demonstrate how the unique capabilities of ultrasound can help in the diagnosis and management of patients.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION / BACKGROUND• Epidemiology, clinical symptoms and classifications of endometriosisROUTINE TRANSVAGINAL ULTRASOUND AND TRANSVAGINAL ULTRASOUND AFTER BOWEL PREPARATION• International Deep Endometriosis Analysis (IDEA) group consensusPELVIC COMPARTMENTS• Anatomy and normal findings in routine transvaginal ultrasoundINCIDENTAL FINDINGS OF PELVIC ENDOMETRIOSIS IN ROUTINE TRANSVAGINAL ULTRASOUND• Anterior compartment• Middle compartment• Posterior compartment• Other findings that may optimize the diagnosis of endometriosis on routine transvaginal ultrasound

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## Abstract Archives of the RSNA, 2023

OBEE-31

### How Far Can We Go With Computed Tomography in the Diagnosis of Endometriosis:- Correlation With MRI and US

#### Participants

Gabriel Faria Medeiros, Santo Andre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recognize the most common CT findings associated with endometriosis and how to describe them 2. Discuss and highlight the role of CT in aiding endometriosis management, by suggesting the diagnosis and prompting MRI recommendation, accelerating diagnosis and improving patient outcomes. 3. Illustrate cases where CT and MRI were both used in the diagnosis of endometriosis, with emphasis on how the correlation between the two modalities aided in the diagnosis. 4. Identify post-treatment changes and potential pitfalls

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Epidemiology, pathophysiology and clinical aspects of endometriosis Currently available treatment options 2. Role of different imaging techniques in diagnosis and assessment of disease extension (benefits and limitations) Hysterosalpingography Transvaginal ultrasound (with bowel preparation) CT MRI Videolaparoscopy 3. CT findings of endometriosis, with MRI correlation - Case-by-case discussion 4. Post-operative changes and confounding factors Salpingo-oophorectomy Hysterectomy Rectosigmoidectomy Post-radiation therapy Adhesions Inflammatory pelvic disease 5. Summary and take-home messages

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## Abstract Archives of the RSNA, 2023

OBEE-32

### Smooth Seas Never Made Skilled Sailors: Navigating the Challenges That Arise After Cervical Cancer Treatments

#### TEACHING POINTS

To review the different radiotherapy modalities and the clinical indications in cervical cancer treatment. To identify the most frequent early and late complications of radiotherapy. To demonstrate that high doses of radiotherapy are associated with a greater risk of complications. To provide key points and radiologic tools in order to differentiate post-actinic changes from residual or recurrent disease.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Epidemiology and clinical importance -FIGO staging review in cervical cancer -The role of radiotherapy treating cervical cancer. Early and late complications in the uterus, ovaries, intestines, bones, and bladder. Case based approach with radiologic correlation. Imaging findings with histologic and colonoscopy correlation. Conclusion.

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## Abstract Archives of the RSNA, 2023

OBEE-33

### Imaging Uterus After Endometrial Ablation

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Endometrial ablation is a minimally invasive surgical procedures available for the management of patients with abnormal uterine bleeding. Post endometrial ablation expected imaging findings and post procedural complications have a characteristic pattern on imaging and if not readily recognized by the radiologists may lead to misinterpretation and unnecessary follow up imaging and inadequate management. Teaching points The goal of this study is to familiarize radiologists with imaging findings of uterus after endometrial ablation therapy. This will serve to enhance recognition of normal imaging findings and life threatening conditions and help radiologists create a focused differential diagnosis for various complications after the procedure.

#### TABLE OF CONTENTS/OUTLINE

A. Review pathophysiology of dysfunctional uterine bleeding.B. Review of treatment options in management of DUB with emphasis on endometrial ablation C. Discuss imaging options available for the assessment of uterus after ablation: US, CT, MRI and their strengths and weaknesses D. Review key imaging features of the post endometrial ablation 1. Expected post-op changes (early: intracavitary air, intrauterine /cervical hematoma, uterus edema; late: endometrial cavity contracture, endometrial thinning) 2. Complications (immediate: infectious (endometritis, myometritis, salpingitis); cornual hematometra, hematosalpinx; chronic: synechia, infertility from post-ablation tubal sterilization syndrome, ectopic pregnancy, abnormal placentation, endometriosis, malignancy (adenocarcinoma of the uterus)E. Management of the presented post-ablation complications will be reviewed.

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## Abstract Archives of the RSNA, 2023

OBEE-34

### Dedicated MR Imaging for Endometriosis: What You Can't Miss in Your Report

#### TEACHING POINTS

MR imaging is an important tool for diagnosis of deep pelvic endometriosis. Understanding and recognizing the MRI manifestations of this disease may be challenging. In this presentation, we will summarize the most important points to include in our reports considering a region-based reading and reporting system

#### TABLE OF CONTENTS/OUTLINE

Anterior compartment: -Differentiating bladder endometriosis from peritoneal endometriosis: bladder endometriosis is diagnosed when the muscular layer of the bladder is involved. If a bladder lesion is identified, informing the location, distance from vesical trigone and distal ureters are mandatory. Middle compartment: Characterization of endometriomas and differentiation with hemorrhagic ovarian cysts- it is a daily point of attention. -Malignant transformation of ovarian endometriosis: it should be considered if vascular solid tissue is identified with Diffusion imaging and Dynamic post contrast sequences.-Endometriotic tissue infiltrating the uterus: including this information and its differential diagnosis is relevant for treatment planning. Posterior compartment: -Differentiating deep rectal endometriosis from superficial endometriosis: characterization of penetration from endometriotic tissue into muscular layer of rectal wall will be definitive. Location of the lesion (intraperitoneal or extraperitoneal) will also impact in treatment options. -Superficial endometriosis: this is a challenge in diagnostic imaging. Small deposits of glandular tissue are missed frequently. An indirect sign to look for is the peritoneal pocket sign, defined as a peritoneal defect that collects fluid, frequently identified in posterior cul de sac.

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## Abstract Archives of the RSNA, 2023

OBEE-35

### Current Concepts in Imaging of Uterine Adenomyosis: What Radiologists Should Know

#### Participants

Alexandre Minoda, MD, Recife, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibit is:• To discuss the pathophysiology of adenomyosis and how it relates to imaging findings.• To describe the various US and MR imaging manifestations of adenomyosis.• To discuss the classifications of adenomyosis based on US and MR imaging findings.• To provide the diagnostic clues that allow differentiation of adenomyosis from its mimics.

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION• Historical background, epidemiology, physiopathology, clinical features and phenotypes of adenomyosis  
THE UTERINE JUNCTIONAL ZONE• Normal zonal anatomy, physiologic variations and alterations in adenomyosis  
IMAGING FINDINGS IN ADENOMYOSIS• Direct and indirect sonographic signs of adenomyosis• Direct and indirect MRI signs of adenomyosis  
CLASSIFICATIONS OF ADENOMYOSIS AND PHENOTYPES IN IMAGING• Atypical presentations  
DIFFERENTIAL DIAGNOSIS AND PITFALLS IN DIAGNOSIS OF ADENOMYOSIS

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## Abstract Archives of the RSNA, 2023

OBEE-36

### Practical Approach to Ovarian Masses - The ABC's

#### Participants

Antonio Michael-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To know how to properly identify ovaries and its organ dependency when facing pelvic lesions.- Going over the most common and specific characteristics and radiological features of the different ovarian lesions

#### TABLE OF CONTENTS/OUTLINE

The differential diagnosis of ovarian lesions is broad and complex. It is not only a diagnostic challenge due to the existence of multiple tumour lineages, but also to the proper differentiation of their ovarian dependence, which is often unclear. First of all, it is important to properly identify the ovaries by knowing pelvic anatomy, their location and their vascular relations. In the same way, when facing pelvic lesions of possible ovarian origin, there are some radiological signs that can help us to better determine their organ dependence (such as the "phantom organ" or the "beak sign"). Once we have confirmed that the dependence is ovarian, it is important to know the different possible lesions that may exist, and their most common radiological characteristics, both in CT and (mostly) in MRI. According to their T1, T2 signal, and internal component (solid, cystic or mixed), we propose a simple diagnostic algorithm that helps to approximate the diagnosis, based on the most frequent radiological characteristics of ovarian tumours.

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## Abstract Archives of the RSNA, 2023

OBEE-37

### First Things First! First Trimester Obstetric Ultrasound From the Basics to the Pearls

#### Participants

Niels Vinicius Padua Carvalho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The aim of this exhibition is to:• Review the recommendations for screening and diagnostic ultrasound in pregnant women during the first trimester of pregnancy.• Demonstrate how the obstetric ultrasound should be documented in this context.• Discuss how to use ultrasound for risk assessment of common forms of aneuploidies, malformations and gestational diseases/complications, in a practical approach.• Highlight the pearls and pitfalls in that evaluation.

#### TABLE OF CONTENTS/OUTLINE

- INTRODUCTIONo Purpose of a first trimester ultrasoundo Standard equipment and protocolo Documentation requirements
- GUIDELINE FOR EXAMINATIONo Demonstrate by case-based images the minimum requirements for a 11-14 weeks gestation examination, including:§ Assessment of viability§ Confirmation of intrauterine pregnancy and uterine integrity§ Fetal biometry§ Fetal anatomy§ Risk assessment for common forms of aneuploidy
- SCREENINGSo Describe the pretest counseling, biomarkers and ultrasound-based assessment for aneuploidies, malformations and gestational diseases
- SUMMARY AND SYSTEMATIC APPROACH
- TAKE HOME MESSAGES

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## Abstract Archives of the RSNA, 2023

OBEE-38

### A Multimodality Review of Gynecologic Medical Devices in the Pelvis

#### Participants

Kaitlin Zaki-Metias, MD, Windsor, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Given the frequency with which gynecologic pelvic devices are encountered on imaging, understanding the imaging characteristics and appropriate positioning on various modalities is important for radiologists to recognize. Positioning and integrity of all pelvic devices should be evaluated on all studies when visualized. Radiologists should be able to confidently communicate pertinent findings of pelvic device malposition to referring clinicians.

#### TABLE OF CONTENTS/OUTLINE

Understand the importance and clinical implications of gynecologic medical devices in the pelvis, including intrauterine contraceptive devices (IUCD), pessaries, contraceptive vaginal rings, tubal occlusion and ligation devices, brachytherapy seeds, and menstrual products. Describe the normal appearance and appropriate positioning of gynecologic medical devices in the pelvis and be familiar with their appearance on various imaging modalities. Describe the strengths and pitfalls of various imaging modalities in the assessment of medical pelvic devices.

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## Abstract Archives of the RSNA, 2023

OBEE-39

### Pelvic Venous Congestion Syndrome: The Forgotten Culprit of Chronic Pelvic Pain

#### TEACHING POINTS

1. To raise awareness of pelvic venous congestion syndrome as an underdiagnosed etiology for chronic pelvic pain. 2. Review the clinical and multimodality (CT, MR and Angiography) imaging work-up of diagnosing pelvic venous congestion syndrome. 3. Discuss various differential diagnoses such as Nutcracker Syndrome, May-Thurner Syndrome, and arteriovenous malformation and understand the importance of an accurate diagnosis as there are different treatment methods for each entity.

#### TABLE OF CONTENTS/OUTLINE

1. Pelvic Venous Congestion Syndrome (PVCS) - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging (CT, MRA, Angiography) - Treatment/Prognosis  
2. Differential Diagnoses  
a) Nutcracker Syndrome - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis  
b) May-Thurner Syndrome - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis  
c) Arteriovenous Malformation (AVM) - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis  
d) Inferior vena cava (IVC) thrombosis - Clinical Presentation - Epidemiology - Pathogenesis - Multimodality Imaging - Treatment/Prognosis  
3. Summary Chart

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## Abstract Archives of the RSNA, 2023

OBEE-4

### First-Trimester US and Current Methods of Genetic Screening

#### Participants

Ami Gokli, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe first trimester ultrasound findings including normal, abnormal and indeterminate with imaging correlates, as well as criteria diagnostic for failed pregnancy and pitfalls. Discuss the current methods of genetic screening including carrier testing and all maternal blood tests in conjunction with fetal ultrasound Review current methods of diagnostic testing in conjunction with fetal ultrasound including common complications, sensitivity/specificity, false neg/pos, how often these occur and why Review clinical management of the most common diseases and necessary details to include in radiology reports that guide management

#### TABLE OF CONTENTS/OUTLINE

Overview of first trimester US and screening tests -what can be detected in the first trimester, limitations of sonography in the first trimester, and safety issues First trimester ultrasound imaging findings (pictorial review) of detailed fetal anatomic survey including normal anatomy, standard views Most common methods of genetic screening and diagnostic testing in conjunction with US Examples of common pathology encountered with sonographic imaging correlation and management discussion Case examples with explanations including: Early hydrops Anencephaly, Body stalk anomaly, Ectopic cordis, omphalocele, gastroschisis, Megacystis Carrier testing, when and why 10-13 week blood test with nuchal translucency and intracranial translucency ultrasound Integrated screening/sequential screening Cell-free DNA screening clinical indications for advanced imaging such as fetal MRI clinical management guidance and reporting future directions for improving diagnostic capabilities

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## Abstract Archives of the RSNA, 2023

OBEE-40

### **MR Imaging of Gynecologic Emergencies in the Pregnant Patient: An Overview of Clinical Indications, Proper Sequence Choice and Not to Miss Emergencies**

#### **TEACHING POINTS**

Describe the clinical indications for MR imaging in pregnancy based upon the risks of fetal harm with ionizing radiation and recommendations from organizations including the American College of Radiology (ACR) and American College of Obstetricians and Gynecologists (ACOG). Outline the sequences included in the protocol for an MRI abdomen/pelvis of a pregnant female with examples of the features best evaluated on each sequence. Review the imaging features of gynecologic emergencies including ovarian torsion, ectopic pregnancy, placenta accreta spectrum and acute uterine rupture based on an understanding of the associated pathophysiology. Understand pertinent positive and negative information that should be conveyed to the primary team and characteristics that may portend prognosis.

#### **TABLE OF CONTENTS/OUTLINE**

Background discussing the difficulty of diagnosing pathology in pregnancy and crucial role of the radiologist. Clinical indications for MR in pregnancy - outline the ACR and ACOG recommendations and reason to avoid gadolinium contrast. Discussion of the risk of fetal harm with ionizing radiation including the difference between stochastic and deterministic effects, absorbed dose of different radiology exams and impact on fetus based on gestational age. List of the sequences included in a typical MR abdomen/pelvis protocol followed by slides with pictures demonstrating the pertinent features evaluated in each sequence. Examples of gynecologic emergencies seen in pregnancy with slides specifically focused on ovarian torsion, ectopic pregnancy (ruptured tubal ectopic, abdominal ectopic and interstitial ectopic), placenta accreta spectrum, and acute uterine rupture.

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## Abstract Archives of the RSNA, 2023

OBEE-41

### First Trimester Ultrasound Screening

#### Participants

Shannon Navarro, MD,MPH, Sacramento, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-The importance of the nuchal translucency exam and significance of a widened nuchal translucency -Quality standards - Correlation with blood work for first trimester screen-significance of the ossification of the nasal bone

#### TABLE OF CONTENTS/OUTLINE

A. What is the nuchal translucency? Pictorial review of a normal nuchal translucencyB. Pitfalls! the amnion before fusion with the chorion, quality standards for appropriate neck flexion/extension, how the ultrasound should be performed C. Abnormal nuchal translucencies: the movement from screening to diagnostic exams. A pictorial review of abnormal nuchal translucency screening exams with correlation from diagnostic tests. D. Pictorial review of normal nasal bone ossificationE. Pictorial review of abnormal nasal bone ossification.

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## Abstract Archives of the RSNA, 2023

OBEE-42

### Pitfalls in Ovarian Imaging: Limits of the ORAD's System

#### TEACHING POINTS

The first step in characterizing a pelvic mass using the ORAD'S system is to determine its ovarian origin. The second step is to avoid misdiagnosing infections and inflammatory conditions. The third step is to identify features of peritoneal carcinomatosis. Finally, the adnexal lesions are analyzed according to the ORADS criteria. Although this system is standardized and clear, care must be taken to avoid the many pitfalls that can occur at each stage of the reasoning.

#### TABLE OF CONTENTS/OUTLINE

We will report our experience on the pitfalls of the ORAD's system from a series of 3000 MRI's obtained over the past 5 years in a large tertiary institution by : - Presenting a variety of extra-ovarian lesions that mimic ovarian lesions such as exophytic myometrial masses, lymphocele, lymph node and other tumors arising from other structures of the pelvis. - Presenting confusing infections and inflammatory conditions such as complicated endometriosis or actinomycosis - Discussing and illustrating lesions that mimic peritoneal carcinomatosis, such as Demons-Meigs syndrome and functionally hyper-stimulated ovaries - Discussing and illustrating some benign ovarian tumors that mimic malignancy, such as cellular fibromas, sclerosing stromal tumors and necrotic, infected or distorted lesions. - Discussing and illustrating some malignant lesions that mimic benignity, such as calcified tumors (low-grade serous ovarian carcinoma) and serous cystadenofibromas associated with a borderline component.

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## Abstract Archives of the RSNA, 2023

OBEE-43

### Serous Tumors in the Female Pelvis: Comprehensive Review of Diagnostic and Therapeutic Strategy

#### TEACHING POINTS

1. Serous tumors are common female pelvic neoplasm presenting a variety of clinical and imaging manifestations. Recently, there has been a paradigm shift that most extrauterine pelvic high-grade serous carcinomas (HGSC) are metastases of STIC. While HGSC is the majority of serous carcinomas, but also low-grade serous carcinoma (LGSC) developing through serous borderline tumor (SBT) may be occur. This exhibit provides an overview of diagnostic and treatment strategies including Hereditary Breast and Ovarian Cancer (HBOC) managements. 2. 3D-DCE-MRI and reduced FOV/computed DWI are useful in detecting early-stage HGSC, or small mural nodules of LGSC. Characteristic imaging findings such as black sponge in adenofibroma, papillary architecture with internal branching in SBT, dense calcification in psammocarcinoma, and CT pattern classifications for genomic subtypes estimation of advanced HGSC, and differentiation of invasive/non-invasive peritoneal implants of SBT are demonstrated.

#### TABLE OF CONTENTS/OUTLINE

Benign: Surface epithelial inclusion /Cystadenoma /Adenofibroma  
SBT: Exophytic /intra-cystic papillary growth; Micropapillary subtype /Adenofibromatous SBT; Peritoneal implants /LN involvement; Fertility-preserving treatment options  
LGSC Psammoma body /Psammocarcinoma; HGSC arising from LGSC/SBT  
HGSC STIC /Tubal /Peritoneal cancers; Advanced MR techniques: SWS, MRS, CEST; Therapeutic strategies for HBOC (BRCA1/2): Risk-reducing surgery /Molecularly targeted drug; Radiomics/Radiogenomics

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## Abstract Archives of the RSNA, 2023

OBEE-44

### Pelvic Perspectives: Unveiling the Imaging Findings and Complications of Female Pelvic Devices

#### TEACHING POINTS

1. Review normal imaging findings of the female pelvis, including CT, US, and MRI. 2. Review normal and abnormal placement of intrauterine devices (IUDs) and required imaging studies for emergent cases, as in perforation. 3. Review indications for pessary placement and imaging findings for pelvic organ prolapse (POP) and describe their appearance on imaging. 4. Review normal imaging appearance of catheter placement in female patients and discuss potential complications that are visible on imaging. 5. Discuss imaging findings for menstrual devices, including tampons and menstrual cups.

#### TABLE OF CONTENTS/OUTLINE

1. Review of normal pelvic anatomy and imaging: CT, MRI, Ultrasound  
2. Contraceptive devices: Types of IUDs (Copper, hormonal), Intravaginal contraception (NuvaRing), CT, KUB, MRI and safety note, Ultrasound, Malpositioned IUDs  
3. Pelvic organ prolapse (POP) and pessaries: Anatomy of POP and imaging before treatment, Pessary types (ring, cube, Gellhorn), CT, MRI, Complications of pessaries (migration, fistulization, forgotten pessary)  
4. Catheter placement in female patients: Indications for catheter placement and review of normal placement, CT, MRI, Misplaced catheters and complications (vaginal placement, bladder perforation from traumatic insertion)  
5. Menstrual Products: Imaging findings of tampons, menstrual cups, CT, MRI  
6. Quick cases with multiple choice questions: Malpositioned IUD, Pessary on CT of patient with POP, Vaginal placement of catheter

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## Abstract Archives of the RSNA, 2023

OBEE-45

### Achy Breaky Baby Heart: Guide to Understanding Normal Fetal Cardiac Views

#### TEACHING POINTS

1) Fetal cardiac assessment is a key component of the fetal anatomic survey. An understanding of the different cardiac views is crucial to accurate image interpretation during a level 1 fetal anatomic survey. 2) Use of 5 standard scan planes and systematic assessment of the fetal cardiovascular system is the initial step in screening for congenital heart disease. 3) Features at risk for congenital heart disease should be further examined using a detailed echocardiogram, which includes 5 additional views.

#### TABLE OF CONTENTS/OUTLINE

A. Overview of basic cardiac exam components  
B. Standardized scan planes, including a graphic schema, US anatomy, CT correlate of the same view, and significance/associated pathologies:  
1) Transabdominal (determining fetal situs and cardiac axis)  
2) 4 chamber view  
3) Left ventricular outflow tract  
4) Right ventricular outflow tract  
5) 3 vessel and 3 vessel trachea  
C. Fetal echocardiography planes, including a graphic schema, US anatomy, CT correlate of the same view, and significance/associated pathologies:  
6) Bicaval  
7) Long axis view of the aortic arch  
8) Long axis view of the ductal arch  
9) Low short axis view of the ventricles  
10) High short axis view of the great arteries  
D. Pictorial review of common congenital heart diseases detected on fetal cardiac views with key diagnostic findings

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## Abstract Archives of the RSNA, 2023

OBEE-46

### Endometrioma - Beyond the Basics: Examining the Nuances and Variations of This Condition

#### Participants

Soumyadeep Ghosh, MBBS, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To apprise radiologists of the imaging features of endometrioma/endometriotic cysts. 2) Case-based illustrations of the atypical locations to watch out for in the appropriate clinical context. 3) To illustrate the imaging predictors of malignancy in endometriotic cysts. 4) To outline the common pitfalls encountered on various imaging techniques. 5) To highlight the implications of endometriomas on fertility. 6) To emphasize the important of pain management techniques in patients with endometriotic cysts.

#### TABLE OF CONTENTS/OUTLINE

1) Background 2) Typical/ovarian endometrioma - Introduction - Classic ultrasound findings - Classic MRI findings 3) Atypical locations - a) Peritoneal Endometrioma b) Perihepatic Endometrioma 4) Imaging predictors of malignancy - Locations - Pathology - Imaging - Pitfalls on Imaging 5) Decidualized endometrioma - What is Decidualization? - Ultrasound appearance - MR imaging 6) Complications 7) Associations - Deep infiltrative endometriosis - Extra gynecological organ involvement 8) Implications on fertility 9) Implications on pain management

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## Abstract Archives of the RSNA, 2023

OBEE-47

### Don't Miss - Understand: Solving Pitfalls in the Diagnosis of Endometriosis and Adenomyosis

#### TEACHING POINTS

Endometriosis and adenomyosis are prevalent diseases among reproductive age women with a negative impact on their quality of life and reproductive outcomes. Their imaging manifestations may be challenging due to a wide imaging spectrum of both diseases, leading to incorrect interpretations even by experienced radiologists. This presentation aims to demonstrate common imaging pitfalls of endometriosis and adenomyosis, with a comprehensive and instructive problem-solving guide.

#### TABLE OF CONTENTS/OUTLINE

1) Overview of endometriosis and adenomyosis, emphasizing the imaging diagnosis: ultrasound and magnetic resonance. 2) Imaging pitfalls in the diagnosis of endometriosis, including: Posterior compartment: Folds in the sigmoid colon; Vessels in the parametrium and paracolpos; Diverticulitis; Pericolic lymph nodes; Middle compartment: Adenomyosis; Fallopian tubes; Functional ovarian cysts; Pelvic Varices; Anterior compartment: Leiomyomas; Fibrocicatricial changes; Folds in the bladder wall; 3) Imaging pitfalls in the diagnosis of adenomyosis, such as: Myometrial contractions; Physiologic thickening of the junctional zone in the menstrual phase; Deep endometriosis with myometrial infiltration; Leiomyomas with cystic or red degeneration; Unicornuate uterus with functional non-communicating uterine remnant 4) A didactic guide for problem-solving pitfalls.

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## Abstract Archives of the RSNA, 2023

OBEE-48

### **Magnetic Resonance Imaging (MRI) of Mayer-Rokitansky- Kuster-Hauser Syndrome, Herlyn-Werner-Wunderlich Syndrome and Related Complex Mullerian Duct Anomalies With Special Emphasis on Surgical Reconstruction Management;- What the Radiologist Should Know to Guide the Reconstruction Surgeon**

#### **TEACHING POINTS**

1) Explain Embryology of Mullerian Duct Anomalies (MDA) and Mayer-Rokitansky-Kuster-Hauser Syndrome(MRKHS) and Herlyn-Wener-Wunderlich Syndrome(HWWS) 2) ASRM Classification of MDA with demography 3) Case based introduction to MRKHS, HWWS other complex MDA, associations with Renal, ovarian, spine anomalies 4) Clinico-social aspects of MDA, effect on menarche, fertility pregnancy 5) MRI protocols, Imaging features of MRKHS,HWWS and MDA with sample cases 6) Document MRI findings and dimensions specially for reconstructive surgeon. Detailed analysis of structures -Cervix,Vagina,Plica palmatae,uterine/vaginal septa, uterine buds and extent of uterovaginal aplasia 7) MRI evaluation of Neovagina, other vaginoplasties follow up their complications (with example cases)

#### **TABLE OF CONTENTS/OUTLINE**

1) Developmental Embryology of MDA genetics 2) Classification of MDA(classes 1-VII) with cases 3) Case based description of MRKHS (type 1II), HWWS and MDA with MRI imaging features imaging pearls, coexistent extragenital genital anomalies, fibroids, endometriosis etc influencing surgical management prognosis 4) Clinical presentations, amenorrhea, subfertility pregnancy complications with sample cases 5) Targeted MRI reporting of MRKHS, HWWS, MDA associated extragenital anomalies. Specific points/dimensions useful for reconstruction, implants, surgery and for assisted reproduction. Describe uterine buds, triangular cord sign etc 6. Introduction to neovagina, vaginoplasty, uterine transplant and other surgical options with MRI features 7. Case based review of MRI of post reconstruction and post treatment follow up their complications (stenosis, fistulae, infections, hernia etc)

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## Abstract Archives of the RSNA, 2023

OBEE-49

### Pelvic Endometriosis: Lexicon on Magnetic Resonance Imaging (MRI)

#### Participants

Claudia Hurtado, Valladolid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The most common sites of involvement are the vesicouterine space (in the anterior compartment) and the uterosacral ligaments (in the posterior compartment). The "T2 black dot sign" is a specific sign of endometriosis. Malignant transformation should be suspected when a nodule enhances, nodule more than 3 cm, growth or loss of T2 shading.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Objectives- Teaching points- MRI protocol- Gross anatomy- Morphological subtypes- Endometriomas- Structured Report- Conclusions

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## Abstract Archives of the RSNA, 2023

OBEE-5

### MRI of Müllerian Duct Anomalies Based on the New ASRM Classification

#### Participants

Marianna Konidari, MD, London, Greece (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Müllerian duct anomalies (MDAs) consist of a wide spectrum of congenital malformations of the uterus, cervix, fallopian tubes and upper 2/3 of the vagina and are the result of abnormal development, fusion or resorption of the Müllerian ducts.
- The new 2021 American Society of Reproductive Medicine-ASRM (previously, American Fertility Society-AFS) MDAs classification (MAC2021) expands the 1988 classification to include cervical and vaginal anomalies; it classifies MDAs into nine categories using standardized descriptive terminology.
- Imaging is crucial in the diagnostic workup of individuals with suspected MDAs, particularly adolescents with primary amenorrhea and adults with infertility, since identification of these anomalies and their complications allows tailored clinical management.
- MRI is the modality of choice for detailed pelvic anatomy evaluation, accurate MDA classification and preoperative planning.

#### TABLE OF CONTENTS/OUTLINE

- Embryology overview and imaging anatomy of internal female genitalia
- MDAs: how do they develop and what are the clinical implications
- ASRM Müllerian anomalies classification 2021: overview and differences with the AFS 1988 classification
- Imaging evaluation: rationale behind imaging of congenital uterovaginal anomalies, available techniques and the role of MRI
- Case-based discussion on MRI appearances, clinical presentation and treatment management of MDAs, according to the new ASRM classification
- Diagnostic algorithm for imaging approach of MDAs

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## Abstract Archives of the RSNA, 2023

OBEE-50

### Endometriosis Revisited: Current Concept of Pathophysiology, Diagnosis, and Therapeutic Strategy

#### TEACHING POINTS

1. Endometriosis, which significantly impairs women's QOL with chronic pain and reduced fertility, is a benign, common, but controversial disease due to its enigmatic etiopathogenesis and biologic behavior. Recent studies suggest multiple genetic, and environmental factors: endocrinic, inflammatory, immunological, and angiogenetic may affect its onset and development. Genomic analysis revealed the presence of cancer-associated gene mutations, which may reflect the neoplastic aspect of endometriosis. The management has changed dramatically with the development of fertility-preserving, minimally invasive therapies. 2. The appropriate examinations with advanced MR techniques (3D-T2WI, reduced FOV DWI, computed DWI, SWI, DCE-MRI, cine MRI), and careful imaging interpretation are considered useful in evaluating endometriosis and associated lesions, which may be effective for therapeutic strategy with improved patient's outcome.

#### TABLE OF CONTENTS/OUTLINE

Imaging manifestations of endometrioma (shading sign; T2 dark spot; hemosiderin deposition on SWI), deep endometriosis, adenomyosis, less common site and rare site endometriosis, endometriosis-associated tumor-like lesions (polypoid endometriosis; decidualized endometriosis), and malignant transformation, with pathophysiologic conditions, clinical classification, optimal treatment options and clinical outcomes.

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## Abstract Archives of the RSNA, 2023

OBEE-51

### Pearls and Pitfalls of First-Trimester US Screening and Prenatal Testing: A Pictorial Review

#### Participants

Cynthia De la Garza Ramos, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. First trimester ultrasound (US) is key in establishing pregnancy viability, number, and location. 2. Early intrauterine pregnancy (IUP) sonographic milestones, including appearance of a gestational sac, yolk sac, embryo, and cardiac activity, follow a consistent timeline. 3. Prenatal genetic testing and sonographic fetal structural assessment serve as initial screening tools for chromosomal disorders and facilitate detection of patients who may benefit from subsequent amniocentesis, chorionic villous sampling, or fetal intervention. 4. Beta human chorionic gonadotropin ( $\beta$ -hCG) in combination with pelvic US can be used to evaluate early pregnancy complications, but threshold  $\beta$ -hCG values should not be used as a sole decision-making tool.

#### TABLE OF CONTENTS/OUTLINE

1. Review the indications for first trimester US. 2. Recognize the normal appearance of an IUP and identify the sonographic milestones of the first trimester. 3. Illustrate the components of a first trimester fetal anatomy scan. 4. Describe the current prenatal genetic screening recommendations for chromosomal defects and their relationship with US fetal anatomy, including nuchal translucency (NT) measurement. 5. Understand the role of  $\beta$ -hCG and its correlation with US findings in the evaluation of early pregnancy complications. 6. Review the Society of Radiologists in Ultrasound (SRU) consensus statement for diagnosing a nonviable pregnancy in the first trimester. 7. Identify US findings that may be associated with poor pregnancy outcomes and require follow-up. 8. Case Examples.

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## Abstract Archives of the RSNA, 2023

OBEE-52

### Nothing Complex about Ovarian Lesions: Expert Guidance from the O-RADS US Committee

#### Participants

Catherine Phillips, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Based on validation studies feedback, the Ovarian-Adnexal Reporting and Data System (O-RADS) US has been updated to address clinical application challenges, improve system specificity, harmonize with other consensus statements and O-RADS MRI. 2. New lexicon terms include bilocular for cystic lesions shadowing for smooth solid lesions, features which favor benignity and may improve specificity by down-scoring lesions. 3. Features of classic benign lesions were further refined to capture their typical appearance and also aim to improve specificity. 4. Updated surveillance and growth parameters optimize management better align with existing consensus statements. 5. Emerging data suggests O-RADS US 3 lesions are at the lower end of the risk of malignancy range (1- <10%); management recommendations have thus been updated to allow short-term US follow-up.

#### TABLE OF CONTENTS/OUTLINE

1. Clarification of updated O-RADS US v2022 governing concepts on applicability criteria, definitions/technique, and rules for system use with diagrammatic depictions illustrative examples. 2. Image rich example cases featuring new lexicon descriptors with an explanation of how their presence alters risk score assessment and management options. 3. Algorithmic approach to assessment and diagnosis using O-RADS US v2022 lexicon terms demonstrating ease use for daily clinical practice.

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## Abstract Archives of the RSNA, 2023

OBEE-53

### Unusual Presentations of Common Female Pelvic Lesions

#### Participants

May Shaaban, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Uterine leiomyomas, uterine adenomyosis, ovarian mature cystic teratomas and endometriomas represent the most common pathologies in everyday practice. They have characteristic imaging features that allow confident diagnosis. Occasionally these common lesions present with atypical features which makes it more challenging. Teaching points: Describe the classic imaging features of Uterine leiomyomas, uterine adenomyosis, ovarian mature cystic teratomas and endometriomas Describe unusual imaging features of variant or complicated lesions Provide differential possibilities based on the imaging features

#### TABLE OF CONTENTS/OUTLINE

Atypical leiomyomas: I. Degenerated and variant leiomyomas: 1. Cellular leiomyoma 2. Cystic degeneration 3. Myxoid degeneration 4. Red degeneration 5. Lipoleiomyoma II. Infected leiomyoma III. Torsion of leiomyoma IV. Prolapsed leiomyoma Atypical adenomyosis/adenomyomas: Focal adenomyosis (adenomyoma) Cystic adenomyosis Adenomyosis in pregnancy Exophytic adenomyoma Atypical endometriomas: Mural nodules and decidualization Malignant transformation Rupture Atypical presentations of dermoid cysts: Rupture Malignant transformation

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## Abstract Archives of the RSNA, 2023

OBEE-54

### Medical Devices of the Female Pelvis: Multimodality Patterns, Pitfalls, and Pearls

#### TEACHING POINTS

Medical devices in the female pelvis are less frequently encountered than those in the chest or abdomen. Nevertheless, radiologist familiarity with these devices is critical for appropriate imaging evaluation. This exhibit reviews normal and abnormal radiologic presentations of medical devices commonly found in the female pelvis on multiple imaging modalities as well as examples of complications that may arise from device placement. Finally, we will present radiologic examples of device mimics that could lead to pitfalls in imaging evaluation.

#### TABLE OF CONTENTS/OUTLINE

Pessaries Pessary Mimic: Menstrual cup Pessary Mimic: NuvaRing Pessary Mimic: Tampon Intrauterine devices (IUDs) Essure devices  
Tubal ligation clips Embolization coils Ureteral stents Foley catheter Rectal tube

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## Abstract Archives of the RSNA, 2023

OBEE-55

### Don't Be Fooled by Uterine Masses: How MRI Can Help You Spot Atypical and Malignant Impostors Among Leiomyomas

#### TEACHING POINTS

Review the specific MRI features of usual leiomyomas. Explain the known and emerging MRI features of atypical leiomyomas and describe how to differentiate them. Describe MRI characteristics of uterine sarcomas and compare them with those of leiomyomas. Develop a systematic image-based approach to recognize these entities.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction- Uterine anatomy - Clinical relevance - Definitions  
2. MRI protocol  
3. Usual leiomyomas - MR typical findings - Other RM signs: flow void sign, bridging vascular sign, high signal intensity rim on T2  
4. Atypical leiomyomas: MR findings correlation with Histology  
4.1. Atypical location- Subserosal - Submucosal  
4.2. Degenerated leiomyomas- Hyaline degeneration - Mixoid degeneration - Red degeneration - Cystic degeneration  
4.3. Histologic subtypes- Cellular leiomyoma - Lipoleiomyoma - STUMP  
5. Uterine sarcomas: MR findings correlation with Histology  
5.1. Uterine leiomyosarcoma  
5.2. Endometrial stromal sarcoma  
6. Differential Diagnosis  
7. Conclusion

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## Abstract Archives of the RSNA, 2023

OBEE-56

### 3D Ultrasound - Troubleshooting in Gynaecological Imaging

#### Participants

Sanchita Gupta, MBBS, MD, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to -1) Provide information about system requirements and scanning techniques to obtain a standard 3D dataset, rendering and image reconstruction.2) Explore newer techniques and software in 3D USG for improving diagnosis.3) Know common clinical scenarios where 3D provides additional information over simple 2D USG.

#### TABLE OF CONTENTS/OUTLINE

1) 2D vs 3D ultrasound2) System requirements for 3D dataset acquisition3) Rendering and multiplanar reconstructions4) Transvaginal 3D USG - Importance of the coronal plane5) Newer techniques and software in 3D USG:- Walk thru mode - Virtual Hysteroscopy- 3D USG with Saline infusion sonography (SIS)- Translabial 3D USG- 3D Power Doppler- Endometrial volume calculation using VOCAL (Virtual Organ Computer-Aided Analysis)- Sono AVC (Automated volume calculation)6) Common clinical scenarios where 3D imaging can help provide a diagnosis- Evaluation of the external and internal uterine contour1) Congenital uterine anomalies2) Subserosal and pedunculated fibroids deforming external contour3) Submucosal fibroids deforming internal contour- Pathologies of the endometrial cavity1) Identifying intrauterine adhesions2) Locating polyps and Retained products of conception3) Placement of Intra-uterine contraceptive devices- Assessment of endo-myometrial junction in adenomyosis and carcinoma endometrium

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## Abstract Archives of the RSNA, 2023

OBEE-57

### How to Handle Hydrops

#### Participants

April Griffith, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1: Hydrops fetalis is defined as the presence of fluid in two spaces -skin, pericardium, pleural space, peritoneal cavity.2: The prognosis is generally poor due to lack of treatment options.3: Fetal tachycardia and fetal anemia are treatable causes. Middle cerebral artery (MCA) Doppler is a non-invasive method to screen for fetal anemia which can be treated by intrauterine transfusion.4: Fetal intervention may be lifesaving - shunt placement in large cysts in a lung mass, laser ablation for twin twin transfusion syndrome, radiofrequency ablation for twin reversed arterial perfusion sequence.5: For some tumors (e.g., sacrococcygeal teratoma) elective preterm delivery with immediate resection is preferable to expectant management. The decision to deliver in such cases is based on multiple factors including the combined cardiac output calculated by echocardiography. 6: Some causes of hydrops can recur. Correct diagnosis of the cause is essential for management of current and future pregnancies.

#### TABLE OF CONTENTS/OUTLINE

1: Pitfalls in diagnosis of abnormal fluid locations. 2: Immune vs Non immune hydrops: Antibody screening, MCA Doppler velocimetry. 3: Cardiac - rhythm disturbance more likely than structural defects. 4: Genetic - Aneuploidy, syndromic. 5: Infection - Serology, growth restriction, hepatosplenomegaly, intracranial and abdominal calcifications. 6: High output states - Vascular malformation, vascular tumor, chorangioma. 7: Mechanical compression - Large lung mass, mediastinal mass. 8: Multiple gestations - Twin twin transfusion, monozygotic twin demise, twin reversed arterial perfusion. 9: Metabolic - Lysosomal storage disorders, gestational alloimmune liver disease.

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## Abstract Archives of the RSNA, 2023

OBEE-58

### A Headache Free Approach to Hydrocephalus

#### Participants

April Griffith, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1: The prognosis for fetal ventriculomegaly depends on the underlying etiology thus a systematic approach is recommended. 2: Scan technique is critical to ensure correct measurements for grading (mild, moderate, severe) and tracking for progression over time. 3: Accurate diagnosis is essential for pregnancy management and delivery planning. 4: Some conditions with ventriculomegaly can recur in future pregnancies (e.g., autosomal recessive Walker Warburg syndrome). 5: Fetal MRI plays an essential role in characterizing the underlying pathology. 6: Isolated mild ventriculomegaly is a diagnosis of exclusion, generally associated with good intellectual outcome. It may be unilateral (usually left), in males.

#### TABLE OF CONTENTS/OUTLINE

A: Technique to measure ventricles - US and MRIB: Evaluate the posterior fossa: Exclude Chiari malformation, Dandy Walker syndrome, aqueductal stenosis, rhombencephalosynapsisC: Systematic assessment of the supratentorial brain: Midline: Is the falx present, is the cavum septi pellucidi normal? Cortical mantle: Gyral and sulcal development, thickness, symmetry, defects? Ventricles: Shape, lining, contents? D: Is there a mass? E: Is there a vascular malformation? F: Are there cystic areas?G: Perform a detailed anatomy scan to look for signs of syndromes, infection, aneuploidy, growth restriction and complications of monochorionic twinning.

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## Abstract Archives of the RSNA, 2023

OBEE-59

### Medical Devices in Female Genital System: What Radiologists Need to Know

#### Participants

Guan Guan, MD, PhD, Guangzhou, China (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the classification and function of medical devices in female genital system (uterus, vagina and adnexa).2. To realize the normal, abnormal and special imaging findings of medical devices in female genital system.3. To introduce complications related to medical devices in female genital system (including imaging appearance, diagnosis and differential diagnosis).4. To learn assistance in imaging diagnosis of medical devices in female genital system.

#### TABLE OF CONTENTS/OUTLINE

1. Classifications of medical devices in female genital system (1) Medical devices of the uterus (IUDs, uterine suspension mesh, etc.); (2) Medical devices of the vagina (pessary, vaginal occluder, vaginal tamponade, etc.); (3) Medical devices of the ovary and adnexa (tubal ligation clips, ovarian suspension clips, etc.).2. Medical devices of the uterus (1) Function and normal imaging appearance; (2) Abnormal imaging appearance and related complications; (3) Assistance in imaging diagnosis.3. Medical devices of the vagina (1) Function and normal imaging appearance; (2) Abnormal imaging appearance and related complications; (3) Assistance in imaging diagnosis.4. Medical devices of the ovary and adnexa (1) Function and normal imaging appearance; (2) Differential diagnosis of post-ovarian suspension findings (e.g. ovarian maldescent, supernumerary ovary); (3) Abnormal imaging appearance and related complications; (4) Assistance in imaging diagnosis.

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## Abstract Archives of the RSNA, 2023

OBEE-6

### Role of Fetal MRI in Antenatal Assessment of Central Nervous System Anomalies: What a Radiologist Should Know

#### Participants

Smily Sharma, MD, MBBS, Jodhpur, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To study the role of fetal MRI for antenatal assessment of various central nervous system anomalies including indications, added advantage over obstetric ultrasound as well as certain limitations. 2. To define a fetal MRI protocol for central nervous system assessment. 3. To learn about normal appearances of sulcation and gyration of brain at various periods of gestation and beware of MR pitfalls in fetal CNS imaging. 4. Using state of the art cases, to learn about myriad of CNS anomalies that can be detected in fetus, their syndromic and non-syndromic associations and their antenatal or postnatal follow up (wherever available).

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to fetal MR for antenatal central nervous system anomalies: Indications, advantages/ disadvantages and comparison with obstetric ultrasound 2. MR protocol to assess various central nervous system anomalies in fetus 3. MRI appearances of fetal brain at different periods of gestation (Pearls and Pitfalls) 4. Various CNS anomalies on fetal MRI with postnatal follow up wherever available: 4A. Fetal Ventriculomegaly 4B. Malformations of cortical development and midline brain anomalies 4C. Corpus Callosal Agenesis/ Dysgenesis and associations 4D. Posterior Fossa Malformations 4E. Neural Tube defects and Spinal Dysraphism 4F. Vascular anomalies 4G. Syndromic associations 4H. Miscellaneous CNS Disorders including ischemic insults, germinal matrix and intraventricular hemorrhage in fetus 5. Conclusion

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## Abstract Archives of the RSNA, 2023

OBEE-60

### Once in a Lifetime Gynecological Cases: Seen One, Seen Them All

#### Participants

Ana Villanueva, MD, Toronto, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To illustrate and review unusual gynecological cases, some of them with classic appearance as well as common gynecological cases with rare presentation. 2. Role of radiologist in evaluation of challenging gynecological cases.

#### TABLE OF CONTENTS/OUTLINE

1. Background How do abdominal radiologists like to report gynecological cases? And what about general radiologists? Many colleagues say that they find themselves in trouble when reporting these cases. And why is that? Probably it is a combination of lack of knowledge or experience; not familiar reporting different techniques TV US, CT and MRI; etc. We as radiologist look for entities that we know. If we do not know about a disease, we will not think about it and therefore we will not reach a correct diagnosis. However, there are certain entities that even they are challenging because they are uncommon, they have a classic appearance (for example malignant adenoma of the cervix). Once you see one case, you will not forget. Also, common gynecological diseases can present in a very unusual way (for example ileal and appendiceal endometriosis without pelvic endometriotic findings). 2. Identification of characteristic imaging features • Different imaging techniques will be shown: Transvaginal US, CT, MRI • To propose key points to accurately reach the diagnosis • Algorithm of differential diagnosis based on imaging features along with relevant clinical and analytical information 3. Understand the clinical and treatment implications of diseases with characteristic radiologic appearance 4. Radiologic- pathologic correlation will be shown for most of the cases 5. Conclusion 6. References

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## Abstract Archives of the RSNA, 2023

OBEE-61

### First Trimester Ultrasound (FTUS): Screening Techniques

#### TEACHING POINTS

Increased nuchal translucency (NT) remains an internationally recognized indication for invasive testing (amniocentesis or CVS). By the end of this educational exhibit, the reader/listener would be able to: 1. Understand the various screening policies for chromosomal abnormalities utilized in the first trimester (Combined screening vs Contingent screening policies). 2. Learn about the importance and technique of measuring NT in the first trimester. 3. Learn about new ultrasound markers utilized in first-trimester screening. 4. Identify important fetal structural abnormalities and their significance system-wise. 5. Algorithmically co-relate first-trimester ultrasound findings to the next steps in the screening process.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to FTUS  
2. Combined screening vs Contingent screening for chromosomal abnormalities  
3. Nuchal translucency (NT)  
i. Significance and efficiency  
ii. The technique of measuring NT  
4. New FTUS markers  
i. Nasal bone  
ii. Tricuspid flow  
iii. Ductus Venosus flow  
5. Cell-free DNA (cfDNA)  
i. The utility of cfDNA in relation to FTUS- When to use and when NOT to use?  
ii. Advantages and limitations of cfDNA compared to FTUS  
6. Fetal structural abnormalities NOT to miss in FTUS  
i. CNS abnormalities  
ii. GI and GU abnormalities  
iii. Skeletal abnormalities  
iv. Cardiac abnormalities  
7. Summary

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## Abstract Archives of the RSNA, 2023

OBEE-62

### The Hidden Enemy: A Visual Journey Through Ovarian Tumor Imaging

#### Participants

Sofia Maksoud, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ovarian tumors are classified according to their origin: epithelial cell tumors, germ cell tumors, sex cord-stromal tumors and metastatic tumors. Among them, epithelial tumors are the most common, with a higher prevalence between 60 and 70 years of age. Imaging exams have the capability to predict the risk of malignancy: mural nodules, papillary projections, solid components, thickened walls and septa (greater than 3.0 mm) with associated vascularization are some aspects that suggest malignancy, while of fat components suggests benignity. Pelvic ultrasound is commonly the first exam to be performed due to its high availability and low cost. However, for adequate characterization of the ovarian mass, additional tests such as magnetic resonance imaging may be requested, with the aim of helping to distinguish between benign and malignant tumors and, mainly, in staging and surgical planning. The results of radiological examinations associated with the clinical features, family history and laboratory tests allow the diagnosis of ovarian lesions. A thorough evaluation provides part of data that may be associated with the histology of these tumors. This information plays a fundamental role in choosing the appropriate therapy.

#### TABLE OF CONTENTS/OUTLINE

To demonstrate cases of malignant and benign ovarian tumors and to review their presentations in different imaging modalities, including pelvic ultrasonography and magnetic resonance imaging, correlating with anatomopathological results and surgical specimens.

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## Abstract Archives of the RSNA, 2023

OBEE-63

### Placenta Accreta Spectrum and the Emergence of MRI

#### Participants

Leslie Nelson, DO, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Placenta Accreta Spectrum (PAS) refers to abnormal placental adherence and/or invasion into the uterine wall due to a defective decidualization process. Difficult placental separation can cause life threatening peripartum hemorrhage if not diagnosed prenatally. 2. The prevalence of PAS has increased 10-fold over the last 4 decades and has been linked to increased rate of cesarean deliveries. 3. Ultrasound is the first line modality for placenta imaging, however, MRI is an emerging modality that provides superior soft tissue contrast and is vital for surgical planning in Placenta percreta. 4. In 2020, SAR and ESUR published a joint consensus statement to standardize MRI acquisition, interpretation and reporting of PAS. 5. This educational exhibit will help the learner understand and identify the described MRI signs associated with PAS and their pathophysiologic subcategories.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction of PAS 2. Compare and contrast use of ultrasound versus MRI 3. Normal MRI appearance of the placenta 4. Review of the MRI features described by SAR and ESUR joint consensus statement 5. Review the three pathophysiological oriented classifications (gross morphologic signs, interface signs and tissue architecture signs) 6. Review pathology proven cases (accreta, increta and percreta)

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## Abstract Archives of the RSNA, 2023

OBEE-64

### CT Imaging of the IUD: Expected Findings, Unexpected Findings, and Complications

#### Participants

Grace Zhu, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

After viewing this exhibit, the reader will be able to: 1. Understand the approach in evaluating the CT appearance of an intrauterine device and recognize a normally positioned intrauterine device. 2. Recognize the CT imaging appearance of wide spectrum of complications involving the intrauterine device.

#### TABLE OF CONTENTS/OUTLINE

Outline: 1. Introduction<sup>a</sup>. Types of IUDs<sup>b</sup>. Approach to evaluating IUDs on CT<sup>c</sup>. Normal Imaging appearance of an appropriately positioned IUD<sup>2</sup>. Complicated IUDs<sup>a</sup>. Malpositioned IUD<sup>i</sup>. Low lying IUD<sup>ii</sup>. Intracervical IUD<sup>iii</sup>. Rotated IUD/Upside Down IUD<sup>b</sup>. Embedded IUD<sup>c</sup>. Extrauterine IUD<sup>d</sup>. Fragmented IUD<sup>e</sup>. Pregnancy and IUD<sup>i</sup>. Ectopic pregnancy<sup>ii</sup>. Intrauterine pregnancy<sup>f</sup>. Miscellaneous<sup>i</sup>. Actinomycoses and IUDs<sup>ii</sup>. Fibroids and IUDs<sup>iii</sup>. Mullerian abnormalities and IUDs

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## Abstract Archives of the RSNA, 2023

OBEE-65

### To Treat, or Not to Treat, That is the Question: Multimodality Approach to Secondary Post Pregnancy Hemorrhage

#### TEACHING POINTS

- Secondary post pregnancy hemorrhage occurs 24 hours to 12 weeks following delivery. Etiologies include retained products of conception (RPOC), subinvolution of the placental site (SIPS), arteriovenous malformation/arteriovenous fistula (AVM/AVF) spectrum.- Ultrasound is often a first line imaging modality in the identification of causes of secondary post pregnancy hemorrhage. However, CT and MRI may also be used in the imaging work up. Recognizing key features of each etiology is essential to timely diagnosis and clinical management.- Certain pathology may mimic causes of secondary post pregnancy hemorrhage such as endometritis and gestational trophoblastic disease.

#### TABLE OF CONTENTS/OUTLINE

- Explanation of causes, pathophysiology, and management of secondary post pregnancy hemorrhage including RPOC, SIPS, and AVM/AVF- Case-based, multimodality imaging review of secondary post pregnancy hemorrhage including US, CT, and MRI with discussion of management options- Imaging review of mimics of retained products of conception including endometritis and gestational trophoblastic disease- Proposed algorithmic approach to management of secondary post pregnancy hemorrhage based on imaging findings and how to differentiate from mimickers

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## Abstract Archives of the RSNA, 2023

OBEE-66

### Malignant Transformation of Endometriosis and Its Mimics

#### Participants

Cesar Resino Sanchez, PhD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the types of malignant transformation of endometriosis, taking into account the typical and atypical locations.
2. To recognize the usefulness of magnetic resonance imaging (MRI) in the early diagnosis of malignant transformation of endometriosis.
3. To describe forms of presentation of endometriosis that can simulate malignant transformation.

#### TABLE OF CONTENTS/OUTLINE

Definition, types and typical and atypical locations of endometriosis. Pathological mechanisms of malignant transformation: genomic alterations, oxidative stress, inflammation, and hormonal influences. Types of ovarian tumors in endometriosis (endometrioid adenocarcinoma and clear cell carcinoma as the most frequent). Optimal protocol and MRI findings suggestive of malignancy: appearance of enhancing intramural nodules, enlargement of the endometrioma and disappearance of shading sign on T2-weighted images. Imaging findings in cancers arising from extraovarian endometriosis. Malignancy simulators: decidualization during pregnancy, polypoid endometriosis, extraovarian endometriosis mimicking peritoneal carcinomatosis, etc.

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## Abstract Archives of the RSNA, 2023

OBEE-67

### Hysterosalpingography: What's Current and What's Next

#### Participants

Erica Cruz, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Hysterosalpingography is an exam with consolidated use in medical practice, with well-established indications and contraindications in the literature. The main indications for the exam are: human reproduction (infertility), preoperative uterine fibroids, repeat abortions and reversal of tubal ligation. Although new technologies and imaging methods have been developed in the past years, it currently persists as the method of choice and gold standard for evaluating the thickening of the mucous pleats of the fallopian tube. The objective of this study is to provide a didact review of hysterosalpingography, from the examination technique to its main findings, since the images acquired's quality depends on the correct preparation and technique. We also provide a comparative study of hysterosalpingography with other emerging imaging methods, such as magnetic resonance hysterosalpingography (HSG-MRI) and hysterosonosalpingography, with future perspectives related to these methods.

#### TABLE OF CONTENTS/OUTLINE

Case-based review of hysterosalpingography exams, including the technique, most common findings and pitfalls, with a literature review, teaching points, and references. We also provide correlation with other imaging methods, such as ultrasonography and magnetic resonance imaging (MRI).

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## Abstract Archives of the RSNA, 2023

OBEE-68

### Highlighting the Updates in Mid-Trimester Fetal Ultrasound Scan According to the Updated International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) Practice Guideline

#### TEACHING POINTS

The mid-trimester ultrasound scan is performed for anatomic evaluation of the fetus and is accepted as a part of routine prenatal care by many countries. The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) published a guideline for the performance of the routine mid-trimester fetal ultrasound scan in 2011 and updated the guideline in 2022. According to these guidelines, a routine mid-trimester fetal ultrasound examination should include an evaluation of the cardiac activity; fetal number (and chorionicity and amnionicity in cases of multiple pregnancy); gestational age/fetal size; basic fetal anatomy; placental appearance and location. In the updated ISUOG guideline, amniotic fluid volume assessment and measurement of cervical length for prediction and prevention of preterm birth are also recommended. Pregnancies in which the umbilical cord inserts into the amniotic membranes (velamentous cord insertion) or at the edge of the placenta (marginal cord insertion) should be reported. Suggested minimum (and optional) requirements for the fetal anatomic survey were also updated and will be discussed in the exhibition. Technical challenges to obtaining these standard images will also be discussed.

#### TABLE OF CONTENTS/OUTLINE

The suggested basic mid-trimester fetal anatomic survey according to ISUOG is updated in 2022. Knowledge of minimum and optional requirements according to the current guideline is important for the appropriate evaluation of the fetus. This exhibit aims to highlight the updates as well as remaining unchanged requirements with ultrasound images.

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## Abstract Archives of the RSNA, 2023

OBEE-69

### Postmenopausal Endometriosis: Clinical Insights and Imaging Considerations

#### TEACHING POINTS

- Postmenopausal endometriosis is estimated to affect around 2-4% of women and is more commonly seen in patients undergoing hormone replacement therapy.
- There is no current guidelines for management of postmenopausal women with endometriosis.
- Transvaginal ultrasound and magnetic resonance imaging are the primary imaging modalities for assessing extent of endometriosis.
- Imaging findings will demonstrate a predominance of the fibrotic component associated with anatomical distortion.

#### TABLE OF CONTENTS/OUTLINE

- To review the clinical presentation of endometriosis in the postmenopausal population
- To understand how hormonal status affects the pathogenesis of endometriosis, including both exogenous and endogenous sources
- To use a case-based approach to illustrate the sonographic and MRI findings of endometriosis in patients undergoing hormonal replacement therapy, as well as in those who are not undergoing hormonal treatment. Laparoscopic correlation will be included, when available.
- To describe the risk of malignant transformation for specific lesions such as endometriomas and deep invasive lesions, while using cases to demonstrate imaging features of neoplasm.
- To explore proposed non-invasive screening imaging methods.

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## Abstract Archives of the RSNA, 2023

OBEE-7

### Hysterosalpingography and Infertility: Beyond Tube Obstruction

#### Participants

Leticia Cardoso Ern, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The causes of infertility can be genetic or acquired. When anatomically compartmentalized, it is possible to determine some groups of causes: uterine, tubal, ovarian, and central (pituitary and hypothalamic). Hysterosalpingography (HSG) is a contrast-enhanced examination of the female genital tract that uses serial radiographs to assess uterine and tubal anatomy. It is known to be the first-line test for assessing tubal obstruction, as it can determine the local anatomy in a relatively simple and inexpensive way. There are several other findings that HSG can offer and suggest diagnoses of other causes of infertility, such as endometriosis, adenomyosis, Müllerian duct malformations, and uterine synechiae. By the end of this study, the reader will be able to define the importance of fluoroscopy in the investigation of infertility, understand the methodology of HSG and identify its causes based on imaging findings.

#### TABLE OF CONTENTS/OUTLINE

Define the role of imaging exams in the investigation of infertility; Determine the methodology of HSG and its usefulness; Explain the causes of infertility and illustrate their compatible findings in HSG through image examples.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

OBEE-70

### From the Pathology Lab to the Radiology Suite: Navigating Neuroendocrine Tumors of the Female Reproductive System

#### Participants

Ana Bavaresco, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Mayara Dos Santos Cruz, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To present a rare subtype of gynecological tumor, the Neuroendocrine gynecological tumors (NEG). To review clinical-pathological features of NEG, highlighting the pathologic differences between NEG and non-NEG cancers. To expose the aggressive clinical behavior of NEG tumors by evolutive imaging examples and well-documented cases, with emphasis on the radiological role for staging and follow-up. To become aware of the different prognostic data between NEG and non-NEG tumors with a brief overview on the suggested treatment.

#### TABLE OF CONTENTS/OUTLINE

Neuroendocrine gynecological tumors can dramatically affect the cervix, ovary, endometrium, vagina, and vulva. As extremely rare tumors, studies on NEG are scarce and most are based on case reports. Although the imaging features are non-specific for diagnosis, imaging is quintessential in staging, treatment response assessment, and surveillance. To demonstrate with clinical cases, imaging exams, and temporal evolution the regional and advanced involvement of NEG. Review in a didactical way the disease-related pathology, and its differentials, based on illustrations, pathology / immunohistochemistry analysis. Case-based discussion and review of the essential information for the radiological report, that will imply the follow-up and treatment of the patient. Discuss the clinical prognosis associated with the disease, and demonstrate briefly the limitations related to the therapies available.

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## Abstract Archives of the RSNA, 2023

OBEE-71

### Many Faces of Uterine Fibroids: Imaging Findings of Degenerations, Differential Diagnoses, and Complications

#### Participants

Shintaro Ichikawa, MD, PhD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Uterine fibroids are benign tumors composed of smooth muscle and are the most common tumors in gynecology. Because uterine fibroids tend to produce different symptoms depending on their site of origin, accurate assessment of the site and size of the fibroids using diagnostic imaging is required. Although typical uterine fibroids are easy to diagnose using imaging, there are a variety of degenerations, and it is important to know the characteristics of each.

#### TABLE OF CONTENTS/OUTLINE

The following typical and degenerated uterine fibroids are discussed along with their key imaging findings: 1. Typical fibroids (intramural, subserosal, submucosal, and cervical) 2. Hyaline degeneration 3. Hydropic degeneration 4. Myxoid degeneration 5. Fatty degeneration 6. Red degeneration The following differential diagnoses and complications are discussed, along with their key imaging findings: 1. Uterine lipoleiomyoma 2. Hypercellular uterine fibroid 3. Uterine leiomyosarcoma 4. Focal adenomyosis 5. Low-grade endometrial stromal sarcoma 6. Submucosal uterine fibroid prolapse into the vagina (vaginal delivery) 7. Uterine intravenous leiomyomatosis 8. Peritoneal leiomyomatosis following uterine fibroid morcellation 9. Rupture of fibroid 10. Torsion of subserosal fibroid 11. Infection of fibroid

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## Abstract Archives of the RSNA, 2023

OBEE-72

### Comprehensive Imaging of Pelvic Medical Devices: Beyond IUDs

#### TEACHING POINTS

Recognize the usual appearance of the main pelvic devices in different imaging methods (Radiographic, Ultrasound, CT and MRI):  
Vaginal tampon  
Menstrual cup  
Contraceptive devices (IUDs, Female sterilization device, Vaginal ring)  
Therapeutic devices (Pessaries, Brachytherapy applicator, etc)  
Post-surgical devices (Suture artifacts, catheters, etc)  
How to assess the proper placement of the most common pelvic devices and what points and measurements should be included in the report  
Recognize the main complications related to Intrauterine contraceptive devices (IUDs) displacement

#### TABLE OF CONTENTS/OUTLINE

INTRODUCTION  
Main pelvic devices and their radiographic features  
How to assess correct placement of pelvic devices and practical points  
COMPLICATIONS RELATED TO INTRAUTERINE CONTRACEPTIVE DEVICES DISPLACEMENT.  
Case based Review of:-  
Displacement- Embedment- Complete perforation

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## Abstract Archives of the RSNA, 2023

OBEE-73

### **Piecing Together the Puzzles: Imaging Diagnostic Approach to Genetic Diseases Affecting the Female Reproductive Organs and Beyond**

#### **Participants**

Tsukasa Saida, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The genetic links to various tumors have become more apparent, and it is crucial for radiologists to understand them in order to make an accurate diagnosis and establish an appropriate testing strategy. This exhibit will describe the genetic diseases associated with neoplastic lesions in gynecology, including the specific characteristics of each tumor and lesions that occur in other regions of the same disease. The teaching points of this exhibit are: 1. Description of the inheritance pattern and characteristics of each genetic disease 2. Presentation of key imaging findings that contribute to the diagnosis of various genetic diseases

#### **TABLE OF CONTENTS/OUTLINE**

A. Inheritance pattern  
B. Characteristics of the genetic disease  
C. Imaging features of gynecologic tumors associated with genetic diseases  
D. Imaging features of lesions that occur in other regions of the body

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## Abstract Archives of the RSNA, 2023

OBEE-74

### Hystero-Salpingography in Current Clinical Practice - Old Flames, Die Hard!

#### Participants

Nitin P. Ghonge, MD, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review the clinical status of Hysterosalpingography[HSG] in infertility work-up in the current era of cross-sectional imaging.
2. To revisit the nuances of HSG procedure and image interpretation for better understanding of uterine, tubo-ovarian and peritoneal lesions in these patients.
3. To understand the spectrum of findings on the initial HSG study and impact on the subsequent infertility work-up.

#### TABLE OF CONTENTS/OUTLINE

1. Status of HSG in current clinical practice as an initial first-line investigation for infertility work-up.
2. Procedural nuances in HSG and the image interpretation skills play an important role in diagnostic accuracy of HSG in patients with infertility and the overall utility.
3. Implications of slow continuous injection of contrast with acquisition of standard set of images: early filling phase, late distended phase, peritoneal spillage phase and post-cannula removal phase.
4. Review of basic principles in Radiation hygiene as applicable to HSG.
5. Image interpretation includes evaluation of endometrial cavity in terms of shape, distension and the mucosal surface. Tubal and peritoneal evaluation is not restricted to contrast spillage alone. Apart from tubal patency, evaluation of tubal mucosa is an important component of tubal evaluation. Apart from the tubal opacification and luminal caliber, the course of fallopian tubes should also be carefully evaluated as it provides vital clues about the status of peri-tubal peritoneum and peritubal adhesions.

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## Abstract Archives of the RSNA, 2023

OBEE-75

### Hereditary and Non-Hereditary Syndromes with Gynecologic Manifestations: What the Radiologist Needs to Know

#### Participants

Ekta Maheshwari, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A number of key hereditary and non-hereditary syndromes are associated with gynecologic manifestations. 2. Awareness of these syndromes and their associations is integral to optimal patient management, facilitating recommendations for ancillary imaging and follow up.

#### TABLE OF CONTENTS/OUTLINE

Hereditary Cancer Predisposition Syndromes Some examples of hereditary cancer predisposition syndromes include Lynch syndrome (mismatch repair genes), Cowden Syndrome (PTEN), hereditary breast and ovarian cancer syndrome (BRCA1/ BRCA2), Peutz-Jeghers syndrome (STK 11) and hereditary leiomyomatosis and renal cell cancer syndrome (FH). These syndromes can predispose individuals to distinct uterine and ovarian neoplasms. Congenital Syndromes with Benign associations • Gynecologic manifestations observed in multiple congenital and acquired syndromes can also be associated with benign entities • Congenital malformation of the reproductive tract can be seen in Mayer-Rokitansky-Küster-Hauser syndrome. Familial clustering of these cases suggests a genetic basis of inheritance. Acquired Syndromes Acquired syndromes with gynecologic manifestations include- • Meig's syndrome • Ovarian hyperstimulation syndrome • Ovarian remnant syndrome • Fitz-Hugh-Curtis syndrome • Growing teratoma syndrome AIMS • Summarize and illustrate imaging findings observed for key hereditary and non-hereditary syndromes associated with gynecologic manifestations, including features of malignancy and those features overlapping and mimicking malignancy. • Describe the clinical implications, most current imaging recommendations and screening and surveillance guidelines for these syndromes.

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## Abstract Archives of the RSNA, 2023

OBEE-8

### Quantification in Fetal MRI: Why, When, and How

#### Participants

Haithuy N. Nguyen, MD, Los Angeles, CA (*Presenter*) Research Grant, Siemens AG

#### TEACHING POINTS

1. Recognize the fetal abnormalities that require a radiologist to use the measuring tool. 2. Understand the impact of measurements on prognostication and/or family counseling. 3. How to correctly perform the measurements and compare to previously published normative values or thresholds.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Why, when, how to measure lung volumes - Congenital diaphragmatic hernia (CDH), congenital lung malformation, giant omphalocele, anhydramnios, skeletal dysplasia, and cervical teratoma. 3. Why, when, how to measure tracheoesophageal displacement index and tumor volume to fetal weight ratio for cervical and sacrococcygeal teratomas, respectively. 4. Why, when, how to measure liver volumes - CDH. 5. Future work - lung signal ratios, estimating CDH defect size, open neural tube myelomeningocele sac size, and amniotic fluid maximum vertical pocket.

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## Abstract Archives of the RSNA, 2023

OBEE-9

### Imaging Cervical Cancer: Beyond Diagnosis

#### TEACHING POINTS

Abdominal imaging plays an essential role in the contemporary management of cervical cancer. MRI is a key imaging modality due to excellent tissue contrast resolution, enabling superior accuracy for tumor size, parametrial and pelvic sidewall invasion and evaluation of nodal metastases, all of which are key prognostic factors for cervical cancer. 18F-FDG-PETCT is essential in the assessment of advanced stage disease to evaluate for distant metastasis and can also aid in the detection of involved locoregional lymph nodes. Imaging also plays an integral role in brachytherapy treatment planning and execution. Ultrasound, MRI, CT and, on occasion radiography, are used for guidance of brachytherapy applicator placement and to confirm appropriate implant positioning prior to the delivery of therapeutic radiation. Imaging is integral in the post-treatment surveillance to detect treatment-related complications and identify recurrent disease.

#### TABLE OF CONTENTS/OUTLINE

Review the current FIGO staging system of cervical cancer and illustrate the role of imaging as it relates to stage determination and stage-specific treatment options. Demonstrate the role of imaging for brachytherapy treatment planning and execution, including structured reporting recommendations for brachytherapy implant assessment. Illustrate expected post-therapy imaging findings and the role for MRI, PETCT and CT. Show imaging findings of common and uncommon post-therapy complications. Illustrate cases of recurrence vs. expected benign post treatment changes.

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## Abstract Archives of the RSNA, 2023

PDEE

### Pediatric Imaging Education Exhibits

#### Sub-Events

#### **PDEE-1 Ear Anatomy and Anomalies in Fetal MRI**

##### Participants

Matheus Dorigatti Soldatelli, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Describe ear anatomy and anomalies using in-vivo MRI in fetuses between 16 and 41 weeks of gestational age (GA). Additional 3D skin-surface reconstructions and postnatal or post-mortem imaging were performed in selected cases.

##### TABLE OF CONTENTS/OUTLINE

- Illustrate the ease of visualization of the pinna, external auditory meatus, cochlea, modiolus, vestibule, and semicircular canals at different GAs.- Demonstrate ear malformations in syndromic and non-syndromic patients and the associated extra-labyrinthine anomalies, such as facial and extremity abnormalities, that aid in phenotype-genotype correlation.

#### **PDEE-10 Bone Deep: Exploring Musculoskeletal Health with Nuclear Medicine**

##### TEACHING POINTS

1.Nuclear medicine imaging of the musculoskeletal system is a valuable tool for diagnosing a variety of conditions and should be performed with appropriate considerations, including image acquisition and radiation dose. 2.Skeletal scintigraphy is a useful tool for evaluating various musculoskeletal conditions, including osteomyelitis, and proper image acquisition is essential for accurate diagnosis. 3.Bone scintigraphy can also be used in the context of non-accidental trauma in children to identify occult lesions and patterns of distribution and interpretation of the images must be done carefully. 4.18 F-fluoride PET/CT is an imaging modality that can be used for low back pain and can also identify conditions such as pseudoarthrosis and hardware loosening. 5.Bone scintigraphy can also lead to unexpected diagnoses, including Langerhans Cell Histiocytosis and various oncologic diseases, emphasizing the importance of thorough interpretation.

##### TABLE OF CONTENTS/OUTLINE

Introduction 1.Pediatric Considerations 2.Image acquisition 3.Radiation dose Skeletal Scintigraphy 1.Indications 2.Image acquisition 3.In the context of Osteomyelitis Bone Scintigraphy and Non-accidental Trauma 1.Image acquisition 2.Interpretation 3.Occult lesions 4.Patterns of distribution 18F-fluoride PET/CT 1.Image acquisition 2.Low back pain 3.Pseudoarthrosis 4.Hardware loosening 5.Skeletal Trauma in non-accidental trauma Bone Scintigraphy and Unexpected Diagnosis 1.Langerhans Cell Histiocytosis 2.Oncologic diseases Conclusions

#### **PDEE-11 Synapses and Signals: Nuclear Medicine Applications in Neurology and Endocrinology**

##### TEACHING POINTS

1. Nuclear medicine imaging can provide valuable diagnostic and therapeutic information in the evaluation of central nervous system and thyroid diseases, but appropriate dose optimization and imaging protocols are essential to minimize the potential risks associated with radiation exposure. 2. Epilepsy evaluation can benefit from various nuclear medicine imaging techniques such as CSF flow studies, CNS radionuclide angiography, and SISCOM, which can provide valuable information about brain function and blood flow. 3. 18F-FDG PET is a useful tool for evaluating epilepsy, as it can provide information on brain metabolism and can help identify the location of seizure foci. 4. Pediatric thyroid diseases, such as hyperthyroidism, nodular thyroid disease, thyroid cancer, Graves Disease, and subacute thyroiditis, can be evaluated using a range of nuclear medicine imaging techniques, including thyroid uptake and scan, 123I whole-body scan, and 99mTc-MIBI imaging. 5. Nuclear medicine imaging can play a crucial role in the diagnosis and management of thyroid cancer, including the use of radioiodine therapy to target and destroy cancerous thyroid cells.

##### TABLE OF CONTENTS/OUTLINE

Introduction 1.PET 2.Image acquisition 3.Radiation dose Epilepsy 1.Epilepsy Evaluation 2.Tracers for Targeted Epilepsy PET Imaging 3.CSF Flow Studies 4.CNS Radionuclide Angiography 5.SISCOM 6.18F-FDG PET Pediatric Thyroid Disease 1.Hyperthyroidism 2.Nodular thyroid disease 3.Thyroid Cancer 4.Graves Disease 5.Subacute Thyroiditis Conclusions

#### **PDEE-12 Cortical Development Evaluation on Fetal Brain MRI Between 22 and 28 weeks: A Practical Guideline**

##### Participants

Mariana Cerdeira Machado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- To demonstrate the correct protocols for the adequate acquisition of the necessary sequences for the analysis of the cortical development; - To illustrate the morphological aspects of the principal sulci and gyri of the fetal brain between 22 and 28 weeks in

a fetal MRI; - To learn the timing of the appearance of each new sulci between 22 and 28 weeks in a fetal MRI; - To recognize the early signs of cortical development abnormalities.

#### **TABLE OF CONTENTS/OUTLINE**

The purpose of this work is to illustrate the morphological aspects of the principal sulci and gyri and their time of appearance in the fetal brain between 22 and 28 weeks in a fetal MRI. For this, we will briefly discuss cortical development (neuronal proliferation, migration, and organization) and explore anatomic landmarks and their normal morphology throughout this period. Furthermore, we will demonstrate how to adequately perform an MRI exam and use it to evaluate the fetal brain cortex. Finally, we shall explore the early signs of cortex developmental abnormalities and the importance of a prompt diagnosis on the outcomes and prognoses.

#### **PDEE-13 Abdominopelvic Emergencies in Pediatric Oncology Patients: A Pictorial Review**

Participants

Sara Garcia, MD, Barakaldo, Spain (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Pediatric cancer patients are at increased risk for life-threatening emergencies that can affect all organs and systems. Such emergencies may be directly related to the disease at its debut or during its evolution or be secondary to the treatment administered.- Abdominal emergencies are frequent in these patients, and the imaging technique of choice for their study is ultrasound. Plain abdominal radiography, CT and MRI are usually used as complementary studies in case of specific suspicions or for better characterization.- Among the pathology affecting the intestinal loops at the debut intestinal obstruction stands out, especially intussusception, which is very typical in the pediatric population. Typhlitis or neutropenic colitis usually occurs as a complication of QT treatment in patients with ALL.- Among the hepato-biliary emergencies secondary to treatment, hepatotoxicity and sinusoidal obstruction syndrome are the most frequent, the latter presenting typical characteristics on Doppler study.- Acute pancreatitis is a possible complication of chemotherapy with L-asparaginase.- Hemorrhagic cystitis occurs as a complication treatment with cyclophosphamide in patients with HSCT. The bladder is the most affected organ.- Testicular neoplasms do not increase the risk of torsion but can present at onset as acute scrotal syndrome.

#### **TABLE OF CONTENTS/OUTLINE**

1. General classification of emergencies in pediatric oncology patients. Classification of abdominal emergencies, both those that occur at the onset of the disease and those that are secondary to oncological treatment.2. Description of the main clinical features and imaging findings of abdominal emergencies in these patients.

#### **PDEE-14 Mind the Gaps: Avoiding Fracture Pitfalls in Pediatric Musculoskeletal Radiology**

Participants

Lucas Medeiros, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is: 1. To review normal pediatric musculoskeletal imaging findings that can mimic fractures in a multimodality approach 2. To discuss hard-to-identify and pediatric-specific fractures 3. To assess the differential diagnosis of pediatric pathological conditions 4. To analyze treatment-related findings that can simulate pathologies

#### **TABLE OF CONTENTS/OUTLINE**

1. Salter-Harris fractures 2. Green-stick fractures 3. Plastic deformation fractures 4. Torus fractures 5. Non-accidental injury fractures 6. Ossification centers mimicking fractures 7. Secondary fracture findings 8. Metabolic and genetic conditions (e.g. rickets, osteogenesis imperfecta) 9. Skeletal dysplasias 10. Obstetric injury 11. Anatomical variations

#### **PDEE-15 Temporosquamous Suture: An Updated View of the Importance of this Finding in Craniosynostosis**

Participants

Yuree Herenio SR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The squamous suture is the main object of our work. While the phenotypic appearances and sequelae of synostosis of the major cranial vault sutures are well documented, little is reported concerning synostosis of the squamous suture. Involvement of this suture can be individual or associated with other sutures, both in syndromic cases and in primary craniosynostosis. This work has the objective to demonstrate the importance of the temporosquamous suture, which has been undervalued over the years in literature. Recent studies and their surgical correlations show different types of cranial deformity, depending on the location of partial or complete closure of this suture. Deformities include scaphocephaly, plagiocephaly or brachycephaly. Our work shows different types of closure evaluated in our department. We also consider fundamental the use of the Maximum Intensity Projection protocol (MIP) to demonstrate the real shape of the sutures and to investigate craniolacunia, which constitutes a relevant finding in the surgical decision, as it may represent signs of intracranial hypertension.

#### **TABLE OF CONTENTS/OUTLINE**

The work shows a literature review about the squamous suture, showing part of the cases of CT with Maximum Intensity Projection protocol (MIP) and volume rendering 3D reconstruction of different types of closure, evaluated in our department.

#### **PDEE-16 Epiphanyes about Epiphyses: Distinguishing Epiphyseal Mass Lesions in Children**

Participants

Eric Tung, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Epiphyses have unique histology and play an important role in osseous development. The differential diagnosis for epiphyseal mass lesions in children is one that radiologists interpreting pediatric imaging should be familiar with. Overlapping imaging findings of epiphyseal tumors and other focal lesions on radiography and magnetic resonance imaging can hinder the ability of radiologists to establish specific diagnoses by imaging alone. However, knowledge of characteristic imaging features for each lesion can improve

the accuracy and specificity of radiologists' interpretations. By the end of this exhibit, learners should be able to provide a differential diagnosis for pediatric epiphyseal mass lesions, recognize the unique imaging features of each diagnosis, and apply a framework for MRI evaluation of epiphyseal lesions to unknown cases.

#### **TABLE OF CONTENTS/OUTLINE**

1. Background: Epiphyseal development, structure, equivalents; 2. Differential diagnosis for epiphyseal tumors and other focal lesions in children; 3. Review of characteristic imaging findings for each diagnosis; 4. Framework for MRI interpretation to help narrow differential diagnosis; 5. Unknown cases to reinforce learning objectives

#### **PDEE-17 Pediatric Metabolic Bone Disorders - A Comprehensive Review**

##### **TEACHING POINTS**

Illustrate the common and uncommon metabolic bone disorders in children. Identify imaging features that can help differentiate the various metabolic disorders.

##### **TABLE OF CONTENTS/OUTLINE**

Metabolic bone disease in children includes hereditary and acquired conditions of varying etiologies. The purpose of this educational exhibit is to describe the characteristic imaging findings of metabolic bone disorders to include endocrine and nutritional deficiencies. Entities such as rickets, scurvy/ hypovitaminosis C, osteogenesis imperfecta, hyperparathyroidism, renal osteodystrophy, celiac disease, inflammatory bowel disease, hypophosphatasia, osteopetrosis, sickle cell anemia, Gaucher's, heavy metal poisoning, and bone disease secondary to medication such as prolonged steroid treatment will be discussed. Early recognition and treatment of potential risk factors is important to avoid significant clinical consequences.

#### **PDEE-18 Pediatric Skull Lesions**

##### **TEACHING POINTS**

• To discuss the common pathologies affecting the pediatric skull. • To discuss imaging appearance of various skull lesions seen in children. • To develop a systematic approach to diagnosing skull lesions.

##### **TABLE OF CONTENTS/OUTLINE**

Goals and objectives -Background information -Common and uncommon skull lesions in children -Imaging spectrum of pediatric skull lesions -Indications for further imaging -Summary. Pediatric skull lesions can be congenital, traumatic, vascular, inflammatory, infectious, or malignant. These lesions can be clinically palpable or incidentally detected on imaging. The incidentally detected lesions include parietal foramina, sinus pericranii, and venous lakes. The palpable abnormalities can be present at birth, such as cephalohematoma, birth trauma, meningocele/encephalocele, venous malformation, and dermoid/epidermoid cysts. Thalassemia, intraosseous hemangioma, osteoma, lipoma, Langerhans Cell Histiocytosis (LCH), Fibrous dysplasia, Neuroblastoma metastases, Ewing's sarcoma usually present later in life. Most of these lesions are visible on skull radiographs. Further evaluation is performed by ultrasound, computed tomography (CT), and Magnetic Resonance Imaging (MRI). Cephalohematoma and Parietal foramina are identified on ultrasound and radiographs respectively. Dermoid /Epidermoid cysts are commonly seen in the midline, frontal and temporal regions. LCH is usually seen as a beveled edge skull lesion. Fibrous dysplasia presents as expansile lesions with a ground glass matrix seen on CT. Our exhibit will discuss various skull lesions seen in the pediatric age group, their imaging appearance, and a systematic approach to the correct diagnosis.

#### **PDEE-19 Focused Thoracic Ultrasonography for the Elucidation of Radiolucent Areas in Pediatric Patient's Chest X-ray: Approach Based on Cases**

Participants

Taila Moura Fe, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The main objectives of this exhibit are to: 1- Review the importance of thoracic ultrasonography in critical pediatric care and its potential benefits in reducing radiation exposure in neonates and infants. 2- Discuss various conditions that present as lucent lesions on chest X-rays and review sonographic findings of these conditions. 3- Emphasize the use of Focused Thoracic Ultrasound as a reliable tool in critical pediatric care and expand the use of bedside thoracic ultrasound helping physical examination.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction; Review of the use of thoracic ultrasonography; Case-based review of conditions that present as lucent lesions, with a challenging chest x-ray at the beginning of each case, followed by sonographic findings; Conditions included: Diaphragmatic hernia (Morgagni's and Bochdalek's hernia); Pneumothorax; Pneumomediastinum; Necrotizing pneumonia; Pulmonary cavitation/pneumatocele; Poland syndrome; Subcutaneous emphysema; Congenital deficiency of surfactant production; Congenital pulmonary airway malformation (CPAM)

#### **PDEE-2 Imaging Review of the Pediatric Spine: Do Abnormalities Always Indicate Disease?**

Participants

Ana Carolina Augusto, MD, MSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The purpose of this study is: • To review the development of the spine, focusing on the formation and malformations of vertebrae. • To illustrate and discuss the normal appearance, anatomical variations, and common pathologies involving the spine during skeletal growth.

##### **TABLE OF CONTENTS/OUTLINE**

• Embryology: The vertebral column and spinal cord develop in a precise, sequential manner during gestation. Any deviation from this normal process can cause structural variations in the spine and spinal cord. • Congenital and acquired deformities of the vertebral bodies: defects related to fusion, formation, and segmentation of the vertebral bodies may lead to congenital scoliosis and could be linked with spinal dysraphisms, skeletal, cardiac, genitourinary, and gastrointestinal anomalies. Acquired deformities of

the vertebral bodies can be caused by different factors, including trauma, infection, malignancies, systemic diseases, among others. • Bone marrow: bone marrow conversion from red to yellow marrow follows a well-established pattern during childhood. Understanding the normal signal intensity changes on MRI is crucial to detect deviations that may represent disease. • Normal developmental events, pitfalls, and common abnormalities during skeletal maturation: recognizing these developmental events and common abnormalities can assist in image interpretation, guiding treatment and management decisions.

#### **PDEE-20 Osteogenesis Imperfecta: A Pictorial Review**

Participants

Adriano Silveira Moreira Novaes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Osteogenesis imperfecta (OI) is a genetic disease characterized by increased bone fragility, low bone mass and other connective tissue manifestations. The most common cause of OI is mutations in one of the two genes encoding collagen type 1, which is a major component of bone and other connective tissues. OI can present with a wide range of symptoms, and there are now seven recognized types of the disorder. The radiologist must be prepared to recognize the image patterns, determining a correct diagnosis, which facilitates the early and adequate treatment of the patient. Excluding differential diagnoses, such as non-accidental injury, is of fundamental importance. The purpose of the present study is to exhibit imaging findings of types I, III, IV, V and VI of OI; to demonstrate how to differentiate the types based on imaging findings; to demonstrate how to differentiate OI from non-accidental injuries.

##### **TABLE OF CONTENTS/OUTLINE**

Introduction. Epidemiology and clinical finds. Main findings of type I, II, III, IV, V and VI. How to differentiate the types based on imaging findings. Excluding differential diagnoses, such as non-accidental injury, is of fundamental importance. Conclusion/Take home message.

#### **PDEE-21 Pediatric Renovascular Hypertension A-Z: Diagnostic Work-up, Imaging, Interventions, and Troubleshooting**

##### **TEACHING POINTS**

1. Renovascular hypertension (RVH) is caused by an upregulation of the renin-angiotensin-aldosterone system due to flow-limiting renovascular disease (RVD). In pediatric patients, the differential includes fibromuscular dysplasia, neurofibromatosis, vasculitis, abnormal arterial supply and trauma. 2. Although ultrasound is the initial imaging modality for diagnosing RVD, it is limited in evaluation of segmental branches. Angiography is the gold standard for diagnosis. 3. Interventional radiology can offer a variety of interventions for RVD, including angioplasty and embolization. Surgical interventions can be offered in angioplasty-refractory stenosis. 4. A multidisciplinary care team consisting of nephrologists, diagnostic and interventional radiologists, and transplant and vascular surgeons is necessary for the global care of young patients with RVH.

##### **TABLE OF CONTENTS/OUTLINE**

1. Differential diagnosis, diagnostic work-up and medical management for pediatric RVH. 2. Multi-modality approach to the imaging diagnosis for pediatric RVD including: renal artery Doppler ultrasound, contrast-enhanced ultrasound, computed tomography angiography, magnetic resonance angiography, and catheter angiography. 3. Endovascular renal artery interventions and technique for RVH management. 4. Indications for surgical intervention. 5. Surveillance and follow-up; troubleshooting for persistent hypertension.

#### **PDEE-22 Radiogenomics of PIK3CA Related Disorders: A New Era**

Participants

Jada Hislop, BA, Decatur, GA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Vascular anomalies are traditionally classified based on clinical characteristics, imaging and pathology. Diagnosis is challenging due to overlapping phenotype and inconsistent naming conventions. With the rapid development of new technologies in oncology, radiogenomics has emerged as a science which is beginning to change our understanding and treatment of vascular anomalies as well. Advances aid in clarifying etiology and elucidate previously unknown pathomechanisms. Through sequencing of tissue samples, postzygotic somatic variants have been discovered for several vascular anomalies with and without overgrowth as is the case with PIK3CA. PIK3CA driven vascular anomalies may now be treated with mTOR inhibitors and newly approved PIK3CA inhibitors. This exhibit will be a case-based approach to review recent advances in diagnosis including imaging finds, genetic testing, and review management of these disorders. Review the clinical spectrum of disorders associated with pathogenic variants in PIK3CA gene - from isolated vascular malformations to recognizable disorders. Highlight the manifestations of some PIK3CA-related disorders presenting with overgrowth (PROS). Review MRI imaging findings and pathology in patients with confirmed variants in PIK3CA. Discuss the evolving nature of genetic testing in somatic disorders and suitable tissue samples for testing. Briefly discuss therapeutic options including new medical managements

##### **TABLE OF CONTENTS/OUTLINE**

Introduction to PROS/PIK3CA Genetic Pathway  
Selected examples and isolated vascular anomalies and overgrowth disorders  
Diagnostic approaches with imaging  
Diagnostic approaches with genetic  
Therapeutic approaches  
Conclusion

#### **PDEE-23 The Top 10 Most Feared Diagnostic Errors by Radiology Trainees in Pediatric Neuroradiology Emergencies: Practical Tips and Tricks for Early Detection and Prevention**

Participants

Agustin Cardenas, MD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Recognize the key imaging findings of the "top 10" Pediatric Neuroradiology Emergencies considered most challenging by Radiology trainees. 2. Identify the most feared potential errors and pitfalls made by Radiology trainees when interpreting these type of cases. 3. Learn potential contributing factors to developing these errors. 4. Provide practical tips and tricks to help prevent these potential errors. Provide specific strategies to apply them, in order to improve diagnostic confidence of Radiology trainees in clinical



practice.

#### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Top 10 challenging Pediatric Neuroradiology cases during call1. Detection of early cerebral edema. 2. Detection of dural sinus thrombosis in noncontrast head CT. 3. Retropharyngeal edema vs early abscess.4. Detection of early shunt failure. 5. Craniocervical junction fracture vs normal developing ossification center.6. Calvarial fracture vs suture. 7. Branchial cleft cyst vs retropharyngeal abscess. 8. Time estimation of heterogeneous subdural collections. 9. Porencephalic cyst vs ventriculomegaly 10. Detection of early orbital cellulitis.III. Take home pointsIV. References

#### **PDEE-24 The Role of Imaging in Radiotherapy Planning: An Illustrated Review of Common Pediatric Tumors Treated with Radiotherapy**

Participants

Susan Gowdy, FRCPC,MBBS, Newcastle, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review some of the more common paediatric tumours treated with radiotherapy. Understand the role of imaging in the decision-making process regarding type of radiation therapy and mode of delivery. Consider how different imaging modalities may be incorporated into planning a radiation therapy field. Evaluate the potential role of imaging surveillance following radiotherapy.

#### TABLE OF CONTENTS/OUTLINE

Successful management of pediatric malignancies requires a multidisciplinary team approach. This educational exhibit aims to highlight the importance of close collaboration between radiologists, nuclear medicine physicians and radiation oncologists when assessing tumours of childhood which can be treated with radiotherapy. Using case examples of a medulloblastoma, Hodgkin's lymphoma and neuroblastoma, we will present imaging to review radiological features at diagnosis, relevant staging systems and response criteria that are important considerations for radiation oncologists planning radiotherapy treatment. The role of the different imaging modalities including various MRI sequences will be illustrated as the process of planning a radiation therapy field is discussed. Potential treatment complications including current literature regarding the role of imaging in surveillance will be reviewed.

#### **PDEE-25 MRI Findings in Hypovitaminosis C: Separating Scurvy from the Crowd**

#### TEACHING POINTS

1. Symmetric metaphyseal edema involving the lower extremities is an uncommon finding. Causes include metabolic disorders, multifocal infection, autoimmune disorders, inherited diseases, and malignancy. Recognizing that bilateral lower extremity metaphyseal edema is a consistent finding in hypovitaminosis C can lead to early diagnosis and avoidance of further unnecessary testing and procedures.2. Differential diagnoses for symmetric metaphyseal edema include focal periphyseal edema zones, chronic noninfectious osteitis, malignancy, osteomyelitis, and sickle cell disease.3. Although subperiosteal hemorrhage can be seen with other etiologies such as bone infarct from sickle cell disease it can be a specific finding in hypovitaminosis C.4. Since the diagnosis of hypovitaminosis C may not be initially considered, recognition of the imaging findings is important for early diagnosis. This allows for timely treatment and avoidance of further testing.5. Scurvy has several clinical and laboratory findings that overlap with more common pathologies.a. Clinical: (Early) Gingival hyperplasia, joint swelling and bruising. (Late) Fever, jaundice, hemolysis, spontaneous bleeding and neuropathy.b. Laboratory: Mild leukocytosis. Elevated ESR and CRP.

#### TABLE OF CONTENTS/OUTLINE

1. Case series of 4 patients with hypovitaminosis C.a. Historyb. Clinical presentationc. Laboratory valuesd. Imaging2. Review of the differential diagnosis of symmetric metaphyseal edemaa. Imaging features that can be specific for hypovitaminosis C.b. Imaging findings suggestive of an alternative diagnosis.c. Nonspecific clinical findings of hypovitaminosis C.

#### **PDEE-26 Pediatric Rhabdomyosarcoma: Imaging Evaluation from Diagnosis to Treatment Monitoring**

Participants

Dana Alkhulaifat, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Rhabdomyosarcomas (RMS) are the most common type of soft tissue sarcomas in children. Risk factors include cancer predisposition syndromes such as Li- Fraumeni, Noonan and Beckwith-Wiedemann.
- Prognosis depends on several factors including location of the tumor, size, histopathology, genetics and imaging findings.
- The most optimal imaging modality for measuring local tumor involvement is cross sectional imaging by CT or MRI.
- For regional lymph node and metastatic assessment, whole-body fluorodeoxyglucose (FDG) PET/CT or PET/MRI in combination with chest CT is recommended.
- Treatment is multimodal and consists of multi-agent chemotherapy, along with surgical resection and radiotherapy of the primary tumor.
- MRI is the recommended modality for monitoring chemotherapy response for primary tumor, while FDG PET/CT or PET/MRI in combination with chest CT is recommended for lymph nodal and metastatic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Brief overview of pediatric rhabdomyosarcomas: epidemiology, risk factors and clinical presentation. 2. Initial tumor assessment: a. Primary tumor b. Regional lymph nodes c. Metastatic lesions 3. Stratification of severity a. Tumor location b. Histological subtype c. Cytogenetic information d. Imaging staging (CT, MRI and PET) 4. Treatment regimens and response monitoring a. Imaging modalities b. Frequency of monitoring c. Definitions of remission or progression.

#### **PDEE-27 Central Nervous System Involvement in Mucopolysaccharidoses: Understanding Pathophysiology and Radiological Findings**

Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the basic pathophysiology that directly or indirectly affects the central nervous system, including bone instability.To

be able to recognize the main radiological findings of the different subtypes of this disease. To inform about new imaging diagnostic strategies such as spectroscopy.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Definition and general characteristics  
2. Clinical presentation in the central nervous system. I: Alpha-L-iduronidase - Hurler (I H): mental retardation, dysostosis - Scheie (I S): normal intelligence - Hurler-Scheie (I H-S): Intermediate between both above II: Iduronate sulphatase - Hunter: dysostosis III: Profound mental deterioration - Sanfilippo A: Heparan sulphamidase - Sanfilippo B: N-acetyl-glucosaminidase - Sanfilippo C: Acetyl-CoA: alpha-glucosaminide acetyltransferase - Sanfilippo D: N-acetylglucosamine 6-sulphatase IV: Galactose-6-sulphate sulphatase, Beta-galactosidase: Dysostosis, motor dysfunction - Morquio A - Morquio B VI: N-acetylgalactosamine-4-sulphatase - Maroteaux-Lamy: dysostosis, kyphosis VII: Beta-glucuronidase - Sly: dysostosis  
3. Diagnostic methods. Imaging findings and protocols.  
4. Treatment options for mucopolysaccharidoses.  
5. Future directions in imaging of mucopolysaccharidoses - Spectroscopy: diagnosis and future applications  
7. Case series

#### PDEE-28 Easy-peasy! Simplifying the Myelination Progress in Term Newborn

Participants

Marcella N. Brandao, MD, MEd, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the normal myelination process in term newborn, as well as its progression. Tips for standardizing the evaluation of the myelination process. Guide step by step the myelination milestones, the main differential diagnoses and the disturbances in the myelination process that must be recognized.

#### TABLE OF CONTENTS/OUTLINE

Infant brain magnetic resonance imaging (MRI) interpretation presents unique challenges due to different appearances depending on age. This occurs through the myelination process which, despite starting in utero, has acceleration and predictability between individuals in the first postnatal year, with a predetermined scheme of chronological and topographical sequences, serving as an important normal brain maturation marker on MRI. Myelination occurs by a gradual myelin sheath dehydration, at the same time that lipids and proteins are deposited. This process is dynamic and the molecular interactions of water with lipids and myelin membrane proteins are modified and affect the relaxation time in the T1W and T2W sequences. T1W weighted images are most useful up to 8 months old with the myelinated white matter showing hypersignal, and T2W weighted images are useful in the later stages of myelination, showing hyposignal in the face of reduced myelin water content. Although predictable, the evaluation of myelination on MRI is still a challenge for many radiologists, so the authors structure a step-by-step guide with the myelination milestones, the main differential diagnoses and the disturbances in the myelination process that must be recognized.

#### PDEE-29 Anatomic Approach to Non-Traumatic Lesions of the Pediatric Visual Pathway

Participants

Vivek Pai, MBBS, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Most of the visual pathway is inaccessible for histopathology; radiology is the only diagnostic modality available. Hence accuracy is of utmost importance for adequate management and optimal outcome  
2. Having an anatomic approach will help narrow differentials.

#### TABLE OF CONTENTS/OUTLINE

A. Discussion on the anatomy of the visual pathway. B. Pictorial essay on lesions affecting the visual pathway with discussion on etiopathogenesis and presentation. Lesions are divided according to the anatomic location: 1. Retina: Retinal Detachment, Retinal hemorrhage, Panophthalmitis, Medulloepithelioma, Retinoma, Retinoblastoma. 2. Optic disc: Papilledema and IIH, Optic Drusen, Coloboma, CHARGE syndrome, Morning Glory syndrome  
3. Optic nerve: Anophthalmia-related aplasia, hypoplasia, demyelinating disorders, mitochondrial disorders, visual pathway gliomas  
4. Optic chiasm: Septo-optic dysplasia, Krabbe disease, Opto-Chiasmatic tuberculosis, hypothalamic-chiasmatic glioma.  
5. Occipital lobes: Adrenoleukodystrophy, hypoxic-ischemic encephalopathy, hypoglycemic encephalopathy, PCA territory infarction, Posterior Reversible Encephalopathy Syndrome, occipital cephalocele, focal cortical dysplasia

#### PDEE-3 US Evaluation of the Pediatric Hand Trauma: From One Through Five

Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

After reviewing this exhibit, the learner should be able to: 1. Recognize the normal US appearance of the pediatric hand. 2. Describe the use of high-resolution US, Doppler US and microvascular imaging for the evaluation of trauma-related conditions of the hand in children. 3. Review the most common traumatic conditions affecting the hand in children. 4. Discuss the US findings of the most frequent traumatic entities occurring in hand and wrist.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Transducers and technical US parameters to optimize the examination of the hand. 3. Normal US appearance of the pediatric hand, including tendons, ligaments, vessels, and nerves. 4. Authors will focus on five compartments (from one through five): 4.1. Ligaments 4.2. Tendons 4.3. Vessels 4.4. Nerves 4.5. Bone. 5. Ligament injuries: Collateral ligaments (Stener lesion), pulley lesions, volar plate lesions. 6. Tendon injuries: Superficial and profundus flexor tendon lacerations and transections, extensor tendon injuries, impingements, tenosynovitis. 7. Vessels: Venous/arterial thrombosis, post-traumatic pseudoaneurysm. 8. Nerves: Laceration and transection, post-traumatic neuroma. 9. Bone: Fractures, callus formation with secondary impingement. 10. Foreign bodies characterization and removal with US guidance. 11. Injuries will be correlated with anatomical draws, as well as with MRI images. 12. Summary

#### PDEE-30 Diagnostic Error in Pediatric Neuroradiology

#### TEACHING POINTS

(1) Medical error has significant impacts on patient outcomes and society as a whole. (2) Error in diagnostic radiology can be organized in terms of types of thinking. (3) Metacognition, self-awareness, and understanding of specific strategies related to types of error can help radiologists reduce error. (4) Case-specific teaching to reduce error in pediatric emergency neuroradiology.

#### TABLE OF CONTENTS/OUTLINE

For each error type there will be: A pediatric neuroimaging case, a definition of error type, lessons learned, and known strategies to prevent this error. (1) Perceptive Error; (2) Cognitive Error: a) Anchoring bias, b) Confirmation bias, c) Availability bias, d) Satisfaction of report, e) Framing bias, f) Attribution bias, g) Satisfaction of search, h) Premature closure, i) Inattentive bias, k) Hindsight bias; (3) Communication Error; (4) Process Error

#### **PDEE-32 Polymorphous Low Grade Neuroepithelial Tumor of the Young: An Institutional Case Series with Radiological and Pathological Correlation**

##### TEACHING POINTS

Polymorphous low grade neuroepithelial tumor of the young (PLNTY) is a rare, epileptogenic brain tumor that was recently described as a distinct entity in the 2021 World Health Organization classification of CNS tumors. Teaching points include: 1) PLNTY usually occurs in children and adolescents, although is occasionally diagnosed in adults. Clinically, patients often present with refractory seizures. 2) Histological characteristics of PLNTY include an infiltrative growth pattern, intense CD34 expression, cellular components resembling oligodendroglioma, and calcifications. 3) Imaging characteristics of PLNTY include T1 hypo/iso-intensity, T2 hyperintensity, GRE blooming artifact, non- (or slight) enhancement on contrast imaging, cystic components, and internal calcifications. Morphologically, PLNTY is often well-circumscribed and located in the temporal lobe. 4) At a molecular level, PLNTY is characterized by the presence of either a BRAF V600E mutation or chromosomal translocations involving FGFR2 and FGFR3. Both genetic alterations activate the MAP kinase pathway. 5) Imaging differential diagnoses include other low grade cortically based tumors such as oligodendroglioma (usually found in adults), dysembryoplastic neuroepithelial tumor (DNET), ganglioglioma, pleomorphic xanthoastrocytoma, and pilocytic astrocytoma. 6) Surgical resection is usually curative of seizures.

#### TABLE OF CONTENTS/OUTLINE

-Introduction, PLNTY's place in the WHO 2021 Classification of CNS tumors -Imaging characteristics of PLNTY -Histological characteristics of PLNTY -Discussion of pathophysiology and molecular subtypes -Imaging comparisons of differential diagnoses

#### **PDEE-33 Inside the Womb: A Fascinating Look at Congenital Kidney Pathology through Fetal MRI**

Participants

Lizbet Perez-Marrero, Santiago De Chile, Chile (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1) Fetal MRI has emerged as a valuable and high-resolution imaging modality for the comprehensive assessment of fetal renal anomalies. 2) By utilizing a systematic review approach, radiologists can effectively characterize the fetal kidneys, providing a comprehensive understanding of the extent and severity of the anomalies. 3) Incorporating functional kidney assessments and measuring total lung volume during fetal MRI can enhance the overall evaluation of the fetus, providing a better understanding of the patient's condition and enabling more informed parental counseling.

#### TABLE OF CONTENTS/OUTLINE

When evaluating the kidneys, the following topics should be assessed, as combined alterations may be found associated with different pathologies:- position: situs solitus versus ectopia.- morphology: duplex, horseshoe.- size: duplex, autosomal recessive polycystic kidney disease (ARPKD)/ autosomal dominant polycystic kidney disease (ADPKD).- focal lesions: cysts, tumors.- excretory system: posterior urethral valves.- renal function: hypofunctioning - related systems: amniotic fluid, assessment of lung volume (hypoplasia cutoff value?), uterus/annexa.

#### **PDEE-34 Neonatal Liver Imaging: Techniques, Normal Variations and Common Pathologies**

Participants

Govind Chavhan, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Neonatal liver has some unique aspects in terms of imaging and imaging appearances as compared to older children. Choosing and tailoring of imaging for each indication in neonate is therefore important for optimal care with minimal invasiveness. Common indications for imaging include incidental focal lesions, neonatal liver failure, cholestasis and sepsis. Imaging is important component of work up in neonatal liver failure helping to narrow differentials. It may help to salvage liver and potential transplant by timely diagnosis of conditions such as neonatal hemochromatosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction (overview of neonatal liver pathology, incidence, etc.; role of imaging) Imaging modalities- (discussion of specific roles, pros/cons, with relevant summary tables) What changes and what is normal at birth? (discussion of normal imaging appearance of structures related to neonatal liver) Indications for imaging (Incidental lesions, liver failure/dysfunction, cholestasis, sepsis, etc) Common pathologies (work up and role of imaging in the work up) - Congenital calcifications (causes, natural course, imaging) - Line related complications (hematoma, abscess) - Infections (TORCH, herpes, bacterial) - Neoplastic lesions (common lesions- hemangioma/HB/mesenchymal hamartoma /mets) - Vascular abnormalities (thrombosis, portosystemic shunts, AVMs, Heterotaxy) - Neonatal liver failure- causes, workup and role of imaging (NH, HLH, metabolic diseases, infection, cholestatic diseases) Summary

#### **PDEE-35 Pediatric Neck Cystic Lesions**

##### TEACHING POINTS

Cystic lesions are common findings in pediatric patients. Imaging plays a crucial role guiding the diagnosis and depicting the anatomical extent of the lesion. Multimodality imaging narrows the differential diagnosis by demonstrating the lesion's components. Age groups and anatomic location in the neck are also diagnostic clues. It is important to recognize potential complications, especially infections.

## TABLE OF CONTENTS/OUTLINE

o Congenital and Developmental Disorders § Thyroglossal duct cyst § Branchial cleft anomalies § Dermoid/Epidermoid cyst § Thymopharyngeal duct cyst o Vascular § Lymphatic malformations § Venous malformations § Cervical hemangioma § Pseudoaneurysms § Internal jugular phlebectasia o Infectious § Suppurative lymphadenitis § Tuberculous lymphadenitis § Abscess o Neoplastic § Schwannoma § Warthin tumor § Congenital cervical teratoma § Cervical lymph node metastases o Miscellaneous § Ranula § Thyroid colloid cyst § Laryngeal cyst

### PDEE-36 Imaging of DDH: An Update on Diagnostic, Follow-up and Post-operative Findings

#### TEACHING POINTS

The purpose of this exhibit is: To review the anatomy of the infant hip. To discuss the incidence, risk factors and pathophysiology of Developmental Dysplasia of the Hip. To review the clinical and imaging diagnostic criteria for DDH. To discuss the role of each imaging method in the context of DDH. To demonstrate the importance of early diagnosis and proper treatment of DDH with successful cases and adequate treatment, as well as late diagnosis and its complications.

## TABLE OF CONTENTS/OUTLINE

Theoretical introduction containing epidemiology, risk factors and pathophysiology. Anatomy of the infant hip, including bone structures and the most relevant anatomic landmarks in DDH's diagnosis and follow-up. Images of clinical cases demonstrating some of the long-term complications, with emphasis on the importance of early diagnosis and proper treatment to avoid them. Brief discussion and illustration of the main current treatments as well as imaging follow-up evaluation with expected and unfavorable outcomes. Latest updates on diagnosis and treatment of DDH.

### PDEE-37 Imaging Appearance of Common and Less Common Fetal Masses from Head to Toe

Participants

Elizabeth Snyder, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Masses detected prenatally range from congenital malformations to tumors; knowledge of the imaging appearance of common and uncommon fetal masses is important for appropriate pregnancy management, delivery planning and immediate postnatal management-2) Both US and fetal MRI play important and complementary roles in the evaluation of fetal masses.3) Using an anatomic approach to fetal masses, the differential diagnosis can be narrowed, allowing for more accurate prenatal counseling and management.

## TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Epidemiology of fetal masses, b. Overview of categories of fetal masses: congenital malformations, benign tumors, malignant tumors2. Imaging approach to fetal masses: a. Prenatal ultrasound, including 3-D ultrasound b. Role of fetal MRI3. Anatomic approach to the prenatal diagnosis of fetal masses: a. Head neck: teratoma, lymphatic malformations, etc. b. Chest: congenital lung lesions, mediastinal teratoma, congenital myofibroblastic tumor, cardiac rhabdomyoma, etc. c. Abdomen/pelvis: hepatic congenital hemangiomas, neuroblastoma, congenital mesoblastic nephroma, sacrococcygeal teratoma, ovarian cyst, etc. d. Extremities: infantile fibrosarcoma, etc.4. Conclusion

### PDEE-38 Detection of Aspirated Food in Pediatric Airway using Computed Tomography (CT)

Participants

Joseph Swicklik, RT, BS, Byron, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

•Explain clinical significance challenges detecting aspirated food in pediatric airway. •Describe challenges solutions for CT imaging. •Explain method for optimal imaging of radiopaque food matter. •Illustrate benefits of CT in detecting aspirated food particles in clinical applications.

## TABLE OF CONTENTS/OUTLINE

1. Foreign body aspiration in pediatric airways a. Common issue in pediatric patients b. The most common type of foreign bodies aspirated is food c. Challenges with plain film radiography in visualizing food due to low contrast 2. How computed tomography can be used to achieve improved visualization of aspirated food particles in the pediatric airway a. CT offers thin slice axial images without superimposition of anatomy b. Multiplanar reformats offer views from multiple angles to better detect food stuck in the airway 3. Challenges of CT imaging and solutions a. CT has a longer exposure time which increases the chance of motion b. Flash scanning to reduce scan time c. Determining the best scanning factors to best visualize radio-translucent food 4. Phantom studies a. Food items commonly aspired in peds seen in the ED b. Tubes representing realistic sizes of airways in children c. Tubes filled with food items placed inside anthropomorphic chest phantoms representing pediatric patients of different ages d. Optimal scanning, reconstruction, and display techniques to visualize food items e. CT number look-up table of commonly aspirated foods 5. Clinical examples and applications a. Gummy bear detected in airway b. Thoracic c. Pediatrics d. Adults at high risk for aspiration

### PDEE-39 Spectrum of Pediatric Distal Bowel Pathology Imaging from Prenatal Period to Adolescence

Participants

Hajer Jarraya, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The differential diagnosis of neonatal colonic obstruction includes Hirschsprung's disease, colonic atresia, congenital segmental dilation of the colon, NEC, anorectal malformation, and meconium plug syndrome. 2. The differential diagnosis of colonic obstruction in infants and children includes incarcerated intestinal hernia, sigmoid, cecal and transverse volvulus, intussusception, and rectal obstruction related to abdominopelvic masses or cysts. 3. The differential diagnosis of colonic wall thickening in older children includes infectious colitis, typhlitis, inflammatory (Crohn's or ulcerative colitis), vasculitis, ischemia, and neoplasm. 4. The differential diagnosis of colonic pathology can be classified based on age at presentation and primary imaging features (wall thickening, dilation/obstruction, transition point).

## TABLE OF CONTENTS/OUTLINE

1.Epidemiology and classification of colonic pathology, 2.Imaging Findings A) Colonic pathology in the prenatal period B) Colonic obstruction in neonates, infants, children and adolescents C) Colonic wall thickening: infectious, inflammatory and neoplastic 3.Differential diagnosis 4.Algorithm of differential diagnosis based on age and primary imaging features

### PDEE-4 Lymphoscintigraphy: A Pictorial Review with Focus on Pediatric Patients

#### TEACHING POINTS

1. Classification of lymphedema and lymphatic dysplasias via illustrative mixed-modality case-examples 2. Sentinel node mapping in pediatric patients 3. Important pitfalls of the technical and interpretive aspects of lymphoscintigraphy

#### TABLE OF CONTENTS/OUTLINE

Introduction: Lymphoscintigraphy is a minimally invasive imaging technique that uses radiolabeled colloidal particles to evaluate lymphatic function Technique: 1. Radiopharmaceuticals 2. Administered activity/radiation dose 3. Imaging Protocols Indications for Lymphoscintigraphy: 1. Primary Lymphedema including Lymphatic Dysplasia 2 .Secondary Lymphedema 3. Chylous Leaks 4. Sentinel Lymph Node Mapping Imaging Findings with Illustrative Case Discussions: 1. Lymphedema 2. Absent Visualization of Regional Lymph Nodes 3. Delayed or Asymmetric lymphatic Transit 4. Collateral Lymphatic Channels 5.Dermal Backflow 6.Chylous Effusion or Ascites 7.Sentinel Lymph Node Visualization Pitfalls Summary:Lymphoscintigraphy plays a unique role in evaluation disorders of lymphatic development, acquired lymphatic disorders, and assessment of chylous fluid collections. Familiarity with normal patterns of lymphatic transit, abnormal lymphatic transit, and common pitfalls are crucial for radiologists performing and interpreting these examinations.

### PDEE-40 Imaging of Congenital Hearing Loss: A Practical Approach

Participants

Rafael Loureiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review important anatomic landmarks in the pediatric temporal bone. 2. To discuss the imaging technique and protocols for the evaluation of congenital hearing loss.3. To present a practical guide to facilitate comprehension of radiologic findings and the role of imaging in the evaluation of congenital hearing loss.

#### TABLE OF CONTENTS/OUTLINE

IntroductionPrinciples of the basic workout investigation- Screening for hearing loss in newborns- Functional evaluation: quick review of audiometric studies for radiologistsTemporal Bone AnatomyClassification of congenital hearing loss- by severity: slight, mild, moderate, severe and profound- by type: conductive, sensorineural, mixed- by causes: genetic (syndromic and non-syndromic); environmental; congenital lesions and malformationsImaging studies: CT and MRI of the temporal bone- imaging protocol and special considerations for congenital hearing loss evaluationInstructive cases by causes and main imaging features A step-by-step guide to diagnose congenital malformationsPrinciples of imaging evaluation for guiding treatmentTake home messages

### PDEE-41 Systematic Approach to Congenital Brain Tumor

Participants

Ana Paula Fonseca, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Felipe Scortegagna SR, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are to:- Describe through illustrative cases the classification and imaging patterns of neonatal brain and spine tumors.- Correlate imaging with molecular and genetic alterations.- Present comprehensive imaging protocols.- Highlight important differential diagnoses to consider.

#### TABLE OF CONTENTS/OUTLINE

- Definition of congenital tumors.- Classification of congenital CNS tumors- Based on location, age and updated WHO Classification 2021.- Overview of common predisposing genetic syndromes.- Recommended fetal and neonatal imaging protocols.- Typical imaging features of each tumor type.- Teratoma Astrocytic tumors.- Neuronal and mixed neuronal-glial tumors.- Choroid plexus papilloma.- Embryonal tumorso Craniopharyngioma.- Ependymoma.- Important tumor mimics to consider.- Hemorrhage.- Vascular malformations.- Infections.- Hamartomas.- Cortical malformations.- Treatment challenges and developments.- Diagnostic algorithm.- Final remarks.

### PDEE-42 Bridging the Gap Between the Symptoms to Radiology Beyond the Anatomy of Temporal Bones in Pediatrics and Young Adults

Participants

Nahyun Jo, MD, Galveston, TX (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The ear is a highly specialized organ in a tightly packed space. Trainees are used to the classification of temporal bone pathology with respect to their anatomical locations; inner, middle, and outer ear. Although anatomical search patterns allow a thorough evaluation of complex ear structures, understanding symptomologic categorization not only aids in an active search for differential diagnosis but also broadens the understanding of the pathophysiology and management.

#### TABLE OF CONTENTS/OUTLINE

The introduction is a basic review of temporal bone anatomy and commonly used modality. The second section, "Bridging the gap," discusses a quick guide to understanding relevant clinical information, such as audiometry or otoscopy. In the third section, "Symptoms to radiology," each ear pathology is categorized by each clinical scenario. For each symptom and appropriate pathology, key points to report or "what surgeons want to know" are detailed. The symptoms are divided into otalgia, hearing loss, tinnitus, and otorrhea. Otolgia is subdivided into the acute and chronic onset of symptoms. Hearing loss is subdivided into

conductive hearing loss and sensory hearing loss. Both conductive and sensory hearing loss has congenital, infectious/inflammatory, tumor, trauma, and miscellaneous etiologies. Tinnitus has vascular, tumor, and various etiologies. Otorrhea may occur with otalgia due to infection, but CSF otorrhea is discussed separately as it can be the sole reason for the exam without other overlapping symptoms.

#### **PDEE-43 Palpable Head and Neck Lumps in Pediatrics: Tips and Tricks in Ultrasound**

Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

To illustrate the ultrasound appearance of the most frequent pediatric head and neck palpable lumps, acknowledge the imaging hallmarks of each condition, and correlate with other imaging tools. To highlight the warning signs on ultrasound, recognize when additional testing is necessary and discuss subsequent management.

##### **TABLE OF CONTENTS/OUTLINE**

The presence of palpable lumps of the head and neck is a frequent complaint in children, including a broad spectrum of infectious, tumoral conditions, embryologic remnants, and vascular malformations, with the large majority proven benign. The radiologist must recognize the warning signs that allow early management of those with potential malignancy or those leading to space compromise over vascular and respiratory structures, including onset during the neonatal period, firm consistency, rapid growth, or location underneath the fascia. Ultrasound has arisen as the first-line imaging modality for initial evaluation. It represents a fast and safe technique, which can provide essential information for the characterization of the lesion, acting as a guide in diagnostic and therapeutic procedures. This ultrasound approach guides subsequent decision-making, including follow-up, complementary testing, or treatment through interventional drainage or surgical excision. Further investigation with cross-sectional imaging is warranted if the characteristics of the mass are beyond the scope of ultrasound or if malignancy is suspected. We provide a pictorial review of illustrative cases from our institution to help identify the key imaging findings and emphasize the role of ultrasound in the diagnosis and interventional treatment of pediatric lumps.

#### **PDEE-44 Atlas of Secondary Ossification Centers, Physeal Variations, and Cortical Buckles" in the Pediatric Skeleton: Radiographic and MRI Correlation of Normal and Abnormal Findings.**

Participants

Jade Iwasaka-Neder, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- Systematically illustrate the variable radiographic appearances of secondary ossification centers and physes at different stages of skeletal development
- Compare and contrast MRI appearances of normal versus abnormal growth centers to highlight their differences and improve their diagnosis
- Elucidate normal and abnormal areas of cortical buckling in children
- Illustrative examples of pathologic mimickers

##### **TABLE OF CONTENTS/OUTLINE**

o Secondary ossification centers on radiography and MRI: imaging characteristics, expected time of appearance, and locational differences.

- Sternum (Manubrium; Sternebrae; Xiphisternum; Unfused sternbrae sternal foramen)
- Scapula (Coracoid centers; Acromion centers)
- Upper limb (Greater humeral tuberosity; Lesser humeral tuberosity; Elbow mnemonics: CRITOE and CRITOL; Carpal bones)
- Pelvis (Iliac spines; Ischial tuberosity; Acetabular rim)
- Lower limb (Distal femoral condyles; Tibial tubercle; Medial and lateral malleoli; Patella; Calcaneus)

o Cortical buckles and nutrient canals. Do they belong here? (Tibia; Fibula; Femur; Clavicle; Tarsal bones; Metacarpals and phalanges; Metatarsals)

o Physeal variations (Distal fibula; Distal tibia; Proximal humerus; Distal radius; Distal ulna; Different types of normal physes)

o Normal versus Fracture (Case review)

#### **PDEE-45 Childhood Constipation: How Imaging Evaluation Can Help**

Participants

Lívia Alves, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

Constipation in the pediatric population is a prevalent diagnosis worldwide. Frequent imaging examinations are required to investigate the diagnosis, and generally to differentiate the functional etiology and its degrees from an organic cause. Therefore, the radiologist must know the particularities of each imaging method, know how to indicate the ideal exam in the face of clinical suspicion, and interpret the most diverse findings to arrive at the final diagnosis. This presentation aims to: (1) point out the main imaging tests that can be used in the diagnosis of constipation in pediatric patients, detail their characteristics and help in choosing the method in the face of clinical suspicion. (2) review the imaging findings in cases of functional and organic constipation, highlighting the main related pathologies: Hirschsprung's disease, visceral myopathy and chronic intestinal pseudo-obstruction. (3) debate the imaging findings of the most frequent complications.

##### **TABLE OF CONTENTS/OUTLINE**

Imaging methods used in the diagnosis of constipation, its characteristics, and main indications in the face of clinical suspicion include abdominal radiography, barium enema and colonic transit, computed tomography, magnetic resonance imaging and ultrasound. Case-based review of the functional and organic etiology of constipation (Hirschsprung's disease, visceral myopathy, chronic intestinal pseudo-obstruction, intra-abdominal tumor and VACTERL association). Case-based review of complications (fecaloma, stercoral colitis, and perforation) and associated diseases (voiding dysfunction).

#### **PDEE-46 The PRETEXT Staging System for Primary Liver Tumors in the Pediatric Population. A Cases-based Pictorial Review**

Participants

Mariano Lorea, Barracas, Argentina (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The PRE-Treatment EXTent of tumor (PRETEXT) system aims to standardize imaging evaluation and risk stratification of

hepatoblastoma and hepatocellular carcinoma before implementation of any treatment. PRETEXT grades provide valuable information regarding prognosis and overall survival. Liver is divided into four sections: left lateral (LL), left medial (LM), right anterior (RA) and right posterior (RP). Liver tumors are separated in four groups (I-IV) based on the number of contiguous tumor-free liver sections. Higher groups are related to worst outcomes.

#### TABLE OF CONTENTS/OUTLINE

Introduction What means PRETEXT? Prognosis implications Liver segmentation How to divide the liver? From Couinaud's segmentation to PRETEXT segments. PRETEXT groups Groups I to IV. Cases-based pictorial review. Imaging clues to precise PRETEXT group assignment. Additional PRETEXT criteria. Hepatic venous involvement (V and P) Extrahepatic disease (E) Multifocality (F) Tumor rupture (R) Caudate lobe involvement (C) Lymph nodes (N) and distant metastasis (M)

#### PDEE-47 Pediatric Primary Intracranial Sarcoma with Features of DICER1 Mutation: A Challenging Diagnosis

Participants

Jossue Espinoza SR, MD, Lima 01, Peru (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS Pediatric primary intracranial sarcomas have an aggressive clinical course. The incidence of pediatric primary intracranial sarcoma with features of DICER1 mutation has been increasing. Imaging features of pediatric primary intracranial sarcomas with features of DICER1 mutation are not well documented. MRI and CT imaging play a crucial role in establishing a diagnosis. MRI plays a crucial role in follow up during treatment and evaluation for residual disease after surgery. Since there are several differential diagnoses, radio-pathologic correlation of these tumors is essential to confirm the diagnosis.

#### TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: Provide a pictorial review of the diverse imaging appearances of pediatric primary intracranial sarcoma with features of DICER1 mutation and differential diagnoses. Discuss specific imaging and pathological characteristics of pediatric primary intracranial sarcoma with features of DICER1 mutation and differential diagnoses. Familiarize the audience with the imaging of pediatric primary intracranial sarcoma with features of DICER1 mutation and emphasize the importance of radio-pathologic correlation. These entities include: • Pediatric Primary intracranial sarcomas with features of DICER1 mutation. • Potential pitfalls and differential diagnoses of these tumors including other mesenchymal non-meningothelial tumors of the central nervous system, cavernous malformation (cavernous angioma or cavernoma) and high-grade brain tumors in pediatric patients.

#### PDEE-48 The Lung and Winding Road - A Pictorial Essay on Cystic Lung Diseases in Pediatric Radiology

Participants

Victor Nishimura, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

PNEUMATOCELE is a transient round and variable sized cyst, adjacent to consolidation or ground glass opacities. INTERSTITIAL LUNG EMPHYSEMA cystic or linear radiolucencies in the interstitium radiating from the hilum can be seen. CONGENITAL LUNG HYPERINFLATION increased lung volume and transparency can be seen. NEURENTERIC CYST is a fluid attenuating paravertebral lesion. BRONCHOGENIC CYST well circumscribed spherical or ovoid masses of variable attenuation can be seen. PULMONARY SEQUESTRATION multiple cystic lesions and anomalous artery nutrition can be seen. CYSTIC LYMPHANGIECTASY can be associated with syndromes, also congenital cardiac anomalies. CONGENITAL PULMONARY AIRWAY MALFORMATION usually presents as a solitary well defined thin walled cyst or multiple cysts of varying sizes. Multiple irregular shaped cysts are characteristic of LANGERHANS CELL HISTIOCYTOSIS. LYMPHANGIOLEIOMYOMATOSIS characterized by diffuse thin walled cysts surrounded by normal lung without regional sparing, accompanied by small centrilobular nodules.

#### TABLE OF CONTENTS/OUTLINE

ACQUIRED PNEUMATOCELE INTERSTITIAL LUNG EMPHYSEMA CONGENITAL CONGENITAL LUNG HYPERINFLATION NEURENTERIC CYST BRONCHOGENIC CYST PULMONARY SEQUESTRATION CYSTIC LYMPHANGIECTASY CONGENITAL PULMONARY AIRWAY MALFORMATION NEOPLASTIC LANGERHANS CELL HISTIOCYTOSIS LYMPHANGIOLEIOMYOMATOSIS

#### PDEE-49 Neonatal Subpial Hemorrhage: A Closer Look

Participants

Eman Marie, MSc, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Understand the anatomy and physiology of the subpial space. 2- Describe causes of subpial hemorrhage in neonates. 3- Discuss the clinical presentation and the indications of imaging. 4- Identify the different imaging modalities used to identify and evaluate the subpial hemorrhage. 5- Discuss and exemplify the imaging features of subpial hemorrhage. 6- Classify the different types of subpial hemorrhage, comorbid conditions, and prognosis.

#### TABLE OF CONTENTS/OUTLINE

1- Embryology and early development of brain meninges with a focus on the pia mater. 2- Anatomy (gross and microscopic) and physiology of the subpial space. 3- Incidence and potential risk factors linked to subpial hemorrhage in neonates. 4- Imaging of neonatal subpial hemorrhage: US, CT and MRI findings, standard protocols and special considerations during neonatal brain imaging. 5- Diagnostic accuracy of each imaging modality and factors that may affect the accuracy of interpretation. 6- Pitfalls and differential diagnosis of subpial hemorrhage. 7- What the referring physician needs to know: diagnosis and extent of abnormalities. 8- Proposed imaging-based prognostication. 9- Neonatal subpial hemorrhage and abusive head trauma. 10- Management strategies of neonatal subpial hemorrhage and the role of imaging follow up. 11- Recent research and future directions on neonatal subpial hemorrhage.

#### PDEE-5 Pediatric Lung and Heart Evaluation: A Pictorial Review of Scintigraphy, Salivagram, and Cardiac Shunts

#### TEACHING POINTS

1. Lung scintigraphy is a useful tool for evaluating pulmonary function in children, with both perfusion and ventilation/perfusion scans providing valuable information about lung physiology. 2. In the context of congenital diaphragmatic hernia, scintigraphy can be used to predict inadequate lung development and assist with surgical planning. 3. When evaluating suspected pulmonary embolism in children, ventilation/perfusion scintigraphy can be a useful alternative to CT angiography. 4. Salivagram can be helpful in the context of concern for silent aspiration and GE reflux in neurologically impaired children.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1. Pediatric Considerations 2. Image acquisition 3. Radiation dose Lung Scintigraphy in Children 1. Indications 2. Lung perfusion Scintigraphy 3. Ventilation/Perfusion scintigraphy 4. Technique in Lung Perfusion Scintigraphy Cardiac Imaging 1. Right to left shunting 2. Left to right shunting Lung Scintigraphy in the Context of Congenital Diaphragmatic Hernia 1. Ventilation/Perfusion in the prediction of inadequate lung development 2. Role of scintigraphy in predicting outcomes and surgical planning 3. Dynamic ventilation abnormalities and matched defects Pulmonary Embolism 1. Indications 2. Ventilation/Perfusion scintigraphy 3. Ventilation/Perfusion vs CT angiography Salivagram 1. Indications 2. Image technique and acquisition Conclusions

#### PDEE-50 Growing Pains: Navigating Pediatric Metabolic Bone Disorder

Participants

Ami Gokli, MD, (Presenter) Nothing to Disclose

#### TEACHING POINTS

- Discuss with illustrative examples the anatomy and physiology of normal bone growth in the pediatric population- Review common pediatric metabolic bone diseases including the pathophysiology and characteristic imaging features associated with these diseases using a multimodality approach- Describe clinical management, necessary details to include in radiologic reports, and the importance of radiologists role in these diseases

#### TABLE OF CONTENTS/OUTLINE

Overview:- Anatomy and physiology of pediatric bone growth/turnover including Identifying regions in the bone growth process particularly susceptible to disease Etiology:- Hereditary-Acquired (Nutritional deficiencies, Drug Treatments, etc) Pathology:- Diseases that can be discussed including discussion of pathophysiology with an image rich, multimodality approach; identify pathognomonic radiographic findings/tools that can aid in diagnosis Primary/Secondary osteoporosis, Osteogenesis imperfecta, Rickets, Skeletal dysplasias (Achondroplasia, cleidocranial dysplasia, achondroplasia), Albright hereditary osteodystrophy, (pseudohypoparathyroidism)/renal osteodystrophy, Fibrous dysplasia/McCune Albright syndrome, Juvenile Paget disease, Sclerosing bone disorders (osteoporosis, pyknodysostosis, osteopoikilosis, osteopathy striata, melorheostosis), Hypophosphatasia- Describe necessary details to include in radiologic reports Treatment/management:- Pediatric metabolic bone disorders require an extensive Team (endocrine, ortho, medical genetics, PM+R, physical/occupational therapy, pediatric radiology, nursing), detailed description of what is involved and the central role radiologists play Conclusion

#### PDEE-51 Imaging Findings and Management Strategies to Liver Masses in Children with Underlying Predispositions: A Review from the ACR Pediatric LI-RADS Working Group

Participants

Amy B. Kolbe, MD, Rochester, MN (Presenter) Nothing to Disclose

#### TEACHING POINTS

1. Review the imaging approach and differential diagnosis for liver masses in children with underlying genetic syndromes, congenital abnormalities, vascular abnormalities, and other conditions that predispose to liver lesions. 2. Illustrate the characteristic imaging findings of benign and malignant liver tumors in children with predisposing conditions. 3. Discuss the screening guidelines and management approach to liver masses encountered in the predisposed child.

#### TABLE OF CONTENTS/OUTLINE

Spectrum of pediatric liver tumors and pseudotumors in: 1. Genetic syndromes: Beckwith Wiedemann syndrome, familial adenomatous polyposis, progressive familial intrahepatic cholestasis, tuberous sclerosis, cystic fibrosis, glycogen storage disease, tyrosinemia, Wilson disease, hereditary hemochromatosis 2. Congenital abnormalities: Biliary atresia, Alagille syndrome, Abernethy malformation 3. Miscellaneous: Metabolic syndrome, Fontan associated liver disease, Budd Chiari syndrome For each entity we will discuss the underlying pathogenesis of liver disease, types of liver masses described with the entity, characteristic imaging findings of each liver mass, surveillance strategies, and key findings that warrant further intervention

#### PDEE-52 Fetal Magnetic Resonance Imaging Findings in Conjoined Twin Pregnancies

#### TEACHING POINTS

The learner will understand how to differentiate the various conjoined twin variants by their fetal MRI appearance. The learner will understand which features of conjoined twin shared anatomy predict survival and the potential for separation and how fetal MRI can be used in this assessment. The learner will review fetal MRI examples of additional congenital anomalies within the context of conjoined twinning.

#### TABLE OF CONTENTS/OUTLINE

Conjoined twins are a rare complication of monozygotic twinning. Fetal MRI can provide a detailed evaluation of these twins' shared anatomy and identify additional congenital anomalies, thereby allowing the fetal care team to anticipate the potential for survival and separation in these complex twin pairs. This exhibit will review the fetal MRI appearance of the different morphological variants of conjoined twins, including several unusual cases of minimally conjoined twins. Emphasis will be placed on those anatomical features most important for determining conjoined twin prognosis and potential for separation. Fetal MRI cases demonstrating additional important congenital anomalies within the context of conjoined twinning will be presented as part of a comprehensive fetal assessment.

#### PDEE-53 Sonographic Evaluation of the Umbilical Region in Children

Participants



Lizbet Perez-Marrero, Santiago De Chile, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

o To describe the normal sonographic appearance of the umbilicus and the midline structures of the anterior abdominal wall. To recognize ultrasound findings of the most common lesions of the umbilicus, including anomalies of the embryonic remnants.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Ultrasound protocol of the umbilical region and anterior abdominal wall. 3. Normal anatomy of the umbilicus and midline anterior abdominal wall 4. Umbilical lesions a. Umbilical granuloma b. Omphalitis b. Epidermal cyst c. Cutaneous ciliated cyst d. Tumors (hemangioma) e. Keloid f. Polyp g. Cutaneous umbilicus h. Umbilical hernia i. Paraumbilical hernia j. Epigastric hernia 5. Embryonal anomalies a. Umbilical vessels i. Omphaloarteritis ii. Omphalophlebitis iii. Thrombosis of umbilical vein varix b. Urachus: i. Urachal cyst ii. Infected urachal cyst iii. Urachal diverticulum iv. Urachal sinus v. Urachal fistula c. Omphalomesenteric duct i. Vitelline cyst ii. Persistent vitelline vessel iii. Meckel diverticulum iv. Omphalomesenteric fistula v. Omphalomesenteric fibrotic cord 6. Conclusions

#### PDEE-54 **Malignant Rhabdoids and Related Pediatric Tumors: A Multimodality Imaging Review and Pathologic Correlation**

Participants  
Apeksha Chaturvedi, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Malignant rhabdoid tumors of childhood include malignant rhabdoid tumor of kidney (MRTK), extrarenal malignant rhabdoid (eMRT) and atypical rhabdoid-teratoid tumors (AT/RT); tumors are highly aggressive, carry a dismal prognosis and may develop in utero 2. "Rhabdoid" morphology on histology- large polygonal cells with eosinophilic cytoplasm, vesicular nuclei and central prominent nucleolus 3. Underlying SMARCB1 mutations, a gene encoding a core subunit of the SWI/SNF chromatin-remodeling complex 4. Imaging appearances overlap with those of other entities, with certain imaging features aiding distinction; eg. cerebellopontine angle involvement and intratumoral hemorrhage favor AT/RT over medulloblastoma 5. Rhabdoid tumor predisposition syndrome (RTPS) is characterized by proband with rhabdoid tumor and/or family history of rhabdoid tumors and/or multiple SMARCB1- and/or SMARCB1-deficient tumors (synchronous or metachronous) and a heterozygous germline variant in SMARCB1 or SMARCB1; imaging surveillance guidelines have been proposed

#### TABLE OF CONTENTS/OUTLINE

1. Spectrum of malignant rhabdoid and related SMARCB1-deficient neoplasms of childhood 2. Updated WHO classification (2021) for malignant rhabdoids and related pediatric tumors 3. Underlying SMARCB1 deficiency and mechanisms by which it drives rhabdoid tumor growth 4. Multimodality imaging manifestations of malignant rhabdoid tumors, with emphasis on PET-CT and PET-MR 5. Role of ultrasound and whole-body MRI in surveillance in patients with RTPS 6. Pathologic correlation

#### PDEE-55 **A Trainee's Guide to Neonatal Abdominal Radiographs**

#### TEACHING POINTS

1. Abdominal radiographs are an important tool to diagnose and screen acute intra-abdominal pathologies in the neonatal population. 2. The widespread availability and portable nature of radiographs make it ideal for the bedside evaluation of unstable neonates. 3. Knowledge of pathologies and their appearance on abdominal radiographs are crucial for timely and accurate diagnoses of life-threatening conditions and to guide further imaging and management.

#### TABLE OF CONTENTS/OUTLINE

1. Technique and views to obtain neonatal abdominal radiographs: Assessment of quality, tips for mobile exams, and use of shielding (ie. gonadal shielding and update on recommendations). 2. Review of lines and tubes on abdominal radiographs in neonates (ie. Umbilical artery and vein catheters, PICC, NG tube and port location). 3. Review of normal findings (ie. Expected gas pattern based on hours of life). 4. Do-not-miss findings: Pneumoperitoneum, pneumatosis, portovenous gas, bowel obstruction, pneumomediastinum/pneumothorax in the lung bases. 5. Review of acute pathologies and findings on abdominal radiographs (abnormal patterns): Necrotizing enterocolitis, congenital causes of bowel obstructions (upper/lower) (ie. Malrotation/volvulus, duodenal/jejunal atresia, Hirschsprung's disease, imperforate anus), gasless abdomen

#### PDEE-56 **From Head to Tail: Exploring Applications of Pediatric Neurological Ultrasound**

#### TEACHING POINTS

1. Ultrasound for neurological pathologies is a useful adjunct to conventional imaging (CT/MRI) as a screening and diagnostic tool in pediatric patients due to its universal availability and low cost. 2. Lack of ionizing radiation and IV contrast, and incomplete pediatric bone ossification and unfused fontanelle make ultrasound an excellent modality for evaluation of neurological pathologies in young patients. 3. Optimal ultrasound technique and understanding of the relevant pathophysiology of pediatric neurological conditions that can be assessed with ultrasound can significantly improve timely access to screening, diagnosis and patient care.

#### TABLE OF CONTENTS/OUTLINE

1. Brain ultrasound: Indication (ie. Premature screen, cooling therapy), Technique, Normal structures, variants and measurements (ie. ventricular index), Vascular assessment, Pathologies (ie. germinal matrix bleed, periventricular leukomalacia). 2. Transcranial doppler ultrasound: Indications (ie. Sickle cell disease), Technique, Vessel anatomy, Normal measurements, Abnormal findings and clinical significance. 3. Cranial sutures ultrasound: Indications (ie. Abnormal skull shape), Technique, Cranial suture anatomy, Normal findings (ie. fontanelles, suture closure), Craniosynostosis and clinical significance. 4. Spine ultrasound: Indication (ie. sacral dimple, suspected spinal dysraphism), Technique, Normal findings and anatomy, Pathologies (ie. low conus, thickened filum, myelomeningocele, intraspinal collections, masses).

#### PDEE-57 **US Evaluation with CT/MRI Correlation of Neonatal and Infantile Brain Tumors and Other Intracranial Masses**

Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

While some neonatal brain tumors are suspected on antenatal US imaging, most are diagnosed postnatally. Head US may be the first imaging modality for work-up of an intracranial mass which can present with non-specific clinical features. Most cases will require further imaging work-up, usually with MRI. Recognition of the US features of the most common neonatal and infantile intracranial masses and their complications can aid in appropriate and timely subspecialty referral. Objectives: 1. Discuss the US features of the most common neonatal and infantile intracranial masses. 2. Describe the correlation between antenatal US and fetal MRI and postnatal US and CT/MRI in the imaging work-up of these masses. 3. Explain the use of US to identify any associated complications which require urgent neurosurgical assessment.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Pseudomass 2a. Intraventricular hemorrhage 3. Non-neoplastic masses 3a. Arachnoid cyst 3b. Choroid fissure cyst 3c. Hypothalamic hamartoma 4. Supratentorial neoplasms 4a. Teratoma 4b. Low-grade glioma 4c. High-grade glioma 4d. Embryonal tumor with multilayered rosettes 4e. Choroid plexus tumors 4f. Osteochondrolipoma 5. Posterior fossa neoplasms 5a. Atypical teratoid/rhabdoid tumor 5b. High-grade glioma 6. Conclusion

#### PDEE-58 US Evaluation with Fetal MRI and CT/MRI Correlation of Pediatric Congenital and Inherited Brain Anomalies

Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. While many congenital and inherited brain anomalies are suspected from antenatal US and fetal MRI, postnatal head US may be the first imaging modality in the work-up of these heterogeneous anomalies 2. Most cases will require further imaging work-up with CT and/or MRI 3. Recognition of the US features of the most common of these lesions is important in order to direct appropriate additional imaging and timely subspecialty referral Objectives 1. Discuss the US features of the most common pediatric congenital and inherited brain anomalies 2. Describe the correlation between antenatal US and fetal MRI and postnatal US and CT/MRI 3. Explain the use of US to narrow the differential diagnosis and direct appropriate additional imaging work-up and management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Midline anomalies a. Agenesis of corpus callosum (ACC) b. Dysgenesis of corpus callosum variants i. Asymmetric ventriculomegaly, interhemispheric cyst and dysgenesis of corpus callosum (AVID) ii. Dysgenesis of corpus callosum with pericallosal lipoma c. Septo-optic dysplasia 3. Malformations of cortical development a. Periventricular nodular heterotopia b. Lissencephaly c. Hemimegalencephaly d. Tuberous sclerosis 4. Metabolic a. Ornithine transcarbamylase (OTC) deficiency 5. Brainstem and posterior fossa anomalies a. Diencephalic mesencephalic junction dysplasia b. Dandy-Walker malformation c. Joubert syndrome and related disorders (JSRD) d. Chiari 2 malformation secondary to myelomeningocele e. Arachnoid cyst f. Mega cisterna magna 6. Vascular anomalies a. COL4A1 mutation b. Vein of Galen malformation 7. Conclusion

#### PDEE-59 Differential Diagnosis of Hyperechoic Lesions on Neonatal Head US

Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. There are normal areas of increased echogenicity on neonatal head US which should not be mistaken for pathology, including choroid, midline vermiformis, hyperechoic caudate heads, periventricular white matter "halo", and white matter tracts including the corticospinal tracts 2. The differential diagnosis of hyperechoic lesions depends on their location 3. Many lesions can be confidently diagnosed and follow on US, while others require further imaging work-up to narrow the differential diagnosis and assist in ongoing management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Normal areas of increased echogenicity a. Choroid b. Midline vermiformis c. Hyperechoic caudate heads d. Mineralizing vasculopathy e. Periventricular white matter "halo" f. Transmantle speckled increased echogenicity g. Corticospinal tracts 3. Caudothalamic groove a. Grade 1 germinal matrix hemorrhage b. Grades 2 and 3 germinal matrix hemorrhage 4. Periventricular/deep white matter a. Periventricular hemorrhagic infarction b. White matter injury c. Deep medullary venous thrombosis d. Infection e.g. Citrobacter koseri e. ECMO-related hemorrhage f. Water-shed infarct g. Punctate foci of white matter injury 5. Diffuse white matter a. Arterial infarction b. Hypoxic-ischemic encephalopathy 6. Deep gray matter a. Central cerebral venous sinus thrombosis 7. Peripheral parenchyma a. Peripheral cerebral venous sinus thrombosis b. Vein of Labbé hemorrhagic venous infarction 8. Cerebellum a. Cerebellar hemorrhage 9. Extraaxial a. Subdural hemorrhage b. Extradural hemorrhage c. Subpial hemorrhage 10. Conclusion

#### PDEE-6 Pictorial Review of Pediatric Neuroimmune Disease

Participants

Alejandra Aguado, MD, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Neuroimmune diseases are a group of inflammatory disorders with varying pathogenic mechanisms, including autoantibodies against self-targets, cell-mediated, infection-triggered, paraneoplastic, and genetically determined diseases. This group continues to expand with the discovery of new clinicopathologic entities. Radiologists should be familiar with these diseases and able to make a differential diagnosis, as early diagnosis and appropriate treatment with immunotherapy can modify disease course in some cases. Additionally, different diseases within this group can present with varied evolution and prognosis. The main teaching points of this exhibit include: 1. Review of the most frequent entities within each group 2. Description of key imaging features that aid in differential diagnosis among different entities.

#### TABLE OF CONTENTS/OUTLINE

This exhibit presents a range of disease pathologies encountered in clinical practice, including: 1. Demyelinating diseases: a) Acute

disseminated encephalomyelitis (ADEM) b) Pediatric multiple sclerosis (MS) c) Neuromyelitis optica spectrum disorders (NMOSDs) d) Anti-MOG associated disease 2. AntiNMDAR encephalitis, including one triggered by herpes simplex virus encephalitis 3. Lupus erythematosus 4. Rasmussen encephalitis 5. Hemophagocytic lymphohistiocytosis.

#### **PDEE-60 Navigating the Fine Line of Pediatric Lines: A Primer on Pediatric Intravascular Catheters**

Participants

Narendra Shet, MD, (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. To review various reasons and approaches for vascular access in pediatric patients. 2. To discuss the role of the radiologist in assessment of pediatric vascular access. 3. To review optimal and suboptimal line placement in pediatric patients in a variety of clinical scenarios, including neonates and patients with congenital heart disease.

##### **TABLE OF CONTENTS/OUTLINE**

1. Overview of vascular access in pediatric patients - reasons for short and long term access and means of guidance (non-guided versus image-guided), and role of radiologist (for diagnostic radiologist, assessing adequacy of line position, and for interventional radiologist, line placement using means of image guidance). 2. Central lines in pediatric patients, including PICC, Non-PICC (IJ/Femoral), and long-term Access including hemodialysis catheters/tunneled central venous lines, as well as ports. 3. Neonatal specific catheters, including umbilical arterial and venous catheters. 4. Cardiac catheters, such as intra-cardiac catheters, ECMO cannulae, and ventricular assist devices. 5. Where relevant, photographs of support devices, either in vivo or ex vivo, will be included in figures to allow for comparison to radiographic appearance.

#### **PDEE-61 Imaging Evaluation of Pediatric Cystic Neck Masses**

Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1. Pediatric neck masses are a common indication for imaging referral and US is often the first imaging modality in their work-up. 2. Following detection of a cystic neck mass on US, the radiologist must determine whether the lesion has a characteristic US appearance and requires no further imaging work-up or whether further imaging work-up is required. 3. Appropriate use of CT/MRI can aid in narrowing the differential diagnosis and assist in surgical planning. Objectives: 1. List the sonographic features of pediatric cystic neck masses which have a characteristic sonographic appearance and require no further imaging work-up 2. Recognize those lesions which require additional imaging work-up 3. Discuss the appropriate use of CT/MRI to aid in narrowing the differential diagnosis

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Congenital anomalies a. First branchial cleft anomalies b. Second branchial cleft anomalies c. Pyriform fossa sinus tract (PFST) lesions d. Dermoid cyst e. Lymphatic malformation f. Thyroglossal duct cyst 3. Inflammatory a. Ranula 4. Infectious a. Suppurative pyogenic lymphadenitis b. Non-tuberculous mycobacterial cervical lymphadenitis (MAIC) c. Retropharyngeal abscess 5. Neoplastic a. Teratoma 6. Conclusion

#### **PDEE-62 Twist and Turns: Comprehensive Radiological Review of Intestinal Malrotation and Midgut Volvulus**

##### **TEACHING POINTS**

1. Describe the imaging findings of intestinal malrotation and midgut volvulus in upper gastrointestinal (UGI) studies. 2. Discuss the utility of ultrasound (US) in intestinal malrotation and midgut volvulus. 3. Highlight the imaging pearls and pitfalls in cases of intestinal malrotation and midgut volvulus. 4. Illustrate different clinical presentations of malrotation and midgut volvulus through a variety of clinical cases.

##### **TABLE OF CONTENTS/OUTLINE**

1. Introduction: Describe the normal orientation and fetal development of the intestine. Highlight the importance of early detection and management of intestinal malrotation. 2. Pathophysiology of intestinal malrotation and midgut volvulus: Discuss the mechanism of midgut volvulus in intestinal malrotation along with clinical presentation and complications. 3. Upper GI studies: Review the standard views in UGI studies with emphasis on imaging landmarks to insure proper position and quality. Discuss the imaging pearls and pitfalls in diagnosing intestinal malrotation/midgut volvulus in UGI studies. 4. Other radiological modalities: Role of other imaging modalities in intestinal malrotation/midgut volvulus as a problem solver in challenging cases including US, computed tomography (CT) and lower GI studies. 5. Atypical cases of midgut volvulus: Examples of atypical cases of midgut volvulus including recurrent and chronic presentations. Use different cases as a teaching key points in diagnosis and management of midgut volvulus. 6. Conclusion: Summary of the radiological approach in intestinal malrotation and midgut volvulus.

#### **PDEE-63 Intestinal Ultrasound in Pediatric Inflammatory Bowel Disease: What Radiology Residents Should Know**

Participants

Paola Aguirre Camino, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

1) Become familiar with the correct performance of pediatric bowel ultrasound scan. 2) Propose a standardized ultrasound report. 3) Recognize the ultrasound appearance of the normal and pathological bowel pattern. 4) Learn the typical sonographic findings, evaluate the activity and assess the presence of possible complications in Inflammatory Bowel Disease.

##### **TABLE OF CONTENTS/OUTLINE**

Crohn's disease and ulcerative colitis are chronic inflammatory bowel diseases frequently diagnosed in childhood, being imaging methods fundamental in the diagnostic approach, severity assessment, treatment monitoring and in the suspicion of complications. Due to the need to frequently evaluate these children, intestinal ultrasound becomes especially important compared to colonoscopy and MRI, as it is a non-invasive technique, easy for the child to accept, accessible and repeatable; however, as it is an operator-

dependent examination, it requires certain experience and should be performed systematically using the appropriate technique. Intestinal ultrasound is a useful modality for intestinal bowel disease imaging and a valuable screening tool in the preliminary diagnostic workup of pediatric patients with suspected Inflammatory Bowel Disease. It assesses the presence of thickening of the intestinal wall as an indicator of inflammation, as well as the location and extent of the disease. It also allows evaluating the activity by quantifying the hyperemia of the intestinal wall using color Doppler, being a useful tool in the follow-up and control of the response to the treatment.

## **PDEE-64 Slipped Capital Femoral Epiphysis: Emphasis on Early Recognition and Potential Pitfalls**

### **TEACHING POINTS**

\* Slipped capital femoral epiphysis (SCFE) is the most common hip disorder in adolescence, however the diagnosis is often delayed or missed due to vague clinical presentation, subtle radiographic findings, and technical variability.\* Early detection of SCFE hinges on close scrutiny of physeal morphology with particular attention to the epiphyseal tubercle, an important stabilizer of the physis in children.\* An AP and frog-lateral view of the pelvis including both hips is the mainstay of radiographic assessment of SCFE, and failure to diagnose SCFE is often a product of improper technique.\* Cross-sectional imaging is not routinely performed in SCFE patients, but can be helpful to identify radiographically occult early slips, assess femoral head perfusion, and better understand anatomy for surgical planning purposes.

### **TABLE OF CONTENTS/OUTLINE**

\* Learning objectives\* Background including rationale for focus on SCFE, definition and epidemiology, pathophysiology and histology, and clinical findings and classification\* Early physeal changes in SCFE, introduction of the epiphyseal tubercle and rotational microinstability, and illustration of the peritubercle lucency on radiographs\* Later radiographic findings and severity grading on frontal and frog-lateral radiographs\* Technical pitfalls on radiography with emphasis on the importance of imaging both hips on all views\* Role of cross-sectional imaging including MRI for early slips, prognostic relevance of femoral head perfusion, and use of CT or Zero-TE MRI to assess callus preoperatively

## **PDEE-65 Imaging Approach to Pediatric Neurometabolic Imaging**

Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Describe the most commonly used classification systems for pediatric neurometabolic diseases 2. Discuss the clinical features and imaging patterns which aid in narrowing the differential diagnosis in the work-up of pediatric neurometabolic diseases 3. Illustrate the MR features of the most common pediatric neurometabolic diseases, including the MR spectra suggestive of specific disorders

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Classification systems a. Organelle dysfunction i. Mitochondrial disorders ii. Lysosomal storage disorders iii. Peroxisomal biosynthesis disorders b. Laboratory markers i. Lactate ii. Ammonia iii. Inborn errors of metabolism c. Presentation i. Neonatal metabolic encephalopathy ii. Head size d. Imaging pattern i. Deep gray matter involvement - striatum, globus pallidus, hyperdense thalami ii. White matter involvement - subcortical U-fibres, central white matter, anterior vs posterior iii. Hypomyelination disorders iv. MR spectroscopy suggestive of specific diseases v. Enhancement pattern 3. 16 "must know" imaging patterns suggestive of a specific neurometabolic disease: a. Maple syrup urine disease b. Canavan disease c. Alexander disease d. X-linked adrenoleucodystrophy e. Metachromatic leucodystrophy f. Pelizaeus-Merzbacher disease g. Mitochondrial encephalopathy with lactic acidosis and stroke-like episodes h. Non-ketotic hyperglycinemia i. Zellweger syndrome j. Mucopolysaccharidosis k. Leigh syndrome l. Panthothenate kinase-associated neurodegeneration m. Creatine kinase deficiency n. Megaloencephalic leucodystrophy with subcortical cysts o. Vigabatrin-related changes p. Methotrexate-related changes 4. Future directions 5. Conclusion

## **PDEE-66 Newborn Skeletal Radiographs: A Practical Guide**

Participants

Marcelo Takahashi, MD, PhD, (*Presenter*) Speaker, Vertex Pharmaceuticals Incorporated

### **TEACHING POINTS**

Neonatal skeletal abnormalities are rare occurrences in pediatric practice with a wide variety of causes and often overlapping radiographic features. The main teaching points of this exhibit are: 1) Illustrate the expected normal plain film appearance of the neonatal bone, including and what the most common pitfalls, regarding both normal development as well as technical imaging aspects. 2) Explain specific diseases radiographic findings with key clinical and epidemiological considerations 3) Illustrate the different imaging patterns with differential diagnosis checklist and explanation for each one

### **TABLE OF CONTENTS/OUTLINE**

&5; &5; Normal newborn particularities and pitfalls&5; Normal Anatomy&5; Physiologic Neonatal Periostitis&5; &5; Trauma:&5; Delivery related fractures&5; Non accidental trauma&5; &5; Diffuse bone disease:&5; Rickets&5; Metabolic Bone Disease of Prematurity&5; Caffey Disease&5; Osteopetrosis&5; &5; Congenital abnormalities and malformations&5; Amniotic band syndrome&5; Hemimelia&5; Proximal Femoral Focal Deficiencies&5; Spine malformations&5; Chondrodysplasia punctata&5; Developmental Dysplasia of the Hip&5; &5; Infections:&5; Congenital Syphilis&5; Neonatal osteomyelitis

## **PDEE-67 Entering a New Dimension: Novel Use of Transabdominal 3D Ultrasound in Pediatric Gynecology**

### **TEACHING POINTS**

3D transvaginal pelvic ultrasound is a well-established imaging technique in the adult population for gynecologic applications. However, transvaginal ultrasound is not commonly utilized in the pediatric population. There are only sparse reports in the literature on the use of 3D transabdominal pelvic ultrasound in the pediatric population for gynecologic applications. In this educational exhibit, we will share our experience with 3D transabdominal pelvic ultrasound in the pediatric population, particularly for the evaluation of Mullerian duct anomalies and IUD positioning. We will begin with a review of scan technique and post-processing. Instructions for creation of a simple homemade ultrasound phantom for practicing these techniques will also be reviewed. We will then share several illustrative cases where 3D ultrasound provided useful information beyond standard 2D imaging in the assessment

of Mullerian duct anomalies and IUD positioning. The challenges and limitations to this technique will also be discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review of scan technique and post-processing 3. Homemade ultrasound phantom: instructions and utility 4. Example cases of Mullerian duct anomalies 5. Example cases of IUD positioning

#### PDEE-68 Ultra Low Dose Fetal CT: A Simple Way to Understand the Various Exposure Doses to the Fetus

##### TEACHING POINTS

(1) When skeletal dysplasia is suspected by fetal ultrasound, it is often difficult to make an accurate prenatal diagnosis using ultrasound alone. (2) In such case, fetal skeletal CT is recommended because it has diagnostic power comparable to postnatal bone survey, but the only drawback is fetal radiation exposure. For this reason, we have devised Ultra low dose fetal CT (ULDFCT) from the viewpoint of ALARA. (3) On the other hand, estimating fetal radiation dose involves complex calculations, and methods that are easily understood by pediatric radiologists and CT technicians are needed. (4) This exhibition introduces a method to insufflate the exposure dose of the fetus and maternal body by simple calculation using the CT dose index (CTDI), which is available immediately before and after scanning.

#### TABLE OF CONTENTS/OUTLINE

A. Data acquisition (n=36); Patients with ULDFCT throughout of 2014 to 2021. CTDIvol : mean 0.48mGy, DLP : mean 18.62mGy.cm. These are the lowest exposure doses in fetal CT scans in the literature search. B. Estimation of various exposure doses of the fetus Fetal dose: mean; 0.36mGy. Fetal dose = CTDIvol x 0.8 mGy Organ dose of uterus; mean 0.58mGy. Organ dose of uterus = CTDIvol x 1.2; SSDE; mean: 0.57mGy, SSDE= = CTDIvol x 1.18 Effective dose (ED) of maternal body; 0.39mSv. ED = CTDIvol x 0.81

#### PDEE-69 Neonatal Chest X-ray: How to Spot Abnormal Gas Patterns and Potential Pitfalls

Participants

Marta Sanmartin Lopez, MD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Review the main projections and technical guidelines of neonatal chest radiography. 2. Review the systematic analysis of chest X-rays performed in neonates. 3. Emphasize some normal findings that differ from X-rays performed in older children and adults. 4. Analyze the typical radiological signs of pneumothorax, pneumomediastinum, pneumopericardium and pneumoperitoneum, and provide some practical examples that may help to differentiate pathology from potential pitfalls and mimics.

#### TABLE OF CONTENTS/OUTLINE

1. Analysis of neonatal chest X-ray a) Radiographic technique b) Systematic interpretation of neonatal chest X-ray. 2. Abnormal gas patterns a) Pneumothorax b) Pneumomediastinum c) Pneumopericardium d) Pneumoperitoneum

#### PDEE-7 Going with the Flow: Implementing a 4D Flow MRI Program at a Children's Hospital

##### TEACHING POINTS

Four-dimensional flow MRI (4D flow) is a three dimensional spatial and velocity encoded phase contrast sequence that has emerged as a versatile imaging technique for qualitative as well as quantitative characterization of cardiovascular flow. The benefits of 4D flow include an easily prescribed volumetric acquisition with the ability to retrospectively quantify flow in any plane, in the acquired field of view. In the past, long scan times and complex post-processing workflows hindered 4D flow adoption into routine clinical practice for cardiovascular velocity and flow assessment, but improvements in image acquisition and processing have enabled standard clinical workflows. Additionally, there are unique in-vivo flow investigative parameters that provide newer insights into understanding cardiovascular physiology and pathophysiology. Our purpose is to: 1. Explain the utility of 4D flow. 2. Describe 4D flow acquisition parameters designed for imaging children with various congenital or acquired cardiovascular diseases. 3. Demonstrate a streamlined clinical 4D flow post-processing workflow. 4. Discuss research 4D flow applications.

#### TABLE OF CONTENTS/OUTLINE

1. General overview of 4D flow and key applications in the pediatric setting 2. Advantages of 4D flow over 2D phase contrast imaging 3. Image acquisition and post-processing using clinical cases (i) 9-years-old male with Fontan (ii) 19-years-old female with Bicuspid Aortic Valve 4. Research utility of 4D flow and future directions

#### PDEE-70 Acute Upper Airway Obstruction in the Pediatric Population: What's Behind the Stridor

Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

- Review the anatomic features of the pediatric airway. - Establish a systematic approach to radiographic evaluation. - Identify the key radiographic findings of common causes of acute upper airway obstruction through cases studied in our center.

#### TABLE OF CONTENTS/OUTLINE

Acute upper airway obstruction is more common in the pediatric population due to its various anatomical and physiological peculiarities. Several causes of airway obstruction have been described, such as foreign body obstruction, infection, neoplasm, congenital or vascular entities. Since the clinical presentation is often nonspecific and the evaluation of pediatric patients in the emergency setting is complicated, imaging techniques play a critical role in achieving an accurate diagnosis. The aim of this review is to evaluate the specific radiologic features that can be found in the different imaging modalities, with special emphasis on plain radiography, which is often sufficient to reach a correct diagnosis. As acute airway obstruction can be a life-threatening condition, it is essential that the radiologist recognizes the key imaging findings in order to ensure prompt management.

## **PDEE-71 What Every Radiologist Should Know About Cranial Ultrasound: A Systematic Approach and Common Pathologies**

Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- Define the technical procedure of standard cranial ultrasound (CUS) and review the normal anatomic structures of the brain. - Identify the spectrum of pathologies seen in clinical practice. - Highlight some tips and tricks for diagnosis.

### **TABLE OF CONTENTS/OUTLINE**

CUS is an extremely valuable tool for evaluating the brain in the first year of life and has become an essential part of routine pediatric radiology practice. It is an accessible, portable, inexpensive, and safe technique that can be used as often as needed. Because of its great advantages, it is imperative for the radiologist to know how to perform CUS and correctly interpret the findings. This review attempts to establish the clinical indications, define a systematic technique to adequately visualize and document all relevant intracranial structures, and highlight the most common pathologies seen in neonates, including - Hypoxic-ischemic encephalopathy in preterm infants (germinal matrix hemorrhage, cerebellar hemorrhage, and periventricular leukomalacia) - Hypoxic-ischemic encephalopathy in term patients - Cerebrovascular disease - Trauma-associated hematomas - Macrocephaly However, the usefulness of CUS is still highly dependent on the skill, knowledge and experience of the observer.

## **PDEE-73 Congenital Anomalies of the Posterior Fossa - An Imaging Travelogue**

Participants

Shivaprakash Hiremath, DMRD,FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

This educational exhibit aims to: 1. Review the embryology and cross-sectional imaging anatomy of the posterior fossa. 2. Describe typical congenital malformations based on predominant cerebellar involvement, cerebellar and brainstem involvement, and predominant brainstem involvement.

### **TABLE OF CONTENTS/OUTLINE**

- Describe the embryology and anatomical assessment of the posterior fossa along with diffusion tensor imaging.
- Depict the imaging findings in malformations predominantly affecting the cerebellum including cerebellar hypoplasia, hyperplasia and dysplasia (Chudley-mccullough syndrome, and Poretti-Bolthausen syndrome).
- Highlight the malformations affecting the cerebellum and brainstem such as alpha dystroglycanopathies, tubulinopathy, molar tooth malformations, and pontocerebellar hypoplasia.
- Illustrate the malformations predominantly affecting the brainstem such as pontine tegmental cap dysplasia, horizontal gaze palsy with progressive scoliosis, and diencephalic-mesencephalic junction dysplasia along with malformations with no known genetic cause such as Rhombencephalosynapsis, PHACE syndrome, and oculocerebrocutaneous syndrome.

## **PDEE-74 Imaging in Pediatric Neuroinflammatory Disorders and Mimics**

Participants

Shivaprakash Hiremath, DMRD,FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

This educational exhibit aims to: 1. Review the basic concepts of neuroinflammatory disorders in childhood 2. Describe the imaging manifestations of Myelin Oligodendrocyte Glycoprotein antibody-associated disease (MOGAD) in different age groups 3. Illustrate both common and uncommon findings in Neuromyelitis Optica Spectrum Disorder (NMOSD) and Multiple Sclerosis in the pediatric age range 4. Illustrate mimics of these entities based on imaging phenotypes encompassing pathologies that target the optic nerves, deep grey nuclei, white matter, and spinal cord.

### **TABLE OF CONTENTS/OUTLINE**

- Review the pathophysiological basis of pediatric neuroinflammatory diseases.
- Illustrate the common and uncommon imaging manifestations in myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) including acute disseminated encephalomyelitis (ADEM)-like phenotype, encephalitis-like phenotype, and leukodystrophy like phenotype.
- Depict common and uncommon findings in AQP4-associated neuromyelitis optica spectrum disorder (NMOSD), and Multiple Sclerosis (MS) including tumefactive demyelinating lesions.
- Provide localization related illustrations of mimics of demyelinating diseases including infectious, inflammatory, and metabolic disorders along with tumors that mimic demyelinating diseases.

## **PDEE-75 Mastering Neck Ultrasound in Pediatric Patients**

Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Neck anatomy from the ultrasound perspective: key structures and sonographic landmarks. 2. Ultrasound protocol focusing on children's peculiarities. 3. Clinical and US findings of common and not-so-common pediatric neck entities. 4. Radiologic approach to a neck lump in a child.

### **TABLE OF CONTENTS/OUTLINE**

1. US technique for the pediatric neck 1.1. Technical recommendations 1.2. Anatomy: spaces of the head and neck and landmarks from the US perspective. 1.3. Basic US protocol and further tricks to get to more unusual locations (palatine tonsils, vocal cords). 2. Pathology of the pediatric neck 2.1. Lymph nodes: Anatomy, node levels. Pathology: reactive, suppurative, malignant. Tips: malignant vs. benign. 2.2. Thyroid: dysgenesias, nodes, thyroiditis. 2.3. Vascular anomalies: tumors, malformations and subtypes. 2.4. Salivary glands: parotitis, submaxillitis, ranula of the sublingual gland. 2.5. Cysts: thyroglossal duct, branchial cleft, dermoid, epidermoid. 2.6. Fibromatosis colli. 2.7. Cervical thymus. 2.8. Soft tissue tumours: sarcoma, schwannoma, neuroblastoma. 2.9. Pilomatricoma. 3. Summary: approach to a neck lump in a child. 4. Take home points

## **PDEE-76 Keeping it Straight: A Guide to Pediatric Renal Neoplasms**

Participants

Hassan Aboughalia, MD, Washington, WA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Ultrasound is the first-line imaging modality for suspected abdominal masses, followed by contrast-enhanced CT or MRI renal mass protocol. 2. When a renal tumor is suspected, the patient's age, imaging characteristics, distribution of metastases, and co-morbid conditions are the most important factors to consider. 3. Synchronous ipsilateral and contralateral renal lesions, metastatic disease, lymphadenopathy, invasion of the renal vein/IVC, and signs of tumor rupture are essential features to be evaluated. 4. Suprarenal pathologies can mimic a renal tumor such as neuroblastoma.

### **TABLE OF CONTENTS/OUTLINE**

1. Imaging approach to a patient with a suspected renal tumor, emphasizing optimal imaging techniques 2. Solid renal neoplasms, including mesoblastic nephroma, nephrogenic rests, Wilms tumor, rhabdoid tumor, clear cell sarcoma, angiomyolipoma, renal cell carcinoma, lymphoma, and metastases. 3. Cystic renal neoplasms, including cystic nephroma, cystic partially differentiated neuroblastoma, and cystic Wilms tumor. 4. Mimics of renal neoplasms, including hypertrophied column of Bertin, focal pyelonephritis and abscess, infarct, granulomatous diseases, suprarenal pathologies, and cystic renal diseases. 5. Diagram slide of pediatric renal neoplasms underscoring key factors differentiating these entities.

## **PDEE-77 Craniovertebral Junction Instability, Fixation and Stenosis in Children**

Participants

Stephen B. Little, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Radiographs of the cervical spine are often inadequate or falsely reassuring in children with torticollis. A high-risk mechanism of injury or high clinical suspicion should prompt further evaluation with CT or MRI. 2. Early recognition and treatment of atlantoaxial rotatory fixation (AARF) is essential to limit morbidity. 3. AARF may be neither purely atlantoaxial, merely rotatory, nor completely fixed. 4. Significant lateral inclination of C1, facet deformity, new bone and multi-ligament insufficiency are associated with irreducible AARF. 5. An increased atlantodental interval (ADI) is a poor indicator of symptomatic atlantoaxial instability in children with trisomy 21. Furthermore, a normal ADI does not exclude craniovertebral junction instability. 6. Symptomatic CVJ instability in children with trisomy 21 is more frequent in those with associated osseous anomalies, particularly os odontoideum. 7. Osseous anomalies in children with CVJ instability include assimilation of the atlas, split atlas, odontoid hypoplasia or aplasia, os odontoideum, and Klippel-Feil syndrome. 8. A variety of skeletal dysplasias are associated with CVJ instability or stenosis. 9. Narrow C2 pedicles increase the risk of vertebral artery groove violation with pedicle screw placement, possibly producing devastating neurovascular consequences.

### **TABLE OF CONTENTS/OUTLINE**

1. Osseous and ligamentous anatomy 2. Key morphometry 3. Rotatory dynamics 4. Atlantoaxial rotatory fixation 5. Trisomy 21 and CVJ instability 6. Osseous anomalies and CVJ instability 7. Skeletal dysplasias 8. Surgical considerations

## **PDEE-78 Pediatric Dural Arteriovenous Fistulas: An Unusual Connection**

### **TEACHING POINTS**

Dural arteriovenous fistulas (DAVFs) are vascular abnormalities in which a meningeal artery drains directly into a meningeal vein or dural venous sinus. DAVFs are rare in children, accounting for around 10% of all intracranial shunts in the pediatric population. The transverse-sigmoid, superior sagittal sinus, and torcular herophili are commonly involved fistula sites in pediatric DAVFs. Pediatric DAVFs can be classified into three types: dural sinus malformations, infantile/juvenile-type dural shunts, or adult-type dural shunts. Younger children with DAVFs tend to present with cardiopulmonary symptoms (congestive heart failure and/or respiratory distress), while older children present with neurological symptoms (headaches, intracranial hemorrhage, focal deficits). The primary treatment for DAVFs is endovascular embolization, commonly with microcoils or liquid adhesives. Challenges in the endovascular treatment of DAVFs include high-flow fistulas, tortuous intracranial feeding arteries, and small femoral artery access sites.

### **TABLE OF CONTENTS/OUTLINE**

- Review neurovascular anatomy relevant to dural arteriovenous fistulas (DAVFs).  
- Recognize DAVFs in the pediatric population using a case-based approach.  
- Review the multimodal imaging appearance of pediatric DAVFs.  
- Understand the treatment of pediatric DAVFs and the application of neurovascular interventional techniques.  
- Discuss the complications and challenges in the treatment of pediatric DAVFs.

## **PDEE-79 Pediatric Coronary Artery Anomalies**

Participants

Maria Navallas, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Recognize the anatomic variations of coronary origin and course. 2. Understand the high risk imaging features in anomalous aortic origin of the coronary arteries. 3. Discuss acquired and post surgical anomalies of the coronary arteries.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Cardiac CT technique 2.1. Type of scanner 2.2. Patient preparation 2.3. Electrocardiogram gating 2.4. Contrast administration 3. Classification of congenital coronary artery anomalies 3.1. Anomalies of origin/course- High take-off- Single coronary artery- ALCAPA/ASCAPA- Origin of coronary artery or branch from opposite or noncoronary sinus and anomalous course: Retroaortic, interarterial, prepulmonic, septal (subpulmonic) 3.2. Anomalies of intrinsic coronary anatomy: Myocardial bridging 3.3. Anomalies of coronary termination: Coronary artery fistula 4. High risk imaging features and risk of sudden death 5. Acquired coronary artery abnormalities: 5.1. Kawasaki disease 5.2. Multisystem inflammatory syndrome in children associated with COVID-19 5.3. Postsurgical anomalies 6. Conclusion

## **PDEE-8 Picture Perfect: A Pictorial Review of Nuclear Medicine in Gastrointestinal and Hepatobiliary Disorders**

### **TEACHING POINTS**

1. Esophageal motility study is a useful tool for evaluating esophageal function, with the test providing valuable information about swallowing mechanics and esophageal peristalsis. 2. Gastric emptying study is commonly used to evaluate delayed gastric emptying, with the test providing valuable information about gastric function and potential causes of vomiting and other symptoms. 3. Hepatobiliary scintigraphy can be used to evaluate neonatal jaundice and to diagnose or rule out biliary atresia, a rare but serious liver condition that can lead to liver failure if left untreated. 4. Colonic scintigraphy is a useful tool for evaluating colon transit time and identifying potential causes of constipation or diarrhea. 5. Heterotaxy syndrome is a rare and complex condition that affects the development of organs in the body. Nuclear medicine imaging can be used to evaluate the function of the liver and other organs in children with this condition. 6. Nuclear medicine imaging can be used to diagnose Meckel's diverticulum and evaluate its function in the gastrointestinal tract.

### **TABLE OF CONTENTS/OUTLINE**

Introduction 1. Image acquisition 2. Radiation dose Esophageal Motility Study 1. Motility disorders 2. Repaired Esophageal Atresia 3. Trauma 4. Achalasia 5. Technique Gastric Emptying Study 1. Image acquisition and techniques 2. Early Satiety 3. Gastroesophageal reflux Hepatobiliary Scintigraphy 1. Neonatal Jaundice 2. Biliary Atresia Colonic Scintigraphy 1. Colon Transit Technique 2. Chronic Constipation 3. Hirschsprung disease 4. Tethered cord 5. Chronic diarrhea 6. Angiotensin converting enzyme patients Others 1. Heterotaxy Syndrome 2. Meckel's Diverticulum Conclusions

## **PDEE-80 Transcranial Doppler Ultrasound in Children with Sickle Cell Disease: All What You Have to Know**

Participants

Joseph Abi Ghanem, Beirut, Lebanon (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1- Sickle cell disease (SCD) has an incidence of 4/10000 births. It is characterized by a chronic proinflammatory state, prothrombotic state and increased aggregation of red blood cells (RBC). Children with the SCD HbSS and HbSBthal0 phenotypes have a 200-fold increased risk of stroke compared to healthy children. 2- Radiologists play a major role in treatment decision plan as Transcranial Doppler ultrasound (TCD) is the only radiologic test of choice to detect SCD children at higher risk for stroke. 3- The stroke prevention trial in sickle cell anemia (STOP) and The Silent Cerebral Infarct Transfusion (SIT) multicentric trial are pivotal studies demonstrating the benefit of chronic transfusion program based on screening with TCD velocities to prevent symptomatic and silent ischemia in SCD children between 2 and 16 years. 4- The tracings on the TCD reflect, the size of the artery, type of flow and flow velocities related to rheologic and hemodynamic factors.

### **TABLE OF CONTENTS/OUTLINE**

1- Introduction of the STOP and SIT trials. 2- Indications and recommendations on when and how to perform TCD. 3- How to interpret Doppler tracing on TCD. 4- Case based presentation of threshold velocities for a conditional and an abnormal TCD. 5- Quantitative ultrasound for RBC aggregation estimation as potential new test to decrease the number needed to treat and avoid unnecessary transfusion.

## **PDEE-81 Dermatologic Ultrasound in Children: Benign and Pseudo-Tumoral Lesions**

Participants

Luis Tierradentro-Garcia, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

- 1. To overview the current applications of dermatologic ultrasound in children. - 2. To illustrate the utility of ultrasound to differentiate benign and pseudo-tumoral dermatologic lesions in children. - 3. To describe the role of conventional and advanced ultrasound as a complementary tool to CT and MRI in making diagnoses and assisting in surgical planning.

### **TABLE OF CONTENTS/OUTLINE**

1. Background: Skin lesions in children are common, most lesions are benign. Clinical findings can be non-specific. 2. Technical aspects: - Image acquisition is non-invasive and harmless. - Frequency > 15 MHz. - Protocol: grayscale, Color Doppler, Pulsed-wave Doppler, microvascular flow imaging. - Normal sonographic appearance of the skin layers. 3. Pseudo-tumoral lesions 3.1 Cystic lesions - Epidermal inclusion cyst. - Trichilemmal cyst. - Dermoid cyst. - Cutaneous bronchogenic cyst. 3.2 Pilomatricoma 3.3 Dermatofibroma 3.4 Neurofibroma 3.5 Lipoma 4. Inflammatory lesions 4.1 Warts 4.2 Foreign body 4.3 Morphea 4.4 Insect bite 4.5 Kerion celsi 4.6 Juvenile xanthogranuloma 4.7 Congenital aplasia cutis 4.8 Annular granuloma 4.9 Keloid 5. Differential diagnosis 6. Take Home points

## **PDEE-82 Pediatric Magnetic Resonance Neurography: Technical Considerations, Indications, and Findings**

### **TEACHING POINTS**

1) Review technical considerations and imaging challenges of pediatric patients referred for magnetic resonance (MR) neurography. 2) Discuss the most common indications and anatomic regions referred for MR Neurography. 3) Illustrate typical imaging findings, their clinical correlation, and management strategies.

### **TABLE OF CONTENTS/OUTLINE**

1) Technical aspects of MR Neurography (3.0 T, conformable phased-array coils) and unique challenges of the pediatric population (e.g. SNR limitations due to small body habitus and size of peripheral nerves, sedation, motion artifact, flexion contracture (developmental or posttraumatic)). 2) Demographics and characteristics of a pediatric database at a tertiary orthopedic referral center 3) Imaging examples of both traumatic (e.g. median nerve entrapment following elbow fracture, drop foot post knee dislocation) and atraumatic (Charcot-Marie-Tooth, neurofibromatosis, limb hemihypoplasia) peripheral neuropathies and their clinical management 4) Strengths and weaknesses of MR Neurography for assessing pediatric patients, role of ultrasound, and discussion of future directions in this field

## **PDEE-83 Acute Pediatric Elbow Trauma - Adding the Orthopedist's Perspective to Imaging Interpretation**



## TEACHING POINTS

1. Knowledge of the specific developmental sequence of pediatric elbow apophyses is key to accurate interpretation of pediatric elbow trauma. 2. Knowledge of pitfalls is important, e.g., normal developmental irregularity of the apophyses can be mistaken for trauma. 3. In younger children, assessment of apophyseal avulsion/displacement on radiographs may be difficult due to incomplete ossification; MR may be necessary for more complete evaluation. 4. Chondroepiphyseal separation/ transphyseal fracture of the distal humerus is a rare manifestation of mechanical birth related trauma of the newborn and may be difficult to diagnose on radiographs. Ultrasound and MRI may aid in further assessment. 5. Optimal orthopedic management of pediatric patients with elbow trauma is hinged on accurate imaging interpretation. Radiology reports should include entity-specific information that will benefit patient management. For example, a radial neck fracture is a sentinel fracture, often accompanied by additional fractures. Post reduction of elbow dislocation, the developing medial epicondyle can be entrapped in joint. A nursemaid's elbow may not manifest any imaging abnormalities.

## TABLE OF CONTENTS/OUTLINE

1. Embryology and normal developmental anatomy of the elbow. 2. Radiographic views used for elbow trauma and technique of acquisition. 3. Role of MRI and CT acquisition parameters. 4. Imaging manifestations of pediatric elbow trauma. 5. Entity-specific additional information to be included in radiology reports that aid in orthopedic management. 6. Complications and mimics of acute elbow trauma. 7. Imaging spectrum of chronic overuse injuries of the developing elbow.

## PDEE-84 Masqueraders of Clarity - Tumor Mimics in Pediatric Oncology

Participants

Manisha Jana, MD, FRCR, New Delhi, India (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Pitfalls in oncologic imaging are inflammatory, infective and vascular disorders which mimic tumors. Post-treatment changes and complications must be differentiated from residual or recurrent disease. Problem-solving tools include a multimodality approach, functional imaging and serial follow-up.

## TABLE OF CONTENTS/OUTLINE

Non-neoplastic entities that mimic tumors lead to diagnostic confusion and delay appropriate therapy. In a patient with focal neurologic deficit or seizures, the cause may be demyelination, sarcoidosis or infections such as fungal, parasitic, tuberculosis and neurocysticercosis. Bone tumors are commonly mistaken in the setting of osteomyelitis, bone cysts, fracture, scurvy and osteogenesis imperfecta. Clinical context and plain radiographs must be correlated with MRI. Intrapulmonary nodes or granuloma mimic lung metastases. Abscesses, focal steatosis, cysts and arterioportal shunting are tumor mimics in the liver. Infarcts, cysts and perfusion abnormalities mimic tumors in the spleen, while adrenal hemorrhage can be mistaken for an adrenal mass. A hypertrophied column of Bertin, sludge and stones in the renal collecting system can mimic a renal mass - CEUS can help in the distinction. In a known cancer patient, radiotherapy-induced organ injury, post-chemotherapy infections, bone marrow changes and thymic rebound hyperplasia are common. Diffusion-weighted imaging and dynamic contrast-enhanced MRI can help in problem-solving.

## PDEE-85 Don't Ovary-act: A Sonographic Approach to Benign Pediatric Ovarian Pathology

Participants

Fatemeh Hadian, MBChB, FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1. A multi-follicular appearance is normal in neonates and teenagers and can be seen in prepubertal children. 2. Doppler flow may still be present in a twisted ovary and should not preclude making a diagnosis of torsion. 3. Benign ovarian lesions include ovarian cysts, para-ovarian cysts, mature cystic teratomas, cystadenomas and benign sex cord stromal tumors. 4. Diagnosing polycystic ovaries in adolescent females is challenging, but at-risk females can be identified for assessment at reproductive maturity. 5. Clinical history is crucial in differentiating between ovarian lesions with similar sonographic characteristics.

## TABLE OF CONTENTS/OUTLINE

Introduction - Normal ovaries, ovarian development, ovum development  
Acute ovarian pathology - ovarian torsion, antenatal ovarian torsion, canal of Nuck hernia, tubo-ovarian abscess  
Benign ovarian lesions  
Ovarian cysts - neonatal cysts, physiological and functional cysts, para-ovarian cysts  
Benign cystic tumors - mature cystic teratoma, cystadenoma  
Other benign ovarian tumors - benign subtypes of sex cord stromal tumors, gonadoblastoma  
Key points in differentiating benign vs malignant ovarian lesions  
Special considerations in adolescents - polycystic ovaries, endometriosis  
Role of O-RADS in children  
Conclusion

## PDEE-86 Imaging Approach for Pediatric Thyroid Diseases

Participants

Yuko Tsujioka, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Pediatric thyroid diseases have unique problems not seen in adult diseases. For example, congenital hypothyroidism is a common disorder that is usually detected on neonatal screening, but if missed, it causes serious intellectual disabilities. Juvenile thyroid dysfunction often manifest with non-specific symptoms (e.g., personality changes, declined school performance, weight fluctuation, decreased growth velocity), and may be fraught with diagnostic errors. Diagnostic imaging can be used to determine the underlying etiologies of endocrine thyroid diseases and provide supplementary information for thyroid hormone replacement therapy and antithyroid medication as well as to aid in the diagnosis of focal thyroid diseases, i.e., severity and extent of thyroid tumors and inflammatory diseases. In this educational exhibit, learners understand 1) the etiology, clinical features, and imaging findings in common pediatric thyroid diseases, 2) their unique features, and 3) how to use imaging modalities in the diagnostic approach for the diverse group of the disorders.

## TABLE OF CONTENTS/OUTLINE

Introduction - Thyroid development - Modalities of thyroid imaging - Congenital thyroid diseases including congenital hypothyroidism

(thyroid dysgenesis, thyroid dysmorphogenesis, transient hypothyroidism, congenital central hypothyroidism) and congenital hyperthyroidism - Acquired thyroid diseases including autoimmune thyroiditis, non-autoimmune thyroiditis, secondary thyroid dysfunction, acquired central hypo- and hyperthyroidism, and tumor and tumor like lesions

### **PDEE-87 Skeletal Disorders Due to Abnormal Aggrecan Biosynthesis**

Participants

Yuko Tsujioka, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

We review the imaging findings of disorders associated with abnormal biosynthesis of aggrecan, a major proteoglycan of cartilage. Proteoglycans are widely distributed in the extracellular matrix, and impaired aggrecan synthesis interferes with normal bone and joint development and causes disorders with abnormal bone and joint. With development of massively parallel sequencing technology and increased understanding of proteoglycan biology, disorders once considered separate entities have been lumped together as a group of disorders called "aggrecanopathies." All aggrecanopathies are autosomal recessive disorders with 25% of recurrence risk, and the accurate diagnosis is crucial for genetic counseling. Aggrecanopathies manifest with growth failure and multiple joint abnormalities that often lead to a misdiagnosis of joint hypermobility/contracture syndromes, such as arthrogyposis and Larsen's syndrome. However, radiological examination allows the differential diagnosis. The skeletal hallmarks of aggrecanopathies include stunted tubular bones due to impaired endochondral ossification and an abnormal "pattern formation" due to maldevelopment of embryonic cartilage templates, such as distal humeral bifurcation, double-layered patella, monkey wrench-like proximal femora, hyperphalangy, and accelerated carpal ossification.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction - Aggrecan synthesis process and related genes - Sulfation disorders (DTDST related, and others) - UDP-sugar deficiency (CANT1-related Desbuquios syndrome and others) - Linkeopathies

### **PDEE-88 High Negative Appendectomy Rates in Under-18-year-old Patients - A 10-year Review with Radiologic-Pathologic Correlation: And Then There Were None**

Participants

Juan Carlos Monte Gonzalez, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

- Radiologist-performed ultrasound (R-US) is a reliable diagnostic technique for acute appendicitis in under-18-year-old (U18) patients. - In inconclusive R-US studies (9% in this sample), positive second-look techniques were CT (55,6%), R-US (33,3%) and MRI (11,1%). - Discordance with pathology findings/negative appendectomy rate (NAR) was 6%, lower than other series.

#### **TABLE OF CONTENTS/OUTLINE**

One of our institution's pediatric surgeons suspected high NAR due to R-US low accuracy. This motivated a review of every appendectomy (610) in U18 patients, since the inauguration of our hospital (2012-2022). For this abstract, we sampled 100 patients that underwent appendectomy. We classified the cases by:- Age: 6-17 years-old (mean: 11,27 yo).- Gender: 41% female, 59% male.- Symptoms: 99% right lower quadrant pain, 63% nausea/vomiting, 18% temperature >37.3°C/99.1°F, 13% diarrhea, 12% hyporexia/anorexia.- Clinical signs: 67% Blumberg, 22% Psoas.- Laboratory values: 83% Leukocytosis >10,000, 68% leukocyte left shift (>75% PMNs), 67% CRP > 0.5.- Alvarado Score: 2-10 points (mean: 7,2).- R-US results: 90% positive, 1% negative, 9% inconclusive.- Second-look positive technique for inconclusive cases: 55,6% CT, 33,3% R-US, 11,1% MRI.- Appendix diameter: 5-20 mm (mean: 8,5 mm).- Surgical findings: 62% phlegmonous/suppurative, 17% phlegmonogangrenous/gangrenous.- Surgical technique: 53% open, 47% laparoscopic.- Pathology findings: 83% phlegmonous, 11% gangrenous, 5% reactive follicular lymphoid hyperplasia, 1% normal.- Discordance with pathology findings/NAR: 6%.- Evolution: 93% favorable, 4% complicated (1% dehiscence, 3% post-operative collections that resolved with antibiotics), 3% N/A.

### **PDEE-89 The Many Faces of Pediatric Langerhans Cell Histiocytosis: A Pictorial Review**

Participants

Maria Dien Esquivel, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Recognizing the typical imaging findings on different modalities of this rare disease is key to an early diagnosis and to guide management.2. MR imaging is the modality of choice to evaluate central nervous system involvement.3. FDG PET/CT plays a crucial role in the diagnosis, staging, surveillance and assessment of response to treatment of patients with LCH.

#### **TABLE OF CONTENTS/OUTLINE**

-Epidemiology-Classification-Etiopathogenesis and molecular findings-Pathology-Clinical Presentation-Treatment-Imaging Modalities• Radiography (skeletal survey)• Computed Tomography• Magnetic Resonance Imaging• Bone scintigraphy• PET/CT -Imaging Features by system• Central Nervous System• Axial and appendicular skeleton (bone marrow)• Chest• Abdomen• Nodal involvement• Other sites: Skin-Role of imaging• At diagnosis/initial staging• To assess response to treatment• During surveillance/follow up

### **PDEE-9 Nuclear Medicine Renal Studies: Indications, Techniques and Limitations for Optimal Patient Care**

#### **TEACHING POINTS**

1.Radiation dose is an important consideration in nuclear medicine imaging, and techniques for dose reduction should be employed whenever possible to minimize radiation exposure in children undergoing renal studies. 2.Radionuclide cystography is a valuable imaging modality for assessing vesicoureteral reflux and other bladder abnormalities in children and is often preferred over fluoroscopy due to lower radiation exposure.3.Renal cortical scintigraphy using DMSA is a common method for evaluating renal function and detecting renal parenchymal abnormalities. Proper image acquisition and technique are crucial for obtaining accurate and reliable results. 4.Diuresis renography using MAG3 is a useful tool for evaluating the functional status of the kidneys and detecting obstructive uropathy. Its role in renal transplant assessment and monitoring is also significant. 5.The appropriate use and interpretation of nuclear medicine renal studies in patients requires an understanding of the indications, techniques, and limitations of each modality, as well as consideration of the unique aspects of renal physiology and pathology.

## TABLE OF CONTENTS/OUTLINE

Introduction Radionuclide Cystography 1. Indications 2. Technique 3. Radionuclide Cystography vs Fluoroscopy Renal Cortical Scintigraphy: DMSA 1. Vesicouretral reflux 2. Cortical Scarring 3. Image acquisition 4. Technique Diuresis Renography-MAG3 1. Neonatal hydronephrosis 2. Uretropelvic junction obstruction 3. Acute intermittent obstruction 4. Image acquisition 5. Role in Renal Transplant Conclusions

### PDEE-90 Intravascular Catheters in Pediatrics: Methods, Imaging and Complications

#### TEACHING POINTS

1. Intravascular catheter insertion in the pediatric population can be challenging, especially in infants. 2. The radiologist must be familiar with the imaging appearance of intravascular catheters, and recognize catheter malposition as well as other complications. In selected cases, a linogram may be diagnostic. 3. Pediatric patients may experience unique complications such as thrombosis of the portal vein associated with umbilical vein catheterization. 4. In some complications, such as malposition, it may be possible to perform an 'over-the-wire exchange.' However, in other cases, the only option may be to insert a new catheter.

#### TABLE OF CONTENTS/OUTLINE

1. Important anatomy highlights. 2. Types of catheters. 3. Insertion methods and pitfalls. 4. Intravascular catheters on pediatric imaging: pearls and pitfalls. 5. Neonatal lines-special considerations. 6. Cases. 7. Diagnosis and management of complications.

### PDEE-91 Little Bellies, Big Impact: Blunt Abdominal Trauma in Pediatric Patients

Participants

Fabiana Gual, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: To emphasize that trauma is a leading cause of death in the pediatric population, with abdominal injuries being a common and often unrecognized cause; To discuss the factors contributing to the higher risk of abdominal injuries in children, such as thinner abdominal wall and reduced adipose tissue; To highlight the importance of using the appropriate imaging test (including radiography, ultrasonography, contrast-enhanced CT and eventually magnetic resonance) based on the severity of the trauma and the stability of the patient; To provide examples of cases of low- and high-energy blunt abdominal trauma to demonstrate the utility of these imaging tests in diagnosing injuries to specific organs, such as the pancreas, liver, spleen, and kidneys; To acknowledge the challenges in evaluating children with blunt abdominal injury, especially pre-verbal children, and the need for diagnostic imaging to guide management decisions.

#### TABLE OF CONTENTS/OUTLINE

A flowchart illustrating the use of diagnostic imaging in low- and high-energy blunt abdominal trauma in children. A table listing the "packages of injuries" that can be identified based on force vectors when the pancreas, liver, spleen, and kidney are injured. Illustrated teaching cases of patients who were treated at the pediatric emergency department of a quaternary hospital and underwent imaging tests. The cases involve low- and high-energy blunt abdominal trauma resulting in pancreatic, hepatic, splenic and renal injuries. The Pediatric Organ Injury Scale was used to classify the severity of these injuries.

### PDEE-92 Multimodality Imaging Review of Inherited Collagen Disorders

#### TEACHING POINTS

1. Describe the epidemiology and pathophysiology of inherited collagen disorders in children. 2. Identify typical and atypical features of inherited collagen disorders. 3. Provide a comprehensive review of the key imaging findings for each disorder using a multi-system and multi-modality approach. 4. Discuss complications of disease and treatment options.

#### TABLE OF CONTENTS/OUTLINE

I. General Introduction to Inherited Collagen Disorders II. Conditions A. Epidemiology B. Diagnostic Imaging Findings and Complications a. Osteogenesis Imperfecta: Wormian bones, multiple fractures, osteoporosis, in-utero manifestations, zebra stripe sign b. Ehlers-Danlos joint dislocations, fractures, hemarthrosis, sigmoid colon rupture, splenic artery aneurysm c. Stickler Syndrome facial deformities, articular manifestations d. Epidermolysis Bullosa cutaneous blisters and erosions with transformation to squamous cell carcinoma, pseudosyndactyly with mitten hand/sock toe deformities, esophageal stricture, pyloric atresia, osteomyelitis e. Alport Syndrome end-stage renal disease manifestations, esophageal leiomyomatosis C. Treatment III. Conclusion

### PDEE-93 Fetal MRI to Detect Congenital Anomalies of the Kidney and Urinary Tract

Participants

Chihiro Tani, MD, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

As congenital anomalies of the kidney and urinary tract (CAKUT) account for 40% of childhood end-stage renal failure, an early diagnosis and appropriate treatment are important. Fetal ultrasonography and MRI help to diagnose some of the diseases included in CAKUT. Fetal MRI is important for postnatal treatment and follow-up. We discuss the development of the renal and urinary system in fetuses and present fetal MRI findings of major diseases in CAKUT.

#### TABLE OF CONTENTS/OUTLINE

(1) The development of the renal and urinary system during the fetal period; kidney, ureter, bladder, urethra (2) Fetal MRI findings of major diseases in CAKUT a. Renal anomalies; multicystic dysplastic kidney, autosomal recessive polycystic kidney disease, horseshoe kidney, pelvic kidney, etc b. Renal pelvis, calyx, and ureter anomalies; ureteropelvic junction obstruction, megaureter, etc c. Bladder and urethral anomalies; bladder exstrophy, posterior urethral valves, etc Outline CAKUT accounts for childhood end-stage renal failure. Therefore, an early diagnosis and appropriate treatment are important. As some of the diseases included in CAKUT can be diagnosed prenatally, radiologists must be cognizant of fetal MRI findings of major diseases in CAKUT.

### PDEE-94 It's all about location! A Practical Compartment-Based Approach to Diagnosing Pediatric Head and Neck Masses

## TEACHING POINTS

1. Provide a practical compartment-based approach to create the best differential diagnosis of pediatric neck masses. 2. Review the anatomy and content of each compartment. 3. Review relevant clinical and specific imaging findings of common and rare pediatric neck lesions based on a compartmentalized approach.

## TABLE OF CONTENTS/OUTLINE

A. Background  
How to diagnose a pediatric neck mass? Why should we prefer a compartment-based approach for diagnosing pediatric neck masses?  
B. Head and neck compartments and compartment-based pediatric head and neck masses • Superficial Fascia • Parapharyngeal Space • Pharyngeal Mucosal Space • Submandibular space • Sublingual Space • Masticator Space • Buccal Space • Parotid Space • Carotid Space • Retropharyngeal Space • Perivertebral Space • Posterior Cervical Space • Visceral Space • Transspatial-multispatial • Miscellaneous  
Summary  
1. Evaluation of pediatric head and neck masses can be challenging due to their embryologic origin, complex anatomy, and various affecting pathologies.  
2. Using a practical compartment-based approach with careful consideration of the clinical details and specific imaging findings will enable the best differential diagnosis.

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## Abstract Archives of the RSNA, 2023

PDEE-1

### Ear Anatomy and Anomalies in Fetal MRI

#### Participants

Matheus Dorigatti Soldatelli, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Describe ear anatomy and anomalies using in-vivo MRI in fetuses between 16 and 41 weeks of gestational age (GA). Additional 3D skin-surface reconstructions and postnatal or post-mortem imaging were performed in selected cases.

#### TABLE OF CONTENTS/OUTLINE

- Illustrate the ease of visualization of the pinna, external auditory meatus, cochlea, modiolus, vestibule, and semicircular canals at different GAs.- Demonstrate ear malformations in syndromic and non-syndromic patients and the associated extra-labyrinthine anomalies, such as facial and extremity abnormalities, that aid in phenotype-genotype correlation.

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## Abstract Archives of the RSNA, 2023

PDEE-10

### Bone Deep: Exploring Musculoskeletal Health with Nuclear Medicine

#### TEACHING POINTS

1. Nuclear medicine imaging of the musculoskeletal system is a valuable tool for diagnosing a variety of conditions and should be performed with appropriate considerations, including image acquisition and radiation dose. 2. Skeletal scintigraphy is a useful tool for evaluating various musculoskeletal conditions, including osteomyelitis, and proper image acquisition is essential for accurate diagnosis. 3. Bone scintigraphy can also be used in the context of non-accidental trauma in children to identify occult lesions and patterns of distribution and interpretation of the images must be done carefully. 4. 18 F-fluoride PET/CT is an imaging modality that can be used for low back pain and can also identify conditions such as pseudoarthrosis and hardware loosening. 5. Bone scintigraphy can also lead to unexpected diagnoses, including Langerhans Cell Histiocytosis and various oncologic diseases, emphasizing the importance of thorough interpretation.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1. Pediatric Considerations 2. Image acquisition 3. Radiation dose Skeletal Scintigraphy 1. Indications 2. Image acquisition 3. In the context of Osteomyelitis Bone Scintigraphy and Non-accidental Trauma 1. Image acquisition 2. Interpretation 3. Occult lesions 4. Patterns of distribution 18F-fluoride PET/CT 1. Image acquisition 2. Low back pain 3. Pseudoarthrosis 4. Hardware loosening 5. Skeletal Trauma in non-accidental trauma Bone Scintigraphy and Unexpected Diagnosis 1. Langerhans Cell Histiocytosis 2. Oncologic diseases Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-11

### Synapses and Signals: Nuclear Medicine Applications in Neurology and Endocrinology

#### TEACHING POINTS

1. Nuclear medicine imaging can provide valuable diagnostic and therapeutic information in the evaluation of central nervous system and thyroid diseases, but appropriate dose optimization and imaging protocols are essential to minimize the potential risks associated with radiation exposure. 2. Epilepsy evaluation can benefit from various nuclear medicine imaging techniques such as CSF flow studies, CNS radionuclide angiography, and SISCO, which can provide valuable information about brain function and blood flow. 3. 18F-FDG PET is a useful tool for evaluating epilepsy, as it can provide information on brain metabolism and can help identify the location of seizure foci. 4. Pediatric thyroid diseases, such as hyperthyroidism, nodular thyroid disease, thyroid cancer, Graves Disease, and subacute thyroiditis, can be evaluated using a range of nuclear medicine imaging techniques, including thyroid uptake and scan, 123I whole-body scan, and 99mTc-MIBI imaging. 5. Nuclear medicine imaging can play a crucial role in the diagnosis and management of thyroid cancer, including the use of radioiodine therapy to target and destroy cancerous thyroid cells.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1.PET 2.Image acquisition 3.Radiation dose Epilepsy 1.Epilepsy Evaluation 2.Tracers for Targeted Epilepsy PET Imaging 3.CSF Flow Studies 4.CNS Radionuclide Angiography 5.SISCO 6.18F-FDG PET Pediatric Thyroid Disease 1.Hyperthyroidism 2.Nodular thyroid disease 3.Thyroid Cancer 4.Graves Disease 5.Subacute Thyroiditis Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-12

### Cortical Development Evaluation on Fetal Brain MRI Between 22 and 28 weeks: A Practical Guideline

#### Participants

Mariana Cerdeira Machado, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To demonstrate the correct protocols for the adequate acquisition of the necessary sequences for the analysis of the cortical development; - To illustrate the morphological aspects of the principal sulci and gyri of the fetal brain between 22 and 28 weeks in a fetal MRI; - To learn the timing of the appearance of each new sulci between 22 and 28 weeks in a fetal MRI; - To recognize the early signs of cortical development abnormalities.

#### TABLE OF CONTENTS/OUTLINE

The purpose of this work is to illustrate the morphological aspects of the principal sulci and gyri and their time of appearance in the fetal brain between 22 and 28 weeks in a fetal MRI. For this, we will briefly discuss cortical development (neuronal proliferation, migration, and organization) and explore anatomic landmarks and their normal morphology throughout this period. Furthermore, we will demonstrate how to adequately perform an MRI exam and use it to evaluate the fetal brain cortex. Finally, we shall explore the early signs of cortex developmental abnormalities and the importance of a prompt diagnosis on the outcomes and prognoses.

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## Abstract Archives of the RSNA, 2023

PDEE-13

### Abdominopelvic Emergencies in Pediatric Oncology Patients: A Pictorial Review

#### Participants

Sara Garcia, MD, Barakaldo, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Pediatric cancer patients are at increased risk for life-threatening emergencies that can affect all organs and systems. Such emergencies may be directly related to the disease at its debut or during its evolution or be secondary to the treatment administered.- Abdominal emergencies are frequent in these patients, and the imaging technique of choice for their study is ultrasound. Plain abdominal radiography, CT and MRI are usually used as complementary studies in case of specific suspicions or for better characterization.- Among the pathology affecting the intestinal loops at the debut intestinal obstruction stands out, especially intussusception, which is very typical in the pediatric population. Typhlitis or neutropenic colitis usually occurs as a complication of QT treatment in patients with ALL.- Among the hepato-biliary emergencies secondary to treatment, hepatotoxicity and sinusoidal obstruction syndrome are the most frequent, the latter presenting typical characteristics on Doppler study.- Acute pancreatitis is a possible complication of chemotherapy with L-asparaginase.- Hemorrhagic cystitis occurs as a complication treatment with cyclophosphamide in patients with HSCT. The bladder is the most affected organ.- Testicular neoplasms do not increase the risk of torsion but can present at onset as acute scrotal syndrome.

#### TABLE OF CONTENTS/OUTLINE

1. General classification of emergencies in pediatric oncology patients. Classification of abdominal emergencies, both those that occur at the onset of the disease and those that are secondary to oncological treatment.2. Description of the main clinical features and imaging findings of abdominal emergencies in these patients.

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## Abstract Archives of the RSNA, 2023

PDEE-14

### Mind the Gaps: Avoiding Fracture Pitfalls in Pediatric Musculoskeletal Radiology

#### Participants

Lucas Medeiros, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. To review normal pediatric musculoskeletal imaging findings that can mimic fractures in a multimodality approach 2. To discuss hard-to-identify and pediatric-specific fractures 3. To assess the differential diagnosis of pediatric pathological conditions 4. To analyze treatment-related findings that can simulate pathologies

#### TABLE OF CONTENTS/OUTLINE

1. Salter-Harris fractures 2. Green-stick fractures 3. Plastic deformation fractures 4. Torus fractures 5. Non-accidental injury fractures 6. Ossification centers mimicking fractures 7. Secondary fracture findings 8. Metabolic and genetic conditions (e.g. rickets, osteogenesis imperfecta) 9. Skeletal dysplasias 10. Obstetric injury 11. Anatomical variations

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## Abstract Archives of the RSNA, 2023

PDEE-15

### Temporosquamous Suture: An Updated View of the Importance of this Finding in Craniosynostosis

#### Participants

Yuree Herenio SR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The squamous suture is the main object of our work. While the phenotypic appearances and sequelae of synostosis of the major cranial vault sutures are well documented, little is reported concerning synostosis of the squamous suture. Involvement of this suture can be individual or associated with other sutures, both in syndromic cases and in primary craniosynostosis. This work has the objective to demonstrate the importance of the temporosquamous suture, which has been undervalued over the years in literature. Recent studies and their surgical correlations show different types of cranial deformity, depending on the location of partial or complete closure of this suture. Deformities include scaphocephaly, plagiocephaly or brachycephaly. Our work shows different types of closure evaluated in our department. We also consider fundamental the use of the Maximum Intensity Projection protocol (MIP) to demonstrate the real shape of the sutures and to investigate craniolacunia, which constitutes a relevant finding in the surgical decision, as it may represent signs of intracranial hypertension.

#### TABLE OF CONTENTS/OUTLINE

The work shows a literature review about the squamous suture, showing part of the cases of CT with Maximum Intensity Projection protocol (MIP) and volume rendering 3D reconstruction of different types of closure, evaluated in our department.

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## Abstract Archives of the RSNA, 2023

PDEE-16

### Epiphany about Epiphyses: Distinguishing Epiphyseal Mass Lesions in Children

#### Participants

Eric Tung, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Epiphyses have unique histology and play an important role in osseous development. The differential diagnosis for epiphyseal mass lesions in children is one that radiologists interpreting pediatric imaging should be familiar with. Overlapping imaging findings of epiphyseal tumors and other focal lesions on radiography and magnetic resonance imaging can hinder the ability of radiologists to establish specific diagnoses by imaging alone. However, knowledge of characteristic imaging features for each lesion can improve the accuracy and specificity of radiologists' interpretations. By the end of this exhibit, learners should be able to provide a differential diagnosis for pediatric epiphyseal mass lesions, recognize the unique imaging features of each diagnosis, and apply a framework for MRI evaluation of epiphyseal lesions to unknown cases.

#### TABLE OF CONTENTS/OUTLINE

1. Background: Epiphyseal development, structure, equivalents; 2. Differential diagnosis for epiphyseal tumors and other focal lesions in children; 3. Review of characteristic imaging findings for each diagnosis; 4. Framework for MRI interpretation to help narrow differential diagnosis; 5. Unknown cases to reinforce learning objectives

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## Abstract Archives of the RSNA, 2023

PDEE-17

### Pediatric Metabolic Bone Disorders - A Comprehensive Review

#### TEACHING POINTS

Illustrate the common and uncommon metabolic bone disorders in children. Identify imaging features that can help differentiate the various metabolic disorders.

#### TABLE OF CONTENTS/OUTLINE

Metabolic bone disease in children includes hereditary and acquired conditions of varying etiologies. The purpose of this educational exhibit is to describe the characteristic imaging findings of metabolic bone disorders to include endocrine and nutritional deficiencies. Entities such as rickets, scurvy/ hypovitaminosis C, osteogenesis imperfecta, hyperparathyroidism, renal osteodystrophy, celiac disease, inflammatory bowel disease, hypophosphatasia, osteopetrosis, sickle cell anemia, Gaucher's, heavy metal poisoning, and bone disease secondary to medication such as prolonged steroid treatment will be discussed. Early recognition and treatment of potential risk factors is important to avoid significant clinical consequences.

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## Abstract Archives of the RSNA, 2023

PDEE-18

### Pediatric Skull Lesions

#### TEACHING POINTS

- To discuss the common pathologies affecting the pediatric skull.
- To discuss imaging appearance of various skull lesions seen in children.
- To develop a systematic approach to diagnosing skull lesions.

#### TABLE OF CONTENTS/OUTLINE

Goals and objectives -Background information -Common and uncommon skull lesions in children -Imaging spectrum of pediatric skull lesions -Indications for further imaging -Summary. Pediatric skull lesions can be congenital, traumatic, vascular, inflammatory, infectious, or malignant. These lesions can be clinically palpable or incidentally detected on imaging. The incidentally detected lesions include parietal foramina, sinus pericranii, and venous lakes. The palpable abnormalities can be present at birth, such as cephalohematoma, birth trauma, meningocele/encephalocele, venous malformation, and dermoid/epidermoid cysts. Thalassemia, intraosseous hemangioma, osteoma, lipoma, Langerhans Cell Histiocytosis (LCH), Fibrous dysplasia, Neuroblastoma metastases, Ewing's sarcoma usually present later in life. Most of these lesions are visible on skull radiographs. Further evaluation is performed by ultrasound, computed tomography (CT), and Magnetic Resonance Imaging (MRI). Cephalohematoma and Parietal foramina are identified on ultrasound and radiographs respectively. Dermoid /Epidermoid cysts are commonly seen in the midline, frontal and temporal regions. LCH is usually seen as a beveled edge skull lesion. Fibrous dysplasia presents as expansile lesions with a ground glass matrix seen on CT. Our exhibit will discuss various skull lesions seen in the pediatric age group, their imaging appearance, and a systematic approach to the correct diagnosis.

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## Abstract Archives of the RSNA, 2023

PDEE-19

### **Focused Thoracic Ultrasonography for the Elucidation of Radiolucent Areas in Pediatric Patient's Chest X-ray: Approach Based on Cases**

#### **Participants**

Taila Moura Fe, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The main objectives of this exhibit are to: 1- Review the importance of thoracic ultrasonography in critical pediatric care and its potential benefits in reducing radiation exposure in neonates and infants. 2- Discuss various conditions that present as lucent lesions on chest X-rays and review sonographic findings of these conditions. 3- Emphasize the use of Focused Thoracic Ultrasound as a reliable tool in critical pediatric care and expand the use of bedside thoracic ultrasound helping physical examination.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction; Review of the use of thoracic ultrasonography; Case-based review of conditions that present as lucent lesions, with a challenging chest x-ray at the beginning of each case, followed by sonographic findings; Conditions included: Diaphragmatic hernia (Morgagni's and Bochdalek's hernia); Pneumothorax; Pneumomediastinum; Necrotizing pneumonia; Pulmonary cavitation/pneumatocele; Poland syndrome; Subcutaneous emphysema; Congenital deficiency of surfactant production; Congenital pulmonary airway malformation (CPAM)

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## Abstract Archives of the RSNA, 2023

PDEE-2

### Imaging Review of the Pediatric Spine: Do Abnormalities Always Indicate Disease?

#### Participants

Ana Carolina Augusto, MD, MSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this study is: • To review the development of the spine, focusing on the formation and malformations of vertebrae. • To illustrate and discuss the normal appearance, anatomical variations, and common pathologies involving the spine during skeletal growth.

#### TABLE OF CONTENTS/OUTLINE

- Embryology: The vertebral column and spinal cord develop in a precise, sequential manner during gestation. Any deviation from this normal process can cause structural variations in the spine and spinal cord.
- Congenital and acquired deformities of the vertebral bodies: defects related to fusion, formation, and segmentation of the vertebral bodies may lead to congenital scoliosis and could be linked with spinal dysraphisms, skeletal, cardiac, genitourinary, and gastrointestinal anomalies. Acquired deformities of the vertebral bodies can be caused by different factors, including trauma, infection, malignancies, systemic diseases, among others.
- Bone marrow: bone marrow conversion from red to yellow marrow follows a well-established pattern during childhood. Understanding the normal signal intensity changes on MRI is crucial to detect deviations that may represent disease.
- Normal developmental events, pitfalls, and common abnormalities during skeletal maturation: recognizing these developmental events and common abnormalities can assist in image interpretation, guiding treatment and management decisions.

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## Abstract Archives of the RSNA, 2023

PDEE-20

### Osteogenesis Imperfecta: A Pictorial Review

#### Participants

Adriano Silveira Moreira Novaes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Osteogenesis imperfecta (OI) is a genetic disease characterized by increased bone fragility, low bone mass and other connective tissue manifestations. The most common cause of OI is mutations in one of the two genes encoding collagen type 1, which is a major component of bone and other connective tissues. OI can present with a wide range of symptoms, and there are now seven recognized types of the disorder. The radiologist must be prepared to recognize the image patterns, determining a correct diagnosis, which facilitates the early and adequate treatment of the patient. Excluding differential diagnoses, such as non-accidental injury, is of fundamental importance. The purpose of the present study is to exhibit imaging findings of types I, III, IV, V and VI of OI; to demonstrate how to differentiate the types based on imaging findings; to demonstrate how to differentiate OI from non-accidental injuries.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Epidemiology and clinical finds. Main findings of type I, II, III, IV, V and VI. How to differentiate the types based on imaging findings. Excluding differential diagnoses, such as non-accidental injury, is of fundamental importance. Conclusion/Take home message.

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## Abstract Archives of the RSNA, 2023

PDEE-21

### Pediatric Renovascular Hypertension A-Z: Diagnostic Work-up, Imaging, Interventions, and Troubleshooting

#### TEACHING POINTS

1. Renovascular hypertension (RVH) is caused by an upregulation of the renin-angiotensin-aldosterone system due to flow-limiting renovascular disease (RVD). In pediatric patients, the differential includes fibromuscular dysplasia, neurofibromatosis, vasculitis, abnormal arterial supply and trauma.2. Although ultrasound is the initial imaging modality for diagnosing RVD, it is limited in evaluation of segmental branches. Angiography is the gold standard for diagnosis.3. Interventional radiology can offer a variety of interventions for RVD, including angioplasty and embolization. Surgical interventions can be offered in angioplasty-refractory stenosis.4. A multidisciplinary care team consisting of nephrologists, diagnostic and interventional radiologists, and transplant and vascular surgeons is necessary for the global care of young patients with RVH.

#### TABLE OF CONTENTS/OUTLINE

1. Differential diagnosis, diagnostic work-up and medical management for pediatric RVH2. Multi-modality approach to the imaging diagnosis for pediatric RVD including: renal artery Doppler ultrasound, contrast-enhanced ultrasound, computed tomography angiography, magnetic resonance angiography, and catheter angiography3. Endovascular renal artery interventions and technique for RVH management4. Indications for surgical intervention5. Surveillance and follow-up; troubleshooting for persistent hypertension

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## Abstract Archives of the RSNA, 2023

PDEE-22

### Radiogenomics of PIK3CA Related Disorders: A New Era

#### Participants

Jada Hislop, BA, Decatur, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Vascular anomalies are traditionally classified based on clinical characteristics, imaging and pathology. Diagnosis is challenging due to overlapping phenotype and inconsistent naming conventions. With the rapid development of new technologies in oncology, radiogenomics has emerged as a science which is beginning to change our understanding and treatment of vascular anomalies as well. Advances aid in clarifying etiology and elucidate previously unknown pathomechanisms. Through sequencing of tissue samples, postzygotic somatic variants have been discovered for several vascular anomalies with and without overgrowth as is the case with PIK3CA. PIK3CA driven vascular anomalies may now be treated with mTOR inhibitors and newly approved PIK3CA inhibitors. This exhibit will be a case-based approach to review recent advances in diagnosis including imaging finds, genetic testing, and review management of these disorders. Review the clinical spectrum of disorders associated with pathogenic variants in PIK3CA gene - from isolated vascular malformations to recognizable disorders. Highlight the manifestations of some PIK3CA-related disorders presenting with overgrowth (PROS). Review MRI imaging findings and pathology in patients with confirmed variants in PIK3CA. Discuss the evolving nature of genetic testing in somatic disorders and suitable tissue samples for testing. Briefly discuss therapeutic options including new medical managements

#### TABLE OF CONTENTS/OUTLINE

Introduction to PROSPIK3CA Genetic Pathway  
Selected examples and isolated vascular anomalies and overgrowth disorders  
Diagnostic approaches with imaging  
Diagnostic approaches with genetic  
Therapeutic approaches  
Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PDEE-23

### **The Top 10 Most Feared Diagnostic Errors by Radiology Trainees in Pediatric Neuroradiology Emergencies: Practical Tips and Tricks for Early Detection and Prevention**

#### **Participants**

Agustin Cardenas, MD, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Recognize the key imaging findings of the "top 10" Pediatric Neuroradiology Emergencies considered most challenging by Radiology trainees. 2. Identify the most feared potential errors and pitfalls made by Radiology trainees when interpreting these type of cases. 3. Learn potential contributing factors to developing these errors. 4. Provide practical tips and tricks to help prevent these potential errors. Provide specific strategies to apply them, in order to improve diagnostic confidence of Radiology trainees in clinical practice.

#### **TABLE OF CONTENTS/OUTLINE**

I. Introduction  
II. Top 10 challenging Pediatric Neuroradiology cases during call  
1. Detection of early cerebral edema. 2. Detection of dural sinus thrombosis in noncontrast head CT. 3. Retropharyngeal edema vs early abscess. 4. Detection of early shunt failure. 5. Craniocervical junction fracture vs normal developing ossification center. 6. Calvarial fracture vs suture. 7. Branchial cleft cyst vs retropharyngeal abscess. 8. Time estimation of heterogeneous subdural collections. 9. Porencephalic cyst vs ventriculomegaly 10. Detection of early orbital cellulitis.  
III. Take home points  
IV. References

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## Abstract Archives of the RSNA, 2023

PDEE-24

### **The Role of Imaging in Radiotherapy Planning: An Illustrated Review of Common Pediatric Tumors Treated with Radiotherapy**

#### **Participants**

Susan Gowdy, FRCPC, MBBS, Newcastle, (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Review some of the more common paediatric tumours treated with radiotherapy. Understand the role of imaging in the decision-making process regarding type of radiation therapy and mode of delivery. Consider how different imaging modalities may be incorporated into planning a radiation therapy field. Evaluate the potential role of imaging surveillance following radiotherapy.

#### **TABLE OF CONTENTS/OUTLINE**

Successful management of pediatric malignancies requires a multidisciplinary team approach. This educational exhibit aims to highlight the importance of close collaboration between radiologists, nuclear medicine physicians and radiation oncologists when assessing tumours of childhood which can be treated with radiotherapy. Using case examples of a medulloblastoma, Hodgkin's lymphoma and neuroblastoma, we will present imaging to review radiological features at diagnosis, relevant staging systems and response criteria that are important considerations for radiation oncologists planning radiotherapy treatment. The role of the different imaging modalities including various MRI sequences will be illustrated as the process of planning a radiation therapy field is discussed. Potential treatment complications including current literature regarding the role of imaging in surveillance will be reviewed.

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## Abstract Archives of the RSNA, 2023

PDEE-25

### MRI Findings in Hypovitaminosis C: Separating Scurvy from the Crowd

#### TEACHING POINTS

1. Symmetric metaphyseal edema involving the lower extremities is an uncommon finding. Causes include metabolic disorders, multifocal infection, autoimmune disorders, inherited diseases, and malignancy. Recognizing that bilateral lower extremity metaphyseal edema is a consistent finding in hypovitaminosis C can lead to early diagnosis and avoidance of further unnecessary testing and procedures. 2. Differential diagnoses for symmetric metaphyseal edema include focal periphyseal edema zones, chronic noninfectious osteitis, malignancy, osteomyelitis, and sickle cell disease. 3. Although subperiosteal hemorrhage can be seen with other etiologies such as bone infarct from sickle cell disease it can be a specific finding in hypovitaminosis C. 4. Since the diagnosis of hypovitaminosis C may not be initially considered, recognition of the imaging findings is important for early diagnosis. This allows for timely treatment and avoidance of further testing. 5. Scurvy has several clinical and laboratory findings that overlap with more common pathologies. a. Clinical: (Early) Gingival hyperplasia, joint swelling and bruising. (Late) Fever, jaundice, hemolysis, spontaneous bleeding and neuropathy. b. Laboratory: Mild leukocytosis. Elevated ESR and CRP.

#### TABLE OF CONTENTS/OUTLINE

1. Case series of 4 patients with hypovitaminosis C. a. History b. Clinical presentation c. Laboratory values d. Imaging 2. Review of the differential diagnosis of symmetric metaphyseal edema. a. Imaging features that can be specific for hypovitaminosis C. b. Imaging findings suggestive of an alternative diagnosis. c. Nonspecific clinical findings of hypovitaminosis C.

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## Abstract Archives of the RSNA, 2023

PDEE-26

### Pediatric Rhabdomyosarcoma: Imaging Evaluation from Diagnosis to Treatment Monitoring

#### Participants

Dana Alkhulaifat, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Rhabdomyosarcomas (RMS) are the most common type of soft tissue sarcomas in children. Risk factors include cancer predisposition syndromes such as Li- Fraumeni, Noonan and Beckwith-Wiedemann.
- Prognosis depends on several factors including location of the tumor, size, histopathology, genetics and imaging findings.
- The most optimal imaging modality for measuring local tumor involvement is cross sectional imaging by CT or MRI.
- For regional lymph node and metastatic assessment, whole-body fluorodeoxyglucose (FDG) PET/CT or PET/MRI in combination with chest CT is recommended.
- Treatment is multimodal and consists of multi-agent chemotherapy, along with surgical resection and radiotherapy of the primary tumor.
- MRI is the recommended modality for monitoring chemotherapy response for primary tumor, while FDG PET/CT or PET/MRI in combination with chest CT is recommended for lymph nodal and metastatic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Brief overview of pediatric rhabdomyosarcomas: epidemiology, risk factors and clinical presentation.
2. Initial tumor assessment:
  - a. Primary tumor
  - b. Regional lymph nodes
  - c. Metastatic lesions
3. Stratification of severity
  - a. Tumor location
  - b. Histological subtype
  - c. Cytogenetic information
  - d. Imaging staging (CT, MRI and PET)
4. Treatment regimens and response monitoring
  - a. Imaging modalities
  - b. Frequency of monitoring
  - c. Definitions of remission or progression.

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## Abstract Archives of the RSNA, 2023

PDEE-27

### Central Nervous System Involvement in Mucopolysaccharidoses: Understanding Pathophysiology and Radiological Findings

#### Participants

Miguel Barrio Piqueras I, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To understand the basic pathophysiology that directly or indirectly affects the central nervous system, including bone instability. To be able to recognize the main radiological findings of the different subtypes of this disease. To inform about new imaging diagnostic strategies such as spectroscopy.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Definition and general characteristics  
2. Clinical presentation in the central nervous system. I: Alpha-L-iduronidase - Hurler (I H): mental retardation, dysostosis - Scheie (I S): normal intelligence - Hurler-Scheie (I H-S): Intermediate between both above II: Iduronate sulphatase - Hunter: dysostosis III: Profound mental deterioration - Sanfilippo A: Heparan sulphamidase - Sanfilippo B: N-acetyl-glucosaminidase - Sanfilippo C: Acetyl-CoA: alpha-glucosaminide acetyltransferase - Sanfilippo D: N-acetylglucosamine 6-sulphatase IV: Galactose-6-sulphate sulphatase, Beta-galactosidase: Dysostosis, motor dysfunction - Morquio A - Morquio B VI: N-acetylgalactosamine-4-sulphatase - Maroteaux-Lamy: dysostosis, kyphosis VII: Beta-glucuronidase - Sly: dysostosis  
3. Diagnostic methods. Imaging findings and protocols.  
4. Treatment options for mucopolysaccharidoses.  
5. Future directions in imaging of mucopolysaccharidoses - Spectroscopy: diagnosis and future applications  
7. Case series

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## Abstract Archives of the RSNA, 2023

PDEE-28

### Easy-peasy! Simplifying the Myelination Progress in Term Newborn

#### Participants

Marcella N. Brandao, MD, MEd, Salvador, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review the normal myelination process in term newborn, as well as its progression. Tips for standardizing the evaluation of the myelination process. Guide step by step the myelination milestones, the main differential diagnoses and the disturbances in the myelination process that must be recognized.

#### TABLE OF CONTENTS/OUTLINE

Infant brain magnetic resonance imaging (MRI) interpretation presents unique challenges due to different appearances depending on age. This occurs through the myelination process which, despite starting in utero, has acceleration and predictability between individuals in the first postnatal year, with a predetermined scheme of chronological and topographical sequences, serving as an important normal brain maturation marker on MRI. Myelination occurs by a gradual myelin sheath dehydration, at the same time that lipids and proteins are deposited. This process is dynamic and the molecular interactions of water with lipids and myelin membrane proteins are modified and affect the relaxation time in the T1W and T2W sequences. T1W weighted images are most useful up to 8 months old with the myelinated white matter showing hypersignal, and T2W weighted images are useful in the later stages of myelination, showing hyposignal in the face of reduced myelin water content. Although predictable, the evaluation of myelination on MRI is still a challenge for many radiologists, so the authors structure a step-by-step guide with the myelination milestones, the main differential diagnoses and the disturbances in the myelination process that must be recognized.

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## Abstract Archives of the RSNA, 2023

PDEE-29

### Anatomic Approach to Non-Traumatic Lesions of the Pediatric Visual Pathway

#### Participants

Vivek Pai, MBBS, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Most of the visual pathway is inaccessible for histopathology; radiology is the only diagnostic modality available. Hence accuracy is of utmost importance for adequate management and optimal outcome 2. Having an anatomic approach will help narrow differentials.

#### TABLE OF CONTENTS/OUTLINE

A. Discussion on the anatomy of the visual pathway. B. Pictorial essay on lesions affecting the visual pathway with discussion on etiopathogenesis and presentation. Lesions are divided according to the anatomic location: 1. Retina: Retinal Detachment, Retinal hemorrhage, Panophthalmitis, Medulloepithelioma, Retinoma, Retinoblastoma. 2. Optic disc: Papilledema and IIH, Optic Drusen, Coloboma, CHARGE syndrome, Morning Glory syndrome. 3. Optic nerve: Anophthalmia-related aplasia, hypoplasia, demyelinating disorders, mitochondrial disorders, visual pathway gliomas. 4. Optic chiasm: Septo-optic dysplasia, Krabbe disease, Opto-Chiasmatic tuberculosis, hypothalamic-chiasmatic glioma. 5. Occipital lobes: Adrenoleukodystrophy, hypoxic-ischemic encephalopathy, hypoglycemic encephalopathy, PCA territory infarction, Posterior Reversible Encephalopathy Syndrome, occipital cephalocele, focal cortical dysplasia

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## Abstract Archives of the RSNA, 2023

PDEE-3

### US Evaluation of the Pediatric Hand Trauma: From One Through Five

#### Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

After reviewing this exhibit, the learner should be able to:1. Recognize the normal US appearance of the pediatric hand.2. Describe the use of high-resolution US, Doppler US and microvascular imaging for the evaluation of trauma-related conditions of the hand in children.3. Review the most common traumatic conditions affecting the hand in children.4. Discuss the US findings of the most frequent traumatic entities occurring in hand and wrist.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Transducers and technical US parameters to optimize the examination of the hand.3. Normal US appearance of the pediatric hand, including tendons, ligaments, vessels, and nerves.4. Authors will focus on five compartments (from one through five):4.1. Ligaments4.2. Tendons4.3. Vessels4.4. Nerves4.5. Bone5. Ligament injuries: Collateral ligaments (Stener lesion), pulley lesions, volar plate lesions.6. Tendon injuries: Superficial and profundus flexor tendon lacerations and transections, extensor tendon injuries, impingements, tenosynovitis.7. Vessels: Venous/arterial thrombosis, post-traumatic pseudoaneurysm8. Nerves: Laceration and transection, post-traumatic neuroma9. Bone: Fractures, callus formation with secondary impingement10. Foreign bodies characterization and removal with US guidance11. Injuries will be correlated with anatomical draws, as well as with MRI images.12. Summary

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## Abstract Archives of the RSNA, 2023

PDEE-30

### Diagnostic Error in Pediatric Neuroradiology

#### TEACHING POINTS

(1) Medical error has significant impacts on patient outcomes and society as a whole. (2) Error in diagnostic radiology can be organized in terms of types of thinking. (3) Metacognition, self-awareness, and understanding of specific strategies related to types of error can help radiologists reduce error. (4) Case-specific teaching to reduce error in pediatric emergency neuroradiology.

#### TABLE OF CONTENTS/OUTLINE

For each error type there will be: A pediatric neuroimaging case, a definition of error type, lessons learned, and known strategies to prevent this error. (1) Perceptive Error; (2) Cognitive Error: a) Anchoring bias, b) Confirmation bias, c) Availability bias, d) Satisfaction of report, e) Framing bias, f) Attribution bias, g) Satisfaction of search, h) Premature closure, i) Inattentive bias, k) Hindsight bias; (3) Communication Error; (4) Process Error

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## Abstract Archives of the RSNA, 2023

PDEE-32

### **Polymorphous Low Grade Neuroepithelial Tumor of the Young: An Institutional Case Series with Radiological and Pathological Correlation**

#### **TEACHING POINTS**

Polymorphous low grade neuroepithelial tumor of the young (PLNTY) is a rare, epileptogenic brain tumor that was recently described as a distinct entity in the 2021 World Health Organization classification of CNS tumors. Teaching points include: 1) PLNTY usually occurs in children and adolescents, although is occasionally diagnosed in adults. Clinically, patients often present with refractory seizures. 2) Histological characteristics of PLNTY include an infiltrative growth pattern, intense CD34 expression, cellular components resembling oligodendroglioma, and calcifications. 3) Imaging characteristics of PLNTY include T1 hypo/iso-intensity, T2 hyperintensity, GRE blooming artifact, non- (or slight) enhancement on contrast imaging, cystic components, and internal calcifications. Morphologically, PLNTY is often well-circumscribed and located in the temporal lobe. 4) At a molecular level, PLNTY is characterized by the presence of either a BRAF V600E mutation or chromosomal translocations involving FGFR2 and FGFR3. Both genetic alterations activate the MAP kinase pathway. 5) Imaging differential diagnoses include other low grade cortically based tumors such as oligodendroglioma (usually found in adults), dysembryoplastic neuroepithelial tumor (DNET), ganglioglioma, pleomorphic xanthoastrocytoma, and pilocytic astrocytoma. 6) Surgical resection is usually curative of seizures.

#### **TABLE OF CONTENTS/OUTLINE**

-Introduction, PLNTY's place in the WHO 2021 Classification of CNS tumors -Imaging characteristics of PLNTY -Histological characteristics of PLNTY -Discussion of pathophysiology and molecular subtypes -Imaging comparisons of differential diagnoses

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## Abstract Archives of the RSNA, 2023

PDEE-33

### Inside the Womb: A Fascinating Look at Congenital Kidney Pathology through Fetal MRI

#### Participants

Lizbet Perez-Marrero, Santiago De Chile, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Fetal MRI has emerged as a valuable and high-resolution imaging modality for the comprehensive assessment of fetal renal anomalies. 2) By utilizing a systematic review approach, radiologists can effectively characterize the fetal kidneys, providing a comprehensive understanding of the extent and severity of the anomalies. 3) Incorporating functional kidney assessments and measuring total lung volume during fetal MRI can enhance the overall evaluation of the fetus, providing a better understanding of the patient's condition and enabling more informed parental counseling.

#### TABLE OF CONTENTS/OUTLINE

When evaluating the kidneys, the following topics should be assessed, as combined alterations may be found associated with different pathologies:- position: situs solitus versus ectopia.- morphology: duplex, horseshoe.- size: duplex, autosomal recessive polycystic kidney disease (ARPKD)/ autosomal dominant polycystic kidney disease (ADPKD).- focal lesions: cysts, tumors.- excretory system: posterior urethral valves.- renal function: hypofunctioning - related systems: amniotic fluid, assessment of lung volume (hypoplasia cutoff value?), uterus/annexa.

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## Abstract Archives of the RSNA, 2023

PDEE-34

### Neonatal Liver Imaging: Techniques, Normal Variations and Common Pathologies

#### Participants

Govind Chavhan, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Neonatal liver has some unique aspects in terms of imaging and imaging appearances as compared to older children. Choosing and tailoring of imaging for each indication in neonate is therefore important for optimal care with minimal invasiveness. Common indications for imaging include incidental focal lesions, neonatal liver failure, cholestasis and sepsis. Imaging is important component of work up in neonatal liver failure helping to narrow differentials. It may help to salvage liver and potential transplant by timely diagnosis of conditions such as neonatal hemochromatosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction (overview of neonatal liver pathology, incidence, etc.; role of imaging) Imaging modalities- (discussion of specific roles, pros/cons, with relevant summary tables) What changes and what is normal at birth? (discussion of normal imaging appearance of structures related to neonatal liver) Indications for imaging (Incidental lesions, liver failure/dysfunction, cholestasis, sepsis, etc) Common pathologies (work up and role of imaging in the work up) - Congenital calcifications (causes, natural course, imaging) - Line related complications (hematoma, abscess) - Infections (TORCH, herpes, bacterial) - Neoplastic lesions (common lesions- hemangioma/HB/mesenchymal hamartoma /mets) - Vascular abnormalities (thrombosis, portosystemic shunts, AVMs, Heterotaxy) - Neonatal liver failure- causes, workup and role of imaging (NH, HLH, metabolic diseases, infection, cholestatic diseases)Summary

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## Abstract Archives of the RSNA, 2023

PDEE-35

### Pediatric Neck Cystic Lesions

#### TEACHING POINTS

Cystic lesions are common findings in pediatric patients. Imaging plays a crucial role guiding the diagnosis and depicting the anatomical extent of the lesion. Multimodality imaging narrows the differential diagnosis by demonstrating the lesion's components. Age groups and anatomic location in the neck are also diagnostic clues. It is important to recognize potential complications, especially infections.

#### TABLE OF CONTENTS/OUTLINE

o Congenital and Developmental Disorders § Thyroglossal duct cyst § Branchial cleft anomalies § Dermoid/Epidermoid cyst § Thymopharyngeal duct cyst o Vascular § Lymphatic malformations § Venous malformations § Cervical hemangioma § Pseudoaneurysms § Internal jugular phlebectasia o Infectious § Suppurative lymphadenitis § Tuberculous lymphadenitis § Abscess o Neoplastic § Schwannoma § Warthin tumor § Congenital cervical teratoma § Cervical lymph node metastases o Miscellaneous § Ranula § Thyroid colloid cyst § Laryngeal cyst

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## Abstract Archives of the RSNA, 2023

PDEE-36

### Imaging of DDH: An Update on Diagnostic, Follow-up and Post-operative Findings

#### TEACHING POINTS

The purpose of this exhibit is: To review the anatomy of the infant hip. To discuss the incidence, risk factors and pathophysiology of Developmental Dysplasia of the Hip. To review the clinical and imaging diagnostic criteria for DDH. To discuss the role of each imaging method in the context of DDH. To demonstrate the importance of early diagnosis and proper treatment of DDH with successful cases and adequate treatment, as well as late diagnosis and its complications.

#### TABLE OF CONTENTS/OUTLINE

Theoretical introduction containing epidemiology, risk factors and pathophysiology. Anatomy of the infant hip, including bone structures and the most relevant anatomic landmarks in DDH's diagnosis and follow-up. Images of clinical cases demonstrating some of the long-term complications, with emphasis on the importance of early diagnosis and proper treatment to avoid them. Brief discussion and illustration of the main current treatments as well as imaging follow-up evaluation with expected and unfavorable outcomes. Latest updates on diagnosis and treatment of DDH.

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## Abstract Archives of the RSNA, 2023

PDEE-37

### Imaging Appearance of Common and Less Common Fetal Masses from Head to Toe

#### Participants

Elizabeth Snyder, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Masses detected prenatally range from congenital malformations to tumors; knowledge of the imaging appearance of common and uncommon fetal masses is important for appropriate pregnancy. management, delivery planning and immediate postnatal management-2) Both US and fetal MRI play important and complementary roles in the evaluation of fetal masses.3) Using an anatomic approach to fetal masses, the differential diagnosis can be narrowed, allowing for more accurate prenatal counseling and management.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Epidemiology of fetal masses, b. Overview of categories of fetal masses: congenital malformations, benign tumors, malignant tumors2. Imaging approach to fetal masses: a. Prenatal ultrasound, including 3-D ultrasound b. Role of fetal MRI3. Anatomic approach to the prenatal diagnosis of fetal masses: a. Head neck: teratoma, lymphatic malformations, etc. b. Chest: congenital lung lesions, mediastinal teratoma, congenital myofibroblastic tumor, cardiac rhabdomyoma, etc. c. Abdomen/pelvis: hepatic congenital hemangiomas, neuroblastoma, congenital mesoblastic nephroma, sacrococcygeal teratoma, ovarian cyst, etc. d. Extremities: infantile fibrosarcoma, etc.4. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-38

### Detection of Aspirated Food in Pediatric Airway using Computed Tomography (CT)

#### Participants

Joseph Swicklik, RT, BS, Byron, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Explain clinical significance challenges detecting aspirated food in pediatric airway.
- Describe challenges solutions for CT imaging.
- Explain method for optimal imaging of radiopaque food matter.
- Illustrate benefits of CT in detecting aspirated food particles in clinical applications.

#### TABLE OF CONTENTS/OUTLINE

1. Foreign body aspiration in pediatric airways
  - a. Common issue in pediatric patients
  - b. The most common type of foreign bodies aspirated is food
  - c. Challenges with plain film radiography in visualizing food due to low contrast
2. How computed tomography can be used to achieve improved visualization of aspirated food particles in the pediatric airway
  - a. CT offers thin slice axial images without superimposition of anatomy
  - b. Multiplanar reformats offer views from multiple angles to better detect food stuck in the airway
3. Challenges of CT imaging and solutions
  - a. CT has a longer exposure time which increases the chance of motion
  - b. Flash scanning to reduce scan time
  - c. Determining the best scanning factors to best visualize radio-translucent food
4. Phantom studies
  - a. Food items commonly aspired in peds seen in the ED
  - b. Tubes representing realistic sizes of airways in children
  - c. Tubes filled with food items placed inside anthropomorphic chest phantoms representing pediatric patients of different ages
  - d. Optimal scanning, reconstruction, and display techniques to visualize food items
  - e. CT number look-up table of commonly aspirated foods
5. Clinical examples and applications
  - a. Gummy bear detected in airway
  - b. Thoracic
  - c. Pediatrics
  - d. Adults at high risk for aspiration

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## Abstract Archives of the RSNA, 2023

PDEE-39

### Spectrum of Pediatric Distal Bowel Pathology Imaging from Prenatal Period to Adolescence

#### Participants

Hajer Jarraya, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. The differential diagnosis of neonatal colonic obstruction includes Hirschsprung's disease, colonic atresia, congenital segmental dilation of the colon, NEC, anorectal malformation, and meconium plug syndrome. 2. The differential diagnosis of colonic obstruction in infants and children includes incarcerated intestinal hernia, sigmoid, cecal and transverse volvulus, intussusception, and rectal obstruction related to abdominopelvic masses or cysts. 3. The differential diagnosis of colonic wall thickening in older children includes infectious colitis, typhlitis, inflammatory (Crohn's or ulcerative colitis), vasculitis, ischemia, and neoplasm. 4. The differential diagnosis of colonic pathology can be classified based on age at presentation and primary imaging features (wall thickening, dilation/obstruction, transition point).

#### TABLE OF CONTENTS/OUTLINE

1.Epidemiology and classification of colonic pathology, 2.Imaging Findings A) Colonic pathology in the prenatal period B) Colonic obstruction in neonates, infants, children and adolescents C) Colonic wall thickening: infectious, inflammatory and neoplastic 3.Differential diagnosis 4.Algorithm of differential diagnosis based on age and primary imaging features

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## Abstract Archives of the RSNA, 2023

PDEE-4

### Lymphoscintigraphy: A Pictorial Review with Focus on Pediatric Patients

#### TEACHING POINTS

1. Classification of lymphedema and lymphatic dysplasias via illustrative mixed-modality case-examples 2. Sentinel node mapping in pediatric patients 3. Important pitfalls of the technical and interpretive aspects of lymphoscintigraphy

#### TABLE OF CONTENTS/OUTLINE

Introduction: Lymphoscintigraphy is a minimally invasive imaging technique that uses radiolabeled colloidal particles to evaluate lymphatic function  
Technique: 1. Radiopharmaceuticals 2. Administered activity/radiation dose 3. Imaging Protocols  
Indications for Lymphoscintigraphy: 1. Primary Lymphedema including Lymphatic Dysplasia 2. Secondary Lymphedema 3. Chylous Leaks 4. Sentinel Lymph Node Mapping  
Imaging Findings with Illustrative Case Discussions: 1. Lymphedema 2. Absent Visualization of Regional Lymph Nodes 3. Delayed or Asymmetric lymphatic Transit 4. Collateral Lymphatic Channels 5. Dermal Backflow 6. Chylous Effusion or Ascites 7. Sentinel Lymph Node Visualization Pitfalls  
Summary: Lymphoscintigraphy plays a unique role in evaluation disorders of lymphatic development, acquired lymphatic disorders, and assessment of chylous fluid collections. Familiarity with normal patterns of lymphatic transit, abnormal lymphatic transit, and common pitfalls are crucial for radiologists performing and interpreting these examinations.

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## Abstract Archives of the RSNA, 2023

PDEE-40

### Imaging of Congenital Hearing Loss: A Practical Approach

#### Participants

Rafael Loureiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review important anatomic landmarks in the pediatric temporal bone. 2. To discuss the imaging technique and protocols for the evaluation of congenital hearing loss. 3. To present a practical guide to facilitate comprehension of radiologic findings and the role of imaging in the evaluation of congenital hearing loss.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
Principles of the basic workout investigation- Screening for hearing loss in newborns- Functional evaluation: quick review of audiometric studies for radiologists  
Temporal Bone Anatomy  
Classification of congenital hearing loss- by severity: slight, mild, moderate, severe and profound- by type: conductive, sensorineural, mixed- by causes: genetic (syndromic and non-syndromic); environmental; congenital lesions and malformations  
Imaging studies: CT and MRI of the temporal bone- imaging protocol and special considerations for congenital hearing loss evaluation  
Instructive cases by causes and main imaging features  
A step-by-step guide to diagnose congenital malformations  
Principles of imaging evaluation for guiding treatment  
Take home messages

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## Abstract Archives of the RSNA, 2023

PDEE-41

### Systematic Approach to Congenital Brain Tumor

#### Participants

Ana Paula Fonseca, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose  
Felipe Scortegagna SR, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are to:- Describe through illustrative cases the classification and imaging patterns of neonatal brain and spine tumors.- Correlate imaging with molecular and genetic alterations.- Present comprehensive imaging protocols.- Highlight important differential diagnoses to consider.

#### TABLE OF CONTENTS/OUTLINE

- Definition of congenital tumors.- Classification of congenital CNS tumors- Based on location, age and updated WHO Classification 2021.- Overview of common predisposing genetic syndromes.- Recommended fetal and neonatal imaging protocols.- Typical imaging features of each tumor type.- Teratoma Astrocytic tumors.- Neuronal and mixed neuronal-glial tumors.- Choroid plexus papilloma.- Embryonal tumorso Craniopharyngioma.- Ependymoma.- Important tumor mimics to consider.- Hemorrhage.- Vascular malformations.- Infections.- Hamartomas.- Cortical malformations.- Treatment challenges and developments.- Diagnostic algorithm.- Final remarks.

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## Abstract Archives of the RSNA, 2023

PDEE-42

### **Bridging the Gap Between the Symptoms to Radiology Beyond the Anatomy of Temporal Bones in Pediatrics and Young Adults**

#### **Participants**

Nahyun Jo, MD, Galveston, TX (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The ear is a highly specialized organ in a tightly packed space. Trainees are used to the classification of temporal bone pathology with respect to their anatomical locations; inner, middle, and outer ear. Although anatomical search patterns allow a thorough evaluation of complex ear structures, understanding symptomatologic categorization not only aids in an active search for differential diagnosis but also broadens the understanding of the pathophysiology and management.

#### **TABLE OF CONTENTS/OUTLINE**

The introduction is a basic review of temporal bone anatomy and commonly used modality. The second section, "Bridging the gap," discusses a quick guide to understanding relevant clinical information, such as audiometry or otoscopy. In the third section, "Symptoms to radiology," each ear pathology is categorized by each clinical scenario. For each symptom and appropriate pathology, key points to report or "what surgeons want to know" are detailed. The symptoms are divided into otalgia, hearing loss, tinnitus, and otorrhea. Otalgia is subdivided into the acute and chronic onset of symptoms. Hearing loss is subdivided into conductive hearing loss and sensory hearing loss. Both conductive and sensory hearing loss has congenital, infectious/inflammatory, tumor, trauma, and miscellaneous etiologies. Tinnitus has vascular, tumor, and various etiologies. Otorrhea may occur with otalgia due to infection, but CSF otorrhea is discussed separately as it can be the sole reason for the exam without other overlapping symptoms.

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## Abstract Archives of the RSNA, 2023

PDEE-43

### Palpable Head and Neck Lumps in Pediatrics: Tips and Tricks in Ultrasound

#### Participants

Ana Berasategui Criado, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate the ultrasound appearance of the most frequent pediatric head and neck palpable lumps, acknowledge the imaging hallmarks of each condition, and correlate with other imaging tools. To Highlight the warning signs on ultrasound, recognize when additional testing is necessary and discuss subsequent management.

#### TABLE OF CONTENTS/OUTLINE

The presence of palpable lumps of the head and neck is a frequent complaint in children, including a broad spectrum of infectious, tumoral conditions, embryologic remnants, and vascular malformations, with the large majority proven benign. The radiologist must recognize the warning signs that allow early management of those with potential malignancy or those leading to space compromise over vascular and respiratory structures, including onset during the neonatal period, firm consistency, rapid growth, or location underneath the fascia. Ultrasound has arisen as the first-line imaging modality for initial evaluation. It represents a fast and safe technique, which can provide essential information for the characterization of the lesion, acting as a guide in diagnostic and therapeutic procedures. This ultrasound approach guides subsequent decision-making, including follow-up, complementary testing, or treatment through interventional drainage or surgical excision. Further investigation with cross-sectional imaging is warranted if the characteristics of the mass are beyond the scope of ultrasound or if malignancy is suspected. We provide a pictorial review of illustrative cases from our institution to help identify the key imaging findings and emphasize the role of ultrasound in the diagnosis and interventional treatment of pediatric lumps.

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## Abstract Archives of the RSNA, 2023

PDEE-44

### Atlas of Secondary Ossification Centers, Physeal Variations, and Cortical Buckles” in the Pediatric Skeleton: Radiographic and MRI Correlation of Normal and Abnormal Findings.

#### Participants

Jade Iwasaka-Neder, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Systematically illustrate the variable radiographic appearances of secondary ossification centers and physes at different stages of skeletal development
- Compare and contrast MRI appearances of normal versus abnormal growth centers to highlight their differences and improve their diagnosis
- Elucidate normal and abnormal areas of cortical buckling in children
- Illustrative examples of pathologic mimickers

#### TABLE OF CONTENTS/OUTLINE

- o Secondary ossification centers on radiography and MRI: imaging characteristics, expected time of appearance, and locational differences.
- Sternum (Manubrium; Sternebrae; Xiphisternum; Unfused sternebrae sternal foramen)
- Scapula (Coracoid centers; Acromion centers)
- Upper limb (Greater humeral tuberosity; Lesser humeral tuberosity; Elbow mnemonics: CRITOE and CRITOL; Carpal bones)
- Pelvis (Iliac spines; Ischial tuberosity; Acetabular rim)
- Lower limb (Distal femoral condyles; Tibial tubercle; Medial and lateral malleoli; Patella; Calcaneus)
- o Cortical buckles and nutrient canals. Do they belong here? (Tibia; Fibula; Femur; Clavicle; Tarsal bones; Metacarpals and phalanges; Metatarsals)
- o Physeal variations (Distal fibula; Distal tibia; Proximal humerus; Distal radius; Distal ulna; Different types of normal physes)
- o Normal versus Fracture (Case review)

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## Abstract Archives of the RSNA, 2023

PDEE-45

### Childhood Constipation: How Imaging Evaluation Can Help

#### Participants

Lívia Alves, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Constipation in the pediatric population is a prevalent diagnosis worldwide. Frequent imaging examinations are required to investigate the diagnosis, and generally to differentiate the functional etiology and its degrees from an organic cause. Therefore, the radiologist must know the particularities of each imaging method, know how to indicate the ideal exam in the face of clinical suspicion, and interpret the most diverse findings to arrive at the final diagnosis. This presentation aims to: (1) point out the main imaging tests that can be used in the diagnosis of constipation in pediatric patients, detail their characteristics and help in choosing the method in the face of clinical suspicion. (2) review the imaging findings in cases of functional and organic constipation, highlighting the main related pathologies: Hirschsprung's disease, visceral myopathy and chronic intestinal pseudo-obstruction. (3) debate the imaging findings of the most frequent complications.

#### TABLE OF CONTENTS/OUTLINE

Imaging methods used in the diagnosis of constipation, its characteristics, and main indications in the face of clinical suspicion include abdominal radiography, barium enema and colonic transit, computed tomography, magnetic resonance imaging and ultrasound. Case-based review of the functional and organic etiology of constipation (Hirschsprung's disease, visceral myopathy, chronic intestinal pseudo-obstruction, intra-abdominal tumor and VACTERL association). Case-based review of complications (fecaloma, stercoral colitis, and perforation) and associated diseases (voiding dysfunction).

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## Abstract Archives of the RSNA, 2023

PDEE-46

### The PRETEXT Staging System for Primary Liver Tumors in the Pediatric Population. A Cases-based Pictorial Review

#### Participants

Mariano Lorea, Barracas, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The PRE-Treatment EXTent of tumor (PRETEXT) system aims to standardize imaging evaluation and risk stratification of hepatoblastoma and hepatocellular carcinoma before implementation of any treatment. PRETEXT grades provide valuable information regarding prognosis and overall survival. Liver is divided into four sections: left lateral (LL), left medial (LM), right anterior (RA) and right posterior (RP). Liver tumors are separated in four groups (I-IV) based on the number of contiguous tumor-free liver sections. Higher groups are related to worst outcomes.

#### TABLE OF CONTENTS/OUTLINE

Introduction  
What means PRETEXT?  
Prognosis implications  
Liver segmentation  
How to divide the liver? From Couinaud's segmentation to PRETEXT segments.  
PRETEXT groups  
Groups I to IV. Cases-based pictorial review. Imaging clues to precise PRETEXT group assignment.  
Additional PRETEXT criteria.  
Hepatic venous involvement (V and P)  
Extrahepatic disease (E)  
Multifocality (F)  
Tumor rupture (R)  
Caudate lobe involvement (C)  
Lymph nodes (N) and distant metastasis (M)

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## Abstract Archives of the RSNA, 2023

PDEE-47

### Pediatric Primary Intracranial Sarcoma with Features of DICER1 Mutation: A Challenging Diagnosis

#### Participants

Jossue Espinoza SR, MD, Lima 01, Peru (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

TEACHING POINTS Pediatric primary intracranial sarcomas have an aggressive clinical course. The incidence of pediatric primary intracranial sarcoma with features of DICER1 mutation has been increasing. Imaging features of pediatric primary intracranial sarcomas with features of DICER1 mutation are not well documented. MRI and CT imaging play a crucial role in establishing a diagnosis. MRI plays a crucial role in follow up during treatment and evaluation for residual disease after surgery. Since there are several differential diagnoses, radio-pathologic correlation of these tumors is essential to confirm the diagnosis.

#### TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: Provide a pictorial review of the diverse imaging appearances of pediatric primary intracranial sarcoma with features of DICER1 mutation and differential diagnoses. Discuss specific imaging and pathological characteristics of pediatric primary intracranial sarcoma with features of DICER1 mutation and differential diagnoses. Familiarize the audience with the imaging of pediatric primary intracranial sarcoma with features of DICER1 mutation and emphasize the importance of radio-pathologic correlation. These entities include:

- Pediatric Primary intracranial sarcomas with features of DICER1 mutation.
- Potential pitfalls and differential diagnoses of these tumors including other mesenchymal non-meningothelial tumors of the central nervous system, cavernous malformation (cavernous angioma or cavernoma) and high-grade brain tumors in pediatric patients.

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## Abstract Archives of the RSNA, 2023

PDEE-48

### The Lung and Winding Road - A Pictorial Essay on Cystic Lung Diseases in Pediatric Radiology

#### Participants

Victor Nishimura, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

PNEUMATOCELE is a transient round and variable sized cyst, adjacent to consolidation or ground glass opacities. INTERSTITIAL LUNG EMPHYSEMA cystic or linear radiolucencies in the interstitium radiating from the hilum can be seen. CONGENITAL LUNG HYPERINFLATION increased lung volume and transparency can be seen. NEURENTERIC CYST is a fluid attenuating paravertebral lesion. BRONCHOGENIC CYST well circumscribed spherical or ovoid masses of variable attenuation can be seen. PULMONARY SEQUESTRATION multiple cystic lesions and anomalous artery nutrition can be seen. CYSTIC LYMPHANGIECTASY can be associated with syndromes, also congenital cardiac anomalies. CONGENITAL PULMONARY AIRWAY MALFORMATION usually presents as a solitary well defined thin walled cyst or multiple cysts of varying sizes. Multiple irregular shaped cysts are characteristic of LANGERHANS CELL HISTIOCYTOSIS. LYMPHANGIOLEIOMYOMATOSIS characterized by diffuse thin walled cysts surrounded by normal lung without regional sparing, accompanied by small centrilobular nodules.

#### TABLE OF CONTENTS/OUTLINE

ACQUIRED PNEUMATOCELE INTERSTITIAL LUNG EMPHYSEMA CONGENITAL CONGENITAL LUNG HYPERINFLATION NEURENTERIC CYST BRONCHOGENIC CYST PULMONARY SEQUESTRATION CYSTIC LYMPHANGIECTASY CONGENITAL PULMONARY AIRWAY MALFORMATION NEOPLASTIC LANGERHANS CELL HISTIOCYTOSIS LYMPHANGIOLEIOMYOMATOSIS

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## Abstract Archives of the RSNA, 2023

PDEE-49

### Neonatal Subpial Hemorrhage: A Closer Look

#### Participants

Eman Marie, MSc, Hamilton, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Understand the anatomy and physiology of the subpial space. 2- Describe causes of subpial hemorrhage in neonates. 3- Discuss the clinical presentation and the indications of imaging. 4- Identify the different imaging modalities used to identify and evaluate the subpial hemorrhage. 5- Discuss and exemplify the imaging features of subpial hemorrhage. 6- Classify the different types of subpial hemorrhage, comorbid conditions, and prognosis.

#### TABLE OF CONTENTS/OUTLINE

1- Embryology and early development of brain meninges with a focus on the pia mater. 2- Anatomy (gross and microscopic) and physiology of the subpial space. 3- Incidence and potential risk factors linked to subpial hemorrhage in neonates. 4- Imaging of neonatal subpial hemorrhage: US, CT and MRI findings, standard protocols and special considerations during neonatal brain imaging. 5- Diagnostic accuracy of each imaging modality and factors that may affect the accuracy of interpretation. 6- Pitfalls and differential diagnosis of subpial hemorrhage. 7- What the referring physician needs to know: diagnosis and extent of abnormalities. 8- Proposed imaging-based prognostication. 9- Neonatal subpial hemorrhage and abusive head trauma. 10- Management strategies of neonatal subpial hemorrhage and the role of imaging follow up. 11- Recent research and future directions on neonatal subpial hemorrhage.

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## Abstract Archives of the RSNA, 2023

PDEE-5

### Pediatric Lung and Heart Evaluation: A Pictorial Review of Scintigraphy, Salivagram, and Cardiac Shunts

#### TEACHING POINTS

1.Lung scintigraphy is a useful tool for evaluating pulmonary function in children, with both perfusion and ventilation/perfusion scans providing valuable information about lung physiology. 2.In the context of congenital diaphragmatic hernia, scintigraphy can be used to predict inadequate lung development and assist with surgical planning. 3.When evaluating suspected pulmonary embolism in children, ventilation/perfusion scintigraphy can be a useful alternative to CT angiography. 4.Salivagram can be helpful in the context of concern for silent aspiration and GE reflux in neurologically impaired children.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1.Pediatric Considerations 2.Image acquisition 3.Radiation dose Lung Scintigraphy in Children 1.Indications 2.Lung perfusion Scintigraphy 3.Ventilation/Perfusion scintigraphy 4.Technique in Lung Perfusion Scintigraphy Cardiac Imaging 1. Right to left shunting 2. Left to right shunting Lung Scintigraphy in the Context of Congenital Diaphragmatic Hernia 1.Ventilation/Perfusion in the prediction of inadequate lung development 2.Role of scintigraphy in predicting outcomes and surgical planning 3.Dynamic ventilation abnormalities and matched defects Pulmonary Embolism 1.Indications 2.Ventilation/Perfusion scintigraphy 3.Ventilation/Perfusion vs CT angiography Salivagram 1. Indications 2. Image technique and acquisition Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-50

### Growing Pains: Navigating Pediatric Metabolic Bone Disorder

#### Participants

Ami Gokli, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Discuss with illustrative examples the anatomy and physiology of normal bone growth in the pediatric population- Review common pediatric metabolic bone diseases including the pathophysiology and characteristic imaging features associated with these diseases using a multimodality approach- Describe clinical management, necessary details to include in radiologic reports, and the importance of radiologists role in these diseases

#### TABLE OF CONTENTS/OUTLINE

Overview:-Anatomy and physiology of pediatric bone growth/turnover including Identifying regions in the bone growth process particularly susceptible to diseaseEtiology:-Hereditary-Acquired (Nutritional deficiencies, Drug Treatments, etc)Pathology:-Diseases that can be discussed including discussion of pathophysiology with an image rich, multimodality approach; identify pathognomonic radiographic findings/tools that can aid in diagnosisPrimary/Secondary osteoporosis, Osteogenesis imperfecta, Rickets, Skeletal dysplasias (Achondroplasia, cleidocranial dysplasia, achondroplasia), Albright hereditary osteodystrophy, (pseudohypoparathyroidism)/renal osteodystrophy, Fibrous dysplasia/McCune Albright syndrome, Juvenile Paget disease, Sclerosing bone disorders (osteoporosis, pyknodysostosis, osteopoikilosis, osteopathy striata, melorheostosis), Hypophosphatasia- Describe necessary details to include in radiologic reportsTreatment/management:- Peds metabolic bone disorders require an extensive Team (endocrine, ortho, medical genetics, PM+R, physical/occupational therapy, pediatric radiology, nursing), detailed description of what is involved and the central role radiologists playConclusion

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## Abstract Archives of the RSNA, 2023

PDEE-51

### Imaging Findings and Management Strategies to Liver Masses in Children with Underlying Predispositions: A Review from the ACR Pediatric LI-RADS Working Group

#### Participants

Amy B. Kolbe, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the imaging approach and differential diagnosis for liver masses in children with underlying genetic syndromes, congenital abnormalities, vascular abnormalities, and other conditions that predispose to liver lesions. 2. Illustrate the characteristic imaging findings of benign and malignant liver tumors in children with predisposing conditions. 3. Discuss the screening guidelines and management approach to liver masses encountered in the predisposed child.

#### TABLE OF CONTENTS/OUTLINE

Spectrum of pediatric liver tumors and pseudotumors in: 1. Genetic syndromes: Beckwith Wiedemann syndrome, familial adenomatous polyposis, progressive familial intrahepatic cholestasis, tuberous sclerosis, cystic fibrosis, glycogen storage disease, tyrosinemia, Wilson disease, hereditary hemochromatosis 2. Congenital abnormalities: Biliary atresia, Alagille syndrome, Abernethy malformation 3. Miscellaneous: Metabolic syndrome, Fontan associated liver disease, Budd Chiari syndrome For each entity we will discuss the underlying pathogenesis of liver disease, types of liver masses described with the entity, characteristic imaging findings of each liver mass, surveillance strategies, and key findings that warrant further intervention

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## Abstract Archives of the RSNA, 2023

PDEE-52

### Fetal Magnetic Resonance Imaging Findings in Conjoined Twin Pregnancies

#### TEACHING POINTS

The learner will understand how to differentiate the various conjoined twin variants by their fetal MRI appearance. The learner will understand which features of conjoined twin shared anatomy predict survival and the potential for separation and how fetal MRI can be used in this assessment. The learner will review fetal MRI examples of additional congenital anomalies within the context of conjoined twinning.

#### TABLE OF CONTENTS/OUTLINE

Conjoined twins are a rare complication of monozygotic twinning. Fetal MRI can provide a detailed evaluation of these twins' shared anatomy and identify additional congenital anomalies, thereby allowing the fetal care team to anticipate the potential for survival and separation in these complex twin pairs. This exhibit will review the fetal MRI appearance of the different morphological variants of conjoined twins, including several unusual cases of minimally conjoined twins. Emphasis will be placed on those anatomical features most important for determining conjoined twin prognosis and potential for separation. Fetal MRI cases demonstrating additional important congenital anomalies within the context of conjoined twinning will be presented as part of a comprehensive fetal assessment.

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## Abstract Archives of the RSNA, 2023

PDEE-53

### Sonographic Evaluation of the Umbilical Region in Children

#### Participants

Lizbet Perez-Marrero, Santiago De Chile, Chile (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the normal sonographic appearance of the umbilicus and the midline structures of the anterior abdominal wall. To recognize ultrasound findings of the most common lesions of the umbilicus, including anomalies of the embryonic remnants.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Ultrasound protocol of the umbilical region and anterior abdominal wall. 3. Normal anatomy of the umbilicus and midline anterior abdominal wall 4. Umbilical lesions a. Umbilical granuloma b. Omphalitis b. Epidermal cyst c. Cutaneous ciliated cyst d. Tumors (hemangioma) e. Keloid f. Polyp g. Cutaneous umbilicus h. Umbilical hernia i. Paraumbilical hernia j. Epigastric hernia 5. Embryonal anomalies a. Umbilical vessels i. Omphaloarteritis ii. Omphalophlebitis iii. Thrombosis of umbilical vein varix b. Urachus: i. Urachal cyst ii. Infected urachal cyst iii. Urachal diverticulum iv. Urachal sinus v. Urachal fistula c. Omphalomesenteric duct i. Vitelline cyst ii. Persistent vitelline vessel iii. Meckel diverticulum iv. Omphalomesenteric fistula v. Omphalomesenteric fibrotic cord 6. Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-54

### Malignant Rhabdoids and Related Pediatric Tumors: A Multimodality Imaging Review and Pathologic Correlation

#### Participants

Apeksha Chaturvedi, MD, Rochester, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Malignant rhabdoid tumors of childhood include malignant rhabdoid tumor of kidney (MRTK), extrarenal malignant rhabdoid (eMRT) and atypical rhabdoid-teratoid tumors (AT/RT); tumors are highly aggressive, carry a dismal prognosis and may develop in utero 2. "Rhabdoid" morphology on histology- large polygonal cells with eosinophilic cytoplasm, vesicular nuclei and central prominent nucleolus 3. Underlying SMARCB1 mutations, a gene encoding a core subunit of the SWI/SNF chromatin-remodeling complex 4. Imaging appearances overlap with those of other entities, with certain imaging features aiding distinction; eg. cerebellopontine angle involvement and intratumoral hemorrhage favor AT/RT over medulloblastoma 5. Rhabdoid tumor predisposition syndrome (RTPS) is characterized by proband with rhabdoid tumor and/or family history of rhabdoid tumors and/or multiple SMARCB1- and/or SMARCB1-deficient tumors (synchronous or metachronous) and a heterozygous germline variant in SMARCB1 or SMARCB1; imaging surveillance guidelines have been proposed

#### TABLE OF CONTENTS/OUTLINE

1. Spectrum of malignant rhabdoid and related SMARCB1-deficient neoplasms of childhood 2. Updated WHO classification (2021) for malignant rhabdoids and related pediatric tumors 3. Underlying SMARCB1 deficiency and mechanisms by which it drives rhabdoid tumor growth 4. Multimodality imaging manifestations of malignant rhabdoid tumors, with emphasis on PET-CT and PET-MR 5. Role of ultrasound and whole-body MRI in surveillance in patients with RTPS 6. Pathologic correlation

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## Abstract Archives of the RSNA, 2023

PDEE-55

### A Trainee's Guide to Neonatal Abdominal Radiographs

#### TEACHING POINTS

1. Abdominal radiographs are an important tool to diagnose and screen acute intra-abdominal pathologies in the neonatal population. 2. The widespread availability and portable nature of radiographs make it ideal for the bedside evaluation of unstable neonates. 3. Knowledge of pathologies and their appearance on abdominal radiographs are crucial for timely and accurate diagnoses of life-threatening conditions and to guide further imaging and management.

#### TABLE OF CONTENTS/OUTLINE

1. Technique and views to obtain neonatal abdominal radiographs: Assessment of quality, tips for mobile exams, and use of shielding (ie. gonadal shielding and update on recommendations). 2. Review of lines and tubes on abdominal radiographs in neonates (ie. Umbilical artery and vein catheters, PICC, NG tube and port location). 3. Review of normal findings (ie. Expected gas pattern based on hours of life). 4. Do-not-miss findings: Pneumoperitoneum, pneumatosis, portovenous gas, bowel obstruction, pneumomediastinum/pneumothorax in the lung bases. 5. Review of acute pathologies and findings on abdominal radiographs (abnormal patterns): Necrotizing enterocolitis, congenital causes of bowel obstructions (upper/lower) (ie. Malrotation/volvulus, duodenal/jejunal atresia, Hirschsprung's disease, imperforate anus), gasless abdomen

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## Abstract Archives of the RSNA, 2023

PDEE-56

### From Head to Tail: Exploring Applications of Pediatric Neurological Ultrasound

#### TEACHING POINTS

1. Ultrasound for neurological pathologies is a useful adjunct to conventional imaging (CT/MRI) as a screening and diagnostic tool in pediatric patients due to its universal availability and low cost. 2. Lack of ionizing radiation and IV contrast, and incomplete pediatric bone ossification and unfused fontanelle make ultrasound an excellent modality for evaluation of neurological pathologies in young patients. 3. Optimal ultrasound technique and understanding of the relevant pathophysiology of pediatric neurological conditions that can be assessed with ultrasound can significantly improve timely access to screening, diagnosis and patient care.

#### TABLE OF CONTENTS/OUTLINE

1. Brain ultrasound: Indication (ie. Premature screen, cooling therapy), Technique, Normal structures, variants and measurements (ie. ventricular index), Vascular assessment, Pathologies (ie. germinal matrix bleed, periventricular leukomalacia). 2. Transcranial doppler ultrasound: Indications (ie. Sickle cell disease), Technique, Vessel anatomy, Normal measurements, Abnormal findings and clinical significance. 3. Cranial sutures ultrasound: Indications (ie. Abnormal skull shape), Technique, Cranial suture anatomy, Normal findings (ie. fontanelles, suture closure), Craniosynostosis and clinical significance. 4. Spine ultrasound: Indication (ie. sacral dimple, suspected spinal dysraphism), Technique, Normal findings and anatomy, Pathologies (ie. low conus, thickened filum, myelomeningocele, intraspinal collections, masses).

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## Abstract Archives of the RSNA, 2023

PDEE-57

### US Evaluation with CT/MRI Correlation of Neonatal and Infantile Brain Tumors and Other Intracranial Masses

#### Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

While some neonatal brain tumors are suspected on antenatal US imaging, most are diagnosed postnatally. Head US may be the first imaging modality for work-up of an intracranial mass which can present with non-specific clinical features. Most cases will require further imaging work-up, usually with MRI. Recognition of the US features of the most common neonatal and infantile intracranial masses and their complications can aid in appropriate and timely subspecialty referral. Objectives: 1. Discuss the US features of the most common neonatal and infantile intracranial masses. 2. Describe the correlation between antenatal US and fetal MRI and postnatal US and CT/MRI in the imaging work-up of these masses. 3. Explain the use of US to identify any associated complications which require urgent neurosurgical assessment.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Pseudomass 2a. Intraventricular hemorrhage 3. Non-neoplastic masses 3a. Arachnoid cyst 3b. Choroid fissure cyst 3c. Hypothalamic hamartoma 4. Supratentorial neoplasms 4a. Teratoma 4b. Low-grade glioma 4c. High-grade glioma 4d. Embryonal tumor with multilayered rosettes 4e. Choroid plexus tumors 4f. Osteochondrolipoma 5. Posterior fossa neoplasms 5a. Atypical teratoid/rhabdoid tumor 5b. High-grade glioma 6. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-58

### US Evaluation with Fetal MRI and CT/MRI Correlation of Pediatric Congenital and Inherited Brain Anomalies

#### Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. While many congenital and inherited brain anomalies are suspected from antenatal US and fetal MRI, postnatal head US may be the first imaging modality in the work-up of these heterogeneous anomalies 2. Most cases will require further imaging work-up with CT and/or MRI 3. Recognition of the US features of the most common of these lesions is important in order to direct appropriate additional imaging and timely subspecialty referral Objectives 1. Discuss the US features of the most common pediatric congenital and inherited brain anomalies 2. Describe the correlation between antenatal US and fetal MRI and postnatal US and CT/MRI 3. Explain the use of US to narrow the differential diagnosis and direct appropriate additional imaging work-up and management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Midline anomalies a. Agenesis of corpus callosum (ACC) b. Dysgenesis of corpus callosum variants i. Asymmetric ventriculomegaly, interhemispheric cyst and dysgenesis of corpus callosum (AVID) ii. Dysgenesis of corpus callosum with pericallosal lipoma c. Septo-optic dysplasia 3. Malformations of cortical development a. Periventricular nodular heterotopia b. Lissencephaly c. Hemimegalencephaly d. Tuberous sclerosis 4. Metabolic a. Ornithine transcarbamylase (OTC) deficiency 5. Brainstem and posterior fossa anomalies a. Diencephalic mesencephalic junction dysplasia b. Dandy-Walker malformation c. Joubert syndrome and related disorders (JSRD) d. Chiari 2 malformation secondary to myelomeningocele e. Arachnoid cyst f. Mega cisterna magna 6. Vascular anomalies a. COL4A1 mutation b. Vein of Galen malformation 7. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-59

### Differential Diagnosis of Hyperechoic Lesions on Neonatal Head US

#### Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. There are normal areas of increased echogenicity on neonatal head US which should not be mistaken for pathology, including choroid, midline vermis, hyperechoic caudate heads, periventricular white matter "halo", and white matter tracts including the corticospinal tracts 2. The differential diagnosis of hyperechoic lesions depends on their location 3. Many lesions can be confidently diagnosed and follow on US, while others require further imaging work-up to narrow the differential diagnosis and assist in ongoing management

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Normal areas of increased echogenicity a. Choroid b. Midline vermis c. Hyperechoic caudate heads d. Mineralizing vasculopathy e. Periventricular white matter "halo" f. Transmantle speckled increased echogenicity g. Corticospinal tracts 3. Caudothalamic groove a. Grade 1 germinal matrix hemorrhage b. Grades 2 and 3 germinal matrix hemorrhage 4. Periventricular/deep white matter a. Periventricular hemorrhagic infarction b. White matter injury c. Deep medullary venous thrombosis d. Infection e.g. *Citrobacter koseri* e. ECMO-related hemorrhage f. Water-shed infarct g. Punctate foci of white matter injury 5. Diffuse white matter a. Arterial infarction b. Hypoxic-ischemic encephalopathy 6. Deep gray matter a. Central cerebral venous sinus thrombosis 7. Peripheral parenchyma a. Peripheral cerebral venous sinus thrombosis b. Vein of Labbé hemorrhagic venous infarction 8. Cerebellum a. Cerebellar hemorrhage 9. Extraaxial a. Subdural hemorrhage b. Extradural hemorrhage c. Subpial hemorrhage 10. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-6

### Pictorial Review of Pediatric Neuroimmune Disease

#### Participants

Alejandra Aguado, MD, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Neuroimmune diseases are a group of inflammatory disorders with varying pathogenic mechanisms, including autoantibodies against self-targets, cell-mediated, infection-triggered, paraneoplastic, and genetically determined diseases. This group continues to expand with the discovery of new clinicopathologic entities. Radiologists should be familiar with these diseases and able to make a differential diagnosis, as early diagnosis and appropriate treatment with immunotherapy can modify disease course in some cases. Additionally, different diseases within this group can present with varied evolution and prognosis. The main teaching points of this exhibit include: 1. Review of the most frequent entities within each group 2. Description of key imaging features that aid in differential diagnosis among different entities.

#### TABLE OF CONTENTS/OUTLINE

This exhibit presents a range of disease pathologies encountered in clinical practice, including: 1. Demyelinating diseases: a) Acute disseminated encephalomyelitis (ADEM) b) Pediatric multiple sclerosis (MS) c) Neuromyelitis optica spectrum disorders (NMOSDs) d) Anti-MOG associated disease 2. AntiNMDAR encephalitis, including one triggered by herpes simplex virus encephalitis 3. Lupus erythematosus 4. Rasmussen encephalitis 5. Hemophagocytic lymphohistiocytosis.

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## Abstract Archives of the RSNA, 2023

PDEE-60

### Navigating the Fine Line of Pediatric Lines: A Primer on Pediatric Intravascular Catheters

#### Participants

Narendra Shet, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To review various reasons and approaches for vascular access in pediatric patients. 2. To discuss the role of the radiologist in assessment of pediatric vascular access. 3. To review optimal and suboptimal line placement in pediatric patients in a variety of clinical scenarios, including neonates and patients with congenital heart disease.

#### TABLE OF CONTENTS/OUTLINE

1. Overview of vascular access in pediatric patients - reasons for short and long term access and means of guidance (non-guided versus image-guided), and role of radiologist (for diagnostic radiologist, assessing adequacy of line position, and for interventional radiologist, line placement using means of image guidance). 2. Central lines in pediatric patients, including PICC, Non-PICC (IJ/Femoral), and long-term Access including hemodialysis catheters/tunneled central venous lines, as well as ports. 3. Neonatal specific catheters, including umbilical arterial and venous catheters. 4. Cardiac catheters, such as intra-cardiac catheters, ECMO cannulae, and ventricular assist devices. 5. Where relevant, photographs of support devices, either in vivo or ex vivo, will be included in figures to allow for comparison to radiographic appearance.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PDEE-61

### Imaging Evaluation of Pediatric Cystic Neck Masses

#### Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Pediatric neck masses are a common indication for imaging referral and US is often the first imaging modality in their work-up. 2. Following detection of a cystic neck mass on US, the radiologist must determine whether the lesion has a characteristic US appearance and requires no further imaging work-up or whether further imaging work-up is required. 3. Appropriate use of CT/MRI can aid in narrowing the differential diagnosis and assist in surgical planning

Objectives: 1. List the sonographic features of pediatric cystic neck masses which have a characteristic sonographic appearance and require no further imaging work-up 2. Recognize those lesions which require additional imaging work-up 3. Discuss the appropriate use of CT/MRI to aid in narrowing the differential diagnosis

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Congenital anomalies a. First branchial cleft anomalies b. Second branchial cleft anomalies c. Pyriform fossa sinus tract (PFST) lesions d. Dermoid cyst e. Lymphatic malformation f. Thyroglossal duct cyst 3. Inflammatory a. Ranula 4. Infectious a. Suppurative pyogenic lymphadenitis b. Non-tuberculous mycobacterial cervical lymphadenitis (MAIC) c. Retropharyngeal abscess 5. Neoplastic a. Teratoma 6. Conclusion

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PDEE-62

### Twist and Turns: Comprehensive Radiological Review of Intestinal Malrotation and Midgut Volvulus

#### TEACHING POINTS

1. Describe the imaging findings of intestinal malrotation and midgut volvulus in upper gastrointestinal (UGI) studies. 2. Discuss the utility of ultrasound (US) in intestinal malrotation and midgut volvulus. 3. Highlight the imaging pearls and pitfalls in cases of intestinal malrotation and midgut volvulus. 4. Illustrate different clinical presentations of malrotation and midgut volvulus through a variety of clinical cases.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction: Describe the normal orientation and fetal development of the intestine. Highlight the importance of early detection and management of intestinal malrotation. 2. Pathophysiology of intestinal malrotation and midgut volvulus: Discuss the mechanism of midgut volvulus in intestinal malrotation along with clinical presentation and complications. 3. Upper GI studies: Review the standard views in UGI studies with emphasis on imaging landmarks to insure proper position and quality. Discuss the imaging pearls and pitfalls in diagnosing intestinal malrotation/midgut volvulus in UGI studies. 4. Other radiological modalities: Role of other imaging modalities in intestinal malrotation/midgut volvulus as a problem solver in challenging cases including US, computed tomography (CT) and lower GI studies. 5. Atypical cases of midgut volvulus: Examples of atypical cases of midgut volvulus including recurrent and chronic presentations. Use different cases as a teaching key points in diagnosis and management of midgut volvulus. 6. Conclusion: Summary of the radiological approach in intestinal malrotation and midgut volvulus.

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## Abstract Archives of the RSNA, 2023

PDEE-63

### Intestinal Ultrasound in Pediatric Inflammatory Bowel Disease: What Radiology Residents Should Know

#### Participants

Paola Aguirre Camino, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) Become familiar with the correct performance of pediatric bowel ultrasound scan. 2) Propose a standardized ultrasound report. 3) Recognize the ultrasound appearance of the normal and pathological bowel pattern. 4) Learn the typical sonographic findings, evaluate the activity and assess the presence of possible complications in Inflammatory Bowel Disease.

#### TABLE OF CONTENTS/OUTLINE

Crohn's disease and ulcerative colitis are chronic inflammatory bowel diseases frequently diagnosed in childhood, being imaging methods fundamental in the diagnostic approach, severity assessment, treatment monitoring and in the suspicion of complications. Due to the need to frequently evaluate these children, intestinal ultrasound becomes especially important compared to colonoscopy and MRI, as it is a non-invasive technique, easy for the child to accept, accessible and repeatable; however, as it is an operator-dependent examination, it requires certain experience and should be performed systematically using the appropriate technique. Intestinal ultrasound is a useful modality for intestinal bowel disease imaging and a valuable screening tool in the preliminary diagnostic workup of pediatric patients with suspected Inflammatory Bowel Disease. It assesses the presence of thickening of the intestinal wall as an indicator of inflammation, as well as the location and extent of the disease. It also allows evaluating the activity by quantifying the hyperemia of the intestinal wall using color Doppler, being a useful tool in the follow-up and control of the response to the treatment.

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## Abstract Archives of the RSNA, 2023

PDEE-64

### Slipped Capital Femoral Epiphysis: Emphasis on Early Recognition and Potential Pitfalls

#### TEACHING POINTS

\* Slipped capital femoral epiphysis (SCFE) is the most common hip disorder in adolescence, however the diagnosis is often delayed or missed due to vague clinical presentation, subtle radiographic findings, and technical variability.\* Early detection of SCFE hinges on close scrutiny of physeal morphology with particular attention to the epiphyseal tubercle, an important stabilizer of the physis in children.\* An AP and frog-lateral view of the pelvis including both hips is the mainstay of radiographic assessment of SCFE, and failure to diagnose SCFE is often a product of improper technique.\* Cross-sectional imaging is not routinely performed in SCFE patients, but can be helpful to identify radiographically occult early slips, assess femoral head perfusion, and better understand anatomy for surgical planning purposes.

#### TABLE OF CONTENTS/OUTLINE

\* Learning objectives\* Background including rationale for focus on SCFE, definition and epidemiology, pathophysiology and histology, and clinical findings and classification\* Early physeal changes in SCFE, introduction of the epiphyseal tubercle and rotational microinstability, and illustration of the peritubercle lucency on radiographs\* Later radiographic findings and severity grading on frontal and frog-lateral radiographs\* Technical pitfalls on radiography with emphasis on the importance of imaging both hips on all views\* Role of cross-sectional imaging including MRI for early slips, prognostic relevance of femoral head perfusion, and use of CT or Zero-TE MRI to assess callus preoperatively

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## Abstract Archives of the RSNA, 2023

PDEE-65

### Imaging Approach to Pediatric Neurometabolic Imaging

#### Participants

Samantha Gerrie, MBChB, FRANZCR, Vancouver, BC (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Describe the most commonly used classification systems for pediatric neurometabolic diseases 2. Discuss the clinical features and imaging patterns which aid in narrowing the differential diagnosis in the work-up of pediatric neurometabolic diseases 3. Illustrate the MR features of the most common pediatric neurometabolic diseases, including the MR spectra suggestive of specific disorders

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Classification systems a. Organelle dysfunction i. Mitochondrial disorders ii. Lysosomal storage disorders iii. Peroxisomal biosynthesis disorders b. Laboratory markers i. Lactate ii. Ammonia iii. Inborn errors of metabolism c. Presentation i. Neonatal metabolic encephalopathy ii. Head size d. Imaging pattern i. Deep gray matter involvement - striatum, globus pallidus, hyperdense thalami ii. White matter involvement - subcortical U-fibres, central white matter, anterior vs posterior iii. Hypomyelination disorders iv. MR spectroscopy suggestive of specific diseases v. Enhancement pattern 3. 16 "must know" imaging patterns suggestive of a specific neurometabolic disease: a. Maple syrup urine disease b. Canavan disease c. Alexander disease d. X-linked adrenoleucodystrophy e. Metachromatic leucodystrophy f. Pelizaeus-Merzbacher disease g. Mitochondrial encephalopathy with lactic acidosis and stroke-like episodes h. Non-ketotic hyperglycinemia i. Zellweger syndrome j. Mucopolysaccharidosis k. Leigh syndrome l. Panthothenate kinase-associated neurodegeneration m. Creatine kinase deficiency n. Megaloencephalic leucodystrophy with subcortical cysts o. Vigabatrin-related changes p. Methotrexate-related changes 4. Future directions 5. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-66

### Newborn Skeletal Radiographs: A Practical Guide

#### Participants

Marcelo Takahashi, MD, PhD, (*Presenter*) Speaker, Vertex Pharmaceuticals Incorporated

#### TEACHING POINTS

Neonatal skeletal abnormalities are rare occurrences in pediatric practice with a wide variety of causes and often overlapping radiographic features. The main teaching points of this exhibit are: 1) Illustrate the expected normal plain film appearance of the neonatal bone, including and what the most common pitfalls, regarding both normal development as well as technical imaging aspects. 2) Explain specific diseases radiographic findings with key clinical and epidemiological considerations 3) Illustrate the different imaging patterns with differential diagnosis checklist and explanation for each one

#### TABLE OF CONTENTS/OUTLINE

&5; &5; Normal newborn particularities and pitfalls&5; Normal Anatomy&5; Physiologic Neonatal Periostitis&5; &5; Trauma:&5; Delivery related fractures&5; Non accidental trauma&5; &5; Diffuse bone disease:&5; Rickets&5; Metabolic Bone Disease of Prematurity&5; Caffey Disease&5; Osteopetrosis&5; &5; Congenital abnormalities and malformations&5; Amniotic band syndrome&5; Hemimelia&5; Proximal Femoral Focal Deficiencies&5; Spine malformations&5; Chondrodysplasia punctata&5; Developmental Dysplasia of the Hip&5; &5; Infections:&5; Congenital Syphilis&5; Neonatal osteomyelitis

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## Abstract Archives of the RSNA, 2023

PDEE-67

### Entering a New Dimension: Novel Use of Transabdominal 3D Ultrasound in Pediatric Gynecology

#### TEACHING POINTS

3D transvaginal pelvic ultrasound is a well-established imaging technique in the adult population for gynecologic applications. However, transvaginal ultrasound is not commonly utilized in the pediatric population. There are only sparse reports in the literature on the use of 3D transabdominal pelvic ultrasound in the pediatric population for gynecologic applications. In this educational exhibit, we will share our experience with 3D transabdominal pelvic ultrasound in the pediatric population, particularly for the evaluation of Mullerian duct anomalies and IUD positioning. We will begin with a review of scan technique and post-processing. Instructions for creation of a simple homemade ultrasound phantom for practicing these techniques will also be reviewed. We will then share several illustrative cases where 3D ultrasound provided useful information beyond standard 2D imaging in the assessment of Mullerian duct anomalies and IUD positioning. The challenges and limitations to this technique will also be discussed.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review of scan technique and post-processing 3. Homemade ultrasound phantom: instructions and utility 4. Example cases of Mullerian duct anomalies 5. Example cases of IUD positioning

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## Abstract Archives of the RSNA, 2023

PDEE-68

### Ultra Low Dose Fetal CT: A Simple Way to Understand the Various Exposure Doses to the Fetus

#### TEACHING POINTS

(1) When skeletal dysplasia is suspected by fetal ultrasound, it is often difficult to make an accurate prenatal diagnosis using ultrasound alone. (2) In such case, fetal skeletal CT is recommended because it has diagnostic power comparable to postnatal bone survey, but the only drawback is fetal radiation exposure. For this reason, we have devised Ultra low dose fetal CT (ULDFCT) from the viewpoint of ALARA. (3) On the other hand, estimating fetal radiation dose involves complex calculations, and methods that are easily understood by pediatric radiologists and CT technicians are needed. (4) This exhibition introduces a method to insuflate the exposure dose of the fetus and maternal body by simple calculation using the CT dose index (CTDI), which is available immediately before and after scanning.

#### TABLE OF CONTENTS/OUTLINE

A. Data acquisition (n=36); Patients with ULDFCT throughout of 2014 to 2021. CTDIvol : mean 0.48mGy, DLP : mean 18.62mGy.cm. These are the lowest exposure doses in fetal CT scans in the literature search. B. Estimation of various exposure doses of the fetus  
Fetal dose: mean; 0.36mGy. Fetal dose = CTDIvol x 0.8 mGy  
Organ dose of uterus; mean 0.58mGy. Organ dose of uterus = CTDIvol x 1.2; SSDE; mean: 0.57mGy, SSDE= = CTDIvol x 1.18  
Effective dose (ED) of maternal body; 0.39mSv. ED = CTDIvol x 0.81

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## Abstract Archives of the RSNA, 2023

PDEE-69

### Neonatal Chest X-ray: How to Spot Abnormal Gas Patterns and Potential Pitfalls

#### Participants

Marta Sanmartin Lopez, MD, Santiago De Compostela, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review the main projections and technical guidelines of neonatal chest radiography. 2. Review the systematic analysis of chest X-rays performed in neonates. 3. Emphasize some normal findings that differ from X-rays performed in older children and adults. 4. Analyze the typical radiological signs of pneumothorax, pneumomediastinum, pneumopericardium and pneumoperitoneum, and provide some practical examples that may help to differentiate pathology from potential pitfalls and mimics.

#### TABLE OF CONTENTS/OUTLINE

1. Analysis of neonatal chest X-ray a) Radiographic technique b) Systematic interpretation of neonatal chest X-ray. 2. Abnormal gas patterns a) Pneumothorax b) Pneumomediastinum c) Pneumopericardium d) Pneumoperitoneum

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## Abstract Archives of the RSNA, 2023

PDEE-7

### Going with the Flow: Implementing a 4D Flow MRI Program at a Children's Hospital

#### TEACHING POINTS

Four-dimensional flow MRI (4D flow) is a three dimensional spatial and velocity encoded phase contrast sequence that has emerged as a versatile imaging technique for qualitative as well as quantitative characterization of cardiovascular flow. The benefits of 4D flow include an easily prescribed volumetric acquisition with the ability to retrospectively quantify flow in any plane, in the acquired field of view. In the past, long scan times and complex post-processing workflows hindered 4D flow adoption into routine clinical practice for cardiovascular velocity and flow assessment, but improvements in image acquisition and processing have enabled standard clinical workflows. Additionally, there are unique in-vivo flow investigative parameters that provide newer insights into understanding cardiovascular physiology and pathophysiology. Our purpose is to: 1. Explain the utility of 4D flow. 2. Describe 4D flow acquisition parameters designed for imaging children with various congenital or acquired cardiovascular diseases. 3. Demonstrate a streamlined clinical 4D flow post-processing workflow. 4. Discuss research 4D flow applications.

#### TABLE OF CONTENTS/OUTLINE

1. General overview of 4D flow and key applications in the pediatric setting 2. Advantages of 4D flow over 2D phase contrast imaging 3. Image acquisition and post-processing using clinical cases (i) 9-years-old male with Fontan (ii) 19-years-old female with Bicuspid Aortic Valve 4. Research utility of 4D flow and future directions

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## Abstract Archives of the RSNA, 2023

PDEE-70

### Acute Upper Airway Obstruction in the Pediatric Population: What's Behind the Stridor

#### Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Review the anatomic features of the pediatric airway. - Establish a systematic approach to radiographic evaluation. - Identify the key radiographic findings of common causes of acute upper airway obstruction through cases studied in our center.

#### TABLE OF CONTENTS/OUTLINE

Acute upper airway obstruction is more common in the pediatric population due to its various anatomical and physiological peculiarities. Several causes of airway obstruction have been described, such as foreign body obstruction, infection, neoplasm, congenital or vascular entities. Since the clinical presentation is often nonspecific and the evaluation of pediatric patients in the emergency setting is complicated, imaging techniques play a critical role in achieving an accurate diagnosis. The aim of this review is to evaluate the specific radiologic features that can be found in the different imaging modalities, with special emphasis on plain radiography, which is often sufficient to reach a correct diagnosis. As acute airway obstruction can be a life-threatening condition, it is essential that the radiologist recognizes the key imaging findings in order to ensure prompt management.

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## Abstract Archives of the RSNA, 2023

PDEE-71

### What Every Radiologist Should Know About Cranial Ultrasound: A Systematic Approach and Common Pathologies

#### Participants

Nahia Lizarraga Oroz, MD, Donostia, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Define the technical procedure of standard cranial ultrasound (CUS) and review the normal anatomic structures of the brain. - Identify the spectrum of pathologies seen in clinical practice. - Highlight some tips and tricks for diagnosis.

#### TABLE OF CONTENTS/OUTLINE

CUS is an extremely valuable tool for evaluating the brain in the first year of life and has become an essential part of routine pediatric radiology practice. It is an accessible, portable, inexpensive, and safe technique that can be used as often as needed. Because of its great advantages, it is imperative for the radiologist to know how to perform CUS and correctly interpret the findings. This review attempts to establish the clinical indications, define a systematic technique to adequately visualize and document all relevant intracranial structures, and highlight the most common pathologies seen in neonates, including - Hypoxic-ischemic encephalopathy in preterm infants (germinal matrix hemorrhage, cerebellar hemorrhage, and periventricular leukomalacia) - Hypoxic-ischemic encephalopathy in term patients - Cerebrovascular disease - Trauma-associated hematomas - Macrocephaly However, the usefulness of CUS is still highly dependent on the skill, knowledge and experience of the observer.

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## Abstract Archives of the RSNA, 2023

PDEE-73

### Congenital Anomalies of the Posterior Fossa - An Imaging Travelogue

#### Participants

Shivaprakash Hiremath, DMRD, FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit aims to: 1. Review the embryology and cross-sectional imaging anatomy of the posterior fossa. 2. Describe typical congenital malformations based on predominant cerebellar involvement, cerebellar and brainstem involvement, and predominant brainstem involvement.

#### TABLE OF CONTENTS/OUTLINE

- Describe the embryology and anatomical assessment of the posterior fossa along with diffusion tensor imaging.
- Depict the imaging findings in malformations predominantly affecting the cerebellum including cerebellar hypoplasia, hyperplasia and dysplasia (Chudley-mccullough syndrome, and Poretti-Bolthausen syndrome).
- Highlight the malformations affecting the cerebellum and brainstem such as alpha dystroglycanopathies, tubulinopathy, molar tooth malformations, and pontocerebellar hypoplasia.
- Illustrate the malformations predominantly affecting the brainstem such as pontine tegmental cap dysplasia, horizontal gaze palsy with progressive scoliosis, and diencephalic-mesencephalic junction dysplasia along with malformations with no known genetic cause such as Rhombencephalosynapsis, PHACE syndrome, and oculocerebrocutaneous syndrome.

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## Abstract Archives of the RSNA, 2023

PDEE-74

### Imaging in Pediatric Neuroinflammatory Disorders and Mimics

#### Participants

Shivaprakash Hiremath, DMRD, FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This educational exhibit aims to: 1. Review the basic concepts of neuroinflammatory disorders in childhood 2. Describe the imaging manifestations of Myelin Oligodendrocyte Glycoprotein antibody-associated disease (MOGAD) in different age groups 3. Illustrate both common and uncommon findings in Neuromyelitis Optica Spectrum Disorder (NMOSD) and Multiple Sclerosis in the pediatric age range 4. Illustrate mimics of these entities based on imaging phenotypes encompassing pathologies that target the optic nerves, deep grey nuclei, white matter, and spinal cord.

#### TABLE OF CONTENTS/OUTLINE

- Review the pathophysiological basis of pediatric neuroinflammatory diseases.
- Illustrate the common and uncommon imaging manifestations in myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) including acute disseminated encephalomyelitis (ADEM)-like phenotype, encephalitis-like phenotype, and leukodystrophy like phenotype.
- Depict common and uncommon findings in AQP4-associated neuromyelitis optica spectrum disorder (NMOSD), and Multiple Sclerosis (MS) including tumefactive demyelinating lesions.
- Provide localization related illustrations of mimics of demyelinating diseases including infectious, inflammatory, and metabolic disorders along with tumors that mimic demyelinating diseases.

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## Abstract Archives of the RSNA, 2023

PDEE-75

### Mastering Neck Ultrasound in Pediatric Patients

#### Participants

Mikel Elgezabal, MD, Barrika, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Neck anatomy from the ultrasound perspective: key structures and sonographic landmarks. 2. Ultrasound protocol focusing on children's peculiarities. 3. Clinical and US findings of common and not-so-common pediatric neck entities. 4. Radiologic approach to a neck lump in a child.

#### TABLE OF CONTENTS/OUTLINE

1. US technique for the pediatric neck 1.1. Technical recommendations 1.2. Anatomy: spaces of the head and neck and landmarks from the US perspective. 1.3. Basic US protocol and further tricks to get to more unusual locations (palatine tonsils, vocal cords). 2. Pathology of the pediatric neck 2.1. Lymph nodes: Anatomy, node levels. Pathology: reactive, suppurative, malignant. Tips: malignant vs. benign. 2.2. Thyroid: dysgenesias, nodes, thyroiditis. 2.3. Vascular anomalies: tumors, malformations and subtypes. 2.4. Salivary glands: parotitis, submaxillitis, ranula of the sublingual gland. 2.5. Cysts: thyroglossal duct, branchial cleft, dermoid, epidermoid. 2.6. Fibromatosis colli. 2.7. Cervical thymus. 2.8. Soft tissue tumours: sarcoma, schwannoma, neuroblastoma. 2.9. Pilomatricoma. 3. Summary: approach to a neck lump in a child. 4. Take home points

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## Abstract Archives of the RSNA, 2023

PDEE-76

### Keeping it Straight: A Guide to Pediatric Renal Neoplasms

#### Participants

Hassan Aboughalia, MD, Washington, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Ultrasound is the first-line imaging modality for suspected abdominal masses, followed by contrast-enhanced CT or MRI renal mass protocol. 2. When a renal tumor is suspected, the patient's age, imaging characteristics, distribution of metastases, and co-morbid conditions are the most important factors to consider. 3. Synchronous ipsilateral and contralateral renal lesions, metastatic disease, lymphadenopathy, invasion of the renal vein/IVC, and signs of tumor rupture are essential features to be evaluated. 4. Suprarenal pathologies can mimic a renal tumor such as neuroblastoma.

#### TABLE OF CONTENTS/OUTLINE

1. Imaging approach to a patient with a suspected renal tumor, emphasizing optimal imaging techniques 2. Solid renal neoplasms, including mesoblastic nephroma, nephrogenic rests, Wilms tumor, rhabdoid tumor, clear cell sarcoma, angiomyolipoma, renal cell carcinoma, lymphoma, and metastases. 3. Cystic renal neoplasms, including cystic nephroma, cystic partially differentiated neuroblastoma, and cystic Wilms tumor. 4. Mimics of renal neoplasms, including hypertrophied column of Bertin, focal pyelonephritis and abscess, infarct, granulomatous diseases, suprarenal pathologies, and cystic renal diseases. 5. Diagram slide of pediatric renal neoplasms underscoring key factors differentiating these entities.

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## Abstract Archives of the RSNA, 2023

PDEE-77

### Craniovertebral Junction Instability, Fixation and Stenosis in Children

#### Participants

Stephen B. Little, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiographs of the cervical spine are often inadequate or falsely reassuring in children with torticollis. A high-risk mechanism of injury or high clinical suspicion should prompt further evaluation with CT or MRI. 2. Early recognition and treatment of atlantoaxial rotatory fixation (AARF) is essential to limit morbidity. 3. AARF may be neither purely atlantoaxial, merely rotatory, nor completely fixed. 4. Significant lateral inclination of C1, facet deformity, new bone and multi-ligament insufficiency are associated with irreducible AARF. 5. An increased atlantodental interval (ADI) is a poor indicator of symptomatic atlantoaxial instability in children with trisomy 21. Furthermore, a normal ADI does not exclude craniovertebral junction instability. 6. Symptomatic CVJ instability in children with trisomy 21 is more frequent in those with associated osseous anomalies, particularly os odontoideum. 7. Osseous anomalies in children with CVJ instability include assimilation of the atlas, split atlas, odontoid hypoplasia or aplasia, os odontoideum, and Klippel-Feil syndrome. 8. A variety of skeletal dysplasias are associated with CVJ instability or stenosis. 9. Narrow C2 pedicles increase the risk of vertebral artery groove violation with pedicle screw placement, possibly producing devastating neurovascular consequences.

#### TABLE OF CONTENTS/OUTLINE

1. Osseous and ligamentous anatomy 2. Key morphometry 3. Rotatory dynamics 4. Atlantoaxial rotatory fixation 5. Trisomy 21 and CVJ instability 6. Osseous anomalies and CVJ instability 7. Skeletal dysplasias 8. Surgical considerations

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## Abstract Archives of the RSNA, 2023

PDEE-78

### Pediatric Dural Arteriovenous Fistulas: An Unusual Connection

#### TEACHING POINTS

Dural arteriovenous fistulas (DAVFs) are vascular abnormalities in which a meningeal artery drains directly into a meningeal vein or dural venous sinus. DAVFs are rare in children, accounting for around 10% of all intracranial shunts in the pediatric population. The transverse-sigmoid, superior sagittal sinus, and torcular herophili are commonly involved fistula sites in pediatric DAVFs. Pediatric DAVFs can be classified into three types: dural sinus malformations, infantile/juvenile-type dural shunts, or adult-type dural shunts. Younger children with DAVFs tend to present with cardiopulmonary symptoms (congestive heart failure and/or respiratory distress), while older children present with neurological symptoms (headaches, intracranial hemorrhage, focal deficits). The primary treatment for DAVFs is endovascular embolization, commonly with microcoils or liquid adhesives. Challenges in the endovascular treatment of DAVFs include high-flow fistulas, tortuous intracranial feeding arteries, and small femoral artery access sites.

#### TABLE OF CONTENTS/OUTLINE

- Review neurovascular anatomy relevant to dural arteriovenous fistulas (DAVFs).
- Recognize DAVFs in the pediatric population using a case-based approach.
- Review the multimodal imaging appearance of pediatric DAVFs.
- Understand the treatment of pediatric DAVFs and the application of neurovascular interventional techniques.
- Discuss the complications and challenges in the treatment of pediatric DAVFs.

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## Abstract Archives of the RSNA, 2023

PDEE-79

### Pediatric Coronary Artery Anomalies

#### Participants

Maria Navallas, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recognize the anatomic variations of coronary origin and course. 2. Understand the high risk imaging features in anomalous aortic origin of the coronary arteries. 3. Discuss acquired and post surgical anomalies of the coronary arteries.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction  
2. Cardiac CT technique  
2.1. Type of scanner  
2.2. Patient preparation  
2.3. Electrocardiogram gating  
2.4. Contrast administration  
3. Classification of congenital coronary artery anomalies  
3.1. Anomalies of origin/course- High take-off- Single coronary artery- ALCAPA/ASCAPA- Origin of coronary artery or branch from opposite or noncoronary sinus and anomalous course: Retroaortic, interarterial, prepulmonic, septal (subpulmonic)  
3.2. Anomalies of intrinsic coronary anatomy: Myocardial bridging  
3.3. Anomalies of coronary termination: Coronary artery fistula  
4. High risk imaging features and risk of sudden death  
5. Acquired coronary artery abnormalities:  
5.1. Kawasaki disease  
5.2. Multisystem inflammatory syndrome in children associated with COVID-19  
5.3. Postsurgical anomalies  
6. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-8

### Picture Perfect: A Pictorial Review of Nuclear Medicine in Gastrointestinal and Hepatobiliary Disorders

#### TEACHING POINTS

1. Esophageal motility study is a useful tool for evaluating esophageal function, with the test providing valuable information about swallowing mechanics and esophageal peristalsis. 2. Gastric emptying study is commonly used to evaluate delayed gastric emptying, with the test providing valuable information about gastric function and potential causes of vomiting and other symptoms. 3. Hepatobiliary scintigraphy can be used to evaluate neonatal jaundice and to diagnose or rule out biliary atresia, a rare but serious liver condition that can lead to liver failure if left untreated. 4. Colonic scintigraphy is a useful tool for evaluating colon transit time and identifying potential causes of constipation or diarrhea. 5. Heterotaxy syndrome is a rare and complex condition that affects the development of organs in the body. Nuclear medicine imaging can be used to evaluate the function of the liver and other organs in children with this condition. 6. Nuclear medicine imaging can be used to diagnose Meckel's diverticulum and evaluate its function in the gastrointestinal tract.

#### TABLE OF CONTENTS/OUTLINE

Introduction 1. Image acquisition 2. Radiation dose Esophageal Motility Study 1. Motility disorders 2. Repaired Esophageal Atresia 3. Trauma 4. Achalasia 5. Technique Gastric Emptying Study 1. Image acquisition and techniques 2. Early Satiety 3. Gastroesophageal reflux Hepatobiliary Scintigraphy 1. Neonatal Jaundice 2. Biliary Atresia Colonic Scintigraphy 1. Colon Transit Technique 2. Chronic Constipation 3. Hirschsprung disease 4. Tethered cord 5. Chronic diarrhea 6. Angiotensin converting enzyme patients Others 1. Heterotaxy Syndrome 2. Meckel's Diverticulum Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-80

### Transcranial Doppler Ultrasound in Children with SickleCell Disease: All What You Have to Know

#### Participants

Joseph Abi Ghanem, Beirut, Lebanon (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1- Sickle cell disease (SCD) has an incidence of 4/10000 births. It is characterized by a chronic proinflammatory state, prothrombotic state and increased aggregation of red blood cells (RBC). Children with the SCD HbSS and HbSBthal0 phenotypes have a 200-fold increased risk of stroke compared to healthy children. 2- Radiologists play a major role in treatment decision plan as Transcranial Doppler ultrasound (TCD) is the only radiologic test of choice to detect SCD children at higher risk for stroke. 3- The stroke prevention trial in sickle cell anemia (STOP) and The Silent Cerebral Infarct Transfusion (SIT) multicentric trial are pivotal studies demonstrating the benefit of chronic transfusion program based on screening with TCD velocities to prevent symptomatic and silent ischemia in SCD children between 2 and 16 years. 4-The tracings on the TCD reflect, the size of the artery, type of flow and flow velocities related to rheologic and hemodynamic factors.

#### TABLE OF CONTENTS/OUTLINE

1- Introduction of the STOP and SIT trials. 2- Indications and recommendations on when and how to perform TCD. 3- How to interpret Doppler tracing on TCD. 4- Case based presentation of threshold velocities for a conditional and an abnormal TCD. 5- Quantitative ultrasound for RBC aggregation estimation as potential new test to decrease the number needed to treat and avoid unnecessary transfusion.

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## Abstract Archives of the RSNA, 2023

PDEE-81

### Dermatologic Ultrasound in Children: Benign and Pseudo-Tumoral Lesions

#### Participants

Luis Tierradentro-Garcia, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 1. To overview the current applications of dermatologic ultrasound in children. - 2. To illustrate the utility of ultrasound to differentiate benign and pseudo-tumoral dermatologic lesions in children. - 3. To describe the role of conventional and advanced ultrasound as a complementary tool to CT and MRI in making diagnoses and assisting in surgical planning.

#### TABLE OF CONTENTS/OUTLINE

1. Background: Skin lesions in children are common, most lesions are benign. Clinical findings can be non-specific. 2. Technical aspects: - Image acquisition is non-invasive and harmless. - Frequency > 15 MHz. - Protocol: grayscale, Color Doppler, Pulsed-wave Doppler, microvascular flow imaging. - Normal sonographic appearance of the skin layers. 3. Pseudo-tumoral lesions 3.1 Cystic lesions - Epidermal inclusion cyst. - Trichilemmal cyst. - Dermoid cyst. - Cutaneous bronchogenic cyst. 3.3 Pilomatricoma 3.4 Dermatofibroma 3.5 Neurofibroma 3.6 Lipoma 4. Inflammatory lesions 4.1 Warts 4.2 Foreign body 4.3 Morphea 4.4 Insect bite 4.5 Kerion celsi 4.6 Juvenile xanthogranuloma 4.7 Congenital aplasia cutis 4.8 Annular granuloma 4.9 Keloid 5. Differential diagnosis 6. Take Home points

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## Abstract Archives of the RSNA, 2023

PDEE-82

### **Pediatric Magnetic Resonance Neurography: Technical Considerations, Indications, and Findings**

#### **TEACHING POINTS**

1) Review technical considerations and imaging challenges of pediatric patients referred for magnetic resonance (MR) neurography. 2) Discuss the most common indications and anatomic regions referred for MR Neurography. 3) Illustrate typical imaging findings, their clinical correlation, and management strategies.

#### **TABLE OF CONTENTS/OUTLINE**

1) Technical aspects of MR Neurography (3.0 T, conformable phased-array coils) and unique challenges of the pediatric population (e.g. SNR limitations due to small body habitus and size of peripheral nerves, sedation, motion artifact, flexion contracture (developmental or posttraumatic)). 2) Demographics and characteristics of a pediatric database at a tertiary orthopedic referral center 3) Imaging examples of both traumatic (e.g. median nerve entrapment following elbow fracture, drop foot post knee dislocation) and atraumatic (Charcot-Marie-Tooth, neurofibromatosis, limb hemihypoplasia) peripheral neuropathies and their clinical management 4) Strengths and weaknesses of MR Neurography for assessing pediatric patients, role of ultrasound, and discussion of future directions in this field

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## Abstract Archives of the RSNA, 2023

PDEE-83

### Acute Pediatric Elbow Trauma - Adding the Orthopedist's Perspective to Imaging Interpretation

#### TEACHING POINTS

1. Knowledge of the specific developmental sequence of pediatric elbow apophyses is key to accurate interpretation of pediatric elbow trauma. 2. Knowledge of pitfalls is important, e.g., normal developmental irregularity of the apophyses can be mistaken for trauma. 3. In younger children, assessment of apophyseal avulsion/displacement on radiographs may be difficult due to incomplete ossification; MR may be necessary for more complete evaluation. 4. Chondroepiphyseal separation/transphyseal fracture of the distal humerus is a rare manifestation of mechanical birth related trauma of the newborn and may be difficult to diagnose on radiographs. Ultrasound and MRI may aid in further assessment. 5. Optimal orthopedic management of pediatric patients with elbow trauma is hinged on accurate imaging interpretation. Radiology reports should include entity-specific information that will benefit patient management. For example, a radial neck fracture is a sentinel fracture, often accompanied by additional fractures. Post reduction of elbow dislocation, the developing medial epicondyle can be entrapped in joint. A nursemaid's elbow may not manifest any imaging abnormalities.

#### TABLE OF CONTENTS/OUTLINE

1. Embryology and normal developmental anatomy of the elbow. 2. Radiographic views used for elbow trauma and technique of acquisition. 3. Role of MRI and CT acquisition parameters. 4. Imaging manifestations of pediatric elbow trauma. 5. Entity-specific additional information to be included in radiology reports that aid in orthopedic management. 6. Complications and mimics of acute elbow trauma. 7. Imaging spectrum of chronic overuse injuries of the developing elbow.

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## Abstract Archives of the RSNA, 2023

PDEE-84

### Masqueraders of Clarity - Tumor Mimics in Pediatric Oncology

#### Participants

Manisha Jana, MD, FRCR, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pitfalls in oncologic imaging are inflammatory, infective and vascular disorders which mimic tumors. Post-treatment changes and complications must be differentiated from residual or recurrent disease. Problem-solving tools include a multimodality approach, functional imaging and serial follow-up.

#### TABLE OF CONTENTS/OUTLINE

Non-neoplastic entities that mimic tumors lead to diagnostic confusion and delay appropriate therapy. In a patient with focal neurologic deficit or seizures, the cause may be demyelination, sarcoidosis or infections such as fungal, parasitic, tuberculosis and neurocysticercosis. Bone tumors are commonly mistaken in the setting of osteomyelitis, bone cysts, fracture, scurvy and osteogenesis imperfecta. Clinical context and plain radiographs must be correlated with MRI. Intrapulmonary nodes or granuloma mimic lung metastases. Abscesses, focal steatosis, cysts and arterioportal shunting are tumor mimics in the liver. Infarcts, cysts and perfusion abnormalities mimic tumors in the spleen, while adrenal hemorrhage can be mistaken for an adrenal mass. A hypertrophied column of Bertin, sludge and stones in the renal collecting system can mimic a renal mass - CEUS can help in the distinction. In a known cancer patient, radiotherapy-induced organ injury, post-chemotherapy infections, bone marrow changes and thymic rebound hyperplasia are common. Diffusion-weighted imaging and dynamic contrast-enhanced MRI can help in problem-solving.

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## Abstract Archives of the RSNA, 2023

PDEE-85

### Don't Ovary-act: A Sonographic Approach to Benign Pediatric Ovarian Pathology

#### Participants

Fatemeh Hadian, MBChB, FRCR, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. A multi-follicular appearance is normal in neonates and teenagers and can be seen in prepubertal children. 2. Doppler flow may still be present in a twisted ovary and should not preclude making a diagnosis of torsion. 3. Benign ovarian lesions include ovarian cysts, para-ovarian cysts, mature cystic teratomas, cystadenomas and benign sex cord stromal tumors. 4. Diagnosing polycystic ovaries in adolescent females is challenging, but at-risk females can be identified for assessment at reproductive maturity. 5. Clinical history is crucial in differentiating between ovarian lesions with similar sonographic characteristics.

#### TABLE OF CONTENTS/OUTLINE

Introduction - Normal ovaries, ovarian development, ovum development  
Acute ovarian pathology - ovarian torsion, antenatal ovarian torsion, canal of Nuck hernia, tubo-ovarian abscess  
Benign ovarian lesions  
Ovarian cysts - neonatal cysts, physiological and functional cysts, para-ovarian cysts  
Benign cystic tumors - mature cystic teratoma, cystadenoma  
Other benign ovarian tumors - benign subtypes of sex cord stromal tumors, gonadoblastoma  
Key points in differentiating benign vs malignant ovarian lesions  
Special considerations in adolescents - polycystic ovaries, endometriosis  
Role of O-RADS in children  
Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-86

### Imaging Approach for Pediatric Thyroid Diseases

#### Participants

Yuko Tsujioka, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Pediatric thyroid diseases have unique problems not seen in adult diseases. For example, congenital hypothyroidism is a common disorder that is usually detected on neonatal screening, but if missed, it causes serious intellectual disabilities. Juvenile thyroid dysfunction often manifest with non-specific symptoms (e.g., personality changes, declined school performance, weight fluctuation, decreased growth velocity), and may be fraught with diagnostic errors. Diagnostic imaging can be used to determine the underlying etiologies of endocrine thyroid diseases and provide supplementary information for thyroid hormone replacement therapy and antithyroid medication as well as to aid in the diagnosis of focal thyroid diseases, i.e., severity and extent of thyroid tumors and inflammatory diseases. In this educational exhibit, learners understand 1) the etiology, clinical features, and imaging findings in common pediatric thyroid diseases, 2) their unique features, and 3) how to use imaging modalities in the diagnostic approach for the diverse group of the disorders.

#### TABLE OF CONTENTS/OUTLINE

Introduction - Thyroid development - Modalities of thyroid imaging - Congenital thyroid diseases including congenital hypothyroidism (thyroid dysgenesis, thyroid dysmorphogenesis, transient hypothyroidism, congenital central hypothyroidism) and congenital hyperthyroidism - Acquired thyroid diseases including autoimmune thyroiditis, non-autoimmune thyroiditis, secondary thyroid dysfunction, acquired central hypo- and hyperthyroidism, and tumor and tumor like lesions

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## Abstract Archives of the RSNA, 2023

PDEE-87

### Skeletal Disorders Due to Abnormal Aggrecan Biosynthesis

#### Participants

Yuko Tsujioka, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

We review the imaging findings of disorders associated with abnormal biosynthesis of aggrecan, a major proteoglycan of cartilage. Proteoglycans are widely distributed in the extracellular matrix, and impaired aggrecan synthesis interferes with normal bone and joint development and causes disorders with abnormal bone and joint. With development of massively parallel sequencing technology and increased understanding of proteoglycan biology, disorders once considered separate entities have been lumped together as a group of disorders called "aggrecanopathies.". All aggrecanopathies are autosomal recessive disorders with 25% of recurrence risk, and the accurate diagnosis is crucial for genetic counseling. Aggrecanopathies manifest with growth failure and multiple joint abnormalities that often lead to a misdiagnosis of joint hypermobility/contracture syndromes, such as arthrogryposis and Larsen's syndrome. However, radiological examination allows the differential diagnosis. The skeletal hallmarks of aggrecanopathies include stunted tubular bones due to impaired endochondral ossification and an abnormal "pattern formation" due to maldevelopment of embryonic cartilage templates, such as distal humeral bifurcation, double-layered patella, monkey wrench-like proximal femora, hyperphalangy, and accelerated carpal ossification.

#### TABLE OF CONTENTS/OUTLINE

Introduction - Aggrecan synthesis process and related genes - Sulfation disorders (DTDST related, and others) - UDP-sugar deficiency (CANT1-related Desbuquios syndrome and others) - Linkeopathies

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## Abstract Archives of the RSNA, 2023

PDEE-88

### High Negative Appendectomy Rates in Under-18-year-old Patients - A 10-year Review with Radiologic-Pathologic Correlation: And Then There Were None

#### Participants

Juan Carlos Monte Gonzalez, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Radiologist-performed ultrasound (R-US) is a reliable diagnostic technique for acute appendicitis in under-18-year-old (U18) patients. - In inconclusive R-US studies (9% in this sample), positive second-look techniques were CT (55,6%), R-US (33,3%) and MRI (11,1%). - Discordance with pathology findings/negative appendectomy rate (NAR) was 6%, lower than other series.

#### TABLE OF CONTENTS/OUTLINE

One of our institution's pediatric surgeons suspected high NAR due to R-US low accuracy. This motivated a review of every appendectomy (610) in U18 patients, since the inauguration of our hospital (2012-2022). For this abstract, we sampled 100 patients that underwent appendectomy. We classified the cases by:- Age: 6-17 years-old (mean: 11,27 yo).- Gender: 41% female, 59% male.- Symptoms: 99% right lower quadrant pain, 63% nausea/vomiting, 18% temperature >37.3°C/99.1°F, 13% diarrhea, 12% hyporexia/anorexia.- Clinical signs: 67% Blumberg, 22% Psoas.- Laboratory values: 83% Leukocytosis >10,000, 68% leukocyte left shift (>75% PMNs), 67% CRP > 0.5.- Alvarado Score: 2-10 points (mean: 7,2).- R-US results: 90% positive, 1% negative, 9% inconclusive.- Second-look positive technique for inconclusive cases: 55,6% CT, 33,3% R-US, 11,1% MRI.- Appendix diameter: 5-20 mm (mean: 8,5 mm).- Surgical findings: 62% phlegmonous/suppurative, 17% phlegmonogangrenous/gangrenous.- Surgical technique: 53% open, 47% laparoscopic.- Pathology findings: 83% phlegmonous, 11% gangrenous, 5% reactive follicular lymphoid hyperplasia, 1% normal.- Discordance with pathology findings/NAR: 6%.- Evolution: 93% favorable, 4% complicated (1% dehiscence, 3% post-operative collections that resolved with antibiotics), 3% N/A.

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## Abstract Archives of the RSNA, 2023

PDEE-89

### The Many Faces of Pediatric Langerhans Cell Histiocytosis: A Pictorial Review

#### Participants

Maria Dien Esquivel, MD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Recognizing the typical imaging findings on different modalities of this rare disease is key to an early diagnosis and to guide management. 2. MR imaging is the modality of choice to evaluate central nervous system involvement. 3. FDG PET/CT plays a crucial role in the diagnosis, staging, surveillance and assessment of response to treatment of patients with LCH.

#### TABLE OF CONTENTS/OUTLINE

-Epidemiology-Classification-Etiopathogenesis and molecular findings-Pathology-Clinical Presentation-Treatment-Imaging Modalities• Radiography (skeletal survey)• Computed Tomography• Magnetic Resonance Imaging• Bone scintigraphy• PET/CT -Imaging Features by system• Central Nervous System• Axial and appendicular skeleton (bone marrow)• Chest• Abdomen• Nodal involvement• Other sites: Skin-Role of imaging• At diagnosis/initial staging• To assess response to treatment• During surveillance/follow up

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## Abstract Archives of the RSNA, 2023

PDEE-9

### Nuclear Medicine Renal Studies: Indications, Techniques and Limitations for Optimal Patient Care

#### TEACHING POINTS

1. Radiation dose is an important consideration in nuclear medicine imaging, and techniques for dose reduction should be employed whenever possible to minimize radiation exposure in children undergoing renal studies. 2. Radionuclide cystography is a valuable imaging modality for assessing vesicoureteral reflux and other bladder abnormalities in children and is often preferred over fluoroscopy due to lower radiation exposure. 3. Renal cortical scintigraphy using DMSA is a common method for evaluating renal function and detecting renal parenchymal abnormalities. Proper image acquisition and technique are crucial for obtaining accurate and reliable results. 4. Diuresis renography using MAG3 is a useful tool for evaluating the functional status of the kidneys and detecting obstructive uropathy. Its role in renal transplant assessment and monitoring is also significant. 5. The appropriate use and interpretation of nuclear medicine renal studies in patients requires an understanding of the indications, techniques, and limitations of each modality, as well as consideration of the unique aspects of renal physiology and pathology.

#### TABLE OF CONTENTS/OUTLINE

Introduction Radionuclide Cystography 1. Indications 2. Technique 3. Radionuclide Cystography vs Fluoroscopy Renal Cortical Scintigraphy: DMSA 1. Vesicoureteral reflux 2. Cortical Scarring 3. Image acquisition 4. Technique Diuresis Renography-MAG3 1. Neonatal hydronephrosis 2. Uretropelvic junction obstruction 3. Acute intermittent obstruction 4. Image acquisition 5. Role in Renal Transplant Conclusions

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## Abstract Archives of the RSNA, 2023

PDEE-90

### Intravascular Catheters in Pediatrics: Methods, Imaging and Complications

#### TEACHING POINTS

1. Intravascular catheter insertion in the pediatric population can be challenging, especially in infants. 2. The radiologist must be familiar with the imaging appearance of intravascular catheters, and recognize catheter malposition as well as other complications. In selected cases, a linogram may be diagnostic. 3. Pediatric patients may experience unique complications such as thrombosis of the portal vein associated with umbilical vein catheterization. 4. In some complications, such as malposition, it may be possible to perform an 'over-the-wire exchange.' However, in other cases, the only option may be to insert a new catheter.

#### TABLE OF CONTENTS/OUTLINE

1. Important anatomy highlights. 2. Types of catheters. 3. Insertion methods and pitfalls. 4. Intravascular catheters on pediatric imaging: pearls and pitfalls. 5. Neonatal lines-special considerations. 6. Cases. 7. Diagnosis and management of complications.

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## Abstract Archives of the RSNA, 2023

PDEE-91

### Little Bellies, Big Impact: Blunt Abdominal Trauma in Pediatric Patients

#### Participants

Fabiana Gual, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: To emphasize that trauma is a leading cause of death in the pediatric population, with abdominal injuries being a common and often unrecognized cause; To discuss the factors contributing to the higher risk of abdominal injuries in children, such as thinner abdominal wall and reduced adipose tissue; To highlight the importance of using the appropriate imaging test (including radiography, ultrasonography, contrast-enhanced CT and eventually magnetic resonance) based on the severity of the trauma and the stability of the patient; To provide examples of cases of low- and high-energy blunt abdominal trauma to demonstrate the utility of these imaging tests in diagnosing injuries to specific organs, such as the pancreas, liver, spleen, and kidneys; To acknowledge the challenges in evaluating children with blunt abdominal injury, especially pre-verbal children, and the need for diagnostic imaging to guide management decisions.

#### TABLE OF CONTENTS/OUTLINE

A flowchart illustrating the use of diagnostic imaging in low- and high-energy blunt abdominal trauma in children. A table listing the "packages of injuries" that can be identified based on force vectors when the pancreas, liver, spleen, and kidney are injured. Illustrated teaching cases of patients who were treated at the pediatric emergency department of a quaternary hospital and underwent imaging tests. The cases involve low- and high-energy blunt abdominal trauma resulting in pancreatic, hepatic, splenic and renal injuries. The Pediatric Organ Injury Scale was used to classify the severity of these injuries.

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## Abstract Archives of the RSNA, 2023

PDEE-92

### Multimodality Imaging Review of Inherited Collagen Disorders

#### TEACHING POINTS

1. Describe the epidemiology and pathophysiology of inherited collagen disorders in children. 2. Identify typical and atypical features of inherited collagen disorders. 3. Provide a comprehensive review of the key imaging findings for each disorder using a multi-system and multi-modality approach. 4. Discuss complications of disease and treatment options.

#### TABLE OF CONTENTS/OUTLINE

I. General Introduction to Inherited Collagen Disorders  
II. Conditions  
A. Epidemiology  
B. Diagnostic Imaging Findings and Complications  
a. Osteogenesis Imperfecta: Wormian bones, multiple fractures, osteoporosis, in-utero manifestations, zebra stripe sign  
b. Ehlers-Danlos joint dislocations, fractures, hemarthrosis, sigmoid colon rupture, splenic artery aneurysm  
c. Stickler Syndrome facial deformities, articular manifestations  
d. Epidermolysis Bullosa cutaneous blisters and erosions with transformation to squamous cell carcinoma, pseudosyndactyly with mitten hand/sock toe deformities, esophageal stricture, pyloric atresia, osteomyelitis  
e. Alport Syndrome end-stage renal disease manifestations, esophageal leiomyomatosis  
C. Treatment  
III. Conclusion

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## Abstract Archives of the RSNA, 2023

PDEE-93

### Fetal MRI to Detect Congenital Anomalies of the Kidney and Urinary Tract

#### Participants

Chihiro Tani, MD, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

As congenital anomalies of the kidney and urinary tract (CAKUT) account for 40% of childhood end-stage renal failure, an early diagnosis and appropriate treatment are important. Fetal ultrasonography and MRI help to diagnose some of the diseases included in CAKUT. Fetal MRI is important for postnatal treatment and follow-up. We discuss the development of the renal and urinary system in fetuses and present fetal MRI findings of major diseases in CAKUT.

#### TABLE OF CONTENTS/OUTLINE

(1) The development of the renal and urinary system during the fetal period; kidney, ureter, bladder, urethra(2) Fetal MRI findings of major diseases in CAKUTa. Renal anomalies; multicystic dysplastic kidney, autosomal recessive polycystic kidney disease, horseshoe kidney, pelvic kidney, etcb. Renal pelvis, calyx, and ureter anomalies; ureteropelvic junction obstruction, megaureter, etc. Bladder and urethral anomalies; bladder exstrophy, posterior urethral valves, etc.OutlineCAKUT accounts for childhood end-stage renal failure. Therefore, an early diagnosis and appropriate treatment are important. As some of the diseases included in CAKUT can be diagnosed prenatally, radiologists must be cognizant of fetal MRI findings of major diseases in CAKUT.

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## Abstract Archives of the RSNA, 2023

PDEE-94

### **It's all about location! A Practical Compartment-Based Approach to Diagnosing Pediatric Head and Neck Masses**

#### **TEACHING POINTS**

1. Provide a practical compartment-based approach to create the best differential diagnosis of pediatric neck masses. 2. Review the anatomy and content of each compartment. 3. Review relevant clinical and specific imaging findings of common and rare pediatric neck lesions based on a compartmentalized approach.

#### **TABLE OF CONTENTS/OUTLINE**

A. Background  
How to diagnose a pediatric neck mass? Why should we prefer a compartment-based approach for diagnosing pediatric neck masses?  
B. Head and neck compartments and compartment-based pediatric head and neck masses • Superficial Fascia • Parapharyngeal Space • Pharyngeal Mucosal Space • Submandibular space • Sublingual Space • Masticator Space • Buccal Space • Parotid Space • Carotid Space • Retropharyngeal Space • Perivertebral Space • Posterior Cervical Space • Visceral Space • Transspatial-multispatial • Miscellaneous  
Summary  
1. Evaluation of pediatric head and neck masses can be challenging due to their embryologic origin, complex anatomy, and various affecting pathologies.  
2. Using a practical compartment-based approach with careful consideration of the clinical details and specific imaging findings will enable the best differential diagnosis.

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## Abstract Archives of the RSNA, 2023

PHEE

### Physics Education Exhibits

#### Sub-Events

#### **PHEE-1 CT Dose Evaluation by Monte Carlo Simulation: Challenges for Personalized Dosimetry**

##### Participants

Kosuke Matsubara, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

The teaching points of this exhibit include the following: (1) Monte Carlo simulation is an effective tool for achieving personalized dosimetry in CT. (2) To improve the accuracy of radiation dose calculation on Monte Carlo simulation, the optimization of the patient or phantom model, energy spectrum, bow-tie filter model, patient support model, number of projections, and tube current modulation method are essential. (3) Radiation dose calculation in dual-energy CT is also feasible by modifying the calculation code of single-energy CT.

##### TABLE OF CONTENTS/OUTLINE

1. Monte Carlo simulation for radiation dose calculation: a) Principles, b) Monte Carlo simulation code, and c) Advantages and disadvantages of Monte Carlo simulation. 2. Optimization of Monte Carlo simulation in CT: a) Patient or phantom model, b) Energy spectrum, c) Bow-tie filter model, d) Patient support model, e) Number of projections, and f) Tube current modulation. 3. Monte Carlo simulation in dual-energy CT: a) Dual-source system and b) Rapid kV switching system. 4. Summary.

#### **PHEE-10 How Can We Establish Direct Radiation Dose Measurement During CT Examinations?**

##### Participants

Hiroaki Hayashi, PhD, Kanazawa, Japan (*Presenter*) Research collaboration, Meditec Japan Co., Ltd; Research collaboration, JOB Corporation

##### TEACHING POINTS

<<1>> Because the surface dose distribution fluctuates approximately twice during helical scanning CT, it is difficult to estimate proper radiation exposure dose when using a small number of dosimeters. <<2>> By estimating the X-ray incident direction from the standard deviation (SD) distribution of the X-ray (CT) image and fitting the predetermined dose function to the measured point dose, it is possible to evaluate the surface dose distribution regardless of both the incident angle of X-rays and heterogeneity of the subject.

##### TABLE OF CONTENTS/OUTLINE

<<1>> The surface dose distribution fluctuates due to the influence of the incident direction of X-rays during helical scanning CT. The information concerning the incident direction of the X-ray can be analyzed from the SD distribution of the X-ray image. <<2>> The proposed algorithm for analyzing doses combines the dose distribution and the SD distribution of the X-ray image. <<3>> A phantom study was conducted using the latest X-ray CT equipment. <<4>> It was demonstrated that consistent mean values could be calculated regardless of the incident direction of X-rays. <<5>> We proved that the measurement data using only one dosimeter showed the same results as the data when using many dosimeters. From this experiment it was determined that our method using only one dosimeter can be applied to actual clinical examinations.

#### **PHEE-11 Artificial Intelligence and MRI Artifacts: A Pictorial Review of MR Artifacts and AI Techniques for Reduction**

##### Participants

Joseph Carbone, MD, Orange, CA (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Teaching Points: 1. To provide a pictorial review of MRI artifacts and their specific causes as it relates to MR physics, with imaging correlates illustrating their significance in hindering radiologists' interpretation of images. 2. To describe emerging artificial intelligence and deep learning architecture as it pertains to the minimization of artifacts and image augmentation. 3. To illustrate how radiologists may benefit in interpretive ability from MRI artifact reduction and image enhancement, and describe future aims pertaining to image augmentation.

##### TABLE OF CONTENTS/OUTLINE

MRI artifacts result from an array of factors and are troublesome for radiologists as they may mimic or obscure structures of interest or disease conditions. Artificial intelligence and deep learning have emerged as a post-processing tool to augment radiologist's interpretation of MRI by eliminating or diminishing various artifacts, increasing signal to noise (SNR), and enhancing image resolution. It is important for radiologists to be familiar with MRI artifacts and emerging methods of negating these artifacts with deep learning and artificial intelligence. This abstract will serve as a pictorial review of varying MRI artifacts, as well as an update on the various methods that deep learning and artificial intelligence can be used as a post-processing tool to negate various

MRI artifacts and augment radiologist's ability to interpret MRI images.

## **PHEE-12 What is Trustworthy AI and How It Contributes in Diagnosis**

Participants

Masahiro Oda, PhD, (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

The purposes of our exhibit are: 1. To confirm difficulty of using AIs that have black box nature in diagnosis assistance 2. To learn what is trustworthy AI that unboxes black box AI 3. To learn explainable AI that clarifies the reason of decision 4. To learn uncertainty in AI that clarifies cases where AI is difficult to decide

### **TABLE OF CONTENTS/OUTLINE**

AI in diagnosis assistance - Provide decision assistance information- How AI decides is difficult to understand for radiologists Trustworthy AI - What is trustable AI for radiologists- Clarification including the reason of decision by AI and what AI doesn't know is necessary- Important research fields in trustworthy AI: Explainable AI, Uncertainty in AI Explainable AI - What is Explainable AI- Outcome explanation: provide explanations for AI outcomes- Model explanation: provide interpretable model that approximates black box model- Model inspection: understand model from its inputs and outcomes- Transparent box design: make parts of black box model interpretable Uncertainty in AI - What is Uncertainty in AI- Aleatoric uncertainty (data uncertainty): uncertainty in AI decision caused by noise or variance in data- Epistemic uncertainty (model uncertainty): uncertainty in AI decision caused by variance in model parameter determination Trustworthy AI in diagnosis assistance - Provide reasons of decisions made by AI- Provide a degree of confidence in AI decision

## **PHEE-13 Contrast Enhancement at CT: Principles and Clinical Applications**

Participants

Toru Higaki, PhD, Minami-ku, Hiroshima, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Contrast enhancement is important in CT examinations to evaluate the vessel morphology and the blood supply in tissues. The enhancement degree of iodine contrast media changes with the injection volume and speed. We describe the properties and pharmacokinetics of contrast agents, the theory of contrast enhancement, present optimized contrast administration methods, and discuss side-effects of contrast media.

### **TABLE OF CONTENTS/OUTLINE**

1. Pharmacokinetics of iodine contrast media (PDF-p.1) 2. Basics of the contrast enhancement protocol for CT- Effect of the injection volume (PDF-p.2)- Effect of the injection duration/speed (PDF-p.3)- Effect of the patient body weight (PDF-p.4) 3. Optimization of contrast protocols- Target organ-based optimization- Body weight-based optimization- Optimization by other body indexes- Low-kV scan / Dual-energy scan (PDF-p.5) 4. Side-effects of contrast media

## **PHEE-14 Spreading a Culture of MR Safety Outside of the Academic Practice: Regional Practices and other Departments**

Participants

Avery Scripture, DO, Hershey, PA (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

· With the development and growth of "Health Systems", and the use of MR units outside of radiology departments, a culture of MR safety must be fostered and maintained at all sites. · Academic medical centers typically image patients with the greatest level of risk related to MR safety, including untested and off-label implants. · Partnering between the Academic Medical Center with Regional Radiology Practices and other off-site MR users helps to establish a uniform culture of safety while maintaining effective clinical operations. · MR safety has a significant role in creating or eliminating MR access disparities, especially in rural areas. · Other non-imaging modalities that utilize magnetic fields, such as transcranial magnetic stimulation, can also benefit from collaboration with the MR safety committee.

### **TABLE OF CONTENTS/OUTLINE**

What is a Culture of MR Safety and how was it established Growth of the MRI fleet from acquisitions of practices and expanding use of technology Regional radiology growth MR-Linac and Intra-op MR units Culture change is difficult - how to do it effectively? Finding partners - benefit of local MDRD Shared expertise - such as one MRSO for all sites Engage all relevant personnel at early stages, to plant the seed of MR Safety Establishing local MR Safety Committees Practices vary, so can help meet specific needs Improves relevance to specific Clinical Operations and maintains efficiency Importance of Quality Assurance Recording at the time of the incident Emphasize non-punitive culture Record "near misses" Review by MR Safety Committee Role of MR safety in imaging access and equity

## **PHEE-15 Alleviating MR Artifacts Induced by Programmable Shunt for Hydrocephalus Patients**

Participants

Kuan Zhang, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1) The primary treatment for idiopathic normal pressure hydrocephalus (iNPH) is surgical insertion of a shunt system, such as the Certas Plus valve (VP shunt), to drain the excess cerebrospinal fluid. 2) MRI is typically used for diagnosis and postoperative monitoring of patients with iNPH. However, susceptibility artifacts may arise due to the metal component in the shunt. 3) Although 3T MRI could provide higher imaging quality than 1.5T, post-shunt imaging with iNPH is usually conducted at 1.5T, due to the recognition that metal artifacts are generally more prominent at higher field strength. 4) Our experience with patient and phantom scans indicates that shunt-induced artifacts demonstrated similar metal artifacts on 3T and 1.5T for some routine clinical imaging sequences, including MPRAGE, DWI, and GRE, due to differences in acquisition parameters between field strengths. Nevertheless, T2 FSE and T2 FLAIR show larger artifacts at 3T, compared to 1.5T. 5) To further improve the quality of post-shunt MRI with the

programmable shunt at 3T, techniques that could be helpful in reducing metal artifacts were shown. 6) The effect of metal presence was demonstrated with advanced technologies such as parallel imaging and deep learning algorithm. 7) With imaging protocol optimization, 3T programmable shunt imaging was feasible and could achieve comparable or superior image quality than 1.5T.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Routine clinical post-shunt imaging sequences at 1.5T vs 3T. 3) Commonly used strategies to alleviate shunt-induced artifacts. 4) Advanced techniques related to shunt-induced artifacts. 5) Conclusion

#### **PHEE-16 Will General Radiography Become More Valuable When Exploiting the Performance of a Photon Counting Detector?**

Participants

Daiki Kobayashi, BS, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Quantitative diagnosis can be established using Energy Resolving Photon Counting Detectors (ERPCD). 2. Because a functional image can be generated via several calculation processes, the quality of a functional image degrades. High-quality images can be obtained by optimizing the imaging parameters. 3. Image blurring interferes with quantitative analysis. Therefore, we should devise a novel blurring correction method instead of using the conventional Unsharp Masking method.

#### TABLE OF CONTENTS/OUTLINE

1. Impact of developing ERPCD. When obtaining functional images using ERPCD, quantitative diagnosis can be performed. The ERPCD system can also generate conventional qualitative diagnosis which can be performed using a traditional Energy Integrating Detector (EID). 2. An in-house program is available to simulate the actual X-ray imaging process in an imaging detector. In the program, X-ray attenuation, detector response, and statistics are taken into consideration. 3. When optimizing the settings of an ERPCD system, we found that a high kV system can generate a higher-quality functional image. 4. Image blurring should be corrected to analyze the object edge of functional images. 5. If ERPCD is used for general radiography, we can extract more information from X-ray images. For example, in the diagnosis of the fractures, we can obtain not only the visual information about the broken bones but also BMD information. ERPCD makes it possible to perform the screening test for osteoporosis.

#### **PHEE-17 DXA Quality Control Review**

Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the types and reasons for different QC tests, 2. Appraise suggested quality control tests based on key limits and elements, 3. Implement a DXA quality control program

#### TABLE OF CONTENTS/OUTLINE

1. Why Establish a DXA QC Program?, 2. Least Significant Change, 3. Elements of a Good QC test, 4. Types of DXA QC Tests, 4a. Cross-calibration of Machines, 5. Example QC Program, 6. Recommendations from National and International Societies

#### **PHEE-18 A Comprehensive Review of Ultrasound-guided Vascular Access for Residents, Fellows, and Medical Students**

Participants

Atlee Witt, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1) To detail different ultrasound techniques for vascular access 2) To explore the indications, contraindications, and potential complications of ultrasound-guided vascular access 3) To examine the utility of ultrasound-guided access for arterial, systemic venous, portomesenteric venous, and AV fistula procedures

#### TABLE OF CONTENTS/OUTLINE

1) Introduction: a) Indications for US vascular access (i. difficult or high-risk IV access ii. delivery of medications, fluids, or blood iii. diagnostic and interventional procedures) b) Relative contraindications (i. time limitations in emergent situations ii. ultrasound resolution with increasing depth iii. subcutaneous emphysema iv. volume depletion v. infection at the site of access) 2) Procedure: a) Equipment (i. ultrasound machine with high-frequency capable probe, ii. supplies for vascular access [1. IV starting kit, sterile gel, IV flushes, sterile probe cover]) b) Pre-procedure (i. consent ii. site identification and preparation) c) Technique (i. static approach ii. real-time approach [1. longitudinal approach 2. transverse or short-access approach]) d) Post-procedure (i. infection prevention) e) Complications (i. vessel puncture ii. malpositioning iii. injury to surrounding structures iv. infection) 3) Access sites: a) Artery (i. radial, brachial, femoral, and dorsalis pedis arteries) b) Systemic vein (i. internal jugular vein ii. subclavian vein iii. femoral vein) c) Portomesenteric vein (i. access to portal vein system ii. portography and portal pressure iii. embolization) d) AV fistula or graft

#### **PHEE-19 Would You Like to Ride the Wave Called CT Images? As a Novel Frequency Analysis Tool**

Participants

Yoichiro Ota, RT, Yokohama, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The spatial resolution CT images is expressed by a wave so-called Modulation Transfer Function. It is difficult to associate clinical CT images with MTFs, which is confusing to interpret. This can be explained by using the proposed method Band-limited CT images. This study will lecture on the contribution of high-frequency components to the image and the interpretation of MTFs intersections.

#### TABLE OF CONTENTS/OUTLINE

The process of Band limited image is based on Fast Fourier Transformation and frequency band limitation of CT images. Each band-limited CT image can contribute to characterizing how much information is in a signal of original CT images. The inclusion of high-frequency components results in high CT value and high resolution. Even if MTFs have an intersection, The band-limited image shows the difference in the amount of information that images have. We can associate clinical CT images MTFs and interpret the feature of CT images from physical point of view.

## **PHEE-2 3D Fast Spin Echo MRI with Variable Refocusing Flip Angles: Principles, Techniques, and Applications**

### **TEACHING POINTS**

3D FSE MRI with variable refocusing flip angles provides high-quality images with good contrast in various clinical applications. Its speed and versatility have made it a workhorse in MRI. The purposes of this Education Exhibit are 1. Overview of 3D FSE MRI acquisition schemes and the rationale of the variable flip angle strategies. 2. Explain the constant low flip angle refocusing and Pseudo Steady State (PSS) Principle, the transitions between pseudo steady states (TRAPS) principle, Mugler's Relaxation-specific Method, and Busse's General method for refocusing flip angle modulation. 3. Discuss the common-used RF excitation techniques such as non-selective/slab-selective RF excitation, inner volume RF excitation, etc. 4. k-space view ordering. 5. Review the RF modules used for magnetization preparation and contrast optimization. 6. T1-preparation (inversion recovery), T2-preparation, magnetization transfer contrast, fat suppression, diffusion weighting, flow suppression or enhancement, etc. are discussed in detail. Clinical protocols along with representative images are given for each magnetization preparation approach. 7. Review acceleration techniques including GRAPPA, CAIPIRINHA, and compressed sensing (CS) MRI.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction; 2. The Constant Low Flip Angle Refocusing and PSS Principle; 3. The TRAPS principle; 4. Mugler's Relaxation-specific method; 5. Busse's General Method; 6. RF excitation techniques; 7. K-space view ordering; 8. Magnetization preparation and contrast optimization; 9. T1-preparation; 10. T2-preparation; 11. MTC; 12. Fat suppression; 13. Diffusion weighting; 14. Flow suppression and enhancement; 15. Acceleration techniques.

## **PHEE-20 Photon-Counting Detector CT in Comparison to Energy-Integrating Detector CT: Optimization and Implementation of a Non-contrast Enhanced Chest Protocol for All Patient Sizes**

Participants

Danielle Vialle, MSc, Den Haag, Netherlands (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

o To demonstrate how to measure the diagnostic image quality (IQ) of a photon-counting detector (PCD) CT protocol  
o To learn how to assess and evaluate IQ of a PCD-CT protocol compared to energy-integrating detector (EID) CT  
o To provide tips and learn how to adjust the imaging protocol for a specific task and patient size

### **TABLE OF CONTENTS/OUTLINE**

With the introduction of PCD-CT in clinical practice, question rises how the IQ relates to the IQ of EID-CT scanners, and what the possibilities are for further dose reduction and/or image quality improvements. This exhibit provides you with knowledge on how IQ could be determined and evaluated by objective and subjective measures.

- o What is image quality and how can it be evaluated?
- Objective IQ quantified by noise, contrast, resolution and combined into the detectability index (d')
- Subjective IQ assessed by radiologists with 5-point Likert Scale
- o Effect on IQ and dose (phantom study examples)
- Determination of your site reference standard
- Determination of differences in scan and reconstruction parameters between scanners (EID-CT and PCD-CT)
- Influence of scan and reconstruction parameters
- Effect of differences in patient size
- Effect of dose adjustment
- o Guidelines on protocol adaptation
- How to find the right balance between IQ and dose
- Tips and tricks in adaptation of current EID- and PCD-CT protocols
- Tips for utilizing the full potential of a PCD-CT

## **PHEE-21 Radiation Protection Essentials for Interventional Radiology Workers**

Participants

Koichi Chida, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

-To understand the present status of medical interventional radiology (IVR) occupational radiation protection/shielding.-To understand the advantages/disadvantages of various radiation-shielding equipment.-To understand current protection/reduction methods and identify methods to improve these methods.-To understand the necessity of combining various reduction methods (tools) to reduce occupational radiation—shielding is only one such component.-To understand that the methods used to reduce the patient radiation dose are the same as the methods employed to reduce staff doses.

### **TABLE OF CONTENTS/OUTLINE**

Advantages/disadvantages of various shielding devices. There is no perfect device! Relationship between the patient radiation dose and medical worker exposure. Physician-received scattered radiation during IVR was strongly correlated with the patient dose. Therefore, reduction of the patient dose will decrease the staff dose. Outline The regulation dose limit is seldom exceeded when protection is appropriate. However, radiation injuries such as cataracts have recently been reported in physicians and staff who perform IVR. There is no perfect shield. Combinations of shields are required. Radiology workers must be appropriately educated in terms of reducing the radiation exposure among both patients and staff; such workers must understand the various methods used to estimate occupational exposure. Decreasing the patient dose reduces occupational exposure. Although shielding is critical, it is only one component of radiation protection. Patient dose optimization means that the patient never receives a higher dose than is necessary, which also reduces the dose received by the staff.

## **PHEE-22 Fluoroscopy: An Overview and Refresher for Radiologists**

### **TEACHING POINTS**

Note to reviewer: this submission is in response to the call of Dr. Christine Cooky Menias for a Physics educational exhibit on Fluoroscopy. 1. Provide an introduction to fluoroscopy and its history. 2. Describe the major components of a fluoroscopy system. 3. Explore principles and techniques, with a focus on image quality and radiation dose. 4. Discuss clinical applications across multiple

subspecialties in diagnostic and interventional radiology.5. Identify similarities and differences between projection radiography and fluoroscopy

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Fluoroscopy and Historya. Invention, early uses, evolution, current state of the art2. Major Components of a Fluoroscopy Systema. Imaging chain from x-ray tube to control consoleb. Image intensifier and flat panel detector systems3. Principles and Techniquesa. Continuous vs. pulsed fluoroscopyb. Automatic brightness controlc. Last-image holdd. Factors influencing image quality and radiation dose4. Clinical Applications Across Subspecialtiesa. Pediatric radiology, body imaging, neuroradiology, musculoskeletal radiology, thoracic radiologyb. Interventional radiology5. Comparing Projection Radiography and Fluoroscopya. Nomenclatureb. Image formation and technologyc. Location and mobility differencesd. Target, filter, and grid similarities and differencese. Continuous exposure vs. pulsatile exposuref. Radiation dose and exposure considerations6. Radiation Protection in Fluoroscopya. Stochastic and deterministic effectsb. Radiation safety for patientsc. Radiation safety for personnel

#### **PHEE-23 Automated Evaluation of Radiograph Accuracy Using Deep Learning With Explainable Artificial Intelligence**

##### TEACHING POINTS

In radiography, it is vital to maintain precise positioning to guarantee consistent image reproducibility. However, the decision to retake a radiograph is the responsibility of the supervising radiological technologists, whose evaluation methods are subjective. With the development of artificial intelligence (AI), deep learning is effectively used to guarantee the accuracy of radiographs. The focus of this study is to develop a deep learning-based automated quantitative evaluation method for radiography. It can guarantee the quality of radiographs and provide useful information for retaking radiography. Furthermore, explainable AI was utilized to determine the typical sources of information that AI relies on when making decisions. Analyzing data from the explainable AI could facilitate enhancements to the network's architecture. The major teaching points of this exhibit are to: 1. Evaluate automatically the radiograph accuracy. 2. Understand how to classify schemes using deep learning. 3. Clarify the typical sources of information that AI relies on when making decisions using explainable AI.

#### TABLE OF CONTENTS/OUTLINE

To provide automated quantitative evaluation of radiograph accuracy using deep learning with explainable artificial intelligence and to discuss clinical usefulness toward an accurate diagnosis in radiography. To reduce variability in individual assessments and achieve a quantitative index. Ultimately, the aim is to reveal the network structure using explainable AI in order to construct an appropriate network.

#### **PHEE-24 Don't Get Burned: Hot Topics in MRI Safety**

##### TEACHING POINTS

Note to reviewer: this submission is in response to the call of Dr. Christine Cooky Menias for a Physics educational exhibit on MRI Safety. This educational exhibit provides a comprehensive overview of MRI safety for radiologists. It covers foundational principles, safety zones, personnel and patient screening, handling of special cases, and emergency procedures. The importance of continuous learning and adherence to guidelines by regulatory bodies is emphasized. Case studies and scenarios supplement the understanding of topics and foster application of knowledge.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction• Safety Ethics in MRI• Importance of MRI Safety2. Understanding the MRI Environment• Safety Zones• MRI Zone Protections3. Staff and Patient Considerations• Personnel Screening• Patient Screening• Special Case: Inability to Obtain Consent4. MRI Hazards• Radiofrequency (RF)-Induced Heating• Metallic Foreign Bodies• Medical Implants• Quenching in MRI5. Safety Guidelines and Emergency Procedures• MRI Safety Guidelines and Standards• Emergency Procedures in MRI6. Case Studies and Scenarios• Case Studies: Stents, Pacemakers, Pregnant Patient, Unconscious Patient• Safety Scenarios and Answers7. Special Topics in MRI Safety• High Field Strength Magnets• MRI and Pregnancy

#### **PHEE-25 Super-resolution Deep Learning Reconstruction of MR Imaging: Technical Features and Clinical Impact on Abdominal and Pelvic MR Imaging**

Participants

Atsushi Nakamoto, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Deep learning reconstruction (DLR) has recently been introduced by several vendors to improve MR image quality by reducing image noise. Super-resolution deep learning reconstruction (SR-DLR) is a newly developed MR image reconstruction method that not only reduces image noise but also improves spatial resolution. SR-DLR is expected to provide even higher image quality and improved diagnostic performance compared to DLR. The aims of this exhibit are: 1. To illustrate the technical features of SR-DLR, 2. To discuss the image quality of MR imaging using SR-DLR, and 3. To discuss the clinical impact on MR studies in the diagnosis of abdominal and pelvic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Overview 2. Principle of SR-DLR 3. Sequences applicable to SR-DLR: fast spin echo T2WI, single-shot fast spin echo T2WI, DWI, steady-state free precession (SSFP), 3D T1-weighted gradient-echo with or without contrast enhancement, etc. 4. Effective reduction of image noise with SR-DLR 5. Improved spatial resolution with SR-DLR 6. Differences in image quality and spatial resolution from the conventional image reconstruction technique and DLR 7. Clinical impact on the diagnosis of abdominal diseases (liver, biliary tract, and pancreas) 8. Clinical impact on the diagnosis of pelvic diseases (uterus, ovaries, prostate, bladder, and rectum) 9. Summary

#### **PHEE-26 Optimal Acquisition and Reconstruction Techniques of Coronary CT Angiography: Current Status and Trends Over the Past Decade**

Participants

Rika Fukui, Tokyo, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1) To introduce recent technological developments in coronary CT angiography (CCTA); 2) To describe optimal acquisition and reconstruction techniques in CCTA based on these developments; 3) To illustrate clinical utilities of these techniques in CCTA by presenting various clinical data and images.

## TABLE OF CONTENTS/OUTLINE

1) Recent technological developments in CCTA (a) Hardware: high-output/fast-rotating x-ray tube, high-definition/ultra-high-resolution CT (HD/UHRCT), area-detector CT (ADCT), dual-source CT (DSCT), dual-energy CT (DECT); (b) Software: automatic selection of optimal acquisition parameters/cardiac phase (Auto gating/Smart phase), motion correction algorithm (MCA), iterative/deep learning reconstruction (IR/DLR). 2) Optimal acquisition and reconstruction techniques in CCTA (a) HD/UHRCT, DECT vs. coronary artery calcification/stent; (b) Fast-rotating x-ray tube, DSCT, Smart phase, MCA: motion artifact reduction; (c) ADCT: misalignment (banding/stair-step) artifact reduction; (d) Low kV acquisition by high-output x-ray tube, Auto gating, IR/DLR: radiation dose reduction; (e) Low kV acquisition by high-output x-ray tube, DECT vs. poor contrast; (f) Auto gating, Smart phase, MCA: workflow improvement; (g) DECT: detailed coronary plaque assessment. 3) Clinical utilities of these techniques in CCTA (a) Better image quality/interpretability/diagnostic accuracy/workflow; (b) Lower radiation/contrast media dose.

## **PHEE-27 Low kV or Low keV, That Is the Question: What the Radiologist and Radiology Technologist Need to Know in Contrast-Enhanced Body CT With Current and Novel Technologies**

Participants  
Haruhiko Machida, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

## TEACHING POINTS

1) To introduce basic principles and clinical usefulness of single-energy CT (SECT) at low tube voltage (kV)/virtual monochromatic imaging (VMI) at low energy (keV) by dual-energy CT (DECT) in contrast-enhanced body CT; 2) To illustrate factors affecting image quality (IQ) of SECT at low kV/VMI at low keV and current and novel technologies for improving the IQ; 3) To demonstrate strategies to determine the optimal imaging option.

## TABLE OF CONTENTS/OUTLINE

1) Basic principles clinical usefulness of SECT at low kV/VMI at low keV (a) Basic principles: SECT/DECT/VMI; (b) Clinical usefulness: improved contrast enhancement/reduced iodine load/reduced radiation dose (for SECT)/reduced beam-hardening (BH) metallic artifact (for DECT)/flexible keV selection (for DECT)/improved material decomposition (MD) various DECT-specific imaging/analysis options (for DECT). 2) Factors affecting IQ of SECT at low kV/VMI at low keV technologies for improving the IQ (a) IQ factors: CT value/image noise/contrast-noise ratio/spatial resolution/BH metallic artifact; (b) Current novel technologies: high output x-ray tube/kV mA synchronized switching/highly efficient detector/iterative deep-learning reconstruction/metallic artifact reduction software. 3) Strategies to determine the optimal imaging option (a) Better spatial resolution for SECT; (b) Better image contrast/less BH metallic artifact/better MD for DECT.

## **PHEE-28 Development of 3D Performance Phantom in UHR-CT (Evaluation of MPR, MIP, VR and VE images)**

Participants  
Katsumi Tsujioka, RT, Toyota-city, Japan (*Presenter*) Researcher, Canon Medical Systems Corporation

## TEACHING POINTS

We report on the new phantom to evaluate the 3D performance. Its name is "Spiral Micro Holes Phantom". This phantom is made of an acrylic cylinder with 40mm diameter. We used two types of phantoms. Phantom A has holes with diameter of 0.5mm and phantom B has holes with diameter of 0.3mm. CT scans were performed with the long axis of phantom placed parallel to the X-Y plane of the CT system. For the experiment, we used a conventional CT system and an ultra-high-resolution CT (UHR-CT) system. The multi planar reconstruction (MPR), maximum intensity projection (MIP), volume rendering (VR), and virtual endoscopy (VE) were performed on the obtained volume data, and the displaying of the holes in each direction was studied. In the MIP image, since the air layer of the acrylic pillar is detected, the comparison between the X-Y plane to the Z axis was performed accurately. VR, VE and curved MPR were able to be evaluated continuously from the X - Y plane to the Z axis. In clinical image diagnosis, MPR, MIP, VR and VE are performed for each case. Evaluation by Spiral Micro Holes Phantom is also useful for explaining the characteristics of each display method to the radiologist.

## TABLE OF CONTENTS/OUTLINE

(1) What is 3D performance (2) Development of Spiral Micro Holes Phantom (3) Development of evaluation method (MPR, MIP, VR and VE images) (4) Experiment using phantom (Positioning and scan) (5) Conclusion and clinical use (For example, CT colonography and CT angiography)

## **PHEE-29 Will That X-Ray Harm My Unborn Child? - A Meta-Analysis of Fetal Health Effects Indicates Very Low Risk to Fetus Following Occupational Exposure of Pregnant Interventional Physicians**

Participants  
Jelena Mihailovic, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

## TEACHING POINTS

For our interventional physicians with proper radiation safety practices, fetal radiation dose is predicted to be <4 mGy per term. Compared with known risk of childhood disorders, the predicted risk of cancer following fetal occupational radiation exposure is very low.

## TABLE OF CONTENTS/OUTLINE

Concern of radiation-induced fetal health effects deters women from entering interventional practices. If proper radiation safety practices are applied, radiation dose to the fetus is expected to be <4mGy per term for physician performing interventional fluoroscopy procedures. In this work we compared predicted risk of early childhood cancer from in-utero fetal radiation exposure to risks associated with maternal BMI, age, and hormonal therapy. We performed random effect meta-analysis of 15 studies (1970-2020) investigating early childhood cancer following in-utero exposure from 0.3 to 1000 mGy. The natural incidence of early

childhood cancer is ~0.3%. Linear no-threshold model fit to the meta-analysis predicted cancer HR of 1.01 (incremental risk 0.003%) for fetal dose 4 mGy. The natural incidence of childhood disorder is 1.3%. Maternal BMI of =30kg/m<sup>2</sup>, age >35yrs, or hormonal therapy were associated with HR in the range 1.14-1.40 [95% CI 0.99-1.75]. The predicted risk of childhood cancer following fetal occupational radiation exposure is very low compared with other fetal risks.

### **PHEE-3 ChatGPT in Medical Physics: What You Need to Know**

Participants

Jie Zhang, PhD, Lexington, KY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. Learn the basics of ChatGPT and its potential applications in medical physics 2. Identify the types of questions ChatGPT can answer, such as those related to radiation safety, imaging protocols, and quality assurance 3. Understand how to integrate ChatGPT with existing systems, such as quality assurance programs, to improve efficiency and accuracy 4. Discuss the limitations of ChatGPT and ethical considerations 5. Recognize the importance of training and validating ChatGPT, including the need to continually update its knowledge base and monitor its performance over time

#### **TABLE OF CONTENTS/OUTLINE**

Since its introduction in November 2022, ChatGPT has become a topic of discussion across various fields, including medicine. A literature search using the keyword ChatGPT on PubMed yielded 340 results as of April 30, 2023, with 335 published in the first four months of 2023. As this number continues to grow, medical physicists may be curious about the potential applications of ChatGPT in their field. This education provides a comprehensive review of ChatGPT and its potential applications in medical physics, along with other relevant considerations. The content is organized as follows: 1. An overview of ChatGPT and its potential applications in Medical Physics 2. Types of questions ChatGPT can answer, including radiation safety, imaging protocols, and quality assurance 3. Integration of ChatGPT with existing systems to improve efficiency and accuracy 4. Limitations of ChatGPT and ethical considerations 5. Continued training and validation of ChatGPT to maintain accuracy and relevance over time.

### **PHEE-30 How Should We Set Tube Voltage for Pediatric Cardiac CT Examination Using Photon-Counting CT?: A Phantom Study**

Participants

Junya Nakamura, BS, Okayama-Shi, Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1) We explain the proper tube voltage setting during a pediatric cardiac CT based on the image quality analysis and exposure dose evaluation. 2) The photon-counting CT scanner can always derive the virtual monoenergetic image (VMI) and high contrast can be obtained by applying lower energy VMI. In addition, using energy integrated image (T3D) at low tube voltage can also create high contrast image. 3) The operator should take into consideration not only exposure dose inside the scanning range but also that outside the range.

#### **TABLE OF CONTENTS/OUTLINE**

1) Explanation of VMI and T3D image obtained by photon counting CT. When the high tube voltage is used, image contrast can be adjusted based on the reconstruction energy of VMI. On the other hand, low tube voltage has been historically applied to pediatric cardiac CT scans. 2) Comparison of image quality of low and high tube voltages. When the same CT DIvol was set for each tube voltage, the image quality was similar trend. 3) A key issue in selecting the tube voltage. The scattered X-rays increase when using high tube voltage, therefore the dose outside the scanning region needs to be considered. 4) Experimental results of dose measurement. When the low tube voltage was adopted, the dose outside the scanning region was reduced. 5) What the operator should know how to determine tube voltage for pediatric cardiac CT.

### **PHEE-4 What You Should Know About CT NCLSC Radiomics: Uncertainties in Data Preparation, Feature Extraction, Feature and Model Selection, and Outcomes**

#### **TEACHING POINTS**

1. Provide overview of radiomics workflow and key components related to inconsistent outcomes 2. Examine data types appropriate for inclusion in effective model training, e.g., high-order, low-order, clinical 3. Learn key aspects of cohort selection for robust models 4. Provide overview of common feature selection methods and predictive models used in literature and their use in different clinical endpoints, e.g., classification and prognosis 5. Understand uncertainty of feature selection methods and predictive models during implementation 6. Provide relative performance of aforementioned teaching points based on actual study outcomes

#### **TABLE OF CONTENTS/OUTLINE**

In radiomics, key components include but are not limited to data quality, feature extraction, feature and model selection, and training/validation. Based on our recent review of more than 160 published papers there is a current emphasis on data quality and feature reproducibility, however, feature and model selection are not yet well defined. In this education exhibit, we provide a review of feature and model selection methods and their effects on outcomes as well as findings from our systemic evaluation of radiomic feature selection and predictive models. The content is organized as follows: 1. Describe the radiomics workflow in clinical studies 2. Overview commonly used feature selection methods and predictive methods 3. Show feature selection method and predictive model selection for different end-points 4. Familiarize sources of uncertainty from feature selection and predictive models in study design

### **PHEE-5 The Echo Chamber: Unraveling the Mysteries of Spin Echo and Gradient Echo MRI Pulse Sequences**

#### **TEACHING POINTS**

MRI sequences and their clinical utility can be difficult to keep track of, particularly for radiology residents and trainees. Understanding the underlying properties of MRI sequences and their image contrast is critical for proper diagnosis. Additionally, understanding the differences between various spin echo and gradient echo sequences is critical for the evaluation of images and for future optimization and design. Once learned, the clinical applications of these techniques are critical for training of radiology and medical physics residents.

## TABLE OF CONTENTS/OUTLINE

1. Basic Pulse Sequence Tenetsa. Review of MRI signal and T1, T2 and T2\* relaxation times.b. Review of basic pulse sequence block including TE and TR2. Review of Basic Spin Echo and Gradient Echo Sequences a. Basic pulse sequence block for spin and gradient echo sequencesb. Comparison of spin echo to fast spin echo sequences and effects on image qualityc. Comparison between bSSFP and RF spoiled sequences and their tradeoffsd. Introduction of inversion prepared sequences (STIR, FLAIR)3. Clinical Applications of FSE, bSSFP, and RF spoiled sequencesa. Clinical examples of FSE sequences- T1 weighted FSE of osteosarcoma- T2 weighted FSE of oligodendroglioma. Clinical examples of gradient echo sequences- bSSFP of multicystic mass in heart- bSSFP in abdomen and B0 artifacts- FLASH imaging in the abdomen- FLASH T2w imaging in the brain, including gliomas- Susceptibility T2\* imaging of brainc. Clinical examples of inversion prepared sequences- STIR imaging of spine- FLAIR imaging of multiple sclerosis

### **PHEE-6 Impact of Reconstruction Field of View, Matrix Size, and Kernel on Spatial Resolution of Photon Counting CT**

Participants

Zhongxing Zhou, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Limited by pixel size (determined by reconstruction FOV and matrix size), the visual spatial resolution on clinical images is often below that allowed by the acquisition geometry and reconstruction kernel. 2. Use of an ultra-sharp kernel without considering the combined effect of pixel size, noise, visual and system spatial resolution may lead to suboptimal image quality. 3. For a given CT acquisition and reconstruction kernel, there is a threshold pixel size, above which the visual spatial resolution will be sacrificed. 4. Dramatically increased image noise associated with small pixel size and high-resolution reconstruction kernels may be controlled using deep-learning-based noise reduction methods.

## TABLE OF CONTENTS/OUTLINE

1. Describe difference between system limit spatial resolution and visual spatial resolution on images: 1). System limit spatial resolution is determined by the CT acquisition geometry and reconstruction kernel. It is often measured and quantified using pre-sampling modulation transfer function. 2). Visual spatial resolution is affected by pixel size in addition to the system limit spatial resolution. 2. Explain how pixel size (determined by reconstruction FOV and matrix size) and reconstruction kernel affect the visual spatial resolution in images and provide a guide on how to determine reconstruction kernel and pixel size. 3. Demonstrate the combined effect of pixel size, matrix size, reconstruction FOV and kernel using clinical image examples. 4. Demonstrate benefit of deep-learning-based noise reduction to improve visual spatial resolution.

### **PHEE-7 The Physics and Clinical Considerations of Radionuclide Therapy**

#### TEACHING POINTS

1. Review the physical properties of different modes of radionuclide decay and their relevant clinical applications.2. Discussion production of radioisotopes and radiopharmaceuticals, and the radiation biophysics that result in tumor cell death and DNA damage. 3. Discuss the physical properties of various radioisotopes used in therapy, as well as emerging clinical applications, and clinical considerations. 4. Describe the management considerations regarding dose limiting properties and off-target biological effects associated with radionuclide therapies. 5. Review patient and general public safety considerations for radiation emitted by patients after discharge.

## TABLE OF CONTENTS/OUTLINE

1. Physics - Types of radionuclide decay and Linear Energy Transfer- Review of radioisotope production2. Biological Effects- Principles of radiotherapy- Ionizing radiation effects (Direct and Indirect Effects)- Implications for treatment3. Dosimetry - how to perform and clinical importance4. Review current and future Radioisotopes and Radiopharmaceuticals- Production, logistics, clinical administration/dosing5. Radiation Safety- Spillage considerations- Precursors to patient discharge, dosage to general public

### **PHEE-8 I Want You To Improve My Abdominal MRI Quality**

Participants

Martin Horwarth, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 - In an interactive form of a quiz, be able to identify magnetic resonance (MR) artifacts on abdominal studies and how to avoid them if needed.2 - Be able to recognize unwanted MR artifacts or imaging errors, especially the ones that can lead to erroneous reports.3 - Understand the sources of these imaging artifacts.4 - Improve radiologists' and technicians' knowledge of MR physics regarding abdominal imaging with practical cases.

## TABLE OF CONTENTS/OUTLINE

1 - Introduction on MR physics, imaging errors and what are some imaging artifacts that we do need.2 - A series of interactive cases with questions. The first question on how to identify the imaging error.3 - The answer is followed by an explanation about the physics of the error and why they occur.4 - Divide these artifacts and imaging errors into the ones we can change and the ones we can not.5 - Those avoidable artifacts are followed by another question on how to do so.6 - Explanation on how to avoid or minimize artifacts.7 - Summary and take home notes.

### **PHEE-9 Multilingual Nuggets or Snippets: Microlearning Video Lessons on CT Radiation Dose Optimization**

Participants

Lina Karout, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Using author-created, multilingual microlearning video lessons, we empower the audience on keys aspects of CT radiation dose optimization with the understanding of 1. Justification 2. Indication-driven CT protocols3. Optimum acquisition parameters 4. Dose metrics and monitoring 5. Diagnostic reference levels (DRLs)



## **TABLE OF CONTENTS/OUTLINE**

We will use several author-created microlearning videos to describe the learning objectives. Each video will be created in three languages (English, Spanish, and Portuguese) with voice and subtitles. The videos will bring real-world examples to help the audience understand the critical aspects of radiation dose optimization in CT. Pre and post short 5 questionnaire will be applied before and after the educational activity. All content will be released online for free open access following the RSNA presentation. The videos will be based on recommendations based on IAEA, ACR and international validated documents.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PHEE-1

### CT Dose Evaluation by Monte Carlo Simulation: Challenges for Personalized Dosimetry

#### Participants

Kosuke Matsubara, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The teaching points of this exhibit include the following: (1) Monte Carlo simulation is an effective tool for achieving personalized dosimetry in CT. (2) To improve the accuracy of radiation dose calculation on Monte Carlo simulation, the optimization of the patient or phantom model, energy spectrum, bow-tie filter model, patient support model, number of projections, and tube current modulation method are essential. (3) Radiation dose calculation in dual-energy CT is also feasible by modifying the calculation code of single-energy CT.

#### TABLE OF CONTENTS/OUTLINE

1. Monte Carlo simulation for radiation dose calculation: a) Principles, b) Monte Carlo simulation code, and c) Advantages and disadvantages of Monte Carlo simulation. 2. Optimization of Monte Carlo simulation in CT: a) Patient or phantom model, b) Energy spectrum, c) Bow-tie filter model, d) Patient support model, e) Number of projections, and f) Tube current modulation. 3. Monte Carlo simulation in dual-energy CT: a) Dual-source system and b) Rapid kV switching system. 4. Summary.

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## Abstract Archives of the RSNA, 2023

PHEE-10

### How Can We Establish Direct Radiation Dose Measurement During CT Examinations?

#### Participants

Hiroaki Hayashi, PhD, Kanazawa, Japan (*Presenter*) Research collaboration, Meditec Japan Co., Ltd; Research collaboration, JOB Corporation

#### TEACHING POINTS

<<1>> Because the surface dose distribution fluctuates approximately twice during helical scanning CT, it is difficult to estimate proper radiation exposure dose when using a small number of dosimeters. <<2>> By estimating the X-ray incident direction from the standard deviation (SD) distribution of the X-ray (CT) image and fitting the predetermined dose function to the measured point dose, it is possible to evaluate the surface dose distribution regardless of both the incident angle of X-rays and heterogeneity of the subject.

#### TABLE OF CONTENTS/OUTLINE

<<1>> The surface dose distribution fluctuates due to the influence of the incident direction of X-rays during helical scanning CT. The information concerning the incident direction of the X-ray can be analyzed from the SD distribution of the X-ray image. <<2>> The proposed algorithm for analyzing doses combines the dose distribution and the SD distribution of the X-ray image. <<3>> A phantom study was conducted using the latest X-ray CT equipment. <<4>> It was demonstrated that consistent mean values could be calculated regardless of the incident direction of X-rays. <<5>> We proved that the measurement data using only one dosimeter showed the same results as the data when using many dosimeters. From this experiment it was determined that our method using only one dosimeter can be applied to actual clinical examinations.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PHEE-11

### Artificial Intelligence and MRI Artifacts: A Pictorial Review of MR Artifacts and AI Techniques for Reduction

#### Participants

Joseph Carbone, MD, Orange, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Teaching Points: 1. To provide a pictorial review of MRI artifacts and their specific causes as it relates to MR physics, with imaging correlates illustrating their significance in hindering radiologists' interpretation of images. 2. To describe emerging artificial intelligence and deep learning architecture as it pertains to the minimization of artifacts and image augmentation. 3. To illustrate how radiologists may benefit in interpretive ability from MRI artifact reduction and image enhancement, and describe future aims pertaining to image augmentation.

#### TABLE OF CONTENTS/OUTLINE

MRI artifacts result from an array of factors and are troublesome for radiologists as they may mimic or obscure structures of interest or disease conditions. Artificial intelligence and deep learning have emerged as a post-processing tool to augment radiologist's interpretation of MRI by eliminating or diminishing various artifacts, increasing signal to noise (SNR), and enhancing image resolution. It is important for radiologists to be familiar with MRI artifacts and emerging methods of negating these artifacts with deep learning and artificial intelligence. This abstract will serve as a pictorial review of varying MRI artifacts, as well as an update on the various methods that deep learning and artificial intelligence can be used as a post-processing tool to negate various MRI artifacts and augment radiologist's ability to interpret MRI images.

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## Abstract Archives of the RSNA, 2023

PHEE-12

### What is Trustworthy AI and How It Contributes in Diagnosis

#### Participants

Masahiro Oda, PhD, (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of our exhibit are: 1. To confirm difficulty of using AIs that have black box nature in diagnosis assistance 2. To learn what is trustworthy AI that unboxes black box AI 3. To learn explainable AI that clarifies the reason of decision 4. To learn uncertainty in AI that clarifies cases where AI is difficult to decide

#### TABLE OF CONTENTS/OUTLINE

AI in diagnosis assistance - Provide decision assistance information- How AI decides is difficult to understand for radiologists Trustworthy AI - What is trustable AI for radiologists- Clarification including the reason of decision by AI and what AI doesn't know is necessary- Important research fields in trustworthy AI: Explainable AI, Uncertainty in AI Explainable AI - What is Explainable AI- Outcome explanation: provide explanations for AI outcomes- Model explanation: provide interpretable model that approximates black box model- Model inspection: understand model from its inputs and outcomes- Transparent box design: make parts of black box model interpretable Uncertainty in AI - What is Uncertainty in AI- Aleatoric uncertainty (data uncertainty): uncertainty in AI decision caused by noise or variance in data- Epistemic uncertainty (model uncertainty): uncertainty in AI decision caused by variance in model parameter determination Trustworthy AI in diagnosis assistance - Provide reasons of decisions made by AI- Provide a degree of confidence in AI decision

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

PHEE-13

### Contrast Enhancement at CT: Principles and Clinical Applications

#### Participants

Toru Higaki, PhD, Minami-ku, Hiroshima, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Contrast enhancement is important in CT examinations to evaluate the vessel morphology and the blood supply in tissues. The enhancement degree of iodine contrast media changes with the injection volume and speed. We describe the properties and pharmacokinetics of contrast agents, the theory of contrast enhancement, present optimized contrast administration methods, and discuss side-effects of contrast media.

#### TABLE OF CONTENTS/OUTLINE

1. Pharmacokinetics of iodine contrast media (PDF-p.1)2. Basics of the contrast enhancement protocol for CT- Effect of the injection volume (PDF-p.2)- Effect of the injection duration/speed (PDF-p.3)- Effect of the patient body weight (PDF-p.4)3. Optimization of contrast protocols- Target organ-based optimization- Body weight-based optimization- Optimization by other body indexes- Low-kV scan / Dual-energy scan (PDF-p.5)4. Side-effects of contrast media

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## Abstract Archives of the RSNA, 2023

PHEE-14

### Spreading a Culture of MR Safety Outside of the Academic Practice: Regional Practices and other Departments

#### Participants

Avery Scripture, DO, Hershey, PA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- With the development and growth of "Health Systems", and the use of MR units outside of radiology departments, a culture of MR safety must be fostered and maintained at all sites.
- Academic medical centers typically image patients with the greatest level of risk related to MR safety, including untested and off-label implants.
- Partnering between the Academic Medical Center with Regional Radiology Practices and other off-site MR users helps to establish a uniform culture of safety while maintaining effective clinical operations.
- MR safety has a significant role in creating or eliminating MR access disparities, especially in rural areas.
- Other non-imaging modalities that utilize magnetic fields, such as transcranial magnetic stimulation, can also benefit from collaboration with the MR safety committee.

#### TABLE OF CONTENTS/OUTLINE

What is a Culture of MR Safety and how was it established Growth of the MRI fleet from acquisitions of practices and expanding use of technology Regional radiology growth MR-Linac and Intra-op MR units Culture change is difficult - how to do it effectively? Finding partners - benefit of local MDRD Shared expertise - such as one MRSO for all sites Engage all relevant personnel at early stages, to plant the seed of MR Safety Establishing local MR Safety Committees Practices vary, so can help meet specific needs Improves relevance to specific Clinical Operations and maintains efficiency Importance of Quality Assurance Recording at the time of the incident Emphasize non-punitive culture Record "near misses" Review by MR Safety Committee Role of MR safety in imaging access and equity

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## Abstract Archives of the RSNA, 2023

PHEE-15

### Alleviating MR Artifacts Induced by Programmable Shunt for Hydrocephalus Patients

#### Participants

Kuan Zhang, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) The primary treatment for idiopathic normal pressure hydrocephalus (iNPH) is surgical insertion of a shunt system, such as the Certas Plus valve (VP shunt), to drain the excess cerebrospinal fluid. 2) MRI is typically used for diagnosis and postoperative monitoring of patients with iNPH. However, susceptibility artifacts may arise due to the metal component in the shunt. 3) Although 3T MRI could provide higher imaging quality than 1.5T, post-shunt imaging with iNPH is usually conducted at 1.5T, due to the recognition that metal artifacts are generally more prominent at higher field strength. 4) Our experience with patient and phantom scans indicates that shunt-induced artifacts demonstrated similar metal artifacts on 3T and 1.5T for some routine clinical imaging sequences, including MPRAGE, DWI, and GRE, due to differences in acquisition parameters between field strengths. Nevertheless, T2 FSE and T2 FLAIR show larger artifacts at 3T, compared to 1.5T. 5) To further improve the quality of post-shunt MRI with the programmable shunt at 3T, techniques that could be helpful in reducing metal artifacts were shown. 6) The effect of metal presence was demonstrated with advanced technologies such as parallel imaging and deep learning algorithm. 7) With imaging protocol optimization, 3T programmable shunt imaging was feasible and could achieve comparable or superior image quality than 1.5T.

#### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Routine clinical post-shunt imaging sequences at 1.5T vs 3T. 3) Commonly used strategies to alleviate shunt-induced artifacts. 4) Advanced techniques related to shunt-induced artifacts. 5) Conclusion

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

PHEE-16

### Will General Radiography Become More Valuable When Exploiting the Performance of a Photon Counting Detector?

#### Participants

Daiki Kobayashi, BS, Kanazawa, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Quantitative diagnosis can be established using Energy Resolving Photon Counting Detectors (ERPCD).2. Because a functional image can be generated via several calculation processes, the quality of a functional image degrades. High-quality images can be obtained by optimizing the imaging parameters.3. Image blurring interferes with quantitative analysis. Therefore, we should devise a novel blurring correction method instead of using the conventional Unsharp Masking method.

#### TABLE OF CONTENTS/OUTLINE

1. Impact of developing ERPCD. When obtaining functional images using ERPCD, quantitative diagnosis can be performed. The ERPCD system can also generate conventional qualitative diagnosis which can be performed using a traditional Energy Integrating Detector (EID).2. An in-house program is available to simulate the actual X-ray imaging process in an imaging detector. In the program, X-ray attenuation, detector response, and statistics are taken into consideration.3. When optimizing the settings of an ERPCD system, we found that a high kV system can generate a higher-quality functional image.4. Image blurring should be corrected to analyze the object edge of functional images.5. If ERPCD is used for general radiography, we can extract more information from X-ray images. For example, in the diagnosis of the fractures, we can obtain not only the visual information about the broken bones but also BMD information. ERPCD makes it possible to perform the screening test for osteoporosis.

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## Abstract Archives of the RSNA, 2023

PHEE-17

### DXA Quality Control Review

#### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the types and reasons for different QC tests, 2. Appraise suggested quality control tests based on key limits and elements, 3. Implement a DXA quality control program

#### TABLE OF CONTENTS/OUTLINE

1. Why Establish a DXA QC Program?, 2. Least Significant Change, 3. Elements of a Good QC test, 4. Types of DXA QC Tests, 4a. Cross-calibration of Machines, 5. Example QC Program, 6. Recommendations from National and International Societies

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## Abstract Archives of the RSNA, 2023

PHEE-18

### A Comprehensive Review of Ultrasound-guided Vascular Access for Residents, Fellows, and Medical Students

#### Participants

Atlee Witt, Nashville, TN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1) To detail different ultrasound techniques for vascular access 2) To explore the indications, contraindications, and potential complications of ultrasound-guided vascular access 3) To examine the utility of ultrasound-guided access for arterial, systemic venous, portomesenteric venous, and AV fistula procedures

#### TABLE OF CONTENTS/OUTLINE

1) Introduction: a) Indications for US vascular access (i. difficult or high-risk IV access ii. delivery of medications, fluids, or blood iii. diagnostic and interventional procedures) b) Relative contraindications (i. time limitations in emergent situations ii. ultrasound resolution with increasing depth iii. subcutaneous emphysema iv. volume depletion v. infection at the site of access) 2) Procedure: a) Equipment (i. ultrasound machine with high-frequency capable probe, ii. supplies for vascular access [1. IV starting kit, sterile gel, IV flushes, sterile probe cover]) b) Pre-procedure (i. consent ii. site identification and preparation) c) Technique (i. static approach ii. real-time approach [1. longitudinal approach 2. transverse or short-access approach]) d) Post-procedure (i. infection prevention) e) Complications (i. vessel puncture ii. malpositioning iii. injury to surrounding structures iv. infection) 3) Access sites: a) Artery (i. radial, brachial, femoral, and dorsalis pedis arteries) b) Systemic vein (i. internal jugular vein ii. subclavian vein iii. femoral vein) c) Portomesenteric vein (i. access to portal vein system ii. portography and portal pressure iii. embolization) d) AV fistula or graft

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## Abstract Archives of the RSNA, 2023

PHEE-19

### Would You Like to Ride the Wave Called CT Images? As a Novel Frequency Analysis Tool

#### Participants

Yoichiro Ota, RT, Yokohama, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The spatial resolution CT images is expressed by a wave so-called Modulation Transfer Function. It is difficult to associate clinical CT images with MTFs, which is confusing to interpret. This can be explained by using the proposed method Band-limited CT images. This study will lecture on the contribution of high-frequency components to the image and the interpretation of MTFs intersections.

#### TABLE OF CONTENTS/OUTLINE

The process of Band limited image is based on Fast Fourier Transformation and frequency band limitation of CT images. Each band-limited CT image can contribute to characterizing how much information is in a signal of original CT images. The inclusion of high-frequency components results in high CT value and high resolution. Even if MTFs have an intersection, The band-limited image shows the difference in the amount of information that images have. We can associate clinical CT images MTFs and interpret the feature of CT images from physical point of view.

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## Abstract Archives of the RSNA, 2023

PHEE-2

### 3D Fast Spin Echo MRI with Variable Refocusing Flip Angles: Principles, Techniques, and Applications

#### TEACHING POINTS

3D FSE MRI with variable refocusing flip angles provides high-quality images with good contrast in various clinical applications. Its speed and versatility have made it a workhorse in MRI. The purposes of this Education Exhibit are 1. Overview of 3D FSE MRI acquisition schemes and the rationale of the variable flip angle strategies. 2. Explain the constant low flip angle refocusing and Pseudo Steady State (PSS) Principle, the transitions between pseudo steady states (TRAPS) principle, Mugler's Relaxation-specific Method, and Busse's General method for refocusing flip angle modulation. 3. Discuss the common-used RF excitation techniques such as non-selective/slab-selective RF excitation, inner volume RF excitation, etc. 4. k-space view ordering. 5. Review the RF modules used for magnetization preparation and contrast optimization. 6. T1-preparation (inversion recovery), T2-preparation, magnetization transfer contrast, fat suppression, diffusion weighting, flow suppression or enhancement, etc. are discussed in detail. Clinical protocols along with representative images are given for each magnetization preparation approach. 7. Review acceleration techniques including GRAPPA, CAIPIRINHA, and compressed sensing (CS) MRI.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. The Constant Low Flip Angle Refocusing and PSS Principle; 3. The TRAPS principle; 4. Mugler's Relaxation-specific method; 5. Busse's General Method; 6. RF excitation techniques; 7. K-space view ordering; 8. Magnetization preparation and contrast optimization; 9. T1-preparation; 10. T2-preparation; 11. MTC; 12. Fat suppression; 13. Diffusion weighting; 14. Flow suppression and enhancement; 15. Acceleration techniques.

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## Abstract Archives of the RSNA, 2023

PHEE-20

### Photon-Counting Detector CT in Comparison to Energy-Integrating Detector CT: Optimization and Implementation of a Non-contrast Enhanced Chest Protocol for All Patient Sizes

#### Participants

Danielle Vialle, MSc, Den Haag, Netherlands (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

o To demonstrate how to measure the diagnostic image quality (IQ) of a photon-counting detector (PCD) CT protocol  
o To learn how to assess and evaluate IQ of a PCD-CT protocol compared to energy-integrating detector (EID) CT  
o To provide tips and learn how to adjust the imaging protocol for a specific task and patient size

#### TABLE OF CONTENTS/OUTLINE

With the introduction of PCD-CT in clinical practice, question rises how the IQ relates to the IQ of EID-CT scanners, and what the possibilities are for further dose reduction and/or image quality improvements. This exhibit provides you with knowledge on how IQ could be determined and evaluated by objective and subjective measures.

- o What is image quality and how can it be evaluated?
- Objective IQ quantified by noise, contrast, resolution and combined into the detectability index ( $d'$ )
- Subjective IQ assessed by radiologists with 5-point Likert Scale
- o Effect on IQ and dose (phantom study examples)
- Determination of your site reference standard
- Determination of differences in scan and reconstruction parameters between scanners (EID-CT and PCD-CT)
- Influence of scan and reconstruction parameters
- Effect of differences in patient size
- Effect of dose adjustment
- o Guidelines on protocol adaptation
- How to find the right balance between IQ and dose
- Tips and tricks in adaptation of current EID- and PCD-CT protocols
- Tips for utilizing the full potential of a PCD-CT

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## Abstract Archives of the RSNA, 2023

PHEE-21

### Radiation Protection Essentials for Interventional Radiology Workers

#### Participants

Koichi Chida, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-To understand the present status of medical interventional radiology (IVR) occupational radiation protection/shielding.-To understand the advantages/disadvantages of various radiation-shielding equipment.-To understand current protection/reduction methods and identify methods to improve these methods.-To understand the necessity of combining various reduction methods (tools) to reduce occupational radiation—shielding is only one such component.-To understand that the methods used to reduce the patient radiation dose are the same as the methods employed to reduce staff doses.

#### TABLE OF CONTENTS/OUTLINE

Advantages/disadvantages of various shielding devices. There is no perfect device! Relationship between the patient radiation dose and medical worker exposure. Physician-received scattered radiation during IVR was strongly correlated with the patient dose. Therefore, reduction of the patient dose will decrease the staff dose. Outline The regulation dose limit is seldom exceeded when protection is appropriate. However, radiation injuries such as cataracts have recently been reported in physicians and staff who perform IVR. There is no perfect shield. Combinations of shields are required. Radiology workers must be appropriately educated in terms of reducing the radiation exposure among both patients and staff; such workers must understand the various methods used to estimate occupational exposure. Decreasing the patient dose reduces occupational exposure. Although shielding is critical, it is only one component of radiation protection. Patient dose optimization means that the patient never receives a higher dose than is necessary, which also reduces the dose received by the staff.

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## Abstract Archives of the RSNA, 2023

PHEE-22

### Fluoroscopy: An Overview and Refresher for Radiologists

#### TEACHING POINTS

Note to reviewer: this submission is in response to the call of Dr. Christine Cooky Menias for a Physics educational exhibit on Fluoroscopy.1. Provide an introduction to fluoroscopy and its history.2. Describe the major components of a fluoroscopy system.3. Explore principles and techniques, with a focus on image quality and radiation dose.4. Discuss clinical applications across multiple subspecialties in diagnostic and interventional radiology.5. Identify similarities and differences between projection radiography and fluoroscopy

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to Fluoroscopy and Historya. Invention, early uses, evolution, current state of the art2. Major Components of a Fluoroscopy Systema. Imaging chain from x-ray tube to control consoleb. Image intensifier and flat panel detector systems3. Principles and Techniquesa. Continuous vs. pulsed fluoroscopyb. Automatic brightness controlc. Last-image holdd. Factors influencing image quality and radiation dose4. Clinical Applications Across Subspecialtiesa. Pediatric radiology, body imaging, neuroradiology, musculoskeletal radiology, thoracic radiologyb. Interventional radiology5. Comparing Projection Radiography and Fluoroscopya. Nomenclatureb. Image formation and technologyc. Location and mobility differencesd. Target, filter, and grid similarities and differencese. Continuous exposure vs. pulsatile exposuref. Radiation dose and exposure considerations6. Radiation Protection in Fluoroscopya. Stochastic and deterministic effectsb. Radiation safety for patientsc. Radiation safety for personnel

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## Abstract Archives of the RSNA, 2023

PHEE-23

### Automated Evaluation of Radiograph Accuracy Using Deep Learning With Explainable Artificial Intelligence

#### TEACHING POINTS

In radiography, it is vital to maintain precise positioning to guarantee consistent image reproducibility. However, the decision to retake a radiograph is the responsibility of the supervising radiological technologists, whose evaluation methods are subjective. With the development of artificial intelligence (AI), deep learning is effectively used to guarantee the accuracy of radiographs. The focus of this study is to develop a deep learning-based automated quantitative evaluation method for radiography. It can guarantee the quality of radiographs and provide useful information for retaking radiography. Furthermore, explainable AI was utilized to determine the typical sources of information that AI relies on when making decisions. Analyzing data from the explainable AI could facilitate enhancements to the network's architecture. The major teaching points of this exhibit are to: 1. Evaluate automatically the radiograph accuracy. 2. Understand how to classify schemes using deep learning. 3. Clarify the typical sources of information that AI relies on when making decisions using explainable AI.

#### TABLE OF CONTENTS/OUTLINE

To provide automated quantitative evaluation of radiograph accuracy using deep learning with explainable artificial intelligence and to discuss clinical usefulness toward an accurate diagnosis in radiography. To reduce variability in individual assessments and achieve a quantitative index. Ultimately, the aim is to reveal the network structure using explainable AI in order to construct an appropriate network.

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## Abstract Archives of the RSNA, 2023

PHEE-24

### Don't Get Burned: Hot Topics in MRI Safety

#### TEACHING POINTS

Note to reviewer: this submission is in response to the call of Dr. Christine Cooky Menias for a Physics educational exhibit on MRI Safety. This educational exhibit provides a comprehensive overview of MRI safety for radiologists. It covers foundational principles, safety zones, personnel and patient screening, handling of special cases, and emergency procedures. The importance of continuous learning and adherence to guidelines by regulatory bodies is emphasized. Case studies and scenarios supplement the understanding of topics and foster application of knowledge.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction • Safety Ethics in MRI • Importance of MRI Safety  
2. Understanding the MRI Environment • Safety Zones • MRI Zone Protections  
3. Staff and Patient Considerations • Personnel Screening • Patient Screening • Special Case: Inability to Obtain Consent  
4. MRI Hazards • Radiofrequency (RF)-Induced Heating • Metallic Foreign Bodies • Medical Implants • Quenching in MRI  
5. Safety Guidelines and Emergency Procedures • MRI Safety Guidelines and Standards • Emergency Procedures in MRI  
6. Case Studies and Scenarios • Case Studies: Stents, Pacemakers, Pregnant Patient, Unconscious Patient • Safety Scenarios and Answers  
7. Special Topics in MRI Safety • High Field Strength Magnets • MRI and Pregnancy

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## Abstract Archives of the RSNA, 2023

PHEE-25

### Super-resolution Deep Learning Reconstruction of MR Imaging: Technical Features and Clinical Impact on Abdominal and Pelvic MR Imaging

#### Participants

Atsushi Nakamoto, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Deep learning reconstruction (DLR) has recently been introduced by several vendors to improve MR image quality by reducing image noise. Super-resolution deep learning reconstruction (SR-DLR) is a newly developed MR image reconstruction method that not only reduces image noise but also improves spatial resolution. SR-DLR is expected to provide even higher image quality and improved diagnostic performance compared to DLR. The aims of this exhibit are: 1. To illustrate the technical features of SR-DLR, 2. To discuss the image quality of MR imaging using SR-DLR, and 3. To discuss the clinical impact on MR studies in the diagnosis of abdominal and pelvic disease.

#### TABLE OF CONTENTS/OUTLINE

1. Overview 2. Principle of SR-DLR 3. Sequences applicable to SR-DLR: fast spin echo T2WI, single-shot fast spin echo T2WI, DWI, steady-state free precession (SSFP), 3D T1-weighted gradient-echo with or without contrast enhancement, etc. 4. Effective reduction of image noise with SR-DLR 5. Improved spatial resolution with SR-DLR 6. Differences in image quality and spatial resolution from the conventional image reconstruction technique and DLR 7. Clinical impact on the diagnosis of abdominal diseases (liver, biliary tract, and pancreas) 8. Clinical impact on the diagnosis of pelvic diseases (uterus, ovaries, prostate, bladder, and rectum) 9. Summary

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## Abstract Archives of the RSNA, 2023

PHEE-26

### Optimal Acquisition and Reconstruction Techniques of Coronary CT Angiography: Current Status and Trends Over the Past Decade

#### Participants

Rika Fukui, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To introduce recent technological developments in coronary CT angiography (CCTA); 2) To describe optimal acquisition and reconstruction techniques in CCTA based on these developments; 3) To illustrate clinical utilities of these techniques in CCTA by presenting various clinical data and images.

#### TABLE OF CONTENTS/OUTLINE

1) Recent technological developments in CCTA (a) Hardware: high-output/fast-rotating x-ray tube, high-definition/ultra-high-resolution CT (HD/UHRCT), area-detector CT (ADCT), dual-source CT (DSCT), dual-energy CT (DECT); (b) Software: automatic selection of optimal acquisition parameters/cardiac phase (Auto gating/Smart phase), motion correction algorithm (MCA), iterative/deep learning reconstruction (IR/DLR). 2) Optimal acquisition and reconstruction techniques in CCTA (a) HD/UHRCT, DECT vs. coronary artery calcification/stent; (b) Fast-rotating x-ray tube, DSCT, Smart phase, MCA: motion artifact reduction; (c) ADCT: misalignment (banding/stair-step) artifact reduction; (d) Low kV acquisition by high-output x-ray tube, Auto gating, IR/DLR: radiation dose reduction; (e) Low kV acquisition by high-output x-ray tube, DECT vs. poor contrast; (f) Auto gating, Smart phase, MCA: workflow improvement; (g) DECT: detailed coronary plaque assessment. 3) Clinical utilities of these techniques in CCTA (a) Better image quality/interpretability/diagnostic accuracy/workflow; (b) Lower radiation/contrast media dose.

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## Abstract Archives of the RSNA, 2023

PHEE-27

### Low kV or Low keV, That Is the Question: What the Radiologist and Radiology Technologist Need to Know in Contrast-Enhanced Body CT With Current and Novel Technologies

#### Participants

Haruhiko Machida, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To introduce basic principles and clinical usefulness of single-energy CT (SECT) at low tube voltage (kV)/virtual monochromatic imaging (VMI) at low energy (keV) by dual-energy CT (DECT) in contrast-enhanced body CT; 2) To illustrate factors affecting image quality (IQ) of SECT at low kV/VMI at low keV and current and novel technologies for improving the IQ; 3) To demonstrate strategies to determine the optimal imaging option.

#### TABLE OF CONTENTS/OUTLINE

1) Basic principles clinical usefulness of SECT at low kV/VMI at low keV (a) Basic principles: SECT/DECT/VMI; (b) Clinical usefulness: improved contrast enhancement/reduced iodine load/reduced radiation dose (for SECT)/reduced beam-hardening (BH) metallic artifact (for DECT)/flexible keV selection (for DECT)/improved material decomposition (MD) various DECT-specific imaging/analysis options (for DECT).2) Factors affecting IQ of SECT at low kV/VMI at low keV technologies for improving the IQ (a) IQ factors: CT value/image noise/contrast-noise ratio/spatial resolution/BH metallic artifact; (b) Current novel technologies: high output x-ray tube/kV mA synchronized switching/highly efficient detector/iterative deep-learning reconstruction/metallic artifact reduction software.3) Strategies to determine the optimal imaging option (a) Better spatial resolution for SECT; (b) Better image contrast/less BH metallic artifact/better MD for DECT.

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## Abstract Archives of the RSNA, 2023

PHEE-28

### Development of 3D Performance Phantom in UHR-CT (Evaluation of MPR, MIP, VR and VE images)

#### Participants

Katsumi Tsujioka, RT, Toyota-city, Japan (*Presenter*) Researcher, Canon Medical Systems Corporation

#### TEACHING POINTS

We report on the new phantom to evaluate the 3D performance. Its name is "Spiral Micro Holes Phantom". This phantom is made of an acrylic cylinder with 40mm diameter. We used two types of phantoms. Phantom A has holes with diameter of 0.5mm and phantom B has holes with diameter of 0.3mm. CT scans were performed with the long axis of phantom placed parallel to the X-Y plane of the CT system. For the experiment, we used a conventional CT system and an ultra-high-resolution CT (UHR-CT) system. The multi planar reconstruction (MPR), maximum intensity projection (MIP), volume rendering (VR), and virtual endoscopy (VE) were performed on the obtained volume data, and the displaying of the holes in each direction was studied. In the MIP image, since the air layer of the acrylic pillar is detected, the comparison between the X-Y plane to the Z axis was performed accurately. VR, VE and curved MPR were able to be evaluated continuously from the X - Y plane to the Z axis. In clinical image diagnosis, MPR, MIP, VR and VE are performed for each case. Evaluation by Spiral Micro Holes Phantom is also useful for explaining the characteristics of each display method to the radiologist.

#### TABLE OF CONTENTS/OUTLINE

(1) What is 3D performance (2) Development of Spiral Micro Holes Phantom (3) Development of evaluation method (MPR, MIP, VR and VE images) (4) Experiment using phantom (Positioning and scan) (5) Conclusion and clinical use (For example, CT colonography and CT angiography)

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## Abstract Archives of the RSNA, 2023

PHEE-29

### Will That X-Ray Harm My Unborn Child?" - A Meta-Analysis of Fetal Health Effects Indicates Very Low Risk to Fetus Following Occupational Exposure of Pregnant Interventional Physicians

#### Participants

Jelena Mihailovic, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

For our interventional physicians with proper radiation safety practices, fetal radiation dose is predicted to be <4 mGy per term. Compared with known risk of childhood disorders, the predicted risk of cancer following fetal occupational radiation exposure is very low.

#### TABLE OF CONTENTS/OUTLINE

Concern of radiation-induced fetal health effects deters women from entering interventional practices. If proper radiation safety practices are applied, radiation dose to the fetus is expected to be <4mGy per term for physician performing interventional fluoroscopy procedures. In this work we compared predicted risk of early childhood cancer from in-utero fetal radiation exposure to risks associated with maternal BMI, age, and hormonal therapy. We performed random effect meta-analysis of 15 studies (1970-2020) investigating early childhood cancer following in-utero exposure from 0.3 to 1000 mGy. The natural incidence of early childhood cancer is ~0.3%. Linear no-threshold model fit to the meta-analysis predicted cancer HR of 1.01 (incremental risk 0.003%) for fetal dose 4 mGy. The natural incidence of childhood disorder is 1.3%. Maternal BMI of =30kg/m<sup>2</sup>, age >35yrs, or hormonal therapy were associated with HR in the range 1.14-1.40 [95% CI 0.99-1.75]. The predicted risk of childhood cancer following fetal occupational radiation exposure is very low compared with other fetal risks.

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## Abstract Archives of the RSNA, 2023

PHEE-3

### ChatGPT in Medical Physics: What You Need to Know

#### Participants

Jie Zhang, PhD, Lexington, KY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Learn the basics of ChatGPT and its potential applications in medical physics 2. Identify the types of questions ChatGPT can answer, such as those related to radiation safety, imaging protocols, and quality assurance 3. Understand how to integrate ChatGPT with existing systems, such as quality assurance programs, to improve efficiency and accuracy 4. Discuss the limitations of ChatGPT and ethical considerations 5. Recognize the importance of training and validating ChatGPT, including the need to continually update its knowledge base and monitor its performance over time

#### TABLE OF CONTENTS/OUTLINE

Since its introduction in November 2022, ChatGPT has become a topic of discussion across various fields, including medicine. A literature search using the keyword ChatGPT on PubMed yielded 340 results as of April 30, 2023, with 335 published in the first four months of 2023. As this number continues to grow, medical physicists may be curious about the potential applications of ChatGPT in their field. This education provides a comprehensive review of ChatGPT and its potential applications in medical physics, along with other relevant considerations. The content is organized as follows: 1. An overview of ChatGPT and its potential applications in Medical Physics 2. Types of questions ChatGPT can answer, including radiation safety, imaging protocols, and quality assurance 3. Integration of ChatGPT with existing systems to improve efficiency and accuracy 4. Limitations of ChatGPT and ethical considerations 5. Continued training and validation of ChatGPT to maintain accuracy and relevance over time.

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## Abstract Archives of the RSNA, 2023

PHEE-30

### How Should We Set Tube Voltage for Pediatric Cardiac CT Examination Using Photon-Counting CT?: A Phantom Study

#### Participants

Junya Nakamura, BS, Okayama-Shi, Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) We explain the proper tube voltage setting during a pediatric cardiac CT based on the image quality analysis and exposure dose evaluation. 2) The photon-counting CT scanner can always derive the virtual monoenergetic image (VMI) and high contrast can be obtained by applying lower energy VMI. In addition, using energy integrated image (T3D) at low tube voltage can also create high contrast image. 3) The operator should take into consideration not only exposure dose inside the scanning range but also that outside the range.

#### TABLE OF CONTENTS/OUTLINE

1) Explanation of VMI and T3D image obtained by photon counting CT. When the high tube voltage is used, image contrast can be adjusted based on the reconstruction energy of VMI. On the other hand, low tube voltage has been historically applied to pediatric cardiac CT scans. 2) Comparison of image quality of low and high tube voltages. When the same CTDIvol was set for each tube voltage, the image quality was similar trend. 3) A key issue in selecting the tube voltage. The scattered X-rays increase when using high tube voltage, therefore the dose outside the scanning region needs to be considered. 4) Experimental results of dose measurement. When the low tube voltage was adopted, the dose outside the scanning region was reduced. 5) What the operator should know how to determine tube voltage for pediatric cardiac CT.

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## Abstract Archives of the RSNA, 2023

PHEE-4

### What You Should Know About CT NCLSC Radiomics: Uncertainties in Data Preparation, Feature Extraction, Feature and Model Selection, and Outcomes

#### TEACHING POINTS

1. Provide overview of radiomics workflow and key components related to inconsistent outcomes 2. Examine data types appropriate for inclusion in effective model training, e.g., high-order, low-order, clinical 3. Learn key aspects of cohort selection for robust models 4. Provide overview of common feature selection methods and predictive models used in literature and their use in different clinical endpoints, e.g., classification and prognosis 5. Understand uncertainty of feature selection methods and predictive models during implementation 6. Provide relative performance of aforementioned teaching points based on actual study outcomes

#### TABLE OF CONTENTS/OUTLINE

In radiomics, key components include but are not limited to data quality, feature extraction, feature and model selection, and training/validation. Based on our recent review of more than 160 published papers there is a current emphasis on data quality and feature reproducibility, however, feature and model selection are not yet well defined. In this education exhibit, we provide a review of feature and model selection methods and their effects on outcomes as well as findings from our systemic evaluation of radiomic feature selection and predictive models. The content is organized as follows: 1. Describe the radiomics workflow in clinical studies 2. Overview commonly used feature selection methods and predictive methods 3. Show feature selection method and predictive model selection for different end-points 4. Familiarize sources of uncertainty from feature selection and predictive models in study design

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## Abstract Archives of the RSNA, 2023

PHEE-5

### The Echo Chamber: Unraveling the Mysteries of Spin Echo and Gradient Echo MRI Pulse Sequences

#### TEACHING POINTS

MRI sequences and their clinical utility can be difficult to keep track of, particularly for radiology residents and trainees. Understanding the underlying properties of MRI sequences and their image contrast is critical for proper diagnosis. Additionally, understanding the differences between various spin echo and gradient echo sequences is critical for the evaluation of images and for future optimization and design. Once learned, the clinical applications of these techniques are critical for training of radiology and medical physics residents.

#### TABLE OF CONTENTS/OUTLINE

1. Basic Pulse Sequence Tenetsa. Review of MRI signal and T1, T2 and T2\* relaxation times.b. Review of basic pulse sequence block including TE and TR2. Review of Basic Spin Echo and Gradient Echo Sequences a. Basic pulse sequence block for spin and gradient echo sequencesb. Comparison of spin echo to fast spin echo sequences and effects on image qualityc. Comparison between bSSFP and RF spoiled sequences and their tradeoffsd. Introduction of inversion prepared sequences (STIR, FLAIR)3. Clinical Applications of FSE, bSSFP, and RF spoiled sequencesa. Clinical examples of FSE sequences- T1 weighted FSE of osteosarcoma- T2 weighted FSE of oligodendrogliomab. Clinical examples of gradient echo sequences- bSSFP of multicystic mass in heart- bSSFP in abdomen and B0 artifacts- FLASH imaging in the abdomen- FLASH T2w imaging in the brain, including gliomas- Susceptibility T2\* imaging of brainc. Clinical examples of inversion prepared sequences- STIR imaging of spine- FLAIR imaging of multiple sclerosis

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## Abstract Archives of the RSNA, 2023

PHEE-6

### Impact of Reconstruction Field of View, Matrix Size, and Kernel on Spatial Resolution of Photon Counting CT

#### Participants

Zhongxing Zhou, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Limited by pixel size (determined by reconstruction FOV and matrix size), the visual spatial resolution on clinical images is often below that allowed by the acquisition geometry and reconstruction kernel. 2. Use of an ultra-sharp kernel without considering the combined effect of pixel size, noise, visual and system spatial resolution may lead to suboptimal image quality. 3. For a given CT acquisition and reconstruction kernel, there is a threshold pixel size, above which the visual spatial resolution will be sacrificed. 4. Dramatically increased image noise associated with small pixel size and high-resolution reconstruction kernels may be controlled using deep-learning-based noise reduction methods.

#### TABLE OF CONTENTS/OUTLINE

1. Describe difference between system limit spatial resolution and visual spatial resolution on images: 1). System limit spatial resolution is determined by the CT acquisition geometry and reconstruction kernel. It is often measured and quantified using pre-sampling modulation transfer function. 2). Visual spatial resolution is affected by pixel size in addition to the system limit spatial resolution. 2. Explain how pixel size (determined by reconstruction FOV and matrix size) and reconstruction kernel affect the visual spatial resolution in images and provide a guide on how to determine reconstruction kernel and pixel size. 3. Demonstrate the combined effect of pixel size, matrix size, reconstruction FOV and kernel using clinical image examples. 4. Demonstrate benefit of deep-learning-based noise reduction to improve visual spatial resolution.

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## Abstract Archives of the RSNA, 2023

PHEE-7

### The Physics and Clinical Considerations of Radionuclide Therapy

#### TEACHING POINTS

1. Review the physical properties of different modes of radionuclide decay and their relevant clinical applications. 2. Discussion production of radioisotopes and radiopharmaceuticals, and the radiation biophysics that result in tumor cell death and DNA damage. 3. Discuss the physical properties of various radioisotopes used in therapy, as well as emerging clinical applications, and clinical considerations. 4. Describe the management considerations regarding dose limiting properties and off-target biological effects associated with radionuclide therapies. 5. Review patient and general public safety considerations for radiation emitted by patients after discharge.

#### TABLE OF CONTENTS/OUTLINE

1. Physics - Types of radionuclide decay and Linear Energy Transfer- Review of radioisotope production 2. Biological Effects- Principles of radiotherapy- Ionizing radiation effects (Direct and Indirect Effects)- Implications for treatment 3. Dosimetry - how to perform and clinical importance 4. Review current and future Radioisotopes and Radiopharmaceuticals- Production, logistics, clinical administration/dosing 5. Radiation Safety- Spillage considerations- Precursors to patient discharge, dosage to general public

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## Abstract Archives of the RSNA, 2023

PHEE-8

### I Want You To Improve My Abdominal MRI Quality

#### Participants

Martin Horwarth, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1 - In an interactive form of a quiz, be able to identify magnetic resonance (MR) artifacts on abdominal studies and how to avoid them if needed.2 - Be able to recognize unwanted MR artifacts or imaging errors, especially the ones that can lead to erroneous reports.3 - Understand the sources of these imaging artifacts.4 - Improve radiologists' and technicians' knowledge of MR physics regarding abdominal imaging with practical cases.

#### TABLE OF CONTENTS/OUTLINE

1 - Introduction on MR physics, imaging errors and what are some imaging artifacts that we do need.2 - A series of interactive cases with questions. The first question on how to identify the imaging error.3 - The answer is followed by an explanation about the physics of the error and why they occur.4 - Divide these artifacts and imaging errors into the ones we can change and the ones we can not.5 - Those avoidable artifacts are followed by another question on how to do so.6 - Explanation on how to avoid or minimize artifacts.7 - Summary and take home notes.

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## Abstract Archives of the RSNA, 2023

PHEE-9

### Multilingual Nuggets or Snippets: Microlearning Video Lessons on CT Radiation Dose Optimization

#### Participants

Lina Karout, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Using author-created, multilingual microlearning video lessons, we empower the audience on keys aspects of CT radiation dose optimization with the understanding of 1. Justification 2. Indication-driven CT protocols 3. Optimum acquisition parameters 4. Dose metrics and monitoring 5. Diagnostic reference levels (DRLs)

#### TABLE OF CONTENTS/OUTLINE

We will use several author-created microlearning videos to describe the learning objectives. Each video will be created in three languages (English, Spanish, and Portuguese) with voice and subtitles. The videos will bring real-world examples to help the audience understand the critical aspects of radiation dose optimization in CT. Pre and post short 5 questionnaire will be applied before and after the educational activity. All content will be released online for free open access following the RSNA presentation. The videos will be based on recommendations based on IAEA, ACR and international validated documents.

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## Abstract Archives of the RSNA, 2023

ROEE

### Radiation Oncology Education Exhibits

#### Sub-Events

#### ROEE-1 Artificial Intelligence for Detecting Interstitial Lung Disease in Radiation Therapy

##### Participants

Sonja Kandel, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Every patient planned for Radiation Therapy (SBRT) must have a CT available for treatment field contouring. 2. The presence of Interstitial Lung Disease (ILD) can be detected on these CTs 3. Reviewing CTs performed for treatment planning is labour-intensive and may cause delays in treatment planning 4. The presence of ILD puts patients at a significantly higher risk of radiation pneumonitis (increased lung toxicity) 5. The use of an automated ILD detection algorithm improves workflow and helps detect patients with high-risk for radiation pneumonitis

##### TABLE OF CONTENTS/OUTLINE

1. Training the AI was performed on 4393 historical patient CTs performed for treatment planning (ethics board approval was obtained, the requirement for consent was waived). In this cohort, 1366 patient CTs showed the presence of interstitial lung disease. 2. Validation in 537 patients. 3. Prospective testing: After go-live, 111 patients have been screened by the AI so far, 15 patients have been flagged by the AI for suspected lung changes indicative for ILD 4. Automated e-mail notification to the treating radiation oncologist under an ongoing quality improvement ethics framework 5. Two patients were caught by the AI with ILD previously unknown to the radiation oncologist 6. Conclusion: An AI-based screening tool for ILD in planning CTs for SBRT may help detect patients with unknown ILD who would otherwise undergo treatment with an increased risk of radiation pneumonitis

#### ROEE-2 More than Skin Deep: Imaging of Dermatologic Disease in the Head and Neck

##### Participants

Cameron Overfield, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

1. Radiologist should be aware of the current trends and guidelines for cutaneous malignancies. After reviewing this presentation, the audience will understand the basics of the different treatment modalities and the major decision pathways available to patients and clinicians. 2. The skin is the largest organ of the human body and present on every radiologic exam. The audience learn how to report pertinent findings, both positive and negative, to the referring clinician as well as recommend the appropriate imaging modality to properly stage a cutaneous malignancy. 3. The audience will be presented with gross images and comparison radiologic exams of both primary and recurrent cutaneous malignancies. The Radiologist should be able to distinguish normal post-treatment changes from findings would prompt further investigation.

##### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Teaching Points and Target Audience 3. Decision-points for Surgical, Systemic, and Radiation therapies a. Surgical techniques b. Systemic therapies (immuno- and chemotherapy) c. Radiation therapy 4. The Role of Imaging for Cutaneous Malignancies a. When should imaging be considered? b. What is the modality of choice? c. What are the goals of imaging? d. How does imaging guide management or treatment options? 5. What the Dermatologist wants to know a. Checklist of pertinent positive and negative findings b. Lesion extent, size, perineural invasion, osseous spread, dermal spread, and metastatic nodal disease 6. Follow-up after treatment a. When to image for recurrence? b. What are the major risk factors for recurrence? (Perineural spread on initial histopathology) 7. Conclusion 8. References

#### ROEE-3 Protect Your Heart and Lungs - Usefulness of Left Side Breast Radiotherapy Using Deep Inspiration Breath Hold Technique

##### TEACHING POINTS

Radiation therapy for postoperative breast cancer significantly reduces intra breast recurrence and improves survival. However, adverse events in normal tissues such as the heart and lungs due to left side breast radiotherapy is a problem. The use of deep inspiration breath hold for left side breast radiotherapy can significantly reduce cardiac and pulmonary doses compared with free breathing treatment.

##### TABLE OF CONTENTS/OUTLINE

Radiation therapy for postoperative breast cancer has been shown to significantly reduce breast recurrence and improve survival. However, adverse events such as pericarditis, myocardial infarction, ischemic heart disease, and pneumonia are problems with left side breast radiotherapy. Left side breast radiation therapy should strive to minimize the dose delivered to the heart and lungs. Deep inspiration breath hold irradiation is a method to reduce the exposure dose to the heart and lungs. The treatment plans were compared from deep inspiration breath hold and free breathing CT images of 36 patients who underwent left side breast radiotherapy. Deep inspiration breath hold radiotherapy performed better than free breathing in most categories. It is useful to use



deep inspiration breath hold technique for radiotherapy after left breast cancer surgery. When performing radiation therapy after surgery for left side breast cancer, it is important to obtain CT images of both deep inspiration breath hold and free breathing to create a treatment plan and compare the results.

#### **ROEE-4 Imaging Features of Anal Carcinoma after Chemoradiation**

Participants

Kyungmin Kim, BMBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Anal cancer is a rare type of cancer primarily treated with chemoradiation. Surgical resection can be considered for residual or recurrent anal canal tumors in suitable patients after chemoradiation. Early salvage surgery is associated with better outcomes. Clinical examination after chemoradiation is often limited by canal stenosis and pain. Therefore, radiological surveillance with pelvic MR and PET-CT plays a fundamental role in assessment of both local treatment response and presence of distant metastasis. Imaging features post-treatment include: Resolution of tumor; Stereotypical patterns of fibrosis; Tumor necrosis/post-treatment inflammation; and Viable tumor residuum or recurrence. It can be challenging to differentiate post-treatment changes from tumor residuum or recurrence. It is important to recognize and differentiate imaging features of incomplete response/recurrence from other post-treatment changes, such that early and timely salvage surgery can be offered to patients.

#### **TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Treatment options for anal cancer  
2.1 Chemoradiation therapy  
2.2 Surgery  
3. Methods of monitoring treatment response  
3.1 Clinical examination  
3.2 Contrast enhanced CT  
3.3 Pelvic MR  
3.3.1 Recommended sequences  
3.4 PET-CT  
4. Imaging appearance of anal cancer after chemoradiation  
4.1 Complete resolution  
4.2 Fibrosis  
4.3 Residual disease  
4.4 Frank progression  
4.5 Pearls and pitfalls  
4.5.1 Tram-track sign  
4.5.2 Pseudotumor  
4.5.3 Post-treatment mucositis  
4.5.4 MR correlation with PET-CT  
5. Summary

#### **ROEE-5 Application of CT Energy Spectrum Curve and Iodine Base Map in Differential Diagnosis of Different Pathological Types of Urinary Tract Tumors**

#### **TEACHING POINTS**

1) Urethral tumor is relatively rare, which is easy to be missed and misdiagnosed clinically.  
2) Energy spectrum CT can convert different single energies, so as to obtain the image with the lowest noise, the best tissue structure contrast, and the clearest anatomical details.  
3) Energy spectrum CT low-energy image can effectively eliminate the problem of hardening artifacts that cannot be solved by conventional CT scanning, and overcome the shortcomings of mixed energy image.  
4) Energy spectrum CT separates each energy level to form a CT value change curve under different keV conditions. Different tissues and diseases have different energy spectrum curves.

#### **TABLE OF CONTENTS/OUTLINE**

1) Urinary tract tumors are mostly malignant, and their pathological types include squamous cell carcinoma, transitional cell carcinoma, adenocarcinoma, clear cell carcinoma, leiomyoma, hemangioma, malignant melanoma and other pathological types. At present, the clinical differentiation of urinary tract tumors mainly depends on a series of invasive examinations such as ureteroscopy biopsy.  
2) According to the comparison of energy spectrum curve, it is helpful for us to determine the pathological type and compare whether there is homology or difference between lesions, so as to determine the depth of invasion of lesions and whether the metastatic lesions are homologous.  
3) The iodine density map separated from the energy spectrum CT can also accurately reflect the absorption of iodine contrast agent by the tumor, that is, the blood supply; at the same time, it can accurately analyze tumor angiogenesis and hemodynamics.

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## Abstract Archives of the RSNA, 2023

ROEE-1

### Artificial Intelligence for Detecting Interstitial Lung Disease in Radiation Therapy

#### Participants

Sonja Kandel, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Every patient planned for Radiation Therapy (SBRT) must have a CT available for treatment field contouring. 2. The presence of Interstitial Lung Disease (ILD) can be detected on these CTs 3. Reviewing CTs performed for treatment planning is labour-intensive and may cause delays in treatment planning 4. The presence of ILD puts patients at a significantly higher risk of radiation pneumonitis (increased lung toxicity) 5. The use of an automated ILD detection algorithm improves workflow and helps detect patients with high-risk for radiation pneumonitis

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## Abstract Archives of the RSNA, 2023

ROEE-2

### More than Skin Deep: Imaging of Dermatologic Disease in the Head and Neck

#### Participants

Cameron Overfield, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Radiologist should be aware of the current trends and guidelines for cutaneous malignancies. After reviewing this presentation, the audience will understand the basics of the different treatment modalities and the major decision pathways available to patients and clinicians. 2. The skin is the largest organ of the human body and present on every radiologic exam. The audience learn how to report pertinent findings, both positive and negative, to the referring clinician as well as recommend the appropriate imaging modality to properly stage a cutaneous malignancy. 3. The audience will be presented with gross images and comparison radiologic exams of both primary and recurrent cutaneous malignancies. The Radiologist should be able to distinguish normal post-treatment changes from findings would prompt further investigation.

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## Abstract Archives of the RSNA, 2023

ROEE-3

### Protect Your Heart and Lungs - Usefulness of Left Side Breast Radiotherapy Using Deep Inspiration Breath Hold Technique

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Radiation therapy for postoperative breast cancer significantly reduces intra breast recurrence and improves survival. However, adverse events in normal tissues such as the heart and lungs due to left side breast radiotherapy is a problem. The use of deep inspiration breath hold for left side breast radiotherapy can significantly reduce cardiac and pulmonary doses compared with free breathing treatment.

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## Abstract Archives of the RSNA, 2023

ROEE-4

### Imaging Features of Anal Carcinoma after Chemoradiation

#### Participants

Kyungmin Kim, BMBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Anal cancer is a rare type of cancer primarily treated with chemoradiation. Surgical resection can be considered for residual or recurrent anal canal tumors in suitable patients after chemoradiation. Early salvage surgery is associated with better outcomes. Clinical examination after chemoradiation is often limited by canal stenosis and pain. Therefore, radiological surveillance with pelvic MR and PET-CT plays a fundamental role in assessment of both local treatment response and presence of distant metastasis. Imaging features post-treatment include: Resolution of tumor; Stereotypical patterns of fibrosis; Tumor necrosis/post-treatment inflammation; and Viable tumor residuum or recurrence. It can be challenging to differentiate post-treatment changes from tumor residuum or recurrence. It is important to recognize and differentiate imaging features of incomplete response/recurrence from other post-treatment changes, such that early and timely salvage surgery can be offered to patients.

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4.5.3 Post-treatment mucositis  
4.5.4 MR correlation with PET-CT  
5. Summary

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## Abstract Archives of the RSNA, 2023

ROEE-5

### Application of CT Energy Spectrum Curve and Iodine Base Map in Differential Diagnosis of Different Pathological Types of Urinary Tract Tumors

#### TEACHING POINTS

1) Urethral tumor is relatively rare, which is easy to be missed and misdiagnosed clinically. 2) Energy spectrum CT can convert different single energies, so as to obtain the image with the lowest noise, the best tissue structure contrast, and the clearest anatomical details. 3) Energy spectrum CT low-energy image can effectively eliminate the problem of hardening artifacts that cannot be solved by conventional CT scanning, and overcome the shortcomings of mixed energy image. 4) Energy spectrum CT separates each energy level to form a CT value change curve under different keV conditions. Different tissues and diseases have different energy spectrum curves.

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1) Urinary tract tumors are mostly malignant, and their pathological types include squamous cell carcinoma, transitional cell carcinoma, adenocarcinoma, clear cell carcinoma, leiomyoma, hemangioma, malignant melanoma and other pathological types. At present, the clinical differentiation of urinary tract tumors mainly depends on a series of invasive examinations such as ureteroscopy biopsy. 2) According to the comparison of energy spectrum curve, it is helpful for us to determine the pathological type and compare whether there is homology or difference between lesions, so as to determine the depth of invasion of lesions and whether the metastatic lesions are homologous. 3) The iodine density map separated from the energy spectrum CT can also accurately reflect the absorption of iodine contrast agent by the tumor, that is, the blood supply; at the same time, it can accurately analyze tumor angiogenesis and hemodynamics.

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## Abstract Archives of the RSNA, 2023

VAEE

### Vascular Imaging Education Exhibits

#### Sub-Events

#### **VAEE-1 Hepatic Vascular Pathology: A Journey From the Hilum to the Cava**

##### Participants

Ignacio De Garcillan, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Review hepatic vascular anatomy. Revise most common anatomic variants. Understand most frequent pathology.

##### TABLE OF CONTENTS/OUTLINE

The liver has a double vascular supply through the portal vein and the hepatic artery. The drainage takes place into the hepatic veins and inferior vena cava. In this poster, pathology that can affect these vascular structures will be reviewed and illustrated with different cases from our hospital. The portal vein and its branches are involved in the main hepatic vascular pathologies. Portal vein thrombosis is one of the most common vascular complications. It can be acute or chronic and produced by bland, tumoral or infected thrombus (thrombophlebitis). Thrombosis can lead to cavernomatous transformation, portal hypertension and portosystemic collateral channels. Understanding hepatic artery anatomy and its variants is mandatory especially in presurgical studies. Pathology is less frequent and it is mainly surgery related. The most frequent anomaly involving the hepatic veins is thrombosis leading to Budd-Chiari syndrome and passive hepatic congestion due to cardiac disease. Within the hepatic sinusoid's pathology, it is important to be familiar with the sinusoidal obstruction syndrome. Connections can develop between vascular structures, leading to arterioportal, arteriovenous and portosystemic shunts. Radiologists must be familiar with all of these in order to make a correct diagnosis and guide appropriate treatment.

#### **VAEE-10 A to Z of Whole-Body Vasculitis Imaging: A Comprehensive Review for Radiologists**

##### Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

Familiarize radiologists with classification of vasculitis. Review the most common arteries involved in different vasculitis. Provide ideal CT, MR, PET, and US imaging protocols for assessment of vasculitis. Review complications of vasculitis and non-vascular findings in vasculitis cases.

##### TABLE OF CONTENTS/OUTLINE

Vasculitis: definition and classification. Overview of different types of vasculitis with their associated immune markers. An algorithmic approach to diagnosis of vasculitis using combination of imaging and non-imaging data. Imaging protocols for vascular imaging: MRI, CT, PET, and US. Pros and cons of each imaging modality for assessment of vasculitis. Pictorial review of expected vascular findings in vasculitis cases. Review of non-vascular findings in vasculitis cases. Pitfalls in vascular imaging related to diagnosis and assessment of response to treatment of vasculitis.

#### **VAEE-11 Let the Waveform Lead the Way: What There Is to Know About Vertebral Arteries Doppler Ultrasound**

##### Participants

Sofia Arizaga, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

##### TEACHING POINTS

after the exhibit the reader would be able- To review the normal anatomy regarding vertebral arteries. To identify normal and abnormal vertebral arteries waveform which may provide useful clues regarding pathology in the subclavian, carotid, brachiocephalic, and intracranial arteries. To recognize the most common vertebral arteries pathology using Color Doppler-ultrasonography.

##### TABLE OF CONTENTS/OUTLINE

Introduction. Normal vertebral arteries anatomy. Ultrasound: Technical requirements and examination techniques. Morphological assessment (B-mode), Color Doppler and spectral normal vertebral arteries waveform. Color Doppler and spectral abnormal vertebral arteries waveform. Subclavian Steal Syndrome: definitions, etiology, clinical presentation and Pre-steal and Steal Waveform. Vertebral arteries stenosis and occlusion: Definitions, Etiology, and Clinical Presentation. Differential diagnosis of changes in vertebral artery waveforms. Illustrative cases- Summary

#### **VAEE-12 Vascular Malformation: From Classification to Characterization**

##### TEACHING POINTS

Vascular malformations and tumors are a heterogeneous group of lesions that may affect the arterial, capillary, venous or lymphatic system or any combination thereof. They encompass a bewildering range of lesions, syndromes, and masses ranging from the relatively common to the rare. The classification available for these lesions is complex and involves various histopathological aspects. Creating a classification system primarily based on different radiological modalities is beneficial. Understanding differentiating features between low flow and high flow vascular malformations is essential as they have different treatment protocols. Understanding differentiating features between arterial, venous and lymphatic malformations helps to understand the different components in a mixed vascular malformation. In case of histopathological dilemma, radiological features play a major role. Knowing different locations, imaging features and progression with age of hemangioma helps to understand their etiology and natural history.

#### TABLE OF CONTENTS/OUTLINE

Imaging features of vascular malformations on ultrasound, color Doppler, CT angiography, MRI. Characterization of vascular malformations. Algorithmic approach to classify vascular malformations. Various syndromes associated with vascular malformations.

#### VAEE-13 **Hands Up! This Is An... Upper Extremities CT Angiography**

Participants

Vanessa Hernandez Olivera, MD, Tlalpan, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Explain an overview of current imaging guidelines for upper extremities CT angiography. Pictorial review of the most frequent pathologies and atypical cases and their diagnosis in our medical center.

#### TABLE OF CONTENTS/OUTLINE

Introduction Review current imaging guidelines for upper extremities CT angiography. Anatomy and anatomical variations of the upper extremities arteries. CT angiography protocols in different clinical scenarios. Upper extremities arterial diseases: • In situ thrombosis. • Aneurysm or pseudoaneurysm. • Vasculitides. • AVF complications. • Trauma. • Post procedure complications. • Thoracic outlet syndrome. Conclusions

#### VAEE-14 **Too Soon to Enhance: Pearls and Pitfalls of Early Venous Enhancement**

Participants

Iza Vieira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Revisit through cases and recall the characteristics of the main pathological and physiological causes of early venous enhancement. - Demonstrate protocols and techniques for optimizing venous studies (CTA/CTV and MRA), allowing differentiation of the various conditions associated with early venous enhancement.

#### TABLE OF CONTENTS/OUTLINE

- Pictorial review of the main physiological causes of early venous enhancement (commonly associated with rapid venous return), including the territories of the jugular veins, venous sinus, renal veins, inferior vena cava and hepatic veins. - Demonstration of the main methods of venous phase acquisition and discussion of techniques and methods. Show examples of techniques that can facilitate specific diagnosis, such as injection of contrast through alternative venous access (e.g. podalic vein). - Demonstrate that in the same venous territory, early enhancement can represent either a pathological or physiological finding depending on the evaluation of the other venous territories and associated pathologies, including territories of left gonadal vein and left iliac vein. - Display selected cases of uncommon causes of early venous enhancement: portosystemic shunt, cecal angiodysplasia, congenital and acquired arteriovenous fistula. - Summary of teaching points.

#### VAEE-15 **Inflammatory and Infectious Conditions of the Aorta: A Review of Concepts and Imaging Findings**

Participants

Vitor Bichuette, MD, Uberaba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To review concepts involving epidemiology, clinical presentation and imaging findings of inflammatory and infectious conditions of the aorta. ? To identify the main imaging features of diseases that affect the aorta and its branches. ? To differentiate pathological and treatment-related imaging patterns of aortic disease. ? To discuss how radiologists can help in the management of aortitis.

#### TABLE OF CONTENTS/OUTLINE

• Introduction - General concepts o The use of different imaging modalities to assess the aorta. • Aortitis classification: o Involvement of the branches of the aorta in the main diseases. o Definition, clinical presentation and imaging features of diseases involving the aorta. • Case-Based Review: o Sample cases explaining and demonstrating imaging findings of aortitis and how imaging modalities can be used before and after the treatment. This section will present illustrative cases of: § Takayasu arteritis § Giant cell arteritis § Granulomatosis with polyangiitis § Polyarteritis nodosa § IgG4-related disease § Idiopathic aortitis § Syphilitic aortitis § Staphylococcus aureus aortitis § Mycobacterium tuberculosis aortitis § COVID-19 aortitis • Future Directions: new perspectives in the assessment of the aorta. • Conclusion and key takeaways.

#### VAEE-16 **Multimodality Imaging in Large Vessel Vasculitides**

Participants

Sahar Alizada, Istanbul, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Large Vessel Vasculitides (LVV) encompass a range of pathologies classified as non-infectious/inflammatory (primary and secondary vasculitides) and infectious vasculitides. • Various imaging modalities are available for diagnosis, including Ultrasound, CTA, MA, and FDG-PET/CT, each with its own advantages and disadvantages. • Each modality has specific imaging features that aid in the



diagnosis of vasculitis, such as the halo sign in ultrasound or circumferential thickening and vessel wall enhancement on CTA or MRA, which are consistent with inflammatory vasculitis. Conversely, crescentic-shaped thickening with adjacent fat stranding are features of infectious vasculitis. Moderate to intense circumferential FDG uptake along the vessel wall on FDG-PET/CT indicates active vasculitis. Recent publications suggest that FDG uptake in the temporal or maxillary arteries has similar sensitivity/specificity in diagnosing LV (GA). • This educational exhibit proposes an algorithm for patients suspected of having either inflammatory large vessel vasculitis or infectious vasculitis. For inflammatory vasculitis, ultrasound should be the first-line imaging modality.

#### TABLE OF CONTENTS/OUTLINE

• LVV classifications. • Available imaging modalities that can be utilized in LVV. • Key imaging features • Proposed algorithm for patients with LVV

#### VAEE-17 **Doppler High Frequency Ultrasound in Vascular Complications: What Radiologists Should Know Before, During or After Injectable Procedures**

Participants

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Facial injections with different dermal fillers have become increasingly common. The explosion in the use of these injectable materials has brought a concomitant rise in the incidence of complications. Vascular compromise is the most concerning complication of all, caused either by intravascular injection (arterial or venous), external compression (mostly of the veins), thrombosis or embolization. As a result, blood flow may be interrupted in the occluded facial arteries, leading to ischemia, necrosis or ulcerations. Fortunately, Doppler high frequency ultrasound (DHFUS) is valuable to avoid, to diagnose and to treat vascular complications in most clinical scenarios. However, the clinicians should be alerted that many factors will affect the sensitivity of this examination. And, in this context, the radiologists may be requested to recognize and evaluate patients before, during or after injectable procedures, for safe and effective injections. This study aims: (1) To review and clarify the facial vascular anatomy and major variations. (2) To describe the correct examination technique: basic probe positions. (3) To teach how to recognize different dermal filler substances and signs of vascular occlusion. (4) To list different possible imaging findings of vascular occlusion (new pattern based on angiosome with fresh-frozen specimen correlation). (5) To describe guided procedures to avoid or treat complications.

#### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION. 2. VASCULAR FACIAL ANATOMY. 3. IMAGING TECHNIQUE. 4. DERMAL FILLERS DESCRIPTION. 5. DHFUS FINDINGS IN VASCULAR OCCLUSIONS: a new finding. 6. GUIDED PROCEDURES. 7. CONCLUSION.

#### VAEE-18 **Collateral Networks in Superior Vena Cava Obstruction**

Participants

Joao Sarmiento Santos, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate with schematic figures and cases the patterns of collateral venous pathways depending on the level of superior vena cava (SVC) obstruction (above or below the junction of the azygos arch). To discuss the technical aspects related to vena cava imaging. To describe the mechanisms and illustrate with cases the different etiologies of SVC obstruction. To discuss the treatment options, the role of imaging to plan therapy, as well as post-therapeutic findings.

#### TABLE OF CONTENTS/OUTLINE

SCV obstruction is a relatively common entity in the everyday practice of different radiology subspecialties, including head and neck, thoracic, abdominal, vascular and interventional radiologists. Hence, to schematize in an easy way the collateral venous pathways developed secondary to caval obstruction is of wide interest to facilitate diagnosis and treatment. We herein describe the collateral pathways resulting from SCV obstruction and correlate the opacification of those collaterals to the site of contrast injection in CT and MR angiography exams. Graphic representations of the sites of obstruction and respective formed collaterals are depicted, as well as the azygos / hemiazygos system participation to the collateral venous return. The normal anatomy and anatomical variations which might play a role in the collateral system development are detailed. The main causes of obstruction are discussed: extrinsic compressions, tumoral invasion, thrombosis and traumatic injury.

#### VAEE-19 **When The Lifeline Becomes a Liability: Comprehensive Analysis of Arterio-Venous Fistula and Graft Complications in Hemodialysis Patient**

Participants

Kamlesh Kumar Ratte, MD, New Delhi, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Simplifying the approach to Doppler ultrasound of Arterio-Venous fistula through a tabular form, and displaying normal imaging findings of patent fistula in gray scale sonography, color Doppler and CT Angiogram Venogram. Understanding the normal post graft hemodynamic changes. To highlight various types of haemodialysis access sites ranging from radiocephalic fistula to transposition basilic vein fistula and less frequently used arterio-venous graft. To demonstrate various possible complications of A-V fistula like infection, aneurysmal dilatation, pseudoaneurysm, stenosis, thrombosis and arterial steal phenomenon. To help the budding radiologists in identifying these complications for prompt diagnosis leading to early intervention and better patient management.

#### TABLE OF CONTENTS/OUTLINE

Simplified version of Arterio-Venous fistula Doppler technique. Normal anatomy on CT Angiogram Venogram. Approach to normal and altered hemodynamics of Arterio-Venous fistula on colour Doppler. Identification of mature Arterio-Venous through Doppler parameter. Comprehensive review of complications of Arterio-Venous fistulae graft.

#### VAEE-2 **Spontaneous Abdominal Wall Hemorrhage: A Practical Diagnostic Guide to Aid the Interventional Radiologist**

Participants

Claudia Campos Bas, Palma De Mallorca, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the diagnostic process using Angio-CT of spontaneous soft tissue haemorrhage (SSTH) in the abdominal wall and the key findings to guide interventional treatment. To share practical advice on identifying the probable bleeding artery in angio-TC using vascular territory mapping and correlating with arteriography.

#### TABLE OF CONTENTS/OUTLINE

SSTH in the abdominal wall characterizes by sudden extravasation of blood into a muscle group without an underlying medical condition. Whilst most cases remain confined, some may become extensive and life-threatening. In such situations, radiological management may be both diagnostic and interventional. Angio-TC is the gold standard for the detection of haemorrhage, allowing a fast and non-invasive diagnosis. Moreover, it enables us to differentiate between arterial and venous bleeding and to approximate the most probable bleeding artery, serving as a road map for targeted angiography and embolization. We retrospectively reviewed 28 patients (aged 59-88) admitted to our angiography suite due to acute anemia in the setting of active arterial abdominal wall bleeding described on triphasic CT. We determined the presence of active arterial bleeding and identifies the responsible vascular pedicle when possible. In all other cases, we inferred the most probable bleeding vessel based on location of contrast extravasation, known as "arterial mapping". We compared our results with the subsequent arteriography. Angio-TC is essential in the setting of SSTH as it enables to determine the presence and origin of bleeding. Differentiating arterial from venous bleeding and identifying the potentially damaged vessel is of paramount to manage these patients.

#### VAEE-20 **Chronic Mesenteric Ischemia: Mesenteric Artery Duplex Sonography and the Utility of Postprandial Imaging**

Participants

Kaitlin Zaki-Metias, MD, Windsor, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Duplex sonography performed in the fasting state serves as a good initial screening tool for chronic mesenteric ischemia. 2. There is a wide range and lack of consensus of established cut-offs for peak systolic velocity criteria suggestive of hemodynamically significant mesenteric arterial stenosis in the literature. 3. The evidence supporting the utility of postprandial assessment of the mesenteric arteries is inconclusive. 4. Failure of peak systolic velocity to increase 20-30% between fasting and postprandial states may indicate hemodynamically significant stenosis. 5. Given the lack of clarity surrounding postprandial duplex sonography of the mesenteric arteries, inclusion of postprandial assessment in the imaging protocol may lead to confusion.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology and clinical presentation of chronic mesenteric ischemia 3. Pathophysiology of chronic mesenteric ischemia 4. Duplex sonography of the mesenteric arteries: common protocols and pitfalls 5. Postprandial imaging of the mesenteric arteries and associated challenges 6. ACR appropriateness criteria for imaging of mesenteric ischemia 7. Case-based review of mesenteric artery duplex sonography including normal cases, abnormal cases, and cases mistakenly interpreted as abnormal 8. Management of chronic mesenteric ischemia 9. Conclusion

#### VAEE-21 **The Forgotten Vessels: Imaging of the Inferior Mesenteric Vasculature**

Participants

Anup Shetty, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The inferior mesenteric artery (IMA) and vein (IMV) supply and drain the distal colon and rectum, but can be neglected as part of a standard search pattern. This exhibit will: 1) Familiarize the reader with the embryology, anatomy, and physiology of the inferior mesenteric vessels 2) Discuss modalities used to image the IMA/IMV 3) Illustrate a broad spectrum of diseases affecting the IMA/IMV through a series of illustrative cases

#### TABLE OF CONTENTS/OUTLINE

Outline- Embryology, Anatomy (and variants), and Physiology- Imaging Modalities (CT, US, MR, angiography)\* IMA abnormalities - acute thromboembolic disease - chronic occlusion (AAA, Leriche) and collateral pathways - dissection, aneurysm, pseudoaneurysm, and arteriovenous fistula - vasculitis - hemorrhage - tumor invasion\* IMV abnormalities - thrombosis - septic thrombophlebitis - intravenous gas in the setting of pneumatosis - tumor invasion - rectal varices in portal hypertension - mass effect from sigmoid volvulus leading to rectal edema\* diagnostic clues- displacement from internal hernia - lymphadenopathy from rectal cancer - flow artifact at portosplenic confluence

#### VAEE-22 **CT Angiography of the Upper Extremity: Purpose, Protocols, Problems, and Pathology**

Participants

Alexander Satei, MBBS, Birmingham, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. CT angiography is a key diagnostic imaging tool to evaluate for upper extremity arterial pathology. 2. Understanding the vascular anatomy of the upper extremity, including variant anatomy, is critical for interpretation of CT angiography of the upper extremity. 3. Benefits of CT angiography include rapid noninvasive image acquisition, lower cost and radiation exposure than digital subtraction angiography, and simultaneous evaluation of the adjacent osseous structures and soft tissues. 4. Limitations of CT angiography include patient positioning for optimal imaging, contrast bolus timing, increased cost and radiation exposure relative to sonographic evaluation, and artifact relating to arterial calcification, implanted hardware, or metallic foreign bodies. 5. CT angiography of the upper extremity is ideal for evaluation of traumatic arterial injury, vasculitides, congenital vascular anomalies, arteriovenous fistulae for hemodialysis, and pre- and post-operative evaluation relating to vascular and surgical intervention.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Vascular anatomy of the upper extremity. 3. Review of important variant vascular anomalies of the upper extremity. 4. Indications for CTA of the upper extremity. 5. Benefits and limitations of CTA of the upper extremity. 6. Extended

case-based review of CTA upper extremity including subclavian steal syndrome, active post-traumatic extravasation, arteriovenous fistulae, pseudoaneurysm and aneurysm, mycotic aneurysm, dissection, transection, hematoma, fibromuscular dysplasia, and thoracic outlet syndrome, among others. 7. Conclusion.

### **VAEE-23 Hearts on Fire: Imaging the Coronary Arteries in Systemic Vasculitis**

Participants

Sean Johnson, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Overview of systemic vasculitis, highlighting entities which can involve the coronary arteries. Review the incidence and prevalence of coronary artery vasculitis. Demonstrate coronary artery manifestation of systemic vasculitis with case-based reviews. Discuss various diagnostic modalities and protocols used to identify and characterize coronary artery vasculitis.

#### **TABLE OF CONTENTS/OUTLINE**

1. Incidence and prevalence of coronary artery vasculitides. 2. Review forms of systemic vasculitis, coronary artery manifestations and pathophysiology, including: Takayasu arteritis, Kawasaki disease, microscopic polyangiitis, Erdheim-Chester disease, IgG4-related vasculitis and polyarteritis nodosa. 3. Case-based review of coronary artery vasculitides, including both acute and chronic manifestations. 4. Brief discussion of non-coronary thoracic aortic disease in systemic vasculitis. 5. An approach evaluating the coronary arteries for involvement in systemic vasculitis, including review of imaging selection and protocols.

### **VAEE-24 Advanced Multimodal MRA Techniques for Cerebrovascular Disease: A Comprehensive Guide**

#### **TEACHING POINTS**

Cerebrovascular disorder treatment has evolved, now employing a range of advanced devices. While time-of-flight MR angiography (TOF-MRA) can suffer from image degradation, innovative multimodal MRA techniques such as phase contrast (PC), ultrashort echo time (UTE), and 4D offer improved image quality. Embracing these cutting-edge imaging methods is crucial in managing cerebrovascular disorders. Our presentation aims to: 1. Provide a comprehensive overview of cerebrovascular diseases. 2. Highlight the technical details of state-of-the-art multimodal MRA imaging techniques. 3. Showcase the clinical applications of multimodal MRA imaging in diagnosis, treatment, and postoperative care for cerebrovascular diseases.

#### **TABLE OF CONTENTS/OUTLINE**

1. Exploring the significance and recent advancements in multimodal MRA imaging for cerebrovascular diseases. 2. Diving deep into the technical aspects of various MRA sequences, including TOF, PC, UTE, and 4D. 3. Unveiling the latest clinical applications of multimodal MRA imaging for cerebrovascular conditions, such as intracranial aneurysms, arteriovenous malformation (AVM), dural arteriovenous fistula (dAVF), and moyamoya disease, through real-life case studies.

### **VAEE-25 US of Lower Extremity Deep Vein Thrombosis: A Review**

#### **TEACHING POINTS**

· Describe SRU Multidisciplinary 2018 Consensus protocol for complete duplex ultrasound (CDUS) of lower extremity · Differentiate acute thrombosis, chronic post thrombotic change · Discuss implications of slow flow · Describe normal and abnormal spectral Doppler and how it can be used to infer more central thrombosis · Describe pitfalls related to anatomy, gray scale and color Doppler

#### **TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline 1. Ultrasound Protocols a. SRU consensus for complete duplex ultrasound (CDUS) b. Alternative (limited protocols) i. Appropriate situations ii. Follow up c. Example of imaging and labeling for CDUS 2. Acute DVT a. Gray scale b. Types: Occlusive, Non-occlusive, Mobile c. Appearance over time d. "Acute on chronic" and indeterminate acuity e. Phlegmasia cerulea dolans 3. Post thrombotic change a. Diminutive size of veins b. Wall thickening c. Synechiae d. Calcification e. Collaterals and deep reflux f. Neovascularization /arterialization 4. Other Issues a. Central DVT implied by abnormal spectral Doppler b. Slow Flow i. Normal ii. Progression to DVT c. Isolated calf thrombus d. Increased venous pulsatility e. Positive DVT with ipsilateral renal transplant 5. Follow up US, alternative imaging and treatment recommendations based on US appearance and extent of thrombus 6. Pitfalls a. Related to frequency of transducers b. Anatomic variations c. Poor color Doppler settings

### **VAEE-26 A Novel Approach to Deforming Device for Optimal Frozen Elephant Trunk Technique via Patient Specific 3D Printed Model**

#### **TEACHING POINTS**

Frozen elephant trunk implantation for thoracic aortic aneurysms is recognized as a less invasive surgical technique. However, because intraoperative fluoroscopy is not available, device insertion must be done with blind operation. To avoid complications, we developed a novel approach for deforming device in advance and simulating surgical procedures via life size 3D model.

#### **TABLE OF CONTENTS/OUTLINE**

Datasets for printing were converted, using CT data which has submillimeter spatial resolution. Patient specific life size 3D printed models were faithfully reproduced luminal surface of thoracic aorta. 3D printed model enables surgeon to assess physiological morphology including stenosis or spiculated atheroma, practically, though it is impossible to see that intraoperatively. Furthermore, this method allowed surgeon to simulate surgical procedures, considering precise device size in advance. 3D printed model is clinically available and promising for facilitating the operation strategy optimization, and assistant for frozen elephant trunk technique safely. There will be contributions to clinical practice for preoperative accurate assessment and simulation.

### **VAEE-27 Nonatherosclerotic Conditions of Peripheral Arteries**

Participants

Taila Moura Fe, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purposes of this exhibit are: Make a didactic review of the nonatherosclerotic conditions of peripheral arteries, including the

following conditions: Aneurysm, Pseudoaneurysm, Dissection, Vascular prosthesis and grafts, Embolism, Arteriovenous fistula, Arterial adventitial cystic disease, Locked-in arterial syndrome. To illustrate these conditions based on cases from our ultrasonography team. Correlate sonography findings with different image methods.

#### **TABLE OF CONTENTS/OUTLINE**

Introduction including the nonatherosclerotic conditions of peripheral arteries, including the following conditions: Aneurysm, Pseudoaneurysm, Dissection, Vascular prosthesis and graft, Embolism Arteriovenous fistula, Arterial adventitial cystic disease, Locked-in arterial syndrome. Describe the main information of each condition. Illustrated teaching cases from our ultrasonography team, each condition. Correlate the ultrasound findings with other image methods.

#### **VAEE-28 Development of a Double Bolus Tracking Method for Individualized CT Angiography Scan Timing**

##### **TEACHING POINTS**

To perform surgical procedures safely, understanding the anatomical variations of the veins in preoperative computed tomography (CT) angiography is critical. The scan timing of the venous phase is generally performed via fixed scan delay, but the contrast effect is often inadequate owing to individual differences in the peak timing of the veins. We have developed the double bolus tracking (DBT) method, which effectively utilizes low-dose monitoring in preoperative CT angiography to individualize the timing of the venous and the arterial phases. The advantage of the DBT method is that the CT angiography enhances the contrast effect in complex anatomical regions such as the portal venous system. Consequently, it might improve the surgical outcomes and patients' quality of life.

##### **TABLE OF CONTENTS/OUTLINE**

A) An overview of the DBT method B) Scanning techniques used for low dose monitoring C) Differences in contrast effects between the fixed scan delay and the DBT methods D) Clinical applications of preoperative vascular mapping E) Advantages of using the DBT method in complex anatomical regions such as the portal venous system F) Limitations and future directions of the DBT method G) Conclusions and clinical relevance of using DBT in preoperative screening methods for colon cancer surgery

#### **VAEE-29 The Anatomy of Danger: Exploring Hemodynamic Perils in Type B Aortic Dissection**

Participants

Hyun Jung Koo, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

- To explore the debated issues regarding the relationship between the number of entries and aneurysm progression in patients with type B aortic dissection (AD)- To simulate in-vitro dissection model for assessing the relationship between the flow and entries in the dissection- To demonstrate the utility of 4D flow magnetic resonance imaging (MRI) and computational fluid dynamics (CFD) for assessing hemodynamic flow in patients with type B AD - To suggest potential applications of CT and 4D flow MRI in personalized treatment planning for aortic dissection, such as selecting the optimal timing for surgical intervention based on hemodynamic parameters and individual patient factors.

##### **TABLE OF CONTENTS/OUTLINE**

1. CT features - Predictors of high-risk adverse outcome in patients with type B AD2. Controversies - Entry and re-entries - Hemodynamic flow and thrombosis in false lumen3. Assessment of Hemodynamics 1) In-vitro Fluid Dynamics Study- Aorta modeling method - In-vitro 4D flow2) In-vivo 4D flow MRI Study- Wall shear stress, flow displacement, and flow velocity - The role in predicting aortic dissection progression3) CT-based CFD Analysis- In-vivo patient study- In-vitro model matching

#### **VAEE-3 Abdominal Aortic Aneurysm: Pre and Post Operative Evaluation**

Participants

Matheus Marcelino Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **TEACHING POINTS**

The purposes of this exhibit are: Make a multimodality-based didactic review of the main topics of infradiaphragmatic aneurysm at pre and post operative evaluation. Make a practice guide on how to perform an evaluation with all the necessary variables for follow-up or surgical planning using different imaging methods. Propose a didactic categorization of these topics: Ultrasound evaluation of Abdominal aortic aneurysm. Postoperative Endovascular Ultrasound Evaluation. Postoperative complications d. Ultrasound with microbubbles contrast. Correlate those findings with other exams. Adequate evaluation and early recognition of post operative complications of endovascular repair of aneurysms. Illustrate those conditions based on cases from our radiology group.

##### **TABLE OF CONTENTS/OUTLINE**

We will discuss the principles of the abdominal aortic aneurysm at pre and post operative evaluation and focus on their imaging features using a multimodality approach in this exhibit. Ultrasound evaluation of infradiaphragmatic aneurysm. Postoperative Endovascular Ultrasound Evaluation. Postoperative complications. Ultrasound with microbubbles contrast.

#### **VAEE-30 Why is CT Useful in the Diagnosis of Klippel-Trenaunay-Weber Syndrome?**

##### **TEACHING POINTS**

The purpose of this exhibit is: 1. Klippel-Trenaunay-Weber syndrome (KTWS) is a rare and intractable disorder characterized by unilateral hypertrophy associated with one or more mixed vascular malformations of the extremities. 2. The main imaging modalities used at KTWS are US, MRI, angiography and CT. 3. CT images can clearly depict the vascular malformations of KTWS. 4. In addition, volume measurement and histogram analysis of the extremity by CT imaging can be used to help diagnose KTWS and guide treatment.

##### **TABLE OF CONTENTS/OUTLINE**

Major headings: 1. Describe KTWS. 2. How to create a CT Venography. 3. Usefulness of volume rendering (VR) images by CT. - About VR images of superficial veins. - About VR images of deep veins. 4. Volumetric measurements with CT imaging of the lower extremities are useful in the diagnosis of KTWS. - The volume of the affected and healthy side can be measured reliably and

easily.5. Histogram analysis with CT images of the lower extremity is useful in the treatment strategy for KTWS.- Histogram analysis can determine the components within the analysis area from the CT number.- In the present case, the enlargement of the lower extremities was determined to be due to an increase in the fat component (CT number indicates a negative value), not edema (CT number indicates near zero).

### **VAEE-31 Vascular Malformations and the Mimickers: A Spectrum of Imaging Features**

Participants

Mayu Uka, , Japan (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

The purpose of this exhibit is: 1) To review contrast-enhanced MRI and other imaging features of vascular malformations and vascular tumors compared to imaging features of other similar diseases and 2) to discuss the differential diagnosis of vascular malformations and vascular tumors with other lesion types.

#### **TABLE OF CONTENTS/OUTLINE**

The cause of most vascular tumors and vascular malformations of the body surface and soft tissue is unknown. Hemangiomas, which are benign vascular tumors, and vascular malformations are often referred to idiomatically as "hemangiomas," but the International Society for the Study of Vascular Anomalies (ISSVA) classifies them as separate diseases. Vascular malformations, which include venous malformations, arteriovenous malformations, lymphatic malformations, capillary malformations, and combined types, whose clinical and imaging findings sometimes resemble not only vascular tumors but also other neoplastic and non-neoplastic lesions. In this presentation, we will present common vascular malformations, vascular tumors, and other rare conditions, and review the imaging features and pathological findings of "mimickers," which sometimes have imaging similarities to vascular malformations and are difficult to diagnose.

### **VAEE-32 Aortitis and Large Vessel Arteritis: Diagnosis, Follow-up, Treatment and Mimics**

Participants

Miltiadis Tembelis, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Aortitis and large vessel arteritis encompass both infections and noninfectious causes of vascular wall inflammation. These pathologies often produce non-specific clinical presentations and inflammatory markers, complicating the diagnosis. Correlation with demographics, key clinical features and recognition of typical imaging features and distribution can allow radiologist to assist in the diagnosis. Diagnosis is not the only difficult aspect of these pathologies though, as recommendations for appropriate follow-up and the definitions of remission in the literature are heterogeneous.

#### **TABLE OF CONTENTS/OUTLINE**

This review will demonstrate different imaging features of infectious and noninfectious large vessel arteritis and aortitis across different modalities to help radiologists clue in on the diagnosis. Common complications and post-interventional appearances will also be exemplified. In addition, treatments and post-treatment follow-up will be addressed.

### **VAEE-33 Which Vascular Variations Are Important to Colorectal Surgeons for Right Colon Surgery?**

Participants

Minho Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

In right colic surgery, the choice of surgical methods, such as right hemicolectomy, transverse colectomy, or extended right colectomy, depends on the location of the colon cancer. However, vascular variations can occasionally necessitate a change in the planned surgical approach, preventing the originally intended reduced surgery and leading to an extended right colectomy instead. The diverse and frequent vascular anatomy variations in the right colon, if not identified preoperatively, can contribute to increased morbidity and mortality rates. Unexpected arterial variations can prolong surgical time, while venous variations can result in bleeding complications. To assess the impact of vascular variations on surgical methods, we will review approximately 380 CT angiographies and determine the type and incidence of right colic and middle colic arterial and venous variations. We will also identify vascular ligation points according to the type of surgery. Additionally, common mistakes and prevention strategies when inexperienced radiologists evaluate CT angiographies will be discussed. Readers will understand that preoperative CT angiographic evaluations can help shorten surgical time, minimize unexpected bleeding risks, and ultimately improve surgical outcomes.

#### **TABLE OF CONTENTS/OUTLINE**

1. Arterial and venous anatomy of the right colon. 2. Various types of right colon surgery and corresponding vascular ligation points for each procedure. 3. Important measurements of right and middle colic arteries relevant to right colon surgery. 4. Incidence and representative cases of vascular variations. 5. Pitfalls in interpretation and associated cases.

### **VAEE-34 Clinical Applications of MR Angiography Based on Arterial Spin Labeling to Cerebrovascular Disorders**

#### **TEACHING POINTS**

1) To explain the basic principles of 3D or 4D arterial spin labeling (ASL)-based MR angiography (MRA) 2) To discuss the advantages of ASL-based MRA over other imaging techniques 3) To review clinical applications of ASL-based MRA for various cerebrovascular diseases

#### **TABLE OF CONTENTS/OUTLINE**

1) Basic principles of ASL-based MRA •Labeling schemes, Pulsed ASL; Pseudo-Continuous ASL (PCASL); Superselective PCASL; Acceleration-selective ASL (AccASL) •3D or 4D imaging acquisition techniques2) Advantages of ASL-based MRA over time-of-flight MRA or digital subtraction angiography •Readily available •No need for contrast media •No radiation exposure •Short acquisition time •Non-invasive •Cost effective •Time-resolved information •Selective vascular visualization •Easy follow-up after treatment •Easily applicable to children3) Specific techniques for ASL-based MRA •3D-MRA using PCASL -Silent MRA •4D-MRA using pulsed ASL - Contrast inherent inflow enhanced multi-phase angiography (CINEMA) •4D-MRA using PCASL -4D-MRA based on PCASL with

CENTRA-Keyhole and view-sharing (4D-PACK) •Vessel-selective 4D-MRA using superselective PCASL (4D-S-PACK) • AccASL MRA 4) Clinical applications •Intracranial steno-occlusive arterial diseases (e.g. Moyamoya disease) •Brain arteriovenous malformation • Intracranial dural arteriovenous fistula •Assessment of extra-intracranial bypass arteries 5) Limitations of each ASL-based MRA technique

### **VAEE-35 Clinical Applications and Implementation of Photon Counting Detector CT in Vascular Imaging**

Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

1. To discuss the advantages of photon-counting detector (PCD) CT in vascular imaging 2. To review the modes, kernels, and protocols of PCD CT in vascular imaging 3. To illustrate the clinical applications of PCD CT in vascular imaging

#### **TABLE OF CONTENTS/OUTLINE**

1. PCD CT TECHNOLOGIES- Single source, Dual-source 2. BENEFITS OF PCD-CT-Ultra-high spatial resolution;Multi energy (ME)/spectral imaging;K-edge imaging ;High vascular signal;Low electronic noise artifacts;Lower radiation and contrast doses; 3. TECHNICAL ASPECTS RELEVANT TO VASCULAR IMAGING-Modes Ultra-high resolution, ME, HR-ME, Flash-ME, gated/ungated;Kernels, denoising;Collimation;Images- Single energy like (T3D), VMI, iodine, VNC, virtual non calcium, spectral post-processing;Radiation doses, CARE keV;4. VASCULAR APPLICATIONS OF PCD CT WITH CASE EXAMPLES-Ultra-high resolution- Improved visualization of small vessels (Flaps ,eg. DIEP, fibular perforators; Artery of Adamkiewicz; distal arteries of hand, feet, head), calcified plaques, small stents;High iodine CNR - Low dose of iodinated contrast, salvage of suboptimal-enhanced studies;Decreased artifacts- Calcium blooming, beam hardening, metal;ME calcium separation- Improved lumen visualization;ME bone subtraction- Rapid and accurate;ME lesion characterization-hematoma vs active bleed vs calcification;Vascular perfusion- Lung, myocardium, extremities;Multi-contrast and novel contrast media- e.g. iodine and gadolinium;Advanced material separation- Calcium;Radiation dose reduction- VNC images in multiphasic studies, lower noise profile; 5. LIMITATIONS, PITFALLS-Increased data - storage and transfer issues; Noise in high resolution mode

### **VAEE-36 Review of CTA Findings in Patients With Circulatory Assisted Devices**

#### **TEACHING POINTS**

Present CT imaging findings and clinical presentations of complications associated with circulatory assisted devices. Review entities that may present as pitfalls in CT imaging of circulatory assisted devices.

#### **TABLE OF CONTENTS/OUTLINE**

This educational exhibit will present pictorial review of multiple CT findings of complications associated with circulatory assisted devices to increase Radiologists awareness. Highlight challenges associated with CT imaging of circulatory assisted devices and also provide tips to overcome the challenges.

### **VAEE-37 CT Angiography's Role in Virtual Surgical Planning for Craniomaxillofacial Reconstruction with Scapular Free Flap**

#### **TEACHING POINTS**

1. Virtual surgical planning plays an important role in craniomaxillofacial (CMF) reconstruction with scapular free flap. 2. Scapular free flaps are preferred over fibular or deep circumflex artery free flaps for CMF reconstruction when there is variant anatomy, significant atherosclerosis, or prior utilization of lower extremity vessels. 3. Preoperative virtual surgical planning (VSP) has numerous advantages over traditional intraoperative decision making including shortened operative times, improved patient matched custom implant design, improved patient specific oncologic margins and anatomic understanding, and decreased rate of nonunion and flap related complications. 4. Virtual surgical planning and 3D printing sterilizable guides at the point of care requires a centralized manufacturing ecosystem and collaboration between surgeons, radiologists, engineers, and support staff. 5. CT angiography is an important first step in the pre-surgical planning for scapular free flap harvesting because of common variant anatomy and localization of perforating branches.

#### **TABLE OF CONTENTS/OUTLINE**

- Scapular free flap advantages over fibular and deep circumflex artery flaps. - CT angiography's role in virtual surgical planning. - Optimal imaging acquisition to achieve optimal radiologic planning. - Role of 3D modeling and medical device design in virtual surgical planning.

### **VAEE-4 Segmental Arterial Mediolytic: A Visual Journey Through Its Imaging Findings**

Participants

Camila Reifegerste, MD, Curitiba, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Segmental arterial mediolysis (SAM) is a nonatherosclerotic and noninflammatory arteriopathy, unknown to many radiologists. It can lead to severe complications, which have a high mortality rate, thus it is important for us to be aware of this disease. SAM is characterized by lysis of the medial arterial layer, normally compromising visceral and renal arteries, coursing with dissections, aneurysms and even arterial rupture. The imaging findings on computed tomography angiography (CTA) of SAM can be very similar to others vasculitides, such as polyarteritis nodosa and granulomatosis with polyangiitis, but most vasculitides can be diagnosed based on clinical, laboratory and imaging findings, while SAM's diagnosis is based majorly on imaging findings and exclusion of other vasculitides. The aim of this presentation is to show some cases of segmental arterial mediolysis from our institution, its complications and some differential diagnosis, for the purpose of making radiologists more familiar with this pathology.

#### **TABLE OF CONTENTS/OUTLINE**

Brief literature review of segmental arterial mediolysis; didactic cases of SMA from the digital archive of our hospital's radiology department, to show SAM typical findings, complications and differential diagnosis on multiple imaging modalities, including computed tomography angiography (CTA), magnetic resonance angiography (MRA), Doppler ultrasound and arterial angiography

## **VAEE-5 The Aortic Isthmus from A to Z**

Participants

Juliana Da Trindade, Niteroi, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To describe the embryology of the aortic isthmus, and its developmental stages. To demonstrate with cases the peculiar anatomical variations of this segment. To exemplify with cases the congenital malformations and pathological states.

### **TABLE OF CONTENTS/OUTLINE**

The aortic isthmus is a small aortic segment located between the left subclavian artery and the ductus arteriosus. This segment undergoes singular changes to allow flow adjustments necessary for the blood circulation from intra to extra-uterine life. The process of closure of the ductus arteriosus after birth normally results in a fibrous band called ligamentum arteriosus. However, different factors as prematurity, genetics, prenatal infections, concomitance of congenital heart diseases, the extension of the ductal tissue to the aortic wall may lead to either persistence of the ductus arteriosus or to variable patterns of ductal involution (aortic knobs or ampullas, aortic-coarctation, etc). The presence of fibrotic tissue within the aortic wall and flow disturbances due to focal ectasia may additionally predispose to aneurysm formation, ulcerations and dissection during adulthood. Therefore, the aortic isthmus is an extremely complex region covering several anatomical variations and a wide spectrum of pathologies that may affect all age groups in a congenital or acquired form. Our goals are to review the isthmic developmental changes along intra to extra-uterine life, and to discuss the imaging findings of different anatomical variations and pathological states of this intricate aortic segment.

## **VAEE-6 Abdominal Vascular Compression Syndromes: What the Radiologist Needs to Know (and Let the Surgeons Know)**

Participants

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

Recognize the key structures of the abdominal vasculature and its anatomical relations. Understand the causes of Abdominal Vascular Compression Syndromes (AVCS) and related clinical features. Comprehend computed tomography angiography (CTA) imaging patterns of AVCS. Recognize the complications associated to AVCS and its imaging patterns. Understand AVCS treatment methods and criteria.

### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: Anatomy of the abdominal vasculature and its relation to other structures. Definition of AVCS. Epidemiology of the most common causes of AVCS. Signs and symptoms. associated to the Median Arcuate Ligament Syndrome (MALS), Superior Mesenteric Artery Syndrome (SMAS), Nutcracker Syndrome (NCS), and May-Thurner Syndrome (MTS). DIAGNOSING, AND IDENTIFYING POST TREATMENT IMAGING PATTERNS - MALS, SMAS, NCS, and MTS: Imaging findings. Complications, and its imaging patterns. Treatment methods, and what to evaluate

## **VAEE-7 Pelvic Congestion Syndrome. CT Angiography and Doppler Ultrasound Findings**

Participants

Carlos Capunay, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

To be aware of pelvic congestion syndrome as a cause of female chronic pelvic pain. To recognize the anatomic variants and pathologic conditions that can cause the pelvic congestion syndrome To illustrate the spectrum of CT and Doppler US findings in these patients. To emphasize the most representative imaging features on this clinical syndrome.

### **TABLE OF CONTENTS/OUTLINE**

Anatomy of the normal female pelvic venous plexus. Pathogenesis of the pelvic congestion syndrome. Description of the Doppler US technique. Description of the CTA scan protocol: technical parameters and IV contrast administration CT image analysis and post-processing algorithms in the different clinical setting. Sample cases of compression syndromes (including superior mesenteric artery compression of the left renal vein, and compression of the left common iliac vein by the right common iliac artery). Summary.

## **VAEE-8 The Use of Ferumoxytol for High-Resolution Vascular Imaging and Troubleshooting for Solid Organ Transplantation**

Participants

Amar Shah, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

### **TEACHING POINTS**

1. Ferumoxytol, a novel MR contrast agent in off-label use, is safe for patients with renal dysfunction. 2. Due to its prolonged intravascular half-life and lack of parenchymal extravasation, high-resolution vascular imaging, including distal intraparenchymal branches, is feasible. 3. Ferumoxytol MRA can identify clinically actionable vascular complications of solid organ transplant several weeks to months before ultrasound or traditional MRA. 4. 3D reconstructions facilitate procedural planning and may obviate unnecessary intervention in select patients.

### **TABLE OF CONTENTS/OUTLINE**

1. Introduction to ferumoxytol as a contrast agent: imaging characteristics, protocol details, and safety/administration. 2. Advantages and utility in comparison to GBCA. a. High-resolution vascular imaging without background parenchymal enhancement. b. Curved planar MIP reformats. c. Virtual angiography (Time-Resolved contrast-enhanced MRA) d. Coadministration with GBCA. e. Repeat imaging up to 72 hours. 3. Catalogue of example cases with preceding equivocal or normal ultrasound and/or GBCA MRA (highlighting above techniques). a. Transplant renal artery stenosis (TRAS) b. Transplant renal vein thrombosis (TRVT) with capsular neovascularization (CV) c. TRVT with CV d. TRAS and transplant pancreas artery stenosis (TPAS). e. Transplant pancreas vein thrombosis. f. Transplant pancreas intraparenchymal AVF. g. Transplant hepatic artery stenosis. h. Transplant hepatic vein

thrombosis.

**VAEE-9      Imaging of Primary Malignancies of Inferior VenaCava and its Involvement in Secondary Abdominal Malignancies**

Participants

Veeraiah Koppula, MD, Hyderabad, India (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After reviewing this educational exhibit, the learner will be able to:• Learn the key imaging features of primary malignancies of Inferior Vena cava• Identify the clinical scenarios in which abdominal malignancies can extrinsically or intrinsically involve the IVC• Review the normal anatomy of IVC and its tributaries

**TABLE OF CONTENTS/OUTLINE**

• Introduction• Normal anatomy and variants of IVC• Clinical and radiological features and management of primary leiomyosarcoma and angiosarcoma of Inferior Vena cava.• Case based discussion of abdominal malignancies involving IVC• Relevance of IVC involvement in staging of malignancies and undertaking oncological surgeries• Conclusion

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## Abstract Archives of the RSNA, 2023

VAEE-1

### Hepatic Vascular Pathology: A Journey From the Hilum to the Cava

#### Participants

Ignacio De Garcillan, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Review hepatic vascular anatomy. Revise most common anatomic variants. Understand most frequent pathology.

#### TABLE OF CONTENTS/OUTLINE

The liver has a double vascular supply through the portal vein and the hepatic artery. The drainage takes place into the hepatic veins and inferior vena cava. In this poster, pathology that can affect these vascular structures will be reviewed and illustrated with different cases from our hospital. The portal vein and its branches are involved in the main hepatic vascular pathologies. Portal vein thrombosis is one of the most common vascular complications. It can be acute or chronic and produced by bland, tumoral or infected thrombus (thrombophlebitis). Thrombosis can lead to cavernomatous transformation, portal hypertension and portosystemic collateral channels. Understanding hepatic artery anatomy and its variants is mandatory especially in presurgical studies. Pathology is less frequent and it is mainly surgery related. The most frequent anomaly involving the hepatic veins is thrombosis leading to Budd-Chiari syndrome and passive hepatic congestion due to cardiac disease. Within the hepatic sinusoid's pathology, it is important to be familiar with the sinusoidal obstruction syndrome. Connections can develop between vascular structures, leading to arterioportal, arteriovenous and portosystemic shunts. Radiologists must be familiar with all of these in order to make a correct diagnosis and guide appropriate treatment.

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## Abstract Archives of the RSNA, 2023

VAEE-10

### A to Z of Whole-Body Vasculitis Imaging: A Comprehensive Review for Radiologists

#### Participants

Seyedarash Mahdavi Anari, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Familiarize radiologists with classification of vasculitis. Review the most common arteries involved in different vasculitis. Provide ideal CT, MR, PET, and US imaging protocols for assessment of vasculitis. Review complications of vasculitis and non-vascular findings in vasculitis cases.

#### TABLE OF CONTENTS/OUTLINE

Vasculitis: definition and classification. Overview of different types of vasculitis with their associated immune markers. An algorithmic approach to diagnosis of vasculitis using combination of imaging and non-imaging data. Imaging protocols for vascular imaging: MRI, CT, PET, and US. Pros and cons of each imaging modality for assessment of vasculitis. Pictorial review of expected vascular findings in vasculitis cases. Review of non-vascular findings in vasculitis cases. Pitfalls in vascular imaging related to diagnosis and assessment of response to treatment of vasculitis.

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## Abstract Archives of the RSNA, 2023

VAEE-11

### Let the Waveform Lead the Way: What There Is to Know About Vertebral Arteries Doppler Ultrasound

#### Participants

Sofia Arizaga, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

after the exhibit the reader would be able- To review the normal anatomy regarding vertebral arteries. To identify normal and abnormal vertebral arteries waveform which may provide useful clues regarding pathology in the subclavian, carotid, brachiocephalic, and intracranial arteries. To recognize the most common vertebral arteries pathology using Color Doppler-ultrasonography.

#### TABLE OF CONTENTS/OUTLINE

Introduction. Normal vertebral arteries anatomy. Ultrasound: Technical requirements and examination techniques. Morphological assessment (B-mode), Color Doppler and spectral normal vertebral arteries waveform. Color Doppler and spectral abnormal vertebral arteries waveform. Subclavian Steal Syndrome: definitions, etiology, clinical presentation and Pre-steal and Steal Waveform. Vertebral arteries stenosis and occlusion: Definitions, Etiology, and Clinical Presentation. Differential diagnosis of changes in vertebral artery waveforms. Illustrative cases- Summary

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## Abstract Archives of the RSNA, 2023

VAEE-13

### Hands Up! This Is An... Upper Extremities CT Angiography

#### Participants

Vanessa Hernandez Olivera, MD, Tlalpan, Mexico (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Explain an overview of current imaging guidelines for upper extremities CT angiography. Pictorial review of the most frequent pathologies and atypical cases and their diagnosis in our medical center.

#### TABLE OF CONTENTS/OUTLINE

Introduction Review current imaging guidelines for upper extremities CT angiography. Anatomy and anatomical variations of the upper extremities arteries. CT angiography protocols in different clinical scenarios. Upper extremities arterial diseases: • In situ thrombosis. • Aneurysm or pseudoaneurysm. • Vasculitides. • AVF complications. • Trauma. • Post procedure complications. • Thoracic outlet syndrome. Conclusions

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## Abstract Archives of the RSNA, 2023

VAEE-14

### Too Soon to Enhance: Pearls and Pitfalls of Early Venous Enhancement

#### Participants

Iza Vieira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Revisit through cases and recall the characteristics of the main pathological and physiological causes of early venous enhancement.- Demonstrate protocols and techniques for optimizing venous studies (CTA/CTV and MRA), allowing differentiation of the various conditions associated with early venous enhancement.

#### TABLE OF CONTENTS/OUTLINE

- Pictorial review of the main physiological causes of early venous enhancement (commonly associated with rapid venous return), including the territories of the jugular veins, venous sinus, renal veins, inferior vena cava and hepatic veins.- Demonstration of the main methods of venous phase acquisition and discussion of techniques and methods. Show examples of techniques that can facilitate specific diagnosis, such as injection of contrast through alternative venous access (e.g. podalic vein). - Demonstrate that in the same venous territory, early enhancement can represent either a pathological or physiological finding depending on the evaluation of the other venous territories and associated pathologies, including territories of left gonadal vein and left iliac vein.- Display selected cases of uncommon causes of early venous enhancement: portosystemic shunt, cecal angiodysplasia, congenital and acquired arteriovenous fistula.- Summary of teaching points.

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## Abstract Archives of the RSNA, 2023

VAEE-15

### Inflammatory and Infectious Conditions of the Aorta: A Review of Concepts and Imaging Findings

#### Participants

Vitor Bichuette, MD, Uberaba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

? To review concepts involving epidemiology, clinical presentation and imaging findings of inflammatory and infectious conditions of the aorta. ? To identify the main imaging features of diseases that affect the aorta and its branches. ? To differentiate pathological and treatment-related imaging patterns of aortic disease. ? To discuss how radiologists can help in the management of aortitis.

#### TABLE OF CONTENTS/OUTLINE

- Introduction - General concepts
  - o The use of different images modalities to assess the aorta.
- Aortitis classification:
  - o Involvement of the branches of the aorta in the main diseases.
  - o Definition, clinical presentation and imaging features of diseases involving the aorta.
- Case-Based Review:
  - o Sample cases explaining and demonstrating image findings of aortitis and how imaging modalities can be used before and after the treatment. This section will present illustrative cases of:
    - § Takayasu arteritis
    - § Giant cell arteritis
    - § Granulomatosis with polyangiitis
    - § Polyarteritis nodosa
    - § IgG4-related disease
    - § Idiopathic aortitis
    - § Siphilitic aortitis
    - § Staphylococcus aureus aortitis
    - § Mycobacterium tuberculosis aortitis
    - § COVID-19 aortitis
- Future Directions: new perspectives in the assessment of the aorta.
- Conclusion and key takeaways.

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## Abstract Archives of the RSNA, 2023

VAEE-16

### Multimodality Imaging in Large Vessel Vasculitides

#### Participants

Sahar Alizada, Istanbul, Turkey (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Large Vessel Vasculitides (LVV) encompass a range of pathologies classified as non-infectious/inflammatory (primary and secondary vasculitides) and infectious vasculitides. • Various imaging modalities are available for diagnosis, including Ultrasound, CTA, MA, and FDG-PET/CT, each with its own advantages and disadvantages. • Each modality has specific imaging features that aid in the diagnosis of vasculitis, such as the halo sign in ultrasound or circumferential thickening and vessel wall enhancement on CTA or MA, which are consistent with inflammatory vasculitis. Conversely, crescentic-shaped thickening with adjacent fat stranding are features of infectious vasculitis. Moderate to intense circumferential FDG uptake along the vessel wall on FDG-PET/CT indicates active vasculitis. Recent publications suggest that FDG uptake in the temporal or maxillary arteries has similar sensitivity/specificity in diagnosing LV (GA). • This educational exhibit proposes an algorithm for patients suspected of having either inflammatory large vessel vasculitis or infectious vasculitis. For inflammatory vasculitis, ultrasound should be the first-line imaging modality.

#### TABLE OF CONTENTS/OUTLINE

- LVV classifications.
- Available imaging modalities that can be utilized in LVV.
- Key imaging features
- Proposed algorithm for patients with LVV

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## Abstract Archives of the RSNA, 2023

VAEE-17

### **Doppler High Frequency Ultrasound in Vascular Complications: What Radiologists Should Know Before, During or After Injectable Procedures**

#### **Participants**

Luciana Zattar, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Facial injections with different dermal fillers have become increasingly common. The explosion in the use of these injectable materials has brought a concomitant rise in the incidence of complications. Vascular compromise is the most concerning complication of all, caused either by intravascular injection (arterial or venous), external compression (mostly of the veins), thrombosis or embolization. As a result, blood flow may be interrupted in the occluded facial arteries, leading to ischemia, necrosis or ulcerations. Fortunately, Doppler high frequency ultrasound (DHFUS) is valuable to avoid, to diagnose and to treat vascular complications in most clinical scenarios. However, the clinicians should be alerted that many factors will affect the sensitivity of this examination. And, in this context, the radiologists may be requested to recognize and evaluate patients before, during or after injectable procedures, for safe and effective injections. This study aims: (1) To review and clarify the facial vascular anatomy and major variations. (2) To describe the correct examination technique: basic probe positions. (3) To teach how to recognize different dermal fillers substances and signs of vascular occlusion. (4) To list different possible imaging findings of vascular occlusion (new pattern based on angiosome with fresh-frozen specimen correlation). (5) To describe guided procedures to avoid or treat complications.

#### **TABLE OF CONTENTS/OUTLINE**

1. INTRODUCTION. 2. VASCULAR FACIAL ANATOMY. 3. IMAGING TECHNIQUE. 4. DERMAL FILLERS DESCRIPTION. 5. DHFUS FINDINGS IN VASCULAR OCCLUSIONS: a new finding. 6. GUIDED PROCEDURES. 7. CONCLUSION.

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## Abstract Archives of the RSNA, 2023

VAEE-18

### Collateral Networks in Superior Vena Cava Obstruction

#### Participants

Joao Sarmiento Santos, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To illustrate with schematic figures and cases the patterns of collateral venous pathways depending on the level of superior vena cava (SVC) obstruction (above or below the junction of the azygos arch). To discuss the technical aspects related to vena cava imaging To describe the mechanisms and illustrate with cases the different etiologies of SVC obstruction. To discuss the treatment options, the role of imaging to plan therapy, as well as post-therapeutic findings.

#### TABLE OF CONTENTS/OUTLINE

SCV obstruction is a relatively common entity in the everyday practice of different radiology subspecialties, including head and neck, thoracic, abdominal, vascular and interventional radiologists. Hence, to schematize in an easy way the collateral venous pathways developed secondary to caval obstruction is of wide interest to facilitate diagnosis and treatment. We herein describe the collateral pathways resulting from SCV obstruction and correlate the opacification of those collaterals to the site of contrast injection in CT and MR angiography exams. Graphic representations of the sites of obstruction and respective formed collaterals are depicted, as well as the azygos / hemiazygos system participation to the collateral venous return. The normal anatomy and anatomical variations which might play a role in the collateral system development are detailed. The main causes of obstruction are discussed: extrinsic compressions, tumoral invasion, thrombosis and traumatic injury.

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## Abstract Archives of the RSNA, 2023

VAEE-19

### **When The Lifeline Becomes a Liability: Comprehensive Analysis of Arterio-Venous Fistula and Graft Complications in Hemodialysis Patient**

#### **Participants**

Kamlesh Kumar Ratre, MD, New Delhi, India (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Simplifying the approach to Doppler ultrasound of Arterio-Venous fistula through a tabular form, and displaying normal imaging findings of patent fistula in gray scale sonography, color Doppler and CT Angiogram Venogram. Understanding the normal post graft hemodynamic changes. To highlight various types of haemodialysis access sites ranging from radiocephalic fistula to transposition basilic vein fistula and less frequently used arterio-venous graft. To demonstrate various possible complications of A-V fistula like infection, aneurysmal dilatation, pseudoaneurysm, stenosis, thrombosis and arterial steal phenomenon. To help the budding radiologists in identifying these complications for prompt diagnosis leading to early intervention and better patient management.

#### **TABLE OF CONTENTS/OUTLINE**

Simplified version of Arterio-Venous fistula Doppler technique. Normal anatomy on CT Angiogram Venogram. Approach to normal and altered hemodynamics of Arterio-Venous fistula on colour Doppler. Identification of mature Arterio-Venous through Doppler parameter. Comprehensive review of complications of Arterio-Venous fistulae graft.

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## Abstract Archives of the RSNA, 2023

VAEE-2

### Spontaneous Abdominal Wall Hemorrhage: A Practical Diagnostic Guide to Aid the Interventional Radiologist

#### Participants

Claudia Campos Bas, Palma De Mallorca, Spain (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the diagnostic process using Angio-CT of spontaneous soft tissue haemorrhage ( SSTH) in the abdominal wall and the key findings to guide interventional treatment.To share practical advice on identifying the probable bleeding artery in angio-TC using vascular territory mapping and correlating with arteriography.

#### TABLE OF CONTENTS/OUTLINE

SSTH in the abdominal wall characterizes by sudden extravasation of blood into a muscle group without an underlying medical condition. Whilst most cases remain confined, some may become extensive and life-threatening. In such situations, radiological management may be both diagnostic and interventional.Angio-TC is the gold standard for the detection of haemorrhage, allowing a fast and non-invasive diagnosis. Moreover, it enables us to differentiate between arterial and venous bleeding and to approximate the most probable bleeding artery, serving as a road map for targeted angiography and embolization. We retrospectively reviewed 28 patients (aged 59-88) admitted to our angiography suite due to acute anemia in the setting of active arterial abdominal wall bleeding described on triphasic CT. We determined the presence of active arterial bleeding and identifies the responsible vascular pedicle when possible. In all other cases, we inferred the most probable bleeding vessel based on location of contrast extravasation, known as "arterial mapping". We compared our results with the subsequent arteriography. Angio-TC is essential in the setting of SSTH as it enables to determine the presence and origin of bleeding. Differentiating arterial from venous bleeding and identifying the potentially damaged vessel is of paramount to manage these patients.

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## Abstract Archives of the RSNA, 2023

VAEE-20

### Chronic Mesenteric Ischemia: Mesenteric Artery Duplex Sonography and the Utility of Postprandial Imaging

#### Participants

Kaitlin Zaki-Metias, MD, Windsor, ON (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Duplex sonography performed in the fasting state serves as a good initial screening tool for chronic mesenteric ischemia. 2. There is a wide range and lack of consensus of established cut-offs for peak systolic velocity criteria suggestive of hemodynamically significant mesenteric arterial stenosis in the literature. 3. The evidence supporting the utility of postprandial assessment of the mesenteric arteries is inconclusive. 4. Failure of peak systolic velocity to increase 20-30% between fasting and postprandial states may indicate hemodynamically significant stenosis. 5. Given the lack of clarity surrounding postprandial duplex sonography of the mesenteric arteries, inclusion of postprandial assessment in the imaging protocol may lead to confusion.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology and clinical presentation of chronic mesenteric ischemia 3. Pathophysiology of chronic mesenteric ischemia 4. Duplex sonography of the mesenteric arteries: common protocols and pitfalls 5. Postprandial imaging of the mesenteric arteries and associated challenges 6. ACR appropriateness criteria for imaging of mesenteric ischemia 7. Case-based review of mesenteric artery duplex sonography including normal cases, abnormal cases, and cases mistakenly interpreted as abnormal 8. Management of chronic mesenteric ischemia 9. Conclusion

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## Abstract Archives of the RSNA, 2023

VAEE-21

### The Forgotten Vessels: Imaging of the Inferior Mesenteric Vasculature

#### Participants

Anup Shetty, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The inferior mesenteric artery (IMA) and vein (IMV) supply and drain the distal colon and rectum, but can be neglected as part of a standard search pattern. This exhibit will: 1) Familiarize the reader with the embryology, anatomy, and physiology of the inferior mesenteric vessels 2) Discuss modalities used to image the IMA/IMV 3) Illustrate a broad spectrum of diseases affecting the IMA/IMV through a series of illustrative cases

#### TABLE OF CONTENTS/OUTLINE

Outline- Embryology, Anatomy (and variants), and Physiology- Imaging Modalities (CT, US, MR, angiography)\* IMA abnormalities - acute thromboembolic disease - chronic occlusion (AAA, Leriche) and collateral pathways - dissection, aneurysm, pseudoaneurysm, and arteriovenous fistula - vasculitis - hemorrhage - tumor invasion\* IMV abnormalities - thrombosis - septic thrombophlebitis - intravenous gas in the setting of pneumatosis - tumor invasion - rectal varices in portal hypertension - mass effect from sigmoid volvulus leading to rectal edema\* diagnostic clues- displacement from internal hernia - lymphadenopathy from rectal cancer - flow artifact at portosplenic confluence

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## Abstract Archives of the RSNA, 2023

VAEE-22

### CT Angiography of the Upper Extremity: Purpose, Protocols, Problems, and Pathology

#### Participants

Alexander Satei, MBBS, Birmingham, MI (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. CT angiography is a key diagnostic imaging tool to evaluate for upper extremity arterial pathology. 2. Understanding the vascular anatomy of the upper extremity, including variant anatomy, is critical for interpretation of CT angiography of the upper extremity. 3. Benefits of CT angiography include rapid noninvasive image acquisition, lower cost and radiation exposure than digital subtraction angiography, and simultaneous evaluation of the adjacent osseous structures and soft tissues. 4. Limitations of CT angiography include patient positioning for optimal imaging, contrast bolus timing, increased cost and radiation exposure relative to sonographic evaluation, and artifact relating to arterial calcification, implanted hardware, or metallic foreign bodies. 5. CT angiography of the upper extremity is ideal for evaluation of traumatic arterial injury, vasculitides, congenital vascular anomalies, arteriovenous fistulae for hemodialysis, and pre- and post-operative evaluation relating to vascular and surgical intervention.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Vascular anatomy of the upper extremity. 3. Review of important variant vascular anomalies of the upper extremity. 4. Indications for CTA of the upper extremity. 5. Benefits and limitations of CTA of the upper extremity. 6. Extended case-based review of CTA upper extremity including subclavian steal syndrome, active post-traumatic extravasation, arteriovenous fistulae, pseudoaneurysm and aneurysm, mycotic aneurysm, dissection, transection, hematoma, fibromuscular dysplasia, and thoracic outlet syndrome, among others. 7. Conclusion.

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## Abstract Archives of the RSNA, 2023

VAEE-23

### Hearts on Fire: Imaging the Coronary Arteries in Systemic Vasculitis

#### Participants

Sean Johnson, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Overview of systemic vasculitis, highlighting entities which can involve the coronary arteries. Review the incidence and prevalence of coronary artery vasculitis. Demonstrate coronary artery manifestation of systemic vasculitis with case-based reviews. Discuss various diagnostic modalities and protocols used to identify and characterize coronary artery vasculitis.

#### TABLE OF CONTENTS/OUTLINE

1. Incidence and prevalence of coronary artery vasculitides. 2. Review forms of systemic vasculitis, coronary artery manifestations and pathophysiology, including: Takayasu arteritis, Kawasaki disease, microscopic polyangiitis, Erdheim-Chester disease, IgG4-related vasculitis and polyarteritis nodosa. 3. Case-based review of coronary artery vasculitides, including both acute and chronic manifestations. 4. Brief discussion of non-coronary thoracic aortic disease in systemic vasculitis. 5. An approach evaluating the coronary arteries for involvement in systemic vasculitis, including review of imaging selection and protocols.

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## Abstract Archives of the RSNA, 2023

VAEE-24

### Advanced Multimodal MRA Techniques for Cerebrovascular Disease: A Comprehensive Guide

#### TEACHING POINTS

Cerebrovascular disorder treatment has evolved, now employing a range of advanced devices. While time-of-flight MR angiography (TOF-MRA) can suffer from image degradation, innovative multimodal MRA techniques such as phase contrast (PC), ultrashort echo time (UTE), and 4D offer improved image quality. Embracing these cutting-edge imaging methods is crucial in managing cerebrovascular disorders. Our presentation aims to:

1. Provide a comprehensive overview of cerebrovascular diseases.
2. Highlight the technical details of state-of-the-art multimodal MRA imaging techniques.
3. Showcase the clinical applications of multimodal MRA imaging in diagnosis, treatment, and postoperative care for cerebrovascular diseases.

#### TABLE OF CONTENTS/OUTLINE

1. Exploring the significance and recent advancements in multimodal MRA imaging for cerebrovascular diseases.
2. Diving deep into the technical aspects of various MRA sequences, including TOF, PC, UTE, and 4D.
3. Unveiling the latest clinical applications of multimodal MRA imaging for cerebrovascular conditions, such as intracranial aneurysms, arteriovenous malformation (AVM), dural arteriovenous fistula (dAVF), and moyamoya disease, through real-life case studies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-25

### US of Lower Extremity Deep Vein Thrombosis: A Review

#### TEACHING POINTS

- Describe SRU Multidisciplinary 2018 Consensus protocol for complete duplex ultrasound (CDUS) of lower extremity· Differentiate acute thrombosis, chronic post thrombotic change· Discuss implications of slow flow· Describe normal and abnormal spectral Doppler and how it can be used to infer more central thrombosis· Describe pitfalls related to anatomy, gray scale and color Doppler

#### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline1. Ultrasound Protocols a. SRU consensus for complete duplex ultrasound (CDUS) b. Alternative (limited protocols) i. Appropriate situations ii. Follow up c. Example of imaging and labeling for CDUS2. Acute DVT a. Gray scale b. Types: Occlusive, Non-occlusive, Mobile c. Appearance over time d. "Acute on chronic" and indeterminate acuity e. Phlegmasia cerulea dolans3. Post thrombotic change a. Diminutive size of veins b. Wall thickening c. Synechiae d. Calcification e. Collaterals and deep reflux f. Neovascularization /arterialization4. Other Issues a. Central DVT implied by abnormal spectral Doppler b. Slow Flow i. Normal ii. Progression to DVT c. Isolated calf thrombus d. Increased venous pulsatility e. Positive DVT with ipsilateral renal transplant5. Follow up US, alternative imaging and treatment recommendations based on US appearance and extent of thrombus6. Pitfalls a. Related to frequency of transducers b. Anatomic variations c. Poor color Doppler settings

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-26

### **A Novel Approach to Deforming Device for Optimal Frozen Elephant Trunk Technique via Patient Specific 3D Printed Model**

#### **TEACHING POINTS**

Frozen elephant trunk implantation for thoracic aortic aneurysms is recognized as a less invasive surgical technique. However, because intraoperative fluoroscopy is not available, device insertion must be done with blind operation. To avoid complications, we developed a novel approach for deforming device in advance and simulating surgical procedures via life size 3D model.

#### **TABLE OF CONTENTS/OUTLINE**

Datasets for printing were converted, using CT data which has submillimeter spatial resolution. Patient specific life size 3D printed models were faithfully reproduced luminal surface of thoracic aorta. 3D printed model enables surgeon to assess physiological morphology including stenosis or spiculated atheroma, practically, though it is impossible to see that intraoperatively. Furthermore, this method allowed surgeon to simulate surgical procedures, considering precise device size in advance. 3D printed model is clinically available and promising for facilitating the operation strategy optimization, and assistant for frozen elephant trunk technique safely. There will be contributions to clinical practice for preoperative accurate assessment and simulation.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-27

### Nonatherosclerotic Conditions of Peripheral Arteries

#### Participants

Taila Moura Fe, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Make a didactic review of the nonatherosclerotic conditions of peripheral arteries, including the following conditions: Aneurysm, Pseudoaneurysm, Dissection, Vascular prosthesis and grafts, Embolism, Arteriovenous fistula, Arterial adventitial cystic disease, Locked-in arterial syndrome. To illustrate these conditions based on cases from our ultrasonography team. Correlate sonography findings with different image methods.

#### TABLE OF CONTENTS/OUTLINE

Introduction including the nonatherosclerotic conditions of peripheral arteries, including the following conditions: Aneurysm, Pseudoaneurysm, Dissection, Vascular prosthesis and graft, EmbolismArteriovenous fistula, Arterial adventitial cystic disease, Locked-in arterial syndrome. Describe the main information of each condition. Illustrated teaching cases from our ultrasonography team, each condition. Correlate the ultrasound findings with other image methods.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-28

### Development of a Double Bolus Tracking Method for Individualized CT Angiography Scan Timing

#### TEACHING POINTS

To perform surgical procedures safely, understanding the anatomical variations of the veins in preoperative computed tomography (CT) angiography is critical. The scan timing of the venous phase is generally performed via fixed scan delay, but the contrast effect is often inadequate owing to individual differences in the peak timing of the veins. We have developed the double bolus tracking (DBT) method, which effectively utilizes low-dose monitoring in preoperative CT angiography to individualize the timing of the venous and the arterial phases. The advantage of the DBT method is that the CT angiography enhances the contrast effect in complex anatomical regions such as the portal venous system. Consequently, it might improve the surgical outcomes and patients' quality of life.

#### TABLE OF CONTENTS/OUTLINE

A) An overview of the DBT method B) Scanning techniques used for low dose monitoring C) Differences in contrast effects between the fixed scan delay and the DBT methods D) Clinical applications of preoperative vascular mapping E) Advantages of using the DBT method in complex anatomical regions such as the portal venous system F) Limitations and future directions of the DBT method G) Conclusions and clinical relevance of using DBT in preoperative screening methods for colon cancer surgery

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-29

### The Anatomy of Danger: Exploring Hemodynamic Perils in Type B Aortic Dissection

#### Participants

Hyun Jung Koo, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To explore the debated issues regarding the relationship between the number of entries and aneurysm progression in patients with type B aortic dissection (AD)- To simulate in-vitro dissection model for assessing the relationship between the flow and entries in the dissection- To demonstrate the utility of 4D flow magnetic resonance imaging (MRI) and computational fluid dynamics (CFD) for assessing hemodynamic flow in patients with type B AD - To suggest potential applications of CT and 4D flow MRI in personalized treatment planning for aortic dissection, such as selecting the optimal timing for surgical intervention based on hemodynamic parameters and individual patient factors.

#### TABLE OF CONTENTS/OUTLINE

1. CT features - Predictors of high-risk adverse outcome in patients with type B AD2. Controversies - Entry and re-entries - Hemodynamic flow and thrombosis in false lumen3. Assessment of Hemodynamics 1) In-vitro Fluid Dynamics Study- Aorta modeling method - In-vitro 4D flow2) In-vivo 4D flow MRI Study- Wall shear stress, flow displacement, and flow velocity - The role in predicting aortic dissection progression3) CT-based CFD Analysis- In-vivo patient study- In-vitro model matching

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-3

### Abdominal Aortic Aneurysm: Pre and Post Operative Evaluation

#### Participants

Matheus Marcelino Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purposes of this exhibit are: Make a multimodality-based didactic review of the main topics of infradiaphragmatic aneurysm at pre and post operative evaluation. Make a practice guide on how to perform an evaluation with all the necessary variables for follow-up or surgical planning using different imaging methods. Propose a didactic categorization of these topics: Ultrasound evaluation of Abdominal aortic aneurysm. Postoperative Endovascular Ultrasound Evaluation. Postoperative complications d. Ultrasound with microbubbles contrast. Correlate those findings with other exams. Adequate evaluation and early recognition of post operative complications of endovascular repair of aneurysms. Illustrate those conditions based on cases from our radiology group.

#### TABLE OF CONTENTS/OUTLINE

We will discuss the principles of the abdominal aortic aneurysm at pre and post operative evaluation and focus on their imaging features using a multimodality approach in this exhibit. Ultrasound evaluation of infradiaphragmatic aneurysm. Postoperative Endovascular Ultrasound Evaluation. Postoperative complications. Ultrasound with microbubbles contrast.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-30

### Why is CT Useful in the Diagnosis of Klippel-Trenaunay-Weber Syndrome?

#### TEACHING POINTS

The purpose of this exhibit is:1. Klippel-Trenaunay-Weber syndrome (KTWS) is a rare and intractable disorder characterized by unilateral hypertrophy associated with one or more mixed vascular malformations of the extremities.2. The main imaging modalities used at KTWS are US, MRI, angiography and CT.3. CT images can clearly depict the vascular malformations of KTWS.4. In addition, volume measurement and histogram analysis of the extremity by CT imaging can be used to help diagnose KTWS and guide treatment.

#### TABLE OF CONTENTS/OUTLINE

Major headings:1. Describe KTWS.2. How to create a CT Venography.3. Usefulness of volume rendering (VR) images by CT.- About VR images of superficial veins.- About VR images of deep veins.4. Volumetric measurements with CT imaging of the lower extremities are useful in the diagnosis of KTWS.- The volume of the affected and healthy side can be measured reliably and easily.5. Histogram analysis with CT images of the lower extremity is useful in the treatment strategy for KTWS.- Histogram analysis can determine the components within the analysis area from the CT number.- In the present case, the enlargement of the lower extremities was determined to be due to an increase in the fat component (CT number indicates a negative value), not edema (CT number indicates near zero).

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

VAEE-31

### Vascular Malformations and the Mimickers: A Spectrum of Imaging Features

#### Participants

Mayu Uka, , Japan (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1) To review contrast-enhanced MRI and other imaging features of vascular malformations and vascular tumors compared to imaging features of other similar diseases and 2) to discuss the differential diagnosis of vascular malformations and vascular tumors with other lesion types.

#### TABLE OF CONTENTS/OUTLINE

The cause of most vascular tumors and vascular malformations of the body surface and soft tissue is unknown. Hemangiomas, which are benign vascular tumors, and vascular malformations are often referred to idiomatically as "hemangiomas," but the International Society for the Study of Vascular Anomalies (ISSVA) classifies them as separate diseases. Vascular malformations, which include venous malformations, arteriovenous malformations, lymphatic malformations, capillary malformations, and combined types, whose clinical and imaging findings sometimes resemble not only vascular tumors but also other neoplastic and non-neoplastic lesions. In this presentation, we will present common vascular malformations, vascular tumors, and other rare conditions, and review the imaging features and pathological findings of "mimickers," which sometimes have imaging similarities to vascular malformations and are difficult to diagnose.

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## Abstract Archives of the RSNA, 2023

VAEE-32

### Aortitis and Large Vessel Arteritis: Diagnosis, Follow-up, Treatment and Mimics

#### Participants

Miltiadis Tembelis, MD, Mineola, NY (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Aortitis and large vessel arteritis encompass both infections and noninfectious causes of vascular wall inflammation. These pathologies often produce non-specific clinical presentations and inflammatory markers, complicating the diagnosis. Correlation with demographics, key clinical features and recognition of typical imaging features and distribution can allow radiologist to assist in the diagnosis. Diagnosis is not the only difficult aspect of these pathologies though, as recommendations for appropriate follow-up and the definitions of remission in the literature are heterogeneous.

#### TABLE OF CONTENTS/OUTLINE

This review will demonstrate different imaging features of infectious and noninfectious large vessel arteritis and aortitis across different modalities to help radiologists clue in on the diagnosis. Common complications and post-interventional appearances will also be exemplified. In addition, treatments and post-treatment follow-up will be addressed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-33

### Which Vascular Variations Are Important to Colorectal Surgeons for Right Colon Surgery?

#### Participants

Minho Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In right colic surgery, the choice of surgical methods, such as right hemicolectomy, transverse colectomy, or extended right colectomy, depends on the location of the colon cancer. However, vascular variations can occasionally necessitate a change in the planned surgical approach, preventing the originally intended reduced surgery and leading to an extended right colectomy instead. The diverse and frequent vascular anatomy variations in the right colon, if not identified preoperatively, can contribute to increased morbidity and mortality rates. Unexpected arterial variations can prolong surgical time, while venous variations can result in bleeding complications. To assess the impact of vascular variations on surgical methods, we will review approximately 380 CT angiographies and determine the type and incidence of right colic and middle colic arterial and venous variations. We will also identify vascular ligation points according to the type of surgery. Additionally, common mistakes and prevention strategies when inexperienced radiologists evaluate CT angiographies will be discussed. Readers will understand that preoperative CT angiographic evaluations can help shorten surgical time, minimize unexpected bleeding risks, and ultimately improve surgical outcomes.

#### TABLE OF CONTENTS/OUTLINE

1. Arterial and venous anatomy of the right colon. 2. Various types of right colon surgery and corresponding vascular ligation points for each procedure. 3. Important measurements of right and middle colic arteries relevant to right colon surgery. 4. Incidence and representative cases of vascular variations. 5. Pitfalls in interpretation and associated cases.

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## Abstract Archives of the RSNA, 2023

VAEE-34

### Clinical Applications of MR Angiography Based on Arterial Spin Labeling to Cerebrovascular Disorders

#### TEACHING POINTS

1) To explain the basic principles of 3D or 4D arterial spin labeling (ASL)-based MR angiography (MRA) 2) To discuss the advantages of ASL-based MRA over other imaging techniques 3) To review clinical applications of ASL-based MRA for various cerebrovascular diseases

#### TABLE OF CONTENTS/OUTLINE

1) Basic principles of ASL-based MRA •Labeling schemes, Pulsed ASL; Pseudo-Continuous ASL (PCASL); Superselective PCASL; Acceleration-selective ASL (AccASL) •3D or 4D imaging acquisition techniques2) Advantages of ASL-based MRA over time-of-flight MRA or digital subtraction angiography •Readily available •No need for contrast media •No radiation exposure •Short acquisition time •Non-invasive •Cost effective •Time-resolved information •Selective vascular visualization •Easy follow-up after treatment •Easily applicable to children3) Specific techniques for ASL-based MRA •3D-MRA using PCASL -Silent MRA •4D-MRA using pulsed ASL - Contrast inherent inflow enhanced multi-phase angiography (CINEMA) •4D-MRA using PCASL -4D-MRA based on PCASL with CENTRA-Keyhole and view-sharing (4D-PACK) •Vessel-selective 4D-MRA using superselective PCASL (4D-S-PACK) • AccASL MRA 4) Clinical applications •Intracranial steno-occlusive arterial diseases (e.g. Moyamoya disease) •Brain arteriovenous malformation • Intracranial dural arteriovenous fistula •Assessment of extra-intracranial bypass arteries 5) Limitations of each ASL-based MRA technique

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## Abstract Archives of the RSNA, 2023

VAEE-35

### Clinical Applications and Implementation of Photon Counting Detector CT in Vascular Imaging

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To discuss the advantages of photon-counting detector (PCD) CT in vascular imaging 2. To review the modes, kernels, and protocols of PCD CT in vascular imaging 3. To illustrate the clinical applications of PCD CT in vascular imaging

#### TABLE OF CONTENTS/OUTLINE

1. PCD CT TECHNOLOGIES- Single source, Dual-source 2. BENEFITS OF PCD-CT-Ultra-high spatial resolution;Multi energy (ME)/spectral imaging;K-edge imaging ;High vascular signal;Low electronic noise artifacts;Lower radiation and contrast doses; 3. TECHNICAL ASPECTS RELEVANT TO VASCULAR IMAGING-Modes Ultra-high resolution, ME, HR-ME, Flash-ME, gated/ungated;Kernels, denoising;Collimation;Images- Single energy like (T3D), VMI, iodine, VNC, virtual non calcium, spectral post-processing;Radiation doses, CARE keV;4. VASCULAR APPLICATIONS OF PCD CT WITH CASE EXAMPLES-Ultra-high resolution- Improved visualization of small vessels (Flaps ,eg. DIEP, fibular perforators; Artery of Adamkiewicz; distal arteries of hand, feet, head), calcified plaques, small stents;High iodine CNR - Low dose of iodinated contrast, salvage of suboptimal-enhanced studies;Decreased artifacts- Calcium blooming, beam hardening, metal;ME calcium separation- Improved lumen visualization;ME bone subtraction- Rapid and accurate;ME lesion characterization-hematoma vs active bleed vs calcification;Vascular perfusion- Lung, myocardium, extremities;Multi-contrast and novel contrast media- e.g. iodine and gadolinium;Advanced material separation- Calcium;Radiation dose reduction- VNC images in multiphasic studies, lower noise profile; 5. LIMITATIONS, PITFALLS-Increased data - storage and transfer issues; Noise in high resolution mode

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## **Abstract Archives of the RSNA, 2023**

VAEE-36

### **Review of CTA Findings in Patients With Circulatory Assisted Devices**

#### **TEACHING POINTS**

Present CT imaging findings and clinical presentations of complications associated with circulatory assisted devices. Review entities that may present as pitfalls in CT imaging of circulatory assisted devices.

#### **TABLE OF CONTENTS/OUTLINE**

This educational exhibit will present pictorial review of multiple CT findings of complications associated with circulatory assisted devices to increase Radiologists awareness. Highlight challenges associated with CT imaging of circulatory assisted devices and also provide tips to overcome the challenges.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-37

### CT Angiography's Role in Virtual Surgical Planning for Craniomaxillofacial Reconstruction with Scapular Free Flap

#### TEACHING POINTS

1. Virtual surgical planning plays an important role in craniomaxillofacial (CMF) reconstruction with scapular free flap. 2. Scapular free flaps are preferred over fibular or deep circumflex artery free flaps for CMF reconstruction when there is variant anatomy, significant atherosclerosis, or prior utilization of lower extremity vessels. 3. Preoperative virtual surgical planning (VSP) has numerous advantages over traditional intraoperative decision making including shortened operative times, improved patient matched custom implant design, improved patient specific oncologic margins and anatomic understanding, and decreased rate of nonunion and flap related complications. 4. Virtual surgical planning and 3D printing sterilizable guides at the point of care requires a centralized manufacturing ecosystem and collaboration between surgeons, radiologists, engineers, and support staff. 5. CT angiography is an important first step in the pre-surgical planning for scapular free flap harvesting because of common variant anatomy and localization of perforating branches.

#### TABLE OF CONTENTS/OUTLINE

- Scapular free flap advantages over fibular and deep circumflex artery flaps. - CT angiography's role in virtual surgical planning. - Optimal imaging acquisition to achieve optimal radiologic planning. - Role of 3D modeling and medical device design in virtual surgical planning.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-4

### Segmental Arterial Mediolytic: A Visual Journey Through Its Imaging Findings

#### Participants

Camila Reifegerste, MD, Curitiba, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Segmental arterial mediolysis (SAM) is a nonatherosclerotic and noninflammatory arteriopathy, unknown to many radiologists. It can lead to severe complications, which have a high mortality rate, thus it is important for us to be aware of this disease. SAM is characterized by lysis of the medial arterial layer, normally compromising visceral and renal arteries, coursing with dissections, aneurysms and even arterial rupture. The imaging findings on computed tomography angiography (CTA) of SAM can be very similar to others vasculitides, such as polyarteritis nodosa and granulomatosis with polyangiitis, but most vasculitides can be diagnosed based on clinical, laboratory and imaging findings, while SAM's diagnosis is based majorly on imaging findings and exclusion of other vasculitides. The aim of this presentation is to show some cases of segmental arterial mediolysis from our institution, its complications and some differential diagnosis, for the purpose of making radiologists more familiar with this pathology.

#### TABLE OF CONTENTS/OUTLINE

Brief literature review of segmental arterial mediolysis; didactic cases of SMA from the digital archive of our hospital's radiology department, to show SAM typical findings, complications and differential diagnosis on multiple imaging modalities, including computed tomography angiography (CTA), magnetic resonance angiography (MRA), Doppler ultrasound and arterial angiography

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

VAEE-5

### The Aortic Isthmus from A to Z

#### Participants

Juliana Da Trindade, Niteroi, Brazil (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe the embryology of the aortic isthmus, and its developmental stages. To demonstrate with cases the peculiar anatomical variations of this segment. To exemplify with cases the congenital malformations and pathological states.

#### TABLE OF CONTENTS/OUTLINE

The aortic isthmus is a small aortic segment located between the left subclavian artery and the ductus arteriosus. This segment undergoes singular changes to allow flow adjustments necessary for the blood circulation from intra to extra-uterine life. The process of closure of the ductus arteriosus after birth normally results in a fibrous band called ligamentum arteriosus. However, different factors as prematurity, genetics, prenatal infections, concomitance of congenital heart diseases, the extension of the ductal tissue to the aortic wall may lead to either persistence of the ductus arteriosus or to variable patterns of ductal involution (aortic knobs or ampullas, aortic-coarctation, etc). The presence of fibrotic tissue within the aortic wall and flow disturbances due to focal ectasia may additionally predispose to aneurysm formation, ulcerations and dissection during adulthood. Therefore, the aortic isthmus is an extremely complex region covering several anatomical variations and a wide spectrum of pathologies that may affect all age groups in a congenital or acquired form. Our goals are to review the isthmic developmental changes along intra to extra-uterine life, and to discuss the imaging findings of different anatomical variations and pathological states of this intricate aortic segment.

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## Abstract Archives of the RSNA, 2023

VAEE-6

### **Abdominal Vascular Compression Syndromes: What the Radiologist Needs to Know (and Let the Surgeons Know)**

#### **Participants**

Daniel Cardoso, MD, Fortaleza, Brazil (*Presenter*) Nothing to Disclose

#### **TEACHING POINTS**

Recognize the key structures of the abdominal vasculature and its anatomical relations. Understand the causes of Abdominal Vascular Compression Syndromes (AVCS) and related clinical features. Comprehend computed tomography angiography (CTA) imaging patterns of AVCS. Recognize the complications associated to AVCS and its imaging patterns. Understand AVCS treatment methods and criteria.

#### **TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: Anatomy of the abdominal vasculature and its relation to other structures. Definition of AVCS. Epidemiology of the most common causes of AVCS. Signs and symptoms. associated to the Median Arcuate Ligament Syndrome (MALS), Superior Mesenteric Artery Syndrome (SMAS), Nutcracker Syndrome (NCS), and May-Thurner Syndrome (MTS). DIAGNOSING, AND IDENTIFYING POST TREATMENT IMAGING PATTERNS - MALS, SMAS, NCS, and MTS: Imaging findings. Complications, and its imaging patterns. Treatment methods, and what to evaluate

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

VAEE-7

### Pelvic Congestion Syndrome. CT Angiography and Doppler Ultrasound Findings

#### Participants

Carlos Capunay, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To be aware of pelvic congestion syndrome as a cause of female chronic pelvic pain. To recognize the anatomic variants and pathologic conditions that can cause the pelvic congestion syndrome To illustrate the spectrum of CT and Doppler US findings in these patients. To emphasize the most representative imaging features on this clinical syndrome.

#### TABLE OF CONTENTS/OUTLINE

Anatomy of the normal female pelvic venous plexus. Pathogenesis of the pelvic congestion syndrome. Description of the Doppler US technique. Description of the CTA scan protocol: technical parameters and IV contrast administration CT image analysis and post-processing algorithms in the different clinical setting. Sample cases of compression syndromes (including superior mesenteric artery compression of the left renal vein, and compression of the left common iliac vein by the right common iliac artery). Summary.

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## Abstract Archives of the RSNA, 2023

VAEE-8

### The Use of Ferumoxytol for High-Resolution Vascular Imaging and Troubleshooting for Solid Organ Transplantation

#### Participants

Amar Shah, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Ferumoxytol, a novel MR contrast agent in off-label use, is safe for patients with renal dysfunction. 2. Due to its prolonged intravascular half-life and lack of parenchymal extravasation, high-resolution vascular imaging, including distal intraparenchymal branches, is feasible. 3. Ferumoxytol MRA can identify clinically actionable vascular complications of solid organ transplant several weeks to months before ultrasound or traditional MRA. 4. 3D reconstructions facilitate procedural planning and may obviate unnecessary intervention in select patients.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to ferumoxytol as a contrast agent: imaging characteristics, protocol details, and safety/administration. 2. Advantages and utility in comparison to GBCA. a. High-resolution vascular imaging without background parenchymal enhancement. b. Curved planar MIP reformats. c. Virtual angiography (Time-Resolved contrast-enhanced MRA) d. Coadministration with GBCA. e. Repeat imaging up to 72 hours. 3. Catalogue of example cases with preceding equivocal or normal ultrasound and/or GBCA MRA (highlighting above techniques). a. Transplant renal artery stenosis (TRAS) b. Transplant renal vein thrombosis (TRVT) with capsular neovascularization (CV) c. TRVT with CV d. TRAS and transplant pancreas artery stenosis (TPAS). e. Transplant pancreas vein thrombosis. f. Transplant pancreas intraparenchymal AVF. g. Transplant hepatic artery stenosis. h. Transplant hepatic vein thrombosis.

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## Abstract Archives of the RSNA, 2023

VAEE-9

### Imaging of Primary Malignancies of Inferior VenaCava and its Involvement in Secondary Abdominal Malignancies

#### Participants

Veeraiah Koppula, MD, Hyderabad, India (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

After reviewing this educational exhibit, the learner will be able to:• Learn the key imaging features of primary malignancies of Inferior Vena cava• Identify the clinical scenarios in which abdominal malignancies can extrinsically or intrinsically involve the IVC• Review the normal anatomy of IVC and its tributaries

#### TABLE OF CONTENTS/OUTLINE

• Introduction• Normal anatomy and variants of IVC• Clinical and radiological features and management of primary leiomyosarcoma and angiosarcoma of Inferior Vena cava.• Case based discussion of abdominal malignancies involving IVC• Relevance of IVC involvement in staging of malignancies and undertaking oncological surgeries• Conclusion

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## Abstract Archives of the RSNA, 2023

DLL01

**RSNA Deep Learning Lab: Basics of NLP in Radiology**

### Participants

Timothy Chen, MD, San Jose, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL01

**RSNA Deep Learning Lab: Basics of NLP in Radiology**

### Participants

Gunvant Chaudhari, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL01

**RSNA Deep Learning Lab: Basics of NLP in Radiology**

### Participants

Jae Ho Sohn, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL01

**Moderator**

### **Participants**

Jae Ho Sohn, MD, MS, San Francisco, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL01

### RSNA Deep Learning Lab: Basics of NLP in Radiology (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Understand common terminology and preprocessing techniques in NLP. 2) Identify several classic and modern approaches used to capture semantic meaning in text. 3) Learn how to implement a basic NLP pipeline from preprocessing to performance evaluation.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This session will feature a brief lecture introducing the basics of natural language processing (NLP) and highlight potential uses for it in radiology. The goal is to survey standard text preprocessing techniques and traditional NLP approaches as well as modern neural network based approaches. We will follow up the didactic portion with a hands-on Google Colab demo implementing discussed concepts for a text classification task. For best experience, we highly recommend attendees bring a laptop with a keyboard as well as have a Gmail account to access Google Colab.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This session will feature a brief lecture introducing the basics of natural language processing (NLP) and highlight potential uses for it in radiology. The goal is to survey standard text preprocessing techniques and traditional NLP approaches as well as modern neural network based approaches. We will follow up the didactic portion with a hands-on Google Colab demo implementing discussed concepts for a text classification task. For best experience, we highly recommend attendees bring a laptop with a keyboard as well as have a Gmail account to access Google Colab.

#### Sub-Events

##### **DLL01 Moderator**

Participants  
Jae Ho Sohn, MD, MS, San Francisco, CA (*Moderator*) Nothing to Disclose

##### **DLL01 RSNA Deep Learning Lab: Basics of NLP in Radiology**

Participants  
Timothy Chen, MD, San Jose, CA (*Presenter*) Nothing to Disclose

##### **DLL01 RSNA Deep Learning Lab: Basics of NLP in Radiology**

Participants  
Gunvant Chaudhari, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### **DLL01 RSNA Deep Learning Lab: Basics of NLP in Radiology**

Participants  
Jae Ho Sohn, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

##### **DLL01 RSNA Deep Learning Lab: Basics of NLP in Radiology**

Participants  
Cody Savage, MD, Tuscaloosa, AL (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

DLL01

**RSNA Deep Learning Lab: Basics of NLP in Radiology**

### Participants

Cody Savage, MD, Tuscaloosa, AL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL02

### RSNA Deep Learning Lab: CT Body Part Classification (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Evaluate an artificial intelligence model designed to determine body part in CT after development. 2) Learn how to interpret raw outputs from this model. 3) Build graphs and visualizations to help understand model performance and interpretability.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Come to this hands-on learning lab for lessons on how to interpret and evaluate an AI model after development.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Come to this hands-on learning lab for lessons on how to interpret and evaluate an AI model after development.

#### Sub-Events

##### DLL02 Moderator

###### Participants

Ross Filice, MD, Washington, DC (*Moderator*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

##### DLL02 RSNA Deep Learning Lab: CT Body Part Classification

###### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

##### DLL02 RSNA Deep Learning Lab: CT Body Part Classification

###### Participants

Ish Talati, MD, Lake Forest, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL02

**Moderator**

### **Participants**

Ross Filice, MD, Washington, DC (*Moderator*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL02

### RSNA Deep Learning Lab: CT Body Part Classification

#### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL02

**RSNA Deep Learning Lab: CT Body Part Classification**

### Participants

Ish Talati, MD, Lake Forest, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL03

**Moderator**

### **Participants**

Kirti Magudia, MD, PhD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL03

**RSNA Deep Learning Lab: Data Processing Curation for Deep Learning**

### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL03

**RSNA Deep Learning Lab: Data Processing Curation for Deep Learning**

### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL03

### RSNA Deep Learning Lab: Data Processing & Curation for Deep Learning (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Extract relevant data from radiology and pathology reports. 2) Understand how to manage and process image-based annotations. 3) Perform image registration and normalization. 4) Recognize features of data formats ideal for deep learning.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This course will provide attendees with the essential tools to perform data processing and curation necessary for deep learning projects. Attendees will start with free text radiology and pathology reports as well as anonymized DICOM data and process data into a unified data file ready for deep learning applications.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This course will provide attendees with the essential tools to perform data processing and curation necessary for deep learning projects. Attendees will start with free text radiology and pathology reports as well as anonymized DICOM data and process data into a unified data file ready for deep learning applications.

#### Sub-Events

##### **DLL03 Moderator**

Participants  
Kirti Magudia, MD, PhD, Durham, NC (*Moderator*) Nothing to Disclose

##### **DLL03 RSNA Deep Learning Lab: Data Processing Curation for Deep Learning**

Participants  
Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

##### **DLL03 RSNA Deep Learning Lab: Data Processing Curation for Deep Learning**

Participants  
Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL04

### RSNA Deep Learning Lab: DICOM Data Wrangling with Python (Beginner Friendly)

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Additional information coming soon.

#### Sub-Events

##### **DLL04** Moderator

Participants

Katherine Andriole, PhD, (*Moderator*) Nothing to Disclose

##### **DLL04** RSNA Deep Learning Lab: DICOM Data Wrangling with Python

Participants

Katherine Andriole, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL04

**Moderator**

### **Participants**

Katherine Andriole, PhD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL04

**RSNA Deep Learning Lab: DICOM Data Wrangling with Python**

### Participants

Katherine Andriole, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL05

**Moderator**

### Participants

Andriy Fedorov, PhD, Arlington, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL05

**RSNA Deep Learning Lab: NCI Imaging Data Commons - Curated Data and Reproducible AI Workflows**

### Participants

Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL05

### RSNA Deep Learning Lab: NCI Imaging Data Commons - Curated Data and Reproducible AI Workflows (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Learn about the functionality of NCI imaging data commons related to selection and preparation of data cohorts for developing AI workflows. 2) Introduce the basic capabilities of IDC in support of development of reproducible AI workflows. 3) Experiment with the application of open source AI tools to public imaging datasets.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. NCI Imaging Data Commons (IDC), <https://imaging.datacommons.cancer.gov>, is a cloud-based repository of publicly available cancer imaging data co-located with the analysis and exploration tools and resources. IDC contains over 40TB of publicly available images and image annotations spanning a variety of cancer types and modalities. Attendees of this course will learn how to search, visualize and download IDC data, and how to build reproducible and shareable analysis workflows using Google Colab. The educational format will combine a lecture followed by a hands-on component and interactive discussions to gain familiarity with this resource.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. NCI Imaging Data Commons (IDC), <https://imaging.datacommons.cancer.gov>, is a cloud-based repository of publicly available cancer imaging data co-located with the analysis and exploration tools and resources. IDC contains over 40TB of publicly available images and image annotations spanning a variety of cancer types and modalities. Attendees of this course will learn how to search, visualize and download IDC data, and how to build reproducible and shareable analysis workflows using Google Colab. The educational format will combine a lecture followed by a hands-on component and interactive discussions to gain familiarity with this resource.

#### Sub-Events

##### DLL05 Moderator

Participants  
Andriy Fedorov, PhD, Arlington, MA (*Moderator*) Nothing to Disclose

##### DLL05 **RSNA Deep Learning Lab: NCI Imaging Data Commons - Curated Data and Reproducible AI Workflows**

Participants  
Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

### RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Introduction to DICOM tags and PHI stored in these tags. 2) Explain the issues around DICOM de-identification (DeID) and provide examples of DeID tools. 3) Leverage Large Language Model (eg, ChatGPT / GPT-4) to create a script to assist with DICOM DeID. 4) Hands-On DICOM DeID using GPT-4 generated scripts. 5) Other ways to leverage GPT-4 for DICOM DeID. 6) DICOM Pixel DeID\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Hands-On learning lab that leverages conventional and AI tools (LLMs like ChatGPT / GPT-4) to help with DICOM de-identification (DeID). Will practice DeID using scripts generated by LLMs and leverage GPT-4 in other ways for the de-identification process.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Hands-On learning lab that leverages conventional and AI tools (LLMs like ChatGPT / GPT-4) to help with DICOM de-identification (DeID). Will practice DeID using scripts generated by LLMs and leverage GPT-4 in other ways for the de-identification process.

#### Sub-Events

##### **DLL06 Moderator**

Participants

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

##### **DLL06 RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

Participants

Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **DLL06 RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

##### **DLL06 RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

Participants

Errol Colak, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### **DLL06 RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

Participants

Chinmay Singhal, MS, Jersey City, NJ (*Presenter*) Nothing to Disclose

##### **DLL06 RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

Participants

Hui Ming Lin, BSc, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**Moderator**

### **Participants**

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

### Participants

Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

### Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

### Participants

Errol Colak, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

### Participants

Chinmay Singhal, MS, Jersey City, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL06

**RSNA Deep Learning Lab: ChatCTP - DICOM de-identification using ChatGPT**

### Participants

Hui Ming Lin, BSc, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL07

**RSNA Deep Learning Lab: NLP - Text Classification with RNNs Transformers**

### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL07

**Moderator**

### **Participants**

Walter Wiggins, MD, PhD, Durham, NC (*Moderator*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL07

**RSNA Deep Learning Lab: NLP - Text Classification with RNNs Transformers**

### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL07

### RSNA Deep Learning Lab: NLP - Text Classification with RNNs & Transformers (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Develop a general understanding of how large language models (LLMs) for natural language processing (NLP) are trained. 2) Define the basic concepts of NLP preprocessing for text analysis (e.g. tokenization, embedding). 3) Use embeddings from an LLM to classify chest x-ray reports as positive or negative for specific findings.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This interactive course will provide participants with the opportunity to learn the basic principles of information extraction from radiology reports by working through a step-by-step example using radiology reports from a chest x-ray data set. Learners will use a large language model (LLM) to classify radiology reports as positive or negative for specific findings. This session will cover basic concepts in preparing data and training LLMs, as well as using a pre-trained LLM to classify radiology reports. No prior coding or machine learning experience is necessary.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This interactive course will provide participants with the opportunity to learn the basic principles of information extraction from radiology reports by working through a step-by-step example using radiology reports from a chest x-ray data set. Learners will use a large language model (LLM) to classify radiology reports as positive or negative for specific findings. This session will cover basic concepts in preparing data and training LLMs, as well as using a pre-trained LLM to classify radiology reports. No prior coding or machine learning experience is necessary.

#### Sub-Events

##### **DLL07 Moderator**

Participants  
Walter Wiggins, MD, PhD, Durham, NC (*Moderator*) Advisor, Qure.ai;

##### **DLL07 RSNA Deep Learning Lab: NLP - Text Classification with RNNs Transformers**

Participants  
Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

##### **DLL07 RSNA Deep Learning Lab: NLP - Text Classification with RNNs Transformers**

Participants  
Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL08

### RSNA Deep Learning Lab: Accessing Freely Available Public Datasets from The Cancer Imaging Archive (TCIA) (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Learn how TCIA makes data sharing easier for researchers and hear a summary of existing datasets that are freely available for download. 2) Practice utilizing TCIA for data exploration, cohort definition, and downloading of data. 3) Learn how to access public and restricted access datasets using TCIA's REST APIs and other command line tools via Jupyter Notebooks.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Access to large, high quality data is essential for researchers to understand disease and precision medicine pathways, especially in cancer. However HIPAA constraints make sharing medical images outside an individual institution a complex process. The Cancer Imaging Archive (TCIA) is a public service funded by the National Cancer Institute which addresses this challenge by providing de-identification and data publication services to take major burdens of data sharing off researchers. TCIA has published over 200 unique data collections containing more than 70 million images. Recognizing that images alone are not enough to conduct meaningful research, most collections are linked to rich supporting data including patient outcomes, treatment information, genomic / proteomic analyses, and expert image analyses (segmentations, annotations, and radiomic / radiogenomic features). In this course we will address basic use cases for identifying TCIA datasets of interest and downloading them via Jupyter Notebooks.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Access to large, high quality data is essential for researchers to understand disease and precision medicine pathways, especially in cancer. However HIPAA constraints make sharing medical images outside an individual institution a complex process. The Cancer Imaging Archive (TCIA) is a public service funded by the National Cancer Institute which addresses this challenge by providing de-identification and data publication services to take major burdens of data sharing off researchers. TCIA has published over 200 unique data collections containing more than 70 million images. Recognizing that images alone are not enough to conduct meaningful research, most collections are linked to rich supporting data including patient outcomes, treatment information, genomic / proteomic analyses, and expert image analyses (segmentations, annotations, and radiomic / radiogenomic features). In this course we will address basic use cases for identifying TCIA datasets of interest and downloading them via Jupyter Notebooks.

#### Sub-Events

##### DLL08 Moderator

Participants  
Justin Kirby, Rockville, MD (*Moderator*) Nothing to Disclose

##### DLL08 RSNA Deep Learning Lab: Accessing Freely Available Public Datasets from The Cancer Imaging Archive (TCIA)

Participants  
Justin Kirby, Rockville, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL08

**Moderator**

### **Participants**

Justin Kirby, Rockville, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL08

**RSNA Deep Learning Lab: Accessing Freely Available Public Datasets from The Cancer Imaging Archive (TCIA)**

### Participants

Justin Kirby, Rockville, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL09

**Moderator**

### Participants

Spyridon Bakas, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL09

**RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks**

### Participants

Ujjwal R. Baid, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL09

**RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks**

### Participants

Sarthak Pati, MSc, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL09

**RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks**

### Participants

Evan Calabrese, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL09

**RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks**

### Participants

Spyridon Bakas, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL09

### RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Identify the processes and tools used to curate and process raw DICOM imaging data. 2) Learn how to train a robust AI model with zero/low code. 3) Recognize the practical applications of the model, deploy it in a clinical setting, and leverage federated learning to train from other institutions' data.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This course aims to enable participants to conduct federated learning studies without writing any code. The main use case will focus on training and deploying a fully automated image segmentation model. The course will cover the end-to-end workflow to develop an AI model, starting from curating and preprocessing DICOM data all the way to using supervised and human-in-the-loop learning to train robust models. Finally, participants will learn how to deploy their models in the clinic and as federated studies. All the tools and code used will be open-source and be made available to the participants prior to the course.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This course aims to enable participants to conduct federated learning studies without writing any code. The main use case will focus on training and deploying a fully automated image segmentation model. The course will cover the end-to-end workflow to develop an AI model, starting from curating and preprocessing DICOM data all the way to using supervised and human-in-the-loop learning to train robust models. Finally, participants will learn how to deploy their models in the clinic and as federated studies. All the tools and code used will be open-source and be made available to the participants prior to the course.

#### Sub-Events

##### DLL09 Moderator

Participants  
Spyridon Bakas, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### DLL09 RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks

Participants  
Ujjwal R. Baid, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### DLL09 RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks

Participants  
Sarthak Pati, MSc, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### DLL09 RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks

Participants  
Evan Calabrese, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

##### DLL09 RSNA Deep Learning Lab: Zero-code Implementation of Federated Learning for Radiology Tasks

Participants  
Spyridon Bakas, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

### RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Understand the genesis and development of the Medical Imaging and Data Resource Center (MIDRC). 2) Appreciate how an imaging based data commons that links to clinical metadata can accelerate machine learning research. 3) Experience how to build your own data cohort for AI research using the MIDRC publication platform - Gen3.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. The Medical Imaging Data and Resource Center (MIDRC) is a multi-institutional effort supported by the AAPM, ACR and RSNA that is funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB) to collect and publish imaging and related clinical data to accelerate research into uses of imaging based AI. MIDRC provides a model for collecting and publishing data to support research that can be applied across all areas of medical imaging. MIDRC initially began in 2020 by aggregating hundreds of thousands of imaging studies of COVID-19 patients. MIDRC has now transitioned into collecting patient data relevant to post-acute sequelae of COVID or "long COVID" and will be pivoting into other medical use cases in the future. This session, led by principal investigators of MIDRC will give an overview of the structure of the MIDRC data commons and a tour of the open access data portal published on the Gen3 platform. During this session, attendees will have the opportunity to experience how to build a selected data cohort direct from the MIDRC data commons for AI research.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. The Medical Imaging Data and Resource Center (MIDRC) is a multi-institutional effort supported by the AAPM, ACR and RSNA that is funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB) to collect and publish imaging and related clinical data to accelerate research into uses of imaging based AI. MIDRC provides a model for collecting and publishing data to support research that can be applied across all areas of medical imaging. MIDRC initially began in 2020 by aggregating hundreds of thousands of imaging studies of COVID-19 patients. MIDRC has now transitioned into collecting patient data relevant to post-acute sequelae of COVID or "long COVID" and will be pivoting into other medical use cases in the future. This session, led by principal investigators of MIDRC will give an overview of the structure of the MIDRC data commons and a tour of the open access data portal published on the Gen3 platform. During this session, attendees will have the opportunity to experience how to build a selected data cohort direct from the MIDRC data commons for AI research.

#### Sub-Events

##### DLL10 Moderator

Participants  
Adam Flanders, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### DLL10 RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons

Participants  
Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc; Royalties, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Co-founder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Royalties, General Electric Company; Royalties, Median Technologies; Royalties, Riverain Technologies, LLC

##### DLL10 RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons

Participants  
Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### DLL10 RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons

Participants  
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Co-founder, PET/X LLC

##### DLL10 RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons

Participants  
Jordan Fuhrman, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Samuel G. Armato III, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Heather Whitney, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG;Research Grant, Siemens AG;Scientific Advisory Board, Hura Imaging, LLC

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Rui Carlos Sa, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

**DLL10** **RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

Participants

Christopher Meyer, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**Moderator**

### **Participants**

Adam Flanders, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Co-founder, PET/X LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Rui Carlos Sa, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Christopher Meyer, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Jordan Fuhrman, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Samuel G. Armato III, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Heather Whitney, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL10

**RSNA Deep Learning Lab: MIDRC - Building and using AI-ready Datasets from a Massive Open Data Commons**

### Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research Grant, Siemens AG; Scientific Advisory Board, Hura Imaging, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL11

**RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

### Participants

Kuan Zhang, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL11

**Moderator**

### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL11

**RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

### Participants

Jayashree Kalpathy-Cramer, PhD, Charlestown, MA (*Presenter*) Institutional Research Grant, General Electric Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL11

**RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL11

### RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI (Beginner Friendly)

#### LEARNING OBJECTIVES

1) Collect, format, and standardize medical image data. Use MONAI transforms to pre-process data. 2) Architect and train a convolutional neural network (CNN) in Pytorch for classification. 3) Evaluate the trained model on test dataset.\*Course Description  
In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Medical image classification plays an essential role in aiding clinical diagnosis and treatment. With the rapid development of artificial intelligence (AI) and computer vision (CV), deep learning-based methods become more accurate and applicable to a variety of clinical tasks ---- potentially serving as a valuable ally for radiologists and pathologists. In this course, learners will get a hands-on practical introduction to deep learning for radiology and medical imaging. An end-to-end training and evaluation example based on the MedNIST dataset will be covered. We will introduce the "MONAI" deep learning platform, which is a Pytorch-based, open-source framework for deep learning in healthcare imaging.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Medical image classification plays an essential role in aiding clinical diagnosis and treatment. With the rapid development of artificial intelligence (AI) and computer vision (CV), deep learning-based methods become more accurate and applicable to a variety of clinical tasks ---- potentially serving as a valuable ally for radiologists and pathologists. In this course, learners will get a hands-on practical introduction to deep learning for radiology and medical imaging. An end-to-end training and evaluation example based on the MedNIST dataset will be covered. We will introduce the "MONAI" deep learning platform, which is a Pytorch-based, open-source framework for deep learning in healthcare imaging.

#### Sub-Events

##### **DLL11 Moderator**

##### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

##### **DLL11 RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

##### Participants

Jayashree Kalpathy-Cramer, PhD, Charlestown, MA (*Presenter*) Institutional Research Grant, General Electric Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Bayer AG

##### **DLL11 RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

##### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

##### **DLL11 RSNA Deep Learning Lab: MedNIST Exam Classification with MONAI**

##### Participants

Kuan Zhang, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL12

### RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology

#### LEARNING OBJECTIVES

1) Learn basic concepts of fairness evaluation in AI for radiology. 2) Learn how to evaluate for fairness in AI models in radiology.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.This hands-on session will comprise a short tutorial about fairness in AI for radiology followed by hands-on, interactive coding session to learn how to evaluate for fairness in trained AI models.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.This hands-on session will comprise a short tutorial about fairness in AI for radiology followed by hands-on, interactive coding session to learn how to evaluate for fairness in trained AI models.

#### Sub-Events

##### **DLL12 Moderator**

Participants

Paul Yi, MD, Baltimore, MD (*Moderator*) Consultant, FH Orthopedics SAS;Consultant, BunkerHill Health

##### **DLL12 RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

Participants

Jacopo Teneggi, Baltimore, MD (*Presenter*) Nothing to Disclose

##### **DLL12 RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

Participants

Jeremias Sulam, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### **DLL12 RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

Participants

Paul Yi, MD, Baltimore, MD (*Presenter*) Consultant, FH Orthopedics SAS;Consultant, BunkerHill Health

##### **DLL12 RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

Participants

Beepul Bharti, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL12

**RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

### Participants

Beepul Bharti, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL12

**Moderator**

### **Participants**

Paul Yi, MD, Baltimore, MD (*Moderator*) Consultant, FH Orthopedics SAS; Consultant, BunkerHill Health

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL12

**RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

### Participants

Jacopo Teneggi, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL12

**RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

### Participants

Jeremias Sulam, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL12

**RSNA Deep Learning Lab: Evaluating for Fairness of AI Models in Radiology**

### Participants

Paul Yi, MD, Baltimore, MD (*Presenter*) Consultant, FH Orthopedics SAS; Consultant, BunkerHill Health

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL13

**Moderator**

### **Participants**

Peter Chang, MD, Irvine, CA (*Moderator*) Co-founder, Avicenna.ai; Stockholder, Avicenna.ai; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Canon Medical Systems Corporation; Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL13

**RSNA Deep Learning Lab: Best Practices for Model Training: Architectures, Hyperparameters Optimization**

### Participants

Peter Chang, MD, Irvine, CA (*Presenter*) Co-founder, Avicenna.ai; Stockholder, Avicenna.ai; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Canon Medical Systems Corporation; Research Grant, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL13

### RSNA Deep Learning Lab: Best Practices for Model Training: Architectures, Hyperparameters & Optimization

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Additional information coming soon.

#### Sub-Events

##### **DLL13 Moderator**

##### Participants

Peter Chang, MD, Irvine, CA (*Moderator*) Co-founder, Avicenna.ai; Stockholder, Avicenna.ai; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Canon Medical Systems Corporation; Research Grant, General Electric Company

##### **DLL13 RSNA Deep Learning Lab: Best Practices for Model Training: Architectures, Hyperparameters Optimization**

##### Participants

Peter Chang, MD, Irvine, CA (*Presenter*) Co-founder, Avicenna.ai; Stockholder, Avicenna.ai; Research Grant, Canon Medical Systems Corporation; Speakers Bureau, Canon Medical Systems Corporation; Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL14

### RSNA Deep Learning Lab: Object Detection in Medical Imaging

#### LEARNING OBJECTIVES

1) To become familiar with the use cases for generative models in radiology. 2) To understand the strengths and weaknesses of GANS and DDPMS, with particular emphasis on diffusion models.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.This course will introduce you to generative models for radiology. There will be a brief description of some of the technologies being used. We will then develop a more in depth investigation of diffusion models, including hands-on coding of a diffusion model for radiology image generaiton.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.This course will introduce you to generative models for radiology. There will be a brief description of some of the technologies being used. We will then develop a more in depth investigation of diffusion models, including hands-on coding of a diffusion model for radiology image generaiton.

#### Sub-Events

##### **DLL14** Moderator

###### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc

##### **DLL14** RSNA Deep Learning Lab: Object Detection in Medical Imaging

###### Participants

Pouria Rouzrokh, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

##### **DLL14** RSNA Deep Learning Lab: Object Detection in Medical Imaging

###### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL14

**Moderator**

### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL14

**RSNA Deep Learning Lab: Object Detection in Medical Imaging**

### Participants

Pouria Rouzrokh, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL14

### RSNA Deep Learning Lab: Object Detection in Medical Imaging

#### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL15

**Moderator**

### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL15

**RSNA Deep Learning Lab: Medical Image Generation**

### Participants

Bardia Khosravi, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL15

### RSNA Deep Learning Lab: Medical Image Generation

#### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL15

### RSNA Deep Learning Lab: Medical Image Generation

#### LEARNING OBJECTIVES

1) Identify the applications of generative adversarial networks (GANs) in Radiology. 2) Explain the general intuition behind GAN training. 3) Train a GAN-based model to create synthetic lesions to augment the real data.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Generative adversarial networks (GANs) have evolved over the past several years and are being widely used for faster image acquisition, image quality improvement, and data augmentation, among many other applications. This hands-on workshop will cover the theoretical bases of GAN training and its applications in Radiology and introduce some of the well-known algorithms in this field. Finally, we will train a GAN to create synthetic lesions for data augmentation.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Generative adversarial networks (GANs) have evolved over the past several years and are being widely used for faster image acquisition, image quality improvement, and data augmentation, among many other applications. This hands-on workshop will cover the theoretical bases of GAN training and its applications in Radiology and introduce some of the well-known algorithms in this field. Finally, we will train a GAN to create synthetic lesions for data augmentation.

#### Sub-Events

##### DLL15 Moderator

###### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Moderator*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

##### DLL15 RSNA Deep Learning Lab: Medical Image Generation

###### Participants

Bardia Khosravi, MD, MPH, Rochester, MN (*Presenter*) Nothing to Disclose

##### DLL15 RSNA Deep Learning Lab: Medical Image Generation

###### Participants

Bradley Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FLOWSIGMA Inc; Officer, FLOWSIGMA Inc; Stockholder, FLOWSIGMA Inc; Officer, Yunu Inc; Stockholder, Yunu Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL16

### **RSNA Deep Learning Lab: Amazon Healthlake Imaging AI Model Development using MONAI on Amazon SageMaker**

#### **COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Additional information coming soon.

#### **Sub-Events**

##### **DLL16 Moderator**

Participants

Christopher Austin, MD, MSc, Sammamish, WA (*Moderator*) Nothing to Disclose

##### **DLL16 RSNA Deep Learning Lab: Amazon Healthlake Imaging AI Model Development using MONAI on Amazon SageMaker**

Participants

Steve Fu, East Palo Alto, CA (*Presenter*) Nothing to Disclose

##### **DLL16 RSNA Deep Learning Lab: Amazon Healthlake Imaging AI Model Development using MONAI on Amazon SageMaker**

Participants

Christopher Austin, MD, MSc, Sammamish, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL16

**Moderator**

### **Participants**

Christopher Austin, MD, MSc, Sammamish, WA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL16

**RSNA Deep Learning Lab: Amazon Healthlake Imaging AI Model Development using MONAI on Amazon SageMaker**

### Participants

Steve Fu, East Palo Alto, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL16

**RSNA Deep Learning Lab: Amazon Healthlake Imaging AI Model Development using MONAI on Amazon SageMaker**

### Participants

Christopher Austin, MD, MSc, Sammamish, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL17

**Moderator**

### Participants

Evan Calabrese, MD, PhD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL17

**RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

### Participants

Jikai Zhang, MS, BS, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL17

**RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

### Participants

Spyridon Bakas, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL17

**RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

### Participants

Evan Calabrese, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL17

### **RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

#### **COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Additional information coming soon.

#### **Sub-Events**

##### **DLL17 Moderator**

Participants

Evan Calabrese, MD, PhD, Durham, NC (*Moderator*) Nothing to Disclose

##### **DLL17 RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

Participants

Jikai Zhang, MS, BS, Durham, NC (*Presenter*) Nothing to Disclose

##### **DLL17 RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

Participants

Spyridon Bakas, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **DLL17 RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model: from DICOM to Deployment**

Participants

Evan Calabrese, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL18

### RSNA Deep Learning Lab: DICOM In, DICOM Out for Segmentation

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Additional information coming soon.

#### Sub-Events

##### **DLL18** Moderator

Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Moderator*) Nothing to Disclose

##### **DLL18** RSNA Deep Learning Lab: DICOM In, DICOM Out for Segmentation

Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL18

**Moderator**

### **Participants**

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL18

**RSNA Deep Learning Lab: DICOM In, DICOM Out for Segmentation**

### Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL19

**Moderator**

### **Participants**

Felipe C. Kitamura, MD, PhD, Sao Paulo, Brazil (*Moderator*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL19

### RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface

#### Participants

Ian Pan, MD, Brookline, MA (*Presenter*) Consultant, MD.ai, Inc; Consultant, Centaur Labs Inc; Consultant, Diagnosticos da America SA; Consultant, CoRead AI

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

DLL19

**RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface**

### Participants

Felipe C. Kitamura, MD, PhD, Sao Paulo, Brazil (*Presenter*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

DLL19

### RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface

#### LEARNING OBJECTIVES

1) Learn the fundamentals of deep learning by training a model in PyTorch. 2) Build and deploy a custom pneumonia classification model in Hugging Face.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Dive into applied deep learning in this focused, hands-on course. You'll directly engage with the process of constructing a pneumonia classification model in PyTorch and deploying it using the Hugging Face platform. This session emphasizes learning through action. You won't be lost in theory but rather immersed in the practical application of deep learning technologies.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Dive into applied deep learning in this focused, hands-on course. You'll directly engage with the process of constructing a pneumonia classification model in PyTorch and deploying it using the Hugging Face platform. This session emphasizes learning through action. You won't be lost in theory but rather immersed in the practical application of deep learning technologies.

#### Sub-Events

##### **DLL19** Moderator

###### Participants

Felipe C. Kitamura, MD, PhD, Sao Paulo, Brazil (*Moderator*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

##### **DLL19** RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface

###### Participants

Ian Pan, MD, Brookline, MA (*Presenter*) Consultant, MD.ai, Inc; Consultant, Centaur Labs Inc; Consultant, Diagnosticos da America SA; Consultant, CoRead AI

##### **DLL19** RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface

###### Participants

Felipe C. Kitamura, MD, PhD, Sao Paulo, Brazil (*Presenter*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CAS01

**Moderator**

### Participants

Brian Fox, MBA, St. Louis, MO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CAS01

**Moderator**

### Participants

Brandy Reed, MBA, RT, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CAS01

### Hurricane Harvey: How MD Anderson's Division of Diagnostic Imaging Weathered the Unusual Storm

#### Participants

Brett W. Carter, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Sharing lessons learned in emergent large scale natural Disasters. 2) Being prepared to react, learn and execute. 3) How we navigated the unforeseen circumstances.\*Course Description Hear perspectives from an administrator and a quality officer on what they experienced during two different hurricanes that had substantial impact to patient care. How an open-mind to learn what they didn't know help navigate their teams to successful recovery.

#### COURSE DESCRIPTION

Hear perspectives from an administrator and a quality officer on what they experienced during two different hurricanes that had substantial impact to patient care. How an open-mind to learn what they didn't know help navigate their teams to successful recovery.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CAS01

**Lessons Learned: Be Prepared to Learn from What You Didn't Know**

### Participants

Aziz Benamar, RT, MBA, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CAS01

### Impacts on Radiology and Lessons Learned After Large Storms (Sponsored by the RSNA Associated Sciences Consortium)

#### Sub-Events

##### **M1-CAS01 Moderator**

#### Participants

Brandy Reed, MBA, RT, Houston, TX (*Moderator*) Nothing to Disclose

##### **M1-CAS01 Hurricane Harvey: How MD Anderson's Division of Diagnostic Imaging Weathered the Unusual Storm**

#### Participants

Brett W. Carter, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Sharing lessons learned in emergent large scale natural Disasters. 2) Being prepared to react, learn and execute. 3) How we navigated the unforeseen circumstances.\*Course Description Hear perspectives from an administrator and a quality officer on what they experienced during two different hurricanes that had substantial impact to patient care. How an open-mind to learn what they didn't know help navigate their teams to successful recovery.

#### COURSE DESCRIPTION

Hear perspectives from an administrator and a quality officer on what they experienced during two different hurricanes that had substantial impact to patient care. How an open-mind to learn what they didn't know help navigate their teams to successful recovery.

##### **M1-CAS01 Lessons Learned: Be Prepared to Learn from What You Didn't Know**

#### Participants

Aziz Benamar, RT, MBA, Houston, TX (*Presenter*) Nothing to Disclose

##### **M1-CAS01 Moderator**

#### Participants

Brian Fox, MBA, St. Louis, MO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCA11

**Moderator**

### Participants

Jacobo Kirsch, MD, MBA, (*Moderator*) Medical Advisory Board, Zebra Medical Vision Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCA11

### Normal Anatomy and Congenital Coronary Arteries Variants

#### Participants

Kyle Spearman, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CCA11

### Coronary CTA: Major Technical Aspects to Achieve a Successful Scan

#### Participants

Diana Litmanovich, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCA11

### Non-atherosclerotic Coronary Artery Disease

#### Participants

Carole A. Ridge, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCA11

**CT of Cardiac Valves and CT Cardiac Function, Including Normal Cardiac Chamber Sizes**

### Participants

Suhny Abbara, MD, Dallas, TX (*Presenter*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCA11

### Cardiac CT Mentored Case Review: Imaging The Heart: Imaging Techniques, Anatomy, and Function

#### Sub-Events

##### **M1-CCA11 Moderator**

Participants

Jacobo Kirsch, MD, MBA, (*Moderator*) Medical Advisory Board, Zebra Medical Vision Ltd

##### **M1-CCA11 Normal Anatomy and Congenital Coronary Arteries Variants**

Participants

Kyle Spearman, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### **M1-CCA11 Coronary CTA: Major Technical Aspects to Achieve a Successful Scan**

Participants

Diana Litmanovich, MD, (*Presenter*) Nothing to Disclose

##### **M1-CCA11 Non-atherosclerotic Coronary Artery Disease**

Participants

Carole A. Ridge, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

##### **M1-CCA11 CT of Cardiac Valves and CT Cardiac Function, Including Normal Cardiac Chamber Sizes**

Participants

Suhny Abbara, MD, Dallas, TX (*Presenter*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCH03

**Surgeon**

### Participants

Ravi Rajaram, MD,MSc, Houston, TX (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) To discuss the diagnosis and staging of lung cancer. 2) Discuss the current multidisciplinary management of lung cancer. 3) Discuss the role of imaging in the post-treatment evaluation.\*Course Description This case-based discussion will expose the attendees to multidisciplinary discussion when treating lung cancer, The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports regarding description of findings during the management of lung cancer patients.

### COURSE DESCRIPTION

This case-based discussion will expose the attendees to multidisciplinary discussion when treating lung cancer, The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports regarding description of findings during the management of lung cancer patients.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCH03

**Radiologist**

### Participants

Jeremy Erasmus, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCH03

**Medical Oncologist**

### **Participants**

Gregory J. Riely, MD, PhD, New York, NY (*Presenter*) Consultant, Boehringer Ingelheim GmbH Consultant, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CCH03

**Moderator**

### **Participants**

Michelle S. Ginsberg, MD, New York, NY (*Moderator*) Speaker, Ultimate Opinions In Medicine LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CCH03

### Lung Cancer Multidisciplinary Tumor Board Meeting

#### Participants

Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCH03

**Radiation Oncologist**

### Participants

Andreas Rimner, MD, New York, NY (*Presenter*) Research Consultant, General Electric Company Research Consultant, Varian Medical Systems, Inc Research Grant, Varian Medical Systems, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CCH03

### Lung Cancer Multidisciplinary Tumor Board Meeting

#### Sub-Events

##### M1-CCH03 Moderator

#### Participants

Michelle S. Ginsberg, MD, New York, NY (*Moderator*) Speaker, Ultimate Opinions In Medicine LLC

##### M1-CCH03 Lung Cancer Multidisciplinary Tumor Board Meeting

#### Participants

Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

##### M1-CCH03 Radiologist

#### Participants

Jeremy Erasmus, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### M1-CCH03 Medical Oncologist

#### Participants

Gregory J. Riely, MD, PhD, New York, NY (*Presenter*) Consultant, Boehringer Ingelheim GmbH Consultant, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd

##### M1-CCH03 Radiation Oncologist

#### Participants

Andreas Rimmer, MD, New York, NY (*Presenter*) Research Consultant, General Electric Company Research Consultant, Varian Medical Systems, Inc Research Grant, Varian Medical Systems, Inc

##### M1-CCH03 Surgeon

#### Participants

Ravi Rajaram, MD, MSc, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To discuss the diagnosis and staging of lung cancer. 2) Discuss the current multidisciplinary management of lung cancer. 3) Discuss the role of imaging in the post-treatment evaluation.\*Course Description This case-based discussion will expose the attendees to multidisciplinary discussion when treating lung cancer, The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports regarding description of findings during the management of lung cancer patients.

#### COURSE DESCRIPTION

This case-based discussion will expose the attendees to multidisciplinary discussion when treating lung cancer, The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports regarding description of findings during the management of lung cancer patients.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CER05

### Fundamentals of Abdominopelvic Trauma

#### LEARNING OBJECTIVES

1) Explore the role of CT, including CT protocols, in the diagnosis of patients who have sustained abdominopelvic trauma specifically with respect to pancreatic trauma, splenic trauma, and bowel and mesenteric trauma. 2) Identify key CT imaging findings in these organ injury types through case examples. 3) Discuss the imaging findings crucial to patient triage and management.\*Course Description In this didactic course on Abdominopelvic trauma, learn state-of-the-art imaging of pancreatic trauma, splenic trauma and bowel and mesenteric trauma from expert emergency radiologists. Radiologists at all levels of training will benefit from the material presented as it can be readily incorporated into their core knowledge base to care for acutely injured patients.

#### COURSE DESCRIPTION

In this didactic course on Abdominopelvic trauma, learn state-of-the-art imaging of pancreatic trauma, splenic trauma and bowel and mesenteric trauma from expert emergency radiologists. Radiologists at all levels of training will benefit from the material presented as it can be readily incorporated into their core knowledge base to care for acutely injured patients.

#### Sub-Events

##### M1-CER05 Moderator

Participants

Christina LeBedis, MD, Newton, MA (*Moderator*) Nothing to Disclose

##### M1-CER05 Pancreas Injuries

Participants

Christina LeBedis, MD, Newton, MA (*Presenter*) Nothing to Disclose

##### M1-CER05 Bowel Mesenteric Injuries

Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### M1-CER05 Splenic Trauma

Participants

Carrie N. Hoff, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CER05

**Moderator**

### Participants

Christina LeBedis, MD, Newton, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CER05

### Pancreas Injuries

#### Participants

Christina LeBedis, MD, Newton, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CER05

### Bowel Mesenteric Injuries

#### Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CER05

### Splenic Trauma

#### Participants

Carrie N. Hoff, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CGI02

### Crohn's Disease Imaging

#### LEARNING OBJECTIVES

1) Refresh understanding of pathophysiology and presentation of Crohn's disease. 2) Identify up to date imaging techniques and advances in diagnosing and reporting Crohn's disease. 3) Appreciate the role of the Radiologist in multidisciplinary care of patients with Crohn's disease.\*Course Description This course will include 5 short lectures to provide up to date knowledge regarding current concepts in imaging of Crohn's disease including CT, MRI and Ultrasound technology with a focus on identification and reporting of disease activity and response to treatment.

#### COURSE DESCRIPTION

This course will include 5 short lectures to provide up to date knowledge regarding current concepts in imaging of Crohn's disease including CT, MRI and Ultrasound technology with a focus on identification and reporting of disease activity and response to treatment.

#### Sub-Events

##### **M1-CGI02 Moderator**

Participants

Tracy A. Jaffe, MD, Durham, NC (*Moderator*) Nothing to Disclose

##### **M1-CGI02 Assessment of Stricturing and Penetrating Crohn Disease**

Participants

Tracy A. Jaffe, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### **M1-CGI02 CT and MR Enterography: Assessment of Disease Activity and Response Treatment**

Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd; Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Motilent Ltd

##### **M1-CGI02 CT and MR Enterography in Crohn's Disease: Patient Preparation and Techniques**

Participants

Bari Dane, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **M1-CGI02 MRI of Perianal Fistula**

Participants

Mahmoud M. Al-Hawary, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **M1-CGI02 Bowel Ultrasound for Crohn's Disease: How to Get Started?**

Participants

Sudha A. Anupindi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

### MRI of Perianal Fistula

#### Participants

Mahmoud M. Al-Hawary, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

### Bowel Ultrasound for Crohn's Disease: How to Get Started?

#### Participants

Sudha A. Anupindi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

### CT and MR Enterography in Crohn's Disease: Patient Preparation and Techniques

#### Participants

Bari Dane, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

**Moderator**

### Participants

Tracy A. Jaffe, MD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

### Assessment of Stricture and Penetrating Crohn Disease

#### Participants

Tracy A. Jaffe, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CGI02

### CT and MR Enterography: Assessment of Disease Activity and Response Treatment

#### Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd; Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Motilent Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CIN07

**Moderator**

### Participants

Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Co-founder, PET/X LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CIN07

**Helping Users Create Cohorts of Image Data: The Use of Coding Schemes Such as LOINC to Identify Specific Subsets of Imaging Exams**

### Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research Grant, Siemens AG; Scientific Advisory Board, Hura Imaging, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CIN07

### The Role and Potential of DICOM in Imaging AI Research

#### Participants

Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CIN07

### Helper AI for Annotation

#### Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CIN07

### Approaches to Annotation

#### Participants

Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CIN07

### The MIDRC Experience with Curating DICOM Images for use in AI Research

#### LEARNING OBJECTIVES

1) Develop artificial intelligence (AI) methods with improved repeatability and reproducibility, a recognized need is for large, publicly available, and curated imaging data sets. 2) Near-universal adoption of the Digital Imaging and Communications in Medicine (DICOM) standard enables this goal using a well-defined common data model. 3) As useful as DICOM is, improvements are needed in harmonization and standardization to better achieve FAIR (Findable, Accessible, Interoperable, Reusable) principles, which we will describe.\*Course Description

#### Sub-Events

##### **M1-CIN07 Moderator**

Participants

Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Co-founder, PET/X LLC

##### **M1-CIN07 Helping Users Create Cohorts of Image Data: The Use of Coding Schemes Such as LOINC to Identify Specific Subsets of Imaging Exams**

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research Grant, Siemens AG; Scientific Advisory Board, Hura Imaging, LLC

##### **M1-CIN07 The Role and Potential of DICOM in Imaging AI Research**

Participants

Andriy Fedorov, PhD, Arlington, MA (*Presenter*) Nothing to Disclose

##### **M1-CIN07 Helper AI for Annotation**

Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

##### **M1-CIN07 Approaches to Annotation**

Participants

Adam Flanders, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

### Imaging in Sports: Common Patterns of Muscle Injury

#### LEARNING OBJECTIVES

1) Knowledge of normal anatomy and anatomical variants in the key regions for sports injury – hamstring, calf, proximal thigh chest wall, and abdominal wall. 2) To become familiar with the common injury patterns in these regions. 3) To be able to describe the injury patterns accurately with emphasis on clinically relevant factors. 4) To have an awareness of the relevant grading systems – understanding both the strengths and weaknesses of grading of injuries.\*Course Description This is a sports imaging session based around common and interesting areas of sports injury. Experts in sports imaging will cover: Pectoralis major injury, hamstring, calf, proximal thigh and chest wall injuries. The series of short lectures will cover the anatomy and typical injury patterns for these commonly injured areas of the body, appearances of the usual injury patterns and description of associated grading systems used in these regions. Knowledge of sports specific injury is important in providing a clear report to the team and will aid the reporter in producing a clear, concise and helpful report.

#### COURSE DESCRIPTION

This is a sports imaging session based around common and interesting areas of sports injury. Experts in sports imaging will cover: Pectoralis major injury, hamstring, calf, proximal thigh and chest wall injuries. The series of short lectures will cover the anatomy and typical injury patterns for these commonly injured areas of the body, appearances of the usual injury patterns and description of associated grading systems used in these regions. Knowledge of sports specific injury is important in providing a clear report to the team and will aid the reporter in producing a clear, concise and helpful report.

#### Sub-Events

##### M1-CMK11 Moderator

Participants

Emma Rowbotham, MBBCHIR, FRCR, Leeds, United Kingdom (*Moderator*) Nothing to Disclose

##### M1-CMK11 Acute Chest Wall and Abdominal Injury in Athletes

Participants

Emma Rowbotham, MBBCHIR, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

##### M1-CMK11 Anatomy and Injury of Pectoralis Major

Participants

Michael J. Tuite, MD, Verona, WI (*Presenter*) Nothing to Disclose

##### M1-CMK11 Rectus Femoris: Anatomy and Patterns of Injury

Participants

Ara Kassarian, MD, FRCPC, Pozuelo de Alarcon, Spain (*Presenter*) Research Consultant, Arthrosurface, Inc

##### M1-CMK11 Hamstring Injury and Classification

Participants

James M. Linklater, FRANZCR, BMedSc, St Leonards, Australia (*Presenter*) Nothing to Disclose

##### M1-CMK11 Soleus Tears, Patterns and Prognosis Factors

Participants

Eva Llopis, MD, Valencia, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

**Moderator**

### Participants

Emma Rowbotham, MBBCHIR, FRCR, Leeds, United Kingdom (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

### Acute Chest Wall and Abdominal Injury in Athletes

#### Participants

Emma Rowbotham, MBBCHIR, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CMK11

### Anatomy and Injury of Pectoralis Major

#### Participants

Michael J. Tuite, MD, Verona, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

### Rectus Femoris: Anatomy and Patterns of Injury

#### Participants

Ara Kassarian, MD, FRCPC, Pozuelo de Alarcon, Spain (*Presenter*) Research Consultant, ArthroSurface, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

### Hamstring Injury and Classification

#### Participants

James M. Linklater, FRANZCR, BMedSc, St Leonards, Australia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMK11

### Soleus Tears, Patterns and Prognosis Factors

#### Participants

Eva Llopis, MD, Valencia, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMS03

### Immunotherapy: New Paradigms for Interpretation and Imaging

#### LEARNING OBJECTIVES

1) Understand basics of immunotherapy and image interpretation. 2) Identify imaging features of side effects and complications associated with immunotherapy in the chest and abdomen. 3) Learn about interventional radiology applications of immunotherapy.\*Course Description A review of how newer immunotherapy changes the paradigm for cancer treatment and image interpretation. This session will also review potential side effects and complications associated with immunotherapy in the chest and abdomen, and interventional radiology applications of immunotherapy

#### COURSE DESCRIPTION

A review of how newer immunotherapy changes the paradigm for cancer treatment and image interpretation. This session will also review potential side effects and complications associated with immunotherapy in the chest and abdomen, and interventional radiology applications of immunotherapy

#### Sub-Events

##### **M1-CMS03 Moderator**

Participants

Malak Itani, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

##### **M1-CMS03 Immunotherapy Side Effects on PET CT in the Chest**

Participants

Malak Itani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### **M1-CMS03 Basics of Immunotherapy and Image Interpretation**

Participants

Priya R. Bhosale, MD, (*Presenter*) Nothing to Disclose

##### **M1-CMS03 Immuno Oncology and Interventional Oncology**

Participants

Kevin Kim, MD, Loma Linda, CA (*Presenter*) Nothing to Disclose

Kevin Kim, MD, Loma Linda, CA (*Presenter*) Nothing to Disclose

##### **M1-CMS03 Abdominal Immunotherapy-Related Adverse Events (irAEs)**

Participants

Ranjodh Dhami, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMS03

**Moderator**

### Participants

Malak Itani, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMS03

### Immunotherapy Side Effects on PET CT in the Chest

#### Participants

Malak Itani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMS03

### Basics of Immunotherapy and Image Interpretation

#### Participants

Priya R. Bhosale, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CMS03

### Immuno Oncology and Interventional Oncology

#### Participants

Kevin Kim, MD, Loma Linda, CA (*Presenter*) Nothing to Disclose

Kevin Kim, MD, Loma Linda, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CMS03

### Abdominal Immunotherapy-Related Adverse Events (irAEs)

#### Participants

Ranjodh Dhami, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

**Moderator**

### Participants

Janie Lee, MD, MSc, Seattle, WA (*Moderator*) Research Grant, General Electric Company; Investigator, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

**Moderator**

### Participants

Susanna Lee, MD, PhD, Boston, MA (*Moderator*) Royalties, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

### CTMW Overview

#### Participants

Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

#### LEARNING OBJECTIVES

1) Review how and why clinical trial protocols change through the development process. 2) Learn about potential facilitators and barriers to launching a clinical trial initially “workshopped” at the CTMW course. 3) Learn key biostatistical lessons regarding trial design and data analysis directly from CTMW biostatisticians using the trials presented by the Principal Investigators.\*Course Description RSNA’s Clinical Trials Methodology Workshop (CTMW) has provided first-class education in clinical trials methodology and has greatly expanded interest and successful efforts in radiology and radiation oncology clinical research. While previously available exclusively to those accepted to the in-person CTMW, this course will make accessible to all RSNA annual meeting attendees the rigor and expertise of the CTMW in a lecture course format. This course highlights the development of clinical trial protocols and pragmatic real world lessons from implementing them, presented by two alumni of the successful RSNA Clinical Trials Methodology Workshop, with biostatistical commentary from a course faculty member. The session will conclude with Q&A with the audience.

#### COURSE DESCRIPTION

RSNA’s Clinical Trials Methodology Workshop (CTMW) has provided first-class education in clinical trials methodology and has greatly expanded interest and successful efforts in radiology and radiation oncology clinical research. While previously available exclusively to those accepted to the in-person CTMW, this course will make accessible to all RSNA annual meeting attendees the rigor and expertise of the CTMW in a lecture course format. This course highlights the development of clinical trial protocols and pragmatic real world lessons from implementing them, presented by two alumni of the successful RSNA Clinical Trials Methodology Workshop, with biostatistical commentary from a course faculty member. The session will conclude with Q&A with the audience.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

**CTMW Alumnus**

### Participants

Amir Iravani, MD, Issaquah, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

**CMW Alumnus**

### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNPM07

### Biostatistics Discussion

#### Participants

Nancy Obuchowski, PhD, MS, Cleveland, OH (*Presenter*) Research Consultant, Siemens AG; Research Consultant, IBM Corporation; Research Consultant, Elucid Bioimaging Inc; Research Consultant, Takeda Pharmaceutical Company Limited

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CNPM07

### Clinical Trials Methodology Workshop Spotlight (Sponsored by the RSNA Research Development Committee)

#### Sub-Events

##### M1-CNPM07 Moderator

###### Participants

Janie Lee, MD, MSc, Seattle, WA (*Moderator*) Research Grant, General Electric Company; Investigator, General Electric Company

##### M1-CNPM07 Moderator

###### Participants

Susanna Lee, MD, PhD, Boston, MA (*Moderator*) Royalties, Wolters Kluwer nv

##### M1-CNPM07 CTMW Overview

###### Participants

Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

#### LEARNING OBJECTIVES

1) Review how and why clinical trial protocols change through the development process. 2) Learn about potential facilitators and barriers to launching a clinical trial initially "workshopped" at the CTMW course. 3) Learn key biostatistical lessons regarding trial design and data analysis directly from CTMW biostatisticians using the trials presented by the Principal Investigators.\*Course Description RSNA's Clinical Trials Methodology Workshop (CTMW) has provided first-class education in clinical trials methodology and has greatly expanded interest and successful efforts in radiology and radiation oncology clinical research. While previously available exclusively to those accepted to the in-person CTMW, this course will make accessible to all RSNA annual meeting attendees the rigor and expertise of the CTMW in a lecture course format. This course highlights the development of clinical trial protocols and pragmatic real world lessons from implementing them, presented by two alumni of the successful RSNA Clinical Trials Methodology Workshop, with biostatistical commentary from a course faculty member. The session will conclude with Q&A with the audience.

#### COURSE DESCRIPTION

RSNA's Clinical Trials Methodology Workshop (CTMW) has provided first-class education in clinical trials methodology and has greatly expanded interest and successful efforts in radiology and radiation oncology clinical research. While previously available exclusively to those accepted to the in-person CTMW, this course will make accessible to all RSNA annual meeting attendees the rigor and expertise of the CTMW in a lecture course format. This course highlights the development of clinical trial protocols and pragmatic real world lessons from implementing them, presented by two alumni of the successful RSNA Clinical Trials Methodology Workshop, with biostatistical commentary from a course faculty member. The session will conclude with Q&A with the audience.

##### M1-CNPM07 CTMW Alumnus

###### Participants

Amir Iravani, MD, Issaquah, WA (*Presenter*) Nothing to Disclose

##### M1-CNPM07 CMW Alumnus

###### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### M1-CNPM07 Biostatistics Discussion

###### Participants

Nancy Obuchowski, PhD, MS, Cleveland, OH (*Presenter*) Research Consultant, Siemens AG; Research Consultant, IBM Corporation; Research Consultant, Elucid Bioimaging Inc; Research Consultant, Takeda Pharmaceutical Company Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

### Conventional Neuroimaging Markers for Secondary Stroke

#### Participants

Luca Saba, MD, Cagliari, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

**Moderator**

### Participants

Achala Vagal, MD, Cincinnati, OH (*Moderator*) Departmental Research Grant, Johnson & Johnson

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

**Moderator**

### Participants

Mahmud Mossa-Basha, MD, Bellevue, WA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

### Small Vessel Disease-What Radiologists Need to Know

#### Participants

Achala Vagal, MD, Cincinnati, OH (*Presenter*) Departmental Research Grant, Johnson & Johnson

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

### Advanced Neuroimaging Markers for Secondary Stroke

#### Participants

Mahmud Mossa-Basha, MD, Bellevue, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

### Pulsatility and Arterial Stiffness: Contributions to Cerebrovascular Disease

#### Participants

Niranjan Balu, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CNR01

### Stroke and Cerebrovascular: Current Imaging Markers and Future Horizons

#### LEARNING OBJECTIVES

1) Understand correct nomenclature of imaging of small vessel disease. 2) Identify imaging makers of pulsatility and arterial stiffness. 3) Identify and learn about the conventional and advanced imaging biomarkers of secondary ischemic stroke.\*Course Description Imaging provides essential insights into small vessel disease and for secondary stroke prevention. Radiologists must be aware of the correct terminology for small vessel disease. Further, the course will help learners to understand the various conventional and advanced imaging biomarkers of cerebrovascular disease and secondary ischemic stroke.

#### COURSE DESCRIPTION

Imaging provides essential insights into small vessel disease and for secondary stroke prevention. Radiologists must be aware of the correct terminology for small vessel disease. Further, the course will help learners to understand the various conventional and advanced imaging biomarkers of cerebrovascular disease and secondary ischemic stroke.

#### Sub-Events

##### **M1-CNR01 Moderator**

Participants

Achala Vagal, MD, Cincinnati, OH (*Moderator*) Departmental Research Grant, Johnson & Johnson

##### **M1-CNR01 Moderator**

Participants

Mahmud Mossa-Basha, MD, Bellevue, WA (*Moderator*) Nothing to Disclose

##### **M1-CNR01 Small Vessel Disease-What Radiologists Need to Know**

Participants

Achala Vagal, MD, Cincinnati, OH (*Presenter*) Departmental Research Grant, Johnson & Johnson

##### **M1-CNR01 Advanced Neuroimaging Markers for Secondary Stroke**

Participants

Mahmud Mossa-Basha, MD, Bellevue, WA (*Presenter*) Nothing to Disclose

##### **M1-CNR01 Pulsatility and Arterial Stiffness: Contributions to Cerebrovascular Disease**

Participants

Niranjana Balu, PhD, (*Presenter*) Nothing to Disclose

##### **M1-CNR01 Conventional Neuroimaging Markers for Secondary Stroke**

Participants

Luca Saba, MD, Cagliari, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-COB04

### Case Based Review of Crazy OB/GYN Cases

#### Participants

Roya Sohaey, MD, Portland, OR (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Develop a logical, systematic approach to complex OB and GYN cases. 2) Identify strategies to reduce a broad differential to a specific diagnosis or a short list of likely options.\*Course Description This will be a case-based interactive session. We will present cases with multiple choice questions for audience response using Poll Everywhere. We will review the correct diagnosis with tips for problem solving and narrowing a lengthy, generic list of differential diagnoses down to more focused list relevant to the case in hand. For OB cases we will provide postnatal or autopsy confirmation and for GYN cases operative results and pathology confirmation. Attendees will have a better visual database of unusual OBGYN pathology and learn a practical approach to complex cases.

#### COURSE DESCRIPTION

This will be a case-based interactive session. We will present cases with multiple choice questions for audience response using Poll Everywhere. We will review the correct diagnosis with tips for problem solving and narrowing a lengthy, generic list of differential diagnoses down to more focused list relevant to the case in hand. For OB cases we will provide postnatal or autopsy confirmation and for GYN cases operative results and pathology confirmation. Attendees will have a better visual database of unusual OBGYN pathology and learn a practical approach to complex cases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-COB04

### Case Based Review of Crazy OB/GYN Cases

#### Participants

Paula J. Woodward, MD, Salt Lake City, UT (*Presenter*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-COB04

### Case Based Review of Crazy OB/GYN Cases

#### Participants

Anne M. Kennedy, MBBCh, Salt Lake City, UT (*Presenter*) Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-COB04

### Case based Review of Crazy OB/GYN Cases

#### Sub-Events

#### M1-COB04 Moderator

##### Participants

Anne M. Kennedy, MBCh, Salt Lake City, UT (*Moderator*) Author with royalties, RELX

#### M1-COB04 Case Based Review of Crazy OB/GYN Cases

##### Participants

Roya Sohaey, MD, Portland, OR (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Develop a logical, systematic approach to complex OB and GYN cases. 2) Identify strategies to reduce a broad differential to a specific diagnosis or a short list of likely options.\*Course Description This will be a case-based interactive session. We will present cases with multiple choice questions for audience response using Poll Everywhere. We will review the correct diagnosis with tips for problem solving and narrowing a lengthy, generic list of differential diagnoses down to more focused list relevant to the case in hand. For OB cases we will provide postnatal or autopsy confirmation and for GYN cases operative results and pathology confirmation. Attendees will have a better visual database of unusual OBGYN pathology and learn a practical approach to complex cases.

#### COURSE DESCRIPTION

This will be a case-based interactive session. We will present cases with multiple choice questions for audience response using Poll Everywhere. We will review the correct diagnosis with tips for problem solving and narrowing a lengthy, generic list of differential diagnoses down to more focused list relevant to the case in hand. For OB cases we will provide postnatal or autopsy confirmation and for GYN cases operative results and pathology confirmation. Attendees will have a better visual database of unusual OBGYN pathology and learn a practical approach to complex cases.

#### M1-COB04 Case Based Review of Crazy OB/GYN Cases

##### Participants

Paula J. Woodward, MD, Salt Lake City, UT (*Presenter*) Royalties, RELX

#### M1-COB04 Case Based Review of Crazy OB/GYN Cases

##### Participants

Anne M. Kennedy, MBCh, Salt Lake City, UT (*Presenter*) Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-COB04

**Moderator**

### Participants

Anne M. Kennedy, MBCh, Salt Lake City, UT (*Moderator*) Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CPH12

**Moderator**

### Participants

Thaddeus Wilson, PhD, Memphis, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CPH12

### Flow Imaging in Ultrasound

#### Participants

Carl Herickhoff, PhD, Memphis, TN (*Presenter*) Technical Advisory Board, Maui Imaging, Inc; Shareholder, Maui Imaging, Inc; Consultant, Bioventus LLC; Consultant, Open Water Internet, Inc; Shareholder, Open Water Internet, Inc; Consultant, Scitus Engineering

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CPH12

### They Don't Make 'Em Like They Used To: Modern Ultrasound Imaging

#### Participants

Stephen McLeavey, PhD, Rochester, NY (*Presenter*) Research collaboration, Siemens AG

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CPH12

### Advanced Ultrasound Technology and Applications

#### LEARNING OBJECTIVES

1) Explain the principles that enable software beamforming, and the advantages over conventional sequential delay-and-sum beamforming. 2) Describe the benefits of advanced ultrasound transducer technologies and geometries, and their clinical impact.\*Course Description Provide an update in current ultrasound technologies in flow imaging, beamforming techniques and advanced transducers.

#### COURSE DESCRIPTION

Provide an update in current ultrasound technologies in flow imaging, beamforming techniques and advanced transducers.

#### Sub-Events

##### M1-CPH12 Moderator

###### Participants

Thaddeus Wilson, PhD, Memphis, TN (*Moderator*) Nothing to Disclose

##### M1-CPH12 Flow Imaging in Ultrasound

###### Participants

Carl Herickhoff, PhD, Memphis, TN (*Presenter*) Technical Advisory Board, Maui Imaging, Inc;Shareholder, Maui Imaging, Inc;Consultant, Bioventus LLC;Consultant, Open Water Internet, Inc;Shareholder, Open Water Internet, Inc;Consultant, Scitus Engineering

##### M1-CPH12 They Don't Make 'Em Like They Used To: Modern Ultrasound Imaging

###### Participants

Stephen McAleavey, PhD, Rochester, NY (*Presenter*) Research collaboration, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CR002

### Head Neck Case Based Multidisciplinary Review

#### Participants

Chad Zender, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating head and neck cancer. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description The purpose of this course will be to replicate a real-world Head & Neck tumor. We will discuss actual cases with a focus on how imaging findings directly change stage, modify treatment and predict outcome.

#### COURSE DESCRIPTION

The purpose of this course will be to replicate a real-world Head & Neck tumor. We will discuss actual cases with a focus on how imaging findings directly change stage, modify treatment and predict outcome.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CR002

**Moderator**

### Participants

Suresh K. Mukherji, MD, MBA, Carmel, IN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CR002

### Head & Neck Case Based Multidisciplinary Review

#### Sub-Events

##### M1-CR002 Moderator

#### Participants

Suresh K. Mukherji, MD, MBA, Carmel, IN (*Moderator*) Nothing to Disclose

##### M1-CR002 Head Neck Case Based Multidisciplinary Review

#### Participants

Chad Zender, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating head and neck cancer. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description The purpose of this course will be to replicate a real-world Head & Neck tumor. We will discuss actual cases with a focus on how imaging findings directly change stage, modify treatment and predict outcome.

#### COURSE DESCRIPTION

The purpose of this course will be to replicate a real-world Head & Neck tumor. We will discuss actual cases with a focus on how imaging findings directly change stage, modify treatment and predict outcome.

##### M1-CR002 Head Neck Case Based Multidisciplinary Review

#### Participants

Sung Kim, MD, New Brunswick, NJ (*Presenter*) Consultant, Nanobiotix

##### M1-CR002 Head Neck Case Based Multidisciplinary Review

#### Participants

Francis Worden, MD, Ann Arbor, MI (*Presenter*) Speaker, Merck & Co, Inc; Advisory Board, Merck & Co, Inc; Institutional research support, Merck & Co, Inc; Travel support, Merck & Co, Inc; Speaker, Eisai Co, Ltd; Advisory Board, Eisai Co, Ltd; Institutional research support, Eisai Co, Ltd; Speaker, Bristol-Myers Squibb Company; Advisory Board, Bristol-Myers Squibb Company; Research funded, Bristol-Myers Squibb Company; Speaker, Eli Lilly and Company; Advisory Board, Eli Lilly and Company; Research funded, Eli Lilly and Company; Speaker, Bayer AG; Advisory Board, Bayer AG; Travel support, Bayer AG; Speaker, Cue Biopharma, Inc; Advisory Board, Cue Biopharma, Inc; Advisory Board, Rakuten Group, Inc; Research funded, Oragenics, Inc; Institutional research support, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CR002

### Head Neck Case Based Multidisciplinary Review

#### Participants

Sung Kim, MD, New Brunswick, NJ (*Presenter*) Consultant, Nanobiotix

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CR002

### Head Neck Case Based Multidisciplinary Review

#### Participants

Francis Worden, MD, Ann Arbor, MI (*Presenter*) Speaker, Merck & Co, Inc;Advisory Board, Merck & Co, Inc;Institutional research support, Merck & Co, Inc;Travel support, Merck & Co, Inc;Speaker, Eisai Co, Ltd;Advisory Board, Eisai Co, Ltd;Institutional research support, Eisai Co, Ltd;Speaker, Bristol-Myers Squibb Company;Advisory Board, Bristol-Myers Squibb Company;Research funded, Bristol-Myers Squibb Company;Speaker, Eli Lilly and Company;Advisory Board, Eli Lilly and Company;Research funded, Eli Lilly and Company;Speaker, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Cue Biopharma, Inc;Advisory Board, Cue Biopharma, Inc;Advisory Board, Rakuten Group, Inc;Research funded, Oragenics, Inc;Institutional research support, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

**Moderator**

### Participants

Anushri Parakh, MBBS, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

**Moderator**

### Participants

Demetrios Raptis, MD, Frontenac, MO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-CVA06

**Imaging After Graft Repairs (Ascending, Descending, and Thoracoabdominal): Expected Post-Surgical findings and Complications**

### Participants

Christopher Mehta, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

### Imaging After Graft Repairs: Key Considerations for the Radiologist

#### Participants

Santiago Restrepo, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

### Imaging in Extracorporeal Membrane Oxygenation

#### Participants

Jody Shen, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

### Imaging After Endovascular Stent Grafts

#### Participants

Gilles P. Soulez, MSc, Montreal, QC (*Presenter*) Speaker, Siemens AG; Research Grant, Siemens AG; Research Grant, Cook Group Incorporated; Advisory Board, Cook Group Incorporated; Patent agreement, Cook Group Incorporated; Research Grant, ViTAA Medical Solutions Inc; Advisory Board, ViTAA Medical Solutions Inc

Constantino S. Pena, MD, Key Biscayne, FL (*Presenter*) Speakers Bureau, Cook Group Incorporated Speakers Bureau, Abbott Laboratories Speakers Bureau, ShockWave Medical Speakers Bureau, Penumbra, Inc Speakers Bureau, Cardinal Health, Inc Speakers Bureau, Becton, Dickinson and Company Advisory Board, Surmodics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-CVA06

### Vascular Imaging After Surgery and Intervention: Expected Findings and Complications

#### LEARNING OBJECTIVES

1) Recognize the postoperative imaging appearance of aortic graft and stent repairs and their complications. 2) Understand the key imaging findings of complications of aortic graft repairs and how they alter management. 3) Understand the imaging of extracorporeal membrane oxygenation.\*Course Description The course will review the key imaging findings of aortic stent and graft repairs in the chest, abdomen, and pelvis. Emphasis will be placed on recognition of post-surgical complications and how they alter management. The imaging of extracorporeal membrane oxygenation will be

#### COURSE DESCRIPTION

The course will review the key imaging findings of aortic stent and graft repairs in the chest, abdomen, and pelvis. Emphasis will be placed on recognition of post-surgical complications and how they alter management. The imaging of extracorporeal membrane oxygenation will be

#### Sub-Events

##### M1-CVA06 Moderator

Participants  
Anushri Parakh, MBBS, MD, Boston, MA (*Moderator*) Nothing to Disclose

##### M1-CVA06 Moderator

Participants  
Demetrios Raptis, MD, Frontenac, MO (*Moderator*) Nothing to Disclose

##### M1-CVA06 Imaging After Graft Repairs (Ascending, Descending, and Thoracoabdominal): Expected Post-Surgical findings and Complications

Participants  
Christopher Mehta, Chicago, IL (*Presenter*) Nothing to Disclose

##### M1-CVA06 Imaging After Graft Repairs: Key Considerations for the Radiologist

Participants  
Santiago Restrepo, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

##### M1-CVA06 Imaging in Extracorporeal Membrane Oxygenation

Participants  
Jody Shen, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

##### M1-CVA06 Imaging After Endovascular Stent Grafts

Participants  
Gilles P. Soulez, MSc, Montreal, QC (*Presenter*) Speaker, Siemens AG;Research Grant, Siemens AG;Research Grant, Cook Group Incorporated;Advisory Board, Cook Group Incorporated;Patent agreement, Cook Group Incorporated;Research Grant, VITAA Medical Solutions Inc;Advisory Board, VITAA Medical Solutions Inc  
Constantino S. Pena, MD, Key Biscayne, FL (*Presenter*) Speakers Bureau, Cook Group Incorporated Speakers Bureau, Abbott Laboratories Speakers Bureau, ShockWave Medical Speakers Bureau, Penumbra, Inc Speakers Bureau, Cardinal Health, Inc Speakers Bureau, Becton, Dickinson and Company Advisory Board, Surmodics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-RCP12

**Moderator**

### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-RCP12

### Challenges and Strategies for the Mid-career Radiologist in Academic Practice

#### Participants

Tara Catanzano, MD, Springfield, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-RCP12

### Challenges and Strategies for the Mid-career Radiologist in Private Practice

#### Participants

Brent Wagner, MD, MBA, Tucson, AZ (*Presenter*) Executive Director, American Board of Radiology

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M1-RCP12

### **Retention of Radiologists: How to Build Loyalty, Support and Fulfill at Work, and Create Leadership Opportunities**

#### **Participants**

Brandon Brown, MD, MA, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-RCP12

### Faculty Development Programming for the Mid-career Radiologist

#### Participants

Cheri Canon, MD, Birmingham, AL (*Presenter*) Royalties, The McGraw-Hill Companies Member of ABR Board of Governors (volunteer appointment)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M1-RCP12

### Engaging the Mid-Career Radiologist: Challenges, Retention, and Opportunities (Sponsored by the RSNA Professionalism Committee)

#### LEARNING OBJECTIVES

1) Identify challenges facing the mid-career radiologist. 2) Discuss opportunities and strategies for retention and engagement of mid-career radiologists including both academic and private practice perspectives. 3) Evaluate faculty development programming for the mid-career radiologist.\*Course Description This session will focus on challenges facing the mid-career radiologist, and opportunities and strategies for retention and engagement including both academic and private practice perspectives.

#### COURSE DESCRIPTION

This session will focus on challenges facing the mid-career radiologist, and opportunities and strategies for retention and engagement including both academic and private practice perspectives.

#### Sub-Events

##### **M1-RCP12 Moderator**

Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### **M1-RCP12 Challenges and Strategies for the Mid-career Radiologist in Academic Practice**

Participants

Tara Catanzano, MD, Springfield, MA (*Presenter*) Nothing to Disclose

##### **M1-RCP12 Challenges and Strategies for the Mid-career Radiologist in Private Practice**

Participants

Brent Wagner, MD, MBA, Tucson, AZ (*Presenter*) Executive Director, American Board of Radiology

##### **M1-RCP12 Retention of Radiologists: How to Build Loyalty, Support and Fulfill at Work, and Create Leadership Opportunities**

Participants

Brandon Brown, MD, MA, Indianapolis, IN (*Presenter*) Nothing to Disclose

##### **M1-RCP12 Faculty Development Programming for the Mid-career Radiologist**

Participants

Cheri Canon, MD, Birmingham, AL (*Presenter*) Royalties, The McGraw-Hill CompaniesMember of ABR Board of Governors (volunteer appointment)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Sheila Sheth, MD, Brooklyn, NY (*Presenter*) Speakers Bureau , Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Vikram S. Dogra, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Gayatri Joshi, MD, Atlanta, GA (*Presenter*) Royalties from Elsevier.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Michelle L. Robbin, MD, MS, Birmingham, AL (*Presenter*) Research Grant, Koninklijke Philips NV

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Deborah J. Rubens, MD, Rochester, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Mary C. Frates, MD, Sharon, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Jade Wong-You-Cheong, MD, Baltimore, MD (*Presenter*) Author, Reed Elsevier

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**Moderator**

### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Lori Mankowski Gettle, MD, Madison, WI (*Presenter*) Stockholder, Elucent Medical; Research support, General Electric Company; Research support, HistoSonics, Inc; Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

### RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Wui K. Chong, MD, Houston, TX (*Presenter*) Research Consultant, Koios Medical, Inc

#### LEARNING OBJECTIVES

1) Identify essential scanning techniques in ultrasound evaluation of the carotid system and abdominal vasculature that ensure accurate assessment and diagnosis. 2) Explain changes in the arterial waveforms encountered in various pathological processes affecting the carotid system and abdominal vasculature. 3) Describe most accepted diagnostic criteria for significant diseases in the carotid and abdominal vascular systems.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This is a hands-on course which will provide a brief didactic review followed by detailed hands-on instructions of basic scanning techniques utilized in the evaluation of the carotid system and abdominal vasculature, including, aorta, IVC, hepatic, mesenteric, and renal systems. Main accepted sonographic criteria for significant diseases of the aorta and its branches and the carotid system will be described. Tips and tricks in scanning will also be provided.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This is a hands-on course which will provide a brief didactic review followed by detailed hands-on instructions of basic scanning techniques utilized in the evaluation of the carotid system and abdominal vasculature, including, aorta, IVC, hepatic, mesenteric, and renal systems. Main accepted sonographic criteria for significant diseases of the aorta and its branches and the carotid system will be described. Tips and tricks in scanning will also be provided.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Mark Lockhart, MD, MPH, Birmingham, AL (*Presenter*) Author, Jaypee Brothers Medical Publishers Ltd; Author, Reed Elsevier; Employee, Journal of Ultrasound in Medicine;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M2-CMS09

**RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

### Participants

Leslie M. Scoutt, MD, Essex, CT (*Presenter*) Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

### Key Imaging Technique in Evaluation of the Abdominal Vasculature including Aorta and its Main Branches and the IVC

#### Participants

Nirvikar Dahiya, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

### Key Imaging Technique in Evaluation of the Carotid System

#### Participants

Corinne Deurdulian, MD, Encino, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-CMS09

### RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Sub-Events

##### M2-CMS09 Moderator

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Moderator*) Nothing to Disclose

##### M2-CMS09 Key Imaging Technique in Evaluation of the Abdominal Vasculature including Aorta and its Main Branches and the IVC

#### Participants

Nirvikar Dahiya, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### M2-CMS09 Key Imaging Technique in Evaluation of the Carotid System

#### Participants

Corinne Deurdulian, MD, Encino, CA (*Presenter*) Nothing to Disclose

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Sheila Sheth, MD, Brooklyn, NY (*Presenter*) Speakers Bureau , Koninklijke Philips NV

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Vikram S. Dogra, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Gayatri Joshi, MD, Atlanta, GA (*Presenter*) Royalties from Elsevier.

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Michelle L. Robbin, MD, MS, Birmingham, AL (*Presenter*) Research Grant, Koninklijke Philips NV

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Deborah J. Rubens, MD, Rochester, NY (*Presenter*) Nothing to Disclose

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

Mary C. Frates, MD, Sharon, MA (*Presenter*) Nothing to Disclose

##### M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature

#### Participants

John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

**M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Participants

Jade Wong-You-Cheong, MD, Baltimore, MD (*Presenter*) Author, Reed Elsevier

**M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Participants

Lori Mankowski Gettle, MD, Madison, WI (*Presenter*) Stockholder, Elucet Medical; Research support, General Electric Company; Research support, HistoSonics, Inc; Royalties, RELX

**M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Participants

Wui K. Chong, MD, Houston, TX (*Presenter*) Research Consultant, Koios Medical, Inc

**LEARNING OBJECTIVES**

1) Identify essential scanning techniques in ultrasound evaluation of the carotid system and abdominal vasculature that ensure accurate assessment and diagnosis. 2) Explain changes in the arterial waveforms encountered in various pathological processes affecting the carotid system and abdominal vasculature. 3) Describe most accepted diagnostic criteria for significant diseases in the carotid and abdominal vascular systems. \*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This is a hands-on course which will provide a brief didactic review followed by detailed hands-on instructions of basic scanning techniques utilized in the evaluation of the carotid system and abdominal vasculature, including, aorta, IVC, hepatic, mesenteric, and renal systems. Main accepted sonographic criteria for significant diseases of the aorta and its branches and the carotid system will be described. Tips and tricks in scanning will also be provided.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This is a hands-on course which will provide a brief didactic review followed by detailed hands-on instructions of basic scanning techniques utilized in the evaluation of the carotid system and abdominal vasculature, including, aorta, IVC, hepatic, mesenteric, and renal systems. Main accepted sonographic criteria for significant diseases of the aorta and its branches and the carotid system will be described. Tips and tricks in scanning will also be provided.

**M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Participants

Mark Lockhart, MD, MPH, Birmingham, AL (*Presenter*) Author, Jaypee Brothers Medical Publishers Ltd; Author, Reed Elsevier; Employee, Journal of Ultrasound in Medicine;

**M2-CMS09 RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Participants

Leslie M. Scouff, MD, Essex, CT (*Presenter*) Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CAS03

**Moderator**

### Participants

Morris Stein, BArch, Phoenix, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CAS03

**Moderator**

### Participants

Catherine Gunn, MBA, RT, Halifax, NS (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CAS03

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CAS03

### Creating Experiential Designs that Add Value and Improve Performance

#### Participants

Morris Stein, BArch, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Create design expectations and measure outcomes. 2) Learn from prototyping solutions. 3) Deliver new models of spatial and functional organization.\*Course Description It is not just about designing rooms or departments, or detailing technology, but designing experiences that impact our patients, staff, and families. Seize the opportunity to learn from current disruptive forces and cast a design vision for the future. Now more than ever, design solutions are process oriented and data driven, beyond product or technology installed.

#### COURSE DESCRIPTION

It is not just about designing rooms or departments, or detailing technology, but designing experiences that impact our patients, staff, and families. Seize the opportunity to learn from current disruptive forces and cast a design vision for the future. Now more than ever, design solutions are process oriented and data driven, beyond product or technology installed.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CAS03

### Creating Experiential Designs that Add Value and Improve Performance

#### Participants

Carlos Amato, MArch, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CAS03

**Creating Experiential Designs that Add Value and Improve Performance (Sponsored by the RSNA Associated Sciences Consortium) (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)**

### Sub-Events

#### M3-CAS03 Moderator

##### Participants

Morris Stein, BArch, Phoenix, AZ (*Moderator*) Nothing to Disclose

#### M3-CAS03 Moderator

##### Participants

Catherine Gunn, MBA, RT, Halifax, NS (*Moderator*) Nothing to Disclose

#### M3-CAS03 Moderator

##### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

#### M3-CAS03 **Creating Experiential Designs that Add Value and Improve Performance**

##### Participants

Morris Stein, BArch, Phoenix, AZ (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Create design expectations and measure outcomes. 2) Learn from prototyping solutions. 3) Deliver new models of spatial and functional organization.\*Course Description It is not just about designing rooms or departments, or detailing technology, but designing experiences that impact our patients, staff, and families. Seize the opportunity to learn from current disruptive forces and cast a design vision for the future. Now more than ever, design solutions are process oriented and data driven, beyond product or technology installed.

### COURSE DESCRIPTION

It is not just about designing rooms or departments, or detailing technology, but designing experiences that impact our patients, staff, and families. Seize the opportunity to learn from current disruptive forces and cast a design vision for the future. Now more than ever, design solutions are process oriented and data driven, beyond product or technology installed.

#### M3-CAS03 **Creating Experiential Designs that Add Value and Improve Performance**

##### Participants

Carlos Amato, MArch, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CBR04

### Multi-modality Challenging Breast Cases

#### LEARNING OBJECTIVES

1) Recognize challenging cases that occur in screening to avoid delayed diagnosis of breast cancer. 2) Learn strategies for incorporating multi-modality breast imaging in the diagnostic setting. 3) Apply a skillful approach to radiologic-pathologic correlation in breast imaging.\*Course Description This course will use an interactive case-based review format presented by an international group of breast imaging experts and will be followed by a live question and answer session.

#### COURSE DESCRIPTION

This course will use an interactive case-based review format presented by an international group of breast imaging experts and will be followed by a live question and answer session.

#### Sub-Events

##### **M3-CBR04 Moderator**

Participants

Bonnie Joe, MD, PhD, (*Moderator*) Institutional Research Grant, Kheiron Medical Technologies Ltd; Institutional research agreement, General Electric Company; Institutional research agreement, Siemens AG

##### **M3-CBR04 Multi-Modality Challenging Cases in Diagnostics**

Participants

Bonnie Joe, MD, PhD, (*Presenter*) Institutional Research Grant, Kheiron Medical Technologies Ltd; Institutional research agreement, General Electric Company; Institutional research agreement, Siemens AG

##### **M3-CBR04 Multi-Modality Challenging Cases in Screening**

Participants

Jean Seely, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

##### **M3-CBR04 Multi-Modality Challenging Cases and Rad-path Correlation**

Participants

Fleur Kilburn-Toppin, MBBChir, MA, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CBR04

**Moderator**

### Participants

Bonnie Joe, MD, PhD, (*Moderator*) Institutional Research Grant, Kheiron Medical Technologies Ltd; Institutional research agreement, General Electric Company; Institutional research agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CBR04

### Multi-Modality Challenging Cases in Diagnostics

#### Participants

Bonnie Joe, MD, PhD, (*Presenter*) Institutional Research Grant, Kheiron Medical Technologies Ltd; Institutional research agreement, General Electric Company; Institutional research agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CBR04

### Multi-Modality Challenging Cases in Screening

#### Participants

Jean Seely, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CBR04

### Multi-Modality Challenging Cases and Rad-path Correlation

#### Participants

Fleur Kilburn-Toppin, MBBChir, MA, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CCA12

### Cardiac CT Mentored Case Review: Coronary Atherosclerotic Disease - From Straightforward to Most Complicated

#### LEARNING OBJECTIVES

1) Learn about the diagnostic methods which detect coronary calcifications, their clinical implications and management strategies. 2) Develop an understanding of atherosclerotic plaque analysis techniques. 3) Understand the components and categories of the CAD-RAD system and how apply it in clinical practice. 4) Become familiar with the key concepts and application of CT fractional flow reserve and myocardial perfusion.\*Course Description This course is a comprehensive synopsis of the complexities of quantitative and qualitative assessment of coronary artery disease, beyond liminal narrowing.

#### COURSE DESCRIPTION

This course is a comprehensive synopsis of the complexities of quantitative and qualitative assessment of coronary artery disease, beyond liminal narrowing.

#### Sub-Events

##### M3-CCA12 All You Need to Know About Cardiac Calcifications

###### Participants

Rozemarijn Vliegthart, MD, PhD, Groningen, Netherlands (*Presenter*) Institutional Research Grant, Siemens Healthineers Speaker's Bureau, Siemens Healthineers Speaker's Bureau, Bayer

##### M3-CCA12 Coronary Atherosclerosis I: Approach to Atherosclerotic Plaque Analysis and Severity of Stenosis Assessment

###### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG

##### M3-CCA12 Coronary Atherosclerosis II: CAD-RAD System

###### Participants

Prachi P. Agarwal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### M3-CCA12 Coronary Atherosclerosis III: How do I Assess the Severity of CAD Role of CT FFR and CT MP

###### Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc

##### M3-CCA12 Moderator

###### Participants

Carole A. Ridge, MD, Dublin, Ireland (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CCA12

### All You Need to Know About Cardiac Calcifications

#### Participants

Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Presenter*) Institutional Research Grant, Siemens Healthineers Speaker's Bureau, Siemens Healthineers Speaker's Bureau, Bayer

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CCA12

### Coronary Atherosclerosis I: Approach to Atherosclerotic Plaque Analysis and Severity of Stenosis Assessment

#### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CCA12

### Coronary Atherosclerosis II: CAD-RAD System

#### Participants

Prachi P. Agarwal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CCA12

### Coronary Atherosclerosis III: How do I Assess the Severity of CAD Role of CT FFR and CT MP

#### Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG; Research Grant, Bracco Group; Research Grant, Elucid BioImaging Inc; Consultant, Elucid BioImaging Inc; Research Grant: General Electric Company; Research Grant, Guerbet SA; Research Grant, Heartflow, Inc; Speakers Bureau, Heartflow Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CCA12

**Moderator**

### Participants

Carole A. Ridge, MD, Dublin, Ireland (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CER06

### Hepato-Pancreato-Biliary Emergencies

#### Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CER06

### Tricky Bowel Obstruction Cases and Internal Hernia

#### Participants

Carl Flink, MD, Sandyt, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CER06

### GI causes of Acute Abdominal Pain: Case-Based Approach

#### LEARNING OBJECTIVES

1) Review GI causes of acute abdominal pain that may be seen on imaging in the acute setting. 2) Identify key imaging findings seen in acute GI related conditions causing acute abdominal pain, including tricky bowel obstruction, hepatobiliary-related, and lower abdominal pain related cases. 3) Discuss potential diagnostic pitfalls.\*Course Description Patients presenting with acute abdominal pain can represent a diagnostic challenge. The differential diagnosis may be vast, ranging from minor to life-threatening conditions, and the clinical symptoms may be nonspecific. Radiologist familiarity with the potential range of imaging findings for cases of acute abdominal pain is important for optimal imaging diagnosis. In this case-based session, cases of acute GI-related conditions will be presented with discussion of pertinent imaging features. This includes cases of hepatobiliary conditions, tricky bowel obstruction, GI causes of lower abdominal pain.

#### COURSE DESCRIPTION

Patients presenting with acute abdominal pain can represent a diagnostic challenge. The differential diagnosis may be vast, ranging from minor to life-threatening conditions, and the clinical symptoms may be nonspecific. Radiologist familiarity with the potential range of imaging findings for cases of acute abdominal pain is important for optimal imaging diagnosis. In this case-based session, cases of acute GI-related conditions will be presented with discussion of pertinent imaging features. This includes cases of hepatobiliary conditions, tricky bowel obstruction, GI causes of lower abdominal pain.

#### Sub-Events

##### M3-CER06 Moderator

Participants

Robin B. Levenson, MD, Newton, MA (*Moderator*) Nothing to Disclose

##### M3-CER06 Lower Abdominal Pain

Participants

Robin B. Levenson, MD, Newton, MA (*Presenter*) Nothing to Disclose

##### M3-CER06 Hepato-Pancreato-Biliary Emergencies

Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

##### M3-CER06 Tricky Bowel Obstruction Cases and Internal Hernia

Participants

Carl Flink, MD, Sandyt, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CER06

**Moderator**

### Participants

Robin B. Levenson, MD, Newton, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CER06

### Lower Abdominal Pain

#### Participants

Robin B. Levenson, MD, Newton, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CGU08

### Imaging Ovarian Cancer: Radiologists as Partners in Cancer Care

#### Sub-Events

#### M3-CGU08 Moderator

##### Participants

Evis Sala, MD, PhD, Rome, Italy (*Moderator*) Co-founder, Lucida Medical Ltd

#### M3-CGU08 Ovarian Cancer: A Glimpse into the Future of Personalized Care

##### Participants

Evis Sala, MD, PhD, Rome, Italy (*Presenter*) Co-founder, Lucida Medical Ltd

#### LEARNING OBJECTIVES

1) Learn the current treatment paradigms available to patients with ovarian cancer. 2) Review the role of multi-modality imaging in treatment selection and planning of patients with ovarian cancer. 3) Highlight the potential added value of radiogenomics and AI in prediction of treatment response and outcome in patients with ovarian cancer.\*Course Description This course will provide a comprehensive review of the current and state of the art treatments for patients with ovarian cancer. It will review the role of multimodality imaging in treatment selection and planning focusing on the added value of various imaging modalities for detection of peritoneal implants that change management. It will also provide a glimpse into the future of personalized care by highlighting the role of artificial intelligence and radiogenomics in improving prediction of response to neoadjuvant chemotherapy and early detection of treatment resistance which determines patient outcome.

#### COURSE DESCRIPTION

This course will provide a comprehensive review of the current and state of the art treatments for patients with ovarian cancer. It will review the role of multimodality imaging in treatment selection and planning focusing on the added value of various imaging modalities for detection of peritoneal implants that change management. It will also provide a glimpse into the future of personalized care by highlighting the role of artificial intelligence and radiogenomics in improving prediction of response to neoadjuvant chemotherapy and early detection of treatment resistance which determines patient outcome.

#### M3-CGU08 Ovarian Cancer Implants: The Tip of the Iceberg - A Case based Discussion

##### Participants

Stephanie Nougaret, MD, PhD, (*Presenter*) Nothing to Disclose

#### M3-CGU08 Ovarian Cancer Staging: Pretreatment Imaging Evaluation (CT, MRI, PET)

##### Participants

Yuliya Lakhman, MD, New York, NY (*Presenter*) Stockholder, Y-mAbs Therapeutics Inc; Consultant, Perceptive Informatics, LLC

#### M3-CGU08 Ovarian Cancer: Current Treatment Paradigms

##### Participants

Annie Leung, MD, Montreal, QC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CGU08

### Ovarian Cancer: A Glimpse into the Future of Personalized Care

#### Participants

Evis Sala, MD, PhD, Rome, Italy (*Presenter*) Co-founder, Lucida Medical Ltd

#### LEARNING OBJECTIVES

1) Learn the current treatment paradigms available to patients with ovarian cancer. 2) Review the role of multi-modality imaging in treatment selection and planning of patients with ovarian cancer. 3) Highlight the potential added value of radiogenomics and AI in prediction of treatment response and outcome in patients with ovarian cancer.\*Course Description This course will provide a comprehensive review of the current and state of the art treatments for patients with ovarian cancer. It will review the role of multimodality imaging in treatment selection and planning focusing on the added value of various imaging modalities for detection of peritoneal implants that change management. It will also provide a glimpse into the future of personalized care by highlighting the role of artificial intelligence and radiogenomics in improving prediction of response to neoadjuvant chemotherapy and early detection of treatment resistance which determines patient outcome.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CGU08

### Ovarian Cancer Implants: The Tip of the Iceberg - A Case based Discussion

#### Participants

Stephanie Nougaret, MD, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CGU08

### Ovarian Cancer Staging: Pretreatment Imaging Evaluation (CT, MRI, PET)

#### Participants

Yuliya Lakhman, MD, New York, NY (*Presenter*) Stockholder, Y-mAbs Therapeutics Inc; Consultant, Perceptive Informatics, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CGU08

### Ovarian Cancer: Current Treatment Paradigms

#### Participants

Annie Leung, MD, Montreal, QC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CGU08

**Moderator**

### Participants

Evis Sala, MD, PhD, Rome, Italy (*Moderator*) Co-founder, Lucida Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

### Imaging of Endocrine Disease in the Head and Neck

#### Sub-Events

#### M3-CHN05 Moderator

##### Participants

Francis Deng, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

#### M3-CHN05 Workup of Thyroid Nodules: TI-RADS and K-TIRADS

##### Participants

Ji-Hoon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Implement a standardized risk-stratification system for reporting thyroid nodules on ultrasound. 2) Describe the typical and atypical imaging characteristics of thyroid cancer, parathyroid adenomas, and paragangliomas in the head and neck. 3) Identify clinically consequential findings during the imaging workup of thyroid nodules, thyroid cancer, hyperparathyroidism, and paragangliomas in the head and neck.\*Course Description This session offers an exploration of head and neck endocrine imaging, blending lectures with case studies and audience response. Topics include risk stratification of thyroid nodules using ACR TI-RADS and K-TIRADS, imaging approaches for thyroid cancer, parathyroid adenoma preoperative localization, and head and neck paragangliomas. Typical and atypical imaging examples will be shared, emphasizing differentiation from common mimics, interpretation pitfalls, and clinical management considerations with which radiologists should be familiar. Get ready to hone your interpretation skills to razor sharpness under the guidance of world experts!

#### COURSE DESCRIPTION

This session offers an exploration of head and neck endocrine imaging, blending lectures with case studies and audience response. Topics include risk stratification of thyroid nodules using ACR TI-RADS and K-TIRADS, imaging approaches for thyroid cancer, parathyroid adenoma preoperative localization, and head and neck paragangliomas. Typical and atypical imaging examples will be shared, emphasizing differentiation from common mimics, interpretation pitfalls, and clinical management considerations with which radiologists should be familiar. Get ready to hone your interpretation skills to razor sharpness under the guidance of world experts!

#### M3-CHN05 Thyroid Cancer Imaging

##### Participants

Maria Gule-Monroe, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### M3-CHN05 Imaging for Difficult Parathyroid Cases

##### Participants

Hillary R. Kelly, MD, Boston, MA (*Presenter*) Investigator, Bayer AG; Institutional research agreement, Bayer AG

#### M3-CHN05 Paragangliomas in the Head and Neck

##### Participants

David Zander, MD, Englewood, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

**Moderator**

### Participants

Francis Deng, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

### Workup of Thyroid Nodules: TI-RADS and K-TIRADS

#### Participants

Ji-Hoon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Implement a standardized risk-stratification system for reporting thyroid nodules on ultrasound. 2) Describe the typical and atypical imaging characteristics of thyroid cancer, parathyroid adenomas, and paragangliomas in the head and neck. 3) Identify clinically consequential findings during the imaging workup of thyroid nodules, thyroid cancer, hyperparathyroidism, and paragangliomas in the head and neck.\*Course Description This session offers an exploration of head and neck endocrine imaging, blending lectures with case studies and audience response. Topics include risk stratification of thyroid nodules using ACR TI-RADS and K-TIRADS, imaging approaches for thyroid cancer, parathyroid adenoma preoperative localization, and head and neck paragangliomas. Typical and atypical imaging examples will be shared, emphasizing differentiation from common mimics, interpretation pitfalls, and clinical management considerations with which radiologists should be familiar. Get ready to hone your interpretation skills to razor sharpness under the guidance of world experts!

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This session offers an exploration of head and neck endocrine imaging, blending lectures with case studies and audience response. Topics include risk stratification of thyroid nodules using ACR TI-RADS and K-TIRADS, imaging approaches for thyroid cancer, parathyroid adenoma preoperative localization, and head and neck paragangliomas. Typical and atypical imaging examples will be shared, emphasizing differentiation from common mimics, interpretation pitfalls, and clinical management considerations with which radiologists should be familiar. Get ready to hone your interpretation skills to razor sharpness under the guidance of world experts!

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

### Thyroid Cancer Imaging

#### Participants

Maria Gule-Monroe, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

### Imaging for Difficult Parathyroid Cases

#### Participants

Hillary R. Kelly, MD, Boston, MA (*Presenter*) Investigator, Bayer AG; Institutional research agreement, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CHN05

### Paragangliomas in the Head and Neck

#### Participants

David Zander, MD, Englewood, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIN26

### Understanding the Foundations: An Introduction to Large Language Models

#### Sub-Events

#### **M3-CIN26 Demystifying LLMs: An Introduction to the Science Behind the Magic of Large Language Models**

##### Participants

Tara Retson, MD, PhD, San Diego, CA (*Presenter*) Research Consultant, CureMetrix, Inc; Stock options, CureMetrix, Inc

#### **M3-CIN26 Moderator**

##### Participants

Tara Retson, MD, PhD, San Diego, CA (*Moderator*) Research Consultant, CureMetrix, Inc; Stock options, CureMetrix, Inc

#### **M3-CIN26 The State-of-the-art Visual Linguistic Transformer-based Models for Radiology Application**

##### Participants

Man Luo, PhD, BS, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### **M3-CIN26 Evolving with AI - An Introduction to Prompt Generation**

##### Participants

Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

#### **M3-CIN26 The Double-edged Sword: Potentials and Pitfalls of LLMs in Radiology**

##### Participants

Woojin Kim, MD, , CA (*Presenter*) Co-founder, Equium Intelligence, Inc; Shareholder, Equium Intelligence, Inc; Stockholder, Nuance Communications, Inc; Consultant, Nuance Communications, Inc; Stockholder, Hyperfine Research, Inc; Consultant, Hyperfine Research, Inc; Stockholder, Nanox Imaging LTD; Advisory Board, Braid Health, Inc; Advisory Board, ImageBiopsy Lab; Advisory Board, Inference Analytics; Advisory Board, Infiniti Medical, LLC; Advisory Board, Luxsonic Technologies Inc; Advisory Board, Rad AI; Advisory Board, Xcel Capital Pty Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CIN26

### Demystifying LLMs: An Introduction to the Science Behind the Magic of Large Language Models

#### Participants

Tara Retson, MD, PhD, San Diego, CA (*Presenter*) Research Consultant, CureMetrix, Inc Stock options, CureMetrix, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIN26

**Moderator**

### Participants

Tara Retson, MD, PhD, San Diego, CA (*Moderator*) Research Consultant, CureMetrix, Inc Stock options, CureMetrix, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIN26

### The State-of-the-art Visual Linguistic Transformer-based Models for Radiology Application

#### Participants

Man Luo, PhD, BS, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIN26

### Evolving with AI - An Introduction to Prompt Generation

#### Participants

Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIN26

### The Double-edged Sword: Potentials and Pitfalls of LLMs in Radiology

#### Participants

Woojin Kim, MD, , CA (*Presenter*) Co-founder, Equium Intelligence, Inc;Shareholder, Equium Intelligence, Inc;Stockholder, Nuance Communications, Inc;Consultant, Nuance Communications, Inc;Stockholder, Hyperfine Research, Inc;Consultant, Hyperfine Research, Inc;Stockholder, Nanox Imaging LTD;Advisory Board, Braid Health, Inc;Advisory Board, ImageBiopsy Lab;Advisory Board, Inference Analytics;Advisory Board, Infiniti Medical, LLC;Advisory Board, Luxsonic Technologies Inc;Advisory Board, Rad AI;Advisory Board, Xcel Capital Pty Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Managing Complications in IR

#### LEARNING OBJECTIVES

1) Key imaging findings of complications of interventional radiology procedures. 2) How to decide which complications of interventional radiology procedures require treatment and which complications can be managed conservatively. 3) How to treat complications of interventional radiology procedures.\*Course Description The aim of this course is to describe the key complications of the wide range interventional radiology procedures including vascular, non-vascular and ablation procedures. Important imaging findings will be discussed and methods will be described regarding how to manage complications. Many complications will be presented and discussed in a case-based format and discussion after each lecture will be encouraged.

#### COURSE DESCRIPTION

The aim of this course is to describe the key complications of the wide range interventional radiology procedures including vascular, non-vascular and ablation procedures. Important imaging findings will be discussed and methods will be described regarding how to manage complications. Many complications will be presented and discussed in a case-based format and discussion after each lecture will be encouraged.

#### Sub-Events

##### M3-CIR09 Moderator

Participants

Robert A. Morgan, MD, Dorking, United Kingdom (*Moderator*) Proctor, Medtronic plc

##### M3-CIR09 Complications of Biopsy and Drainage Procedures

Participants

Robert A. Morgan, MD, Dorking, United Kingdom (*Presenter*) Proctor, Medtronic plc

##### M3-CIR09 Complications of Vascular Access and Dialysis Maintenance Procedures

Participants

Robert L. Vogelzang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### M3-CIR09 Venous Interventions Gone Wrong

Participants

Maha Jarmakani, DO,BS, Oklahoma City, OK (*Presenter*) Nothing to Disclose

##### M3-CIR09 Complications of Interventional Oncology Procedures

Participants

William S. Rilling, MD, Milwaukee, WI (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Agilent Technologies, Inc; Consultant, Terumo Corporation; Consultant, Becton, Dickinson and Company; Consultant, Sirtex Medical Ltd; Consultant, AstraZeneca PLC

##### M3-CIR09 Complications of Interventions for Pulmonary Thromboembolism

Participants

Venkat Tummala, MD, Lakeland, FL (*Presenter*) Nothing to Disclose

##### M3-CIR09 Arterial Complications

Participants

Uei Pua, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Complications of Interventions for Pulmonary Thromboembolism

#### Participants

Venkat Tummala, MD, Lakeland, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Arterial Complications

#### Participants

Uei Pua, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CIR09

**Moderator**

### Participants

Robert A. Morgan, MD, Dorking, United Kingdom (*Moderator*) Proctor, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Complications of Biopsy and Drainage Procedures

#### Participants

Robert A. Morgan, MD, Dorking, United Kingdom (*Presenter*) Proctor, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Complications of Vascular Access and Dialysis Maintenance Procedures

#### Participants

Robert L. Vogelzang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Venous Interventions Gone Wrong

#### Participants

Maha Jarmakani, DO,BS, Oklahoma City, OK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CIR09

### Complications of Interventional Oncology Procedures

#### Participants

William S. Rilling, MD, Milwaukee, WI (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Agilent Technologies, Inc; Consultant, Terumo Corporation; Consultant, Becton, Dickinson and Company; Consultant, Sirtex Medical Ltd; Consultant, AstraZeneca PLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

### Imaging Differentials of Hip and Groin Pain

#### LEARNING OBJECTIVES

1) Improve understanding of pre- and postoperative imaging for femoroacetabular impingement. 2) Learn to recognize clinically important tendon derangements about the hip and groin. 3) Assess the value of advanced imaging methods in acute hip trauma.\*Course Description This five part lecture course focuses on common, clinically important disorders associated with hip and groin pain. Attendees will hear from experts on key issues in assessment of femoroacetabular impingement, including how to assess the painful postoperative hip. Acute hip trauma will be highlighted including how to assess for bone marrow changes on CT as well as MRI in fracture diagnosis. Tendon disorders about the hip and pubis will also be covered, with an aim to understand which abnormalities are more likely to be clinically relevant.

#### COURSE DESCRIPTION

This five part lecture course focuses on common, clinically important disorders associated with hip and groin pain. Attendees will hear from experts on key issues in assessment of femoroacetabular impingement, including how to assess the painful postoperative hip. Acute hip trauma will be highlighted including how to assess for bone marrow changes on CT as well as MRI in fracture diagnosis. Tendon disorders about the hip and pubis will also be covered, with an aim to understand which abnormalities are more likely to be clinically relevant.

#### Sub-Events

##### M3-CMK04 Moderator

Participants  
Christopher Beaulieu, MD, PhD, Stanford, CA (*Moderator*) Nothing to Disclose

##### M3-CMK04 Core Muscle Injuries - Pubalgia and "Sports Hernia"

Participants  
Christopher Beaulieu, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

##### M3-CMK04 Femoroacetabular Impingement - Imaging Workup

Participants  
Daniel E. Wessell, PhD, (*Presenter*) Nothing to Disclose

##### M3-CMK04 Acute Hip Trauma - Fracture Detection and Characterization

Participants  
Pamela Walsh, MD, (*Presenter*) Nothing to Disclose

##### M3-CMK04 Clinically Important Tendinopathies about the Hip

Participants  
Angela Atinga, MBBChir, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

##### M3-CMK04 Painful Hip after FAI Surgery - Now What?

Participants  
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

**Moderator**

### Participants

Christopher Beaulieu, MD, PhD, Stanford, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

### Core Muscle Injuries - Pubalgia and "Sports Hernia"

#### Participants

Christopher Beaulieu, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CMK04

### Femoroacetabular Impingement - Imaging Workup

#### Participants

Daniel E. Wessell, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

### Acute Hip Trauma - Fracture Detection and Characterization

#### Participants

Pamela Walsh, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

### Clinically Important Tendinopathies about the Hip

#### Participants

Angela Atinga, MBBChir, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CMK04

### Painful Hip after FAI Surgery - Now What?

#### Participants

Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CNMMI03

### SPECT-CT for the Assessment of Hardware Complications

#### Participants

Kevin P. Banks, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CNMMI03

**Moderator**

### Participants

Kevin P. Banks, MD, San Antonio, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CNMMI03

### Musculoskeletal PET: The Good, the Bad, and the Indeterminant

#### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CNMMI03

### PET/CT Imaging in Musculoskeletal Pathology

#### Participants

Olga G. James, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-CNMMI03

### Musculoskeletal Imaging: When Molecular Imaging Helps

#### LEARNING OBJECTIVES

1) To review cases with musculoskeletal pathology and correlative imaging. 2) To discuss where/ when to use molecular imaging with an emphasis on malignancy, trauma, and infection. 3) To illustrate incidental findings and review what to do with them.\*Course Description This course will provide a review of when molecular imaging (including PET/CT and SPECT/CT) is most helpful in the evaluation of musculoskeletal pathology.

#### COURSE DESCRIPTION

This course will provide a review of when molecular imaging (including PET/CT and SPECT/CT) is most helpful in the evaluation of musculoskeletal pathology.

#### Sub-Events

##### **M3- CNMMI03** Moderator

Participants  
Kevin P. Banks, MD, San Antonio, TX (*Moderator*) Nothing to Disclose

##### **M3- CNMMI03** Musculoskeletal PET: The Good, the Bad, and the Indeterminant

Participants  
Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG;Speaker,Lantheus Holdings;Research support, General Electric Company;Research support, F. Hoffmann-La Roche Ltd;Research support, Lantheus Holdings;Research support, Novartis AG

##### **M3- CNMMI03** PET/CT Imaging in Musculoskeletal Pathology

Participants  
Olga G. James, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

##### **M3- CNMMI03** SPECT-CT for the Assessment of Hardware Complications

Participants  
Kevin P. Banks, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CPD01

### **Pediatric Neuroradiology: Difficult Concepts Simplified for all Practices**

#### **Sub-Events**

#### **M3-CPD01 Moderator**

##### Participants

Tina Y. Poussaint, MD, Boston, MA (*Moderator*) Nothing to Disclose

#### **M3-CPD01 Stroke Imaging in Children: Smart Techniques and Practical Diagnoses**

##### Participants

Susan Palasis, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### **LEARNING OBJECTIVES**

1) Acquire knowledge of the etiologies and risk factors associated with stroke in children and understand how imaging can aid in their diagnosis and management. 2) Interpret neuroimaging findings and genetic profiles to establish a comprehensive understanding of congenital brain malformations. 3) Recognize the role of neuroimaging and molecular profiling in the diagnosis and management of pediatric brain tumors.\*Course Description This is an educational session designed to provide in-depth knowledge and practical insights into three critical areas of pediatric neuroradiology: neuroimaging of pediatric stroke, neuroimaging of brain tumors, and neuroimaging of congenital brain malformations. Through lecture format and detailed discussion, participants will gain the necessary tools to accurately diagnose these entities on imaging ultimately improving patient care and outcomes.

#### **COURSE DESCRIPTION**

This is an educational session designed to provide in-depth knowledge and practical insights into three critical areas of pediatric neuroradiology: neuroimaging of pediatric stroke, neuroimaging of brain tumors, and neuroimaging of congenital brain malformations. Through lecture format and detailed discussion, participants will gain the necessary tools to accurately diagnose these entities on imaging ultimately improving patient care and outcomes.

#### **M3-CPD01 Neuroimaging and Genetic Profiles of Congenital Brain Malformations: Putting the Pieces Together**

##### Participants

Winnie C. Chu, MD, FRCR, Shatin, Hong Kong (*Presenter*) Nothing to Disclose

#### **M3-CPD01 Pediatric Brain Tumors in the Child: Updates in Classification and Genetics**

##### Participants

Matthias Wagner, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CPD01

**Moderator**

### Participants

Tina Y. Poussaint, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CPD01

### Stroke Imaging in Children: Smart Techniques and Practical Diagnoses

#### Participants

Susan Palasis, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Acquire knowledge of the etiologies and risk factors associated with stroke in children and understand how imaging can aid in their diagnosis and management. 2) Interpret neuroimaging findings and genetic profiles to establish a comprehensive understanding of congenital brain malformations. 3) Recognize the role of neuroimaging and molecular profiling in the diagnosis and management of pediatric brain tumors.\*Course Description This is an educational session designed to provide in-depth knowledge and practical insights into three critical areas of pediatric neuroradiology: neuroimaging of pediatric stroke, neuroimaging of brain tumors, and neuroimaging of congenital brain malformations. Through lecture format and detailed discussion, participants will gain the necessary tools to accurately diagnose these entities on imaging ultimately improving patient care and outcomes.

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This is an educational session designed to provide in-depth knowledge and practical insights into three critical areas of pediatric neuroradiology: neuroimaging of pediatric stroke, neuroimaging of brain tumors, and neuroimaging of congenital brain malformations. Through lecture format and detailed discussion, participants will gain the necessary tools to accurately diagnose these entities on imaging ultimately improving patient care and outcomes.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CPD01

### Neuroimaging and Genetic Profiles of Congenital Brain Malformations: Putting the Pieces Together

#### Participants

Winnie C. Chu, MD, FRCR, Shatin, Hong Kong (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-CPD01

### Pediatric Brain Tumors in the Child: Updates in Classification and Genetics

#### Participants

Matthias Wagner, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-RCP18

### Pearls and Pitfalls of Social Media in Radiology (Sponsored by the RSNA Resident & Fellow Committee)

#### Sub-Events

##### **M3-RCP18 Moderator**

Participants

Yasha Parikh Gupta, MD, Cambridge, MA (*Moderator*) Nothing to Disclose

##### **M3-RCP18 Pearls and Pitfalls of Using Twitter in Radiology Education Today**

Participants

Judith Gadde, DO, MBA, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To illustrate effective ways to utilize Twitter for radiology education. 2) Illustrate why branding is important professionally. 3) How to get started with Education on Social Media.\*Course Description This course will help radiologists utilize social media for their own personal branding, education, and networking in addition to understanding how social media can impact their career.

#### COURSE DESCRIPTION

This course will help radiologists utilize social media for their own personal branding, education, and networking in addition to understanding how social media can impact their career.

##### **M3-RCP18 How to Brand Yourself as an Educator on YouTube**

Participants

Omer Awan, MD, MPH, (*Presenter*) Nothing to Disclose

##### **M3-RCP18 Pearls and Pitfalls of Social Media in Radiology (Sponsored by the RSNA Resident Fellow Committee)**

Participants

Yasha Parikh Gupta, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

##### **M3-RCP18 How to Multipurpose Educational Content across Social Media Platforms**

Participants

Puneet Bhargava, MD, Seattle, WA (*Presenter*) Editor, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-RCP18

**Moderator**

### Participants

Yasha Parikh Gupta, MD, Cambridge, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M3-RCP18

### Pearls and Pitfalls of Using Twitter in Radiology Education Today

#### Participants

Judith Gadde, DO, MBA, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To illustrate effective ways to utilize Twitter for radiology education. 2) Illustrate why branding is important professionally. 3) How to get started with Education on Social Media.\*Course Description This course will help radiologists utilize social media for their own personal branding, education, and networking in addition to understanding how social media can impact their career.

#### COURSE DESCRIPTION

This course will help radiologists utilize social media for their own personal branding, education, and networking in addition to understanding how social media can impact their career.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-RCP18

### How to Brand Yourself as an Educator on YouTube

#### Participants

Omer Awan, MD, MPH, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-RCP18

**Pearls and Pitfalls of Social Media in Radiology (Sponsored by the RSNA Resident Fellow Committee)**

### Participants

Yasha Parikh Gupta, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M3-RCP18

### How to Multipurpose Educational Content across Social Media Platforms

#### Participants

Puneet Bhargava, MD, Seattle, WA (*Presenter*) Editor, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CAS02

**Moderator**

### Participants

Jennifer Kroken, MBA, Lewisville, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CAS02

**Instability in PE-Backed Radiology Groups (Sponsored by the RSNA Associated Sciences Consortium)**

### Participants

William Davis Jr, JD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CAS02

**Instability in PE-Backed Radiology Groups (Sponsored by the RSNA Associated Sciences Consortium)**

### Participants

Kurt Schoppe, MD, Grapevine, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CAS02

**Instability in PE-Backed Radiology Groups (Sponsored by the RSNA Associated Sciences Consortium)**

### Sub-Events

#### **M4-CAS02 Moderator**

Participants

Jennifer Kroken, MBA, Lewisville, TX (*Moderator*) Nothing to Disclose

#### **M4-CAS02 Instability in PE-Backed Radiology Groups (Sponsored by the RSNA Associated Sciences Consortium)**

Participants

Kurt Schoppe, MD, Grapevine, TX (*Presenter*) Nothing to Disclose

#### **M4-CAS02 Instability in PE-Backed Radiology Groups (Sponsored by the RSNA Associated Sciences Consortium)**

Participants

William Davis Jr, JD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M4-CIN02

**Informatics and Patient Centered Care- Creating the Tools For a Better Radiology Experience (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc.)**

### LEARNING OBJECTIVES

1) Explain the challenges and opportunities to make price transparency tools useful for patients. 2) Describe how informatics tools can minimize missed care opportunities. 3) Understand how to partner with a patient and family advisory council to develop informatics tools that improve patient experience.\*Course Description In this educational session and panel discussion, informatics innovations that improve the patient experience and promote patient and family centered care will be presented. Hot topics including price transparency, follow up recommendations and missed care opportunities, and incorporation of patient feedback into practice operations will be discussed. This session will present practical informatics solutions that can be implemented in a variety of radiology practice settings.

### COURSE DESCRIPTION

In this educational session and panel discussion, informatics innovations that improve the patient experience and promote patient and family centered care will be presented. Hot topics including price transparency, follow up recommendations and missed care opportunities, and incorporation of patient feedback into practice operations will be discussed. This session will present practical informatics solutions that can be implemented in a variety of radiology practice settings.

### Sub-Events

#### M4-CIN02 Moderator

Participants

Nina S. Vincoff, MD, New York, NY (*Moderator*) Nothing to Disclose

#### M4-CIN02 Price Transparency

Participants

Gelareh Sadigh, MD, Irvine, CA (*Presenter*) Nothing to Disclose

#### M4-CIN02 Reducing Missed Care Opportunities

Participants

Efren J. Flores, MD, Boston, MA (*Presenter*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc

#### M4-CIN02 Partnering with Patients

Participants

Nina S. Vincoff, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN02

### Partnering with Patients

#### Participants

Nina S. Vincoff, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN02

### Reducing Missed Care Opportunities

#### Participants

Efren J. Flores, MD, Boston, MA (*Presenter*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN02

**Moderator**

### Participants

Nina S. Vincoff, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN02

### Price Transparency

#### Participants

Gelareh Sadigh, MD, Irvine, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN13

**Moderator**

### Participants

Christopher J. Roth, MD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN13

### Do You Fund AI Software, Higher Staff Salaries, or Infrastructure?

#### Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand industry's process to translate new technology and research into their product roadmap. 2) Grasp how innovative private practices and university hospitals weigh AI product return on investment and return on health against financial realities today. 3) Learn steps to ensure purchased products meet the expected ROI and ROH.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN13

### How Private Practices Should Consider ROI and Governance

#### Participants

Nina E. Kottler, MD, MS, San Diego, CA (*Presenter*) Partner, Radiology Partners Stockholder, Radiology Partners (Radiology Partners owns a minority interest in Aidoc medical and an indirect minority interest in Rad AI) Employee, Radiology Partners Consultant, ES3 Consultant, W.L. Gore & Associates, Inc Consultant, Synapsica Healthcare Pvt Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M4-CIN13

### Onboarding Clinical AI, From Procurement to Go Live

#### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN13

### Translating New Technology Into A Product Roadmap Imagers Want

#### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Presenter*) Advisor, Segmed, Inc; Shareholder, Segmed, Inc; Advisor, Bunkerhill Health; Shareholder, Bunkerhill Health; Employee, Microsoft Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CIN13

### Best Practices for Procuring AI Platforms

#### Sub-Events

##### **M4-CIN13 Moderator**

###### Participants

Christopher J. Roth, MD, Durham, NC (*Moderator*) Nothing to Disclose

##### **M4-CIN13 Do You Fund AI Software, Higher Staff Salaries, or Infrastructure?**

###### Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand industry's process to translate new technology and research into their product roadmap. 2) Grasp how innovative private practices and university hospitals weigh AI product return on investment and return on health against financial realities today. 3) Learn steps to ensure purchased products meet the expected ROI and ROH.\*Course Description

##### **M4-CIN13 How Private Practices Should Consider ROI and Governance**

###### Participants

Nina E. Kottler, MD, MS, San Diego, CA (*Presenter*) Partner, Radiology Partners Stockholder, Radiology Partners (Radiology Partners owns a minority interest in Aidoc medical and an indirect minority interest in Rad AI) Employee, Radiology Partners Consultant, ES3 Consultant, W.L. Gore & Associates, Inc Consultant, Synapsica Healthcare Pvt Ltd

##### **M4-CIN13 Onboarding Clinical AI, From Procurement to Go Live**

###### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

##### **M4-CIN13 Translating New Technology Into A Product Roadmap Imagers Want**

###### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Presenter*) Advisor, Segmed, Inc;Shareholder, Segmed, Inc;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health;Employee, Microsoft Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CNPM05

**Moderator**

### Participants

Jennifer Kemp, MD, Denver, CO (*Moderator*) Stockholder, Scanslated, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CNPM05

### Could we be Doing More Harm than Good?

#### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CNPM05

### **Radiologists Should Embrace this Opportunity to Provide Patient Centered Care**

#### **Participants**

Jonathan Mezrich, MD, JD, Guilford, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CNPM05

### Immediate Release of Results: A CMIO Report from the Front Lines of a 12-Hospital, 800-Clinic Organization

#### Participants

CT Lin, MD, Denver, CO (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize the potential benefits of patient access to radiology reports, including improved patient education, increased transparency, and the ability to make more informed healthcare decisions. 2) Evaluate the potential harms associated with patient access to reports that patients may not fully understand, including increased patient anxiety, confusion, and potential misinterpretation of medical information. 3) Explore the perspective of referring physicians from a large academic center on patients having immediate access to radiology reports, including potential benefits, concerns, and impact on patient care and the physician-patient relationship.\*Course Description In this thought-provoking course, we delve into the complex and controversial topic of the Information Blocking Provision within the 21st Century Cures Act. The course features three engaging lectures, each presenting a different perspective on the impact and implications of this provision. Through a lively debate-style format, we aim to explore the benefits, challenges, and potential unintended consequences of this regulatory change.

#### COURSE DESCRIPTION

In this thought-provoking course, we delve into the complex and controversial topic of the Information Blocking Provision within the 21st Century Cures Act. The course features three engaging lectures, each presenting a different perspective on the impact and implications of this provision. Through a lively debate-style format, we aim to explore the benefits, challenges, and potential unintended consequences of this regulatory change.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-CNPM05

### 21st Century Cures Act Information Blocking Provision: Friend or Foe? - A Debate

#### Sub-Events

##### M4-CNPM05 Moderator

###### Participants

Jennifer Kemp, MD, Denver, CO (*Moderator*) Stockholder, Scanslated, Inc

##### M4-CNPM05 Could we be Doing More Harm than Good?

###### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

##### M4-CNPM05 Radiologists Should Embrace this Opportunity to Provide Patient Centered Care

###### Participants

Jonathan Mezrich, MD, JD, Guilford, CT (*Presenter*) Nothing to Disclose

##### M4-CNPM05 Immediate Release of Results: A CMIO Report from the Front Lines of a 12-Hospital, 800-Clinic Organization

###### Participants

CT Lin, MD, Denver, CO (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize the potential benefits of patient access to radiology reports, including improved patient education, increased transparency, and the ability to make more informed healthcare decisions. 2) Evaluate the potential harms associated with patient access to reports that patients may not fully understand, including increased patient anxiety, confusion, and potential misinterpretation of medical information. 3) Explore the perspective of referring physicians from a large academic center on patients having immediate access to radiology reports, including potential benefits, concerns, and impact on patient care and the physician-patient relationship.\*Course Description In this thought-provoking course, we delve into the complex and controversial topic of the Information Blocking Provision within the 21st Century Cures Act. The course features three engaging lectures, each presenting a different perspective on the impact and implications of this provision. Through a lively debate-style format, we aim to explore the benefits, challenges, and potential unintended consequences of this regulatory change.

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Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CAS04

### Preventing Workplace Violence

#### Participants

Eileen McChrystal, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CAS04

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CAS04

**Moderator**

### Participants

Jennifer Kroken, MBA, Lewisville, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CAS04

### Preventing Workplace Violence(Sponsored by the RSNA Associated Sciences Consortium)

#### LEARNING OBJECTIVES

1) Define workplace violence. 2) Prevention and intervention programs. 3) Response and incident management. 4) Safe separation practices.\*Course Description Preventing Workplace Violence is a 60-minute Federal Bureau of Investigation (FBI) Behavioral Analysis Unit (BAU) presentation for private-sector and corporate security managers on preventing targeted violence in the workplace. This presentation identifies systems for identifying and reducing risks of workplace violence. It introduces the concept of threat assessment threat management (TATM) and how to apply TATM principles to threat assessment investigations within your organization.

#### COURSE DESCRIPTION

Preventing Workplace Violence is a 60-minute Federal Bureau of Investigation (FBI) Behavioral Analysis Unit (BAU) presentation for private-sector and corporate security managers on preventing targeted violence in the workplace. This presentation identifies systems for identifying and reducing risks of workplace violence. It introduces the concept of threat assessment threat management (TATM) and how to apply TATM principles to threat assessment investigations within your organization.

#### Sub-Events

##### M6-CAS04 Moderator

Participants  
Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### M6-CAS04 Moderator

Participants  
Jennifer Kroken, MBA, Lewisville, TX (*Moderator*) Nothing to Disclose

##### M6-CAS04 Preventing Workplace Violence

Participants  
Eileen McChrystal, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CBR05

**Moderator**

### **Participants**

Wendy B. Demartini, MD, (*Moderator*) Advisory Board, Kheiron Medical Technologies Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CBR05

### **BIRADS Atlas Update in Mammography**

#### **Participants**

Stamatia Destounis, MD, Rochester, NY (*Presenter*) Medical Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CBR05

### **BIRADS Atlas Update in Ultrasound**

#### **Participants**

Jessica Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CBR05

### **BIRADS Atlas Update in Auditing and Outcomes Monitoring**

#### **Participants**

Peter Eby, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CBR05

### **BIRADS Atlas Update in MRI**

#### **Participants**

Wendy B. Demartini, MD, (*Presenter*) Advisory Board, Kheiron Medical Technologies Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CBR05

### BIRADS 6th Edition Update

#### LEARNING OBJECTIVES

1) Understand the important anticipated changes to the BI-RADS 6th edition Mammography, Breast Ultrasound, Breast MRI and Audit and Outcomes Monitoring sections.\*Course Description This image-rich course will describe the anticipated updates to the Breast Imaging and Data System (BI-RADS) 6th Edition. The important anticipated upcoming changes to the Mammography, Breast Ultrasound, Breast MRI and Audit and Outcomes Monitoring sections will be reviewed.

#### COURSE DESCRIPTION

This image-rich course will describe the anticipated updates to the Breast Imaging and Data System (BI-RADS) 6th Edition. The important anticipated upcoming changes to the Mammography, Breast Ultrasound, Breast MRI and Audit and Outcomes Monitoring sections will be reviewed.

#### Sub-Events

##### **M6-CBR05 Moderator**

Participants

Wendy B. Demartini, MD, (*Moderator*) Advisory Board, Kheiron Medical Technologies Ltd

##### **M6-CBR05 BIRADS Atlas Update in Mammography**

Participants

Stamatia Destounis, MD, Rochester, NY (*Presenter*) Medical Advisory Board, iCad, Inc

##### **M6-CBR05 BIRADS Atlas Update in Ultrasound**

Participants

Jessica Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

##### **M6-CBR05 BIRADS Atlas Update in Auditing and Outcomes Monitoring**

Participants

Peter Eby, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### **M6-CBR05 BIRADS Atlas Update in MRI**

Participants

Wendy B. Demartini, MD, (*Presenter*) Advisory Board, Kheiron Medical Technologies Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

### Pre- TAVR Imaging

#### Participants

Amar B. Shah, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

### Post- TAVR Imaging

#### Participants

Cristina Fuss, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

### Pre- and Post TMVR Imaging

#### Participants

Eric E. Williamson, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

### Cardiac CT Mentored Case Review: Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions

#### LEARNING OBJECTIVES

1) Describe cardiac imaging for pre and post TAVR planning. 2) Discuss and identify imaging for pre and post TMVR planning. 3) Discuss the Approach to Assessment of Coronary Stents/CABG Patency.\*Course Description Cardiac CT Mentored Case Review: Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions

#### COURSE DESCRIPTION

Cardiac CT Mentored Case Review: Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions

#### Sub-Events

##### M6-CCA13 Moderator

Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### M6-CCA13 Pre- TAVR Imaging

Participants

Amar B. Shah, MD, New York, NY (*Presenter*) Nothing to Disclose

##### M6-CCA13 Post- TAVR Imaging

Participants

Cristina Fuss, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

##### M6-CCA13 Pre- and Post TMVR Imaging

Participants

Eric E. Williamson, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### M6-CCA13 Approach to Assessment of Coronary Stents/CABG Patency

Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

**Moderator**

### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCA13

### Approach to Assessment of Coronary Stents/CABG Patency

#### Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CCH04

**Moderator**

### Participants

David M. Naeger, MD, Denver, CO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCH04

### Cystic Lung Disease

#### Participants

Joanna Escalon, MD, New York, NY (*Presenter*) Research Consultant, Vingroup

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCH04

### Airspace Opacity

#### Participants

David M. Naeger, MD, Denver, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCH04

### Mosaic Lung Attenuation

#### Participants

Saurabh Agarwal, MD, Providence, RI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCH04

### Micronodular Lung Disease

#### Participants

Smita Patel, MBBS, FRCR, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CCH04

### Fundamentals of Diffuse Lung Disease

#### LEARNING OBJECTIVES

1) Evaluate chest CT images for the presence of diffuse lung disease. 2) Define key imaging features used to characterize diffuse lung diseases. 3) Formulate a differential diagnosis based on the presence or absence of key chest CT imaging features.\*Course Description This course will review four important topics needed to evaluate diffuse lung disease. The course is intended for radiologists re-reviewing the fundamentals of this important aspect of chest radiology. We will use didactic and case-based material to review how to evaluate consolidations and ground-glass opacities, cystic lung disease, mosaic lung attenuation, and micronodular lung disease.

#### COURSE DESCRIPTION

This course will review four important topics needed to evaluate diffuse lung disease. The course is intended for radiologists re-reviewing the fundamentals of this important aspect of chest radiology. We will use didactic and case-based material to review how to evaluate consolidations and ground-glass opacities, cystic lung disease, mosaic lung attenuation, and micronodular lung disease.

#### Sub-Events

##### M6-CCH04 Moderator

Participants  
David M. Naeger, MD, Denver, CO (*Moderator*) Nothing to Disclose

##### M6-CCH04 Cystic Lung Disease

Participants  
Joanna Escalon, MD, New York, NY (*Presenter*) Research Consultant, Vingroup

##### M6-CCH04 Airspace Opacity

Participants  
David M. Naeger, MD, Denver, CO (*Presenter*) Nothing to Disclose

##### M6-CCH04 Mosaic Lung Attenuation

Participants  
Saurabh Agarwal, MD, Providence, RI (*Presenter*) Nothing to Disclose

##### M6-CCH04 Micronodular Lung Disease

Participants  
Smita Patel, MBBS, FRCR, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CER07

### GU Causes of Acute Abdominal Pain: Case-Based Approach

#### LEARNING OBJECTIVES

1) To point out the role of CT and MRI in the management of patients with acute gynecological diseases. 2) To be able to identify the specific findings that help correctly classify the etiology of obstructive urinary symptoms, that are not always due to urolithiasis. 3) To be aware of the possible differential diagnoses of renal colic in patients with flank pain. 4) To know the imaging findings of infectious processes of the genitourinary system and the particularities of some of them to make a more accurate diagnosis. 5) To remember that postoperative patients, both urologic and non-urologic, are at high risk for damage to the urinary tract. 6) Do not ignore findings suggestive of this and perform special imaging protocols to properly characterize Scrotal and penile emergencies are relatively uncommon but need to be diagnosed and treated urgently. The focus of this talk is on imaging techniques, interpretation and differential diagnosis as well as on clinical pictures of non-traumatic causes of scrotal and penile emergencies.\*Course Description Discuss the common and uncommon causes of gynecological, genitourinary and scrotal emergencies. The session will focus on imaging findings on US, CT, and MRI.

#### COURSE DESCRIPTION

Discuss the common and uncommon causes of gynecological, genitourinary and scrotal emergencies. The session will focus on imaging findings on US, CT, and MRI.

#### Sub-Events

##### M6-CER07 Moderator

Participants  
Refky Nicola, DO, MSc, Pittsford, NY (*Moderator*) Royalties, RELX

##### M6-CER07 Penile and Scrotal Emergencies

Participants  
Tiina Lehtimäki, MD, Helsinki, Finland (*Presenter*) Nothing to Disclose

##### M6-CER07 Renal Emergencies

Participants  
Javier Cuetos, MD, Donostia-San Sebastian, Spain (*Presenter*) Nothing to Disclose

##### M6-CER07 Gynecological Emergencies

Participants  
Olivera Nikolic, PhD, Novi Sad, Serbia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CER07

### Gynecological Emergencies

#### Participants

Olivera Nikolic, PhD, Novi Sad, Serbia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CER07

**Moderator**

### Participants

Refky Nicola, DO, MSc, Pittsford, NY (*Moderator*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CER07

### Penile and Scrotal Emergencies

#### Participants

Tiina Lehtimäki, MD, Helsinki, Finland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CER07

### Renal Emergencies

#### Participants

Javier Cuetos, MD, Donostia-San Sebastian, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

### Contrast Agents

#### Participants

Benjamin Yeh, MD, Hillsborough, CA (*Presenter*) Grant, Koninklijke Philips NV; Grant, General Electric Company; Consultant, Canon Medical Systems Corporation; Speaker, Canon Medical Systems Corporation; Royalties, Oxford University Press; Shareholder, Nextrast, Inc; Board Member, Nextrast, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

### Interpretation of Abdominal Pelvic Dual Energy CT in Clinical Practice

#### Participants

Bari Dane, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

### Practical Clinical Adoption of Dual Energy CT

#### Participants

Alvin C. Silva, MD, Scottsdale, AZ (*Presenter*) Scientific Advisory Committee, HealthMyne, Inc; Consultant, Exact Sciences Corporation; Research Grant, Ascelia Pharma AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

### Fundamentals of Photon Detector Counting CT

#### Participants

Cynthia McCollough, PhD, Byron, MN (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

**Moderator**

### **Participants**

Benjamin Yeh, MD, Hillsborough, CA (*Moderator*) Grant, Koninklijke Philips NV; Grant, General Electric Company; Consultant, Canon Medical Systems Corporation; Speaker, Canon Medical Systems Corporation; Royalties, Oxford University Press; Shareholder, Nextrast, Inc; Board Member, Nextrast, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CGI03

### Clinical Experience with Photon Counting CT

#### Participants

Joel Fletcher, MD, Rochester, MN (*Presenter*) Research Grant, Siemens AG; Research Grant, Pfizer Inc; Research Grant, Takeda Pharmaceutical Company Limited; Consultant, Takeda Pharmaceutical Company Limited; Research Grant, Nextrast, Inc; Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CGI03

### Dual- and Multi-energy CT of the Abdomen and Pelvis

#### LEARNING OBJECTIVES

1) Identify ways that multi-energy CT can improve clinical image interpretation. 2) Explain how to introduce multi-energy CT imaging to everyday clinical practice. 3) Describe advantages of photon counting CT for reducing radiation dose and medical errors. 4) Identify strategies for use of contrast agents with multi-energy CT.\*Course Description Multi-energy CT is increasingly utilized and the scanners are rapidly evolving. In particular, abdominal imaging benefits from the ability of multi-energy CT to emphasize iodine signal, differentiate iodine from non-iodine radiodensities, reduce artifacts, and improve lesion detection. This course will explore ways to adopt multi-energy CT in every day clinical practice. The basics of photon counting as they pertain to clinical imaging will be reviewed, and the advantages of photon counting CT for body imaging applications will be explored. New considerations for contrast agent usage for body applications in the setting of multi energy CT will be explored.

#### COURSE DESCRIPTION

Multi-energy CT is increasingly utilized and the scanners are rapidly evolving. In particular, abdominal imaging benefits from the ability of multi-energy CT to emphasize iodine signal, differentiate iodine from non-iodine radiodensities, reduce artifacts, and improve lesion detection. This course will explore ways to adopt multi-energy CT in every day clinical practice. The basics of photon counting as they pertain to clinical imaging will be reviewed, and the advantages of photon counting CT for body imaging applications will be explored. New considerations for contrast agent usage for body applications in the setting of multi energy CT will be explored.

#### Sub-Events

##### M6-CGI03 Moderator

###### Participants

Benjamin Yeh, MD, Hillsborough, CA (*Moderator*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc

##### M6-CGI03 Interpretation of Abdominal Pelvic Dual Energy CT in Clinical Practice

###### Participants

Bari Dane, MD, New York, NY (*Presenter*) Nothing to Disclose

##### M6-CGI03 Practical Clinical Adoption of Dual Energy CT

###### Participants

Alvin C. Silva, MD, Scottsdale, AZ (*Presenter*) Scientific Advisory Committee, HealthMyne, Inc;Consultant, Exact Sciences Corporation;Research Grant, Ascelia Pharma AB

##### M6-CGI03 Fundamentals of Photon Detector Counting CT

###### Participants

Cynthia McCollough, PhD, Byron, MN (*Presenter*) Research Grant, Siemens AG

##### M6-CGI03 Clinical Experience with Photon Counting CT

###### Participants

Joel Fletcher, MD, Rochester, MN (*Presenter*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc

##### M6-CGI03 Contrast Agents

###### Participants

Benjamin Yeh, MD, Hillsborough, CA (*Presenter*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

### AI Development Processes

#### Participants

Imon Banerjee, PhD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the principles involved in selecting, developing, and deploying artificial intelligence algorithms in radiology.\*Course Description This course will be comprised of 5 short 10-minute presentations on selecting, developing, and deploying AI algorithms, including deployment in private practice, academics, and through third-party platforms.

#### COURSE DESCRIPTION

This course will be comprised of 5 short 10-minute presentations on selecting, developing, and deploying AI algorithms, including deployment in private practice, academics, and through third-party platforms.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

**Moderator**

### Participants

Benjamin Strong, MD, Eden Prairie, MN (*Moderator*) Officer, Virtual Radiologic Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

### Focused Selection of AI Algorithms

#### Participants

Benjamin Strong, MD, Eden Prairie, MN (*Presenter*) Officer, Virtual Radiologic Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

### Practical Application of Platform AI

#### Participants

Ryan K. Lee, MD, MBA, Philadelphia, PA (*Presenter*) Bayer, Speaker's BureauPhilips, Speaker's BureauBracco, Advisor

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

### Academic Aspirations in AI Application

#### Participants

Hanna M. Zafar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIN14

### AI Platforms and Widespread Access

#### Participants

Pelu Tran, San Francisco, CA (*Presenter*) Employee, Ferrum

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CIN14

### Best Practices for AI Model Creation

#### Sub-Events

##### **M6-CIN14 Moderator**

Participants

Benjamin Strong, MD, Eden Prairie, MN (*Moderator*) Officer, Virtual Radiologic Corporation

##### **M6-CIN14 Focused Selection of AI Algorithms**

Participants

Benjamin Strong, MD, Eden Prairie, MN (*Presenter*) Officer, Virtual Radiologic Corporation

##### **M6-CIN14 Practical Application of Platform AI**

Participants

Ryan K. Lee, MD, MBA, Philadelphia, PA (*Presenter*) Bayer, Speaker's Bureau Philips, Speaker's Bureau Bracco, Advisor

##### **M6-CIN14 Academic Aspirations in AI Application**

Participants

Hanna M. Zafar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **M6-CIN14 AI Platforms and Widespread Access**

Participants

Pelu Tran, San Francisco, CA (*Presenter*) Employee, Ferrum

##### **M6-CIN14 AI Development Processes**

Participants

Imon Banerjee, PhD, Phoenix, AZ (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the principles involved in selecting, developing, and deploying artificial intelligence algorithms in radiology.\*Course Description This course will be comprised of 5 short 10-minute presentations on selecting, developing, and deploying AI algorithms, including deployment in private practice, academics, and through third-party platforms.

#### COURSE DESCRIPTION

This course will be comprised of 5 short 10-minute presentations on selecting, developing, and deploying AI algorithms, including deployment in private practice, academics, and through third-party platforms.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### Moderator

#### Participants

Julius Chapiro, MD, PhD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Boston Scientific Corporation; Consultant, AstraZeneca PLC; Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### Data Science in HCC

#### Participants

Julius Chapiro, MD, PhD, New Haven, CT (*Presenter*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### The Future of Ablation Technology and its Role in HCC

#### Participants

Jeong Min Lee, MD, PhD, (*Presenter*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### Combining TACE and Immunotherapy

#### Participants

Valerie Vilgrain, MD, Paris, France (*Presenter*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, Aldream Group LLC;Expert Witness, Terumo Corporation;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### A Hepatologist's Vision for Multidisciplinary Care in HCC

#### Participants

Mario Strazzabosco, MD, PhD, New Haven, CT (*Presenter*) Advisory Board, Bayer AG; Advisory Board, Engitix Limited; Advisory Board, Merck & Co, Inc; Advisory Board, Eisai Co, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CIR02

### Combining Y90 and Immunotherapy

#### Participants

Riad Salem, MBA, Chicago, IL (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Eisai Co, Ltd; Consultant, Sirtex Medical Ltd; Consultant, Cook Group Incorporated; Consultant, Siemens AG

Printed on: 04/12/24

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## Abstract Archives of the RSNA, 2023

M6-CIR02

### Cutting Edge HCC Management

#### LEARNING OBJECTIVES

1) Explore the latest advancements in data science of HCC and familiarize themselves with breakthroughs in image-analysis, machine learning, and novel forms of outcome prediction and clinical endpoints relevant to HCC diagnosis and therapy. 2) Understand the role of a multi-disciplinary tumor board in a rapidly evolving landscape of novel ablative modalities, image-guided navigational support, therapy guidelines, and staging systems pertinent to HCC. 3) Gain insights into current recommendations and ongoing trials combining loco-regional therapies with immunotherapy of HCC, with focus on novel concepts in adjuvant, and neoadjuvant therapy. 4) Identify emerging trends in combining radioembolization and chemoembolization with immunotherapy across stages. 5) Discuss the multidisciplinary approach to oncology imaging endpoints, including novel tumor response assessment techniques and standards pertinent to targeted HCC therapies.\*Course Description The educational course session is a comprehensive learning opportunity that focuses on the latest developments, cutting-edge technologies, and emerging trends in the field of primary liver cancer interventions. Attendees will be provided with a rich learning experience that explores innovative imaging techniques, novel guidelines and therapeutics and their impact on hepatocellular carcinoma (HCC) management, with lectures provided by global experts in the field of image-guided intervention in HCC.

#### COURSE DESCRIPTION

The educational course session is a comprehensive learning opportunity that focuses on the latest developments, cutting-edge technologies, and emerging trends in the field of primary liver cancer interventions. Attendees will be provided with a rich learning experience that explores innovative imaging techniques, novel guidelines and therapeutics and their impact on hepatocellular carcinoma (HCC) management, with lectures provided by global experts in the field of image-guided intervention in HCC.

#### Sub-Events

##### M6-CIR02 Moderator

###### Participants

Julius Chapiro, MD, PhD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG

##### M6-CIR02 Data Science in HCC

###### Participants

Julius Chapiro, MD, PhD, New Haven, CT (*Presenter*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG

##### M6-CIR02 The Future of Ablation Technology and its Role in HCC

###### Participants

Jeong Min Lee, MD, PhD, (*Presenter*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

##### M6-CIR02 Combining TACE and Immunotherapy

###### Participants

Valerie Vilgrain, MD, Paris, France (*Presenter*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, AIdream Group LLC;Expert Witness, Terumo Corporation;;

##### M6-CIR02 A Hepatologist's Vision for Multidisciplinary Care in HCC

###### Participants

Mario Strazzabosco, MD, PhD, New Haven, CT (*Presenter*) Advisory Board, Bayer AG;Advisory Board, Engitix Limited;Advisory Board, Merck & Co, Inc;Advisory Board, Eisai Co, Ltd

##### M6-CIR02 Combining Y90 and Immunotherapy

###### Participants

Riad Salem, MBA, Chicago, IL (*Presenter*) Consultant, Boston Scientific Corporation;Consultant, Eisai Co, Ltd;Consultant, Sirtex Medical Ltd;Consultant, Cook Group Incorporated;Consultant, Siemens AG

##### M6-CIR02 Imaging Response to Local and Systemic Therapies of HCC

###### Participants

Laura Crocetti, MD, PhD, Pisa, Italy (*Presenter*) Speaker, Terumo Corporation; Advisory Board, Boston Scientific Corporation; Research Consultant, Biomedical; Speaker, Eisai Co, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**Moderator**

### Participants

Viviane Khoury, BSc, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**Moderator**

### Participants

Linda Probyn, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Kenneth Lee, MD, MBA, Madison, WI (*Presenter*) Grant, NFL; Research support, Hologic, Inc; Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Presenter*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Christopher Beaulieu, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CMK16

### **RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

#### **Participants**

Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Presenter*) Travel support, Bracco Group; Travel support, Esaote SpA; Speakers Bureau, Esaote SpA; Travel support, ABIOTEN PHARMA SpA; Speakers Bureau, P&R Holding; Speakers Bureau, Pfizer Inc ; Speaker, Novartis AG; Speaker, Merck KGaA; Speaker, MSD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Rob Campbell, MBChB, FRCR, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

### **RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

#### **Participants**

Jon Jacobson, MD, Ann Arbor, MI (*Presenter*) Research Consultant, BioClinica, Inc; Advisory Board, Koninklijke Philips NV; Royalties, RELX; Contactor, POCUS PRO

#### **LEARNING OBJECTIVES**

1) Review anatomy and ultrasound imaging techniques for evaluation of the shoulder. 2) Describe useful dynamic imaging techniques to enhance assessment of the shoulder. 3) Discuss ultrasound imaging of common pathologic musculoskeletal conditions at the shoulder.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This session will review an approach to ultrasound of the shoulder including dynamic maneuvers. Part 1: There will be a hands-on demonstration by an instructor showing an approach to ultrasound examination of the shoulder. This will include assessment of the long head of biceps tendon, rotator cuff tendons, acromioclavicular joint, subacromial/subdeltoid bursa, posterior labrum, spinoglenoid notch and will include dynamic evaluation for biceps subluxation and subacromial impingement. This will be followed by a brief presentation highlighting common pathologic musculoskeletal conditions about the shoulder that are seen on ultrasound. Part 2: The participants will be divided into small groups and will practice an approach to ultrasound of the shoulder on a model with an instructor teaching the participants. Proper patient positioning will be shown. Tips on how to optimize ultrasound imaging to best evaluate the area of concern will be discussed.

#### **COURSE DESCRIPTION**

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## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Mark Cresswell, MBBCh, BSc, Vancouver, BC (*Presenter*) Consultant, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Angela Atinga, MBBChir, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Emma Rowbotham, MBBCHIR, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Humberto G. Rosas, MD, Middleton, WI (*Presenter*) Co-founder, AyrFlo; Stockholder, AyrFlo

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CMK16

### **RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

#### **Participants**

Carlo Martinoli, MD, Genova, Italy (*Presenter*) Speaker, Koninklijke Philips NV; Speaker, Canon Medical Systems Corporation; Speaker, Novo Nordisk AS; Speaker, Pfizer Inc; Speaker, Novartis AG; Speaker, Swedish Orphan Biovitrum AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

**RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

### Participants

Etienne Cardinal, MD, BSc, Montreal, QC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CMK16

### RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

#### Sub-Events

##### M6-CMK16 Moderator

#### Participants

Viviane Khoury, BSc, MD, (*Moderator*) Nothing to Disclose

##### M6-CMK16 Moderator

#### Participants

Linda Probyn, MD, (*Moderator*) Nothing to Disclose

##### M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

#### Participants

Jon Jacobson, MD, Ann Arbor, MI (*Presenter*) Research Consultant, BioClinica, Inc; Advisory Board, Koninklijke Philips NV; Royalties, RELX; Contactor, POCUS PRO

#### LEARNING OBJECTIVES

1) Review anatomy and ultrasound imaging techniques for evaluation of the shoulder. 2) Describe useful dynamic imaging techniques to enhance assessment of the shoulder. 3) Discuss ultrasound imaging of common pathologic musculoskeletal conditions at the shoulder.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This session will review an approach to ultrasound of the shoulder including dynamic maneuvers. Part 1: There will be a hands-on demonstration by an instructor showing an approach to ultrasound examination of the shoulder. This will include assessment of the long head of biceps tendon, rotator cuff tendons, acromioclavicular joint, subacromial/subdeltoid bursa, posterior labrum, spinoglenoid notch and will include dynamic evaluation for biceps subluxation and subacromial impingement. This will be followed by a brief presentation highlighting common pathologic musculoskeletal conditions about the shoulder that are seen on ultrasound. Part 2: The participants will be divided into small groups and will practice an approach to ultrasound of the shoulder on a model with an instructor teaching the participants. Proper patient positioning will be shown. Tips on how to optimize ultrasound imaging to best evaluate the area of concern will be discussed.

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##### M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

#### Participants

Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

##### M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

#### Participants

Mark Cresswell, MBBCh, BSc, Vancouver, BC (*Presenter*) Consultant, Koninklijke Philips NV

##### M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

#### Participants

Rob Campbell, MBChB, FRCR, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

##### M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers

Participants

Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Presenter*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOMED PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSD

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Humberto G. Rosas, MD, Middleton, WI (*Presenter*) Co-founder, AyrFlo;Stockholder, AyrFlo

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Carlo Martinoli, MD, Genova, Italy (*Presenter*) Speaker, Koninklijke Philips NV;Speaker, Canon Medical Systems Corporation;Speaker, Novo Nordisk AS;Speaker, Pfizer Inc;Speaker, Novartis AG;Speaker, Swedish Orphan Biovitrum AB

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Etienne Cardinal, MD, BSc, Montreal, QC (*Presenter*) Nothing to Disclose

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Angela Atinga, MBBChir, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Emma Rowbotham, MBBChir,FRCP, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Presenter*) Speakers Bureau, General Electric Company

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Christopher Beaulieu, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

**M6-CMK16 RSNA Hands-On Lab: Musculoskeletal Ultrasound: Approach to Ultrasound Assessment of the Shoulder with Dynamic Maneuvers**

Participants

Kenneth Lee, MD, MBA, Madison, WI (*Presenter*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CNR03

### Multidisciplinary (Adult) Brain Tumor Board

#### LEARNING OBJECTIVES

1) Explain the current standard of care for diagnosis and treatment of adult diffuse gliomas. 2) Demonstrate the importance of role various sub-specialists play in multidisciplinary tumor board.\*Course Description We will present multiple cases of adult diffuse gliomas in a setting similar to multidisciplinary tumor board. Each case will be discussed by a neuro-radiologist, followed by a neuropathologist and a neurosurgeon to enhance various aspects of multidisciplinary contribution to patient care. Each specialist will discuss pertinent important aspects of adult diffuse glioma diagnosis, treatment and surveillance.

#### COURSE DESCRIPTION

We will present multiple cases of adult diffuse gliomas in a setting similar to multidisciplinary tumor board. Each case will be discussed by a neuro-radiologist, followed by a neuropathologist and a neurosurgeon to enhance various aspects of multidisciplinary contribution to patient care. Each specialist will discuss pertinent important aspects of adult diffuse glioma diagnosis, treatment and surveillance.

#### Sub-Events

##### M6-CNR03 Moderator

Participants

Javier Villanueva-Meyer, MD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company

##### M6-CNR03 Moderator

Participants

Rajan Jain, MD, New York, NY (*Moderator*) Nothing to Disclose

##### M6-CNR03 Neurosurgeon: Buck Stops Here!

Participants

Isabelle Germano, MD, New York, NY (*Presenter*) Nothing to Disclose

##### M6-CNR03 Neuropathologist: Leading The (Genomic) Innovations!

Participants

Daniel J. Brat, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

##### M6-CNR03 Neuroradiologist: Movers and Shakers!

Participants

Javier Villanueva-Meyer, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

##### M6-CNR03 Neuroradiologist: Movers and Shakers!

Participants

Rajan Jain, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CNR03

**Neuroradiologist: Movers and Shakers!**

### Participants

Javier Villanueva-Meyer, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CNR03

**Neuroradiologist: Movers and Shakers!**

### Participants

Rajan Jain, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CNR03

**Moderator**

### **Participants**

Javier Villanueva-Meyer, MD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CNR03

**Moderator**

### Participants

Rajan Jain, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CNR03

### Neurosurgeon: Buck Stops Here!

#### Participants

Isabelle Germano, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CNR03

**Neuropathologist: Leading The (Genomic) Innovations!**

### Participants

Daniel J. Brat, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-COB02

**Moderator**

### Participants

Nicole M. Hindman, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-COB02

**Surgeon's Perspective: Preoperative Determination of Leiomyoma vs Leiomyosarcoma: Why is it so Important**

### Participants

Annie Leung, MD, Montreal, QC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-COB02

**MR Evaluation for Uterine Masses for Risk for LMS**

### Participants

Nicole M. Hindman, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-COB02

### Leiomyosarcoma: Clinical Perspective and MRI Update

#### Sub-Events

##### M6-COB02 Moderator

###### Participants

Nicole M. Hindman, MD, New York, NY (*Moderator*) Nothing to Disclose

##### M6-COB02 **Surgeon's Perspective: Preoperative Determination of Leiomyoma vs Leiomyosarcoma: Why is it so Important**

###### Participants

Annie Leung, MD, Montreal, QC (*Presenter*) Nothing to Disclose

##### M6-COB02 **MR Evaluation for Uterine Masses for Risk for LMS**

###### Participants

Nicole M. Hindman, MD, New York, NY (*Presenter*) Nothing to Disclose

##### M6-COB02 **Case-based Review of Uterine Masses**

###### Participants

Angela Tong, MD, New York, NY (*Presenter*) Equipment support, Siemens AG

#### LEARNING OBJECTIVES

1) Review current clinical challenges for Gynecologists in surgical resection of symptomatic fibroids- role of laparoscopic myomectomy and morcellation. 2) Identify role of MR imaging in risk-stratification of uterine masses that have features suspicious for leiomyosarcoma. 3) Learn to apply an imaging flow chart to uterine masses to differentiate subtypes of uterine fibroids. 4) Review a management flowchart that balances preserving fertility with optimal treatment of suspicious uterine masses.\*Course Description The prevalence of uterine leiomyosarcoma is greater than previously believed, with the American College of Obstetricians and Gynecologists reporting a prevalence of 1 in 770 (0.1%). The high profile deaths of previously healthy women after iatrogenic spread of an unsuspected uterine leiomyosarcoma had reverberating effects in the gynecologic community and affected subsequent FDA policies around surgical techniques from 2014 to the present. MR imaging can serve as an important role in pre-operative risk stratification for symptomatic uterine fibroids that are planned for surgery. This course will review the background of this clinical need, and apply an MR imaging evaluation of fibroids and a proposed management algorithm.

#### COURSE DESCRIPTION

The prevalence of uterine leiomyosarcoma is greater than previously believed, with the American College of Obstetricians and Gynecologists reporting a prevalence of 1 in 770 (0.1%). The high profile deaths of previously healthy women after iatrogenic spread of an unsuspected uterine leiomyosarcoma had reverberating effects in the gynecologic community and affected subsequent FDA policies around surgical techniques from 2014 to the present. MR imaging can serve as an important role in pre-operative risk stratification for symptomatic uterine fibroids that are planned for surgery. This course will review the background of this clinical need, and apply an MR imaging evaluation of fibroids and a proposed management algorithm.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-COB02

### Case-based Review of Uterine Masses

#### Participants

Angela Tong, MD, New York, NY (*Presenter*) Equipment support, Siemens AG

#### LEARNING OBJECTIVES

1) Review current clinical challenges for Gynecologists in surgical resection of symptomatic fibroids- role of laparoscopic myomectomy and morcellation. 2) Identify role of MR imaging in risk-stratification of uterine masses that have features suspicious for leiomyosarcoma. 3) Learn to apply an imaging flow chart to uterine masses to differentiate subtypes of uterine fibroids. 4) Review a management flowchart that balances preserving fertility with optimal treatment of suspicious uterine masses.\*Course Description The prevalence of uterine leiomyosarcoma is greater than previously believed, with the American College of Obstetricians and Gynecologists reporting a prevalence of 1 in 770 (0.1%). The high profile deaths of previously healthy women after iatrogenic spread of an unsuspected uterine leiomyosarcoma had reverberating effects in the gynecologic community and affected subsequent FDA policies around surgical techniques from 2014 to the present. MR imaging can serve as an important role in pre-operative risk stratification for symptomatic uterine fibroids that are planned for surgery. This course will review the background of this clinical need, and apply an MR imaging evaluation of fibroids and a proposed management algorithm.

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Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CPH03

**Moderator**

### Participants

Emily Marshall, PhD, Chicago, IL (*Moderator*) Scientific Advisory Board, Bayer AG; Consultant, Bayer AG; Scientific Advisory Board, Radimetrics Dosimetry Services; Consultant, Radimetrics Dosimetry Services

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH03

**Moderator**

### Participants

David Borrego, PhD, Washington, DC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH03

**A Comprehensive Discussion on Dose Coefficients and Dose Metrics: Their Development, Computation, and Appropriateness in Dose Estimation to the Patient**

### Participants

Emily Marshall, PhD, Chicago, IL (*Presenter*) Scientific Advisory Board, Bayer AG; Consultant, Bayer AG; Scientific Advisory Board, Radimetrics Dosimetry Services; Consultant, Radimetrics Dosimetry Services

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH03

### Practical Tools for Patient Dose Calculation Following Fluoroscopic Procedures: NCIRF Case Study

#### Participants

Choonsik Lee, PhD, Rockville, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH03

### Patient-Care Driven Discussions on Dose and Risk for Pediatric Patients and Their Caregivers

#### Participants

Lisa Kang, MD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH03

### **Dose Calculation Tools for Fluoroscopic Imaging: An Overview of Their Development, Accessibility, and What Role They Play in Communicating and Managing Patient Risk**

#### **LEARNING OBJECTIVES**

1) Explain the limitations and challenges in estimating radiation dose to the patient. 2) Evaluate the various dose metrics available and how these may be useful within their clinical workflow in communicating with patients and managing their risk. 3) Discuss the current state and future needs of radiation dosimetry in the context of low-dose research studies and what role attendees may play as stakeholders in the field. \*Course Description There are several tools and resources available to estimate the amount of radiation delivered to patients during fluoroscopic imaging procedures. This session, with a special emphasis on pediatric fluoroscopic imaging, will provide an overview of the current state of radiation dosimetry, the challenges in estimating patient dose, and what role these tools may play in improving communication and the management of patient risk. Attendees will leave the course with a developed understanding of appropriate applications and limitations of radiation dose estimates and tools available for their own educational use. This course, delivered lecture style, will provide practitioners the background needed to confidently produce, explain, and contextualize patient dose and risk following fluoroscopic imaging procedures.

#### **COURSE DESCRIPTION**

There are several tools and resources available to estimate the amount of radiation delivered to patients during fluoroscopic imaging procedures. This session, with a special emphasis on pediatric fluoroscopic imaging, will provide an overview of the current state of radiation dosimetry, the challenges in estimating patient dose, and what role these tools may play in improving communication and the management of patient risk. Attendees will leave the course with a developed understanding of appropriate applications and limitations of radiation dose estimates and tools available for their own educational use. This course, delivered lecture style, will provide practitioners the background needed to confidently produce, explain, and contextualize patient dose and risk following fluoroscopic imaging procedures.

#### **Sub-Events**

##### **M6-CPH03 Moderator**

###### Participants

Emily Marshall, PhD, Chicago, IL (*Moderator*) Scientific Advisory Board, Bayer AG; Consultant, Bayer AG; Scientific Advisory Board, Radimetrics Dosimetry Services; Consultant, Radimetrics Dosimetry Services

##### **M6-CPH03 Moderator**

###### Participants

David Borrego, PhD, Washington, DC (*Moderator*) Nothing to Disclose

##### **M6-CPH03 A Comprehensive Discussion on Dose Coefficients and Dose Metrics: Their Development, Computation, and Appropriateness in Dose Estimation to the Patient**

###### Participants

Emily Marshall, PhD, Chicago, IL (*Presenter*) Scientific Advisory Board, Bayer AG; Consultant, Bayer AG; Scientific Advisory Board, Radimetrics Dosimetry Services; Consultant, Radimetrics Dosimetry Services

##### **M6-CPH03 Practical Tools for Patient Dose Calculation Following Fluoroscopic Procedures: NCIRF Case Study**

###### Participants

Choonsik Lee, PhD, Rockville, MD (*Presenter*) Nothing to Disclose

##### **M6-CPH03 Patient-Care Driven Discussions on Dose and Risk for Pediatric Patients and Their Caregivers**

###### Participants

Lisa Kang, MD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH15

**Moderator**

### Participants

Matt Vanderhoek, PhD, Detroit, MI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH15

### Practical Implementation of Radiography Quality Assurance

#### Participants

Nicole Lafata, MS, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define and examine the roles of technologists, QA techs, physicists, radiologists, and engineers with respect to quality assurance. 2) Recognize and describe methods of quality assurance for application to routine clinical practice. 3) Understand the importance of regular quality control testing in radiographic imaging and its impact on clinical image quality and patient radiation exposure. 4) Understand the principles and application of the IAEA's remote, automated quality control solution.\*Course Description Enhance your understanding of routine quality assurance (QA) practices in radiography through this two-part lecture. Emphasizing teamwork, this course delves into the roles and relationships of technologists, physicists, engineers, and radiologists pertaining to QA. The course examines the QA significance of routine tasks performed by technologists such as reviewing images for proper exposure, positioning, and artifacts to maintain high standards in image quality. Course participants also gain valuable insights into annual QA procedures performed by physicists. In addition, the course dives into the use of remote and automated tools as part of a quality assurance program. Participants explore the IAEA's novel solution for cost-effective, automated quality control using simple test objects and free software. A practical guide is provided on use of the IAEA dedicated software & supplementary material to ensure consistent and superior image quality.

#### COURSE DESCRIPTION

Enhance your understanding of routine quality assurance (QA) practices in radiography through this two-part lecture. Emphasizing teamwork, this course delves into the roles and relationships of technologists, physicists, engineers, and radiologists pertaining to QA. The course examines the QA significance of routine tasks performed by technologists such as reviewing images for proper exposure, positioning, and artifacts to maintain high standards in image quality. Course participants also gain valuable insights into annual QA procedures performed by physicists. In addition, the course dives into the use of remote and automated tools as part of a quality assurance program. Participants explore the IAEA's novel solution for cost-effective, automated quality control using simple test objects and free software. A practical guide is provided on use of the IAEA dedicated software & supplementary material to ensure consistent and superior image quality.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-CPH15

### Quality Control of Radiographic Imaging Systems

#### Participants

Zahra Razi, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-CPH15

### Radiography Quality Assurance

#### Sub-Events

#### M6-CPH15 Moderator

Participants

Matt Vanderhoek, PhD, Detroit, MI (*Moderator*) Nothing to Disclose

#### M6-CPH15 Practical Implementation of Radiography Quality Assurance

Participants

Nicole Lafata, MS, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define and examine the roles of technologists, QA techs, physicists, radiologists, and engineers with respect to quality assurance. 2) Recognize and describe methods of quality assurance for application to routine clinical practice. 3) Understand the importance of regular quality control testing in radiographic imaging and its impact on clinical image quality and patient radiation exposure. 4) Understand the principles and application of the IAEA's remote, automated quality control solution.\*Course Description Enhance your understanding of routine quality assurance (QA) practices in radiography through this two-part lecture. Emphasizing teamwork, this course delves into the roles and relationships of technologists, physicists, engineers, and radiologists pertaining to QA. The course examines the QA significance of routine tasks performed by technologists such as reviewing images for proper exposure, positioning, and artifacts to maintain high standards in image quality. Course participants also gain valuable insights into annual QA procedures performed by physicists. In addition, the course dives into the use of remote and automated tools as part of a quality assurance program. Participants explore the IAEA's novel solution for cost-effective, automated quality control using simple test objects and free software. A practical guide is provided on use of the IAEA dedicated software & supplementary material to ensure consistent and superior image quality.

#### COURSE DESCRIPTION

Enhance your understanding of routine quality assurance (QA) practices in radiography through this two-part lecture. Emphasizing teamwork, this course delves into the roles and relationships of technologists, physicists, engineers, and radiologists pertaining to QA. The course examines the QA significance of routine tasks performed by technologists such as reviewing images for proper exposure, positioning, and artifacts to maintain high standards in image quality. Course participants also gain valuable insights into annual QA procedures performed by physicists. In addition, the course dives into the use of remote and automated tools as part of a quality assurance program. Participants explore the IAEA's novel solution for cost-effective, automated quality control using simple test objects and free software. A practical guide is provided on use of the IAEA dedicated software & supplementary material to ensure consistent and superior image quality.

#### M6-CPH15 Quality Control of Radiographic Imaging Systems

Participants

Zahra Razi, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

**Cystic Neoplasms of the Pancreas: Worrisome features and High Risk Stigmata - Which Guidelines?**

### Participants

Pablo Soffia, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

**Moderator**

### Participants

Pablo Soffia, MD, Santiago, Chile (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

**Moderator**

### Participants

Fatima Matute Teresa, MD, Madrid, Spain (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

### Adenocarcinomas of the Pancreas: Role of the Radiologist in Multidisciplinary Hospital Committees

#### Participants

Daniel UPEGUI JIMENEZ, PhD, PhD, Bogota, Colombia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

### Tips and Tricks for Postoperative and Chemotherapeutic Follow-up

#### Participants

Juan C. Spina JR, MD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP04

### Update on Neuroendocrine Neoplasms of the Pancreas

#### Participants

Manoel S. Rocha, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-RCP04

### Neoplasias del Pancreas/Pancreatic Neoplasms (CIR)

#### LEARNING OBJECTIVES

1) Learn how to diagnose the most common malignant tumors of the pancreas using computed tomography and magnetic resonance imaging. 2) Learn how to image pancreatic tumors undergoing chemotherapy treatment and how to differentiate fibrosis from recurrence. 3) Learn the radiological features of neuroendocrine neoplasms of the pancreas and how to differentiate them from other types of tumors. 4) Learn to detect and characterize the most frequent cystic neoplasms of the pancreas and what are their signs of aggressiveness and malignancy.\*Course Description In this course, attendees will be able to refresh their knowledge about pancreatic neoplasms and their different forms of presentation. The most frequent malignant neoplasms, such as adenocarcinoma, will be reviewed, emphasizing the criteria of resectability and irresectability. It will also discuss how to follow up these tumors after starting chemotherapy treatment and how to detect fibrosis from recurrences. A review of the diagnostic criteria for neuroendocrine tumors of the pancreas and expert recommendations for their detection and follow-up will be presented. Finally, the spectrum of cystic neoplasms of the pancreas will be shown, highlighting when aggressiveness or malignancy should be suspected.

#### COURSE DESCRIPTION

In this course, attendees will be able to refresh their knowledge about pancreatic neoplasms and their different forms of presentation. The most frequent malignant neoplasms, such as adenocarcinoma, will be reviewed, emphasizing the criteria of resectability and irresectability. It will also discuss how to follow up these tumors after starting chemotherapy treatment and how to detect fibrosis from recurrences. A review of the diagnostic criteria for neuroendocrine tumors of the pancreas and expert recommendations for their detection and follow-up will be presented. Finally, the spectrum of cystic neoplasms of the pancreas will be shown, highlighting when aggressiveness or malignancy should be suspected.

#### Sub-Events

##### **M6-RCP04 Moderator**

Participants  
Pablo Soffia, MD, Santiago, Chile (*Moderator*) Nothing to Disclose

##### **M6-RCP04 Moderator**

Participants  
Fatima Matute Teresa, MD, Madrid, Spain (*Moderator*) Nothing to Disclose

##### **M6-RCP04 Adenocarcinomas of the Pancreas: Role of the Radiologist in Multidisciplinary Hospital Committees**

Participants  
Daniel UPEGUI JIMENEZ, PhD, PhD, Bogota, Colombia (*Presenter*) Nothing to Disclose

##### **M6-RCP04 Tips and Tricks for Postoperative and Chemotherapeutic Follow-up**

Participants  
Juan C. Spina JR, MD, Capital Federal, Argentina (*Presenter*) Nothing to Disclose

##### **M6-RCP04 Update on Neuroendocrine Neoplasms of the Pancreas**

Participants  
Manoel S. Rocha, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### **M6-RCP04 Cystic Neoplasms of the Pancreas: Worrisome features and High Risk Stigmata - Which Guidelines?**

Participants  
Pablo Soffia, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP11

**From the Editors of RADIOLOGY: New Research that Should Impact your Practice**

### LEARNING OBJECTIVES

1) To highlight key articles published in Radiology in 2023. 2) To review how novel imaging techniques and AI are impacting our field.\*Course Description

### Sub-Events

#### **M6-RCP11 Moderator**

Participants

Linda Moy, MD, New York, NY (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

#### **M6-RCP11 Top Breast Imaging Papers That Should Impact Your Practice**

Participants

Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

#### **M6-RCP11 Gastrointestinal Imaging: Research that Should Impact your Practice**

Participants

Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company

#### **M6-RCP11 New Research That Should Impact Your Practice Neuroradiology**

Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### **M6-RCP11 Genitourinary Imaging: Research that Should Impact your Practice**

Participants

Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP11

**Moderator**

### **Participants**

Linda Moy, MD, New York, NY (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M6-RCP11

### Top Breast Imaging Papers That Should Impact Your Practice

#### Participants

Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP11

### Gastrointestinal Imaging: Research that Should Impact your Practice

#### Participants

Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG; Research support, General Electric Company; Research Grant, Pfizer Inc; Institutional Grant, MEDIAN Technologies; Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP11

**New Research That Should Impact Your Practice Neuroradiology**

### Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M6-RCP11

### Genitourinary Imaging: Research that Should Impact your Practice

#### Participants

Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CAS06

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CAS06

### Shift Work and Mental Health Among R.T.s

#### Participants

Kevin Clark, RT, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss the current state of mental health in the United States and assess anxiety and depression among a working sample of radiologic technologists. 2) Evaluate the relationship between mental health and working various shifts, including weekends, and taking call. 3) Identify coping strategies used to deal with anxiety and depression.\*Course Description Shift work is essential in health care where 24-hour access and service are expected. Engaging in shift work, however, is associated with mental health issues like depression and anxiety. Shift workers are also at a high risk for adverse health outcomes, such as stroke, obesity, gastrointestinal issues, and various types of cancer. This lecture (a) emphasizes the importance of assessing and managing mental health among health care professionals and (b) shares results from an original research study that explored shift work and mental health among a sample of working medical imaging and radiation therapy professionals.

#### COURSE DESCRIPTION

Shift work is essential in health care where 24-hour access and service are expected. Engaging in shift work, however, is associated with mental health issues like depression and anxiety. Shift workers are also at a high risk for adverse health outcomes, such as stroke, obesity, gastrointestinal issues, and various types of cancer. This lecture (a) emphasizes the importance of assessing and managing mental health among health care professionals and (b) shares results from an original research study that explored shift work and mental health among a sample of working medical imaging and radiation therapy professionals.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CAS06

### Shift Work and Mental Health Among R.T.s (Sponsored by the RSNA Associated Sciences Consortium)

#### Sub-Events

##### M7-CAS06 Moderator

#### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### M7-CAS06 Shift Work and Mental Health Among R.T.s

#### Participants

Kevin Clark, RT, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss the current state of mental health in the United States and assess anxiety and depression among a working sample of radiologic technologists. 2) Evaluate the relationship between mental health and working various shifts, including weekends, and taking call. 3) Identify coping strategies used to deal with anxiety and depression.\*Course Description Shift work is essential in health care where 24-hour access and service are expected. Engaging in shift work, however, is associated with mental health issues like depression and anxiety. Shift workers are also at a high risk for adverse health outcomes, such as stroke, obesity, gastrointestinal issues, and various types of cancer. This lecture (a) emphasizes the importance of assessing and managing mental health among health care professionals and (b) shares results from an original research study that explored shift work and mental health among a sample of working medical imaging and radiation therapy professionals.

#### COURSE DESCRIPTION

Shift work is essential in health care where 24-hour access and service are expected. Engaging in shift work, however, is associated with mental health issues like depression and anxiety. Shift workers are also at a high risk for adverse health outcomes, such as stroke, obesity, gastrointestinal issues, and various types of cancer. This lecture (a) emphasizes the importance of assessing and managing mental health among health care professionals and (b) shares results from an original research study that explored shift work and mental health among a sample of working medical imaging and radiation therapy professionals.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CBR01

### Contrast Enhanced Mammography

#### LEARNING OBJECTIVES

1) Review how to perform contrast enhanced mammography (CEM) and considerations when starting a CEM program. 2) Discuss the emerging roles of contrast enhanced mammography in both the screening and diagnostic settings.\*Course Description Contrast enhanced mammography (CEM) is an FDA approved technique that is emerging as an alternative vascular based technique to conventional breast imaging and MRI in both the screening and diagnostic settings. This session will review considerations in beginning a CEM program and review data supporting the use of CEM in both the screening and diagnostic settings.

#### COURSE DESCRIPTION

Contrast enhanced mammography (CEM) is an FDA approved technique that is emerging as an alternative vascular based technique to conventional breast imaging and MRI in both the screening and diagnostic settings. This session will review considerations in beginning a CEM program and review data supporting the use of CEM in both the screening and diagnostic settings.

#### Sub-Events

##### M7-CBR01 Moderator

Participants

Janice S. Sung, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

##### M7-CBR01 Contrast Enhanced Mammography: Technique, Indications and Outcomes

Participants

Janice S. Sung, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

##### M7-CBR01 Contrast Enhanced Mammography: Is MRI Better?

Participants

Ulrich Bick, MD, Berlin, Germany (*Presenter*) License agreement, Hologic, Inc; Royalties, Hologic, Inc

##### M7-CBR01 Contrast Enhanced Mammography: Ready for Screening?

Participants

Jordana Phillips, MD, Newton Center, MA (*Presenter*) Research Grant, General Electric Company; Consultant, General Electric Company; Consultant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CBR01

**Moderator**

### Participants

Janice S. Sung, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CBR01

### Contrast Enhanced Mammography: Technique, Indications and Outcomes

#### Participants

Janice S. Sung, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CBR01

### Contrast Enhanced Mammography: Is MRI Better?

#### Participants

Ulrich Bick, MD, Berlin, Germany (*Presenter*) License agreement, Hologic, Inc; Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CBR01

### Contrast Enhanced Mammography: Ready for Screening?

#### Participants

Jordana Phillips, MD, Newton Center, MA (*Presenter*) Research Grant, General Electric Company; Consultant, General Electric Company; Consultant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CCA14

### Left Atrial Pre- and Post-Ablation Imaging

#### Participants

Phillip Young, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CCA14

**Moderator**

### Participants

Daniel Ocazonez-Trujillo, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CCA14

### Cardiac and Pericardial Neoplasms

#### Participants

Jacobo Kirsch, MD, MBA, (*Presenter*) Medical Advisory Board, Zebra Medical Vision Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CCA14

### Adult Congenital Heart Disease

#### Participants

Dominique DaBreo, MD, FRCPC, KINGSTON, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CCA14

### Mixed Case-Review - Summary

#### Participants

Gautham Reddy, MD, MPH, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CCA14

### Cardiac CT Mentored Case Review: Imaging of Pulmonary Veins, Pericardium, and Adult Congenital Heart Disease

#### Sub-Events

##### **M7-CCA14 Moderator**

###### Participants

Daniel Ocazonez-Trujillo, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### **M7-CCA14 Cardiac and Pericardial Neoplasms**

###### Participants

Jacobo Kirsch, MD, MBA, (*Presenter*) Medical Advisory Board, Zebra Medical Vision Ltd

##### **M7-CCA14 Adult Congenital Heart Disease**

###### Participants

Dominique DaBreo, MD, FRCPC, KINGSTON, ON (*Presenter*) Nothing to Disclose

##### **M7-CCA14 Mixed Case-Review - Summary**

###### Participants

Gautham Reddy, MD, MPH, Seattle, WA (*Presenter*) Nothing to Disclose

##### **M7-CCA14 Left Atrial Pre- and Post-Ablation Imaging**

###### Participants

Phillip Young, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CER14

### Hot Topics in Emergency Radiology

#### LEARNING OBJECTIVES

1) To understand how emergency radiology practices are being covered following the COVID pandemic and how the paradigm has changed in Canada, the US, and elsewhere. 2) To review the current practice of peer review and peer learning in emergency radiology and how quality assurance in radiology has changed, with examples from recent practice. 3) To overview the current role of point-of-care ultrasound and to understand how radiologists, emergency medicine practitioners, and other clinical providers are utilizing ultrasound at the patient's bedside, and the implications for other imaging and patient practice. \*Course Description The ER 'hot topics' session will include three relevant current topics in emergency radiology practice: staffing given the challenges of COVID and following the COVID pandemic, with changes in practice and remote coverage; peer learning and peer review, with evolution of how quality assurance is being performed in emergency radiology and in radiology in general; and the current use of point-of-care ultrasound and how it fits in with emergency radiology practice during the day time and after hours, and the implications for other imaging and for coverage.

#### COURSE DESCRIPTION

The ER 'hot topics' session will include three relevant current topics in emergency radiology practice: staffing given the challenges of COVID and following the COVID pandemic, with changes in practice and remote coverage; peer learning and peer review, with evolution of how quality assurance is being performed in emergency radiology and in radiology in general; and the current use of point-of-care ultrasound and how it fits in with emergency radiology practice during the day time and after hours, and the implications for other imaging and for coverage.

#### Sub-Events

##### **M7-CER14 Moderator**

Participants  
Douglas Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

##### **M7-CER14 Peer Learning and Peer Review/Quality Assurance in Emergency Radiology**

Participants  
Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

##### **M7-CER14 Current Role of Point of Care Emergency Ultrasound in North America and Elsewhere**

Participants  
John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

##### **M7-CER14 Staffing of Emergency Radiology in the Era of COVID**

Participants  
Michael Patlas, MD, FRCPC, Hamilton, ON (*Presenter*) Royalties, Holtzbrinck Publishing Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CER14

**Moderator**

### Participants

Douglas Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CER14

**Peer Learning and Peer Review/Quality Assurance in Emergency Radiology**

### Participants

Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CER14

### Current Role of Point of Care Emergency Ultrasound in North America and Elsewhere

#### Participants

John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CER14

### Staffing of Emergency Radiology in the Era of COVID

#### Participants

Michael Patlas, MD, FRCPC, Hamilton, ON (*Presenter*) Royalties, Holtzbrinck Publishing Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

### Pancreatic Tumor Imaging

#### LEARNING OBJECTIVES

1) Describe the key updates in the imaging diagnosis of pancreatic cancer. 2) Explain the current role of imaging in assessment of therapeutic response in pancreatic cancer. 3) Discuss the importance of structured reporting in pancreatic cancer and implications for patient management. 4) Review the current and emerging applications of artificial intelligence in pancreatic cancer. 5) Explain recent advances in pancreatic neuroendocrine tumor imaging.\*Course Description This course will review the current state-of-the-art and recent advances in imaging of pancreatic cancer and pancreatic neuroendocrine tumors. The attendees will also learn the role of structured reporting and emerging applications of artificial intelligence in pancreatic cancer.

#### COURSE DESCRIPTION

This course will review the current state-of-the-art and recent advances in imaging of pancreatic cancer and pancreatic neuroendocrine tumors. The attendees will also learn the role of structured reporting and emerging applications of artificial intelligence in pancreatic cancer.

#### Sub-Events

##### **M7-CGI04 Moderator**

###### Participants

Avinash Kambadakone, MD, FRCR, Boston, MA (*Moderator*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

##### **M7-CGI04 Diagnosis and Staging of Pancreatic Cancer: State of the Art**

###### Participants

Avinash Kambadakone, MD, FRCR, Boston, MA (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

##### **M7-CGI04 Pearls and Pitfalls in Pancreatic Cancer Response Assessment**

###### Participants

Zhen J. Wang, MD, San Francisco, CA (*Presenter*) Stockholder, Nextrast, Inc

##### **M7-CGI04 Pancreatic Cancer: Structured Reporting**

###### Participants

Olga Brook, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

##### **M7-CGI04 Artificial Intelligence in the Fight Against Pancreatic Cancer**

###### Participants

Michael H. Rosenthal, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

##### **M7-CGI04 Pancreatic Neuroendocrine Neoplasms**

###### Participants

Motoyo Yano, MD, PhD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

**Moderator**

### **Participants**

Avinash Kambadakone, MD, FRCR, Boston, MA (*Moderator*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

### Diagnosis and Staging of Pancreatic Cancer: State of the Art

#### Participants

Avinash Kambadakone, MD, FRCR, Boston, MA (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

### Pearls and Pitfalls in Pancreatic Cancer Response Assessment

#### Participants

Zhen J. Wang, MD, San Francisco, CA (*Presenter*) Stockholder, Nextrast, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

### Pancreatic Cancer: Structured Reporting

#### Participants

Olga Brook, MD,MBA, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGI04

### Artificial Intelligence in the Fight Against Pancreatic Cancer

#### Participants

Michael H. Rosenthal, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CGI04

### Pancreatic Neuroendocrine Neoplasms

#### Participants

Motoyo Yano, MD, PhD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

### Cutting Edge GU-Specific Diagnostic Classification Systems

#### LEARNING OBJECTIVES

1) Integrate standardized reporting of GU body systems into clinical practice. 2) Appreciate the importance of newer GU classification systems including Bosniak v2019, O-RADS and VI-RADS.\*Course Description In this 5 speaker course, attendees will be given an introduction to the importance of standardized reporting and emerging GU classification systems including Bosniak version 2019, O-RADS and VI-RADS. Standardized reporting in general and the implications of artificial intelligence and machine learning on reporting in GU will be discussed.

#### COURSE DESCRIPTION

In this 5 speaker course, attendees will be given an introduction to the importance of standardized reporting and emerging GU classification systems including Bosniak version 2019, O-RADS and VI-RADS. Standardized reporting in general and the implications of artificial intelligence and machine learning on reporting in GU will be discussed.

#### Sub-Events

##### **M7-CGU01 Moderator**

Participants  
Nicola Schieda, MD, Ottawa, ON (*Moderator*) Nothing to Disclose

##### **M7-CGU01 Adding Value through Disease-Specific Structured Reporting**

Participants  
Atul Shinagare, MD, Boston, MA (*Presenter*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

##### **M7-CGU01 Bosniak Classification v.2019: Dose Emerging Evidence Support Clinical Use?**

Participants  
Nicola Schieda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

##### **M7-CGU01 Vesical Imaging Reporting and Data System (VI-RADS): Diagnostic Accuracy, Inter-observer Agreement, and Clinical Use**

Participants  
Valeria Panebianco, MD, Rome, Italy (*Presenter*) Nothing to Disclose

##### **M7-CGU01 O-RADS for MRI**

Participants  
Andrea Rockall, FRCR, MRCP, (*Presenter*) Nothing to Disclose

##### **M7-CGU01 How Will Machine Learning Influence our Diagnostic Classification Systems?**

Participants  
Caroline Reinhold, MD, MSc, Westmount, QC (*Presenter*) Research Grant, Imagia Cybernetics Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

**Moderator**

### Participants

Nicola Schieda, MD, Ottawa, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

### Adding Value through Disease-Specific Structured Reporting

#### Participants

Atul Shinagare, MD, Boston, MA (*Presenter*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

**Bosniak Classification v.2019: Dose Emerging Evidence Support Clinical Use?**

### Participants

Nicola Schieda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

**Vesical Imaging Reporting and Data System (VI-RADS): Diagnostic Accuracy, Inter-observer Agreement, and Clinical Use**

### Participants

Valeria Panebianco, MD, Rome, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

### O-RADS for MRI

#### Participants

Andrea Rockall, FRCR, MRCP, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CGU01

**How Will Machine Learning Influence our Diagnostic Classification Systems?**

### Participants

Caroline Reinhold, MD, MSc, Westmount, QC (*Presenter*) Research Grant, Imagia Cybernetics Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CHN02

### Pediatric Sensorineural Hearing Loss

#### Participants

Caroline Robson, MBChB, (*Presenter*) Author with royalties, Reed Elsevier

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CHN02

**Moderator**

### Participants

Salman Qureshi, MBChB, Doha, United Arab Emirates (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CHN02

### Practical Temporal Bone Anatomy

#### Participants

Bruno A. Policeni, MD, MBA, Iowa City, IA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To understand radiological anatomy of the temporal bone with a systematic approach. 2) To identify the clinical context of hearing loss management via surgical approaches. 3) To assess the radiological manifestations of hearing loss in paediatrics.\*Course Description Lecture format reviewing spectrum of temporal bone pathology from childhood to adulthood.

#### COURSE DESCRIPTION

Lecture format reviewing spectrum of temporal bone pathology from childhood to adulthood.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CHN02

### Surgical Approaches in the Temporal Bone

#### Participants

Amy Juliano, MD, MA, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CHN02

### Infection in the Temporal Bone

#### Participants

Kalen Riley, MD, MBA, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CHN02

### T-Bone Central: High-Yield Topics in Temporal Bone Imaging

#### Sub-Events

##### M7-CHN02 Moderator

###### Participants

Salman Qureshi, MBChB, Doha, United Arab Emirates (*Moderator*) Nothing to Disclose

##### M7-CHN02 Practical Temporal Bone Anatomy

###### Participants

Bruno A. Policeni, MD, MBA, Iowa City, IA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To understand radiological anatomy of the temporal bone with a systematic approach. 2) To identify the clinical context of hearing loss management via surgical approaches. 3) To assess the radiological manifestations of hearing loss in paediatrics.\*Course Description Lecture format reviewing spectrum of temporal bone pathology from childhood to adulthood.

#### COURSE DESCRIPTION

Lecture format reviewing spectrum of temporal bone pathology from childhood to adulthood.

##### M7-CHN02 Surgical Approaches in the Temporal Bone

###### Participants

Amy Juliano, MD, MA, Boston, MA (*Presenter*) Nothing to Disclose

##### M7-CHN02 Pediatric Sensorineural Hearing Loss

###### Participants

Caroline Robson, MBChB, (*Presenter*) Author with royalties, Reed Elsevier

##### M7-CHN02 Infection in the Temporal Bone

###### Participants

Kalen Riley, MD, MBA, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CIN15

**Moderator**

### Participants

Krishna Juluru, MD, Silver Spring, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CIN15

### How the FDA Considers AI

#### Participants

Krishna Juluru, MD, Silver Spring, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CIN15

**Best Practices for AI Model Regulation and Human-AI Collaboration (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc.)**

### Sub-Events

#### M7-CIN15 Moderator

Participants

Krishna Juluru, MD, Silver Spring, NY (*Moderator*) Nothing to Disclose

#### M7-CIN15 How the FDA Considers AI

Participants

Krishna Juluru, MD, Silver Spring, NY (*Presenter*) Nothing to Disclose

#### M7-CIN15 Human - AI Collaboration

Participants

Shandong Wu, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Describe the FDA clearance and approval process for AI models including the necessary steps, timelines, and costs. Attendees will gain an understanding of the regulatory landscape and learn how to access up-to-date information about FDA regulated AI models. 2) Examine regulatory compliance when implementing AI models in the healthcare setting. 3) Illustrate practical strategies for enhancing human-AI interaction.\*Course Description This course is part of the "Best Practices in AI" series, designed to assist practicing radiologists and administrators in comprehending and enhancing process related to AI regulation and human-AI interaction. The course is comprised of three lectures by industry experts followed by an open Q and A session. The discussion will focus on two key topics. The first two lectures will provide an overview of the FDA process, covering important aspects such as timelines, costs associated with FDA clearance/approval, how to access an up-to-date list of FDA regulated AI models, understanding clearance documents, and ensuring compliant with regulatory guidelines when implementing an AI model. The second topic and final lecture will explore strategies to optimize human-machine interaction. It will delve into methods for integrating AI capabilities with clinical intelligence (medical knowledge) to improve the accuracy of AI systems, enhance explainability of AI-generated results, and expedite the development of clinician trust in AI technology.

### COURSE DESCRIPTION

This course is part of the "Best Practices in AI" series, designed to assist practicing radiologists and administrators in comprehending and enhancing process related to AI regulation and human-AI interaction. The course is comprised of three lectures by industry experts followed by an open Q and A session. The discussion will focus on two key topics. The first two lectures will provide an overview of the FDA process, covering important aspects such as timelines, costs associated with FDA clearance/approval, how to access an up-to-date list of FDA regulated AI models, understanding clearance documents, and ensuring compliant with regulatory guidelines when implementing an AI model. The second topic and final lecture will explore strategies to optimize human-machine interaction. It will delve into methods for integrating AI capabilities with clinical intelligence (medical knowledge) to improve the accuracy of AI systems, enhance explainability of AI-generated results, and expedite the development of clinician trust in AI technology.

#### M7-CIN15 FDA AI Basics

Participants

Lisa Baumhardt, BSc, MS, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CIN15

### Human - AI Collaboration

#### Participants

Shandong Wu, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the FDA clearance and approval process for AI models including the necessary steps, timelines, and costs. Attendees will gain an understanding of the regulatory landscape and learn how to access up-to-date information about FDA regulated AI models. 2) Examine regulatory compliance when implementing AI models in the healthcare setting. 3) Illustrate practical strategies for enhancing human-AI interaction.\*Course Description This course is part of the "Best Practices in AI" series, designed to assist practicing radiologists and administrators in comprehending and enhancing process related to AI regulation and human-AI interaction. The course is comprised of three lectures by industry experts followed by an open Q and A session. The discussion will focus on two key topics. The first two lectures will provide an overview of the FDA process, covering important aspects such as timelines, costs associated with FDA clearance/approval, how to access an up-to-date list of FDA regulated AI models, understanding clearance documents, and ensuring compliant with regulatory guidelines when implementing an AI model. The second topic and final lecture will explore strategies to optimize human-machine interaction. It will delve into methods for integrating AI capabilities with clinical intelligence (medical knowledge) to improve the accuracy of AI systems, enhance explainability of AI-generated results, and expedite the development of clinician trust in AI technology.

#### COURSE DESCRIPTION

This course is part of the "Best Practices in AI" series, designed to assist practicing radiologists and administrators in comprehending and enhancing process related to AI regulation and human-AI interaction. The course is comprised of three lectures by industry experts followed by an open Q and A session. The discussion will focus on two key topics. The first two lectures will provide an overview of the FDA process, covering important aspects such as timelines, costs associated with FDA clearance/approval, how to access an up-to-date list of FDA regulated AI models, understanding clearance documents, and ensuring compliant with regulatory guidelines when implementing an AI model. The second topic and final lecture will explore strategies to optimize human-machine interaction. It will delve into methods for integrating AI capabilities with clinical intelligence (medical knowledge) to improve the accuracy of AI systems, enhance explainability of AI-generated results, and expedite the development of clinician trust in AI technology.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CIN15

**FDA AI Basics**

### Participants

Lisa Baumhardt, BSc, MS, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

### High Resolution Imaging of Common Pathology in the Wrist and Hand

#### Sub-Events

##### **M7-CMK03 Moderator**

###### Participants

Hillary Garner, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

##### **M7-CMK03 Radiographic and CT Evaluation of Metacarpal and Phalangeal Fractures and Dislocations**

###### Participants

Hillary Garner, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### **M7-CMK03 Radiographic, CT, and MR Evaluation of Carpal Fractures, Dislocations, and Instability**

###### Participants

Naveen Subhas, MD, MPH, Cleveland, OH (*Presenter*) Research support, Siemens AG

##### **M7-CMK03 MRI of Wrist and Thumb Ligamentous Injuries**

###### Participants

Christine Chung, MD, Solana Beach, CA (*Presenter*) Nothing to Disclose

##### **M7-CMK03 Imaging Evaluation of Common Nerve Pathology in the Wrist and Hand**

###### Participants

Zaid Jibri, MBChB, FRCR, Ottawa, ON (*Presenter*) Nothing to Disclose

##### **M7-CMK03 Ultrasound Evaluation of Tendon and Pulley Injuries in the Wrist and Hand**

###### Participants

Aline Serfaty Sr, MD, Cabo Frio, Brazil (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Demonstrate the imaging features of common pathologies of the wrist and hand. 2) Explain the advantages and limitations of radiographs, ultrasound, CT, and MRI in the evaluation of hand and wrist pathology.\*Course Description Common pathologies of the hand and wrist will be demonstrated in a case-based lecture format using radiographs and ultrasound as well as high-resolution CT and MRI. Tips and tricks on how to hone the differential diagnosis will be incorporated. At the end of the session, the audience will have a better understanding of optimal imaging techniques for various hand and wrist pathologies.

#### COURSE DESCRIPTION

Common pathologies of the hand and wrist will be demonstrated in a case-based lecture format using radiographs and ultrasound as well as high-resolution CT and MRI. Tips and tricks on how to hone the differential diagnosis will be incorporated. At the end of the session, the audience will have a better understanding of optimal imaging techniques for various hand and wrist pathologies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

### Radiographic and CT Evaluation of Metacarpal and Phalangeal Fractures and Dislocations

#### Participants

Hillary Garner, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

**Radiographic, CT, and MR Evaluation of Carpal Fractures, Dislocations, and Instability**

### Participants

Naveen Subhas, MD, MPH, Cleveland, OH (*Presenter*) Research support, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

### MRI of Wrist and Thumb Ligamentous Injuries

#### Participants

Christine Chung, MD, Solana Beach, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

### Imaging Evaluation of Common Nerve Pathology in the Wrist and Hand

#### Participants

Zaid Jibri, MBChB, FRCR, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CMK03

### Ultrasound Evaluation of Tendon and Pulley Injuries in the Wrist and Hand

#### Participants

Aline Serfaty Sr, MD, Cabo Frio, Brazil (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Demonstrate the imaging features of common pathologies of the wrist and hand. 2) Explain the advantages and limitations of radiographs, ultrasound, CT, and MRI in the evaluation of hand and wrist pathology.\*Course Description Common pathologies of the hand and wrist will be demonstrated in a case-based lecture format using radiographs and ultrasound as well as high-resolution CT and MRI. Tips and tricks on how to hone the differential diagnosis will be incorporated. At the end of the session, the audience will have a better understanding of optimal imaging techniques for various hand and wrist pathologies.

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Common pathologies of the hand and wrist will be demonstrated in a case-based lecture format using radiographs and ultrasound as well as high-resolution CT and MRI. Tips and tricks on how to hone the differential diagnosis will be incorporated. At the end of the session, the audience will have a better understanding of optimal imaging techniques for various hand and wrist pathologies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CMK03

**Moderator**

### Participants

Hillary Garner, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CNPM15

### Reimbursement Issues: Updates in 2023

#### LEARNING OBJECTIVES

1) Identify key changes to Medicare reimbursement, including both the physician fee schedule and the Quality Payment Program, that are relevant to radiology reimbursement. 2) Identify key issues with implementation of the No Surprises Act that are relevant to radiology reimbursement. 3) List actions that medical practices and physicians can take to help protect patients' access to high quality medical imaging.\*Course Description The session will provide updates on three important aspects of radiology reimbursement policy: the Medicare physician fee schedule, the Quality Payment Program (created by MACRA) and the No Surprises Act.

#### COURSE DESCRIPTION

The session will provide updates on three important aspects of radiology reimbursement policy: the Medicare physician fee schedule, the Quality Payment Program (created by MACRA) and the No Surprises Act.

#### Sub-Events

##### **M7-CNPM15 Moderator**

Participants

Richard Heller III, MD, Chicago, IL (*Moderator*) Consultant, Gerson Lehrman Group, Inc;

##### **M7-CNPM15 Medicare Fee Schedule Update**

Participants

Richard Heller III, MD, Chicago, IL (*Presenter*) Consultant, Gerson Lehrman Group, Inc;

##### **M7-CNPM15 Medicare: Quality Payment Program Updates**

Participants

Lauren Nicola, MD, Summerfield, NC (*Presenter*) Nothing to Disclose

##### **M7-CNPM15 No Surprises Act**

Participants

Ed Gaines III, JD, Greensboro, NC (*Presenter*) Officer, Zotec Partners LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CNPM15

### Medicare: Quality Payment Program Updates

#### Participants

Lauren Nicola, MD, Summerfield, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CNPM15

### No Surprises Act

#### Participants

Ed Gaines III, JD, Greensboro, NC (*Presenter*) Officer, Zotec Partners LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CNPM15

**Moderator**

### **Participants**

Richard Heller III, MD, Chicago, IL (*Moderator*) Consultant, Gerson Lehrman Group, Inc;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CNPM15

### Medicare Fee Schedule Update

#### Participants

Richard Heller III, MD, Chicago, IL (*Presenter*) Consultant, Gerson Lehrman Group, Inc;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPD02

### Protecting the Innocent: Recognizing Child Abuse on Imaging

#### Sub-Events

#### **M7-CPD02 The Pediatric Skeleton: Differentiating Metabolic Bone Disease and Child Abuse**

##### Participants

Jeannette M. Perez-Rossello, MD, Wellesley, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Differentiating metabolic bone disease and child abuse. 2) Develop an understanding of pathophysiology of neuroimaging findings in non-accidental trauma and recognize suspicious imaging findings. 3) Differentiating accidental and non-accidental abdominal injuries in children.\*Course Description This comprehensive series of lectures focuses on various aspects of child abuse recognition and diagnosis through imaging techniques. Participants will learn how to protect innocent children by recognizing signs of abuse on imaging, including skeletal injuries, head trauma, and abdominal injuries. The lectures cover differentiating between metabolic bone diseases and child abuse, identifying abusive head trauma and describing it accurately, as well as determining whether abdominal injuries in children are accidental or non-accidental. By acquiring these skills and knowledge, attendees will be better equipped to safeguard vulnerable children and provide appropriate care and intervention when necessary.

#### COURSE DESCRIPTION

This comprehensive series of lectures focuses on various aspects of child abuse recognition and diagnosis through imaging techniques. Participants will learn how to protect innocent children by recognizing signs of abuse on imaging, including skeletal injuries, head trauma, and abdominal injuries. The lectures cover differentiating between metabolic bone diseases and child abuse, identifying abusive head trauma and describing it accurately, as well as determining whether abdominal injuries in children are accidental or non-accidental. By acquiring these skills and knowledge, attendees will be better equipped to safeguard vulnerable children and provide appropriate care and intervention when necessary.

#### **M7-CPD02 Abusive Head Trauma: What to Look for and How to Describe It**

##### Participants

Murat Alp Oztek, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **M7-CPD02 Abdominal Injuries in Children: Accidental or not?**

##### Participants

Peter J. Strouse, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### **M7-CPD02 Moderator**

##### Participants

Yoshino Tamaki Sameshima, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CPD02

**Moderator**

### Participants

Yoshino Tamaki Sameshima, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPD02

### The Pediatric Skeleton: Differentiating Metabolic Bone Disease and Child Abuse

#### Participants

Jeannette M. Perez-Rossello, MD, Wellesley, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Differentiating metabolic bone disease and child abuse. 2) Develop an understanding of pathophysiology of neuroimaging findings in non-accidental trauma and recognize suspicious imaging findings. 3) Differentiating accidental and non-accidental abdominal injuries in children.\*Course Description This comprehensive series of lectures focuses on various aspects of child abuse recognition and diagnosis through imaging techniques. Participants will learn how to protect innocent children by recognizing signs of abuse on imaging, including skeletal injuries, head trauma, and abdominal injuries. The lectures cover differentiating between metabolic bone diseases and child abuse, identifying abusive head trauma and describing it accurately, as well as determining whether abdominal injuries in children are accidental or non-accidental. By acquiring these skills and knowledge, attendees will be better equipped to safeguard vulnerable children and provide appropriate care and intervention when necessary.

#### COURSE DESCRIPTION

This comprehensive series of lectures focuses on various aspects of child abuse recognition and diagnosis through imaging techniques. Participants will learn how to protect innocent children by recognizing signs of abuse on imaging, including skeletal injuries, head trauma, and abdominal injuries. The lectures cover differentiating between metabolic bone diseases and child abuse, identifying abusive head trauma and describing it accurately, as well as determining whether abdominal injuries in children are accidental or non-accidental. By acquiring these skills and knowledge, attendees will be better equipped to safeguard vulnerable children and provide appropriate care and intervention when necessary.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPD02

### Abusive Head Trauma: What to Look for and How to Describe It

#### Participants

Murat Alp Oztek, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPD02

### Abdominal Injuries in Children: Accidental or not?

#### Participants

Peter J. Strouse, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPH16

### Chicago Fireside Chat: Best of AAPM Summer School - MRgRT (MR-guided Radiation Therapy)

#### LEARNING OBJECTIVES

1) Overview the state of the art in MRgRT. 2) Understand the basic clinical implementation of MRgRT. 3) Understand the promise and challenges of MRgRT.\*Course Description With the introduction of MRgRT systems, Magnetic Resonance Imaging-Guided Radiation Therapy has expanded into community practice settings. Using an interactive Q and A session with participants, this session aims to educate new and seasoned users on the practical implementation of MRgRT and the workflows related to online adapted therapy as discussed at the AAPM Summer School. (<https://w4.aapm.org/meetings/2021SS/programInfo/postMeetingAccess.php>).

#### COURSE DESCRIPTION

With the introduction of MRgRT systems, Magnetic Resonance Imaging-Guided Radiation Therapy has expanded into community practice settings. Using an interactive Q and A session with participants, this session aims to educate new and seasoned users on the practical implementation of MRgRT and the workflows related to online adapted therapy as discussed at the AAPM Summer School. (<https://w4.aapm.org/meetings/2021SS/programInfo/postMeetingAccess.php>).

#### Sub-Events

##### M7-CPH16 Moderator

Participants  
Vrinda Narayana, PhD, Southfield, MI (*Moderator*) Nothing to Disclose

##### M7-CPH16 Panel Participants

Participants  
Daniel A. Low, PhD, Los Angeles, CA (*Presenter*) Scientific Advisory Board, ViewRay, Inc

##### M7-CPH16 Panel Participants

Participants  
R. Jason Stafford, PhD, Houston, TX (*Presenter*) Nothing to Disclose

##### M7-CPH16 Panel Participants

Participants  
Eenas Omari, PHD, Milwaukee, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPH16

### Panel Participants

#### Participants

R. Jason Stafford, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPH16

### Panel Participants

#### Participants

Daniel A. Low, PhD, Los Angeles, CA (*Presenter*) Scientific Advisory Board, ViewRay, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CPH16

**Moderator**

### Participants

Vrinda Narayana, PhD, Southfield, MI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CPH16

### Panel Participants

#### Participants

Eenas Omari, PHD, Milwaukee, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

### GYN Case Based Multidisciplinary Review

#### LEARNING OBJECTIVES

1) Expose the attendees to a multidisciplinary discussion related to diagnosis and treatment of Gynecologic malignancies. 2) Demonstrate important imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that can directly affect prognosis and management.\*Course Description This is a case-based multidisciplinary review, for Radiologists and Radiation Oncologists, on the diagnosis and management of Gynecologic Malignancy.

#### COURSE DESCRIPTION

This is a case-based multidisciplinary review, for Radiologists and Radiation Oncologists, on the diagnosis and management of Gynecologic Malignancy.

#### Sub-Events

##### M7-CR007 Moderator

#### Participants

Aoife Kilcoyne, MBBCh, Boston, MA (*Moderator*) Royalties, Wolters Kluwer nv;Author, Wolters Kluwer nv

##### M7-CR007 GYN Case Based Multidisciplinary Review

#### Participants

Madeleine Sertic, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose

##### M7-CR007 GYN Case Based Multidisciplinary Review

#### Participants

Stephanie Markovina, MD, PhD, Saint Louis, MO (*Presenter*) Research Grant, GlaxoSmithKline plc

##### M7-CR007 GYN Case Based Multidisciplinary Review

#### Participants

Lilie Lin, MD, Houston, TX (*Presenter*) Investigator, AstraZeneca PLC;Research Grant, Pfizer Inc

##### M7-CR007 GYN Case Based Multidisciplinary Review

#### Participants

Premal Thaker, MD, Saint Louis, MO (*Presenter*) Advisory Board, Mersana Therapeutics, Inc;Advisory Board, ImmunoGen, Inc;Advisory Board, NovoCure Ltd;Advisory Board, Merck & Co, Inc;Advisory Board, AstraZeneca PLC;Advisory Board, GSK plc;Advisory Board, Clovis Oncology, Inc;Advisory Board, Zentalis Pharmaceuticals, Inc;Advisory Board, Eisai Co, Ltd;Advisory Board, Novartis AG;Data Safety Monitoring Board, Celsion Corporation;Data Safety Monitoring Board, Iovance Biotherapeutics, Inc;Research Grant, Merck & Co, Inc;Research Grant, GSK plc;Stockholder, Celsion Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

### GYN Case Based Multidisciplinary Review

#### Participants

Premal Thaker, MD, Saint Louis, MO (*Presenter*) Advisory Board, Mersana Therapeutics, Inc;Advisory Board, ImmunoGen, Inc;Advisory Board, NovoCure Ltd;Advisory Board, Merck & Co, Inc;Advisory Board, AstraZeneca PLC;Advisory Board, GSK plc;Advisory Board, Clovis Oncology, Inc;Advisory Board, Zentalis Pharmaceuticals, Inc;Advisory Board, Eisai Co, Ltd;Advisory Board, Novartis AG;Data Safety Monitoring Board, Celsion Corporation;Data Safety Monitoring Board, Iovance Biotherapeutics, Inc;Research Grant, Merck & Co, Inc;Research Grant, GSK plc;Stockholder, Celsion Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

### GYN Case Based Multidisciplinary Review

#### Participants

Lilie Lin, MD, Houston, TX (*Presenter*) Investigator, AstraZeneca PLC; Research Grant, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

**Moderator**

### **Participants**

Aoife Kilcoyne, MBBCh, Boston, MA (*Moderator*) Royalties, Wolters Kluwer nv; Author, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

### GYN Case Based Multidisciplinary Review

#### Participants

Madeleine Sertic, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CR007

### GYN Case Based Multidisciplinary Review

#### Participants

Stephanie Markovina, MD,PhD, Saint Louis, MO (*Presenter*) Research Grant, GlaxoSmithKline plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

**Moderator**

### Participants

Felipe Sanchez, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M7-CVA07

### Vasculitis and Inflammatory Aortic Disease

#### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review essential pathological and clinical features of non-atherosclerotic vascular arterial diseases. 2) Illustrate multimodality imaging findings of different non-atherosclerotic arterial disorders and congenital vascular anomalies. 3) Explain the role of non-invasive imaging in non-atherosclerotic arterial diseases.\*Course Description Besides atherosclerosis, arterial vessels may be affected by several pathological entities. This session is focused on non-atherosclerotic arterial vascular diseases, including inflammatory, non-inflammatory, congenital, and heritable disorders. Format: Lectures

#### COURSE DESCRIPTION

Besides atherosclerosis, arterial vessels may be affected by several pathological entities. This session is focused on non-atherosclerotic arterial vascular diseases, including inflammatory, non-inflammatory, congenital, and heritable disorders. Format: Lectures

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

### Congenital Vascular Anomalies and Malformations

#### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

### Imaging in Heritable Thoracic Aortic Disease

#### Participants

Gauri Karur, MBBS, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

**Moderator**

### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Moderator*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

### Fibromuscular Dysplasia and Related Non-Inflammatory Disorders

#### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M7-CVA07

### Non-Atherosclerotic Arterial Vascular Disease

#### Sub-Events

##### M7-CVA07 Moderator

###### Participants

Felipe Sanchez, MD, (*Moderator*) Nothing to Disclose

##### M7-CVA07 Vasculitis and Inflammatory Aortic Disease

###### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review essential pathological and clinical features of non-atherosclerotic vascular arterial diseases. 2) Illustrate multimodality imaging findings of different non-atherosclerotic arterial disorders and congenital vascular anomalies. 3) Explain the role of non-invasive imaging in non-atherosclerotic arterial diseases.\*Course Description Besides atherosclerosis, arterial vessels may be affected by several pathological entities. This session is focused on non-atherosclerotic arterial vascular diseases, including inflammatory, non-inflammatory, congenital, and heritable disorders. Format: Lectures

#### COURSE DESCRIPTION

Besides atherosclerosis, arterial vessels may be affected by several pathological entities. This session is focused on non-atherosclerotic arterial vascular diseases, including inflammatory, non-inflammatory, congenital, and heritable disorders. Format: Lectures

##### M7-CVA07 Congenital Vascular Anomalies and Malformations

###### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

##### M7-CVA07 Imaging in Heritable Thoracic Aortic Disease

###### Participants

Gauri Karur, MBBS, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### M7-CVA07 Moderator

###### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Moderator*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

##### M7-CVA07 Fibromuscular Dysplasia and Related Non-Inflammatory Disorders

###### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CAS05

### Basics of Establishing a Radioligand Therapy Program

#### Participants

Lyndsi Hay, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify the use of theranostic agents in cancer diagnosis, staging and treatment. 2) Explain operational and logistical needs to build your own Theranostics Program. 3) Gain a comprehensive understanding of theranostics and radiotherapeutics to contribute to the development and implementation of Radioligand Therapy Program.\*Course Description This program is designed to provide an in-depth understanding of the principles, techniques and applications of Theranostics and Radiotherapeutics in medicine. This interdisciplinary course explores the triaging, ancillary medications needed, billing and design of Radioligand Program.

#### COURSE DESCRIPTION

This program is designed to provide an in-depth understanding of the principles, techniques and applications of Theranostics and Radiotherapeutics in medicine. This interdisciplinary course explores the triaging, ancillary medications needed, billing and design of Radioligand Program.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CAS05

**Moderator**

### Participants

Nancy McDonald, MS, Dallas, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-CAS05

**Moderator**

### Participants

Napapong Pongnapang, BSc, PhD, Salaya, Thailand (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CAS05

### Diving Deeper from Diagnostics - Theranostics & Radiotherapeutics (Sponsored by the RSNA Associated Sciences Consortium)

#### Sub-Events

##### M8-CAS05 Moderator

Participants

Nancy McDonald, MS, Dallas, TX (*Moderator*) Nothing to Disclose

##### M8-CAS05 Moderator

Participants

Napapong Pongnapang, BSc, PhD, Salaya, Thailand (*Moderator*) Nothing to Disclose

##### M8-CAS05 Basics of Establishing a Radioligand Therapy Program

Participants

Lyndsi Hay, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify the use of theranostic agents in cancer diagnosis, staging and treatment. 2) Explain operational and logistical needs to build your own Theranostics Program. 3) Gain a comprehensive understanding of theranostics and radiotherapeutics to contribute to the development and implementation of Radioligand Therapy Program.\*Course Description This program is designed to provide an in-depth understanding of the principles, techniques and applications of Theranostics and Radiotherapeutics in medicine. This interdisciplinary course explores the triaging, ancillary medications needed, billing and design of Radioligand Program.

#### COURSE DESCRIPTION

This program is designed to provide an in-depth understanding of the principles, techniques and applications of Theranostics and Radiotherapeutics in medicine. This interdisciplinary course explores the triaging, ancillary medications needed, billing and design of Radioligand Program.

##### M8-CAS05 Evolution of Radiotherapeutics

Participants

Dena Abdelhameed, PharmD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CAS05

### Evolution of Radiotherapeutics

#### Participants

Dena Abdelhameed, PharmD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CIN16

**Moderator**

### Participants

Judy Gichoya, MBChB,MS, Atlanta, GA (*Moderator*) Consultant, Softbrew Digital LTD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CIN16

### How to Evaluate an AI Model (Accuracy, Reliability, ROI)

#### Participants

Ryan K. Lee, MD, MBA, Philadelphia, PA (*Presenter*) Bayer, Speaker's BureauPhilips, Speaker's BureauBracco, Advisor

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CIN16

### How to Evaluate AI use Cases and Vendors

#### Participants

K. Elizabeth Hawk, MD, PhD, Studio City, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-CIN16

### AI Vendor and Market Landscape Overview

#### Participants

Lyndsey Burton, MD, Shoreline, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CIN16

### Best Practices for AI Model Selection

#### LEARNING OBJECTIVES

1) Learn how to evaluate an AI model effectively in practice (accuracy, ROI, scalability). 2) Learn how to prioritize use cases of AI that work the best for your practice. 3) Learn about the AI Vendor Market Landscape.\*Course Description Join a panel discussion of experts to learn about strategies for AI model selection, pilot evaluation, and the overall market landscape.

#### COURSE DESCRIPTION

Join a panel discussion of experts to learn about strategies for AI model selection, pilot evaluation, and the overall market landscape.

#### Sub-Events

##### **M8-CIN16 How to Evaluate AI use Cases and Vendors**

Participants

K. Elizabeth Hawk, MD, PhD, Studio City, CA (*Presenter*) Nothing to Disclose

##### **M8-CIN16 AI Vendor and Market Landscape Overview**

Participants

Lyndsey Burton, MD, Shoreline, WA (*Presenter*) Nothing to Disclose

##### **M8-CIN16 How to Evaluate an AI Model (Accuracy, Reliability, ROI)**

Participants

Ryan K. Lee, MD, MBA, Philadelphia, PA (*Presenter*) Bayer, Speaker's BureauPhilips, Speaker's BureauBracco, Advisor

##### **M8-CIN16 Moderator**

Participants

Judy Gichoya, MBChB,MS, Atlanta, GA (*Moderator*) Consultant, Softbrew Digital LTD

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-CNMMI04

### Chest Imaging: When Molecular Imaging Helps

#### LEARNING OBJECTIVES

1) A case-based review discussing the emerging of Molecular Imaging techniques, which can improve detection of ischemic heart disease, infiltrative cardiomyopathies, and inflammatory cardiomyopathies, with a focus on sarcoidosis. 2) Provide a discussion of new Molecular Imaging techniques that are available for routine clinical diagnosis of pathologies related to coronary artery disease and infiltrative/inflammatory cardiomyopathies. Further, the rationale of the examinations will be provided by explaining the medical and imaging sciences that necessitate when and how to perform these examinations. 3) The case-based approach will discuss the key imaging findings that can be used to improve diagnosis of cardiothoracic diseases. Given the novelty of these exams, a review of important incidental findings and imaging pitfalls will also be provided to improve examination implementation and interpretation.\*Course Description Imaging of the heart and lungs has increasingly become a multi-modality approach. With numerous recent advances in Molecular Imaging, physicians increasingly need an approach as to when hybrid or targeted Molecular Imaging examinations can confirm pathophysiologic processes affecting the Cardiothoracic system.

#### COURSE DESCRIPTION

Imaging of the heart and lungs has increasingly become a multi-modality approach. With numerous recent advances in Molecular Imaging, physicians increasingly need an approach as to when hybrid or targeted Molecular Imaging examinations can confirm pathophysiologic processes affecting the Cardiothoracic system.

#### Sub-Events

##### **M8-CNMMI04 Moderator**

Participants

Ryan Avery, MD, Chicago, IL (*Moderator*) Research Consultant, Konica Minolta, Inc

##### **M8-CNMMI04 Multimodality Perspective of Cardiac Sarcoidosis - Hybridizing FDG-PET and Cardiac MR Imaging**

Participants

Ryan Avery, MD, Chicago, IL (*Presenter*) Research Consultant, Konica Minolta, Inc

##### **M8-CNMMI04 Complementary Roles of PET, MRI, and CT in Cardiac Ischemia, Small Vessel Disease, and COVID**

Participants

Pamela Woodard, MD, Saint Louis, MO (*Presenter*) Researcher, Siemens AG;Consulting, Medtronic plc;Researcher, Bayer AG;Patent, Washington University

##### **M8-CNMMI04 Multimodality Imaging of Infiltrative and Inflammatory Cardiomyopathy**

Participants

Robert K. Zeman, MD, Potomac, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNMMI04

**Moderator**

### Participants

Ryan Avery, MD, Chicago, IL (*Moderator*) Research Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNMMI04

### Multimodality Perspective of Cardiac Sarcoidosis - Hybridizing FDG-PET and Cardiac MR Imaging

#### Participants

Ryan Avery, MD, Chicago, IL (*Presenter*) Research Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNMMI04

### Complementary Roles of PET, MRI, and CT in Cardiac Ischemia, Small Vessel Disease, and COVID

#### Participants

Pamela Woodard, MD, Saint Louis, MO (*Presenter*) Researcher, Siemens AG; Consulting, Medtronic plc; Researcher, Bayer AG; Patent, Washington University

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNMMI04

### Multimodality Imaging of Infiltrative and Inflammatory Cardiomyopathy

#### Participants

Robert K. Zeman, MD, Potomac, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNPM06

### Spotlight on Safety Net Hospitals, Health Disparities, and Unique Barriers to Rural Care (Sponsored by the RSNA Health Equity Committee and the RSNA Committee on Diversity, Equity & Inclusion)

#### Sub-Events

##### M8-CNPM06 Moderator

###### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Moderator*) Nothing to Disclose

##### M8-CNPM06 History of Safety Net Hospitals in the US: Are They Still Needed?

###### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain the history of safety net hospitals in the United States and the role of these hospitals in current day healthcare. 2) Identify unique barriers to radiologic care for rural populations. 3) Discuss developing breast and lung cancer screening programs for underserved populations.\*Course Description This course will spotlight safety net hospitals, health disparities, challenges to providing care for underserved and rural populations, and strategies to overcome these challenges. Many physicians and other members of the health care team are unaware of the history and purpose of the safety net hospital system in the United States. The safety net hospital system addresses unique barriers to care that marginalized and diverse populations endure, including rural populations. Many health care team members have limited understanding of how safety net hospitals meet these challenges. This course will provide an opportunity to gain an understanding of unique barriers to care for marginalized populations, immigrant, rural, urban, and gender diverse groups so that we might improve and become more helpful during our physician-patient interactions.

#### COURSE DESCRIPTION

This course will spotlight safety net hospitals, health disparities, challenges to providing care for underserved and rural populations, and strategies to overcome these challenges. Many physicians and other members of the health care team are unaware of the history and purpose of the safety net hospital system in the United States. The safety net hospital system addresses unique barriers to care that marginalized and diverse populations endure, including rural populations. Many health care team members have limited understanding of how safety net hospitals meet these challenges. This course will provide an opportunity to gain an understanding of unique barriers to care for marginalized populations, immigrant, rural, urban, and gender diverse groups so that we might improve and become more helpful during our physician-patient interactions.

##### M8-CNPM06 Developing Programs for Breast Cancer Screening for Underserved Populations

###### Participants

Ronda Henry-Tillman, MD, Little Rock, AR (*Presenter*) Nothing to Disclose

##### M8-CNPM06 Moderator

###### Participants

Gwendolyn M. Bryant-Smith, MD, (*Moderator*) Nothing to Disclose

##### M8-CNPM06 Unique Barriers to Rural Populations Concerning Breast Health

###### Participants

Daniela Ochoa, MD, Little Rock, AR (*Presenter*) Nothing to Disclose

##### M8-CNPM06 Partnering with Rural Community Hospitals to Establish a Satellite Lung Cancer Screening Network

###### Participants

Michael Hanley, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

Cecelia Brewington, MD, Plano, TX (*Presenter*) Research Grant, Canon Medical Systems Corporation

## Abstract Archives of the RSNA, 2023

M8-CNPM06

### Partnering with Rural Community Hospitals to Establish a Satellite Lung Cancer Screening Network

#### Participants

Michael Hanley, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

Cecelia Brewington, MD, Plano, TX (*Presenter*) Research Grant, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNPM06

### Unique Barriers to Rural Populations Concerning Breast Health

#### Participants

Daniela Ochoa, MD, Little Rock, AR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-CNPM06

**Moderator**

### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNPM06

### History of Safety Net Hospitals in the US: Are They Still Needed?

#### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain the history of safety net hospitals in the United States and the role of these hospitals in current day healthcare. 2) Identify unique barriers to radiologic care for rural populations. 3) Discuss developing breast and lung cancer screening programs for underserved populations.\*Course Description This course will spotlight safety net hospitals, health disparities, challenges to providing care for underserved and rural populations, and strategies to overcome these challenges. Many physicians and other members of the health care team are unaware of the history and purpose of the safety net hospital system in the United States. The safety net hospital system addresses unique barriers to care that marginalized and diverse populations endure, including rural populations. Many health care team members have limited understanding of how safety net hospitals meet these challenges. This course will provide an opportunity to gain an understanding of unique barriers to care for marginalized populations, immigrant, rural, urban, and gender diverse groups so that we might improve and become more helpful during our physician-patient interactions.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNPM06

### Developing Programs for Breast Cancer Screening for Underserved Populations

#### Participants

Ronda Henry-Tillman, MD, Little Rock, AR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CNPM06

**Moderator**

### Participants

Gwendolyn M. Bryant-Smith, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CPH04

**Moderator**

### Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CPH04

### Magnetic Resonance Spectroscopy: Fundamental Physics and Emerging Technologies

#### Participants

Samuel Einstein, PhD, Hershey, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CPH04

### Standardization of Data Acquisition and Analysis of Clinical Magnetic Resonance Spectroscopy

#### Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-CPH04

**MRS Applications, Reporting Standards and Future Perspectives in Clinical Reality**

### Participants

Ichiro Ikuta, MD,MMedSc, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-CPH04

### Clinical Implementation and Standardization of Proton Magnetic Resonance Spectroscopy

#### LEARNING OBJECTIVES

1) Review the physical principles of magnetic resonance spectroscopy (MRS) and MRS pulse sequences. 2) Describe strategies to effectively acquire, analyze, and quantify the quality of MRS data. 3) Discuss emerging applications of MRS in clinical practice. 4) Provide MRS reporting standards and discuss future perspectives in clinical reality.\*Course Description Magnetic resonance spectroscopy (MRS) permits the quantification of metabolites within a diverse range of tissues and pathologies. This metabolic information has been shown to enable better diagnoses, personalized treatments, and rapid assessment of treatment response. However, implementation of MRS remains challenging and consistent acquisition of high-quality data remains difficult due to the lack of technical standardization. This session will provide experts' advice, consensus recommendations, standardization of MRS acquisition, analysis and reporting to improve MRS quality in routine clinical practice. First, this educational course will introduce the physical principles of MRS and describe the latest clinically available MRS pulse sequences. Next, this course will present strategies to effectively and consistently acquire high-quality MRS data, robustly analyze this data, and perform MRS quality management in routine clinical practice. Finally, this session will discuss established and emerging applications of MRS, reporting standards and future perspectives in clinical reality.

#### COURSE DESCRIPTION

Magnetic resonance spectroscopy (MRS) permits the quantification of metabolites within a diverse range of tissues and pathologies. This metabolic information has been shown to enable better diagnoses, personalized treatments, and rapid assessment of treatment response. However, implementation of MRS remains challenging and consistent acquisition of high-quality data remains difficult due to the lack of technical standardization. This session will provide experts' advice, consensus recommendations, standardization of MRS acquisition, analysis and reporting to improve MRS quality in routine clinical practice. First, this educational course will introduce the physical principles of MRS and describe the latest clinically available MRS pulse sequences. Next, this course will present strategies to effectively and consistently acquire high-quality MRS data, robustly analyze this data, and perform MRS quality management in routine clinical practice. Finally, this session will discuss established and emerging applications of MRS, reporting standards and future perspectives in clinical reality.

#### Sub-Events

##### M8-CPH04 Moderator

Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Moderator*) Nothing to Disclose

##### M8-CPH04 Magnetic Resonance Spectroscopy: Fundamental Physics and Emerging Technologies

Participants

Samuel Einstein, PhD, Hershey, PA (*Presenter*) Nothing to Disclose

##### M8-CPH04 Standardization of Data Acquisition and Analysis of Clinical Magnetic Resonance Spectroscopy

Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### M8-CPH04 MRS Applications, Reporting Standards and Future Perspectives in Clinical Reality

Participants

Ichiro Ikuta, MD,MMedSc, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP09

### The Academy for Radiology & Biomedical Imaging Research's 2023 Imaging Shark Bait Session

#### LEARNING OBJECTIVES

1) Identifying strategies for bringing research to the competitive marketplace. 2) Presenting a proposal in a way that elicits interest from potential investors. 3) Taking steps to secure investor funding while developing and protecting their intellectual property. 4) Identifying ways to generate business value through licensing and collaborations.\*Course Description An educational session, where three nominated "Pitch Teams" are chosen through a competitive process in advance of the final live session held during the RSNA annual meeting. The chosen Pitch Teams, generally comprised of early-mid career investigators, then have a timed period during which the pitch their ideas to a panel consisting of representatives from industry, academia and venture capital, who in turn offer advice and critique on each specific pitch. This ninety-minute session offers an interactive educational opportunity for investigators to test their skills at pitching new technologies and product development ideas to an expert panel of sharks. A winner is chosen, during the live session, through a rubric scoring system developed by our expert panel with the top pitch team walking away with a \$1000.00 cash prize and are invited to pitch the Academy's partners in industry during the annual CIBR Steering Committee meeting during the RSNA. 2023 will mark the 8th session we've held at RSNA - this is a widely attended event that becomes more and more popular each year, with a higher level of engagement year to year.

#### COURSE DESCRIPTION

An educational session, where three nominated "Pitch Teams" are chosen through a competitive process in advance of the final live session held during the RSNA annual meeting. The chosen Pitch Teams, generally comprised of early-mid career investigators, then have a timed period during which the pitch their ideas to a panel consisting of representatives from industry, academia and venture capital, who in turn offer advice and critique on each specific pitch. This ninety-minute session offers an interactive educational opportunity for investigators to test their skills at pitching new technologies and product development ideas to an expert panel of sharks. A winner is chosen, during the live session, through a rubric scoring system developed by our expert panel with the top pitch team walking away with a \$1000.00 cash prize and are invited to pitch the Academy's partners in industry during the annual CIBR Steering Committee meeting during the RSNA. 2023 will mark the 8th session we've held at RSNA - this is a widely attended event that becomes more and more popular each year, with a higher level of engagement year to year.

#### Sub-Events

##### M8-RCP09 Moderator

###### Participants

Scott Penner, JD, San Diego, CA (*Moderator*) Spouse, Research Grant, General Electric Company;Spouse, Consultant, Human Longevity, Inc;Spouse, Stockholder, CureMetrix, Inc;Spouse, Stock options, Cortechs.ai

##### M8-RCP09 Expert Shark - Intellectual Property Law

###### Participants

Scott Penner, JD, San Diego, CA (*Presenter*) Spouse, Research Grant, General Electric Company;Spouse, Consultant, Human Longevity, Inc;Spouse, Stockholder, CureMetrix, Inc;Spouse, Stock options, Cortechs.ai

##### M8-RCP09 Expert Shark - Academia

###### Participants

Miriam A. Bredella, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

##### M8-RCP09 Expert Shark - Industry

###### Participants

Susan Harris, MS, BS, Wauwatosa, WI (*Presenter*) Employee, General Electric Company

##### M8-RCP09 Expert Shark - Venture Capital

###### Participants

Emir Sandhu, MD, Stanford, CA (*Presenter*) Nothing to Disclose

##### M8-RCP09 Expert Shark - Entrepreneur

###### Participants

Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

##### M8-RCP09 Expert Shark - Venture Capital

###### Participants

Kelsey Tsai, MBA, Chicago, IL (*Presenter*) Employee, Blue Venture Fund



## Abstract Archives of the RSNA, 2023

M8-RCP09

### Moderator

#### Participants

Scott Penner, JD, San Diego, CA (*Moderator*) Spouse, Research Grant, General Electric Company; Spouse, Consultant, Human Longevity, Inc; Spouse, Stockholder, CureMetrix, Inc; Spouse, Stock options, Cortechs.ai

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP09

### Expert Shark - Intellectual Property Law

#### Participants

Scott Penner, JD, San Diego, CA (*Presenter*) Spouse, Research Grant, General Electric Company; Spouse, Consultant, Human Longevity, Inc; Spouse, Stockholder, CureMetrix, Inc; Spouse, Stock options, Cortechs.ai

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP09

**Expert Shark - Academia**

### Participants

Miriam A. Bredella, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-RCP09

**Expert Shark - Industry**

### **Participants**

Susan Harris, MS, BS, Wauwatosa, WI (*Presenter*) Employee, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP09

### Expert Shark - Venture Capital

#### Participants

Emir Sandhu, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-RCP09

### Expert Shark - Entrepreneur

#### Participants

Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-RCP09

### Expert Shark - Venture Capital

#### Participants

Kelsey Tsai, MBA, Chicago, IL (*Presenter*) Employee, Blue Venture Fund

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

**Moderator**

### Participants

Bettina Siewert, MD, Brookline, MA (*Moderator*) Editor, Wolters Kluwer nv; Reviewer, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

### Moral Distress and Its Impact on Burn-out

#### Participants

Rama Ayyala, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the impact of moral distress on radiologists' well-being and staff retention. 2) Identify the most common contributors to moral distress in radiologists. 3) Identify countermeasures to moral distress in radiology practice.\*Course Description 18% of radiologists have left a position because of moral distress and 28% have considered doing. This course will explore the impact of moral distress on radiologists' well-being and explore its connection to burn-out. Common causes of moral distress will be discussed as well as countermeasures mitigating its impact. The course consists of five 10-minutes lectures with time for discussion. Participants will be provided with practical action items for implementation in their work environment to decrease moral distress.

#### COURSE DESCRIPTION

18% of radiologists have left a position because of moral distress and 28% have considered doing. This course will explore the impact of moral distress on radiologists' well-being and explore its connection to burn-out. Common causes of moral distress will be discussed as well as countermeasures mitigating its impact. The course consists of five 10-minutes lectures with time for discussion. Participants will be provided with practical action items for implementation in their work environment to decrease moral distress.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

### Common Contributors to Moral Distress in Radiology

#### Participants

Bettina Siewert, MD, Brookline, MA (*Presenter*) Editor, Wolters Kluwer nv; Reviewer, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

### Managing the Workload-radiologist Mismatch

#### Participants

Michael A. Bruno, MD, MS, Hummelstown, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

### Maintaining the Teaching Mission to Reduce Moral Distress in Academic Radiology

#### Participants

Marion Hughes, MD, JD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-RCP22

### Importance of Leadership in Countering Moral Distress

#### Participants

Frank J. Lexa, MD, MBA, Wynnewood, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-RCP22

### Solving the Retention Problem: Addressing Moral Injury in Radiology Practice (Sponsored by the RSNA Quality Improvement Committee)

#### Sub-Events

##### M8-RCP22 Moderator

#### Participants

Bettina Siewert, MD, Brookline, MA (*Moderator*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

##### M8-RCP22 Moral Distress and Its Impact on Burn-out

#### Participants

Rama Ayyala, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the impact of moral distress on radiologists' well-being and staff retention. 2) Identify the most common contributors to moral distress in radiologists. 3) Identify countermeasures to moral distress in radiology practice.\*Course Description 18% of radiologists have left a position because of moral distress and 28% have considered doing. This course will explore the impact of moral distress on radiologists' well-being and explore its connection to burn-out. Common causes of moral distress will be discussed as well as countermeasures mitigating its impact. The course consists of five 10-minutes lectures with time for discussion. Participants will be provided with practical action items for implementation in their work environment to decrease moral distress.

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##### M8-RCP22 Common Contributors to Moral Distress in Radiology

#### Participants

Bettina Siewert, MD, Brookline, MA (*Presenter*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

##### M8-RCP22 Managing the Workload-radiologist Mismatch

#### Participants

Michael A. Bruno, MD, MS, Hummelstown, PA (*Presenter*) Nothing to Disclose

##### M8-RCP22 Maintaining the Teaching Mission to Reduce Moral Distress in Academic Radiology

#### Participants

Marion Hughes, MD, JD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

##### M8-RCP22 Importance of Leadership in Countering Moral Distress

#### Participants

Frank J. Lexa, MD, MBA, Wynnewood, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CER16

**Moderator**

### Participants

Peter M. Doubilet, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CER16

### Trauma and the ER Pregnant Patient

#### Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Diagnose normal and abnormal intrauterine and ectopic pregnancy. 2) Diagnose or exclude placental abruption based on sonographic findings. 3) Understand how best to use imaging modalities in pregnant women who present to the emergency room following trauma.\*Course Description This course will cover the use of diagnostic imaging in evaluating pregnant woman who present to the emergency room. One focus will be on women who present following trauma, where the course will address the appropriate use of imaging modalities, including ultrasound and computed tomography, and approaches to diagnosis (including the FAST ultrasound exam). A second focus will be on women who present with emergency symptoms, most commonly pain or vaginal bleeding, in the first trimester, where the course will address diagnosis of ectopic pregnancy, miscarriage of intrauterine pregnancy, and ovarian torsion. The third focus will be on women who present with emergency symptoms in the second and third trimesters, where the course will address diagnosis of placenta previa or abruption, cervical shortening, and assessment of fetal well-being.

#### COURSE DESCRIPTION

This course will cover the use of diagnostic imaging in evaluating pregnant woman who present to the emergency room. One focus will be on women who present following trauma, where the course will address the appropriate use of imaging modalities, including ultrasound and computed tomography, and approaches to diagnosis (including the FAST ultrasound exam). A second focus will be on women who present with emergency symptoms, most commonly pain or vaginal bleeding, in the first trimester, where the course will address diagnosis of ectopic pregnancy, miscarriage of intrauterine pregnancy, and ovarian torsion. The third focus will be on women who present with emergency symptoms in the second and third trimesters, where the course will address diagnosis of placenta previa or abruption, cervical shortening, and assessment of fetal well-being.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CER16

### First Trimester in the Emergency Room

#### Participants

Peter M. Doubilet, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CER16

### Second and Third Trimester in the Emergency Room

#### Participants

Carol Benson, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CER16

### Pregnancy in the Emergency Room, Collaborative Session OB/GYN and Multisystem

#### Sub-Events

#### R1-CER16 Moderator

##### Participants

Peter M. Doubilet, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose

#### R1-CER16 Trauma and the ER Pregnant Patient

##### Participants

Kedar Sharbidre, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Diagnose normal and abnormal intrauterine and ectopic pregnancy. 2) Diagnose or exclude placental abruption based on sonographic findings. 3) Understand how best to use imaging modalities in pregnant women who present to the emergency room following trauma.\*Course Description This course will cover the use of diagnostic imaging in evaluating pregnant woman who present to the emergency room. One focus will be on women who present following trauma, where the course will address the appropriate use of imaging modalities, including ultrasound and computed tomography, and approaches to diagnosis (including the FAST ultrasound exam). A second focus will be on women who present with emergency symptoms, most commonly pain or vaginal bleeding, in the first trimester, where the course will address diagnosis of ectopic pregnancy, miscarriage of intrauterine pregnancy, and ovarian torsion. The third focus will be on women who present with emergency symptoms in the second and third trimesters, where the course will address diagnosis of placenta previa or abruption, cervical shortening, and assessment of fetal well-being.

#### COURSE DESCRIPTION

This course will cover the use of diagnostic imaging in evaluating pregnant woman who present to the emergency room. One focus will be on women who present following trauma, where the course will address the appropriate use of imaging modalities, including ultrasound and computed tomography, and approaches to diagnosis (including the FAST ultrasound exam). A second focus will be on women who present with emergency symptoms, most commonly pain or vaginal bleeding, in the first trimester, where the course will address diagnosis of ectopic pregnancy, miscarriage of intrauterine pregnancy, and ovarian torsion. The third focus will be on women who present with emergency symptoms in the second and third trimesters, where the course will address diagnosis of placenta previa or abruption, cervical shortening, and assessment of fetal well-being.

#### R1-CER16 First Trimester in the Emergency Room

##### Participants

Peter M. Doubilet, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### R1-CER16 Second and Third Trimester in the Emergency Room

##### Participants

Carol Benson, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CGI12

### Pancreaticobiliary Imaging

#### LEARNING OBJECTIVES

1) Be able to recognize causes of secondary sclerosing cholangitis. 2) Recognize the clinical implications of the level of biliary obstruction in malignant bile duct obstruction. 3) Learn the importance of template reporting of severe acute pancreatitis. 3) Understand the revised Atlanta criteria for acute pancreatitis.\*Course Description 1. Cover common and uncommon causes of secondary sclerosing cholangitis.2. Focus on the importance of accurate and detailed review of imaging prior to percutaneous biliary intervention for malignant bile duct obstruction.3. Understand the revised Atlanta criteria for acute pancreatitis.

#### COURSE DESCRIPTION

1. Cover common and uncommon causes of secondary sclerosing cholangitis.2. Focus on the importance of accurate and detailed review of imaging prior to percutaneous biliary intervention for malignant bile duct obstruction.3. Understand the revised Atlanta criteria for acute pancreatitis.

#### Sub-Events

##### **R1-CGI12 Biliary Pathology (Example, PSC, IgG4, Stones, Recurrent Pyogenic Cholangitis, etc.)**

Participants

Mark Anderson, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **R1-CGI12 Cholangiocarcinoma**

Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

##### **R1-CGI12 Pancreatitis**

Participants

Kumaresan Sandrasegaran, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

##### **R1-CGI12 Biliary Interventions**

Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

##### **R1-CGI12 Moderator**

Participants

Kumaresan Sandrasegaran, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CGI12

**Moderator**

### **Participants**

Kumaresan Sandrasegaran, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CGI12

**Biliary Pathology (Example, PSC, IgG4, Stones, Recurrent Pyogenic Cholangitis, etc.)**

### Participants

Mark Anderson, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CGI12

### Cholangiocarcinoma

#### Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CGI12

### Pancreatitis

#### Participants

Kumaresan Sandrasegaran, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CGI12

### Biliary Interventions

#### Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIN09

### Coronary Calcium Screening Deployment Considerations

#### Participants

John Mongan, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Amazon Web Services, Inc; Royalties, General Electric Company; Spouse, Employee, Annexon, Inc; Spouse, Employee, AbbVie Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIN09

### Referral Pathways for Patients with a High Coronary Artery Calcium Score Detected by AI

#### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIN09

**Moderator**

### **Participants**

Ross Filice, MD, Washington, DC (*Moderator*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIN09

### Perks and Pitfalls of General Coronary Artery Calcium Score Screening from the Cardiologist's Perspective

#### Participants

Monvadi Barbara Srichai-Parsia, MD, MS, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CIN09

### Coronary Artery Calcium Opportunistic Screening with Real-World Implementation Experience

#### LEARNING OBJECTIVES

1) Understand the utility and expanded screening population enabled by this technology. 2) Learn about real-world implementation challenges, opportunities, and considerations. 3) Consider how to establish care pathways with cardiology and other specialties.\*Course Description Coronary artery calcium (CAC) scoring is one of the cornerstones of cardiology risk assessment providing an opportunity to intervene on patients at risk and to save lives. Artificial intelligence now allows us to reliably obtain a CAC score on routine non-gated chest CTs and establish care pathways for referral and treatment. Learn about the underlying technology but also important regulatory and deployment considerations as well as how to establish a care pathway with an important perspective from a cardiologist.

#### COURSE DESCRIPTION

Coronary artery calcium (CAC) scoring is one of the cornerstones of cardiology risk assessment providing an opportunity to intervene on patients at risk and to save lives. Artificial intelligence now allows us to reliably obtain a CAC score on routine non-gated chest CTs and establish care pathways for referral and treatment. Learn about the underlying technology but also important regulatory and deployment considerations as well as how to establish a care pathway with an important perspective from a cardiologist.

#### Sub-Events

##### **R1-CIN09 Coronary Calcium Screening Deployment Considerations**

#### Participants

John Mongan, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Amazon Web Services, Inc; Royalties, General Electric Company; Spouse, Employee, Annexon, Inc; Spouse, Employee, AbbVie Inc

##### **R1-CIN09 Referral Pathways for Patients with a High Coronary Artery Calcium Score Detected by AI**

#### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

##### **R1-CIN09 Moderator**

#### Participants

Ross Filice, MD, Washington, DC (*Moderator*) Advisor, BunkerHill Health, Inc; Shareholder, BunkerHill Health, Inc; Speaker, General Electric Company; Speaker, Koios Medical; Researcher, Koios Medical

##### **R1-CIN09 Perks and Pitfalls of General Coronary Artery Calcium Score Screening from the Cardiologist's Perspective**

#### Participants

Monvadi Barbara Srichai-Parsia, MD, MS, Washington, DC (*Presenter*) Nothing to Disclose

##### **R1-CIN09 Coronary Calcium Meets AI**

#### Participants

Bhavik Patel, MD, MBA, Paradise Valley, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIN09

### Coronary Calcium Meets AI

#### Participants

Bhavik Patel, MD, MBA, Paradise Valley, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

**Moderator**

### **Participants**

Robert A. Lookstein, MD, MSc, New York, NY (*Moderator*) Consultant, Boston Scientific Corporation; Consultant, Medtronic plc; Consultant, Penumbra, Inc; Consultant, ShockWave Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### Therapeutic Options: Endovascular Lysis

#### Participants

Julie Bulman, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### How to Start a PE Program: Lessons Learned

#### Participants

Nora Tabori, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### IVC Reconstruction and Filters

#### Participants

Gordon McLennan, MD, Aurora, CO (*Presenter*) Consulting, Becton, Dickinson and Company; Consulting, General Electric Company; Stock Options, TriSalus Life Sciences; Grant, TriSalus Life Sciences

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### Acute and Chronic DVT Management

#### Participants

Juan Carlos Perez Lozada, MD, Fairfield, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### Acute Pulmonary Embolism and Venous Interventions

#### LEARNING OBJECTIVES

1) Review the evidence base for endovascular management of venous thromboembolism. 2) Discuss the current status of prospective research related to the endovascular management of venous thromboembolism.\*Course Description Endovascular Therapy is increasingly being utilized to treat patients with symptomatic venous thromboembolism (Acute Pulmonary Embolism and Deep Vein Thrombosis). A number of prospective research trials are currently underway or are being planned to define the exact role of this growing practice. A diverse faculty will review the current evidence base and give insight for the data needed for the future.

#### COURSE DESCRIPTION

Endovascular Therapy is increasingly being utilized to treat patients with symptomatic venous thromboembolism (Acute Pulmonary Embolism and Deep Vein Thrombosis). A number of prospective research trials are currently underway or are being planned to define the exact role of this growing practice. A diverse faculty will review the current evidence base and give insight for the data needed for the future.

#### Sub-Events

##### **R1-CIR05 Moderator**

#### Participants

Robert A. Lookstein, MD, MSc, New York, NY (*Moderator*) Consultant, Boston Scientific Corporation; Consultant, Medtronic plc; Consultant, Penumbra, Inc; Consultant, ShockWave Medical

##### **R1-CIR05 Therapeutic Options: Endovascular Lysis**

#### Participants

Julie Bulman, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **R1-CIR05 How to Start a PE Program: Lessons Learned**

#### Participants

Nora Tabori, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **R1-CIR05 IVC Reconstruction and Filters**

#### Participants

Gordon McLennan, MD, Aurora, CO (*Presenter*) Consulting, Becton, Dickinson and Company; Consulting, General Electric Company; Stock Options, TriSalus Life Sciences; Grant, TriSalus Life Sciences

##### **R1-CIR05 Acute and Chronic DVT Management**

#### Participants

Juan Carlos Perez Lozada, MD, Fairfield, CT (*Presenter*) Nothing to Disclose

##### **R1-CIR05 Therapeutic Options: Endovascular Thrombectomy**

#### Participants

Leigh Casadaban, MD, Denver, CO (*Presenter*) Nothing to Disclose  
Mona Ranade, MD, Brookfield, WI (*Presenter*) Nothing to Disclose

##### **R1-CIR05 State of Science: Trial Landscape and Future Prospects**

#### Participants

Robert A. Lookstein, MD, MSc, New York, NY (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Medtronic plc; Consultant, Penumbra, Inc; Consultant, ShockWave Medical  
Akhilesh Sista, MD, (*Presenter*) Advisory Board, Thrombolex; Advisory Board, Vascular Medicure



## Abstract Archives of the RSNA, 2023

R1-CIR05

### Therapeutic Options: Endovascular Thrombectomy

#### Participants

Leigh Casadaban, MD, Denver, CO (*Presenter*) Nothing to Disclose  
Mona Ranade, MD, Brookfield, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CIR05

### State of Science: Trial Landscape and Future Prospects

#### Participants

Robert A. Lookstein, MD, MSc, New York, NY (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Medtronic plc; Consultant, Penumbra, Inc; Consultant, ShockWave Medical

Akhilesh Sista, MD, (*Presenter*) Advisory Board, Thrombolex; Advisory Board, Vascular Medicine

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

**Moderator**

### Participants

Erin F. Alaia, MD, New York, NY (*Moderator*) Biorez Inc, Consultant

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

### Imaging of Spine Infection

#### Participants

David Gimarc, MD, Centennial, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

### Imaging Features of Infection in Joints, Tendon Sheaths and Bursae

#### Participants

Felix Gonzalez, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

### Imaging of Soft Tissue Infection

#### Participants

William Morrison, MD, Philadelphia, PA (*Presenter*) Co-founder, Trace Orthopedics; Patent agreement, Trace Orthopedics; Consultant, AprioMed AB; Patent agreement, AprioMed AB; Consultant, Centinel Spine, LLC; Consultant, Medical Metrics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

### Imaging of Chronic Bone Infection

#### Participants

Matthew Bucknor, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CMK09

### From Skin to Bone: Imaging of Infection

#### LEARNING OBJECTIVES

1) To recognize the characteristic imaging findings of bone and soft tissue infection. 2) To review important pearls and common pitfalls in the diagnosis of musculoskeletal infection.\*Course Description This course will include lectures which review in detail the imaging of musculoskeletal infection. The attendee will gain understanding of the imaging of osteomyelitis, chronic bone infection, and spine infection, as well as joint, tendon sheath, bursa, and soft tissue infection.

#### COURSE DESCRIPTION

This course will include lectures which review in detail the imaging of musculoskeletal infection. The attendee will gain understanding of the imaging of osteomyelitis, chronic bone infection, and spine infection, as well as joint, tendon sheath, bursa, and soft tissue infection.

#### Sub-Events

##### **R1-CMK09 Moderator**

Participants

Erin F. Alaia, MD, New York, NY (*Moderator*) Biorez Inc, Consultant

##### **R1-CMK09 Imaging of Spine Infection**

Participants

David Gimarc, MD, Centennial, CO (*Presenter*) Nothing to Disclose

##### **R1-CMK09 Imaging Features of Infection in Joints, Tendon Sheaths and Bursae**

Participants

Felix Gonzalez, MD, (*Presenter*) Nothing to Disclose

##### **R1-CMK09 Imaging of Soft Tissue Infection**

Participants

William Morrison, MD, Philadelphia, PA (*Presenter*) Co-founder, Trace Orthopedics;Patent agreement, Trace Orthopedics;Consultant, AprioMed AB;Patent agreement, AprioMed AB;Consultant, Centinel Spine, LLC;Consultant, Medical Metrics, Inc

##### **R1-CMK09 Imaging of Chronic Bone Infection**

Participants

Matthew Bucknor, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### **R1-CMK09 Imaging of Osteomyelitis**

Participants

Erin F. Alaia, MD, New York, NY (*Presenter*) Biorez Inc, Consultant

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CMK09

### Imaging of Osteomyelitis

#### Participants

Erin F. Alaia, MD, New York, NY (*Presenter*) Biorez Inc, Consultant

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

**Moderator**

### Participants

Judy Yee, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

**Moderator**

### Participants

Charlotte J. Yong-Hing, MD, FRCPC, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

### The Mid-Career Leaky Pipeline

#### Participants

Charlotte J. Yong-Hing, MD, FRCPC, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

### The Importance of Supporting Invisible Minorities

#### Participants

Justin Holder, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

### How to Effectively Mentor and Sponsor Mid-Career Faculty

#### Participants

Christine M. Glastonbury, MBBS, San Francisco, CA (*Presenter*) Author with royalties, RELX;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

### Assuring that Women Radiologists Thrive in Your Program

#### Participants

Gloria Salazar, MD, Chapel Hill, NC (*Presenter*) Consultant, Speakers Bureau, Medtronic plc; Consultant, Boston Scientific Corporation; Speakers Bureau, Boston Scientific Corporation; Speakers Bureau, Cook Group Incorporated; Consultant, Avail Medsystems, Inc; Consultant, Mentice AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNPM12

### Panel Discussion

#### Participants

Daria Manos, FRCPC, Halifax, NS (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Advisory Board, AstraZeneca PLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CNPM12

### **Mentorship, Sponsorship and Coaching: Not Just for Early Career (Sponsored by the RSNA Committee on Diversity, Equity & Inclusion)**

#### **Sub-Events**

##### **R1-CNPM12 Moderator**

###### Participants

Judy Yee, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

##### **R1-CNPM12 Moderator**

###### Participants

Charlotte J. Yong-Hing, MD, FRCPC, (*Moderator*) Nothing to Disclose

##### **R1-CNPM12 The Mid-Career Leaky Pipeline**

###### Participants

Charlotte J. Yong-Hing, MD, FRCPC, (*Presenter*) Nothing to Disclose

##### **R1-CNPM12 The Importance of Supporting Invisible Minorities**

###### Participants

Justin Holder, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **R1-CNPM12 How to Effectively Mentor and Sponsor Mid-Career Faculty**

###### Participants

Christine M. Glastonbury, MBBS, San Francisco, CA (*Presenter*) Author with royalties, RELX;

##### **R1-CNPM12 Assuring that Women Radiologists Thrive in Your Program**

###### Participants

Gloria Salazar, MD, Chapel Hill, NC (*Presenter*) Consultant, Speakers Bureau, Medtronic plc; Consultant, Boston Scientific Corporation; Speakers Bureau, Boston Scientific Corporation; Speakers Bureau, Cook Group Incorporated; Consultant, Avail Medsystems, Inc; Consultant, Mentice AB

##### **R1-CNPM12 Panel Discussion**

###### Participants

Daria Manos, FRCPC, Halifax, NS (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Advisory Board, AstraZeneca PLC

##### **R1-CNPM12 Panel Discussion**

###### Participants

Maureen Kohi, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

#### **LEARNING OBJECTIVES**

1) Understand the importance of using mentorship, sponsorship and coaching to help decrease the loss of mid career women and URiM in radiology. 2) Identify the challenges of invisible minorities including LGBTQ radiologists and how we can provide support. 3) Learn how to implement institution and department specific strategies to assure that all radiologists thrive after hire.\*Course Description The percentage of women and URiM faculty in radiology has remained stagnant despite an increase in medical school matriculants who have been traditionally underrepresented. There is a distinct need to increase the number of women and URiM entering radiology and to assure that they receive appropriate mentorship, sponsorship and coaching to succeed and to be promoted to higher ranks. This session will focus on the mid-career leaky pipeline that occurs for women and URiM and will provide potential solutions. The perspective of invisible minorities including LGBTQ faculty will be provided and how we can also provide support. Because institutions can be quite different, understanding the local culture is key to successfully implementing strategies to help with fixing the leaky pipeline.

#### **COURSE DESCRIPTION**

The percentage of women and URiM faculty in radiology has remained stagnant despite an increase in medical school matriculants who have been traditionally underrepresented. There is a distinct need to increase the number of women and URiM entering radiology and to assure that they receive appropriate mentorship, sponsorship and coaching to succeed and to be promoted to higher ranks. This session will focus on the mid-career leaky pipeline that occurs for women and URiM and will provide potential solutions. The perspective of invisible minorities including LGBTQ faculty will be provided and how we can also provide support. Because institutions can be quite different, understanding the local culture is key to successfully implementing strategies to help with fixing the leaky pipeline.



## Abstract Archives of the RSNA, 2023

R1-CNPM12

### Panel Discussion

#### Participants

Maureen Kohi, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the importance of using mentorship, sponsorship and coaching to help decrease the loss of mid career women and URiM in radiology.2) Identify the challenges of invisible minorities including LGBTQ radiologists and how we can provide support.3) Learn how to implement institution and department specific strategies to assure that all radiologists thrive after hire.\*Course Description The percentage of women and URiM faculty in radiology has remained stagnant despite an increase in medical school matriculants who have been traditionally underrepresented. There is a distinct need to increase the number of women and URiM entering radiology and to assure that they receive appropriate mentorship, sponsorship and coaching to succeed and to be promoted to higher ranks. This session will focus on the mid-career leaky pipeline that occurs for women and URiM and will provide potential solutions. The perspective of invisible minorities including LGBTQ faculty will be provided and how we can also provide support. Because institutions can be quite different, understanding the local culture is key to successfully implementing strategies to help with fixing the leaky pipeline.

#### COURSE DESCRIPTION

The percentage of women and URiM faculty in radiology has remained stagnant despite an increase in medical school matriculants who have been traditionally underrepresented. There is a distinct need to increase the number of women and URiM entering radiology and to assure that they receive appropriate mentorship, sponsorship and coaching to succeed and to be promoted to higher ranks. This session will focus on the mid-career leaky pipeline that occurs for women and URiM and will provide potential solutions. The perspective of invisible minorities including LGBTQ faculty will be provided and how we can also provide support. Because institutions can be quite different, understanding the local culture is key to successfully implementing strategies to help with fixing the leaky pipeline.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNR10

### What's New in Pediatric Neuroinfectious and Neuroinflammatory Disorders

#### Sub-Events

##### **R1-CNR10 Moderator**

Participants

Rupa Radhakrishnan, MD, MS, Indianapolis, IN (*Moderator*) Nothing to Disclose

##### **R1-CNR10 They Read the Book: Classic Presentations of Common Pediatric CNS Infections**

Participants

Julie Guerin, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Familiar with characteristic imaging patterns of pediatric CNS infectious conditions. 2) Understand the impact of perinatal infections on the developing brain. 3) Be aware of advances in pediatric autoimmune and demyelinating disorders.\*Course Description

##### **R1-CNR10 Alphabet Soup of CNS: Autoimmune and Demyelinating Conditions in Children**

Participants

Susan Palasis, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### **R1-CNR10 More than TORCH: Neuroimaging of Perinatal and Neonatal Infections**

Participants

Rupa Radhakrishnan, MD, MS, Indianapolis, IN (*Presenter*) Nothing to Disclose

##### **R1-CNR10 Not Your Everyday Case: Endemic and Emergent Tropical CNS Infections**

Participants

Kshitij Mankad, MBBS, MRCP, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNR10

**Moderator**

### Participants

Rupa Radhakrishnan, MD, MS, Indianapolis, IN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNR10

### They Read the Book: Classic Presentations of Common Pediatric CNS Infections

#### Participants

Julie Guerin, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Familiar with characteristic imaging patterns of pediatric CNS infectious conditions. 2) Understand the impact of perinatal infections on the developing brain. 3) Be aware of advances in pediatric autoimmune and demyelinating disorders.\*Course Description

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## Abstract Archives of the RSNA, 2023

R1-CNR10

### Alphabet Soup of CNS: Autoimmune and Demyelinating Conditions in Children

#### Participants

Susan Palasis, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CNR10

### More than TORCH: Neuroimaging of Perinatal and Neonatal Infections

#### Participants

Rupa Radhakrishnan, MD, MS, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CNR10

**Not Your Everyday Case: Endemic and Emergent Tropical CNS Infections**

### Participants

Kshitij Mankad, MBBS, MRCP, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

### Non-interpretative AI: Enhancing Workflow and Simplifying Processes

#### Participants

Nabile Safdar, MD, MPH, Milton, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

### Guidelines for AI use in Pediatric Radiology Practice

#### Participants

Susan Shelmerdine, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

### Interpretive AI: How Can it Help the Busy Pediatric Radiologist?

#### Participants

Safwan Halabi, MD, (*Presenter*) Advisor, Change Healthcare

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

### Deploying AI Algorithms in Pediatric Radiology: Risks and Opportunities of Emulating Models of Adults

#### Participants

Marla Sammer, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

### AI in Pediatric Radiology: What is a Reality Now and in the Near Future

#### LEARNING OBJECTIVES

1) Learn about how both interpretive and non-interpretive AI tools can help improve efficiency and productivity in a pediatric radiology practice. 2) Understand why AI designed for adults may not be expected to perform similarly in pediatric patients and what may be done to mitigate this risk.\*Course Description We will explore the current state of understanding regarding benefits, challenges, and risks in implementing AI in a pediatric radiology practice, including risks associated with the use of AI models trained on adults applied to pediatric populations. The session will feature four expert presenters followed by a panel Q&A.

#### COURSE DESCRIPTION

We will explore the current state of understanding regarding benefits, challenges, and risks in implementing AI in a pediatric radiology practice, including risks associated with the use of AI models trained on adults applied to pediatric populations. The session will feature four expert presenters followed by a panel Q&A.

#### Sub-Events

##### R1-CPD10 Guidelines for AI use in Pediatric Radiology Practice

Participants

Susan Shelmerdine, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

##### R1-CPD10 Interpretive AI: How Can it Help the Busy Pediatric Radiologist?

Participants

Safwan Halabi, MD, (*Presenter*) Advisor, Change Healthcare

##### R1-CPD10 Deploying AI Algorithms in Pediatric Radiology: Risks and Opportunities of Emulating Models of Adults

Participants

Marla Sammer, MD, (*Presenter*) Nothing to Disclose

##### R1-CPD10 Moderator

Participants

David Larson, MD, MBA, Portola Valley, CA (*Moderator*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health

##### R1-CPD10 Non-interpretative AI: Enhancing Workflow and Simplifying Processes

Participants

Nabile Safdar, MD, MPH, Milton, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPD10

**Moderator**

### **Participants**

David Larson, MD, MBA, Portola Valley, CA (*Moderator*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPH10

**Moderator**

### Participants

Fang Liu, PhD, MSc, Charlestown, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-CPH10

### Rapid MRI Using AI: Methodology, Evaluation, and Clinical Translation

#### Participants

Susie Huang, MD, PhD, Boston, MA (*Presenter*) Research Grant, Siemens AG

#### LEARNING OBJECTIVES

1) Explain the current clinical applications of deep learning in MRI. 2) Understand the basic methods applied in rapid MRI and MRI analysis.\*Course Description This course offers an overview of present deep learning (DL) techniques for MRI, including an introduction to DL principles in rapid image acquisition, reconstruction, post-processing, and analysis. Speakers will deliver a review of current DL utility and impact in clinical MRI, for example, musculoskeletal imaging, and an outlook on challenges and future directions of DL in MRI translational and clinical applications.

#### COURSE DESCRIPTION

This course offers an overview of present deep learning (DL) techniques for MRI, including an introduction to DL principles in rapid image acquisition, reconstruction, post-processing, and analysis. Speakers will deliver a review of current DL utility and impact in clinical MRI, for example, musculoskeletal imaging, and an outlook on challenges and future directions of DL in MRI translational and clinical applications.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPH10

### Applications of AI in Musculoskeletal MRI: Disease Diagnosis and Prediction

#### Participants

Jayashree Kalpathy-Cramer, PhD, Charlestown, MA (*Presenter*) Institutional Research Grant, General Electric Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Bayer AG

Richard Kijowski, MD, New York, NY (*Presenter*) Research Consultant, Boston Imaging Core Lab, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-CPH10

### Deep Learning in MRI

#### Sub-Events

##### R1-CPH10 Moderator

#### Participants

Fang Liu, PhD, MSc, Charlestown, MA (*Moderator*) Nothing to Disclose

##### R1-CPH10 Rapid MRI Using AI: Methodology, Evaluation, and Clinical Translation

#### Participants

Susie Huang, MD, PhD, Boston, MA (*Presenter*) Research Grant, Siemens AG

#### LEARNING OBJECTIVES

1) Explain the current clinical applications of deep learning in MRI. 2) Understand the basic methods applied in rapid MRI and MRI analysis.\*Course Description This course offers an overview of present deep learning (DL) techniques for MRI, including an introduction to DL principles in rapid image acquisition, reconstruction, post-processing, and analysis. Speakers will deliver a review of current DL utility and impact in clinical MRI, for example, musculoskeletal imaging, and an outlook on challenges and future directions of DL in MRI translational and clinical applications.

#### COURSE DESCRIPTION

This course offers an overview of present deep learning (DL) techniques for MRI, including an introduction to DL principles in rapid image acquisition, reconstruction, post-processing, and analysis. Speakers will deliver a review of current DL utility and impact in clinical MRI, for example, musculoskeletal imaging, and an outlook on challenges and future directions of DL in MRI translational and clinical applications.

##### R1-CPH10 Applications of AI in Musculoskeletal MRI: Disease Diagnosis and Prediction

#### Participants

Jayashree Kalpathy-Cramer, PhD, Charlestown, MA (*Presenter*) Institutional Research Grant, General Electric Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Bayer AG  
Richard Kijowski, MD, New York, NY (*Presenter*) Research Consultant, Boston Imaging Core Lab, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-RCP21

### Artificial Intelligence (AI) in Medical Imaging - Conceptualizing Clinical Needs

#### Participants

Anthony Samir, MD, MPH, (*Presenter*) Consultant, AstraZeneca PLC; Research funded, AstraZeneca PLC; Consultant, Bracco Group; Consultant, Bristol-Myers Squibb Company; Consultant, General Electric Company; Scientific Advisory Board, General Electric Company; Research support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-RCP21

**Moderator**

### Participants

J. Brian Fowlkes, PhD, (*Moderator*) Research Grant, Koninklijke Philips NV; Equipment support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-RCP21

**Moderator**

### Participants

Shadi Abdar Esfahani, MD, MPH, Boston, MA (*Moderator*) Scientific Advisory Board, RefleXion Medical Inc;Scientific Advisory Board, ImaginAb, Inc;Scientific Advisory Board, General Electric Company;Scientific Advisory Board, Trevarx Biomedical, Inc;Consultant, General Electric Company;Spouse, CEO, Trevarx Biomedical, Inc;Spouse, Owner, Trevarx Biomedical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-RCP21

### Artificial Intelligence (AI) in Medical Imaging - The Pathway to Translation (Translational Research Educational Course (TREC) (Sponsored by the RSNA Research Development Committee)

#### LEARNING OBJECTIVES

1) Describe the current landscape for translating new AI tools to the clinic. 2) Understand aspects needed to move a new AI tool from an academic research lab to a commercial product. 3) Recognize essential needs of startup companies in this environment.\*Course Description This 1-hour session is designed to address the knowledge gap concerning guiding researchers to successfully translate research into clinical practice. This year it will provide a specific example on Artificial Intelligence (AI) as applied to robotics for image-guided intervention in the context of a startup company. This course will cover some of the steps needed such as developing the idea, assessing the clinical need, commercial demand, securing funding, making a team of collaborators to translate and commercialize the product. These topics will be addressed by speakers with expertise on different aspects of translational imaging research in the context of AI. The format will be presentations by 1) Translational clinician-investigator involved in the AI tool development and testing, 2) Computer/data scientist that helped developed the AI tools used and 3) the company CEO considering the commercialization, regulatory approval and marketing, with a Q&A panel session. The outcome of the course will be to provide the audience with a representative example of such translation efforts and the opportunity to discuss with the speakers their experiences.

#### COURSE DESCRIPTION

This 1-hour session is designed to address the knowledge gap concerning guiding researchers to successfully translate research into clinical practice. This year it will provide a specific example on Artificial Intelligence (AI) as applied to robotics for image-guided intervention in the context of a startup company. This course will cover some of the steps needed such as developing the idea, assessing the clinical need, commercial demand, securing funding, making a team of collaborators to translate and commercialize the product. These topics will be addressed by speakers with expertise on different aspects of translational imaging research in the context of AI. The format will be presentations by 1) Translational clinician-investigator involved in the AI tool development and testing, 2) Computer/data scientist that helped developed the AI tools used and 3) the company CEO considering the commercialization, regulatory approval and marketing, with a Q&A panel session. The outcome of the course will be to provide the audience with a representative example of such translation efforts and the opportunity to discuss with the speakers their experiences.

#### Sub-Events

##### R1-RCP21 Moderator

Participants

J. Brian Fowlkes, PhD, (*Moderator*) Research Grant, Koninklijke Philips NV; Equipment support, General Electric Company

##### R1-RCP21 Moderator

Participants

Shadi Abdar Esfahani, MD, MPH, Boston, MA (*Moderator*) Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, ImaginAb, Inc; Scientific Advisory Board, General Electric Company; Scientific Advisory Board, Trevarx Biomedical, Inc; Consultant, General Electric Company; Spouse, CEO, Trevarx Biomedical, Inc; Spouse, Owner, Trevarx Biomedical, Inc

##### R1-RCP21 Artificial Intelligence (AI) in Medical Imaging - Conceptualizing Clinical Needs

Participants

Anthony Samir, MD, MPH, (*Presenter*) Consultant, AstraZeneca PLC; Research funded, AstraZeneca PLC; Consultant, Bracco Group; Consultant, Bristol-Myers Squibb Company; Consultant, General Electric Company; Scientific Advisory Board, General Electric Company; Research support, General Electric Company

##### R1-RCP21 Artificial Intelligence (AI) in Medical Imaging - From Need to Functioning and Investible Prototype Technology

Participants

Matthew Johnson, MS, New York, NY (*Presenter*) Nothing to Disclose

##### R1-RCP21 Artificial Intelligence (AI) in Medical Imaging - From Prototype Technology to Translational Plan

Participants

Romeo Catracchia, MBA, BSc, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R1-RCP21

### Artificial Intelligence (AI) in Medical Imaging - From Need to Functioning and Investible Prototype Technology

#### Participants

Matthew Johnson, MS, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R1-RCP21

**Artificial Intelligence (AI) in Medical Imaging - From Prototype Technology to Translational Plan**

### Participants

Romeo Catracchia, MBA, BSc, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CBR12

### Localization and Biopsy Techniques for the Breast

#### Sub-Events

#### R3-CBR12 Moderator

##### Participants

Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Alphabet Inc

#### R3-CBR12 Tomo Guided Biopsy and Localization Techniques

##### Participants

Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Alphabet Inc

#### LEARNING OBJECTIVES

1) Identify different ways to optimize tomosynthesis, US and MRI guided biopsies. 2) Appreciate different methods of image guided localizations, and understand their strengths and limitations.\*Course Description In this course, the attendee will learn the basics of DBT, US and MRI guided biopsies as well as different localization techniques. The most recent literature supporting these techniques will be reviewed. Additionally, through imaging examples, different scenarios will be presented that the radiologist may encounter during these procedures. A practical guide on how to troubleshoot various issues that might arise will be presented.

#### COURSE DESCRIPTION

In this course, the attendee will learn the basics of DBT, US and MRI guided biopsies as well as different localization techniques. The most recent literature supporting these techniques will be reviewed. Additionally, through imaging examples, different scenarios will be presented that the radiologist may encounter during these procedures. A practical guide on how to troubleshoot various issues that might arise will be presented.

#### R3-CBR12 US Guided Biopsy, Localization and Seeds

##### Participants

Liane E. Philpotts, MD, Madison, CT (*Presenter*) Nothing to Disclose

#### R3-CBR12 MRI Guided Biopsy and Localization Techniques

##### Participants

Laurie Margolies, MD, New York, NY (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CBR12

**Moderator**

### **Participants**

Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Alphabet Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CBR12

### Tomo Guided Biopsy and Localization Techniques

#### Participants

Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Alphabet Inc

#### LEARNING OBJECTIVES

1) Identify different ways to optimize tomosynthesis, US and MRI guided biopsies. 2) Appreciate different methods of image guided localizations, and understand their strengths and limitations.\*Course Description In this course, the attendee will learn the basics of DBT, US and MRI guided biopsies as well as different localization techniques. The most recent literature supporting these techniques will be reviewed. Additionally, through imaging examples, different scenarios will be presented that the radiologist may encounter during these procedures. A practical guide on how to troubleshoot various issues that might arise will be presented.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CBR12

### US Guided Biopsy, Localization and Seeds

#### Participants

Liane E. Philpotts, MD, Madison, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CBR12

### MRI Guided Biopsy and Localization Techniques

#### Participants

Laurie Margolies, MD, New York, NY (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CCH10

### Lung Cancer Screening

#### Sub-Events

##### R3-CCH10 Moderator

###### Participants

Caroline Chiles, MD, Winston-salem, NC (*Moderator*) Advisory Board, AstraZeneca PLC

##### R3-CCH10 Tools for Tracking Lung Nodule Follow-up

###### Participants

Debra Dyer, MD, (*Presenter*) Consultant, AstraZeneca PLC;Clinical Advisory Board, IMIDEX Inc

#### LEARNING OBJECTIVES

1) Recognize important additions to Lung-RADS 2022. 2) Understand how radiologists can optimize the risk: benefit ratio in their lung cancer screening patients. 3) Compare human intelligence and artificial intelligence in the interpretation and reporting of lung screening CT. 4) Appreciate the need for lung nodule tracking tools in lung cancer screening and incidental pulmonary nodule programs.\*Course Description Lung-RADS 2022 contains significant revisions that, in part, move suspected infectious lesions to "Lung-RADS 0, incomplete" rather than Lung-RADS 4, suspicious, allow juxtapleural nodules the same assessment as perifissural nodules, and define a Stepped Management to the follow-up of nodules. CT screening for lung cancer can reduce lung-cancer specific mortality, but this benefit must be weighed in each patient against potential risks. We describe how radiologists can mitigate the risks associated with CT screening. As the number of lung screening CTs increases, radiologists may benefit from artificial intelligence that can not only identify nodules but also provide risk assessment. Appropriate follow-up of lung nodules is necessary for the early detection of lung cancer. Tools for tracking lung nodules are essential for successful lung nodule management in lung cancer screening and incidental pulmonary nodule programs.

#### COURSE DESCRIPTION

Lung-RADS 2022 contains significant revisions that, in part, move suspected infectious lesions to "Lung-RADS 0, incomplete" rather than Lung-RADS 4, suspicious, allow juxtapleural nodules the same assessment as perifissural nodules, and define a Stepped Management to the follow-up of nodules. CT screening for lung cancer can reduce lung-cancer specific mortality, but this benefit must be weighed in each patient against potential risks. We describe how radiologists can mitigate the risks associated with CT screening. As the number of lung screening CTs increases, radiologists may benefit from artificial intelligence that can not only identify nodules but also provide risk assessment. Appropriate follow-up of lung nodules is necessary for the early detection of lung cancer. Tools for tracking lung nodules are essential for successful lung nodule management in lung cancer screening and incidental pulmonary nodule programs.

##### R3-CCH10 The Role of Radiologists in Mitigating the Harms of Lung Cancer Screening

###### Participants

Terrance Healey, MD, North Scituate, RI (*Presenter*) Nothing to Disclose

##### R3-CCH10 Humans and Machines in Early Lung Cancer Detection

###### Participants

Denise R. Aberle, MD, Los Angeles, CA (*Presenter*) Investigator, Johnson & Johnson;Research Grant, Johnson & Johnson

##### R3-CCH10 Lung-RADS 2022 - A User's Guide

###### Participants

Ashley Prosper, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CCH10

### Humans and Machines in Early Lung Cancer Detection

#### Participants

Denise R. Aberle, MD, Los Angeles, CA (*Presenter*) Investigator, Johnson & Johnson; Research Grant, Johnson & Johnson

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-CCH10

### The Role of Radiologists in Mitigating the Harms of Lung Cancer Screening

#### Participants

Terrance Healey, MD, North Scituate, RI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CCH10

**Moderator**

### **Participants**

Caroline Chiles, MD, Winston-salem, NC (*Moderator*) Advisory Board, AstraZeneca PLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CCH10

### Tools for Tracking Lung Nodule Follow-up

#### Participants

Debra Dyer, MD, (*Presenter*) Consultant, AstraZeneca PLC; Clinical Advisory Board, IMIDEX Inc

#### LEARNING OBJECTIVES

1) Recognize important additions to Lung-RADS 2022. 2) Understand how radiologists can optimize the risk: benefit ratio in their lung cancer screening patients. 3) Compare human intelligence and artificial intelligence in the interpretation and reporting of lung screening CT. 4) Appreciate the need for lung nodule tracking tools in lung cancer screening and incidental pulmonary nodule programs.\*Course Description Lung-RADS 2022 contains significant revisions that, in part, move suspected infectious lesions to "Lung-RADS 0, incomplete" rather than Lung-RADS 4, suspicious, allow juxtaleural nodules the same assessment as perifissural nodules, and define a Stepped Management to the follow-up of nodules. CT screening for lung cancer can reduce lung-cancer specific mortality, but this benefit must be weighed in each patient against potential risks. We describe how radiologists can mitigate the risks associated with CT screening. As the number of lung screening CTs increases, radiologists may benefit from artificial intelligence that can not only identify nodules but also provide risk assessment. Appropriate follow-up of lung nodules is necessary for the early detection of lung cancer. Tools for tracking lung nodules are essential for successful lung nodule management in lung cancer screening and incidental pulmonary nodule programs.

#### COURSE DESCRIPTION

Lung-RADS 2022 contains significant revisions that, in part, move suspected infectious lesions to "Lung-RADS 0, incomplete" rather than Lung-RADS 4, suspicious, allow juxtaleural nodules the same assessment as perifissural nodules, and define a Stepped Management to the follow-up of nodules. CT screening for lung cancer can reduce lung-cancer specific mortality, but this benefit must be weighed in each patient against potential risks. We describe how radiologists can mitigate the risks associated with CT screening. As the number of lung screening CTs increases, radiologists may benefit from artificial intelligence that can not only identify nodules but also provide risk assessment. Appropriate follow-up of lung nodules is necessary for the early detection of lung cancer. Tools for tracking lung nodules are essential for successful lung nodule management in lung cancer screening and incidental pulmonary nodule programs.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CCH10

### Lung-RADS 2022 - A User's Guide

#### Participants

Ashley Prosper, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CGU06

### Emerging Technologies in GU Imaging

#### Sub-Events

##### R3-CGU06 Moderator

###### Participants

Fiona Fennessy, MBBCh, PhD, Brookline, MA (*Moderator*) Consultant, Imaging Endpoints II LLC

##### R3-CGU06 Artificial Intelligence

###### Participants

Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

##### R3-CGU06 Molecular Imaging

###### Participants

Jan Grimm, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### R3-CGU06 MRI Technology

###### Participants

Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

##### R3-CGU06 Radiofrequency Track Cautery to Prevent Biopsy-Related Bleeding or Tumor Seeding

###### Participants

Paul B. Shyn, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the current and future roles of targeted molecular imaging in improving GU cancer diagnosis, treatment planning, and surveillance. 2) Understand when and how to use a radiofrequency needle track cautery device to prevent bleeding or tumor track seeding during abdominal biopsies. 3) Identify the benefits and limitations of AI in improving workflow efficiency and patient outcomes in GU imaging.\*Course Description This course will provide participants information on how the future of GU imaging looks, outlining new MR, molecular, interventional and AI imaging pathways, and demonstrate how these will have the potential to improve accuracy and efficiency of complex GU imaging.

#### COURSE DESCRIPTION

This course will provide participants information on how the future of GU imaging looks, outlining new MR, molecular, interventional and AI imaging pathways, and demonstrate how these will have the potential to improve accuracy and efficiency of complex GU imaging.

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## Abstract Archives of the RSNA, 2023

R3-CGU06

### Radiofrequency Track Cautery to Prevent Biopsy-Related Bleeding or Tumor Seeding

#### Participants

Paul B. Shyn, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the current and future roles of targeted molecular imaging in improving GU cancer diagnosis, treatment planning, and surveillance. 2) Understand when and how to use a radiofrequency needle track cautery device to prevent bleeding or tumor track seeding during abdominal biopsies. 3) Identify the benefits and limitations of AI in improving workflow efficiency and patient outcomes in GU imaging.\*Course Description This course will provide participants information on how the future of GU imaging looks, outlining new MR, molecular, interventional and AI imaging pathways, and demonstrate how these will have the potential to improve accuracy and efficiency of complex GU imaging.

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## Abstract Archives of the RSNA, 2023

R3-CGU06

**Moderator**

### **Participants**

Fiona Fennessy, MBBCh, PhD, Brookline, MA (*Moderator*) Consultant, Imaging Endpoints II LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CGU06

### Artificial Intelligence

#### Participants

Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-CGU06

### Molecular Imaging

#### Participants

Jan Grimm, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CGU06

### MRI Technology

#### Participants

Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNMMI05

### Revolution in Alzheimer's Disease Therapy is Finally Here: What does the Radiologist Need to Know

#### LEARNING OBJECTIVES

1) Understand the roles of amyloid PET and MRI in the treatment protocol for anti-amyloid therapy. 2) Review appropriate use criteria of amyloid PET in the era of anti-amyloid therapy. 3) Discuss the neurologist's perspective on what the radiologist/ nuclear medicine physician needs to know.\*Course Description We are on the cusp of a revolution in dementia therapy. In particular, new anti-amyloid therapy may have a meaningful impact in slowing cognitive impairment. Neurologists, neuroradiologists and nuclear medicine specialists will play key role determining the impact of this therapy.

#### COURSE DESCRIPTION

We are on the cusp of a revolution in dementia therapy. In particular, new anti-amyloid therapy may have a meaningful impact in slowing cognitive impairment. Neurologists, neuroradiologists and nuclear medicine specialists will play key role determining the impact of this therapy.

#### Sub-Events

##### **R3-CNMMI05** Moderator

Participants

Katherine Zukotynski, MD, PhD, Hamilton, ON (*Moderator*) Research Consultant, Konica Minolta, Inc;Research Consultant, General Electric Company;Speakers Bureau, Jubilant DraxImage Inc

##### **R3-CNMMI05** Introduction to PET Biomarkers for Alzheimer's Disease

Participants

Katherine Zukotynski, MD, PhD, Hamilton, ON (*Presenter*) Research Consultant, Konica Minolta, Inc;Research Consultant, General Electric Company;Speakers Bureau, Jubilant DraxImage Inc

##### **R3-CNMMI05** Molecular Imaging for Optimal Patient Selection for Anti-Amyloid Therapy

Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Presenter*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc

##### **R3-CNMMI05** What your Neurologist Wants You to Know about Diagnosis and Therapy of Alzheimer's Disease

Participants

Gil Rabinovici, MD, San Francisco, CA (*Presenter*) Scientific Advisory Board, Eisai Co, Ltd;Committee member, Johnson & Johnson;Research Grant, Eli Lilly and Company;Research Grant, General Electric Company;Research Grant, Life Molecular Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNMMI05

**Moderator**

### **Participants**

Katherine Zukotynski, MD, PhD, Hamilton, ON (*Moderator*) Research Consultant, Konica Minolta, Inc; Research Consultant, General Electric Company; Speakers Bureau, Jubilant DraxImage Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNMMI05

### Introduction to PET Biomarkers for Alzheimer's Disease

#### Participants

Katherine Zukotynski, MD, PhD, Hamilton, ON (*Presenter*) Research Consultant, Konica Minolta, Inc; Research Consultant, General Electric Company; Speakers Bureau, Jubilant DraxImage Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNMMI05

### Molecular Imaging for Optimal Patient Selection for Anti-Amyloid Therapy

#### Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Presenter*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNMMI05

### What your Neurologist Wants You to Know about Diagnosis and Therapy of Alzheimer's Disease

#### Participants

Gil Rabinovici, MD, San Francisco, CA (*Presenter*) Scientific Advisory Board, Eisai Co, Ltd; Committee member, Johnson & Johnson; Research Grant, Eli Lilly and Company; Research Grant, General Electric Company; Research Grant, Life Molecular Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNPM13

### Reimagining Academia

#### Sub-Events

##### R3-CNPM13 Moderator

###### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### R3-CNPM13 Leveraging Teleradiology for Academic Medical Centers

###### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify challenges faced with recruitment and retention in academia. 2) Explain how these challenges can be met through orthodox and novel operational approaches.\*Course Description With growing radiologist shortage, increasing hospital consolidation, and growth of teleradiology, the academic landscape looks very different today from twenty years ago. How does academia maintain its traditional mission and yet support high clinical output in a competitive market without the faculty suffering burnout?

#### COURSE DESCRIPTION

With growing radiologist shortage, increasing hospital consolidation, and growth of teleradiology, the academic landscape looks very different today from twenty years ago. How does academia maintain its traditional mission and yet support high clinical output in a competitive market without the faculty suffering burnout?

##### R3-CNPM13 How to Recruit Retain in Academia in Current Job Market

###### Participants

Mitchell Schnall, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG

##### R3-CNPM13 Does Academia Still Glitter?

###### Participants

Jessica Fried, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-CNPM13

**Moderator**

### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNPM13

### Leveraging Teleradiology for Academic Medical Centers

#### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify challenges faced with recruitment and retention in academia. 2) Explain how these challenges can be met through orthodox and novel operational approaches.\*Course Description With growing radiologist shortage, increasing hospital consolidation, and growth of teleradiology, the academic landscape looks very different today from twenty years ago. How does academia maintain its traditional mission and yet support high clinical output in a competitive market without the faculty suffering burnout?

#### COURSE DESCRIPTION

With growing radiologist shortage, increasing hospital consolidation, and growth of teleradiology, the academic landscape looks very different today from twenty years ago. How does academia maintain its traditional mission and yet support high clinical output in a competitive market without the faculty suffering burnout?

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNPM13

### How to Recruit Retain in Academia in Current Job Market

#### Participants

Mitchell Schnall, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CNPM13

### Does Academia Still Glitter?

#### Participants

Jessica Fried, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-COB07

### Abnormal Premenopausal Bleeding

#### Participants

Catherine Phillips, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define normal and abnormal uterine bleeding in premenopausal, pregnant and postmenopausal patients. 2) Outline etiologies of abnormal uterine bleeding in premenopausal, pregnant and postmenopausal patients. 3) Explain the role of appropriate imaging algorithms in different clinical scenarios.\*Course Description This course will enhance skills in formulating accurate and comprehensive radiology reports for patients with dysfunctional uterine bleeding throughout the life cycle. Structural and nonstructural causes of dysfunctional uterine bleeding in premenopausal: pregnant, non pregnant and in postmenopausal patients will be reviewed. A detailed explanation of appropriate imaging approach including US, CT, MRI, Hysterosalpingography will be provided for all entities involving the premenopausal, pregnant and postmenopausal patients who present with dysfunctional uterine bleeding. After completion of this course the attendees will have a comprehensive understanding and have developed an expertise in most common causes to rare etiologies of dysfunctional uterine bleeding.

#### COURSE DESCRIPTION

This course will enhance skills in formulating accurate and comprehensive radiology reports for patients with dysfunctional uterine bleeding throughout the life cycle. Structural and nonstructural causes of dysfunctional uterine bleeding in premenopausal: pregnant, non pregnant and in postmenopausal patients will be reviewed. A detailed explanation of appropriate imaging approach including US, CT, MRI, Hysterosalpingography will be provided for all entities involving the premenopausal, pregnant and postmenopausal patients who present with dysfunctional uterine bleeding. After completion of this course the attendees will have a comprehensive understanding and have developed an expertise in most common causes to rare etiologies of dysfunctional uterine bleeding.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-COB07

### Dysfunctional Uterine Bleeding

#### Sub-Events

##### **R3-COB07 Moderator**

###### Participants

Liina Poder, MD, Mill Valley, CA (*Moderator*) Nothing to Disclose

##### **R3-COB07 Postmenopausal Bleeding**

###### Participants

Mark Sugi, MD, San Francisco, CA (*Presenter*) Consultant, Nextrast, Inc; Author with royalties, RELX

##### **R3-COB07 Bleeding in Pregnancy**

###### Participants

Liina Poder, MD, Mill Valley, CA (*Presenter*) Nothing to Disclose

##### **R3-COB07 Abnormal Premenopausal Bleeding**

###### Participants

Catherine Phillips, MD, Nashville, TN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define normal and abnormal uterine bleeding in premenopausal, pregnant and postmenopausal patients. 2) Outline etiologies of abnormal uterine bleeding in premenopausal, pregnant and postmenopausal patients. 3) Explain the role of appropriate imaging algorithms in different clinical scenarios.\*Course Description This course will enhance skills in formulating accurate and comprehensive radiology reports for patients with dysfunctional uterine bleeding throughout the life cycle. Structural and nonstructural causes of dysfunctional uterine bleeding in premenopausal: pregnant, non pregnant and in postmenopausal patients will be reviewed. A detailed explanation of appropriate imaging approach including US, CT, MRI, Hysterosalpingography will be provided for all entities involving the premenopausal, pregnant and postmenopausal patients who present with dysfunctional uterine bleeding. After completion of this course the attendees will have a comprehensive understanding and have developed an expertise in most common causes to rare etiologies of dysfunctional uterine bleeding.

#### COURSE DESCRIPTION

This course will enhance skills in formulating accurate and comprehensive radiology reports for patients with dysfunctional uterine bleeding throughout the life cycle. Structural and nonstructural causes of dysfunctional uterine bleeding in premenopausal: pregnant, non pregnant and in postmenopausal patients will be reviewed. A detailed explanation of appropriate imaging approach including US, CT, MRI, Hysterosalpingography will be provided for all entities involving the premenopausal, pregnant and postmenopausal patients who present with dysfunctional uterine bleeding. After completion of this course the attendees will have a comprehensive understanding and have developed an expertise in most common causes to rare etiologies of dysfunctional uterine bleeding.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-COB07

**Moderator**

### Participants

Liina Poder, MD, Mill Valley, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-COB07

### Postmenopausal Bleeding

#### Participants

Mark Sugi, MD, San Francisco, CA (*Presenter*) Consultant, Nextrast, Inc; Author with royalties, RELX

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-COB07

### Bleeding in Pregnancy

#### Participants

Liina Poder, MD, Mill Valley, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

### Musculoskeletal Case Based Multidisciplinary Review

#### Participants

F. Joseph Simeone, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

### Musculoskeletal Case Based Multidisciplinary Review

#### Participants

Kevin Raskin, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

### Musculoskeletal Case Based Multidisciplinary Review

#### Participants

Seth Pollack, MD, Chicago, IL (*Presenter*) Consultant, Bayer AG; Consultant, Deciphera Pharmaceuticals, LLC; Consultant, Apexigen Inc; Consultant, T-Knife, GmbH; Consultant, Aadi Bioscience, Inc; Consultant, Epizyme, Inc; Consultant, Obsidian; Consultant, Sensei; Consultant, SpringWorks Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

### Musculoskeletal Case Based Multidisciplinary Review

#### Participants

Meng Welliver, MD, PhD, Columbus, OH (*Presenter*) Advisory Board, NovoCure Ltd; Advisory Board, Eli Lilly and Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

**Moderator**

### Participants

Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CRO06

### Musculoskeletal Case Based Multidisciplinary Review

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating sarcomas and other musculoskeletal malignancies. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description This multidisciplinary panel will discuss a series of challenging soft tissue and bone sarcoma cases. The session will highlight the importance of imaging in the diagnosis and treatment of these rare tumors. Panelists will represent radiology, orthopedic oncology, medical oncology, and radiation oncology.

#### COURSE DESCRIPTION

This multidisciplinary panel will discuss a series of challenging soft tissue and bone sarcoma cases. The session will highlight the importance of imaging in the diagnosis and treatment of these rare tumors. Panelists will represent radiology, orthopedic oncology, medical oncology, and radiation oncology.

#### Sub-Events

##### R3-CRO06 Moderator

Participants

Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

##### R3-CRO06 Musculoskeletal Case Based Multidisciplinary Review

Participants

Meng Welliver, MD, PhD, Columbus, OH (*Presenter*) Advisory Board, NovoCure Ltd;Advisory Board, Eli Lilly and Company

##### R3-CRO06 Musculoskeletal Case Based Multidisciplinary Review

Participants

Seth Pollack, MD, Chicago, IL (*Presenter*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc

##### R3-CRO06 Musculoskeletal Case Based Multidisciplinary Review

Participants

Kevin Raskin, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### R3-CRO06 Musculoskeletal Case Based Multidisciplinary Review

Participants

F. Joseph Simeone, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CVA01

### Multimodality Thoracic Aortic Imaging: What the Radiologist and Surgeon Need to Know

#### Sub-Events

#### R3-CVA01 Moderator

##### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

#### R3-CVA01 Moderator

##### Participants

James Carr, MD, Chicago, IL (*Moderator*) Institutional Research Grant, Siemens AG; Advisory Board, Siemens AG; Travel support, Siemens AG; Institutional Research Grant, Bayer AG; Advisory Board, Bayer AG; Travel support, Bayer AG; Speaker, Bayer AG; Institutional Research Grant, Guerbet SA; Advisory Board, Bracco Group

#### R3-CVA01 Thoracic Aortic Imaging for the Diagnostic Radiologist: Measurements and Practical Considerations

##### Participants

Bradley Allen, MD, MS, Evanston, IL (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc; Speaker, WebMD LLC

#### LEARNING OBJECTIVES

1) Describe key aortic imaging findings for the radiologist including measurements. 2) Discuss imaging findings and reporting from the surgeons perspective. 3) Identify aortic imaging findings for interventional planning and post-intervention evaluation. \*Course Description This educational course will discuss aortic imaging from the perspective of the surgeon, diagnostic radiologist, and intervention radiologist.

#### COURSE DESCRIPTION

This educational course will discuss aortic imaging from the perspective of the surgeon, diagnostic radiologist, and intervention radiologist.

#### R3-CVA01 Thoracic Aortic Imaging: What the Surgeon Needs to Know

##### Participants

Jennifer Chung, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### R3-CVA01 Thoracic Aortic Imaging: What the Interventional Radiologist Needs to Know

##### Participants

William Sherk, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## **Abstract Archives of the RSNA, 2023**

R3-CVA01

### **Thoracic Aortic Imaging: What the Surgeon Needs to Know**

#### **Participants**

Jennifer Chung, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CVA01

**Moderator**

### **Participants**

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CVA01

### Moderator

#### Participants

James Carr, MD, Chicago, IL (*Moderator*) Institutional Research Grant, Siemens AG;Advisory Board, Siemens AG;Travel support, Siemens AG;Institutional Research Grant, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Bayer AG;Institutional Research Grant, Guerbet SA;Advisory Board, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CVA01

### Thoracic Aortic Imaging for the Diagnostic Radiologist: Measurements and Practical Considerations

#### Participants

Bradley Allen, MD, MS, Evanston, IL (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc; *Speaker*, WebMD LLC

#### LEARNING OBJECTIVES

1) Describe key aortic imaging findings for the radiologist including measurements. 2) Discuss imaging findings and reporting from the surgeons perspective. 3) Identify aortic imaging findings for interventional planning and post-intervention evaluation. \*Course Description This educational course will discuss aortic imaging from the perspective of the surgeon, diagnostic radiologist, and intervention radiologist.

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This educational course will discuss aortic imaging from the perspective of the surgeon, diagnostic radiologist, and intervention radiologist.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-CVA01

### Thoracic Aortic Imaging: What the Interventional Radiologist Needs to Know

#### Participants

William Sherk, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### MR Safety: Case Based Approach to Scanning Patients with Active Implants (Sponsored by the RSNA Quality Improvement Committee)

#### Sub-Events

##### R3-RCP23 Moderator

Participants

William Sensakovic, PhD, Cave Creek, AZ (*Moderator*) Nothing to Disclose

##### R3-RCP23 Off-label Scanning of Patients with Active Implants

Participants

Candice Bookwalter, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

##### R3-RCP23 Safety Assessment of Patients with Active Implants

Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

##### R3-RCP23 Off-label Scanning of Patients with Active Implants

Participants

Samuel Fahrenholtz, PhD, Scottsdale, AZ (*Presenter*) Stockholder, Nano X Imaging

##### R3-RCP23 What to Do When an Incident, or Near Miss, Occurs

Participants

Anshuman Panda, PhD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

##### R3-RCP23 Heating and Scan Time Management: Tricks of the Trade

Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### R3-RCP23 Safety Assessment of Patients with Active Implants

Participants

Maureen Hood, PhD, RN, Bethesda, MD (*Presenter*) In-kind support, General Electric Company

##### R3-RCP23 Heating and Scan Time Management: Tricks of the Trade

Participants

Scott Reeder, MD, PhD, Madison, WI (*Presenter*) Owner, Calimetrix; Owner, Reveal Pharmaceuticals; Owner, Collectar Biosciences, Inc.; Owner, Elucent Medical; Owner, HeartVista, Inc.;

##### R3-RCP23 Moderator

Participants

Samuel Fahrenholtz, PhD, Scottsdale, AZ (*Moderator*) Stockholder, Nano X Imaging

##### R3-RCP23 What to Do When an Incident, or Near Miss, Occurs

Participants

Andrew Bowman, MD, PhD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify safety issues related to active implants. 2) Describe strategies to meet implant scanning requirements. 3) Review considerations for scanning off-label. 4) Understand actions to take when a safety incident occurs.\*Course Description Description of Program: A unique challenge to MR safety is the logistics of managing patients with active implants due to the diversity of device safety labeling and large number of requested exams. In this session, there are four talks presenting case-based examples of managing patients with active implants. These talks progress from initial screening, to MR scanning protocol modifications, to off-label considerations, to managing safety events.

#### COURSE DESCRIPTION

Description of Program: A unique challenge to MR safety is the logistics of managing patients with active implants due to the diversity of device safety labeling and large number of requested exams. In this session, there are four talks presenting case-based

examples of managing patients with active implants. These talks progress from initial screening, to MR scanning protocol modifications, to off-label considerations, to managing safety events.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

**Moderator**

### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-RCP23

### Off-label Scanning of Patients with Active Implants

#### Participants

Candice Bookwalter, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### Safety Assessment of Patients with Active Implants

#### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### Off-label Scanning of Patients with Active Implants

#### Participants

Samuel Fahrenholtz, PhD, Scottsdale, AZ (*Presenter*) Stockholder, Nano X Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### What to Do When an Incident, or Near Miss, Occurs

#### Participants

Anshuman Panda, PhD, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### Heating and Scan Time Management: Tricks of the Trade

#### Participants

Yuxiang Zhou, PHD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### Safety Assessment of Patients with Active Implants

#### Participants

Maureen Hood, PhD, RN, Bethesda, MD (*Presenter*) In-kind support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

### Heating and Scan Time Management: Tricks of the Trade

#### Participants

Scott Reeder, MD, PhD, Madison, WI (*Presenter*) Owner, Calimetrix; Owner, Reveal Pharmaceuticals; Owner, Celectar Biosciences, Inc; Owner, Elucent Medical; Owner, HeartVista, Inc;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R3-RCP23

**Moderator**

### **Participants**

Samuel Fahrenholtz, PhD, Scottsdale, AZ (*Moderator*) Stockholder, Nano X Imaging

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R3-RCP23

### What to Do When an Incident, or Near Miss, Occurs

#### Participants

Andrew Bowman, MD, PhD, Jacksonville, FL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify safety issues related to active implants. 2) Describe strategies to meet implant scanning requirements. 3) Review considerations for scanning off-label. 4) Understand actions to take when a safety incident occurs.\*Course Description Description of Program: A unique challenge to MR safety is the logistics of managing patients with active implants due to the diversity of device safety labeling and large number of requested exams. In this session, there are four talks presenting case-based examples of managing patients with active implants. These talks progress from initial screening, to MR scanning protocol modifications, to off-label considerations, to managing safety events.

#### COURSE DESCRIPTION

Description of Program: A unique challenge to MR safety is the logistics of managing patients with active implants due to the diversity of device safety labeling and large number of requested exams. In this session, there are four talks presenting case-based examples of managing patients with active implants. These talks progress from initial screening, to MR scanning protocol modifications, to off-label considerations, to managing safety events.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

### Status of Screening in USA

#### Participants

Murray Rebner, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

### Status of Screening in Australia

#### Participants

Helen Frazer, FRANZCR, MBBS, Fitzroy, Australia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

### Status of Screening in Europe

#### Participants

Rosalind M. Given-Wilson, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To provide an update on breast screening strategies in the US, Canada, Europe and Australia. 2) To be aware how AI, supplement screening and screening with tomosynthesis has been introduced in these countries.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

### Breast Screening Update

#### Sub-Events

##### R4-CBR13 Moderator

###### Participants

Thomas H. Helbich, MD, MBA, Vienna, Austria (*Moderator*) Grant, Siemens AG; Grant, Bracco Group; Grant, Guerbet SA; Grant, Hologic, Inc; Grant, Novomed GmbH

##### R4-CBR13 Status of Screening in Canada

###### Participants

Paula B. Gordon, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc; Stockholder, Volpara Health Technologies Limited; Scientific Advisor, Besins Healthcare SA

##### R4-CBR13 Status of Screening in Australia

###### Participants

Helen Frazer, FRANZCR, MBBS, Fitzroy, Australia (*Presenter*) Nothing to Disclose

##### R4-CBR13 Status of Screening in USA

###### Participants

Murray Rebner, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### R4-CBR13 Status of Screening in Europe

###### Participants

Rosalind M. Given-Wilson, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To provide an update on breast screening strategies in the US, Canada, Europe and Australia. 2) To be aware how AI, supplement screening and screening with tomosynthesis has been introduced in these countries.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

**Moderator**

### **Participants**

Thomas H. Helbich, MD, MBA, Vienna, Austria (*Moderator*) Grant, Siemens AG; Grant, Bracco Group; Grant, Guerbet SA; Grant, Hologic, Inc; Grant, Novomed GmbH

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CBR13

### Status of Screening in Canada

#### Participants

Paula B. Gordon, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc; Stockholder, Volpara Health Technologies Limited; Scientific Advisor, Besins Healthcare SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CCA02

**Moderator**

### Participants

Phillip Young, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CCA02

### TMVR: MAC, Rings and Other Things

#### Participants

Jonathon Leipsic, MD, Vancouver, BC (*Presenter*) Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc; Speakers Bureau, General Electric Company; Research Grant, Edwards Lifesciences Corporation; Research Grant, Medtronic plc; Research Grant, Abbott Laboratories; Research Grant, Boston Scientific Corporation; Research Grant, PI-Cardia Ltd

#### LEARNING OBJECTIVES

1) To become familiar with the more common structural heart interventions and the role of CT in pre-procedural planning. 2) To understand potential complications of these interventions and the role of imaging in post-procedural care.\*Course Description Several speakers will review current state-of-the-art imaging for procedural planning and followup. Radiologists should come out with a better understanding of how to support this rapidly growing field.

#### COURSE DESCRIPTION

Several speakers will review current state-of-the-art imaging for procedural planning and followup. Radiologists should come out with a better understanding of how to support this rapidly growing field.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CCA02

### Plugs Baskets: Imaging for LAA Closure

#### Participants

Monika Radike, MD, PhD, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CCA02

### When Things Go Sideways: TAVR and Beyond

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CCA02

**Moderator**

### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CCA02

### Cardiac Transcatheter Intervention: The Whole Journey from Planning to Fixing it

#### Sub-Events

##### R4-CCA02 Moderator

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

##### R4-CCA02 TMVR: MAC, Rings and Other Things

#### Participants

Jonathon Leipsic, MD, Vancouver, BC (*Presenter*) Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc; Speakers Bureau, General Electric Company; Research Grant, Edwards Lifesciences Corporation; Research Grant, Medtronic plc; Research Grant, Abbott Laboratories; Research Grant, Boston Scientific Corporation; Research Grant, PI-Cardia Ltd

#### LEARNING OBJECTIVES

1) To become familiar with the more common structural heart interventions and the role of CT in pre-procedural planning. 2) To understand potential complications of these interventions and the role of imaging in post-procedural care.\*Course Description Several speakers will review current state-of-the-art imaging for procedural planning and followup. Radiologists should come out with a better understanding of how to support this rapidly growing field.

#### COURSE DESCRIPTION

Several speakers will review current state-of-the-art imaging for procedural planning and followup. Radiologists should come out with a better understanding of how to support this rapidly growing field.

##### R4-CCA02 Plugs Baskets: Imaging for LAA Closure

#### Participants

Monika Radike, MD, PhD, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

##### R4-CCA02 When Things Go Sideways: TAVR and Beyond

#### Participants

Prabhakar Rajiah, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

##### R4-CCA02 Moderator

#### Participants

Phillip Young, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CER17

**Moderator**

### Participants

Laura L. Avery, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CER17

**Hold My Beer and Watch This: High Force Trauma to the Spine and Pelvis**

### Participants

Laura L. Avery, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CER17

### Should Have Taken an Uber: MVC Chest and Aortic Trauma

#### Participants

Ashwin V. Asrani, MD, Short Hills, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CER17

**It's Not How Fast You Go- it's How Quickly You Stop: MVC Abdominal Trauma**

### Participants

Polina Kanj, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CER17

### Brought a Knife to a Gun Fight: Gunshot Injuries

#### Participants

Noah Ditkofsky, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CER17

### Scary Stories Told in the Dark: Nightmare on Night Float - Trauma Cases

#### LEARNING OBJECTIVES

1) Learners will improve time to recognition of traumatic diagnoses, helping to establish dominance over the trauma team. 2) Learners will gain confidence with tricky trauma diagnoses decreasing the learner's fight-or-flight response to trauma cases. 3) Learners will enjoy entertaining trauma cases, never let the truth get in the way of a good story.\*Course Description As your grandmother said, "Nothing good happens after midnight, the only thing open is the 7-11 and trouble". Unfortunately, you are on the receiving end of bad choices resulting in full-body CT scans. Spend an hour reviewing rapid-fire trauma cases with an emphasis on tricky traumatic injuries.

#### COURSE DESCRIPTION

As your grandmother said, "Nothing good happens after midnight, the only thing open is the 7-11 and trouble". Unfortunately, you are on the receiving end of bad choices resulting in full-body CT scans. Spend an hour reviewing rapid-fire trauma cases with an emphasis on tricky traumatic injuries.

#### Sub-Events

##### **R4-CER17 Moderator**

Participants

Laura L. Avery, MD, Boston, MA (*Moderator*) Nothing to Disclose

##### **R4-CER17 Hold My Beer and Watch This: High Force Trauma to the Spine and Pelvis**

Participants

Laura L. Avery, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **R4-CER17 Should Have Taken an Uber: MVC Chest and Aortic Trauma**

Participants

Ashwin V. Asrani, MD, Short Hills, NJ (*Presenter*) Nothing to Disclose

##### **R4-CER17 It's Not How Fast You Go- it's How Quickly You Stop: MVC Abdominal Trauma**

Participants

Polina Kanj, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **R4-CER17 Brought a Knife to a Gun Fight: Gunshot Injuries**

Participants

Noah Ditkofsky, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CGI13

### Colorectal Imaging

#### LEARNING OBJECTIVES

1) Explain the disparities in colorectal cancer screening and how CT Colonography can be used to improve health equity. 2) Provide best practices for state-of-the-art CTC technique. 3) Understand MRI staging and reporting of rectal cancer and evaluation following neoadjuvant treatment.\*Course Description The drivers of disparities in colorectal cancer screening and treatment are based in the social determinants of health. Current state-of-the art CT Colonography technique will be provided and we will describe how CTC can positively impact health equity. Additionally, the use of MR for accurate rectal cancer staging and efficient reporting will be included as well as a review of MR findings following neoadjuvant therapy.

#### COURSE DESCRIPTION

The drivers of disparities in colorectal cancer screening and treatment are based in the social determinants of health. Current state-of-the art CT Colonography technique will be provided and we will describe how CTC can positively impact health equity. Additionally, the use of MR for accurate rectal cancer staging and efficient reporting will be included as well as a review of MR findings following neoadjuvant therapy.

#### Sub-Events

##### **R4-CGI13 Moderator**

Participants

Judy Yee, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

##### **R4-CGI13 Colorectal Cancer Screening and Using CT Colonography to Improve Health Equity**

Participants

Judy Yee, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

##### **R4-CGI13 Optimizing CT Colonography Technique**

Participants

Kevin Chang, MD, (*Presenter*) Speaker, RELX;Speaker, Koninklijke Philips NV

##### **R4-CGI13 Rectal Cancer MRI Staging and Reporting**

Participants

Kartik S. Jhaveri, MD, FRCPC, Mississauga, ON (*Presenter*) Research Grant, General Electric Company;Research Grant, Bayer AG;Research Consultant, Perspectum Diagnostics Ltd;

##### **R4-CGI13 Rectal MRI Evaluation after Neoadjuvant Therapy**

Participants

Natally Horvat, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CGI13

**Moderator**

### Participants

Judy Yee, MD, New York, NY (*Moderator*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CGI13

### Colorectal Cancer Screening and Using CT Colonography to Improve Health Equity

#### Participants

Judy Yee, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CGI13

### Optimizing CT Colonography Technique

#### Participants

Kevin Chang, MD, (*Presenter*) Speaker, RELX; Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CGI13

### Rectal Cancer MRI Staging and Reporting

#### Participants

Kartik S. Jhaveri, MD, FRCPC, Mississauga, ON (*Presenter*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Consultant, Perspectum Diagnostics Ltd;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CGI13

### Rectal MRI Evaluation after Neoadjuvant Therapy

#### Participants

Natally Horvat, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

### Regulating AI in Africa - Should the Regulations be Difficult or Different?

#### Participants

Hugh Harvey, MBBS, MD, London, United Kingdom (*Presenter*) Advisor, Segmed.ai; Advisor, AlgoMedica, Inc; Advisor, Regulatory Agency; Consultant, Qure.ai; Managing Director, Hardian Health

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

**Moderator**

### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

### Reverse Innovation: an Overview of AI in LMICs

#### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

**Big Data: This Time for Africa**

### Participants

Udunna Anazodo, PhD, London, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

### The Challenges in Implementing an AI Product

#### Participants

Khan Siddiqui, MD, (*Presenter*) Officer, Hyperfine Research, Inc; Founder and Chairman, IntellixAI, Inc (DBA "HOPPR"); Founder and CMO, Higi SH Holdings, Inc; Stockholder, Lunit Inc; Advisory Board, Lunit Inc; Stockholder, Inference Analytics, Inc; Advisory Board, Inference Analytics, Inc; Stockholder, mHealthCoach, Inc; Advisory Board, mHealthCoach, Inc; Stockholder, KalMed, Inc; Advisory Board, KalMed, Inc; Advisory Board, Pier88health, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

### Keeping Radiologists in the Loop with AI

#### Participants

Farouk Dako, MD, MPH, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIN22

### Algorithms Without Borders

#### LEARNING OBJECTIVES

1) Understand the use cases for AI in LMICs. 2) Appreciate the opportunities and challenges of implementing an AI product. 3) Appreciate the importance of big data in Africa. 4) Appreciate the role of radiologists in facilitating the adoption of AI in LMICs.\*Course Description In LMICs, where there's a shortage of radiologists, AI algorithms improves access to imaging. Thus, AI is an equity promoting technology and its widespread use in LMICs is an example of reverse innovation. The state of AI in LMICs is discussed. The implications of reverse innovation for AI in the American market are analyzed.

#### COURSE DESCRIPTION

In LMICs, where there's a shortage of radiologists, AI algorithms improves access to imaging. Thus, AI is an equity promoting technology and its widespread use in LMICs is an example of reverse innovation. The state of AI in LMICs is discussed. The implications of reverse innovation for AI in the American market are analyzed.

#### Sub-Events

##### R4-CIN22 Moderator

Participants  
Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### R4-CIN22 Reverse Innovation: an Overview of AI in LMICs

Participants  
Saurabh Jha, MRCS, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### R4-CIN22 Big Data: This Time for Africa

Participants  
Udunna Anazodo, PhD, London, ON (*Presenter*) Nothing to Disclose

##### R4-CIN22 The Challenges in Implementing an AI Product

Participants  
Khan Siddiqui, MD, (*Presenter*) Officer, Hyperfine Research, Inc; Founder and Chairman, IntellixAI, Inc (DBA "HOPPR"); Founder and CMO, High SH Holdings, Inc; Stockholder, Lunit Inc; Advisory Board, Lunit Inc; Stockholder, Inference Analytics, Inc; Advisory Board, Inference Analytics, Inc; Stockholder, mHealthCoach, Inc; Advisory Board, mHealthCoach, Inc; Stockholder, KalMed, Inc; Advisory Board, KalMed, Inc; Advisory Board, Pier88health, Inc

##### R4-CIN22 Keeping Radiologists in the Loop with AI

Participants  
Farouk Dako, MD, MPH, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### R4-CIN22 Regulating AI in Africa - Should the Regulations be Difficult or Different?

Participants  
Hugh Harvey, MBBS, MD, London, United Kingdom (*Presenter*) Advisor, Segmed.ai; Advisor, AlgoMedica, Inc; Advisor, Regulatory Agency; Consultant, Qure.ai; Managing Director, Hardian Health

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CIR03

### GI Interventions and Enteric Access

#### Participants

Joao G. Amaral, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

### Urological Interventions

#### Participants

Alex Barnacle, BMBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

### Vascular Malformations

#### Participants

Clifford R. Weiss, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG;Consultant, Siemens AG;Research Grant, Boston Scientific Corporation;Consultant, Boston Scientific Corporation;Research Grant, Medtronic plc;Consultant, Medtronic plc;Research Grant, Guerbet SA;Consultant, Guerbet SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

### Interventional Oncology

#### Participants

Michael Temple, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

### MSK Interventions

#### Participants

Shankar Rajeswaran, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

**Moderator**

### Participants

Joao G. Amaral, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CIR03

### Advanced Pediatric Interventions

#### LEARNING OBJECTIVES

1) Recognize pediatric pathologies that can be treated with Interventional Radiology. 2) Learn some pediatric techniques in Genitourinary, MSK, Oncologic, Gastrointestinal, Vascular Malformations, and Vascular Access interventions that differ from Adult Interventional Radiology. 3) Learn some tips and tricks on Pediatric Interventional Radiology.\*Course Description Advanced Pediatric Interventions is a course for the Adult Interventional Radiologist that is familiar with interventional techniques but has limited experience with pediatric patients, and for the General and/ or Pediatric Radiologist who performs some procedures in children but would like to expand their practice. This course will consist of a series of lectures given by experts on the field. It will showcase a broad spectrum of common pediatric procedures, including Genitourinary, MSK, Oncologic, Gastrointestinal, Vascular Malformations and Vascular Access interventions. Of particular importance is the fact that, although similar in many aspects, Pediatric Interventional Radiology techniques have several subtle differences in comparison to Adult Interventional Radiology. These include the type of disease, the longer life expectancy, the proper clinical management and the appropriate material/ device to be used in children. Lecturers will focus on pediatric indications and how these procedures may differ from adult interventions. There will be an opportunity for some questions and brief discussion at the end of each lecture. Attendees will be able to learn some tips and tricks and refine their knowledge in Pediatric Interventional Radiology.

#### COURSE DESCRIPTION

Advanced Pediatric Interventions is a course for the Adult Interventional Radiologist that is familiar with interventional techniques but has limited experience with pediatric patients, and for the General and/ or Pediatric Radiologist who performs some procedures in children but would like to expand their practice. This course will consist of a series of lectures given by experts on the field. It will showcase a broad spectrum of common pediatric procedures, including Genitourinary, MSK, Oncologic, Gastrointestinal, Vascular Malformations and Vascular Access interventions. Of particular importance is the fact that, although similar in many aspects, Pediatric Interventional Radiology techniques have several subtle differences in comparison to Adult Interventional Radiology. These include the type of disease, the longer life expectancy, the proper clinical management and the appropriate material/ device to be used in children. Lecturers will focus on pediatric indications and how these procedures may differ from adult interventions. There will be an opportunity for some questions and brief discussion at the end of each lecture. Attendees will be able to learn some tips and tricks and refine their knowledge in Pediatric Interventional Radiology.

#### Sub-Events

##### R4-CIR03 Moderator

Participants  
Joao G. Amaral, MD, (*Moderator*) Nothing to Disclose

##### R4-CIR03 GI Interventions and Enteric Access

Participants  
Joao G. Amaral, MD, (*Presenter*) Nothing to Disclose

##### R4-CIR03 Urological Interventions

Participants  
Alex Barnacle, BMBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

##### R4-CIR03 Vascular Malformations

Participants  
Clifford R. Weiss, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; Consultant, Siemens AG; Research Grant, Boston Scientific Corporation; Consultant, Boston Scientific Corporation; Research Grant, Medtronic plc; Consultant, Medtronic plc; Research Grant, Guerbet SA; Consultant, Guerbet SA

##### R4-CIR03 Interventional Oncology

Participants  
Michael Temple, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### R4-CIR03 MSK Interventions

Participants  
Shankar Rajeswaran, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### R4-CIR03 Venous Access

Participants  
Sheena Pimpalwar, Houston, TX (*Presenter*) Nothing to Disclose

Brian L. Han, MD, MS, Dallas, Usa (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CIR03

### Venous Access

#### Participants

Sheena Pimpalwar, Houston, TX (*Presenter*) Nothing to Disclose  
Brian L. Han, MD, MS, Dallas, Usa (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

**Moderator**

### **Participants**

Darryl Sneag, MD, Plainview, NY (*Moderator*) Researcher, General Electric Company; Researcher, Siemens AG; Research support, AMAG Pharmaceuticals, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Role of Whole-Body MRI in Peripheral Nerve Tumor Syndromes

#### Participants

Shivani Ahlawat, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain strategies to improve diagnostic image quality in qualitative and quantitative MR neurography. 2) Identify the role of whole-body MRI in peripheral nerve tumor assessment. 3) Appreciate the role of high-resolution ultrasound for diagnostic and therapeutic management of peripheral neuropathies.\*Course Description Imaging plays an increasingly important role in the diagnostic and therapeutic management of peripheral neuropathies. This educational program, in the form of lectures and question/answer sessions and geared towards both clinical radiologists and researchers, will focus on the latest ultrasound and MRI techniques for peripheral nerve evaluation. Emerging research topics, in particular use of quantitative diffusion MRI for evaluation of muscle denervation, will be presented. At the program's conclusion, attendees will gain a deeper appreciation of the role of both imaging modalities in clinical and research practice.

#### COURSE DESCRIPTION

Imaging plays an increasingly important role in the diagnostic and therapeutic management of peripheral neuropathies. This educational program, in the form of lectures and question/answer sessions and geared towards both clinical radiologists and researchers, will focus on the latest ultrasound and MRI techniques for peripheral nerve evaluation. Emerging research topics, in particular use of quantitative diffusion MRI for evaluation of muscle denervation, will be presented. At the program's conclusion, attendees will gain a deeper appreciation of the role of both imaging modalities in clinical and research practice.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Ultra High-Resolution Peripheral Nerve Ultrasound

#### Participants

Swati Deshmukh, MD, East Lyme, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Advances in Quantitative MR Neurography and Muscle Denervation Imaging

#### Participants

Ek Tsoon Tan, PhD, New York, NY (*Presenter*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Medtronic Inc Research Grant, AMAG Pharmaceuticals

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Ultrasound-Guided Perineural Injections

#### Participants

Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Nerve Imaging: Latest Perspectives and Advances

#### Sub-Events

#### R4-CMK07 Moderator

##### Participants

Darryl Sneag, MD, Plainview, NY (*Moderator*) Researcher, General Electric Company; Researcher, Siemens AG; Research support, AMAG Pharmaceuticals, Inc

#### R4-CMK07 Role of Whole-Body MRI in Peripheral Nerve Tumor Syndromes

##### Participants

Shivani Ahlawat, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain strategies to improve diagnostic image quality in qualitative and quantitative MR neurography. 2) Identify the role of whole-body MRI in peripheral nerve tumor assessment. 3) Appreciate the role of high-resolution ultrasound for diagnostic and therapeutic management of peripheral neuropathies.\*Course Description Imaging plays an increasingly important role in the diagnostic and therapeutic management of peripheral neuropathies. This educational program, in the form of lectures and question/answer sessions and geared towards both clinical radiologists and researchers, will focus on the latest ultrasound and MRI techniques for peripheral nerve evaluation. Emerging research topics, in particular use of quantitative diffusion MRI for evaluation of muscle denervation, will be presented. At the program's conclusion, attendees will gain a deeper appreciation of the role of both imaging modalities in clinical and research practice.

#### COURSE DESCRIPTION

Imaging plays an increasingly important role in the diagnostic and therapeutic management of peripheral neuropathies. This educational program, in the form of lectures and question/answer sessions and geared towards both clinical radiologists and researchers, will focus on the latest ultrasound and MRI techniques for peripheral nerve evaluation. Emerging research topics, in particular use of quantitative diffusion MRI for evaluation of muscle denervation, will be presented. At the program's conclusion, attendees will gain a deeper appreciation of the role of both imaging modalities in clinical and research practice.

#### R4-CMK07 Ultra High-Resolution Peripheral Nerve Ultrasound

##### Participants

Swati Deshmukh, MD, East Lyme, CT (*Presenter*) Nothing to Disclose

#### R4-CMK07 Advances in Quantitative MR Neurography and Muscle Denervation Imaging

##### Participants

Ek Tsoon Tan, PhD, New York, NY (*Presenter*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Medtronic Inc Research Grant, AMAG Pharmaceuticals

#### R4-CMK07 Ultrasound-Guided Perineural Injections

##### Participants

Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

#### R4-CMK07 Advances in Qualitative MR Neurography

##### Participants

Darryl Sneag, MD, Plainview, NY (*Presenter*) Researcher, General Electric Company; Researcher, Siemens AG; Research support, AMAG Pharmaceuticals, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMK07

### Advances in Qualitative MR Neurography

#### Participants

Darryl Sneag, MD, Plainview, NY (*Presenter*) Researcher, General Electric Company; Researcher, Siemens AG; Research support, AMAG Pharmaceuticals, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CMS07

### Pitfalls and Mimics in Oncologic Imaging

#### LEARNING OBJECTIVES

1) Identify various pitfalls in Oncological imaging that can lead to erroneous diagnoses. 2) Describe relevant technical background, pathophysiology, and hemodynamics of these pitfalls. 3) Be familiar with various clues to reach a specific diagnosis.\*Course Description The purpose of this course is to illustrate the various pitfalls, mimics, and atypical features that can lead to inaccurate diagnosis in cancer patients. The content includes relevant pathogenesis and background as well as specific clues that can be used to reach an accurate diagnosis. It is important to avoid pitfalls and misdiagnoses that can alter the management plan. Helpful strategies for avoiding pitfalls include paying close attention to the clinical history of the patient, carefully evaluating all of the available imaging studies, and being aware of the various radiologic mimics.

#### COURSE DESCRIPTION

The purpose of this course is to illustrate the various pitfalls, mimics, and atypical features that can lead to inaccurate diagnosis in cancer patients. The content includes relevant pathogenesis and background as well as specific clues that can be used to reach an accurate diagnosis. It is important to avoid pitfalls and misdiagnoses that can alter the management plan. Helpful strategies for avoiding pitfalls include paying close attention to the clinical history of the patient, carefully evaluating all of the available imaging studies, and being aware of the various radiologic mimics.

#### Sub-Events

##### R4-CMS07 Moderator

Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose

##### R4-CMS07 Tumor Mimics in Abdomen

Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

##### R4-CMS07 Tumor Mimics in Pelvis

Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

##### R4-CMS07 Tumor Mimics in Brain

Participants

John Heymann, MD, Galveston, TX (*Presenter*) Nothing to Disclose

##### R4-CMS07 Tumor Mimics in Thorax

Participants

Cristina Fuss, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMS07

### Tumor Mimics in Brain

#### Participants

John Heymann, MD, Galveston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMS07

**Moderator**

### Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMS07

### Tumor Mimics in Abdomen

#### Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMS07

### Tumor Mimics in Pelvis

#### Participants

Maria Zulfiqar, MD, MBBS, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CMS07

### Tumor Mimics in Thorax

#### Participants

Cristina Fuss, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNPM11

**Moderator**

### Participants

Randy Miles, MD, MPH, Denver, CO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNPM11

### Leveraging Operational Tools and Local Resources to Establish Health Equity in Breast Imaging

#### Participants

Randy Miles, MD, MPH, Denver, CO (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand how to improve operational efficiency through strategies and innovations in breast imaging centers located in resource limited settings. 2) Understand the importance of equity into and inclusion in lung cancer screening. 3) Learn how to leverage Community-Based Participatory Research and community outreach to inform the development of health equity programs focused on improving access to care among Latino/Hispanic communities. 4) Discuss practical methods to incorporate health equity principles radiology care. \*Course Description As a result of participation in this course, radiology practitioners will learn best practices of providing equitable care to diverse patient groups. The course will include practical, high yield, lectures focused on equipping radiology practices with discrete tools and resources to improve health equity and inclusivity in their practice.

#### COURSE DESCRIPTION

As a result of participation in this course, radiology practitioners will learn best practices of providing equitable care to diverse patient groups. The course will include practical, high yield, lectures focused on equipping radiology practices with discrete tools and resources to improve health equity and inclusivity in their practice.

Printed on: 04/12/24





## Abstract Archives of the RSNA, 2023

R4-CNPM11

**Bridging the Gap in Radiology: Strategies to Create an Equitable System for Latino Communities**

### Participants

Efren J. Flores, MD, Boston, MA (*Presenter*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNPM11

### Promoting Health Equity in Radiology: From Theory to Action

#### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNPM11

### Health Equity in Radiology: Clinical Practice (Sponsored by the RSNA Research Development Committee and the RSNA Health Equity Committee)

#### Sub-Events

##### R4-CNPM11 Moderator

###### Participants

Randy Miles, MD, MPH, Denver, CO (*Moderator*) Nothing to Disclose

##### R4-CNPM11 Leveraging Operational Tools and Local Resources to Establish Health Equity in Breast Imaging

###### Participants

Randy Miles, MD, MPH, Denver, CO (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand how to improve operational efficiency through strategies and innovations in breast imaging centers located in resource limited settings. 2) Understand the importance of equity into and inclusion in lung cancer screening. 3) Learn how to leverage Community-Based Participatory Research and community outreach to inform the development of health equity programs focused on improving access to care among Latino/Hispanic communities. 4) Discuss practical methods to incorporate health equity principles radiology care. \*Course Description As a result of participation in this course, radiology practitioners will learn best practices of providing equitable care to diverse patient groups. The course will include practical, high yield, lectures focused on equipping radiology practices with discrete tools and resources to improve health equity and inclusivity in their practice.

#### COURSE DESCRIPTION

As a result of participation in this course, radiology practitioners will learn best practices of providing equitable care to diverse patient groups. The course will include practical, high yield, lectures focused on equipping radiology practices with discrete tools and resources to improve health equity and inclusivity in their practice.

##### R4-CNPM11 Lung Cancer Screening in Historically Underserved Groups: The Time to Act Is Now

###### Participants

Ashley Prosper, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### R4-CNPM11 Bridging the Gap in Radiology: Strategies to Create an Equitable System for Latino Communities

###### Participants

Efren J. Flores, MD, Boston, MA (*Presenter*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

##### R4-CNPM11 Promoting Health Equity in Radiology: From Theory to Action

###### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNPM11

### Lung Cancer Screening in Historically Underserved Groups: The Time to Act Is Now

#### Participants

Ashley Prosper, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNR13

**Moderator**

### Participants

Vinodh A. Kumar, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNR13

### Advanced Imaging of Treated Brain Tumors: A Case-Based Session

#### Participants

Vinodh A. Kumar, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNR13

**Did we get that right? Differentiating Treatment Response from Pseudoresponse and Pseudoprogression**

### Participants

Kiran Talekar, MD, Philadelphia, PA (*Presenter*) Spouse, Employee, GlaxoSmithKline plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNR13

### Glioma Radiogenomics

#### Participants

Rivka R. Colen, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-CNR13

### Consequences and Complications of Treated Pediatric Brain Tumors

#### Participants

Hisham Dahmouh, MD, Redwood City, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CNR13

### The Many Faces of Post-Treatment Adult and Pediatric Brain Tumors

#### LEARNING OBJECTIVES

1) Review the imaging manifestations of treated adult and pediatric brain tumors. 2) Become familiar with the use of radiogenomics in gliomas.\*Course Description The session will review post-treatment brain tumor MR perfusion imaging, glioma pseudoresponse & pseudoprogression, glioma radiogenomics, and post-therapy related complications in pediatric brain tumors. Format: Case-based & Didactic

#### COURSE DESCRIPTION

The session will review post-treatment brain tumor MR perfusion imaging, glioma pseudoresponse & pseudoprogression, glioma radiogenomics, and post-therapy related complications in pediatric brain tumors. Format: Case-based & Didactic

#### Sub-Events

##### **R4-CNR13 Moderator**

Participants

Vinodh A. Kumar, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### **R4-CNR13 Advanced Imaging of Treated Brain Tumors: A Case-Based Session**

Participants

Vinodh A. Kumar, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **R4-CNR13 Did we get that right? Differentiating Treatment Response from Pseudoresponse and Pseudoprogression**

Participants

Kiran Talekar, MD, Philadelphia, PA (*Presenter*) Spouse, Employee, GlaxoSmithKline plc

##### **R4-CNR13 Glioma Radiogenomics**

Participants

Rivka R. Colen, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

##### **R4-CNR13 Consequences and Complications of Treated Pediatric Brain Tumors**

Participants

Hisham Dahmouh, MD, Redwood City, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

### Herding CAT(Scans): When and How to Use IV Contrast

#### Participants

Rajesh Krishnamurthy, MD, Columbus, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

**Appropriate Use of Intravascular Contrast in Children: It Ain't Just Water! (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)**

### LEARNING OBJECTIVES

1) Review different types of contrast media and safety considerations in ultrasound, CT, and MRI, as well as availability, considerations for use, and possible substitutions. 2) Review considerations for implementing contrast-enhanced ultrasound in pediatric practice. 4) Evaluate potential methods to improve sustainability in pediatric radiology practice, including decreasing contrast media utilization.\*Course Description Many diagnostic imaging studies require the use of IV and/or enteric contrast media, however, emerging technologies are decreasing the need in some circumstances. When contrast is necessary, there are different types of contrast, with some better suited for use in certain clinical scenarios. Additionally, there are many important short and long term safety considerations when using contrast media. Finally, contrast media have unique considerations for institutional, regulatory, and supply chain constraints. This course will review important considerations when using contrast media in children for imaging at ultrasound, CT, and MRI, including possible alternatives, safety considerations, and anticipated upcoming advancements.

### COURSE DESCRIPTION

Many diagnostic imaging studies require the use of IV and/or enteric contrast media, however, emerging technologies are decreasing the need in some circumstances. When contrast is necessary, there are different types of contrast, with some better suited for use in certain clinical scenarios. Additionally, there are many important short and long term safety considerations when using contrast media. Finally, contrast media have unique considerations for institutional, regulatory, and supply chain constraints. This course will review important considerations when using contrast media in children for imaging at ultrasound, CT, and MRI, including possible alternatives, safety considerations, and anticipated upcoming advancements.

### Sub-Events

#### R4-CPD12 Moderator

Participants

Judy Squires, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

#### R4-CPD12 Living in a (Micro)Bubble: Building a Program for Contrast-enhanced Ultrasound

Participants

Susan J. Back, MD, Penn Valley, PA (*Presenter*) Nothing to Disclose

#### R4-CPD12 Apple of my (MR)I: Updates in MRI Contrast Media

Participants

Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Presenter*) Research collaboration, General Electric Company;Consultant, Arterys Inc;Advisory Board, HeartVista, Inc

#### R4-CPD12 Waste not, Want not: Working Together to Eliminate Waste in the Radiology Department

Participants

Helen Hye Ryong Kim, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### R4-CPD12 Herding CAT(Scans): When and How to Use IV Contrast

Participants

Rajesh Krishnamurthy, MD, Columbus, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

### Apple of my (MR)I: Updates in MRI Contrast Media

#### Participants

Shreyas S. Vasanaawala, MD, PhD, Palo Alto, CA (*Presenter*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Advisory Board, HeartVista, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

**Waste not, Want not: Working Together to Eliminate Waste in the Radiology Department**

### Participants

Helen Hye Ryong Kim, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

**Moderator**

### Participants

Judy Squires, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-CPD12

**Living in a (Micro)Bubble: Building a Program for Contrast-enhanced Ultrasound**

### Participants

Susan J. Back, MD, Penn Valley, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-RCP25

**Moderator**

### Participants

Samuel G. Armato III, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-RCP25

**Moderator**

### Participants

Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-RCP25

### Data Collection and Use in AI for Medical Imaging

#### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-RCP25

### Clinical Acceptance of AI in Radiology

#### Participants

Berkman Sahiner, PhD, Silver Spring, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-RCP25

### Clinical Translation of AI in Radiology

#### Participants

Ronald Summers, MD, PhD, Potomac, MD (*Presenter*) Royalties, iCAD, Inc; Royalties, Koninklijke Philips NV; Royalties, ScanMed, LLC; Royalties, Ping An Insurance (Group) Company of China, Ltd; Royalties, Translation Holdings; Research support, Ping An Insurance (Group) Company of China, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-RCP25

### From Bench to Bedside: Practical Considerations for AI in Medical Imaging

#### LEARNING OBJECTIVES

1) Understand the importance of data (in terms of sources, demographic distributions, and ethical uses) for training CAD-AI systems in a manner that promotes generalizability. 2) Describe the role of clinical acceptance testing from the perspectives of generalizability, efficiency in a clinical workflow, output explainability, and performance stability over time. 3) Identify practical considerations for the translation of CAD-AI tools to the clinic, including the human-machine interface, user training, and prospective surveillance.\*Course Description Rapid advances in artificial intelligence (AI) and machine learning (specifically, deep learning techniques) have enabled broad application of these methods in healthcare. The promise of deep-learning has promoted further interest in computer-aided diagnosis (CAD) development and applications using both "traditional" machine learning and newer deep-learning-based approaches; this expanded clinical decision support environment is referred to as "CAD-AI." It is of paramount importance to ensure that a clinical decision support tool undergoes proper training and rigorous validation of its generalizability and robustness before adoption for patient care. A task group of the American Association of Physicists in Medicine (AAPM) developed recommendations on practices and standards for the development and performance assessment of decision support systems in a CAD-AI environment. With CAD applications expanding to new stages of the patient care process, this educational session will explore the broader issues common to the development of CAD-AI applications and their translation from the bench to the clinic. The goal of this lecture-based session (followed by discussion) is to bring attention to the proper training and validation of machine learning algorithms that may improve their generalizability and reliability, thus accelerating the adoption of CAD-AI systems for clinical decision support.

#### COURSE DESCRIPTION

Rapid advances in artificial intelligence (AI) and machine learning (specifically, deep learning techniques) have enabled broad application of these methods in healthcare. The promise of deep-learning has promoted further interest in computer-aided diagnosis (CAD) development and applications using both "traditional" machine learning and newer deep-learning-based approaches; this expanded clinical decision support environment is referred to as "CAD-AI." It is of paramount importance to ensure that a clinical decision support tool undergoes proper training and rigorous validation of its generalizability and robustness before adoption for patient care. A task group of the American Association of Physicists in Medicine (AAPM) developed recommendations on practices and standards for the development and performance assessment of decision support systems in a CAD-AI environment. With CAD applications expanding to new stages of the patient care process, this educational session will explore the broader issues common to the development of CAD-AI applications and their translation from the bench to the clinic. The goal of this lecture-based session (followed by discussion) is to bring attention to the proper training and validation of machine learning algorithms that may improve their generalizability and reliability, thus accelerating the adoption of CAD-AI systems for clinical decision support.

#### Sub-Events

##### R4-RCP25 Moderator

Participants  
Samuel G. Armato III, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

##### R4-RCP25 Moderator

Participants  
Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

##### R4-RCP25 Data Collection and Use in AI for Medical Imaging

Participants  
Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

##### R4-RCP25 Clinical Acceptance of AI in Radiology

Participants  
Berkman Sahiner, PhD, Silver Spring, MD (*Presenter*) Nothing to Disclose

##### R4-RCP25 Clinical Translation of AI in Radiology

Participants  
Ronald Summers, MD, PhD, Potomac, MD (*Presenter*) Royalties, iCAD, Inc; Royalties, Koninklijke Philips NV; Royalties, ScanMed, LLC; Royalties, Ping An Insurance (Group) Company of China, Ltd; Royalties, Translation Holdings; Research support, Ping An Insurance (Group) Company of China, Ltd

## Abstract Archives of the RSNA, 2023

R6-CCH11

**Moderator**

### Participants

Mylene T. Truong, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CCH11

### Post Radiation Imaging in NSCLC

#### Participants

Jane P. Ko, MD, New York, NY (*Presenter*) Research collaboration, Siemens AG

#### LEARNING OBJECTIVES

1) Review the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies, and rare tumors. 2) Discuss the imaging of lung cancer following radiation therapy.\*Course Description This session includes lectures pertaining to the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies and rare tumors. In addition, the spectrum of imaging manifestations following radiation therapy for lung cancer will also be addressed.

#### COURSE DESCRIPTION

This session includes lectures pertaining to the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies and rare tumors. In addition, the spectrum of imaging manifestations following radiation therapy for lung cancer will also be addressed.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R6-CCH11

### Carcinoid and DIPNECH

#### Participants

Kristopher W. Cummings, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

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## Abstract Archives of the RSNA, 2023

R6-CCH11

### Rare Tumors of the Thorax

#### Participants

John Lichtenberger III, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CCH11

### Issues in Thoracic Malignancy

#### Sub-Events

##### **R6-CCH11 Moderator**

#### Participants

Mylene T. Truong, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### **R6-CCH11 Post Radiation Imaging in NSCLC**

#### Participants

Jane P. Ko, MD, New York, NY (*Presenter*) Research collaboration, Siemens AG

#### LEARNING OBJECTIVES

1) Review the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies, and rare tumors. 2) Discuss the imaging of lung cancer following radiation therapy.\*Course Description This session includes lectures pertaining to the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies and rare tumors. In addition, the spectrum of imaging manifestations following radiation therapy for lung cancer will also be addressed.

#### COURSE DESCRIPTION

This session includes lectures pertaining to the imaging evaluation of thoracic malignancies, including neuroendocrine carcinoma, thymic malignancies and rare tumors. In addition, the spectrum of imaging manifestations following radiation therapy for lung cancer will also be addressed.

##### **R6-CCH11 Carcinoid and DIPNECH**

#### Participants

Kristopher W. Cummings, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### **R6-CCH11 Thymoma Update**

#### Participants

Edith Marom, MD, Tel Aviv, Israel (*Presenter*) Speaker, Boehringer Ingelheim GmbH;Speaker, Merck & Co, Inc;Speaker, AstraZeneca PLC

##### **R6-CCH11 Rare Tumors of the Thorax**

#### Participants

John Lichtenberger III, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### LEARNING OBJECTIVES

1) Recognize typical and atypical entities that occur within the head and neck. 2) Differentiate between common head and neck pathologies from relevant mimics. \*Course Description In this case-based head and neck imaging session, attendees will be presented with classic, unusual and diagnostic dilemma cases within the head and neck as selected by the experts. Speakers will emphasize pearls for differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

#### COURSE DESCRIPTION

In this case-based head and neck imaging session, attendees will be presented with classic, unusual and diagnostic dilemma cases within the head and neck as selected by the experts. Speakers will emphasize pearls for differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

#### Sub-Events

##### R6-CHN07 Moderator

Participants  
Tanya Rath, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

##### R6-CHN07 Best Head and Neck Cases of 2023 From the Experts

Participants  
Deborah Shatzkes, MD, Asbury Park, NJ (*Presenter*) Nothing to Disclose

##### R6-CHN07 Best Head and Neck Cases of 2023 From the Experts

Participants  
C. Douglas Phillips, MD, Asbury Park, NJ (*Presenter*) Nothing to Disclose

##### R6-CHN07 Best Head and Neck Cases of 2023 From the Experts

Participants  
Philip Chapman, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### R6-CHN07 Best Head and Neck Cases of 2023 From the Experts

Participants  
William T. O'Brien Sr, DO, Orlando, FL (*Presenter*) Nothing to Disclose

##### R6-CHN07 Best Head and Neck Cases of 2023 From the Experts

Participants  
Ilona Schmalfluss, MD, Gainesville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### Participants

Deborah Shatzkes, MD, Asbury Park, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### Participants

C. Douglas Phillips, MD, Asbury Park, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### Participants

Philip Chapman, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### Participants

William T. O'Brien Sr, DO, Orlando, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

**Moderator**

### Participants

Tanya Rath, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CHN07

### Best Head and Neck Cases of 2023 From the Experts

#### Participants

Ilona Schmalfluss, MD, Gainesville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CIN04

### Custom Toolbars to Collect Structured Data at the Point of Care for Radiologist Dictations

#### Participants

Gregory M. Grimaldi, MD, Larchmont, NY (*Presenter*) Nothing to Disclose

David S. Hirschorn, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CIN04

### Informatics Tools for QI

#### Sub-Events

##### **R6-CIN04 Moderator**

###### Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Moderator*) Nothing to Disclose

##### **R6-CIN04 Custom Web Applications for Quality and Workflow Optimizations**

###### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

##### **R6-CIN04 NLP Pipelines to Collect and Analyze Patient Feedback, Assess Report Quality and Practice Patterns**

###### Participants

Imon Banerjee, PhD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### **R6-CIN04 Flexible Process for Developing Custom Report Classifiers to Organize Radiology and Pathology Reports for Downstream QA and Operational Workflows**

###### Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

##### **R6-CIN04 Custom Toolbars to Collect Structured Data at the Point of Care for Radiologist Dictations**

###### Participants

Gregory M. Grimaldi, MD, Larchmont, NY (*Presenter*) Nothing to Disclose  
David S. Hirschorn, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CIN04

**NLP Pipelines to Collect and Analyze Patient Feedback, Assess Report Quality and Practice Patterns**

### Participants

Imon Banerjee, PhD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CIN04

**Flexible Process for Developing Custom Report Classifiers to Organize Radiology and Pathology Reports for Downstream QA and Operational Workflows**

### Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CIN04

**Moderator**

### Participants

Thomas Loehfelm, MD, PhD, Sacramento, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R6-CIN04

### Custom Web Applications for Quality and Workflow Optimizations

#### Participants

Ross Filice, MD, Washington, DC (*Presenter*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

**Moderator**

### **Participants**

Jonathon Leipsic, MD, Vancouver, BC (*Moderator*) Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc; Speakers Bureau, General Electric Company; Research Grant, Edwards Lifesciences Corporation; Research Grant, Medtronic plc; Research Grant, Abbott Laboratories; Research Grant, Boston Scientific Corporation; Research Grant, PI-Cardia Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

**Moderator**

### Participants

Jeremy D. Collins, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

### Vascular Access Needs for TAVR

#### Participants

Jeremy D. Collins, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

### Vascular Access Needs for Transcatheter Mitral and Tricuspid Valve Interventions

#### Participants

Amar B. Shah, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

### **Multi-Modal Imaging Guidance to Enable Minimally Invasive Surgeries and Percutaneous Structural Heart Interventions**

#### **Participants**

Dianna Bardo, MD, Chicago, IL (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; License agreement, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc; Research support, Bracco Group; Consultant, Guerbet SA; Consultant, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

**Vascular Access for Transcatheter Procedures and Minimally Invasive Surgery: Surgical Perspective**

### Participants

Jennifer Chung, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R6-CVA02

### Vascular Access Imaging for Structural Heart Practices

#### Sub-Events

##### R6-CVA02 Moderator

###### Participants

Jonathon Leipsic, MD, Vancouver, BC (*Moderator*) Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc; Speakers Bureau, General Electric Company; Research Grant, Edwards Lifesciences Corporation; Research Grant, Medtronic plc; Research Grant, Abbott Laboratories; Research Grant, Boston Scientific Corporation; Research Grant, PI-Cardia Ltd

##### R6-CVA02 Moderator

###### Participants

Jeremy D. Collins, MD, Rochester, MN (*Moderator*) Nothing to Disclose

##### R6-CVA02 Vascular Access Needs for TAVR

###### Participants

Jeremy D. Collins, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### R6-CVA02 Vascular Access Needs for Transcatheter Mitral and Tricuspid Valve Interventions

###### Participants

Amar B. Shah, MD, New York, NY (*Presenter*) Nothing to Disclose

##### R6-CVA02 Multi-Modal Imaging Guidance to Enable Minimally Invasive Surgeries and Percutaneous Structural Heart Interventions

###### Participants

Dianna Bardo, MD, Chicago, IL (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; License agreement, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc; Research support, Bracco Group; Consultant, Guerbet SA; Consultant, RELX

##### R6-CVA02 Vascular Access for Transcatheter Procedures and Minimally Invasive Surgery: Surgical Perspective

###### Participants

Jennifer Chung, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CBR14

**Moderator**

### Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CBR14

### How to Improve Reimbursement and Overall Profitability of your Practice

#### Participants

Dana Smetherman, MPH, New Orleans, LA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CBR14

### How to Achieve Staff Retention and Make Physicians Happy

#### Participants

Vilert A. Loving, MD, MMM, Gilbert, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CBR14

### Practice Issues Post Pandemic and Remote Reading

#### Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CBR14

### Practice Issues and Reimbursement Improvement

#### LEARNING OBJECTIVES

1) Identify & describe strategies to improve reimbursement & overall profitability of your practice in the fragmented US healthcare payer landscape. 2) Understand the sources of practice dissatisfaction/burnout & explain strategies for staff engagement/retention. 3) Discuss Post-Pandemic practice issues & how to implement changes to overcome a reduced workforce.\*Course Description This session will focus on the unique ways to improve practice issues and profitability, including methods to achieve staff retention, in the Post-Pandemic era. The course is applicable to radiologists and technologists of all career levels. The educational format of this course is lecture form with discussion.

#### COURSE DESCRIPTION

This session will focus on the unique ways to improve practice issues and profitability, including methods to achieve staff retention, in the Post-Pandemic era. The course is applicable to radiologists and technologists of all career levels. The educational format of this course is lecture form with discussion.

#### Sub-Events

##### **R7-CBR14 Moderator**

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Moderator*) Nothing to Disclose

##### **R7-CBR14 How to Improve Reimbursement and Overall Profitability of your Practice**

Participants

Dana Smetherman, MPH, New Orleans, LA (*Presenter*) Nothing to Disclose

##### **R7-CBR14 How to Achieve Staff Retention and Make Physicians Happy**

Participants

Vilert A. Loving, MD, MMM, Gilbert, AZ (*Presenter*) Nothing to Disclose

##### **R7-CBR14 Practice Issues Post Pandemic and Remote Reading**

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCA01

### Cases 21-40 - Valvular Disease

#### Participants

Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCA01

**Moderator**

### **Participants**

Liisa Bergmann, MD,MBA, Lexington, KY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCA01

**Moderator**

### Participants

Jean Jeudy JR, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CCA01

**Cases 1-20 - Cardiac Pericardial Masses**

### Participants

Jean Jeudy JR, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCA01

**Cases 41-60 - Congenital Heart Disease**

### Participants

Lauren M. Sena, MD, Jamaica Plain, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCA01

### Cardiac Rapid Fire: 60 Cases in 60 minutes

#### LEARNING OBJECTIVES

1) Interpret and recognize cardiac and pericardial masses through the review of clinical cases and enabling participants to feel more confident in their ability to identify such conditions in their patients. 2) Improve the management of valvular disease by understanding the different imaging techniques used and by gaining a thorough knowledge of the diagnosis and treatment of such diseases. 3) Implement a better understanding of congenital heart disease in clinical scenarios and explain the imaging methods used for the diagnosis, management, and treatment plans for patients with this condition.\*Course Description This advanced course is designed to provide attendees with an extensive review of cardiac imaging, with a particular focus on cardiac CT and cardiac MRI. Through the presentation of clinical cases, participants will be able to better identify and manage the diverse range of cardiovascular issues that they may encounter in their practice. The course is composed of primary topics that aim to explore the problems cardiovascular specialists typically encounter. Attendees will gain a greater understanding of cardiac and pericardial masses, valvular disease, and congenital heart disease. Radiology professionals at all levels of experience are encouraged to participate. This session will be delivered as a rapid-fire case presentation format with summary knowledge review. Attendees will be able to interact with the presenter and ask questions at the end of the session. After completing the course, attendees will be able to apply their enhanced knowledge of cardiac imaging in practical, real-world situations. Join us at #RSNA23 for an engaging and fast-paced educational experience that will enrich your practice and benefit your patients. #CV60in60

#### COURSE DESCRIPTION

This advanced course is designed to provide attendees with an extensive review of cardiac imaging, with a particular focus on cardiac CT and cardiac MRI. Through the presentation of clinical cases, participants will be able to better identify and manage the diverse range of cardiovascular issues that they may encounter in their practice. The course is composed of primary topics that aim to explore the problems cardiovascular specialists typically encounter. Attendees will gain a greater understanding of cardiac and pericardial masses, valvular disease, and congenital heart disease. Radiology professionals at all levels of experience are encouraged to participate. This session will be delivered as a rapid-fire case presentation format with summary knowledge review. Attendees will be able to interact with the presenter and ask questions at the end of the session. After completing the course, attendees will be able to apply their enhanced knowledge of cardiac imaging in practical, real-world situations. Join us at #RSNA23 for an engaging and fast-paced educational experience that will enrich your practice and benefit your patients. #CV60in60

#### Sub-Events

##### R7-CCA01 Moderator

Participants  
Liisa Bergmann, MD, MBA, Lexington, KY (*Moderator*) Nothing to Disclose

##### R7-CCA01 Moderator

Participants  
Jean Jeudy JR, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

##### R7-CCA01 Cases 1-20 - Cardiac Pericardial Masses

Participants  
Jean Jeudy JR, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### R7-CCA01 Cases 41-60 - Congenital Heart Disease

Participants  
Laureen M. Sena, MD, Jamaica Plain, MA (*Presenter*) Nothing to Disclose

##### R7-CCA01 Cases 21-40 - Valvular Disease

Participants  
Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCH12

### Pearls and Pitfalls in Chest Radiography

#### Sub-Events

#### R7-CCH12 Moderator

##### Participants

Gerald F. Abbott, MD, (*Moderator*) Nothing to Disclose

#### R7-CCH12 If These Images Could Talk: Diffuse ILD on Chest Radiography

##### Participants

Andetta R. Hunsaker, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To recognize the various chest radiographic features of diffuse interstitial lung diseases and their respective CT correlates. 2) To recognize the various chest radiographic features of pleural diseases and their respective CT correlates. 3) To learn the normal anatomy demonstrated on lateral chest radiography and recognize imaging abnormalities unique to the lateral view with their respective CT correlations.\*Course Description The chest radiograph is a foundational modality in thoracic imaging that remains one of the most frequently ordered diagnostic studies. It serves an important function in multiple healthcare settings – in emergency departments, intensive care units, outpatient clinics –and in the diagnosis and monitoring of oncologic disease. The effective interpretation of chest radiographs requires experience and a knowledge of radiographic anatomy, imaging signs of disease, and important pitfalls to avoid. This session will feature three case-based lectures presented by experienced thoracic radiologists whose teaching skills will be focused on giving attendees an expanded appreciation and skill in the interpretation of chest radiographs.

#### COURSE DESCRIPTION

The chest radiograph is a foundational modality in thoracic imaging that remains one of the most frequently ordered diagnostic studies. It serves an important function in multiple healthcare settings – in emergency departments, intensive care units, outpatient clinics –and in the diagnosis and monitoring of oncologic disease. The effective interpretation of chest radiographs requires experience and a knowledge of radiographic anatomy, imaging signs of disease, and important pitfalls to avoid. This session will feature three case-based lectures presented by experienced thoracic radiologists whose teaching skills will be focused on giving attendees an expanded appreciation and skill in the interpretation of chest radiographs.

#### R7-CCH12 Imaging of Pleural Disease: Chest Radiography

##### Participants

Gerald F. Abbott, MD, (*Presenter*) Nothing to Disclose

#### R7-CCH12 The Lateral Chest Radiograph: Test Your Knowledge Skills

##### Participants

Mark S. Parker, MD, Richmond, VA (*Presenter*) Co-author, Thieme Medical Publishers, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCH12

**Moderator**

### Participants

Gerald F. Abbott, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCH12

### If These Images Could Talk: Diffuse ILD on Chest Radiography

#### Participants

Andetta R. Hunsaker, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To recognize the various chest radiographic features of diffuse interstitial lung diseases and their respective CT correlates. 2) To recognize the various chest radiographic features of pleural diseases and their respective CT correlates. 3) To learn the normal anatomy demonstrated on lateral chest radiography and recognize imaging abnormalities unique to the lateral view with their respective CT correlations.\*Course Description The chest radiograph is a foundational modality in thoracic imaging that remains one of the most frequently ordered diagnostic studies. It serves an important function in multiple healthcare settings – in emergency departments, intensive care units, outpatient clinics –and in the diagnosis and monitoring of oncologic disease. The effective interpretation of chest radiographs requires experience and a knowledge of radiographic anatomy, imaging signs of disease, and important pitfalls to avoid. This session will feature three case-based lectures presented by experienced thoracic radiologists whose teaching skills will be focused on giving attendees an expanded appreciation and skill in the interpretation of chest radiographs.

#### COURSE DESCRIPTION

The chest radiograph is a foundational modality in thoracic imaging that remains one of the most frequently ordered diagnostic studies. It serves an important function in multiple healthcare settings – in emergency departments, intensive care units, outpatient clinics –and in the diagnosis and monitoring of oncologic disease. The effective interpretation of chest radiographs requires experience and a knowledge of radiographic anatomy, imaging signs of disease, and important pitfalls to avoid. This session will feature three case-based lectures presented by experienced thoracic radiologists whose teaching skills will be focused on giving attendees an expanded appreciation and skill in the interpretation of chest radiographs.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCH12

### Imaging of Pleural Disease: Chest Radiography

#### Participants

Gerald F. Abbott, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CCH12

### The Lateral Chest Radiograph: Test Your Knowledge Skills

#### Participants

Mark S. Parker, MD, Richmond, VA (*Presenter*) Co-author, Thieme Medical Publishers, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CER13

### Disaster Preparedness - Are you Ready for Chaos?

#### LEARNING OBJECTIVES

1) To understand what changes when disaster strikes and (examples of) things to consider to be well prepared. 2) To explore the value provided by your residency and how to embed it in your disaster preparedness plan. 3) To explain the use of exercises for plan development and testing.\*Course Description Disaster can happen at any time and any place to anyone, so your hospital and department and you should be prepared to deal with the consequences of a variety of types of potential disasters in your region. This course will provide insight in how operations may have to change in this setting and how to best include and prepare your personnel for these rare occasions. Your residency is a valuable part and thinking about its role and preparedness is a unique feature that will be highlighted in this session.

#### COURSE DESCRIPTION

Disaster can happen at any time and any place to anyone, so your hospital and department and you should be prepared to deal with the consequences of a variety of types of potential disasters in your region. This course will provide insight in how operations may have to change in this setting and how to best include and prepare your personnel for these rare occasions. Your residency is a valuable part and thinking about its role and preparedness is a unique feature that will be highlighted in this session.

#### Sub-Events

##### **R7-CER13 Moderator**

Participants  
Ferco H. Berger, MD, Toronto, ON (*Moderator*) Nothing to Disclose

##### **R7-CER13 What to Think About to be Prepared**

Participants  
Ronald Bilow, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **R7-CER13 Evaluate and Value Your Residency for Disaster Preparedness**

Participants  
Courtney Orsbon, MD, PhD, Burlington, VT (*Presenter*) Nothing to Disclose

##### **R7-CER13 Reality Check: Using Exercises to be Prepared**

Participants  
Ferco H. Berger, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CER13

**Moderator**

### Participants

Ferco H. Berger, MD, Toronto, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CER13

### What to Think About to be Prepared

#### Participants

Ronald Bilow, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CER13

### Evaluate and Value Your Residency for Disaster Preparedness

#### Participants

Courtney Orsbon, MD,PhD, Burlington, VT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CER13

### Reality Check: Using Exercises to be Prepared

#### Participants

Ferco H. Berger, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CGI14

### GI Transplant Imaging

#### LEARNING OBJECTIVES

1) Review the findings which should be reported in patients undergoing evaluation for potential living donor liver transplant. 2) Describe the findings that may be contraindications for living donor liver transplant. 3) Review the normal appearance of the liver post-transplant and early and late complications. 3) Illustrate the typical bowel and vascular anatomy of small bowel transplants and describe imaging techniques and postoperative complications. 4) Discuss the role of imaging in pancreatic transplantation focusing on post-surgical evaluation and review normal and abnormal appearances after pancreas transplantation.\*Course Description This lecture series will review the indications, imaging anatomy, surgical techniques and critical findings in patients undergoing evaluation for potential small bowel, pancreas and living liver transplant and review imaging post liver transplant.

#### COURSE DESCRIPTION

This lecture series will review the indications, imaging anatomy, surgical techniques and critical findings in patients undergoing evaluation for potential small bowel, pancreas and living liver transplant and review imaging post liver transplant.

#### Sub-Events

##### **R7-CGI14 Liver Transplant - Pre- Op**

Participants

Jeff L. Fidler, MD, (*Presenter*) Nothing to Disclose

##### **R7-CGI14 Liver Transplant - Post Op**

Participants

Reena C. Jha, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

##### **R7-CGI14 Pancreas Transplant**

Participants

Avinash Kambadakone, MD, FRCR, Boston, MA (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

##### **R7-CGI14 Bowel Transplant**

Participants

Erick Remer, MD, Beachwood, OH (*Presenter*) Advisory Panel, Concept Pharmaceuticals Ltd

##### **R7-CGI14 Moderator**

Participants

Reena C. Jha, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CGI14

### Liver Transplant - Pre- Op

#### Participants

Jeff L. Fidler, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CGI14

### Liver Transplant - Post Op

#### Participants

Reena C. Jha, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CGI14

### Pancreas Transplant

#### Participants

Avinash Kambadakone, MD, FRCR, Boston, MA (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CGI14

### Bowel Transplant

#### Participants

Erick Remer, MD, Beachwood, OH (*Presenter*) Advisory Panel, Concept Pharmaceuticals Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CGI14

**Moderator**

### Participants

Reena C. Jha, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIN08

**Moderator**

### Participants

Howard Chen, MD, MBA, Cleveland, OH (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIN08

### FDA's Cybersecurity Modernization Action Plan

#### Participants

Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIN08

**Is Clinical Decision Support a Software Medical Device? Review of Current FDA Position**

### Participants

Shinjini Kundu, MD, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIN08

### New ONC Rules on Data Sharing

#### Participants

Bibb Allen JR, MD, Mountain Brk, AL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIN08

**PAMA/Appropriate Use Criteria Program: Where We Are, How We Got Here, and Where We Are Going**

### Participants

David R. Gruen, MD, MBA, Weston, CT (*Presenter*) Employee, Merative LP  
Keith D. Hentel, MD, MS, Briarcliff, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CIN08

### Radiology Informatics Legislation Update

#### LEARNING OBJECTIVES

1) Know when, in what context and under what names the most impactful recent legislation on informatics has presented. 2) Understand implications of current legislative product or debate on Informatics. 3) Perceive the political context in which Informatics-relevant legislation has occurred.\*Course Description This course is will help attendees stay updated and informed about the latest legislative developments relevant to radiology informatics. During this traditional lecture format, we will address crucial issues related to informatics such as the cybersecurity implications of new regulations, the political context in which informatics-relevant legislation occurs, and the history and updates of significant acts like the No Surprise Act. Additionally, we will discuss the new rules on data sharing introduced by the Office of the National Coordinator for Health Information Technology (ONC). Attending this session will give you a deep understanding of the legislative landscape and its impact on informatics.

#### COURSE DESCRIPTION

This course is will help attendees stay updated and informed about the latest legislative developments relevant to radiology informatics. During this traditional lecture format, we will address crucial issues related to informatics such as the cybersecurity implications of new regulations, the political context in which informatics-relevant legislation occurs, and the history and updates of significant acts like the No Surprise Act. Additionally, we will discuss the new rules on data sharing introduced by the Office of the National Coordinator for Health Information Technology (ONC). Attending this session will give you a deep understanding of the legislative landscape and its impact on informatics.

#### Sub-Events

##### **R7-CIN08 Moderator**

Participants  
Howard Chen, MD, MBA, Cleveland, OH (*Moderator*) Nothing to Disclose

##### **R7-CIN08 FDA's Cybersecurity Modernization Action Plan**

Participants  
Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

##### **R7-CIN08 Is Clinical Decision Support a Software Medical Device? Review of Current FDA Position**

Participants  
Shinjini Kundu, MD, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### **R7-CIN08 New ONC Rules on Data Sharing**

Participants  
Bibb Allen JR, MD, Mountain Brk, AL (*Presenter*) Nothing to Disclose

##### **R7-CIN08 PAMA/Appropriate Use Criteria Program: Where We Are, How We Got Here, and Where We Are Going**

Participants  
David R. Gruen, MD, MBA, Weston, CT (*Presenter*) Employee, Merative LP  
Keith D. Hentel, MD, MS, Briarcliff, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### Management of Enteric Access and Feeding Tubes in IR

#### Participants

Fabian Laage Gaupp, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### Management of Malignant Ascites

#### Participants

Hooman Yarmohammadi, MD, New York, NY (*Presenter*) Grant, Guerbet SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### Ablation and Embolization for Pain Therapy

#### Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### Nerve Blocks in Unresectable Cancers

#### Participants

Dimitrios Filippiadis, MD, PhD, Athens, Greece (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### Lower GI Bleed

#### Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc; Research Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

### GI Interventions and Pain Management

#### LEARNING OBJECTIVES

1) Understand clinical indications and procedures for palliative care, emergencies, and pain management. 2) Recognize appropriate anatomy as it relates to the interventional procedural techniques. 3) Explain clinical outcomes of different interventional procedures.\*Course Description In this course learners will be exposed to didactic lectures regarding different procedures in interventional radiology as it relates to gastrointestinal interventions, pain management and palliative care

#### COURSE DESCRIPTION

In this course learners will be exposed to didactic lectures regarding different procedures in interventional radiology as it relates to gastrointestinal interventions, pain management and palliative care

#### Sub-Events

##### **R7-CIR11 Management of Enteric Access and Feeding Tubes in IR**

Participants

Fabian Laage Gaupp, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### **R7-CIR11 Management of Malignant Ascites**

Participants

Hooman Yarmohammadi, MD, New York, NY (*Presenter*) Grant, Guerbet SA

##### **R7-CIR11 Ablation and Embolization for Pain Therapy**

Participants

Merve Ozen, MD, Lexington, KY (*Presenter*) Nothing to Disclose

##### **R7-CIR11 Nerve Blocks in Unresectable Cancers**

Participants

Dimitrios Filippiadis, MD, PhD, Athens, Greece (*Presenter*) Nothing to Disclose

##### **R7-CIR11 Lower GI Bleed**

Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc; Research Consultant, Medtronic plc

##### **R7-CIR11 Moderator**

Participants

David Mauro, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

##### **R7-CIR11 Upper GI Bleed**

Participants

David Mauro, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CIR11

**Moderator**

### Participants

David Mauro, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CIR11

### Upper GI Bleed

#### Participants

David Mauro, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### T2 Dixon Imaging of Tumors: Advantages and Disadvantages

#### Participants

Stephanie Bernard, MD, Helotes, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize imaging differences between lipoma and well differentiated liposarcoma and current cytogenetic aberrations used in this distinction. 2) Understand recent advances in multidisciplinary management of spinal bone metastases and imaging of post-tumor resection reconstructions. 3) Identify updates to musculoskeletal tumor staging and use of T2 Dixon imaging of musculoskeletal tumors.\*Course Description This lecture format course includes a discussion of a range of topics concerning musculoskeletal tumor imaging and both current trends and recent advances. Topics range from a discussion of adipocytic neoplasms and use of cytogenetic aberrations that allow their distinction, imaging of post-resection reconstructions, the use of T2 Dixon imaging of neoplasms, recent advances in multidisciplinary management of spinal bone metastases and an update on musculoskeletal tumor staging. Attendees should expect a review and update on these important topics on imaging of musculoskeletal tumors.

#### COURSE DESCRIPTION

This lecture format course includes a discussion of a range of topics concerning musculoskeletal tumor imaging and both current trends and recent advances. Topics range from a discussion of adipocytic neoplasms and use of cytogenetic aberrations that allow their distinction, imaging of post-resection reconstructions, the use of T2 Dixon imaging of neoplasms, recent advances in multidisciplinary management of spinal bone metastases and an update on musculoskeletal tumor staging. Attendees should expect a review and update on these important topics on imaging of musculoskeletal tumors.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### Imaging of Post-Resection Reconstructions: Tricks of the Trade

#### Participants

Ty K. Subhawong, MD, Miami, FL (*Presenter*) Research Consultant, Arog Pharmaceuticals, Inc; Stockholder, AbbVie Inc; Stockholder, AstraZeneca PLC; Stockholder, Johnson & Johnson; Stockholder, Pfizer Inc ; Stockholder, F. Hoffmann-La Roche Ltd; Stockholder, Teva Pharmaceutical Industries Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### Recent Advances in Multidisciplinary Management of Spinal Bone Metastases

#### Participants

Behrang Amini, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### Imaging of Fatty Tumors: Lipoma versus Atypical Lipomatous Tumor

#### Participants

Doris E. Wenger, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

**Moderator**

### Participants

Mark D. Murphey, MD, Silver Spring, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### Update on Musculoskeletal Tumor Staging

#### Participants

Mark D. Murphey, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMK08

### Musculoskeletal Tumor Imaging: Current Trends and Recent Advances

#### Sub-Events

#### R7-CMK08 Moderator

##### Participants

Mark D. Murphey, MD, Silver Spring, MD (*Moderator*) Nothing to Disclose

#### R7-CMK08 T2 Dixon Imaging of Tumors: Advantages and Disadvantages

##### Participants

Stephanie Bernard, MD, Helotes, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize imaging differences between lipoma and well differentiated liposarcoma and current cytogenetic aberrations used in this distinction. 2) Understand recent advances in multidisciplinary management of spinal bone metastases and imaging of post-tumor resection reconstructions. 3) Identify updates to musculoskeletal tumor staging and use of T2 Dixon imaging of musculoskeletal tumors.\*Course Description This lecture format course includes a discussion of a range of topics concerning musculoskeletal tumor imaging and both current trends and recent advances. Topics range from a discussion of adipocytic neoplasms and use of cytogenetic aberrations that allow their distinction, imaging of post-resection reconstructions, the use of T2 Dixon imaging of neoplasms, recent advances in multidisciplinary management of spinal bone metastases and an update on musculoskeletal tumor staging. Attendees should expect a review and update on these important topics on imaging of musculoskeletal tumors.

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#### R7-CMK08 Imaging of Post-Resection Reconstructions: Tricks of the Trade

##### Participants

Ty K. Subhawong, MD, Miami, FL (*Presenter*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd

#### R7-CMK08 Recent Advances in Multidisciplinary Management of Spinal Bone Metastases

##### Participants

Behrang Amini, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

#### R7-CMK08 Imaging of Fatty Tumors: Lipoma versus Atypical Lipomatous Tumor

##### Participants

Doris E. Wenger, MD, Rochester, MN (*Presenter*) Nothing to Disclose

#### R7-CMK08 Update on Musculoskeletal Tumor Staging

##### Participants

Mark D. Murphey, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CMS02

### Challenging Pediatric Ultrasound Cases

#### Participants

Edward Lee, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify the role of ultrasound in common and uncommon pediatric emergencies. 2) Understand some common and uncommon causes of acute pelvic pain in women. 3) Identify the ultrasound findings of musculoskeletal pathologies presenting in the acute setting.\*Course Description This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis throughout the body with a focus on challenging emergent cases. A wide range of applications will be covered including vascular, pelvic, pediatric, and musculoskeletal. Attendees will have the opportunity to test their knowledge in real time as interesting unknown cases are presented in question/answer format with topic review by the speakers. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice

#### COURSE DESCRIPTION

This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis throughout the body with a focus on challenging emergent cases. A wide range of applications will be covered including vascular, pelvic, pediatric, and musculoskeletal. Attendees will have the opportunity to test their knowledge in real time as interesting unknown cases are presented in question/answer format with topic review by the speakers. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMS02

**Moderator**

### **Participants**

Shweta Bhatt, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMS02

### Acute Abdominal Pain- Challenging Cases

#### Participants

Shweta Bhatt, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMS02

### Acute Pelvic Pain - Challenging Cases

#### Participants

Akshya Gupta, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMS02

### Acute Ultrasound Pearls and Pitfalls: Case Based Review

#### Sub-Events

##### R7-CMS02 Moderator

###### Participants

Shweta Bhatt, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

##### R7-CMS02 Acute Abdominal Pain- Challenging Cases

###### Participants

Shweta Bhatt, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### R7-CMS02 Acute Pelvic Pain - Challenging Cases

###### Participants

Akshya Gupta, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

##### R7-CMS02 Challenging Pediatric Ultrasound Cases

###### Participants

Edward Lee, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify the role of ultrasound in common and uncommon pediatric emergencies. 2) Understand some common and uncommon causes of acute pelvic pain in women. 3) Identify the ultrasound findings of musculoskeletal pathologies presenting in the acute setting.\*Course Description This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis throughout the body with a focus on challenging emergent cases. A wide range of applications will be covered including vascular, pelvic, pediatric, and musculoskeletal. Attendees will have the opportunity to test their knowledge in real time as interesting unknown cases are presented in question/answer format with topic review by the speakers. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice

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This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis throughout the body with a focus on challenging emergent cases. A wide range of applications will be covered including vascular, pelvic, pediatric, and musculoskeletal. Attendees will have the opportunity to test their knowledge in real time as interesting unknown cases are presented in question/answer format with topic review by the speakers. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice

##### R7-CMS02 Acute Pain Rapid Fire Challenging MSK Cases

###### Participants

Humberto G. Rosas, MD, Middleton, WI (*Presenter*) Co-founder, AyrFlo; Stockholder, AyrFlo

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CMS02

### Acute Pain Rapid Fire Challenging MSK Cases

#### Participants

Humberto G. Rosas, MD, Middleton, WI (*Presenter*) Co-founder, AyrFlo; Stockholder, AyrFlo

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNMMI08

**Moderator**

### Participants

David A. Mankoff, PhD, Philadelphia, PA (*Moderator*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevarx Biomedical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNMMI08

### Update on PET CT Application of Response Assessment to Therapy in Gynecological Malignancies

#### Participants

Esma Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review current response assessment criteria applicable to PET/CT. 2) Illustrate the applications of these response assessment criteria in clinical practice. 3) Discuss advances in the field of PET/CT and response assessment.\*Course Description This course reviews the application of PET molecular imaging assessment of response to therapy and provides example of current disease-specific applications and response criteria. Presenters provide an overview on the approach to cancer response assessment and provide some cases examples to illustrate principles and practice of this methodology.

#### COURSE DESCRIPTION

This course reviews the application of PET molecular imaging assessment of response to therapy and provides example of current disease-specific applications and response criteria. Presenters provide an overview on the approach to cancer response assessment and provide some cases examples to illustrate principles and practice of this methodology.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CNMMI08

### Updates and Controversies in PET/CT Response Assessment

#### Participants

Eric Rohren, PhD, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNMMI08

### Update on Prostate Therapy Response Assessment

#### Participants

Don Yoo, MD, (*Presenter*) Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNMMI08

### Therapy Response Assessment: Read with the Experts

#### Sub-Events

##### **R7- CNMMI08** Moderator

Participants

David A. Mankoff, PhD, Philadelphia, PA (*Moderator*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevarx Biomedical, Inc

##### **R7- CNMMI08** Update on PET CT Application of Response Assessment to Therapy in Gynecological Malignancies

Participants

Esma Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review current response assessment criteria applicable to PET/CT. 2) Illustrate the applications of these response assessment criteria in clinical practice. 3) Discuss advances in the field of PET/CT and response assessment.\*Course Description This course reviews the application of PET molecular imaging assessment of response to therapy and provides example of current disease-specific applications and response criteria. Presenters provide an overview on the approach to cancer response assessment and provide some cases examples to illustrate principles and practice of this methodology.

#### COURSE DESCRIPTION

This course reviews the application of PET molecular imaging assessment of response to therapy and provides example of current disease-specific applications and response criteria. Presenters provide an overview on the approach to cancer response assessment and provide some cases examples to illustrate principles and practice of this methodology.

##### **R7- CNMMI08** Updates and Controversies in PET/CT Response Assessment

Participants

Eric Rohren, PhD, MD, (*Presenter*) Nothing to Disclose

##### **R7- CNMMI08** Update on Prostate Therapy Response Assessment

Participants

Don Yoo, MD, (*Presenter*) Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNPM18

**Moderator**

### **Participants**

Vikas Gulani, PhD, Ann Arbor, MI (*Moderator*) Research support, Siemens AG; Consulting, Cook Group Incorporated

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNPM18

### Unprofessionalism in the Workplace

#### LEARNING OBJECTIVES

1) Recognize the manifestations of professional disruptions in the workplace. 2) Identify mitigation strategies for professional disruptions in the workplace.\*Course Description Unprofessional and disruptive behavior in the radiology workplace can be on the spectrum of overt to insidious. In this course, we will explore microaggressions, sexual harassment, and professionalism transgressions, and consider trainee professionalism and wellness. We will discuss how these behaviors may manifest themselves and provide examples of mitigation strategies.

#### COURSE DESCRIPTION

Unprofessional and disruptive behavior in the radiology workplace can be on the spectrum of overt to insidious. In this course, we will explore microaggressions, sexual harassment, and professionalism transgressions, and consider trainee professionalism and wellness. We will discuss how these behaviors may manifest themselves and provide examples of mitigation strategies.

#### Sub-Events

##### R7-CNPM18 Microaggressions

Participants

Tracy A. Jaffe, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### R7-CNPM18 Trainee Professionalism and Wellness

Participants

Steven Harris, MD, PhD, Franklin, TN (*Presenter*) Nothing to Disclose

##### R7-CNPM18 Moderator

Participants

Vikas Gulani, PhD, Ann Arbor, MI (*Moderator*) Research support, Siemens AG;Consulting, Cook Group Incorporated

##### R7-CNPM18 Professionalism Transgressions

Participants

Vikas Gulani, PhD, Ann Arbor, MI (*Presenter*) Research support, Siemens AG;Consulting, Cook Group Incorporated

##### R7-CNPM18 Gender Harassment

Participants

Vaz Zavaletta, MD, PhD, Denver, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNPM18

### Professionalism Transgressions

#### Participants

Vikas Gulani, PhD, Ann Arbor, MI (*Presenter*) Research support, Siemens AG; Consulting, Cook Group Incorporated

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNPM18

### Gender Harassment

#### Participants

Vaz Zavaletta, MD, PhD, Denver, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNPM18

### Microaggressions

#### Participants

Tracy A. Jaffe, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CNPM18

### Trainee Professionalism and Wellness

#### Participants

Steven Harris, MD, PhD, Franklin, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

### Epilepsy Imaging: What More Can We See With 7T?

#### Participants

Erik Middlebrooks, MD, (*Presenter*) Research Consultant, Siemens AG; Research support, Siemens AG; Consultant, Boston Scientific Corporation; Research support, Boston Scientific Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

**PET/MR in Oncologic Imaging: Does PET/MR Improve Patient Outcomes?**

### Participants

Jana Ivanidze, MD, PhD, New York, NY (*Presenter*) Research Grant, Novartis AG;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

### PET/MR for Neurodegeneration and Alzheimer's Dementia

#### Participants

Tammie Benzinger, MD, PhD, Saint Louis, MO (*Presenter*) Research Grant, Eli Lilly and Company; Investigator, Eli Lilly and Company; Investigator, F. Hoffmann-La Roche Ltd; Consultant, Siemens AG; Research Grant, Siemens AG; Consultant, ADM Diagnostics, LLC; Speakers Bureau, Biogen Idec Inc; Advisory Board, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

**Moderator**

### **Participants**

Hediyeh Baradaran, MD, MS, Salt Lake City, UT (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

### 7T Vascular and CSVD Imaging: Clinical Utility of Higher Resolution

#### Participants

Hediyeh Baradaran, MD, MS, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review advances in 7T imaging as it pertains to specific clinical applications. 2) Identify potential benefits in clinical adoption of PET MR imaging. 3) Explain the difficulties with widespread use of 7T and PET MR imaging.\*Course Description Are 7T and PET MR imaging going to revolutionize neuroimaging or will they be relegated to the research realm? In this session, we will describe the current potential uses and limitations in using both 7T and PET/MR imaging. This lecture based session will provide evidence-based discussion of newer MR imaging technology to prepare neuroradiologists for potential changes in future practice.

#### COURSE DESCRIPTION

Are 7T and PET MR imaging going to revolutionize neuroimaging or will they be relegated to the research realm? In this session, we will describe the current potential uses and limitations in using both 7T and PET/MR imaging. This lecture based session will provide evidence-based discussion of newer MR imaging technology to prepare neuroradiologists for potential changes in future practice.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CNR08

### Emerging Neuroimaging Techniques: Stuck in the Research Realm or Ready for Prime-Time?

#### Sub-Events

#### R7-CNR08 Moderator

##### Participants

Hediyeh Baradaran, MD, MS, Salt Lake City, UT (*Moderator*) Nothing to Disclose

#### R7-CNR08 7T Vascular and CSVD Imaging: Clinical Utility of Higher Resolution

##### Participants

Hediyeh Baradaran, MD, MS, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review advances in 7T imaging as it pertains to specific clinical applications. 2) Identify potential benefits in clinical adoption of PET MR imaging. 3) Explain the difficulties with widespread use of 7T and PET MR imaging.\*Course Description Are 7T and PET MR imaging going to revolutionize neuroimaging or will they be relegated to the research realm? In this session, we will describe the current potential uses and limitations in using both 7T and PET/MR imaging. This lecture based session will provide evidence-based discussion of newer MR imaging technology to prepare neuroradiologists for potential changes in future practice.

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#### R7-CNR08 Epilepsy Imaging: What More Can We See With 7T?

##### Participants

Erik Middlebrooks, MD, (*Presenter*) Research Consultant, Siemens AG;Research support, Siemens AG;Consultant, Boston Scientific Corporation;Research support, Boston Scientific Corporation

#### R7-CNR08 PET/MR in Oncologic Imaging: Does PET/MR Improve Patient Outcomes?

##### Participants

Jana Ivanidze, MD, PhD, New York, NY (*Presenter*) Research Grant, Novartis AG;

#### R7-CNR08 PET/MR for Neurodegeneration and Alzheimer's Dementia

##### Participants

Tammie Benzinger, MD, PhD, Saint Louis, MO (*Presenter*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-COB06

### Endometrial and Cervical Cancer Staging: How to Get it Right the First Time!

#### LEARNING OBJECTIVES

1) Understand the requirements to optimise imaging-based staging of endometrial and cervical cancer staging. 2) Be aware of key findings on imaging that will impact treatment planning. \*Course Description This lecture-based course will describe protocols and top tips to ensure accurate staging of endometrial and cervical cancer and will include ultrasound, MRI, and FDG-PET/CT. Pitfalls will be described. The key findings on imaging that will influence treatment planning will be discussed.

#### COURSE DESCRIPTION

This lecture-based course will describe protocols and top tips to ensure accurate staging of endometrial and cervical cancer and will include ultrasound, MRI, and FDG-PET/CT. Pitfalls will be described. The key findings on imaging that will influence treatment planning will be discussed.

#### Sub-Events

##### **R7-COB06 Moderator**

Participants

Andrea Rockall, FRCR, MRCP, (*Moderator*) Nothing to Disclose

##### **R7-COB06 US and MRI of Endometrial Cancer Staging: Tips and Tricks**

Participants

Krupa Patel-Lippmann, MD, Nashville, TN (*Presenter*) Nothing to Disclose

##### **R7-COB06 MRI of Cervical Cancer: Radiologists Guiding the Way**

Participants

Andrea Rockall, FRCR, MRCP, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-COB06

**Moderator**

### Participants

Andrea Rockall, FRCR, MRCP, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-COB06

### US and MRI of Endometrial Cancer Staging: Tips and Tricks

#### Participants

Krupa Patel-Lippmann, MD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-COB06

### MRI of Cervical Cancer: Radiologists Guiding the Way

#### Participants

Andrea Rockall, FRCR, MRCP, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPD05

### Pediatric Body MR Imaging: Whole Body Screening, Pitfalls, and Standardized Reports

#### Sub-Events

#### R7-CPD05 Pitfalls with MR Enterography: Beyond Inflammatory Bowel Disease

Participants

Ethan A. Smith, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

#### R7-CPD05 Cut to the Chase: Potential Uses of Rapid MRI in Children

Participants

Govind Chavhan, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### R7-CPD05 Reporting Templates: Here to Save the Day Extra?

Participants

Sherwin Chan, MD, PhD, Kansas City, MO (*Presenter*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

#### R7-CPD05 Moderator

Participants

Govind Chavhan, MD, Toronto, ON (*Moderator*) Nothing to Disclose

#### R7-CPD05 Whole Body MRI in Pediatric Patients: Clinical Applications and Up-to-Date Protocols

Participants

Andrea S. Doria, PhD, Toronto, ON (*Presenter*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

#### LEARNING OBJECTIVES

1) Discuss the protocols and current clinical applications of whole body MRI and Rapid Abdominal MRI in children. 2) Identify pitfalls of MR Enterography in children and describe its applications beyond inflammatory bowel disease. 3) List the benefits and methods to use reporting template effectively in clinical practice.\*Course Description MR imaging is playing important role in body imaging in children with ever expanding clinical applications in various disease process. Update on new techniques and protocols as well as new emerging clinical applications of MR in pediatric body is essential. This educational session is designed to provide learners with updates on current techniques, protocols and pitfalls in pediatric body MR imaging via lectures. Clinical applications of whole-body MRI in screening of children with oncologic and non-oncologic disease processes, and applications of MR Enterography in evaluations of gastrointestinal diseases other than inflammatory bowel disease will be discussed. Strategies to use rapid abdominal MRI and its potential applications in children will be illustrated. Finally, importance and methods in communicating the imaging findings effectively through standardized reporting will be discussed.

#### COURSE DESCRIPTION

MR imaging is playing important role in body imaging in children with ever expanding clinical applications in various disease process. Update on new techniques and protocols as well as new emerging clinical applications of MR in pediatric body is essential. This educational session is designed to provide learners with updates on current techniques, protocols and pitfalls in pediatric body MR imaging via lectures. Clinical applications of whole-body MRI in screening of children with oncologic and non-oncologic disease processes, and applications of MR Enterography in evaluations of gastrointestinal diseases other than inflammatory bowel disease will be discussed. Strategies to use rapid abdominal MRI and its potential applications in children will be illustrated. Finally, importance and methods in communicating the imaging findings effectively through standardized reporting will be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPD05

**Moderator**

### Participants

Govind Chavhan, MD, Toronto, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPD05

### Whole Body MRI in Pediatric Patients: Clinical Applications and Up-to-Date Protocols

#### Participants

Andrea S. Doria, PhD, Toronto, ON (*Presenter*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

#### LEARNING OBJECTIVES

1) Discuss the protocols and current clinical applications of whole body MRI and Rapid Abdominal MRI in children. 2) Identify pitfalls of MR Enterography in children and describe its applications beyond inflammatory bowel disease. 3) List the benefits and methods to use reporting template effectively in clinical practice.\*Course Description MR imaging is playing important role in body imaging in children with ever expanding clinical applications in various disease process. Update on new techniques and protocols as well as new emerging clinical applications of MR in pediatric body is essential. This educational session is designed to provide learners with updates on current techniques, protocols and pitfalls in pediatric body MR imaging via lectures. Clinical applications of whole-body MRI in screening of children with oncologic and non-oncologic disease processes, and applications of MR Enterography in evaluations of gastrointestinal diseases other than inflammatory bowel disease will be discussed. Strategies to use rapid abdominal MRI and its potential applications in children will be illustrated. Finally, importance and methods in communicating the imaging findings effectively through standardized reporting will be discussed.

#### COURSE DESCRIPTION

MR imaging is playing important role in body imaging in children with ever expanding clinical applications in various disease process. Update on new techniques and protocols as well as new emerging clinical applications of MR in pediatric body is essential. This educational session is designed to provide learners with updates on current techniques, protocols and pitfalls in pediatric body MR imaging via lectures. Clinical applications of whole-body MRI in screening of children with oncologic and non-oncologic disease processes, and applications of MR Enterography in evaluations of gastrointestinal diseases other than inflammatory bowel disease will be discussed. Strategies to use rapid abdominal MRI and its potential applications in children will be illustrated. Finally, importance and methods in communicating the imaging findings effectively through standardized reporting will be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPD05

### Pitfalls with MR Enterography: Beyond Inflammatory Bowel Disease

#### Participants

Ethan A. Smith, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPD05

### Cut to the Chase: Potential Uses of Rapid MRI in Children

#### Participants

Govind Chavhan, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CPD05

**Reporting Templates: Here to Save the Day Extra?**

### Participants

Sherwin Chan, MD, PhD, Kansas City, MO (*Presenter*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPH11

**Moderator**

### Participants

Zhihua Qi, PhD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPH11

### Preparing High Quality Data for AI

#### Participants

Zhihua Qi, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPH11

### Data Quality and Generalizability in AI

#### Participants

Ran Zhang, PhD, Madison, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPH11

### Clinical Integration of AI Models

#### Participants

John Garrett, PhD, Madison, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CPH11

### Data Curation for AI with Proper Medical Imaging Physics Context

#### LEARNING OBJECTIVES

1) To review the process and to demonstrate methods and tools to collect and prepare clinical data for AI model development and related research. 2) To learn how data quality and data size affect the performance and generalizability of deep neural network models. 3) To understand practical methods for series and study selection for clinically deployed AI models, common issues that arise in deployment, and several techniques for evaluating AI in an ongoing fashion.\*Course Description This course reviews the selection, procurement, quality and evaluation of data for AI development and deployment in radiology. With a focus on the technical and imaging physics aspects of AI in radiology, it is of high educational value to those interested in active involvement in such activities.

#### COURSE DESCRIPTION

This course reviews the selection, procurement, quality and evaluation of data for AI development and deployment in radiology. With a focus on the technical and imaging physics aspects of AI in radiology, it is of high educational value to those interested in active involvement in such activities.

#### Sub-Events

##### R7-CPH11 Moderator

Participants  
Zihua Qi, PhD, (*Moderator*) Nothing to Disclose

##### R7-CPH11 Preparing High Quality Data for AI

Participants  
Zihua Qi, PhD, (*Presenter*) Nothing to Disclose

##### R7-CPH11 Data Quality and Generalizability in AI

Participants  
Ran Zhang, PhD, Madison, WI (*Presenter*) Nothing to Disclose

##### R7-CPH11 Clinical Integration of AI Models

Participants  
John Garrett, PhD, Madison, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CRO03

### Breast Cancer Case Based Multidisciplinary Review

#### Participants

Avan Armaghani, MD, Tampa, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CRO03

### Breast Cancer Case Based Multidisciplinary Review

#### Participants

Anna Shapiro, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.\*Course Description This course utilizes a case-based multi-disciplinary approach to discuss appropriate breast imaging examinations, radiologic-pathologic correlation, available radiotherapy options, as well as medical and surgical oncologic treatment planning in the setting of breast cancer.

#### COURSE DESCRIPTION

This course utilizes a case-based multi-disciplinary approach to discuss appropriate breast imaging examinations, radiologic-pathologic correlation, available radiotherapy options, as well as medical and surgical oncologic treatment planning in the setting of breast cancer.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R7-CRO03

### Breast Cancer Case Based Multidisciplinary Review

#### Participants

Rohin Mehta, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CRO03

### Breast Cancer Case Based Multidisciplinary Review

#### Sub-Events

#### R7-CRO03 Breast Cancer Case Based Multidisciplinary Review

##### Participants

Anna Shapiro, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.\*Course Description This course utilizes a case-based multi-disciplinary approach to discuss appropriate breast imaging examinations, radiologic-pathologic correlation, available radiotherapy options, as well as medical and surgical oncologic treatment planning in the setting of breast cancer.

#### COURSE DESCRIPTION

This course utilizes a case-based multi-disciplinary approach to discuss appropriate breast imaging examinations, radiologic-pathologic correlation, available radiotherapy options, as well as medical and surgical oncologic treatment planning in the setting of breast cancer.

#### R7-CRO03 Breast Cancer Case Based Multidisciplinary Review

##### Participants

Avan Armaghani, MD, Tampa, FL (*Presenter*) Nothing to Disclose

#### R7-CRO03 Breast Cancer Case Based Multidisciplinary Review

##### Participants

Lorena Gonzalez, MD, Torrance, CA (*Presenter*) Nothing to Disclose

#### R7-CRO03 Moderator

##### Participants

Bethany L. Niell, MD, PhD, Tampa, FL (*Moderator*) Equipment support, Hologic, Inc

#### R7-CRO03 Breast Cancer Case Based Multidisciplinary Review

##### Participants

Rohin Mehta, MD, Syracuse, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CRO03

### Breast Cancer Case Based Multidisciplinary Review

#### Participants

Lorena Gonzalez, MD, Torrance, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R7-CRO03

**Moderator**

### **Participants**

Bethany L. Niell, MD, PhD, Tampa, FL (*Moderator*) Equipment support, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CBR02

### AI in Breast Imaging

#### Sub-Events

##### S1-CBR02 Moderator

###### Participants

Constance Lehman, MD, PhD, Boston, MA (*Moderator*) Institutional Grant, General Electric Company; Institutional Grant, Hologic, Inc; Co-founder, Clarity, Inc.

##### S1-CBR02 AI in Breast Imaging: Pearls and Pitfalls of Implementation

###### Participants

Constance Lehman, MD, PhD, Boston, MA (*Presenter*) Institutional Grant, General Electric Company; Institutional Grant, Hologic, Inc; Co-founder, Clarity, Inc.

#### LEARNING OBJECTIVES

1) Develop critical thinking and understanding of the terminology in the development and evaluation of AI systems for breast cancer screening, diagnosis and treatment. 2) Gain insights from prospective interventional studies including diagnostic improvements, biases, and limitations. 3) Attain a realistic appreciation for the opportunities and challenges in the implementation of AI in clinical practice. \*Course Description Build your knowledge with top experts in evaluating, implementing, and understanding the wider impact of AI systems in breast cancer screening, diagnosis and intervention. There will be three lectures followed by an open panel discussion. We will cover the full cycle from development and evaluation of AI systems, including how the FDA evaluates AI algorithms, what developers might expect for post-market surveillance requirements, implications of results of large clinical trials, and future opportunities and challenges when implementing AI in routine clinical practice. In the final panel discussion, all presenters are available to discuss important topics brought forward by the panel and audience.

#### COURSE DESCRIPTION

Build your knowledge with top experts in evaluating, implementing, and understanding the wider impact of AI systems in breast cancer screening, diagnosis and intervention. There will be three lectures followed by an open panel discussion. We will cover the full cycle from development and evaluation of AI systems, including how the FDA evaluates AI algorithms, what developers might expect for post-market surveillance requirements, implications of results of large clinical trials, and future opportunities and challenges when implementing AI in routine clinical practice. In the final panel discussion, all presenters are available to discuss important topics brought forward by the panel and audience.

##### S1-CBR02 AI in Breast Imaging: Outcomes from Screening Trials

###### Participants

Fredrik Strand, MD, PhD, Stockholm, Sweden (*Presenter*) Speaker, Lunit Inc

##### S1-CBR02 AI in Breast Imaging: Development and Testing of Breast AI

###### Participants

Etta D. Pisano, MD, Sullivan's Island, SC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CBR02

**Moderator**

### **Participants**

Constance Lehman, MD, PhD, Boston, MA (*Moderator*) Institutional Grant, General Electric Company; Institutional Grant, Hologic, Inc; Co-founder, Clarity, Inc.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CBR02

### AI in Breast Imaging: Pearls and Pitfalls of Implementation

#### Participants

Constance Lehman, MD, PhD, Boston, MA (*Presenter*) Institutional Grant, General Electric Company; Institutional Grant, Hologic, Inc; Co-founder, Clarity, Inc.

#### LEARNING OBJECTIVES

1) Develop critical thinking and understanding of the terminology in the development and evaluation of AI systems for breast cancer screening, diagnosis and treatment. 2) Gain insights from prospective interventional studies including diagnostic improvements, biases, and limitations. 3) Attain a realistic appreciation for the opportunities and challenges in the implementation of AI in clinical practice. \*Course Description Build your knowledge with top experts in evaluating, implementing, and understanding the wider impact of AI systems in breast cancer screening, diagnosis and intervention. There will be three lectures followed by an open panel discussion. We will cover the full cycle from development and evaluation of AI systems, including how the FDA evaluates AI algorithms, what developers might expect for post-market surveillance requirements, implications of results of large clinical trials, and future opportunities and challenges when implementing AI in routine clinical practice. In the final panel discussion, all presenters are available to discuss important topics brought forward by the panel and audience.

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## Abstract Archives of the RSNA, 2023

S1-CBR02

### AI in Breast Imaging: Outcomes from Screening Trials

#### Participants

Fredrik Strand, MD, PhD, Stockholm, Sweden (*Presenter*) Speaker, Lunit Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CBR02

### AI in Breast Imaging: Development and Testing of Breast AI

#### Participants

Etta D. Pisano, MD, Sullivans Island, SC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CCA05

**Moderator**

### Participants

Jiayin Zhang, MD, Shanghai, China (*Moderator*) Nothing to Disclose

Eric E. Williamson, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CCA05

### Cardiac MRI Biomarkers in EP Planning

#### Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV  
Jiayin Zhang, MD, Shanghai, China (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CCA05

### Beyond the Scar: Advanced CT Imaging

#### Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV  
Jamie Schroeder, MD,DPhil, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CCA05

### Mapping the Target & Pushing the Limits: Imaging Guidance for Electrophysiology Procedure Planning

#### LEARNING OBJECTIVES

1) Identify the MR biomarkers in electrophysiology (EP) planning and learn how to guide procedure by the use of biomarkers. 2) Discover the latest advanced CT techniques for EP imaging. 3) Learn how to use interactive 3D modeling to plan EP procedure.\*Course Description Pre-procedural imaging is essential for guiding electrophysiology procedure planning. Learning the advanced EP imaging techniques is of educational importance for radiologists and cardiologists. This 1-hour course includes lectures from 3 distinguished professors, focusing on CMR, CT and 3D modelling respectively. In this session, you will be guided through the up-to-date MR and CT application in pre-procedural EP imaging and learn how to perform in clinical practice.

#### COURSE DESCRIPTION

Pre-procedural imaging is essential for guiding electrophysiology procedure planning. Learning the advanced EP imaging techniques is of educational importance for radiologists and cardiologists. This 1-hour course includes lectures from 3 distinguished professors, focusing on CMR, CT and 3D modelling respectively. In this session, you will be guided through the up-to-date MR and CT application in pre-procedural EP imaging and learn how to perform in clinical practice.

#### Sub-Events

##### S1-CCA05 Moderator

#### Participants

Jiayin Zhang, MD, Shanghai, China (*Moderator*) Nothing to Disclose

Eric E. Williamson, MD, Rochester, MN (*Moderator*) Nothing to Disclose

##### S1-CCA05 Cardiac MRI Biomarkers in EP Planning

#### Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV

Jiayin Zhang, MD, Shanghai, China (*Presenter*) Nothing to Disclose

##### S1-CCA05 Beyond the Scar: Advanced CT Imaging

#### Participants

Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV

Jamie Schroeder, MD, DPhil, San Francisco, CA (*Presenter*) Nothing to Disclose

##### S1-CCA05 Interactive 3D Modeling: Creating the Cardiac Avatar

#### Participants

Menhel Kinno, MD, MPH, Maywood, IL (*Presenter*) Nothing to Disclose

Jamie Schroeder, MD, DPhil, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CCA05

### Interactive 3D Modeling: Creating the Cardiac Avatar

#### Participants

Menhel Kinno, MD,MPH, Maywood, IL (*Presenter*) Nothing to Disclose

Jamie Schroeder, MD,DPhil, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CER01

**Moderator**

### **Participants**

Koenraad Nieboer, MD, Brussels, Belgium (*Moderator*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CER01

### Essentials of Acute Brain Trauma

#### Participants

Koenraad Nieboer, MD, Brussels, Belgium (*Presenter*) Speakers Bureau, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CER01

### Traumatic Emergencies of the Soft Tissues of the Neck

#### Participants

Carlota Andreu Arasa, MD, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CER01

### Skull Base Trauma (Including Mastoid)

#### Participants

Divya Gunda, MD, Edmond, OK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CER01

### Essential Head and Neck Trauma

#### LEARNING OBJECTIVES

1) Identify and describe correctly acute traumatic lesions on CT scan of the head, skull base, and lesions of the soft-tissues of the neck. 2) When to use advanced neuroimaging techniques in the setting of traumatic brain injury. 3) What is important to include in your report.\*Course Description This session offers 3 highly recommended lectures.From basic assessment of CT scan of the brain, skull base and soft-tissue lesions of the neck in the context of acute trauma to advanced imaging, for all experience levels. Clear identification and description of acute traumatic lesions are essential for rapid communication with referring physicians and trauma surgeons. And when do you recommend advanced imaging?

#### COURSE DESCRIPTION

This session offers 3 highly recommended lectures.From basic assessment of CT scan of the brain, skull base and soft-tissue lesions of the neck in the context of acute trauma to advanced imaging, for all experience levels. Clear identification and description of acute traumatic lesions are essential for rapid communication with referring physicians and trauma surgeons. And when do you recommend advanced imaging?

#### Sub-Events

##### **S1-CER01 Moderator**

Participants

Koenraad Nieboer, MD, Brussels, Belgium (*Moderator*) Speakers Bureau, General Electric Company

##### **S1-CER01 Essentials of Acute Brain Trauma**

Participants

Koenraad Nieboer, MD, Brussels, Belgium (*Presenter*) Speakers Bureau, General Electric Company

##### **S1-CER01 Skull Base Trauma (Including Mastoid)**

Participants

Divya Gunda, MD, Edmond, OK (*Presenter*) Nothing to Disclose

##### **S1-CER01 Traumatic Emergencies of the Soft Tissues of the Neck**

Participants

Carlota Andreu Arasa, MD, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Moderator**

### Participants

Cooky Menias, MD, Phoenix, AZ (*Moderator*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

### Panelist/Contestant

#### Participants

Shaun A. Wahab, MD, Mason, OH (*Presenter*) Consultant, GlaxoSmithKline plc; Consultant, BioClinica, Inc; Consultant, Mersana Therapeutics, Inc

#### LEARNING OBJECTIVES

1) Attendees will broaden their abdominal imaging skills as experts guide them through their approach to diagnosing difficult cases.\*Course Description Using the popular game show format, experts will tackle abdominal imaging cases as challenging unknowns. Discussion will highlight working through differential diagnoses, and clues to getting it right.

#### COURSE DESCRIPTION

Using the popular game show format, experts will tackle abdominal imaging cases as challenging unknowns. Discussion will highlight working through differential diagnoses, and clues to getting it right.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Moderator/MC**

### Participants

Olga Brook, MD,MBA, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Moderator**

### Participants

David DiSantis, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Panelist/Contestant**

### **Participants**

Rachita Khot, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CGI01

**Panelist/Contestant**

### **Participants**

Satheesh Krishna, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Panelist/Contestant**

### **Participants**

Natally Horvat, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Panelist/Contestant**

### Participants

Sarah Bastawrous, DO, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

**Panelist/Contestant**

### **Participants**

Gaurav Khatri, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CGI01

### GI/GU Jeopardy

#### Sub-Events

##### **S1-CGI01 Moderator**

Participants

Cooky Menias, MD, Phoenix, AZ (*Moderator*) Royalties, RELX

##### **S1-CGI01 Moderator**

Participants

David DiSantis, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose

##### **S1-CGI01 Moderator/MC**

Participants

Olga Brook, MD,MBA, Boston, MA (*Moderator*) Nothing to Disclose

##### **S1-CGI01 Panelist/Contestant**

Participants

Gaurav Khatri, MD, Dallas, TX (*Presenter*) Nothing to Disclose

##### **S1-CGI01 Panelist/Contestant**

Participants

Shaun A. Wahab, MD, Mason, OH (*Presenter*) Consultant, GlaxoSmithKline plc;Consultant, BioClinica, Inc;Consultant, Mersana Therapeutics, Inc

#### LEARNING OBJECTIVES

1) Attendees will broaden their abdominal imaging skills as experts guide them through their approach to diagnosing difficult cases.\*Course Description Using the popular game show format, experts will tackle abdominal imaging cases as challenging unknowns. Discussion will highlight working through differential diagnoses, and clues to getting it right.

#### COURSE DESCRIPTION

Using the popular game show format, experts will tackle abdominal imaging cases as challenging unknowns. Discussion will highlight working through differential diagnoses, and clues to getting it right.

##### **S1-CGI01 Panelist/Contestant**

Participants

Nataly Horvat, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### **S1-CGI01 Panelist/Contestant**

Participants

Sarah Bastawrous, DO, Seattle, WA (*Presenter*) Nothing to Disclose

##### **S1-CGI01 Panelist/Contestant**

Participants

Satheesh Krishna, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### **S1-CGI01 Panelist/Contestant**

Participants

Rachita Khot, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CIN10

### Moderator

#### Participants

Nicole Wake, PhD, Aurora, OH (*Moderator*) Employee, GE HealthCare  
Peter Liacouras, PhD, North Potomac, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CIN10

### Improving Efficiency of 3D Printing Workflows

#### Participants

Summer J. Decker, PhD, Tampa, FL (*Presenter*) Nothing to Disclose  
David Ballard, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CIN10

### Evaluating and Optimizing Accuracy of Clinical 3D Printing

#### Participants

Nicole Wake, PhD, Aurora, OH (*Presenter*) Employee, GE HealthCare

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CIN10

### Pitching the Business Case for 3D Printing in Health Care Facilities

#### Participants

Justin Ryan, PhD, San Diego, CA (*Presenter*) Nothing to Disclose

Summer J. Decker, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CIN10

### Pearls and Pitfalls of 3D Printing from Imaging Data

#### LEARNING OBJECTIVES

1) Understand how to evaluate and optimize the accuracy of clinical 3D printing. 2) Identify strategies to improve efficiency of 3D printing workflows. 3) Explain how to pitch the business case for 3D printing in healthcare facilities.\*Course Description Safety and quality in clinical 3D printing depend on many technical and operational factors. 3D printed anatomic models must reliably represent the patient's anatomy to be useful to the clinician, but the workflow required to create these models from medical imaging data is complex and time consuming. The inherent complexity of image-based 3D printing allows the possibility of errors at any stage of the process. These stages include imaging acquisition, fusion of multiple exam types, segmentation, computer aided design, 3D printing, and post processing of the final 3D printed product. In this educational course, the stages where variances in the 3D printing workflow can occur will be reviewed. Specific clinical scenarios and challenges will be used to illustrate strategies for successful 3D printing. Tips on how to assess quality as well as improve efficiency and address variances will be described. From an operational standpoint, strategies for making the business case for 3D printing capabilities in health care facilities will also be discussed. 3D printed models will be circulated as examples. Interactive polling questions will be used throughout the session to engage the audience and assess their knowledge base. This interactive didactic session addresses the needs outlined above and provides a framework to address potential pitfalls in performing clinical 3D printing. This topic is relevant to trainees and practicing radiologists engaged in the management of complex surgical conditions, as well as technologists and scientists involved in image optimization and processing for visualization and 3D modeling.

#### COURSE DESCRIPTION

Safety and quality in clinical 3D printing depend on many technical and operational factors. 3D printed anatomic models must reliably represent the patient's anatomy to be useful to the clinician, but the workflow required to create these models from medical imaging data is complex and time consuming. The inherent complexity of image-based 3D printing allows the possibility of errors at any stage of the process. These stages include imaging acquisition, fusion of multiple exam types, segmentation, computer aided design, 3D printing, and post processing of the final 3D printed product. In this educational course, the stages where variances in the 3D printing workflow can occur will be reviewed. Specific clinical scenarios and challenges will be used to illustrate strategies for successful 3D printing. Tips on how to assess quality as well as improve efficiency and address variances will be described. From an operational standpoint, strategies for making the business case for 3D printing capabilities in health care facilities will also be discussed. 3D printed models will be circulated as examples. Interactive polling questions will be used throughout the session to engage the audience and assess their knowledge base. This interactive didactic session addresses the needs outlined above and provides a framework to address potential pitfalls in performing clinical 3D printing. This topic is relevant to trainees and practicing radiologists engaged in the management of complex surgical conditions, as well as technologists and scientists involved in image optimization and processing for visualization and 3D modeling.

#### Sub-Events

##### **S1-CIN10 Evaluating and Optimizing Accuracy of Clinical 3D Printing**

Participants  
Nicole Wake, PhD, Aurora, OH (*Presenter*) Employee, GE HealthCare

##### **S1-CIN10 Pitching the Business Case for 3D Printing in Health Care Facilities**

Participants  
Justin Ryan, PhD, San Diego, CA (*Presenter*) Nothing to Disclose  
Summer J. Decker, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

##### **S1-CIN10 Moderator**

Participants  
Nicole Wake, PhD, Aurora, OH (*Moderator*) Employee, GE HealthCare  
Peter Liacouras, PhD, North Potomac, MD (*Moderator*) Nothing to Disclose

##### **S1-CIN10 Improving Efficiency of 3D Printing Workflows**

Participants  
Summer J. Decker, PhD, Tampa, FL (*Presenter*) Nothing to Disclose  
David Ballard, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

### Emerging Imaging Techniques in MSK Imaging

#### Sub-Events

##### **S1-CMK12 Moderator**

###### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

##### **S1-CMK12 MR Imaging of Metallic Orthopedic Hardware**

###### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### **S1-CMK12 Photon-counting CT in the MSK Practice: Opportunities and Challenges**

###### Participants

Francis Baffour, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### **S1-CMK12 Machine Learning for MRI Analysis**

###### Participants

Benjamin Fritz, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose

##### **S1-CMK12 Deep Learning for Image Reconstruction**

###### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **S1-CMK12 New Ways to Assess Muscle with MRI**

###### Participants

Margaret A. Hall-Craggs, MD, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

Timothy Bray, MBBChir, PhD, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

**Moderator**

### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

### MR Imaging of Metallic Orthopedic Hardware

#### Participants

Iman Khodarahmi, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

### Photon-counting CT in the MSK Practice: Opportunities and Challenges

#### Participants

Francis Baffour, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

### Machine Learning for MRI Analysis

#### Participants

Benjamin Fritz, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CMK12

### Deep Learning for Image Reconstruction

#### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CMK12

### New Ways to Assess Muscle with MRI

#### Participants

Margaret A. Hall-Craggs, MD, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose  
Timothy Bray, MBBChir, PhD, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

### From Careerism to Professionalism: A Personal and Institutional Imperative (Sponsored by the RSNA Professionalism Committee)

#### LEARNING OBJECTIVES

1) Learn how to fit in and stand out by developing self-awareness of personal strengths/weaknesses and institutional culture and opportunities. 2) Learn how to avoid career self-sabotage by focusing on productive habits rather than goals, negotiating resources and authority commensurate with authority, engaging in supportive rather than exploitative relationships, and responding to challenges with resilience and antifragility. 3) Learn how to lead with or without titles to guide and inspire others to thrive and move beyond status-seeking careerism to professionalism based on a commitment to excellence and magnanimity.\*Course Description This course will be comprised of several presentations addressing how to best facilitate a successful transition from trainee to early and mid career radiologist and recognize the important distinction between "careerism" and professionalism. Advice will be provided on how to fit in and stand out by achieving the self-awareness to determine what practice setting and roles are best aligned to take advantage of personal strengths and promote professional growth. Tips for avoiding career self-sabotage will be offered, including focusing on productive habits rather than all-or-none goals, negotiating resources and authority commensurate with responsibility, engaging in supportive rather than exploitative relationships, developing resilience and antifragility in response to challenges, and adapting to cultural norms. While professional success can be measured in terms of metrics such as publications, citations, invited lectures, awards, grants, degrees, and titles, status-seeking "careerism" is ultimately much less fulfilling than building a strong sense of professionalism based on a passion for excellence and magnanimity that guides and inspires others to thrive.

#### COURSE DESCRIPTION

This course will be comprised of several presentations addressing how to best facilitate a successful transition from trainee to early and mid career radiologist and recognize the important distinction between "careerism" and professionalism. Advice will be provided on how to fit in and stand out by achieving the self-awareness to determine what practice setting and roles are best aligned to take advantage of personal strengths and promote professional growth. Tips for avoiding career self-sabotage will be offered, including focusing on productive habits rather than all-or-none goals, negotiating resources and authority commensurate with responsibility, engaging in supportive rather than exploitative relationships, developing resilience and antifragility in response to challenges, and adapting to cultural norms. While professional success can be measured in terms of metrics such as publications, citations, invited lectures, awards, grants, degrees, and titles, status-seeking "careerism" is ultimately much less fulfilling than building a strong sense of professionalism based on a passion for excellence and magnanimity that guides and inspires others to thrive.

#### Sub-Events

##### S1-CNPM04 Moderator

Participants

R. Paul Guillerman, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### S1-CNPM04 Moderator

Participants

Sarah D. Bixby, MD, MBA, Boston, MA (*Moderator*) Nothing to Disclose

##### S1-CNPM04 Fitting In and Standing Out

Participants

R. Paul Guillerman, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### S1-CNPM04 Avoiding Career Self-Sabotage

Participants

Charles M. Maxfield, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### S1-CNPM04 Leading With or Without Titles - Part A

Participants

Sarah D. Bixby, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

##### S1-CNPM04 Leading With or Without Titles - Part B

Participants

Mariana Meyers, MD, Aurora, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

**Moderator**

### Participants

R. Paul Guillerman, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

**Moderator**

### Participants

Sarah D. Bixby, MD, MBA, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

### Fitting In and Standing Out

#### Participants

R. Paul Guillerman, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

### Avoiding Career Self-Sabotage

#### Participants

Charles M. Maxfield, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

### Leading With or Without Titles - Part A

#### Participants

Sarah D. Bixby, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNPM04

### Leading With or Without Titles - Part B

#### Participants

Mariana Meyers, MD, Aurora, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CNR02

### Essential Updates in Ischemic Stroke Imaging and Treatment

#### LEARNING OBJECTIVES

1) To describe new large artery occlusion targets for thrombectomy treatment in acute ischemic stroke patients. 2) To understand existing evidence for the treatment of medium and small artery occlusion targets by thrombectomy. 3) To understand new thrombectomy eligibility criteria based upon non-invasive imaging studies. 4) To describe new frontiers in endovascular thrombectomy and how they may impact ischemic stroke treatment in the near future.\*Course Description Acute ischemic stroke is the leading cause of disability in the United States and results in significant mortality worldwide. New randomized trials published in the past two years have substantially increased patient eligibility for endovascular thrombectomy. In this course, we will review new selection criteria for endovascular thrombectomy (such as patients with large ischemic cores and low ASPECTS) and the evidence for expanded treatment of vessel occlusions (such as basilar artery occlusions and small/medium vessel occlusions). In addition, we will describe existing and emerging changes in hospital systems to facilitate expeditious transfer and treatment of thrombectomy-eligible patients and discuss commonly encountered challenges in patient treatment through a case-based discussion.

#### COURSE DESCRIPTION

Acute ischemic stroke is the leading cause of disability in the United States and results in significant mortality worldwide. New randomized trials published in the past two years have substantially increased patient eligibility for endovascular thrombectomy. In this course, we will review new selection criteria for endovascular thrombectomy (such as patients with large ischemic cores and low ASPECTS) and the evidence for expanded treatment of vessel occlusions (such as basilar artery occlusions and small/medium vessel occlusions). In addition, we will describe existing and emerging changes in hospital systems to facilitate expeditious transfer and treatment of thrombectomy-eligible patients and discuss commonly encountered challenges in patient treatment through a case-based discussion.

#### Sub-Events

##### **S1-CNR02 Moderator**

###### Participants

Jeremy Heit, MD, PhD, Los Altos, CA (*Moderator*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Consultant, iSchemaView, Inc; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc; Committee Member, Vesalio

##### **S1-CNR02 Expanded Eligibility for Endovascular Thrombectomy: Treatment of Patients with Low ASPECTS and Large Ischemic Cores**

###### Participants

Jeremy Heit, MD, PhD, Los Altos, CA (*Presenter*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Consultant, iSchemaView, Inc; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc; Committee Member, Vesalio

##### **S1-CNR02 Large Vessel Occlusions to Not-So-Large Vessel Occlusions: What's the Evidence for Thrombectomy?**

###### Participants

Michele Johnson, MD, New Haven, CT (*Presenter*) Medical Advisory Board, iSchemaView, Inc

##### **S1-CNR02 Hospital Systems of Care for Ischemic Stroke Patients and the Changing Role of the Radiologist**

###### Participants

Mahesh V. Jayaraman, MD, (*Presenter*) Nothing to Disclose

##### **S1-CNR02 Challenges in Ischemic Stroke Treatment: A Case-Based Discussion**

###### Participants

Katyucia De Macedo Rodrigues, MD, Greensboro, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNR02

**Moderator**

### **Participants**

Jeremy Heit, MD, PhD, Los Altos, CA (*Moderator*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Consultant, iSchemaView, Inc; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc; Committee Member, Vesalio

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNR02

### Expanded Eligibility for Endovascular Thrombectomy: Treatment of Patients with Low ASPECTS and Large Ischemic Cores

#### Participants

Jeremy Heit, MD, PhD, Los Altos, CA (*Presenter*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Consultant, iSchemaView, Inc; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc; Committee Member, Vesalio

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNR02

**Large Vessel Occlusions to Not-So-Large Vessel Occlusions: What's the Evidence for Thrombectomy?**

### Participants

Michele Johnson, MD, New Haven, CT (*Presenter*) Medical Advisory Board, iSchemaView, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNR02

### Hospital Systems of Care for Ischemic Stroke Patients and the Changing Role of the Radiologist

#### Participants

Mahesh V. Jayaraman, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CNR02

### Challenges in Ischemic Stroke Treatment: A Case-Based Discussion

#### Participants

Katyucia De Macedo Rodrigues, MD, Greensboro, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-COB05

### Placenta Accreta Spectrum (PAS): Pearls, Pitfalls, and Perils

#### Sub-Events

#### S1-COB05 Moderator

##### Participants

Diane M. Twickler, MD, Dallas, TX (*Moderator*) Nothing to Disclose

#### S1-COB05 Perspectives of the Pathologist: FIGO Classifications and Case Review

##### Participants

Jonathan Hecht, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain current clinical implications of placenta accreta spectrum (PAS) diagnosis. 2) Evaluate 1st trimester PAS with US, and PAS beyond 14 weeks gestation with US and MRI. 3) Understand the pathology of PAS and current FIGO classifications.\*Course Description Placenta Accreta Spectrum is a serious complication of pregnancy. This lecture will address how imaging with US and MRI can affect surgical planning that improves outcomes. Current US and MRI evaluation recommendations of PAS in pregnancy will be reviewed, including case presentations. The importance of correlation with pathologic outcomes and recommended FIGO classifications will be discussed.

#### COURSE DESCRIPTION

Placenta Accreta Spectrum is a serious complication of pregnancy. This lecture will address how imaging with US and MRI can affect surgical planning that improves outcomes. Current US and MRI evaluation recommendations of PAS in pregnancy will be reviewed, including case presentations. The importance of correlation with pathologic outcomes and recommended FIGO classifications will be discussed.

#### S1-COB05 Beyond 14 Weeks: US Placenta Accreta Index and 2nd Opinion MR

##### Participants

Diane M. Twickler, MD, Dallas, TX (*Presenter*) Nothing to Disclose

#### S1-COB05 Perspectives of the Maternal Fetal Medicine Specialist and 1st Trimester US Cesarean Scar of Pregnancy

##### Participants

Catherine Spong, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-COB05

**Moderator**

### Participants

Diane M. Twickler, MD, Dallas, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-COB05

### Perspectives of the Pathologist: FIGO Classifications and Case Review

#### Participants

Jonathan Hecht, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain current clinical implications of placenta accreta spectrum (PAS) diagnosis. 2) Evaluate 1st trimester PAS with US, and PAS beyond 14 weeks gestation with US and MRI. 3) Understand the pathology of PAS and current FIGO classifications.\*Course Description Placenta Accreta Spectrum is a serious complication of pregnancy. This lecture will address how imaging with US and MRI can affect surgical planning that improves outcomes. Current US and MRI evaluation recommendations of PAS in pregnancy will be reviewed, including case presentations. The importance of correlation with pathologic outcomes and recommended FIGO classifications will be discussed.

#### COURSE DESCRIPTION

Placenta Accreta Spectrum is a serious complication of pregnancy. This lecture will address how imaging with US and MRI can affect surgical planning that improves outcomes. Current US and MRI evaluation recommendations of PAS in pregnancy will be reviewed, including case presentations. The importance of correlation with pathologic outcomes and recommended FIGO classifications will be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-COB05

**Beyond 14 Weeks: US Placenta Accreta Index and 2nd Opinion MR**

### Participants

Diane M. Twickler, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-COB05

**Perspectives of the Maternal Fetal Medicine Specialist and 1st Trimester US Cesarean Scar of Pregnancy**

### Participants

Catherine Spong, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Abra Kilgore, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

### RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

#### Participants

Izabella Karney, RDMS, Chicago, IL (*Presenter*) Nothing to Disclose  
Falguni Patel, RDMS, RVT, Willowbrook, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Lauren May, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Matthew Hammer, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Stephanie Caputo, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Swati Patel, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Ayla Kljako, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Anna Alexiev, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Natalie Anzaldi, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

### RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

#### LEARNING OBJECTIVES

1) Review the anatomy and common pediatric pathologic musculoskeletal conditions in three pediatric joints: the elbow, hand and ankle. 2) Use dynamic scanning of the joints to better demonstrate the anatomy of soft tissue and osteochondral components of three pediatric joints and will point out the distinction of soft tissue structures by a compression technique. 3) Discuss pathologies in the aforementioned joints as an overview of common pediatric pathologic musculoskeletal conditions.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This 90-min pediatric musculoskeletal hands-on session is targeted to general radiologists who aim to get an overview of technical and clinical application perspectives on ultrasound scanning and interpreting pathology of elbows, hands and ankles of children and adolescents. The information provided in this session adds value to the diagnostic tools that can be used for assessment of musculoskeletal disorders that affect growing joints, particularly in young children who may require general anesthesia for MRI assessment of their joints. The session has two parts, a 60-min hands-on part where pre-assigned radiologists scan teenager models' joints in real time and a second 30-min knowledge application part where the audience has the opportunity to scan models' joints by themselves. In the first part of the session lecturers will demonstrate ultrasound protocols for scanning of pediatric elbows, hands and ankles in real-time and will discuss ultrasound findings of pathologies in these joints. In the second part of the session tutoring to scanning by the audience will be provided by assigned radiologists in a controlled educational environment where the audience will have the opportunity to apply the a priori discussed ultrasound protocols into scanning the models' joints.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This 90-min pediatric musculoskeletal hands-on session is targeted to general radiologists who aim to get an overview of technical and clinical application perspectives on ultrasound scanning and interpreting pathology of elbows, hands and ankles of children and adolescents. The information provided in this session adds value to the diagnostic tools that can be used for assessment of musculoskeletal disorders that affect growing joints, particularly in young children who may require general anesthesia for MRI assessment of their joints. The session has two parts, a 60-min hands-on part where pre-assigned radiologists scan teenager models' joints in real time and a second 30-min knowledge application part where the audience has the opportunity to scan models' joints by themselves. In the first part of the session lecturers will demonstrate ultrasound protocols for scanning of pediatric elbows, hands and ankles in real-time and will discuss ultrasound findings of pathologies in these joints. In the second part of the session tutoring to scanning by the audience will be provided by assigned radiologists in a controlled educational environment where the audience will have the opportunity to apply the a priori discussed ultrasound protocols into scanning the models' joints.

#### Sub-Events

##### S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

Participants  
Erica Schallert, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

Participants  
Andrea S. Doria, PhD, Toronto, ON (*Presenter*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

##### S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

Participants  
Monica Kalume Brigido, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

Participants  
Jonathan D. Samet, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

Participants  
Kathryn Milks, MD, Columbus, OH (*Presenter*) Nothing to Disclose

##### S1-CPD13 Moderator

Participants  
Andrea S. Doria, PhD, Toronto, ON (*Moderator*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox

Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Abra Kilgore, Chicago, IL (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Izabella Karney, RDMS, Chicago, IL (*Presenter*) Nothing to Disclose

Falguni Patel, RDMS, RVT, Willowbrook, IL (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Lauren May, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Matthew Hammer, MD, Dallas, TX (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Natalie Anzaldi, (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Anna Alexiev, (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Swati Patel, (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Ayla Kljako, (*Presenter*) Nothing to Disclose

**S1-CPD13 RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Participants

Stephanie Caputo, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

### Moderator

#### Participants

Andrea S. Doria, PhD, Toronto, ON (*Moderator*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Erica Schallert, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

### RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound

#### Participants

Andrea S. Doria, PhD, Toronto, ON (*Presenter*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Monica Kalume Brigido, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Jonathan D. Samet, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CPD13

**RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

### Participants

Kathryn Milks, MD, Columbus, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CRO09

### Lung/Mediastinum Case Based Multidisciplinary Review

#### Sub-Events

#### S1-CRO09 Moderator

##### Participants

Simon Lo, MBChB, (*Moderator*) Committee member, Elekta AB

#### S1-CRO09 Lung/Mediastinum Case Based Multidisciplinary Review

##### Participants

Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

#### LEARNING OBJECTIVES

1) Identify imaging strategies in the diagnosis and staging of thoracic malignancies. 2) Explain the current multidisciplinary management of thoracic malignancies. 3) Identify imaging strategies for post-treatment evaluation.\*Course Description This case-based discussion will expose the attendees to multidisciplinary discussion when treating thoracic malignancies. The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports that directly affect prognosis and management. The cases to be discussed will be stage III non-small cell lung cancer, superior vena cava obstruction from small cell lung carcinoma, and mesothelioma.

#### COURSE DESCRIPTION

This case-based discussion will expose the attendees to multidisciplinary discussion when treating thoracic malignancies. The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports that directly affect prognosis and management. The cases to be discussed will be stage III non-small cell lung cancer, superior vena cava obstruction from small cell lung carcinoma, and mesothelioma.

#### S1-CRO09 Lung/Mediastinum Case Based Multidisciplinary Review

##### Participants

David Johnstone, Milwaukee, WI (*Presenter*) Nothing to Disclose

#### S1-CRO09 Lung/Mediastinum Case Based Multidisciplinary Review

##### Participants

Rafael Santana-Davila, Seattle, WA (*Presenter*) Nothing to Disclose

#### S1-CRO09 Lung/Mediastinum Case Based Multidisciplinary Review

##### Participants

Stephen Chun, MD, Houston, TX (*Presenter*) Consultant, AstraZeneca PLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CRO09

**Moderator**

### Participants

Simon Lo, MBChB, (*Moderator*) Committee member, Elekta AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CRO09

### Lung/Mediastinum Case Based Multidisciplinary Review

#### Participants

Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

#### LEARNING OBJECTIVES

1) Identify imaging strategies in the diagnosis and staging of thoracic malignancies. 2) Explain the current multidisciplinary management of thoracic malignancies. 3) Identify imaging strategies for post-treatment evaluation.\*Course Description This case-based discussion will expose the attendees to multidisciplinary discussion when treating thoracic malignancies. The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports that directly affect prognosis and management. The cases to be discussed will be stage III non-small cell lung cancer, superior vena cava obstruction from small cell lung carcinoma, and mesothelioma.

#### COURSE DESCRIPTION

This case-based discussion will expose the attendees to multidisciplinary discussion when treating thoracic malignancies. The panel will demonstrate specific imaging findings that directly affect staging and treatment decisions and will provide the audience with specific information they should include in their reports that directly affect prognosis and management. The cases to be discussed will be stage III non-small cell lung cancer, superior vena cava obstruction from small cell lung carcinoma, and mesothelioma.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CRO09

### Lung/Mediastinum Case Based Multidisciplinary Review

#### Participants

David Johnstone, Milwaukee, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CRO09

### Lung/Mediastinum Case Based Multidisciplinary Review

#### Participants

Rafael Santana-Davila, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CRO09

### Lung/Mediastinum Case Based Multidisciplinary Review

#### Participants

Stephen Chun, MD, Houston, TX (*Presenter*) Consultant, AstraZeneca PLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

**Moderator**

### Participants

Bradley Allen, MD, MS, Evanston, IL (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc; Speaker, WebMD LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

### Limited Tears and Ulcer-Like Aortic Lesions

#### Participants

Kacie Steinbrecher, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

**Moderator**

### **Participants**

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

### Imaging Acute Aortic Syndrome

#### Participants

Diana Litmanovich, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

### Imaging for Surgical and Intervention Planning in Aortic Dissection

#### Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Presenter*) Research Grant, Siemens AG; Stockholder, iSchemaView, Inc; Stockholder, Segmed, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S1-CVA08

### Aortic Dissection

#### LEARNING OBJECTIVES

1) Understand the subtypes and imaging appearance of aortic pathologies that are associated with acute aortic syndrome. 2) Explain the role of imaging for interventional planning in aortic dissection. 3) Describe the changes in imaging appearance of aortic dissection over time and the implications for patient risk.\*Course Description Aortic dissection and acute aortic syndromes are frequently encountered in clinical practice, but there is often confusion related to appropriate imaging and creating clinically impactful radiology reports. This session will review imaging approaches in acute aortic syndrome while providing learners with expert recommendation on reporting terminology and measurements, imaging for interventional planning in aortic dissection, and imaging in chronic aortic dissection.

#### COURSE DESCRIPTION

Aortic dissection and acute aortic syndromes are frequently encountered in clinical practice, but there is often confusion related to appropriate imaging and creating clinically impactful radiology reports. This session will review imaging approaches in acute aortic syndrome while providing learners with expert recommendation on reporting terminology and measurements, imaging for interventional planning in aortic dissection, and imaging in chronic aortic dissection.

#### Sub-Events

##### S1-CVA08 Moderator

Participants

Bradley Allen, MD, MS, Evanston, IL (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

##### S1-CVA08 Moderator

Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### S1-CVA08 Imaging Acute Aortic Syndrome

Participants

Diana Litmanovich, MD, (*Presenter*) Nothing to Disclose

##### S1-CVA08 Imaging for Surgical and Intervention Planning in Aortic Dissection

Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Presenter*) Research Grant, Siemens AG;Stockholder, iSchemaView, Inc;Stockholder, Segmed, Inc

##### S1-CVA08 Imaging Chronic Aortic Dissection

Participants

Nicholas Burris, MD, Ann Arbor, MI (*Presenter*) Royalties, ImBio, LLC

##### S1-CVA08 Limited Tears and Ulcer-Like Aortic Lesions

Participants

Kacie Steinbrecher, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-CVA08

### Imaging Chronic Aortic Dissection

#### Participants

Nicholas Burris, MD, Ann Arbor, MI (*Presenter*) Royalties, ImBio, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-RCP24

**Moderator**

### Participants

Heba Albasha, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-RCP24

**Contract Review and Negotiation for Trainees (Sponsored by the RSNA Resident Fellow Committee)**

### Participants

Seetharam Chadalavada, MS, Cincinnati, OH (*Presenter*) Consultant, Cook Group Incorporated; Grant, Cook Group Incorporated; Speaker, Cook Group Incorporated; Consultant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S1-RCP24

**Contract Review and Negotiation for Trainees (Sponsored by the RSNA Resident & Fellow Committee)**

### Sub-Events

#### **S1-RCP24 Moderator**

##### Participants

Heba Albasha, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose

#### **S1-RCP24 Contract Review and Negotiation for Trainees (Sponsored by the RSNA Resident Fellow Committee)**

##### Participants

Seetharam Chadalavada, MS, Cincinnati, OH (*Presenter*) Consultant, Cook Group Incorporated; Grant, Cook Group Incorporated; Speaker, Cook Group Incorporated; Consultant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

### HRCT Topics

#### Sub-Events

##### S2-CCH01 Moderator

###### Participants

Brett M. Elicker, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

##### S2-CCH01 Organizing Pneumonia

###### Participants

Jeffrey Galvin, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the typical findings of different patterns of injury within the lungs. 2) Understand the histologic, clinical, and radiologic aspects of organizing pneumonia. 3) Describe the role of HRCT in the setting of connective tissue disease and drug induced lung disease. 4) Explain the spectrum of findings and patterns seen in patients with hypersensitivity pneumonitis.\*Course Description The course will be a review of several topics in the field of diffuse lung disease. It will focus on a practical approach to reading high-resolution chest CTs, and identifying common findings and patterns of disease. A particular emphasis will be on patterns of injury seen in connective tissue disease and drug induced lung disease. It will also include a review of the multi-disciplinary approach to hypersensitivity pneumonitis and organizing pneumonia.

#### COURSE DESCRIPTION

The course will be a review of several topics in the field of diffuse lung disease. It will focus on a practical approach to reading high-resolution chest CTs, and identifying common findings and patterns of disease. A particular emphasis will be on patterns of injury seen in connective tissue disease and drug induced lung disease. It will also include a review of the multi-disciplinary approach to hypersensitivity pneumonitis and organizing pneumonia.

##### S2-CCH01 Collagen Vascular/Autoimmune Disease in the Lungs

###### Participants

Brett M. Elicker, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### S2-CCH01 Hypersensitivity Pneumonitis

###### Participants

Justus E. Roos, MD, Luzern, Switzerland (*Presenter*) Nothing to Disclose

##### S2-CCH01 Drug Induced Lung Disease

###### Participants

Kimberly Kallianos, MD, San Rafael, CA (*Presenter*) Nothing to Disclose

##### S2-CCH01 HRCT Topics

###### Participants

Teri Franks, MD, , MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

**Moderator**

### Participants

Brett M. Elicker, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

### Organizing Pneumonia

#### Participants

Jeffrey Galvin, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe the typical findings of different patterns of injury within the lungs. 2) Understand the histologic, clinical, and radiologic aspects of organizing pneumonia. 3) Describe the role of HRCT in the setting of connective tissue disease and drug induced lung disease. 4) Explain the spectrum of findings and patterns seen in patients with hypersensitivity pneumonitis.\*Course Description  
The course will be a review of several topics in the field of diffuse lung disease. It will focus on a practical approach to reading high-resolution chest CTs, and identifying common findings and patterns of disease. A particular emphasis will be on patterns of injury seen in connective tissue disease and drug induced lung disease. It will also include a review of the multi-disciplinary approach to hypersensitivity pneumonitis and organizing pneumonia.

#### COURSE DESCRIPTION

The course will be a review of several topics in the field of diffuse lung disease. It will focus on a practical approach to reading high-resolution chest CTs, and identifying common findings and patterns of disease. A particular emphasis will be on patterns of injury seen in connective tissue disease and drug induced lung disease. It will also include a review of the multi-disciplinary approach to hypersensitivity pneumonitis and organizing pneumonia.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CCH01

### Collagen Vascular/Autoimmune Disease in the Lungs

#### Participants

Brett M. Elicker, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

### Hypersensitivity Pneumonitis

#### Participants

Justus E. Roos, MD, Luzern, Switzerland (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

### Drug Induced Lung Disease

#### Participants

Kimberly Kallianos, MD, San Rafael, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CCH01

### HRCT Topics

#### Participants

Teri Franks, MD, , MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CER02

**Moderator**

### Participants

Nicholas Beckmann, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CER02

### CT of Cervical Spine Trauma

#### Participants

Nicholas Beckmann, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CER02

### CT of Thoracolumbar Spine Trauma

#### Participants

Ken Linnau, MD, MS, (*Presenter*) Royalties, Cambridge University Press; Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CER02

### MRI in Spine Trauma

#### Participants

Kuang-Chun Hsieh, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CER02

### Essentials of Spine Trauma

#### LEARNING OBJECTIVES

1) Describe mechanisms and associated injury patterns of cervical and thoracolumbar spine trauma. 2) Demonstrate common classifications used for spine trauma and understand their clinical relevance. 3) Recognize significant traumatic spine soft tissue injuries on MRI.\*Course Description The anatomy of the spine is complex and traumatic spine injuries can be subtle, which can make it challenging to correctly diagnosis significant traumatic spine injuries. In this three-part didactic session, the typical injury patterns and classification systems used for diagnosing traumatic spine injuries on CT will be presented along with the role and interpretation of MRI in imaging spine trauma.

#### COURSE DESCRIPTION

The anatomy of the spine is complex and traumatic spine injuries can be subtle, which can make it challenging to correctly diagnosis significant traumatic spine injuries. In this three-part didactic session, the typical injury patterns and classification systems used for diagnosing traumatic spine injuries on CT will be presented along with the role and interpretation of MRI in imaging spine trauma.

#### Sub-Events

##### S2-CER02 Moderator

Participants  
Nicholas Beckmann, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### S2-CER02 CT of Cervical Spine Trauma

Participants  
Nicholas Beckmann, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### S2-CER02 CT of Thoracolumbar Spine Trauma

Participants  
Ken Linnau, MD, MS, (*Presenter*) Royalties, Cambridge University Press;Research Grant, Siemens AG

##### S2-CER02 MRI in Spine Trauma

Participants  
Kuang-Chun Hsieh, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

**Moderator**

### **Participants**

Antonio Westphalen, MD, PhD, (*Moderator*) Shareholder, ScanMed, LLC; Research funded, BotImage, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

### Radiology

#### Participants

Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Presenter*) Research Grant, Siemens AG

#### LEARNING OBJECTIVES

1) Familiarize oneself with the most up-to-date data pertaining to genitourinary oncology, radiology, and associated fields.\*Course Description In this session we will summarize the newest and best GU oncology research published and presented at the most recent meetings in and outside radiology. Speakers will present research in their area of practice, but that are relevant for practicing radiologists.

#### COURSE DESCRIPTION

In this session we will summarize the newest and best GU oncology research published and presented at the most recent meetings in and outside radiology. Speakers will present research in their area of practice, but that are relevant for practicing radiologists.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

**Urology**

### **Participants**

Yaw Nyame, MD, Seattle, WA (*Presenter*) Research Consultant, Ortho-Clinical Diagnostics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

### Radiation Oncology

#### Participants

Michael Zelefsky, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

**Radiology**

### Participants

Victoria Chernyak, MD, MS, Bronx, NY (*Presenter*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CGU07

### Best of Sessions in GU Oncology

#### Sub-Events

##### S2-CGU07 Moderator

###### Participants

Antonio Westphalen, MD, PhD, (*Moderator*) Shareholder, ScanMed, LLC; Research funded, BotImage, Inc

##### S2-CGU07 Radiology

###### Participants

Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Presenter*) Research Grant, Siemens AG

#### LEARNING OBJECTIVES

1) Familiarize oneself with the most up-to-date data pertaining to genitourinary oncology, radiology, and associated fields.\*Course Description In this session we will summarize the newest and best GU oncology research published and presented at the most recent meetings in and outside radiology. Speakers will present research in their area of practice, but that are relevant for practicing radiologists.

#### COURSE DESCRIPTION

In this session we will summarize the newest and best GU oncology research published and presented at the most recent meetings in and outside radiology. Speakers will present research in their area of practice, but that are relevant for practicing radiologists.

##### S2-CGU07 Urology

###### Participants

Yaw Nyame, MD, Seattle, WA (*Presenter*) Research Consultant, Ortho-Clinical Diagnostics, Inc

##### S2-CGU07 Radiation Oncology

###### Participants

Michael Zelefsky, MD, New York, NY (*Presenter*) Nothing to Disclose

##### S2-CGU07 Radiology

###### Participants

Victoria Chernyak, MD, MS, Bronx, NY (*Presenter*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN12

### The Symbiotic Relationship of AI and Patient Centered Radiology (Sponsored by the RSNA Public Information Committee)

#### LEARNING OBJECTIVES

1) How to include patients as our partner in AI implementation. 2) List 5 uses of AI to improve patient experience. 3) Learn how AI is seen by patients around the world.\*Course Description Both Artificial Intelligence and Patient Centered Care are hot topics in radiology, but the concepts at first glance may seem contradictory. This course will help its audience better understand how these two concepts can have a symbiotic relationship. Listeners will learn what patients want to know about AI and how to discuss how AI may affect their care. Specific AI tools to improve the patient experience in the radiologic care journey will be discussed. AI and patient-centric radiology may look different depending on practice demographics and geographic locations; how can we learn from each other?

#### COURSE DESCRIPTION

Both Artificial Intelligence and Patient Centered Care are hot topics in radiology, but the concepts at first glance may seem contradictory. This course will help its audience better understand how these two concepts can have a symbiotic relationship. Listeners will learn what patients want to know about AI and how to discuss how AI may affect their care. Specific AI tools to improve the patient experience in the radiologic care journey will be discussed. AI and patient-centric radiology may look different depending on practice demographics and geographic locations; how can we learn from each other?

#### Sub-Events

##### S2-CIN12 Moderator

Participants

Jennifer Kemp, MD, Denver, CO (*Moderator*) Stockholder, Scanslated, Inc

##### S2-CIN12 Patient Preferences Determine AI Boundaries- An International Perspective

Participants

Derya Yakar, MD, PhD, Meerstad, Netherlands (*Presenter*) Research Grant, Siemens AG

##### S2-CIN12 Noninterpretive use of AI in Radiology to Improve Patient Experience

Participants

Judy Gichoya, MBChB,MS, Atlanta, GA (*Presenter*) Consultant, Softbrew Digital LTD

##### S2-CIN12 Using AI to Improve Patient-Reported Outcomes

Participants

Scott Adams, MD,PhD, Saskatoon, SK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CIN12

**Moderator**

### **Participants**

Jennifer Kemp, MD, Denver, CO (*Moderator*) Stockholder, Scanslated, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN12

### Patient Preferences Determine AI Boundaries- An International Perspective

#### Participants

Derya Yakar, MD, PhD, Meerstad, Netherlands (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN12

### Noninterpretive use of AI in Radiology to Improve Patient Experience

#### Participants

Judy Gichoya, MBChB,MS, Atlanta, GA (*Presenter*) Consultant, Softbrew Digital LTD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN12

### Using AI to Improve Patient-Reported Outcomes

#### Participants

Scott Adams, MD,PhD, Saskatoon, SK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN21

### Accelerating to the Future of AI in Radiology: A Demonstration of Imaging AI in Practice

#### Sub-Events

##### **S2-CIN21 Moderator**

Participants

Katherine Andriole, PhD, (*Moderator*) Nothing to Disclose

##### **S2-CIN21 RSNA Imaging AI in Practice (IAIP): Introduction and Clinical Considerations**

Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the future of AI applications throughout the entire radiology workflow. 2) Recognize practical implementation considerations, most importantly semantic and interoperability standards necessary to implement AI into the clinical arena. 3) Consider what the future of radiology AI implementation may hold.\*Course Description

##### **S2-CIN21 Under the Hood of IAIP: Technical Considerations for a Successful Live Demo**

Participants

Mohannad Hussain, Waterloo, ON (*Presenter*) Consultant, Techie Maestro Inc

##### **S2-CIN21 Panelist**

Participants

Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

##### **S2-CIN21 Panelist**

Participants

Madhavi Duvvuri, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN21

**Moderator**

### Participants

Katherine Andriole, PhD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN21

### RSNA Imaging AI in Practice (IAIP): Introduction and Clinical Considerations

#### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the future of AI applications throughout the entire radiology workflow. 2) Recognize practical implementation considerations, most importantly semantic and interoperability standards necessary to implement AI into the clinical arena. 3) Consider what the future of radiology AI implementation may hold.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN21

**Under the Hood of IAIP: Technical Considerations for a Successful Live Demo**

### Participants

Mohannad Hussain, Waterloo, ON (*Presenter*) Consultant, Techie Maestro Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CIN21

### Panelist

#### Participants

Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIN21

### Panelist

#### Participants

Madhavi Duvvuri, MD, MS, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Management of Traumatic Hepatic AV Fistulas

#### Participants

Maria del Pilar Bayona Molano, MD, Irving, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Thoracic Vascular Injury Management

#### Participants

Claudia Gonzalez Nieto, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### IVC Filters and Venous Interventions in Trauma

#### Participants

Bernhard Gebauer, MD, Berlin, Germany (*Presenter*) Speaker, PAREXEL International Corporation; Speaker, Becton, Dickinson and Company; Speaker, Sirtex Medical Ltd; Speaker, Abbott Laboratories; Speaker, Cook Group Incorporated; Speaker, AngioDynamics, Inc; Speaker, PharmCept; Speaker, ewimed GmbH; Speaker, Novartis AG; Speaker, F. Hoffmann-La Roche Ltd; Speaker, Merck & Co, Inc; Speaker, ICON plc; Speaker, Ipsen SA; Speaker, Bayer AG; Speaker, Pfizer Inc; Speaker, Guerbet SA; Speaker, Terumo Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Imaging Workup and Indications for Trauma Interventions

#### Participants

Maxime Ronot, MD, PhD, Clichy, France (*Presenter*) Speaker, General Electric Company; Speaker, Ipsen SA; Speaker, Canon Medical Systems Corporation; Speaker, Alexion Pharmaceuticals, Inc; Speaker, Guerbet SA; Speaker, Sirtex Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Trauma Interventions

#### LEARNING OBJECTIVES

1) Understand the principles and techniques of interventions for trauma, including the use of imaging modalities, and vascular and non-vascular interventions. 2) Assess and prioritize traumatic injuries in the context of interventional radiology, recognizing indications and contraindications for different interventional procedures, and developing appropriate treatment plans. 3) Effectively communicate and collaborate with interdisciplinary teams involved in trauma care, contributing their knowledge and expertise in interventional radiology to facilitate comprehensive and coordinated management of trauma patients.\*Course Description The session is a comprehensive course that delves into the vital connection between interventional radiology and trauma. This session is designed to provide healthcare professionals with a deep understanding of the key topics in this field, including imaging workup, indications for trauma interventions, and management of various traumatic injuries. Through a combination of engaging lectures and interactive discussions, participants will gain the knowledge and skills necessary to effectively utilize interventional radiology techniques in trauma care. By the end of this session, participants will have a comprehensive understanding of the principles and techniques involved in interventional radiology for trauma intervention. They will be able to apply this knowledge to make informed decisions. Additionally, participants will develop the skills to effectively collaborate with multidisciplinary teams, facilitating improved outcomes for trauma patients through the integration of interventional radiology into trauma care protocols.

#### COURSE DESCRIPTION

The session is a comprehensive course that delves into the vital connection between interventional radiology and trauma. This session is designed to provide healthcare professionals with a deep understanding of the key topics in this field, including imaging workup, indications for trauma interventions, and management of various traumatic injuries. Through a combination of engaging lectures and interactive discussions, participants will gain the knowledge and skills necessary to effectively utilize interventional radiology techniques in trauma care. By the end of this session, participants will have a comprehensive understanding of the principles and techniques involved in interventional radiology for trauma intervention. They will be able to apply this knowledge to make informed decisions. Additionally, participants will develop the skills to effectively collaborate with multidisciplinary teams, facilitating improved outcomes for trauma patients through the integration of interventional radiology into trauma care protocols.

#### Sub-Events

##### S2-CIR01 Moderator

###### Participants

Maxime Ronot, MD, PhD, Clichy, France (*Moderator*) Speaker, General Electric Company;Speaker, Ipsen SA;Speaker, Canon Medical Systems Corporation;Speaker, Alexion Pharmaceuticals, Inc;Speaker, Guerbet SA;Speaker, Sirtex Medical Ltd

##### S2-CIR01 Splenic Artery Embolization

###### Participants

Theresa Caridi, MD, Birmingham, AL (*Presenter*) Consultant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Consultant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Terumo Corporation;Speaker, Terumo Corporation;Consultant, Siemens AG;Speaker, Siemens AG;Speaker, Penumbra, Inc;Research Grant, Siemens AG

##### S2-CIR01 Non-Vascular Injury Management

###### Participants

Shelagh Dyer, MD, (*Presenter*) Nothing to Disclose

##### S2-CIR01 Management of Traumatic Hepatic AV Fistulas

###### Participants

Maria del Pilar Bayona Molano, MD, Irving, TX (*Presenter*) Nothing to Disclose

##### S2-CIR01 Thoracic Vascular Injury Management

###### Participants

Claudia Gonzalez Nieto, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

##### S2-CIR01 IVC Filters and Venous Interventions in Trauma

###### Participants

Bernhard Gebauer, MD, Berlin, Germany (*Presenter*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation

## **S2-CIR01 Imaging Workup and Indications for Trauma Interventions**

### Participants

Maxime Ronot, MD, PhD, Clichy, France (*Presenter*) Speaker, General Electric Company; Speaker, Ipsen SA; Speaker, Canon Medical Systems Corporation; Speaker, Alexion Pharmaceuticals, Inc; Speaker, Guerbet SA; Speaker, Sirtex Medical Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CIR01

**Moderator**

### **Participants**

Maxime Ronot, MD, PhD, Clichy, France (*Moderator*) Speaker, General Electric Company; Speaker, Ipsen SA; Speaker, Canon Medical Systems Corporation; Speaker, Alexion Pharmaceuticals, Inc; Speaker, Guerbet SA; Speaker, Sirtex Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Splenic Artery Embolization

#### Participants

Theresa Caridi, MD, Birmingham, AL (*Presenter*) Consultant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Consultant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Terumo Corporation;Speaker, Terumo Corporation;Consultant, Siemens AG;Speaker, Siemens AG;Speaker, Penumbra, Inc;Research Grant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CIR01

### Non-Vascular Injury Management

#### Participants

Shelagh Dyer, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMK15

**Moderator**

### Participants

Robert Boutin, MD, Stanford, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMK15

### Controversies Solutions at Wake Forest: From Geroscience to Biologic Age

#### Participants

Leon Lenchik, MD, Winston-salem, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMK15

### Controversies Solutions at Jefferson: From Coping with Increased Volumes to Thriving in Daily Clinical Practice

#### Participants

Adam Zoga, MD, MBA, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMK15

**Controversies Solutions at Johns Hopkins: From Spine Protocols to Diagnosis of Foot Osteomyelitis**

### Participants

Laura M. Fayad, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMK15

### Current Controversies in MSK Imaging

#### LEARNING OBJECTIVES

1) Identify practical solutions to address common challenges and controversies experienced in musculoskeletal imaging.\*Course Description Speakers from diverse perspectives share highlights of their struggles and strategies for overcoming obstacles experienced in their clinical practices – with ample time for audience questions and discussion.

#### COURSE DESCRIPTION

Speakers from diverse perspectives share highlights of their struggles and strategies for overcoming obstacles experienced in their clinical practices – with ample time for audience questions and discussion.

#### Sub-Events

##### **S2-CMK15 Moderator**

Participants  
Robert Boutin, MD, Stanford, CA (*Moderator*) Nothing to Disclose

##### **S2-CMK15 Controversies Solutions at Wake Forest: From Geroscience to Biologic Age**

Participants  
Leon Lenchik, MD, Winston-salem, NC (*Presenter*) Nothing to Disclose

##### **S2-CMK15 Controversies Solutions at Jefferson: From Coping with Increased Volumes to Thriving in Daily Clinical Practice**

Participants  
Adam Zoga, MD, MBA, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **S2-CMK15 Controversies Solutions at Johns Hopkins: From Spine Protocols to Diagnosis of Foot Osteomyelitis**

Participants  
Laura M. Fayad, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

##### **S2-CMK15 Controversies Solutions at Stanford: From Knee MRI to Opportunistic Imaging**

Participants  
Robert Boutin, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CMK15

### Controversies Solutions at Stanford: From Knee MRI to Opportunistic Imaging

#### Participants

Robert Boutin, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

### Multisystem Imaging Manifestations of COVID-19 and Related Complications

#### LEARNING OBJECTIVES

1) Briefly explain pathophysiology of COVID-19. 2) Review diagnostic imaging hallmarks of COVID-19. 3) Describe multisystem immediate and long-term complications of COVID-19 including CNS, cardiovascular, pulmonary, and abdominal systems. 4) Discuss controversies of post COVID-19 vaccination.\*Course Description This session will provide a comprehensive review of the diagnostic imaging hallmarks, imaging features, multisystemic involvement, and evolution of imaging findings in patients with COVID-19. Neurologic, cardiac, abdominal, chest (early and chronic) complications will be discussed. Specific imaging considerations in COVID-19 related myocarditis and post vaccination complications will be also provided.

#### COURSE DESCRIPTION

This session will provide a comprehensive review of the diagnostic imaging hallmarks, imaging features, multisystemic involvement, and evolution of imaging findings in patients with COVID-19. Neurologic, cardiac, abdominal, chest (early and chronic) complications will be discussed. Specific imaging considerations in COVID-19 related myocarditis and post vaccination complications will be also provided.

#### Sub-Events

##### S2-CMS05 Moderator

Participants  
Margarita Revzin, MD, MS, Wilton, CT (*Moderator*) Nothing to Disclose

##### S2-CMS05 Adominopelvic Imaging in COVID: Lessons Learned

Participants  
Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

##### S2-CMS05 Neuroimaging of the SARS-CoV-2 Infection and Post-vaccination Neurological Syndromes

Participants  
Otto Rapalino, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### S2-CMS05 Cardiac Imaging in COVID and After Vaccination (with Myocarditis)

Participants  
Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### S2-CMS05 CT of Post-Acute Lung Complications of COVID-19

Participants  
David A. Lynch, MBCh, Denver, CO (*Presenter*) Research Consultant, CALYX Inc;Research Consultant, Boehringer Ingelheim GmbH;Research Consultant, Veracyte, Inc;Research Consultant, DAIICHI SANKYO Group;Research Consultant, AstraZeneca PLC;Consultant, Polarean, Inc;Consultant, Bristol Myers Squibb Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

### CT of Post-Acute Lung Complications of COVID-19

#### Participants

David A. Lynch, MBBCh, Denver, CO (*Presenter*) Research Consultant, CALYX Inc; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Veracyte, Inc; Research Consultant, DAIICHI SANKYO Group; Research Consultant, AstraZeneca PLC; Consultant, Polarean, Inc; Consultant, Bristol Myers Squibb Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

### Cardiac Imaging in COVID and After Vaccination (with Myocarditis)

#### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

### Neuroimaging of the SARS-CoV-2 Infection and Post-vaccination Neurological Syndromes

#### Participants

Otto Rapalino, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

**Moderator**

### **Participants**

Margarita Revzin, MD, MS, Wilton, CT (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CMS05

### Adominopelvic Imaging in COVID: Lessons Learned

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNMMI01

**Moderator**

### Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Moderator*) Consultant, ICON plc;;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CNMMI01

### Update on Pediatric Renal Scintigraphy

#### Participants

Reza Vali, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To discuss advances in pediatric general nuclear medicine and PET. 2) To review patient preparation and clinical indications for nuclear medicine and PET studies in pediatrics. 3) To illustrate pearls and pitfalls of imaging in the pediatric population.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNMMI01

### Current Practices in Pediatric Thyroid Disease

#### Participants

Frederick Grant, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNMMI01

### Pediatric PET Hybrid Imaging

#### Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNMMI01

### Update and Advances in Pediatric Nuclear Medicine

#### Sub-Events

##### **S2-CNMMI01 Moderator**

Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Moderator*) Consultant, ICON plc;;

##### **S2-CNMMI01 Update on Pediatric Renal Scintigraphy**

Participants

Reza Vali, MD, Toronto, ON (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To discuss advances in pediatric general nuclear medicine and PET. 2) To review patient preparation and clinical indications for nuclear medicine and PET studies in pediatrics. 3) To illustrate pearls and pitfalls of imaging in the pediatric population.\*Course Description

##### **S2-CNMMI01 Current Practices in Pediatric Thyroid Disease**

Participants

Frederick Grant, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **S2-CNMMI01 Pediatric PET Hybrid Imaging**

Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNPM20

**Moderator**

### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNPM20

**Big vs. Small - The Economics of Getting Radiologists, not Corporations, to Rural Areas**

### Participants

Danny Hughes, PhD, Reston, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNPM20

### Leveraging Private Equity to Help Rural Inhabitants

#### Participants

Catherine Everett, MD, MBA, New Bern, NC (*Presenter*) Shareholder, Radiology Partners; Officer, Radiology Partners; President, Eidetico Radiology Solutions; Medical Director, MSN Healthcare Solutions

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNPM20

### Radiology Workforce Shortage: Considerations for Rural and Sprawling Systems

#### LEARNING OBJECTIVES

1) Identify the economic challenges in bringing radiology to rural areas. 2) Understand how policy and radiology financing can improve access to radiology in rural areas.\*Course Description Despite the public and private sector investment in imaging, access to imaging remains anemic in rural and underserved areas in the US. Increasingly responsibility for providing imaging to underserved populations falls on large hospitals. However, small practices have an important role, too. What can radiology leverage to improve access to imaging across the income gradient?

#### COURSE DESCRIPTION

Despite the public and private sector investment in imaging, access to imaging remains anemic in rural and underserved areas in the US. Increasingly responsibility for providing imaging to underserved populations falls on large hospitals. However, small practices have an important role, too. What can radiology leverage to improve access to imaging across the income gradient?

#### Sub-Events

##### S2-CNPM20 Moderator

Participants  
Saurabh Jha, MRCS, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### S2-CNPM20 Big vs. Small - The Economics of Getting Radiologists, not Corporations, to Rural Areas

Participants  
Danny Hughes, PhD, Reston, VA (*Presenter*) Nothing to Disclose

##### S2-CNPM20 Leveraging Private Equity to Help Rural Inhabitants

Participants  
Catherine Everett, MD, MBA, New Bern, NC (*Presenter*) Shareholder, Radiology Partners;Officer, Radiology Partners;President, Eidetico Radiology Solutions;Medical Director, MSN Healthcare Solutions

##### S2-CNPM20 Race, Poverty, and Imaging: The Challenge of Improving Access in Rural Mississippi

Participants  
Richard Duszak JR, MD, (*Presenter*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CNPM20

### Race, Poverty, and Imaging: The Challenge of Improving Access in Rural Mississippi

#### Participants

Richard Duszak JR, MD, (*Presenter*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

### Alzheimer's Disease Neuroimaging: State-Of-The-Art

#### Sub-Events

#### S2-CNR05 Moderator

##### Participants

Gloria C. Chiang, MD, New York, NY (*Moderator*) Advisory Board, Biogen Idec Inc;Consultant, Life Molecular Imaging;Speaker, Horizon CME

#### S2-CNR05 Imaging of Alzheimer's Disease: An Update

##### Participants

Petrice Cogswell, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review the imaging biomarkers of common neurodegenerative diseases that are encountered in routine clinical practice, including the sequences that should be included in a dementia protocol. 2) Describe the role of neuroradiologists in diagnosing and monitoring amyloid-related imaging abnormalities (ARIA). 3) Identify new imaging biomarkers that could play a role in understanding Alzheimer's disease, including vascular, glymphatic, and inflammatory biomarkers.\*Course Description The diagnosis of Alzheimer's disease has shifted dramatically in the last 10 years from clinical/phenotypic criteria to a biological definition of the disease, for which imaging is crucial. Beyond assessing atrophy on MRI and hypometabolism on FDG-PET, radiologists play a key role in reviewing amyloid and tau PET scans, both clinically and in research, and performing lumbar punctures for CSF biomarkers. In the new era of anti-amyloid immunotherapies, imaging will also form the basis for diagnosing and monitoring amyloid-related imaging abnormalities (ARIA) in patients receiving aducanumab and lecanemab. This course will provide an update on state-of-the-art imaging of Alzheimer's disease, both in the context of differential diagnosis and therapy.

#### COURSE DESCRIPTION

The diagnosis of Alzheimer's disease has shifted dramatically in the last 10 years from clinical/phenotypic criteria to a biological definition of the disease, for which imaging is crucial. Beyond assessing atrophy on MRI and hypometabolism on FDG-PET, radiologists play a key role in reviewing amyloid and tau PET scans, both clinically and in research, and performing lumbar punctures for CSF biomarkers. In the new era of anti-amyloid immunotherapies, imaging will also form the basis for diagnosing and monitoring amyloid-related imaging abnormalities (ARIA) in patients receiving aducanumab and lecanemab. This course will provide an update on state-of-the-art imaging of Alzheimer's disease, both in the context of differential diagnosis and therapy.

#### S2-CNR05 Anti-Amyloid Therapies and ARIA: The Radiologist's Role

##### Participants

Greg Zaharchuk, MD, PhD, Stanford, CA (*Presenter*) Research Grant, General Electric Company;Research Grant, Bayer AG;Stockholder, Subtle Medical, Inc;Advisory Board, Biogen Idec Inc

#### S2-CNR05 Vascular Contributions to Alzheimer's and Dementia

##### Participants

Laura Eisenmenger, MD, Middleton, WI (*Presenter*) Nothing to Disclose

#### S2-CNR05 Alzheimer's Disease Biomarkers: What's on the Horizon

##### Participants

Gloria C. Chiang, MD, New York, NY (*Presenter*) Advisory Board, Biogen Idec Inc;Consultant, Life Molecular Imaging;Speaker, Horizon CME

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

**Moderator**

### **Participants**

Gloria C. Chiang, MD, New York, NY (*Moderator*) Advisory Board, Biogen Idec Inc; Consultant, Life Molecular Imaging; Speaker, Horizon CME

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

### Imaging of Alzheimer's Disease: An Update

#### Participants

Petrice Cogswell, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review the imaging biomarkers of common neurodegenerative diseases that are encountered in routine clinical practice, including the sequences that should be included in a dementia protocol. 2) Describe the role of neuroradiologists in diagnosing and monitoring amyloid-related imaging abnormalities (ARIA). 3) Identify new imaging biomarkers that could play a role in understanding Alzheimer's disease, including vascular, glymphatic, and inflammatory biomarkers.\*Course Description The diagnosis of Alzheimer's disease has shifted dramatically in the last 10 years from clinical/phenotypic criteria to a biological definition of the disease, for which imaging is crucial. Beyond assessing atrophy on MRI and hypometabolism on FDG-PET, radiologists play a key role in reviewing amyloid and tau PET scans, both clinically and in research, and performing lumbar punctures for CSF biomarkers. In the new era of anti-amyloid immunotherapies, imaging will also form the basis for diagnosing and monitoring amyloid-related imaging abnormalities (ARIA) in patients receiving aducanumab and lecanemab. This course will provide an update on state-of-the-art imaging of Alzheimer's disease, both in the context of differential diagnosis and therapy.

#### COURSE DESCRIPTION

The diagnosis of Alzheimer's disease has shifted dramatically in the last 10 years from clinical/phenotypic criteria to a biological definition of the disease, for which imaging is crucial. Beyond assessing atrophy on MRI and hypometabolism on FDG-PET, radiologists play a key role in reviewing amyloid and tau PET scans, both clinically and in research, and performing lumbar punctures for CSF biomarkers. In the new era of anti-amyloid immunotherapies, imaging will also form the basis for diagnosing and monitoring amyloid-related imaging abnormalities (ARIA) in patients receiving aducanumab and lecanemab. This course will provide an update on state-of-the-art imaging of Alzheimer's disease, both in the context of differential diagnosis and therapy.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

### Anti-Amyloid Therapies and ARIA: The Radiologist's Role

#### Participants

Greg Zaharchuk, MD, PhD, Stanford, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical, Inc; Advisory Board, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

### Vascular Contributions to Alzheimer's and Dementia

#### Participants

Laura Eisenmenger, MD, Middleton, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CNR05

### Alzheimer's Disease Biomarkers: What's on the Horizon

#### Participants

Gloria C. Chiang, MD, New York, NY (*Presenter*) Advisory Board, Biogen Idec Inc; Consultant, Life Molecular Imaging; Speaker, Horizon CME

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CPH01

### Updates on MR Safety Guidance for Imaging Patients with Implanted Medical Devices

#### Participants

R. Jason Stafford, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S2-CPH01

**Updates to MRI Safety Guidance for Varied MR Environments and Devices (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)**

### LEARNING OBJECTIVES

1) Describe unique MRI safety considerations and corresponding guidance in radiation oncology environments. 2) Describe unique MRI safety considerations and corresponding guidance in low field, high field, and alternate layout MR environments. 3) Understand unique concerns of implants and devices within the context of new MR environments.\*Course Description MRI safety guidance is continually evolving to keep pace with the changing MRI landscape. Recent years have seen the introduction of novel clinical MR environments, including those with the MR/LINAC and ultra-high and low field systems, challenging the abilities of institutions, governing bodies, and regulators to stay abreast of the wave of change. It is not only essential that new safety standards for these diverse environments are established, but it is also necessary to clearly communicate new guidance to radiological personnel in a timely fashion. These lectures will outline key MRI safety considerations involving radiation oncology, variable magnetic fields, and patients with implants and devices, with special attention paid to the unique challenges in each environment, how radiologists, physicists, and technologists can address them.

### COURSE DESCRIPTION

MRI safety guidance is continually evolving to keep pace with the changing MRI landscape. Recent years have seen the introduction of novel clinical MR environments, including those with the MR/LINAC and ultra-high and low field systems, challenging the abilities of institutions, governing bodies, and regulators to stay abreast of the wave of change. It is not only essential that new safety standards for these diverse environments are established, but it is also necessary to clearly communicate new guidance to radiological personnel in a timely fashion. These lectures will outline key MRI safety considerations involving radiation oncology, variable magnetic fields, and patients with implants and devices, with special attention paid to the unique challenges in each environment, how radiologists, physicists, and technologists can address them.

### Sub-Events

#### **S2-CPH01 Moderator**

Participants  
Michael Hoff, PhD, Seattle, WA (*Moderator*) Nothing to Disclose

#### **S2-CPH01 Moderator**

Participants  
R. Jason Stafford, PhD, Houston, TX (*Moderator*) Nothing to Disclose

#### **S2-CPH01 Updates on MR Safety Guidance for Imaging Patients with Implanted Medical Devices**

Participants  
R. Jason Stafford, PhD, Houston, TX (*Presenter*) Nothing to Disclose

#### **S2-CPH01 MRI Safety Guidance in Alternate Fields: The Highs and Lows**

Participants  
Michael Hoff, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

#### **S2-CPH01 Current MR Safety Guidance in Radiation Oncology Environments**

Participants  
Lisa Singer, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CPH01

### MRI Safety Guidance in Alternate Fields: The Highs and Lows

#### Participants

Michael Hoff, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CPH01

### Current MR Safety Guidance in Radiation Oncology Environments

#### Participants

Lisa Singer, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CPH01

**Moderator**

### Participants

R. Jason Stafford, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S2-CPH01

**Moderator**

### Participants

Michael Hoff, PhD, Seattle, WA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

**Moderator**

### Participants

Gayle Woloschak, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Welcome and Introductory Remarks

#### Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To gain insights as to how to approach preparation of an R01 award. 2) To learn about other awards such as fellowships and clinical trials. 3) To hear from NIH on current perspectives on grant applications. 4) To witness a mock study section.\*Course Description The goal of this course is to help students gain insights into the NIH process from proposal preparation to review of applications. It will also review R, K, and clinical trials applications. The review process will be considered from the lens of a mock study section done for the entire class.

#### COURSE DESCRIPTION

The goal of this course is to help students gain insights into the NIH process from proposal preparation to review of applications. It will also review R, K, and clinical trials applications. The review process will be considered from the lens of a mock study section done for the entire class.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Preparing an R01 Research Application

#### Participants

Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S3-RCP29

### Preparing K Awards

#### Participants

Ruth C. Carlos, MD, MS, (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Clinical Trials in Applications

#### Participants

Michael W. Vannier, MD, Crete, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Program Perspectives

#### Participants

Tina Gatlin, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Mock Study Section

#### Participants

Ruth C. Carlos, MD, MS, (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Mock Study Section

#### Participants

Elizabeth A. Krupinski, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Mock Study Section

#### Participants

David A. Mankoff, PhD, Philadelphia, PA (*Presenter*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, Reflexion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevarx Biomedical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Mock Study Section

#### Participants

Michael W. Vannier, MD, Crete, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### Questions to the Faculty

#### Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S3-RCP29

### Summary

#### Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3-RCP29

### NIH Grantsmanship Workshop

#### Sub-Events

##### S3-RCP29 Moderator

###### Participants

Gayle Woloschak, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

##### S3-RCP29 Welcome and Introductory Remarks

###### Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To gain insights as to how to approach preparation of an R01 award. 2) To learn about other awards such as fellowships and clinical trials. 3) To hear from NIH on current perspectives on grant applications. 4) To witness a mock study section.\*Course Description The goal of this course is to help students gain insights into the NIH process from proposal preparation to review of applications. It will also review R, K, and clinical trials applications. The review process will be considered from the lens of a mock study section done for the entire class.

#### COURSE DESCRIPTION

The goal of this course is to help students gain insights into the NIH process from proposal preparation to review of applications. It will also review R, K, and clinical trials applications. The review process will be considered from the lens of a mock study section done for the entire class.

##### S3-RCP29 Preparing an R01 Research Application

###### Participants

Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

##### S3-RCP29 Preparing K Awards

###### Participants

Ruth C. Carlos, MD, MS, (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

##### S3-RCP29 Clinical Trials in Applications

###### Participants

Michael W. Vannier, MD, Crete, IL (*Presenter*) Nothing to Disclose

##### S3-RCP29 Program Perspectives

###### Participants

Tina Gatlin, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

##### S3-RCP29 Mock Study Section

###### Participants

Ruth C. Carlos, MD, MS, (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

##### S3-RCP29 Mock Study Section

###### Participants

Elizabeth A. Krupinski, PhD, (*Presenter*) Nothing to Disclose

##### S3-RCP29 Mock Study Section

###### Participants

David A. Mankoff, PhD, Philadelphia, PA (*Presenter*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevax Biomedical, Inc

**S3-RCP29 Mock Study Section**

Participants

Michael W. Vannier, MD, Crete, IL (*Presenter*) Nothing to Disclose

**S3-RCP29 Questions to the Faculty**

Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

**S3-RCP29 Summary**

Participants

Gayle Woloschak, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CBR03

### Reducing Overtreatment in Early Stage Breast Cancer

#### Participants

Nisha Sharma, MBChB, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose  
Nisha Sharma, MBChB, FRCR, Leeds, United Kingdom (*Moderator*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe overtreatment and the implications for patient care. 2) Explain the limitations of current strategies to identify patients at risk for overtreatment. 3) Identify promising new approaches in development that can triage patients away from overtreatment.\*  
Course Description Overtreatment is one of the principal harms of breast cancer screening programs that primarily originates new diagnosed early stage breast cancers. Identifying which patients will be overtreated is a key challenge as the underlying natural history of breast cancer is poorly understood. Drs. Grimm, Niell, and Wallis will lecture on key elements of the overtreatment debate including radiology, radiomics, and population data. At the completion of the session, attendees should understand the current up to date thinking about overtreatment, identify which patients are at risk, and understand new and emerging strategies for triage currently in development.

#### COURSE DESCRIPTION

Overtreatment is one of the principal harms of breast cancer screening programs that primarily originates new diagnosed early stage breast cancers. Identifying which patients will be overtreated is a key challenge as the underlying natural history of breast cancer is poorly understood. Drs. Grimm, Niell, and Wallis will lecture on key elements of the overtreatment debate including radiology, radiomics, and population data. At the completion of the session, attendees should understand the current up to date thinking about overtreatment, identify which patients are at risk, and understand new and emerging strategies for triage currently in development.

#### Sub-Events

##### S4-CBR03 Moderator

#### Participants

Lars Grimm, MD, Durham, NC (*Moderator*) Advisor, Hologic, Inc; Consultant, Hologic, Inc; Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)

##### S4-CBR03 Reducing Overtreatment in Early Stage Breast Cancer: Insights from Radiology

#### Participants

Lars Grimm, MD, Durham, NC (*Presenter*) Advisor, Hologic, Inc; Consultant, Hologic, Inc; Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)

##### S4-CBR03 Reducing Overtreatment in Early Stage Breast Cancer: Promise of Radiomics

#### Participants

Bethany L. Niell, MD, PhD, Tampa, FL (*Presenter*) Equipment support, Hologic, Inc

##### S4-CBR03 Reducing Overtreatment in Early Stage Breast Cancer: Insights from Population Data

#### Participants

Nisha Sharma, MBChB, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CBR03

### Reducing Overtreatment in Early Stage Breast Cancer: Insights from Population Data

#### Participants

Nisha Sharma, MBChB, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CBR03

### Reducing Overtreatment in Early Stage Breast Cancer: Insights from Radiology

#### Participants

Lars Grimm, MD, Durham, NC (*Presenter*) Advisor, Hologic, Inc; Consultant, Hologic, Inc; Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CBR03

### Reducing Overtreatment in Early Stage Breast Cancer: Promise of Radiomics

#### Participants

Bethany L. Niell, MD, PhD, Tampa, FL (*Presenter*) Equipment support, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CBR03

**Moderator**

### **Participants**

Lars Grimm, MD, Durham, NC (*Moderator*) Advisor, Hologic, Inc; Consultant, Hologic, Inc; Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CCA07

**Fast Focused: Cardiac MRI in 20 Minutes**

### Participants

Michael Markl, PhD, Chicago, IL (*Presenter*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc  
Chiara Bucciarelli Ducci, MD, PhD, Rome, United Kingdom (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CCA07

**Moderator**

### **Participants**

Karen Ordovas, MD, MS, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CCA07

**Moderator**

### Participants

Jens Bremerich, MD, Basel, Switzerland (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CCA07

### Stress, Don't Sweat: Quick Ischemia Imaging With Cardiac MRI

#### Participants

Ming-Yen Ng, BMBS, FRCR, Hong Kong, Hong Kong (*Presenter*) Education Grant, General Electric Company; Education Grant, Bayer AG; Education Grant, Circle Cardiovascular Imaging Inc; Education Grant, TeraRecon, Inc; Education Grant, Arterys Inc; Speakers Bureau, Boehringer Ingelheim GmbH

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CCA07

### Go With The Flow: All-In-One 4D Flow MRI

#### Participants

James Carr, MD, Chicago, IL (*Presenter*) Institutional Research Grant, Siemens AG; Advisory Board, Siemens AG; Travel support, Siemens AG; Institutional Research Grant, Bayer AG; Advisory Board, Bayer AG; Travel support, Bayer AG; Speaker, Bayer AG; Institutional Research Grant, Guerbet SA; Advisory Board, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CCA07

### Efficient and Focused Cardiac MRI

#### Sub-Events

##### S4-CCA07 Moderator

###### Participants

Karen Ordovas, MD, MS, (*Moderator*) Nothing to Disclose

##### S4-CCA07 Moderator

###### Participants

Jens Bremerich, MD, Basel, Switzerland (*Moderator*) Nothing to Disclose

##### S4-CCA07 Stress, Don't Sweat: Quick Ischemia Imaging With Cardiac MRI

###### Participants

Ming-Yen Ng, BMBS, FRCR, Hong Kong, Hong Kong (*Presenter*) Education Grant, General Electric Company; Education Grant, Bayer AG; Education Grant, Circle Cardiovascular Imaging Inc; Education Grant, TeraRecon, Inc; Education Grant, Arterys Inc; Speakers Bureau, Boehringer Ingelheim GmbH

##### S4-CCA07 Go With The Flow: All-In-One 4D Flow MRI

###### Participants

James Carr, MD, Chicago, IL (*Presenter*) Institutional Research Grant, Siemens AG; Advisory Board, Siemens AG; Travel support, Siemens AG; Institutional Research Grant, Bayer AG; Advisory Board, Bayer AG; Travel support, Bayer AG; Speaker, Bayer AG; Institutional Research Grant, Guerbet SA; Advisory Board, Bracco Group

##### S4-CCA07 Fast Focused: Cardiac MRI in 20 Minutes

###### Participants

Michael Markl, PhD, Chicago, IL (*Presenter*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc  
Chiara Bucciarelli Ducci, MD, PhD, Rome, United Kingdom (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CER03

### Fundamentals of Thoracic Trauma

#### Sub-Events

##### **S4-CER03 Moderator**

Participants

Krystal Archer-Arroyo, MD, Decatur, GA (*Moderator*) Nothing to Disclose

##### **S4-CER03 Acute Traumatic Lung Injury**

Participants

Gary Danton, MD, PhD, Miami, FL (*Presenter*) Nothing to Disclose

##### **S4-CER03 Don't Miss Cardiovascular Lesions**

Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### **S4-CER03 Musculoskeletal Chest Trauma**

Participants

Krystal Archer-Arroyo, MD, Decatur, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CER03

**Moderator**

### Participants

Krystal Archer-Arroyo, MD, Decatur, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CER03

### Acute Traumatic Lung Injury

#### Participants

Gary Danton, MD, PhD, Miami, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CER03

### Don't Miss Cardiovascular Lesions

#### Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CER03

### Musculoskeletal Chest Trauma

#### Participants

Krystal Archer-Arroyo, MD, Decatur, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI06

**Moderator**

### **Participants**

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI06

### AI Bias and Fairness

#### Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc; Shareholder, MD.ai, Inc

#### LEARNING OBJECTIVES

1) Learn about AI applied in GI Imaging. 2) Learn about the application of natural language processing in radiology, including about large language models (eg, ChatGPT). 3) Learn about different aspects of AI in medical imaging including bias, fairness, and safety. \*Course Description This session will focus on various aspects of Abdominal AI including specific applications in GI Imaging. Natural language processing (NLP) including newer techniques like Large Language Models (LLMs) and other AI issues like bias, fairness, and safety will also be discussed.

#### COURSE DESCRIPTION

This session will focus on various aspects of Abdominal AI including specific applications in GI Imaging. Natural language processing (NLP) including newer techniques like Large Language Models (LLMs) and other AI issues like bias, fairness, and safety will also be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI06

### AI and Natural Language Processing

#### Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Grant, Independence Blue Cross; *Speaker*, Sectra AB;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI06

### Safety in AI

#### Participants

Errol Colak, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI06

### AI for GI Imaging

#### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CGI06

### Abdominal AI

#### Sub-Events

##### S4-CGI06 Moderator

###### Participants

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

##### S4-CGI06 AI Bias and Fairness

###### Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

#### LEARNING OBJECTIVES

1) Learn about AI applied in GI Imaging. 2) Learn about the application of natural language processing in radiology, including about large language models (eg, ChatGPT). 3) Learn about different aspects of AI in medical imaging including bias, fairness, and safety.\*Course Description This session will focus on various aspects of Abdominal AI including specific applications in GI Imaging. Natural language processing (NLP) including newer techniques like Large Language Models (LLMs) and other AI issues like bias, fairness, and safety will also be discussed.

#### COURSE DESCRIPTION

This session will focus on various aspects of Abdominal AI including specific applications in GI Imaging. Natural language processing (NLP) including newer techniques like Large Language Models (LLMs) and other AI issues like bias, fairness, and safety will also be discussed.

##### S4-CGI06 AI and Natural Language Processing

###### Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

##### S4-CGI06 Safety in AI

###### Participants

Errol Colak, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### S4-CGI06 AI for GI Imaging

###### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Sub-Events

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

#### LEARNING OBJECTIVES

1) Review the protocol required for accurate liver stiffness measurements. 2) Discuss the confounding factors needed to be considered when interpreting results. 3) Identify the various quantitative ultrasound methods for liver fat quantification.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Chronic Liver disease is a world-wide health problem. The use of multiparametric ultrasound can assess the presence of disease, severity of the disease, and monitor treatment. This course will review how to perform and interpret liver elastography. For accurate measurements a strict protocol is required. The protocol will be reviewed, and potential acquisition errors will be discussed. Confounding factors will be discussed as they can significantly affect the interpretation of the results. The course will also review the state-of-the-art for quantitative ultrasound assessment of liver fat content which is critical in making the diagnosis of non-alcoholic fatty liver disease. The combination of these techniques will be discussed on how to evaluate chronic liver disease.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Chronic Liver disease is a world-wide health problem. The use of multiparametric ultrasound can assess the presence of disease, severity of the disease, and monitor treatment. This course will review how to perform and interpret liver elastography. For accurate measurements a strict protocol is required. The protocol will be reviewed, and potential acquisition errors will be discussed. Confounding factors will be discussed as they can significantly affect the interpretation of the results. The course will also review the state-of-the-art for quantitative ultrasound assessment of liver fat content which is critical in making the diagnosis of non-alcoholic fatty liver disease. The combination of these techniques will be discussed on how to evaluate chronic liver disease.

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Giovanna Ferraioli, MD, Pavia, Italy (*Presenter*) Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, FUJIFILM Holdings Corporation;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Shenzhen Mindray Bio-Medical Electronics Co, Ltd;Speakers Bureau, Siemens AG

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Nitin Chaubal, MD, Thane, India (*Presenter*) Nothing to Disclose

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Rajas Chaubal, MBBS,MD, Thane, India (*Presenter*) Nothing to Disclose

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Vito Cantisani, MD, Roma, Italy (*Presenter*) Speaker, Canon Medical Systems Corporation;Speaker, Bracco Group;Speaker, Samsung Electronics Co, Ltd;

#### S4-CGI15 RSNA Hands-On Lab: Liver Elastography

##### Participants

Giovanni del Gaudio, Rome, Italy (*Presenter*) Nothing to Disclose

**S4-CGI15 RSNA Hands-On Lab: Liver Elastography**

Participants

Maija Radzina, MD, PhD, Riga, Latvia (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation; Speakers Bureau, Bayer AG; Speakers Bureau, Medtronic plc; Speakers Bureau, Bracco Group

**S4-CGI15 RSNA Hands-On Lab: Liver Elastography**

Participants

Ronald Hidalgo, MD, BS, Chatham, IL (*Presenter*) Nothing to Disclose

**S4-CGI15 Moderator**

Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Moderator*) Consultant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV; Consultant, Canon Medical Systems Corporation; Advisor, Hologic, Inc; Research Grant, Hologic, Inc

**S4-CGI15 RSNA Hands-On Lab: Liver Elastography**

Participants

Chander Lulla, MD, MBBS, Mumbai, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

#### LEARNING OBJECTIVES

1) Review the protocol required for accurate liver stiffness measurements. 2) Discuss the confounding factors needed to be considered when interpreting results. 3) Identify the various quantitative ultrasound methods for liver fat quantification.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Chronic Liver disease is a world-wide health problem. The use of multiparametric ultrasound can assess the presence of disease, severity of the disease, and monitor treatment. This course will review how to perform and interpret liver elastography. For accurate measurements a strict protocol is required. The protocol will be reviewed, and potential acquisition errors will be discussed. Confounding factors will be discussed as they can significantly affect the interpretation of the results. The course will also review the state-of-the-art for quantitative ultrasound assessment of liver fat content which is critical in making the diagnosis of non-alcoholic fatty liver disease. The combination of these techniques will be discussed on how to evaluate chronic liver disease.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Chronic Liver disease is a world-wide health problem. The use of multiparametric ultrasound can assess the presence of disease, severity of the disease, and monitor treatment. This course will review how to perform and interpret liver elastography. For accurate measurements a strict protocol is required. The protocol will be reviewed, and potential acquisition errors will be discussed. Confounding factors will be discussed as they can significantly affect the interpretation of the results. The course will also review the state-of-the-art for quantitative ultrasound assessment of liver fat content which is critical in making the diagnosis of non-alcoholic fatty liver disease. The combination of these techniques will be discussed on how to evaluate chronic liver disease.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Giovanna Ferraioli, MD, Pavia, Italy (*Presenter*) Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, FUJIFILM Holdings Corporation; Speakers Bureau, Canon Medical Systems Corporation; Speakers Bureau, Shenzhen Mindray Bio-Medical Electronics Co, Ltd; Speakers Bureau, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Nitin Chaubal, MD, Thane, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Rajas Chaubal, MBBS,MD, Thane, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd; Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Motilent Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Vito Cantisani, MD, Roma, Italy (*Presenter*) Speaker, Canon Medical Systems Corporation; Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd;

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## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Giovanni del Gaudio, Rome, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Maija Radzina, MD, PhD, Riga, Latvia (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation; Speakers Bureau, Bayer AG; Speakers Bureau, Medtronic plc; Speakers Bureau, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Ronald Hidalgo, MD, BS, Chatham, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### RSNA Hands-On Lab: Liver Elastography

#### Participants

Chander Lulla, MD, MBBS, Mumbai, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CGI15

### Moderator

#### Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Moderator*) Consultant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV; Consultant, Canon Medical Systems Corporation; Advisor, Hologic, Inc; Research Grant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CHN01

### Metastatic Cervical Lymph Node or Mimic?

#### Participants

Ann K. Jay, MD, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CHN01

### Degenerative Disc Disease or Mimic?

#### Participants

Wende Gibbs, MD, MA, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CHN01

### Stroke or Mimic?

#### Participants

Carlos H. Torres, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CHN01

**Moderator**

### Participants

Courtney Tomblinson, MD, Nashville, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CHN01

### Inflammatory Sinus Disease or Mimic?

#### Participants

Nicholas A. Koontz, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CHN01

### Horse or Zebra: Case Based Review of Common Mimics in the Brain, Spine, Head and Neck (Joint Session)

#### LEARNING OBJECTIVES

1) Recognize typical and atypical imaging features of stroke, degenerative disc disease, inflammatory sinus disease, and metastatic cervical lymph nodes. 2) Differentiate stroke, degenerative disc disease, inflammatory sinus disease, and metastatic cervical lymph nodes from relevant mimics.\*Course Description In this case-based combined Neuroradiology and Head and Neck session, attendees will be presented with frequent imaging diagnoses in the brain, spine, sinuses and neck. Speakers will emphasize imaging pearls that distinguish these diagnoses from common mimics. This session offers attendees the opportunity to refine their interpretation of complex neuroradiology and head and neck imaging studies by incorporating tips from world experts.

#### COURSE DESCRIPTION

In this case-based combined Neuroradiology and Head and Neck session, attendees will be presented with frequent imaging diagnoses in the brain, spine, sinuses and neck. Speakers will emphasize imaging pearls that distinguish these diagnoses from common mimics. This session offers attendees the opportunity to refine their interpretation of complex neuroradiology and head and neck imaging studies by incorporating tips from world experts.

#### Sub-Events

##### S4-CHN01 Moderator

Participants  
Courtney Tomblinson, MD, Nashville, TN (*Moderator*) Nothing to Disclose

##### S4-CHN01 Inflammatory Sinus Disease or Mimic?

Participants  
Nicholas A. Koontz, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

##### S4-CHN01 Degenerative Disc Disease or Mimic?

Participants  
Wende Gibbs, MD, MA, Scottsdale, AZ (*Presenter*) Nothing to Disclose

##### S4-CHN01 Stroke or Mimic?

Participants  
Carlos H. Torres, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

##### S4-CHN01 Metastatic Cervical Lymph Node or Mimic?

Participants  
Ann K. Jay, MD, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CNPM19

### Fundamentals on Financial Literacy

#### Participants

Christopher Walker, MD, Fairway, KS (*Presenter*) Author, RELX; Speakers Bureau, Boehringer Ingelheim GmbH

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CNPM19

### Insurance Basics

#### Participants

Sherwin Chan, MD, PhD, Kansas City, MO (*Presenter*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CNPM19

### Financial Planning: A Shield from Burnout

#### Sub-Events

##### S4-CNPM19 Moderator

###### Participants

Sherwin Chan, MD, PhD, Kansas City, MO (*Moderator*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

##### S4-CNPM19 Wealth Building with Real Estate

###### Participants

Jenny K. Hoang, MBBS, MBA, Baltimore, MD (*Presenter*) Spouse, Employee, Merck & Co, Inc

##### S4-CNPM19 Fundamentals on Financial Literacy

###### Participants

Christopher Walker, MD, Fairway, KS (*Presenter*) Author, RELX; Speakers Bureau, Boehringer Ingelheim GmbH

##### S4-CNPM19 Insurance Basics

###### Participants

Sherwin Chan, MD, PhD, Kansas City, MO (*Presenter*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

##### S4-CNPM19 Loan Forgiveness Programs

###### Participants

Grace S. Mitchell, MD, MBA, Fairway, KS (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the basics of budgeting, debt reduction, and planning for retirement. 2) Recognize the importance of wealth building and advantages of major asset classes for radiologists. 3) Gain insight into asset protection, insurance and loan forgiveness programs.\*Course Description Many radiologists are unable to translate their high income into a high net worth. This is due to high student debt, poor financial literacy and lifestyle creep. High debt drives choices in career path for trainees and practicing radiologists and contributes to physician burnout and mental health issues. Despite the importance of personal financial health, education on finances is absent from the majority of radiology training programs. Some highly successful and intelligent radiologists who contribute enormously to research, radiology education, and clinical care have not spent the necessary time learning about finances and preparing for retirement. The gap in financial literacy for women is even greater.

#### COURSE DESCRIPTION

Many radiologists are unable to translate their high income into a high net worth. This is due to high student debt, poor financial literacy and lifestyle creep. High debt drives choices in career path for trainees and practicing radiologists and contributes to physician burnout and mental health issues. Despite the importance of personal financial health, education on finances is absent from the majority of radiology training programs. Some highly successful and intelligent radiologists who contribute enormously to research, radiology education, and clinical care have not spent the necessary time learning about finances and preparing for retirement. The gap in financial literacy for women is even greater.

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## Abstract Archives of the RSNA, 2023

S4-CNPM19

**Moderator**

### **Participants**

Sherwin Chan, MD, PhD, Kansas City, MO (*Moderator*) Consultant, Jazz Pharmaceuticals plc; Research Grant, Jazz Pharmaceuticals plc; Research Grant, Hyperfine, Inc; Research Grant, General Electric Company

Printed on: 04/12/24





## Abstract Archives of the RSNA, 2023

S4-CNPM19

### Wealth Building with Real Estate

#### Participants

Jenny K. Hoang, MBBS, MBA, Baltimore, MD (*Presenter*) Spouse, Employee, Merck & Co, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CNPM19

### Loan Forgiveness Programs

#### Participants

Grace S. Mitchell, MD, MBA, Fairway, KS (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the basics of budgeting, debt reduction, and planning for retirement. 2) Recognize the importance of wealth building and advantages of major asset classes for radiologists. 3) Gain insight into asset protection, insurance and loan forgiveness programs.\*Course Description Many radiologists are unable to translate their high income into a high net worth. This is due to high student debt, poor financial literacy and lifestyle creep. High debt drives choices in career path for trainees and practicing radiologists and contributes to physician burnout and mental health issues. Despite the importance of personal financial health, education on finances is absent from the majority of radiology training programs. Some highly successful and intelligent radiologists who contribute enormously to research, radiology education, and clinical care have not spent the necessary time learning about finances and preparing for retirement. The gap in financial literacy for women is even greater.

#### COURSE DESCRIPTION

Many radiologists are unable to translate their high income into a high net worth. This is due to high student debt, poor financial literacy and lifestyle creep. High debt drives choices in career path for trainees and practicing radiologists and contributes to physician burnout and mental health issues. Despite the importance of personal financial health, education on finances is absent from the majority of radiology training programs. Some highly successful and intelligent radiologists who contribute enormously to research, radiology education, and clinical care have not spent the necessary time learning about finances and preparing for retirement. The gap in financial literacy for women is even greater.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPD11

**Moderator**

### Participants

Amy Mehollin-Ray, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPD11

### **You get a Renal Ultrasound! Appropriate Postnatal Follow-up for Antenatally Detected Renal and Bladder Abnormalities**

#### **Participants**

Harriet J. Paltiel, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPD11

### MR Urography: Protocol and Interpretation Tips for Adjunct Imaging

#### Participants

Joo Cho, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPD11

**There's a Problem with Your Plumbing: Fetal Imaging of Urinary Tract Obstruction**

### Participants

Jennifer N. Kucera, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPD11

### Pediatric Genitourinary Anomalies: The Prenatal-Postnatal Continuum

#### Sub-Events

##### S4-CPD11 Moderator

###### Participants

Amy Mehollin-Ray, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

##### S4-CPD11 **You get a Renal Ultrasound! Appropriate Postnatal Follow-up for Antenatally Detected Renal and Bladder Abnormalities**

###### Participants

Harriet J. Paltiel, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### S4-CPD11 **MR Urography: Protocol and Interpretation Tips for Adjunct Imaging**

###### Participants

Joo Cho, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

##### S4-CPD11 **There's a Problem with Your Plumbing: Fetal Imaging of Urinary Tract Obstruction**

###### Participants

Jennifer N. Kucera, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPH13

**Moderator**

### Participants

Thaddeus Wilson, PhD, Memphis, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S4-CPH13

### Tutorial on Ultrasound Imaging

#### Participants

Stephen McLeavey, PhD, Rochester, NY (*Presenter*) Research collaboration, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S4-CPH13

### Tutorial on Ultrasound Imaging

#### LEARNING OBJECTIVES

1) Explain the advantages and challenges of software beamforming, and its impact for the sonographer. 2) Describe ultrasound methods of tissue property quantification, including elastography, tomography, and backscatter methods. 3) Summarize advancements in transducer technology and their impact on image quality.\*Course Description This lecture will review the physics and principles underlying current diagnostic ultrasound imaging. Advances in computing power and transducer technology have driven significant changes in how ultrasound can be used to form images, map blood flow, measure tissue elasticity, and track contrast agents. Developments in both conventional and tomographic ultrasound are further enabling quantitative tissue characterization. This course will describe the fundamentals of these technologies and provide the student with an understanding of their capabilities and current challenges.

#### COURSE DESCRIPTION

This lecture will review the physics and principles underlying current diagnostic ultrasound imaging. Advances in computing power and transducer technology have driven significant changes in how ultrasound can be used to form images, map blood flow, measure tissue elasticity, and track contrast agents. Developments in both conventional and tomographic ultrasound are further enabling quantitative tissue characterization. This course will describe the fundamentals of these technologies and provide the student with an understanding of their capabilities and current challenges.

#### Sub-Events

##### S4-CPH13 Moderator

Participants

Thaddeus Wilson, PhD, Memphis, TN (*Moderator*) Nothing to Disclose

##### S4-CPH13 Tutorial on Ultrasound Imaging

Participants

Stephen McAleavey, PhD, Rochester, NY (*Presenter*) Research collaboration, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

### Clinical Significance of Interstitial Lung Abnormality

#### Participants

Rachel Putman, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define interstitial lung abnormalities (ILAs) and identify the different subtypes. 2) Differentiate between ILAs and early/subclinical interstitial lung disease (ILD). 3) Understand the clinical significance and management of ILAs.\*Course Description This session will provide the latest imaging and clinical updates on interstitial lung abnormalities (ILAs). Discussion topics will include defining ILAs and the different CT patterns, smoking related interstitial abnormalities, the clinical significance of ILAs from a pulmonologist's perspective, and identifying early ILD in connective tissue diseases.

#### COURSE DESCRIPTION

This session will provide the latest imaging and clinical updates on interstitial lung abnormalities (ILAs). Discussion topics will include defining ILAs and the different CT patterns, smoking related interstitial abnormalities, the clinical significance of ILAs from a pulmonologist's perspective, and identifying early ILD in connective tissue diseases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

### Interstitial Lung Abnormality (ILA): What to do and Why

#### Sub-Events

#### S5-CCH02 Moderator

##### Participants

David A. Lynch, MBBCh, Denver, CO (*Moderator*) Research Consultant, CALYX Inc; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Veracyte, Inc; Research Consultant, DAIICHI SANKYO Group; Research Consultant, AstraZeneca PLC; Consultant, Polarean, Inc; Consultant, Bristol Myers Squibb Company

#### S5-CCH02 Moderator

##### Participants

Andrea Oh, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

#### S5-CCH02 Interstitial Lung Abnormality: Definition and Patterns

##### Participants

Andrea Oh, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### S5-CCH02 Smoking Related Interstitial Abnormalities

##### Participants

David A. Lynch, MBBCh, Denver, CO (*Presenter*) Research Consultant, CALYX Inc; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Veracyte, Inc; Research Consultant, DAIICHI SANKYO Group; Research Consultant, AstraZeneca PLC; Consultant, Polarean, Inc; Consultant, Bristol Myers Squibb Company

#### S5-CCH02 Early Interstitial Lung Disease in Connective Tissue Diseases

##### Participants

Jonathan Chung, MD, Chicago, IL (*Presenter*) Speaker, Veracyte, Inc; Consultant, Veracyte, Inc; Consultant, Boehringer Ingelheim GmbH; Speaker, Boehringer Ingelheim GmbH; Consultant, F. Hoffmann-La Roche Ltd; Speaker, F. Hoffmann-La Roche Ltd

#### S5-CCH02 Clinical Significance of Interstitial Lung Abnormality

##### Participants

Rachel Putman, MD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Define interstitial lung abnormalities (ILAs) and identify the different subtypes. 2) Differentiate between ILAs and early/subclinical interstitial lung disease (ILD). 3) Understand the clinical significance and management of ILAs.\*Course Description This session will provide the latest imaging and clinical updates on interstitial lung abnormalities (ILAs). Discussion topics will include defining ILAs and the different CT patterns, smoking related interstitial abnormalities, the clinical significance of ILAs from a pulmonologist's perspective, and identifying early ILD in connective tissue diseases.

#### COURSE DESCRIPTION

This session will provide the latest imaging and clinical updates on interstitial lung abnormalities (ILAs). Discussion topics will include defining ILAs and the different CT patterns, smoking related interstitial abnormalities, the clinical significance of ILAs from a pulmonologist's perspective, and identifying early ILD in connective tissue diseases.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

### Moderator

#### Participants

David A. Lynch, MBBCh, Denver, CO (*Moderator*) Research Consultant, CALYX Inc; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Veracyte, Inc; Research Consultant, DAIICHI SANKYO Group; Research Consultant, AstraZeneca PLC; Consultant, Polarean, Inc; Consultant, Bristol Myers Squibb Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

**Moderator**

### Participants

Andrea Oh, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

### Interstitial Lung Abnormality: Definition and Patterns

#### Participants

Andrea Oh, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CCH02

### Smoking Related Interstitial Abnormalities

#### Participants

David A. Lynch, MBBCh, Denver, CO (*Presenter*) Research Consultant, CALYX Inc; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Veracyte, Inc; Research Consultant, DAIICHI SANKYO Group; Research Consultant, AstraZeneca PLC; Consultant, Polarean, Inc; Consultant, Bristol Myers Squibb Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CCH02

### Early Interstitial Lung Disease in Connective Tissue Diseases

#### Participants

Jonathan Chung, MD, Chicago, IL (*Presenter*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

**Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

### Participants

Laura Kohl, MD, Greendale, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

**Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

### Participants

Hei Shun Yu, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

**Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

### Participants

Karen Buch, MD, Newton, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

### Emergency Radiology: Are You Game For It?

#### Sub-Events

##### **S5-CER12 Moderator**

Participants

Jennifer Uyeda, MD, Lexington, MA (*Moderator*) Nothing to Disclose

##### **S5-CER12 Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

Participants

Hei Shun Yu, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### **S5-CER12 Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

Participants

Karen Buch, MD, Newton, MA (*Presenter*) Nothing to Disclose

##### **S5-CER12 Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

Participants

Laura Kohl, MD, Greendale, WI (*Presenter*) Nothing to Disclose

##### **S5-CER12 Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

Participants

Scott Steenburg, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

**Emergency Radiology-Are you game for it? Jeopardy Session using PowerPoint**

### Participants

Scott Steenburg, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CER12

**Moderator**

### Participants

Jennifer Uyeda, MD, Lexington, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIN01

**Opportunistic CT Screening for Population Health: Radiology Scientific Expert Panel (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc.)**

### Sub-Events

#### **S5-CIN01 Moderator**

##### Participants

Perry J. Pickhardt, MD, Madison, WI (*Moderator*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### **S5-CIN01 Challenges to Clinical Implementation**

##### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

#### **S5-CIN01 Regulatory Hurdles Pathways to Reimbursement**

##### Participants

Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### **S5-CIN01 Rationale for Leveraging Opportunistic CT Data**

##### Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

#### **S5-CIN01 Technical Considerations for Implementation**

##### Participants

John Garrett, PhD, Madison, WI (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Explain the systematic opportunistic use of quantitative imaging findings on CT for population health purposes. 2) Explain how Artificial intelligence (AI) may facilitate the widespread implementation of opportunistic CT screening. 3) Identify barriers to acceptance of opportunistic screening, including managing regulatory clearance, demonstrating cost-effectiveness, and achieving reimbursement.\*Course Description This session will cover the promise and challenges related to the implementation of AI-based opportunistic CT screening for population health. All speakers are members of the recently convened Radiology Scientific Expert Panel on this topic, which recently published its findings in Radiology.

### COURSE DESCRIPTION

This session will cover the promise and challenges related to the implementation of AI-based opportunistic CT screening for population health. All speakers are members of the recently convened Radiology Scientific Expert Panel on this topic, which recently published its findings in Radiology.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CIN01

### Technical Considerations for Implementation

#### Participants

John Garrett, PhD, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain the systematic opportunistic use of quantitative imaging findings on CT for population health purposes. 2) Explain how Artificial intelligence (AI) may facilitate the widespread implementation of opportunistic CT screening. 3) Identify barriers to acceptance of opportunistic screening, including managing regulatory clearance, demonstrating cost-effectiveness, and achieving reimbursement.\*Course Description This session will cover the promise and challenges related to the implementation of AI-based opportunistic CT screening for population health. All speakers are members of the recently convened Radiology Scientific Expert Panel on this topic, which recently published its findings in Radiology.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIN01

### Rationale for Leveraging Opportunistic CT Data

#### Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIN01

**Moderator**

### **Participants**

Perry J. Pickhardt, MD, Madison, WI (*Moderator*) Advisor, Bracco Group; Advisor, Zebra Medical Vision Ltd; Advisor, Nano X Imaging;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIN01

### Challenges to Clinical Implementation

#### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIN01

### Regulatory Hurdles Pathways to Reimbursement

#### Participants

Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Advanced Biliary Interventions

#### Sub-Events

#### S5-CIR06 Moderator

##### Participants

Todd Schlachter, MD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA

#### S5-CIR06 Cholangioscopy and Lithotripsy of Biliary Stone Disease

##### Participants

Todd Schlachter, MD, New Haven, CT (*Presenter*) Research Grant, Guerbet SA

#### LEARNING OBJECTIVES

1) Gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders. 2) Identify what is cutting-edge right now and what may come next. \*Course Description The Advanced Biliary Interventions lecture series is a didactic program designed to provide IR physicians with knowledge and skills in biliary interventions. This course aims to equip participants with an advanced understanding of complex biliary disorders' diagnosis, management, and treatment through interactive lectures and case-based discussions. Throughout the course, participants will delve into the latest advancements, techniques, and evidence-based practices in biliary interventions, focusing on therapeutic and diagnostic procedures. The course will cover a wide range of topics, including but not limited to: Emerging Technologies and Innovations: Examining emerging technologies, minimally invasive approaches, and novel therapeutic options in biliary interventions, emphasizing what is cutting-edge right now and what may come next. Interventional Techniques: Detailed exploration of advanced interventional techniques, such as percutaneous transhepatic cholangiography and drainage (PTCD), endoscopic interventions, biliary stenting, and ablation. Biliary Anatomy and Physiology: A review of the anatomy and physiology of the biliary system, gallbladder, bile ducts, and connections. Benign Biliary Disorders: Discussion of the diagnosis and management of benign biliary conditions, including biliary strictures, stones, bile leaks, and other lesions. Malignant Biliary Disorders: Overview of the diagnostic and therapeutic approaches for malignant biliary disorders, including cholangiocarcinoma and metastatic disease. Complications and Management: Understanding the potential complications associated with biliary interventions and developing strategies for their prevention and management. The course will be delivered through a combination of didactic lectures, interactive case discussions, and multimedia presentations. Expert faculty, comprising experienced clinicians and researchers in the field, will guide participants through the course material, emphasizing evidence-based practice and clinical decision-making. Upon completion of the Advanced Biliary Interventions lecture series, participants will have gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders.

#### COURSE DESCRIPTION

The Advanced Biliary Interventions lecture series is a didactic program designed to provide IR physicians with knowledge and skills in biliary interventions. This course aims to equip participants with an advanced understanding of complex biliary disorders' diagnosis, management, and treatment through interactive lectures and case-based discussions. Throughout the course, participants will delve into the latest advancements, techniques, and evidence-based practices in biliary interventions, focusing on therapeutic and diagnostic procedures. The course will cover a wide range of topics, including but not limited to: Emerging Technologies and Innovations: Examining emerging technologies, minimally invasive approaches, and novel therapeutic options in biliary interventions, emphasizing what is cutting-edge right now and what may come next. Interventional Techniques: Detailed exploration of advanced interventional techniques, such as percutaneous transhepatic cholangiography and drainage (PTCD), endoscopic interventions, biliary stenting, and ablation. Biliary Anatomy and Physiology: A review of the anatomy and physiology of the biliary system, gallbladder, bile ducts, and connections. Benign Biliary Disorders: Discussion of the diagnosis and management of benign biliary conditions, including biliary strictures, stones, bile leaks, and other lesions. Malignant Biliary Disorders: Overview of the diagnostic and therapeutic approaches for malignant biliary disorders, including cholangiocarcinoma and metastatic disease. Complications and Management: Understanding the potential complications associated with biliary interventions and developing strategies for their prevention and management. The course will be delivered through a combination of didactic lectures, interactive case discussions, and multimedia presentations. Expert faculty, comprising experienced clinicians and researchers in the field, will guide participants through the course material, emphasizing evidence-based practice and clinical decision-making. Upon completion of the Advanced Biliary Interventions lecture series, participants will have gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders.

#### S5-CIR06 Cholangioscopy in the Treatment of Benign / Indeterminate / Malignant Biliary Strictures

##### Participants

John Smimiotopoulos, MD,MS, Arlington, VA (*Presenter*) Nothing to Disclose

#### S5-CIR06 Billing for Biliary Procedures

##### Participants

Ammar Sarwar, MD, Boston, MA (*Presenter*) Stockholder, Agile Devices, Inc; Scientific Advisory Board, Agile Devices, Inc; Grant, Sirtex Medical Ltd; Consultant, Sirtex Medical Ltd

**S5-CIR06 Cholangioscopy in the Treatment of Secondary Assisted Patency of Malignant Strictures**

Participants

Andrew Gunn, MD, Vestavia Hills, IL (*Presenter*) Consultant, Boston Scientific Corporation; Speaker, Boston Scientific Corporation; Research support, Penumbra, Inc; Research support, Varian Medical Systems, Inc; Consultant, Varian Medical Systems, Inc

**S5-CIR06 Cryoablation of the Gallbladder**

Participants

Hugh McGregor, San Francisco, CA (*Presenter*) Nothing to Disclose

**S5-CIR06 Cystic Duct Interventions**

Participants

Meaghan Dendy, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

**Moderator**

### Participants

Todd Schlachter, MD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CIR06

### Cholangioscopy and Lithotripsy of Biliary Stone Disease

#### Participants

Todd Schlachter, MD, New Haven, CT (*Presenter*) Research Grant, Guerbet SA

#### LEARNING OBJECTIVES

1) Gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders. 2) Identify what is cutting-edge right now and what may come next.\*Course Description The Advanced Biliary Interventions lecture series is a didactic program designed to provide IR physicians with knowledge and skills in biliary interventions. This course aims to equip participants with an advanced understanding of complex biliary disorders' diagnosis, management, and treatment through interactive lectures and case-based discussions. Throughout the course, participants will delve into the latest advancements, techniques, and evidence-based practices in biliary interventions, focusing on therapeutic and diagnostic procedures. The course will cover a wide range of topics, including but not limited to: Emerging Technologies and Innovations: Examining emerging technologies, minimally invasive approaches, and novel therapeutic options in biliary interventions, emphasizing what is cutting-edge right now and what may come next. Interventional Techniques: Detailed exploration of advanced interventional techniques, such as percutaneous transhepatic cholangiography and drainage (PTCD), endoscopic interventions, biliary stenting, and ablation. Biliary Anatomy and Physiology: A review of the anatomy and physiology of the biliary system, gallbladder, bile ducts, and connections. Benign Biliary Disorders: Discussion of the diagnosis and management of benign biliary conditions, including biliary strictures, stones, bile leaks, and other lesions. Malignant Biliary Disorders: Overview of the diagnostic and therapeutic approaches for malignant biliary disorders, including cholangiocarcinoma and metastatic disease. Complications and Management: Understanding the potential complications associated with biliary interventions and developing strategies for their prevention and management. The course will be delivered through a combination of didactic lectures, interactive case discussions, and multimedia presentations. Expert faculty, comprising experienced clinicians and researchers in the field, will guide participants through the course material, emphasizing evidence-based practice and clinical decision-making. Upon completion of the Advanced Biliary Interventions lecture series, participants will have gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders.

#### COURSE DESCRIPTION

The Advanced Biliary Interventions lecture series is a didactic program designed to provide IR physicians with knowledge and skills in biliary interventions. This course aims to equip participants with an advanced understanding of complex biliary disorders' diagnosis, management, and treatment through interactive lectures and case-based discussions. Throughout the course, participants will delve into the latest advancements, techniques, and evidence-based practices in biliary interventions, focusing on therapeutic and diagnostic procedures. The course will cover a wide range of topics, including but not limited to: Emerging Technologies and Innovations: Examining emerging technologies, minimally invasive approaches, and novel therapeutic options in biliary interventions, emphasizing what is cutting-edge right now and what may come next. Interventional Techniques: Detailed exploration of advanced interventional techniques, such as percutaneous transhepatic cholangiography and drainage (PTCD), endoscopic interventions, biliary stenting, and ablation. Biliary Anatomy and Physiology: A review of the anatomy and physiology of the biliary system, gallbladder, bile ducts, and connections. Benign Biliary Disorders: Discussion of the diagnosis and management of benign biliary conditions, including biliary strictures, stones, bile leaks, and other lesions. Malignant Biliary Disorders: Overview of the diagnostic and therapeutic approaches for malignant biliary disorders, including cholangiocarcinoma and metastatic disease. Complications and Management: Understanding the potential complications associated with biliary interventions and developing strategies for their prevention and management. The course will be delivered through a combination of didactic lectures, interactive case discussions, and multimedia presentations. Expert faculty, comprising experienced clinicians and researchers in the field, will guide participants through the course material, emphasizing evidence-based practice and clinical decision-making. Upon completion of the Advanced Biliary Interventions lecture series, participants will have gained the knowledge and expertise necessary to optimize patient outcomes through advanced diagnostic and therapeutic interventions in biliary disorders.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Cholangioscopy in the Treatment of Benign / Indeterminate / Malignant Biliary Strictures

#### Participants

John Smirniotopoulos, MD,MS, Arlington, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Billing for Biliary Procedures

#### Participants

Ammar Sarwar, MD, Boston, MA (*Presenter*) Stockholder, Agile Devices, Inc;Scientific Advisory Board, Agile Devices, Inc;Grant, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Cholangioscopy in the Treatment of Secondary Assisted Patency of Malignant Strictures

#### Participants

Andrew Gunn, MD, Vestavia Hills, IL (*Presenter*) Consultant, Boston Scientific Corporation; Speaker, Boston Scientific Corporation; Research support, Penumbra, Inc; Research support, Varian Medical Systems, Inc; Consultant, Varian Medical Systems, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Cryoablation of the Gallbladder

#### Participants

Hugh McGregor, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CIR06

### Cystic Duct Interventions

#### Participants

Meaghan Dendy, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

**Moderator**

### Participants

Soterios Gyftopoulos, MD, MBA, Scarsdale, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

### Bone Injuries: Anterior Shoulder Instability

#### Participants

Soterios Gyftopoulos, MD, MBA, Scarsdale, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CMK01

### Approach to Imaging of Rotator Cuff and Biceps Tendon: MRI and Ultrasound

#### Participants

Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

### Acromioclavicular Joint Imaging

#### Participants

Megan Mills, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

### Post-operative Shoulder Imaging

#### Participants

Mohammad Samim, MD, MRCS, Eastchester, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

### Glenoid Labrum Tears

#### Participants

Tony T. Wong, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMK01

### Shoulder Imaging: Fundamentals

#### LEARNING OBJECTIVES

1) Recognize frequently encountered imaging findings of pathologic processes of the acromioclavicular joint on radiographic and cross section imaging. 2) To review the post-operative imaging appearance of common shoulder surgeries involving the labrum, rotator cuff tendons, and shoulder joints. 3) To review MRI and US findings of rotator cuff abnormalities.\*Course Description Shoulder Imaging: Fundamentals will provide an overview of the important clinical and imaging findings for common shoulder conditions. Expert musculoskeletal radiologists will present live lectures on topics including shoulder instability, acromioclavicular pathologies, rotator cuff tears, superior labral tears, and post-operative shoulder imaging. Individuals who attend this course will leave with crucial pearls and pitfalls of shoulder imaging, including MRI, CT, ultrasound, and x-ray, that can be easily applied to everyday practice. This is a can't miss session for all RSNA attendees, from medical students to attending physicians!

#### COURSE DESCRIPTION

Shoulder Imaging: Fundamentals will provide an overview of the important clinical and imaging findings for common shoulder conditions. Expert musculoskeletal radiologists will present live lectures on topics including shoulder instability, acromioclavicular pathologies, rotator cuff tears, superior labral tears, and post-operative shoulder imaging. Individuals who attend this course will leave with crucial pearls and pitfalls of shoulder imaging, including MRI, CT, ultrasound, and x-ray, that can be easily applied to everyday practice. This is a can't miss session for all RSNA attendees, from medical students to attending physicians!

#### Sub-Events

##### S5-CMK01 Moderator

Participants

Soterios Gyftopoulos, MD, MBA, Scarsdale, NY (*Moderator*) Nothing to Disclose

##### S5-CMK01 Bone Injuries: Anterior Shoulder Instability

Participants

Soterios Gyftopoulos, MD, MBA, Scarsdale, NY (*Presenter*) Nothing to Disclose

##### S5-CMK01 Approach to Imaging of Rotator Cuff and Biceps Tendon: MRI and Ultrasound

Participants

Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### S5-CMK01 Acromioclavicular Joint Imaging

Participants

Megan Mills, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### S5-CMK01 Post-operative Shoulder Imaging

Participants

Mohammad Samim, MD, MRCS, Eastchester, NY (*Presenter*) Nothing to Disclose

##### S5-CMK01 Glenoid Labrum Tears

Participants

Tony T. Wong, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMS01

### Child Abuse Imaging: Protocol Updates and Challenges

#### Participants

Megan B. Marine, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMS01

### Nonaccidental Injury in the Elderly: What Radiologists Need to Know

#### Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMS01

**Moderator**

### Participants

Marcia C. Javitt, MD, Zichron Yaakov, Israel (*Moderator*) Spouse, Consultant, NeuroRx, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CMS01

**Cancer in Pregnancy: Challenges and Insights for Safe, Effective, and Compassionate Care**

### Participants

Marcia C. Javitt, MD, Zichron Yaakov, Israel (*Presenter*) Spouse, Consultant, NeuroRx, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMS01

### Imaging Obese Patients: Physicist Perspective

#### Participants

Kalpana M. Kanal, PhD, MS, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CMS01

### Imaging Considerations in Challenging Population

#### LEARNING OBJECTIVES

1) Gain increased awareness about caring for vulnerable or marginalized patients in the Radiology Department. 2) Understand the imaging modalities best suited to safe and appropriate personalized care of these populations. 3) Recognize and respond quickly and effectively to urgent and emergent conditions requiring imaging triage to essential treatment and intervention.\*Course Description This session will review imaging challenges and specific health related issues in obese, elderly, pediatric, and pregnant patients. Relevant problem-solving techniques, clinical information and multidisciplinary collaboration will be discussed. Imaging pearls and pitfalls will be provided. The format will be lectures and some discussion.

#### COURSE DESCRIPTION

This session will review imaging challenges and specific health related issues in obese, elderly, pediatric, and pregnant patients. Relevant problem-solving techniques, clinical information and multidisciplinary collaboration will be discussed. Imaging pearls and pitfalls will be provided. The format will be lectures and some discussion.

#### Sub-Events

##### **S5-CMS01 Moderator**

Participants

Marcia C. Javitt, MD, Zichron Yaakov, Israel (*Moderator*) Spouse, Consultant, NeuroRx, Inc

##### **S5-CMS01 Cancer in Pregnancy: Challenges and Insights for Safe, Effective, and Compassionate Care**

Participants

Marcia C. Javitt, MD, Zichron Yaakov, Israel (*Presenter*) Spouse, Consultant, NeuroRx, Inc

##### **S5-CMS01 Imaging Obese Patients: Physicist Perspective**

Participants

Kalpana M. Kanal, PhD, MS, Seattle, WA (*Presenter*) Nothing to Disclose

##### **S5-CMS01 Child Abuse Imaging: Protocol Updates and Challenges**

Participants

Megan B. Marine, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

##### **S5-CMS01 Nonaccidental Injury in the Elderly: What Radiologists Need to Know**

Participants

Margarita Revzin, MD, MS, Wilton, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNMMI02

### Movement Disorders and the Spectrum of Parkinsonian Syndromes

#### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

#### LEARNING OBJECTIVES

1) To discuss advances in imaging of dementia and Parkinsonism using radiopharmaceuticals. 2) To review imaging interpretation. 3) To illustrate advances and imaging interpretation with images from the field.\*Course Description This course will provide an update on molecular imaging for neurologic applications. There will be a series of lectures including a mix of core materials and new innovations. We will also include clinical pearls and pitfalls and illustrative case examples.

#### COURSE DESCRIPTION

This course will provide an update on molecular imaging for neurologic applications. There will be a series of lectures including a mix of core materials and new innovations. We will also include clinical pearls and pitfalls and illustrative case examples.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNMMI02

### PET Imaging Evaluation of Dementia: New Diseases and Co-pathologies

#### Participants

Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Consultant, Hamamatsu Photonics KK; Grant, Hamamatsu Photonics KK; Grant, Nihon Medi-Physics Co, Ltd; Grant, FUJIFILM Holdings Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNMMI02

### Current and Emerging Approaches to Brain Tumor Imaging

#### Participants

Jonathan E. McConathy, MD, PhD, Birmingham, AL (*Presenter*) Research Consultant, Eli Lilly and Company; Research Grant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Grant, Blue Earth Diagnostics Ltd; Research Consultant, General Electric Company; Research support, General Electric Company; Research support, CytoSite Biopharma; Research Consultant, ImaginAb, Inc; Research support, ImaginAb, Inc; Spouse, Research Consultant, Baird Capital; Spouse, Research Grant, Navidea Biopharmaceuticals, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNMMI02

### Neurologic Molecular Imaging: Read with the Experts

#### Sub-Events

#### **S5-CNMMI02 Movement Disorders and the Spectrum of Parkinsonian Syndromes**

##### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

#### LEARNING OBJECTIVES

1) To discuss advances in imaging of dementia and Parkinsonism using radiopharmaceuticals. 2) To review imaging interpretation. 3) To illustrate advances and imaging interpretation with images from the field.\*Course Description This course will provide an update on molecular imaging for neurologic applications. There will be a series of lectures including a mix of core materials and new innovations. We will also include clinical pearls and pitfalls and illustrative case examples.

#### COURSE DESCRIPTION

This course will provide an update on molecular imaging for neurologic applications. There will be a series of lectures including a mix of core materials and new innovations. We will also include clinical pearls and pitfalls and illustrative case examples.

#### **S5-CNMMI02 PET Imaging Evaluation of Dementia: New Diseases and Co-pathologies**

##### Participants

Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Consultant, Hamamatsu Photonics KK;Grant, Hamamatsu Photonics KK;Grant, Nihon Medi-Physics Co, Ltd;Grant, FUJIFILM Holdings Corporation

#### **S5-CNMMI02 Current and Emerging Approaches to Brain Tumor Imaging**

##### Participants

Jonathan E. McConathy, MD, PhD, Birmingham, AL (*Presenter*) Research Consultant, Eli Lilly and Company;Research Grant, Eli Lilly and Company;Research Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Research Consultant, General Electric Company;Research support, General Electric Company;Research support, CytoSite Biopharma;Research Consultant, ImaginAb, Inc;Research support, ImaginAb, Inc;Spouse, Research Consultant, Baird Capital;Spouse, Research Grant, Navidea Biopharmaceuticals, Inc

#### **S5-CNMMI02 Moderator**

##### Participants

Paulo Henrique Rosado de Castro, MD, PhD, Rio de Janeiro, Brazil (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNMMI02

**Moderator**

### Participants

Paulo Henrique Rosado de Castro, MD, PhD, Rio de Janeiro, Brazil (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CNPM01

**Moderator**

### Participants

David Pryluck, MD, MBA, Cupecoy, Dutch Lowlands, Sint Maartin (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

**Moderator**

### Participants

Courtney Tomblinson, MD, Nashville, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

### Navigating Healthcare as a Person Who Is Transgender

#### Participants

Nicolas Freeman, BA, Brookline, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

### Gender in the Radiology Workplace

#### Participants

Evelyn Carroll, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

### Collecting Gender Data: From Collection to Direction

#### Participants

Vaz Zavaletta, MD, PhD, Denver, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

**Panel Discussion: Supporting Peers Who Are Transgender and/or Gender Diverse**

### Participants

Florence Doo, MD,MA, Sunset Beach, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNPM01

### **Beyond Binary: Supporting Gender Diversity in Radiology (Sponsored by the RSNA Committee on Diversity, Equity & Inclusion)**

#### **LEARNING OBJECTIVES**

1) Describe the foundational terms and concepts used within the transgender community and discuss the experiences of transgender patients in healthcare and radiologic subspecialties. 2) Understand the challenges faced by TGD people in the radiology workforce and learn how radiology practices can adapt facilities and practices to be more inclusive. 3) Present the importance of collecting robust Gender Data for radiology health care and for radiology research. Discuss how robust data leads to a better understanding of health outcomes and effectiveness of preventive interventions. 4) Discuss examples and tools to foster a supportive workplace environment and facilitate change, including: pronoun usage, being a vocal and visible ally, reviewing & updating local policies.\*Course Description The field of Radiology must adapt to support patients and workforce members whose identity extends beyond traditional binary gender models of male and female. In this session, participants will learn about experiences of transgender and/or gender diverse (TGD) persons as they navigate the current healthcare environment. Employees in the Radiology workforce will also discuss challenges faced by TGD persons and how Radiology practices can adapt facilities and practices to be more inclusive. We will discuss how to accurately collect more inclusive and comprehensive gender data to drive initiatives for recruitment and retention in Radiology. The session will close with a panel discussion offering tangible examples for supporting TGD peers and patients in our Radiology community.

#### **COURSE DESCRIPTION**

The field of Radiology must adapt to support patients and workforce members whose identity extends beyond traditional binary gender models of male and female. In this session, participants will learn about experiences of transgender and/or gender diverse (TGD) persons as they navigate the current healthcare environment. Employees in the Radiology workforce will also discuss challenges faced by TGD persons and how Radiology practices can adapt facilities and practices to be more inclusive. We will discuss how to accurately collect more inclusive and comprehensive gender data to drive initiatives for recruitment and retention in Radiology. The session will close with a panel discussion offering tangible examples for supporting TGD peers and patients in our Radiology community.

#### **Sub-Events**

##### **S5-CNPM01 Moderator**

Participants

David Pryluck, MD, MBA, Cupecoy, Dutch Lowlands, Sint Maartin (*Moderator*) Nothing to Disclose

##### **S5-CNPM01 Moderator**

Participants

Courtney Tomblinson, MD, Nashville, TN (*Moderator*) Nothing to Disclose

##### **S5-CNPM01 Navigating Healthcare as a Person Who Is Transgender**

Participants

Nicolas Freeman, BA, Brookline, MA (*Presenter*) Nothing to Disclose

##### **S5-CNPM01 Gender in the Radiology Workplace**

Participants

Evelyn Carroll, MD, New York, NY (*Presenter*) Nothing to Disclose

##### **S5-CNPM01 Collecting Gender Data: From Collection to Direction**

Participants

Vaz Zavaletta, MD, PhD, Denver, CO (*Presenter*) Nothing to Disclose

##### **S5-CNPM01 Panel Discussion: Supporting Peers Who Are Transgender and/or Gender Diverse**

Participants

Florence Doo, MD, MA, Sunset Beach, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNR14

### Reaching a Tipping Point: Balancing Workload and Staffing of Neuroradiologists

#### Sub-Events

##### S5-CNR14 Moderator

#### Participants

Melissa Chen, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### S5-CNR14 RVU: Is it an Effective Measurement of Productivity?

#### Participants

Melissa Chen, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand how work RVUs are derived and potential consequences of using these values as measurements of productivity. 2) Explore ways to objectively measure non-clinical work efforts. 3) Review academic work practice volumes and potential need for establishing limits.\*Course Description Demand for imaging continues to increase and will likely outpace the workforce supply. Academic and private radiology practice will face significant challenges. Sustaining the academic mission of radiology will also be a challenge. This session will review common metrics and benchmarks used to measure productivity of radiologists. Limitations of the systems will be discussed. Attendees will learn potential ways to measure non-clinical work efforts and productivity. Data from recent work survey of neuroradiology academic department productivity will be reviewed. Finally, the session will explore whether it is time for work limits for radiologists and what types of limits should be established.

#### COURSE DESCRIPTION

Demand for imaging continues to increase and will likely outpace the workforce supply. Academic and private radiology practice will face significant challenges. Sustaining the academic mission of radiology will also be a challenge. This session will review common metrics and benchmarks used to measure productivity of radiologists. Limitations of the systems will be discussed. Attendees will learn potential ways to measure non-clinical work efforts and productivity. Data from recent work survey of neuroradiology academic department productivity will be reviewed. Finally, the session will explore whether it is time for work limits for radiologists and what types of limits should be established.

##### S5-CNR14 Academic Performance Based Value Unit

#### Participants

William A. Mehan, MD, MBA, Boston, MA (*Presenter*) Researcher, Kura Oncology

##### S5-CNR14 Realistic Productivity in an Academic Setting

#### Participants

Max Wintermark, MD, Houston, TX (*Presenter*) Consultant, Magnetic Insight, Inc;Consultant, icoMetrix NV;Consultant, Subtle Medical, Inc;Consultant, EMTensor Imaging

##### S5-CNR14 Duty Hours Limits, is it time?

#### Participants

Frank J. Lexa, MD, MBA, Wynnewood, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CNR14

**Moderator**

### Participants

Melissa Chen, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNR14

### **RVU: Is it an Effective Measurement of Productivity?**

#### **Participants**

Melissa Chen, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### **LEARNING OBJECTIVES**

1) Understand how work RVUs are derived and potential consequences of using these values as measurements of productivity. 2) Explore ways to objectively measure non-clinical work efforts. 3) Review academic work practice volumes and potential need for establishing limits.\*Course Description Demand for imaging continues to increase and will likely outpace the workforce supply. Academic and private radiology practice will face significant challenges. Sustaining the academic mission of radiology will also be a challenge. This session will review common metrics and benchmarks used to measure productivity of radiologists. Limitations of the systems will be discussed. Attendees will learn potential ways to measure non-clinical work efforts and productivity. Data from recent work survey of neuroradiology academic department productivity will be reviewed. Finally, the session will explore whether it is time for work limits for radiologists and what types of limits should be established.

#### **COURSE DESCRIPTION**

Demand for imaging continues to increase and will likely outpace the workforce supply. Academic and private radiology practice will face significant challenges. Sustaining the academic mission of radiology will also be a challenge. This session will review common metrics and benchmarks used to measure productivity of radiologists. Limitations of the systems will be discussed. Attendees will learn potential ways to measure non-clinical work efforts and productivity. Data from recent work survey of neuroradiology academic department productivity will be reviewed. Finally, the session will explore whether it is time for work limits for radiologists and what types of limits should be established.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNR14

### Academic Performance Based Value Unit

#### Participants

William A. Mehan, MD, MBA, Boston, MA (*Presenter*) Researcher, Kura Oncology

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNR14

### Realistic Productivity in an Academic Setting

#### Participants

Max Wintermark, MD, Houston, TX (*Presenter*) Consultant, Magnetic Insight, Inc; Consultant, icoMetrix NV; Consultant, Subtle Medical, Inc; Consultant, EMTensor Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CNR14

### Duty Hours Limits, is it time?

#### Participants

Frank J. Lexa, MD, MBA, Wynnewood, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPD09

**Moderator**

### **Participants**

Kassa Darge, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPD09

**Here's the Twist: Multimodality Imaging of Gonadal Torsion**

### Participants

Summer Kaplan, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPD09

### When the Gut Turns: Midgut Volvulus and Beyond

#### Participants

Haithuy N. Nguyen, MD, Los Angeles, CA (*Presenter*) Research Grant, Siemens AG

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CPD09

### STAT! Emergency Imaging of the Pediatric Patient

#### LEARNING OBJECTIVES

1) Demonstrate the utility of ultrasound and other modalities in the diagnosis of targeted pediatric abnormalities from the emergency room. 2) Identify tips and tricks to avoid pitfalls when diagnosing gonadal torsion, midgut volvulus and acute neck emergencies.\*Course Description This course focuses on the diagnostic aspects of specific pediatric emergencies which include gonadal torsion, midgut volvulus and acute neck abnormalities. The utility of different modalities will be covered.

#### COURSE DESCRIPTION

This course focuses on the diagnostic aspects of specific pediatric emergencies which include gonadal torsion, midgut volvulus and acute neck abnormalities. The utility of different modalities will be covered.

#### Sub-Events

##### **S5-CPD09 Moderator**

Participants

Kassa Darge, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### **S5-CPD09 Here's the Twist: Multimodality Imaging of Gonadal Torsion**

Participants

Summer Kaplan, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **S5-CPD09 When the Gut Turns: Midgut Volvulus and Beyond**

Participants

Haithuy N. Nguyen, MD, Los Angeles, CA (*Presenter*) Research Grant, Siemens AG

##### **S5-CPD09 Don't Stick your Neck Out: Dissecting the Spectrum of Pediatric Neck Emergencies**

Participants

Ajay Malhotra, MD, MMM, New Canaan, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPD09

### Don't Stick your Neck Out: Dissecting the Spectrum of Pediatric Neck Emergencies

#### Participants

Ajay Malhotra, MD, MMM, New Canaan, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH02

**Moderator**

### Participants

Mahadevappa Mahesh, PhD, MS, Baltimore, MD (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH02

### Overview of Cone Beam CT and the Challenges in Quality Control

#### Participants

Jeffrey Siewerdsen, PhD, Houston, TX (*Presenter*) Research Grant, Siemens AG; Advisory Board, Siemens AG; Research Grant, Medtronic plc; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Precision X-Ray, Inc; License agreement, Elekta AB;;;

#### LEARNING OBJECTIVES

1) To learn the principles of CBCT and cone beam breast CT systems. 2) To understand image acquisition and dose measurement in cone beam breast CT. 3) To become familiar with clinical application of cone beam breast CT.\*Course Description Cone-beam CT (CBCT) is increasingly used in diagnostic imaging and image-guided procedures, ranging from interventional radiology to breast imaging, radiation therapy and surgery. The proliferation of CBCT systems that are used as standalone or as part of the fluoroscopy systems are used not only in radiology but in surgery, pain clinic, dental clinics, etc. Even though the fundamentals of cone beam breast CT are similar to CBCT, there are distinct differences between the two technologies, in terms of acquisition, image processing and radiation dose estimation. This course is aimed to cover the general principles of CBCT and Cone Beam Breast CT systems, along with the challenges of quality control evaluation, radiation dose measurements and clinical applications. The course has three presentations with first two aimed at describing the physics principles of CBCT and cone beam breast CT, while the final presentation will focus on clinical applications of breast CT.

#### COURSE DESCRIPTION

Cone-beam CT (CBCT) is increasingly used in diagnostic imaging and image-guided procedures, ranging from interventional radiology to breast imaging, radiation therapy and surgery. The proliferation of CBCT systems that are used as standalone or as part of the fluoroscopy systems are used not only in radiology but in surgery, pain clinic, dental clinics, etc. Even though the fundamentals of cone beam breast CT are similar to CBCT, there are distinct differences between the two technologies, in terms of acquisition, image processing and radiation dose estimation. This course is aimed to cover the general principles of CBCT and Cone Beam Breast CT systems, along with the challenges of quality control evaluation, radiation dose measurements and clinical applications. The course has three presentations with first two aimed at describing the physics principles of CBCT and cone beam breast CT, while the final presentation will focus on clinical applications of breast CT.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH02

### CBCT Breast: Clinical Applications

#### Participants

Shadi Aminololama-Shakeri, MD, Sacramento, CA (*Presenter*) Consultant, Becton, Dickinson and Company; Consultant, Izotropic Corporation; Stock options, Izotropic Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH02

### Breast Cone Beam CT Imaging System, Technology, Image Quality and Dose

#### Participants

Ioannis Sechopoulos, PhD, (*Presenter*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH02

### Cone Beam Breast CT: Technology, Clinical Application, and Quality Image

#### Sub-Events

##### S5-CPH02 Moderator

#### Participants

Mahadevappa Mahesh, PhD, MS, Baltimore, MD (*Moderator*) Nothing to Disclose

##### S5-CPH02 Overview of Cone Beam CT and the Challenges in Quality Control

#### Participants

Jeffrey Siewerdsen, PhD, Houston, TX (*Presenter*) Research Grant, Siemens AG; Advisory Board, Siemens AG; Research Grant, Medtronic plc; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Precision X-Ray, Inc; License agreement, Elekta AB;;;

#### LEARNING OBJECTIVES

1) To learn the principles of CBCT and cone beam breast CT systems. 2) To understand image acquisition and dose measurement in cone beam breast CT. 3) To become familiar with clinical application of cone beam breast CT.\*Course Description Cone-beam CT (CBCT) is increasingly used in diagnostic imaging and image-guided procedures, ranging from interventional radiology to breast imaging, radiation therapy and surgery. The proliferation of CBCT systems that are used as standalone or as part of the fluoroscopy systems are used not only in radiology but in surgery, pain clinic, dental clinics, etc. Even though the fundamentals of cone beam breast CT are similar to CBCT, there are distinct differences between the two technologies, in terms of acquisition, image processing and radiation dose estimation. This course is aimed to cover the general principles of CBCT and Cone Beam Breast CT systems, along with the challenges of quality control evaluation, radiation dose measurements and clinical applications. The course has three presentations with first two aimed at describing the physics principles of CBCT and cone beam breast CT, while the final presentation will focus on clinical applications of breast CT.

#### COURSE DESCRIPTION

Cone-beam CT (CBCT) is increasingly used in diagnostic imaging and image-guided procedures, ranging from interventional radiology to breast imaging, radiation therapy and surgery. The proliferation of CBCT systems that are used as standalone or as part of the fluoroscopy systems are used not only in radiology but in surgery, pain clinic, dental clinics, etc. Even though the fundamentals of cone beam breast CT are similar to CBCT, there are distinct differences between the two technologies, in terms of acquisition, image processing and radiation dose estimation. This course is aimed to cover the general principles of CBCT and Cone Beam Breast CT systems, along with the challenges of quality control evaluation, radiation dose measurements and clinical applications. The course has three presentations with first two aimed at describing the physics principles of CBCT and cone beam breast CT, while the final presentation will focus on clinical applications of breast CT.

##### S5-CPH02 CBCT Breast: Clinical Applications

#### Participants

Shadi Aminololama-Shakeri, MD, Sacramento, CA (*Presenter*) Consultant, Becton, Dickinson and Company; Consultant, Izotropic Corporation; Stock options, Izotropic Corporation

##### S5-CPH02 Breast Cone Beam CT Imaging System, Technology, Image Quality and Dose

#### Participants

Ioannis Sechopoulos, PhD, (*Presenter*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Canon Medical Systems Corporation; Research Grant, Sectra AB; Research Grant, ScreenPoint Medical BV; Research Grant, Volpara Health Technologies Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH14

**Moderator**

### **Participants**

Zheng Feng Lu, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-CPH14

### Ultrasound Contrast Agent

#### Participants

Shuchi K. Rodgers, MD, Cherry Hill, NJ (*Presenter*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH14

### Ultrasound Parametric Imaging

#### Participants

Thaddeus Wilson, PhD, Memphis, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CPH14

### Tutorial on the Use of Ultrasound Contrast Agent and Parametric Imaging

#### LEARNING OBJECTIVES

1) To understand the basics of contrast-enhanced ultrasound (CEUS) and ultrasound parametric imaging. 2) To gain knowledge of these emerging ultrasound technologies in various clinical applications. 3) To identify the technical considerations when implementing CEUS and parametric imaging in clinical applications.\*Course Description The first half of the course will provide a comprehensive understanding of contrast-enhanced ultrasound (CEUS) and its clinical applications by introducing the basics of contrast-enhanced ultrasound (CEUS), describing the technical considerations specific to CEUS, and explaining its clinical implementations as well as utilities. The second half of the course will showcase the emerging ultrasound parametric imaging. You will learn the basic physics principles underlying this technology. Various clinical applications of ultrasound parametric imaging will be explored.

#### COURSE DESCRIPTION

The first half of the course will provide a comprehensive understanding of contrast-enhanced ultrasound (CEUS) and its clinical applications by introducing the basics of contrast-enhanced ultrasound (CEUS), describing the technical considerations specific to CEUS, and explaining its clinical implementations as well as utilities. The second half of the course will showcase the emerging ultrasound parametric imaging. You will learn the basic physics principles underlying this technology. Various clinical applications of ultrasound parametric imaging will be explored.

#### Sub-Events

##### S5-CPH14 Moderator

Participants  
Zheng Feng Lu, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

##### S5-CPH14 Ultrasound Contrast Agent

Participants  
Shuchi K. Rodgers, MD, Cherry Hill, NJ (*Presenter*) Royalties, RELX

##### S5-CPH14 Ultrasound Parametric Imaging

Participants  
Thaddeus Wilson, PhD, Memphis, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CRO08

### Lymphoma: Imaging for Diagnosis and Prognosis

#### LEARNING OBJECTIVES

1) To enable participants to use standardized tools for response assessment in lymphoma.2) To identify strategies for diagnosis of lymphoma in the head and neck.3) To recognize current clinical challenges in lymphoma diagnosis and treatment.\*Course Description Imaging of lymphoma will be encountered by radiologists in all subspecialties and general practice. Accurate diagnosis and response assessment are of great clinical importance for lymphoma patients. This series of case-based lectures will enable participants to become comfortable with diagnosis and response assessment for imaging of lymphoma.

#### COURSE DESCRIPTION

Imaging of lymphoma will be encountered by radiologists in all subspecialties and general practice. Accurate diagnosis and response assessment are of great clinical importance for lymphoma patients. This series of case-based lectures will enable participants to become comfortable with diagnosis and response assessment for imaging of lymphoma.

#### Sub-Events

##### S5-CRO08 Moderator

Participants

Sarah A. Johnson, MD, FRCPC, Toronto, ON (*Moderator*) Nothing to Disclose

##### S5-CRO08 Lymphoma: Imaging for Diagnosis and Prognosis

Participants

Eugene Yu, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### S5-CRO08 Lymphoma: Imaging for Diagnosis and Prognosis

Participants

Anca Prica, Toronto, ON (*Presenter*) Speaker, AstraZeneca PLC;Speaker, Kite Gilead

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CRO08

**Moderator**

### Participants

Sarah A. Johnson, MD, FRCPC, Toronto, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CRO08

### Lymphoma: Imaging for Diagnosis and Prognosis

#### Participants

Eugene Yu, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-CRO08

### Lymphoma: Imaging for Diagnosis and Prognosis

#### Participants

Anca Prisca, Toronto, ON (*Presenter*) Speaker, AstraZeneca PLC; Speaker, Kite Gilead

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-RCP10

**Moderator**

### **Participants**

Linda Moy, MD, New York, NY (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S5-RCP10

**Leveraging your Peer Review Skills to Expand your Network**

### **Participants**

Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-RCP10

### Mentor-mentee Relationship: Finding the Right Fit

#### Participants

Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-RCP10

### Radiology's Mentor Review Program

#### Participants

Jacob Sosna, MD, (*Presenter*) Stockholder, HighRAD Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S5-RCP10

### Peer Review in Diagnostic Radiology: Mentoring our Next Generation of Leaders

#### LEARNING OBJECTIVES

1) To highlight the elements of a good peer review and to discuss Radiology's Mentor Review Program. 2) To illustrate the importance of the mentor-mentee relationship. 3) To explain how mentoring and networking within a peer review community can help reviewers build a pipeline to academic success.\*Course Description

#### Sub-Events

##### **S5-RCP10 Moderator**

Participants

Linda Moy, MD, New York, NY (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

##### **S5-RCP10 Leveraging your Peer Review Skills to Expand your Network**

Participants

Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

##### **S5-RCP10 Mentor-mentee Relationship: Finding the Right Fit**

Participants

Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

##### **S5-RCP10 Radiology's Mentor Review Program**

Participants

Jacob Sosna, MD, (*Presenter*) Stockholder, HighRAD Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CAS07

### Exploring the Experiences of Autistic Children Within Radiology

#### Participants

Jane Harvey Lloyd, PhD, MSc, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CAS07

**Moderator**

### Participants

Charlotte Beardmore, MBA, London, United Kingdom (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CAS07

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CAS07

### Caring for Patients with Dementia Within Radiology

#### Participants

Miranda Hurley, ARRT,BS,RT, Milwaukee, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CAS07

### Supporting Patients with Neuro Diverse Needs Within Radiology (Sponsored by the RSNA Associated Sciences Consortium)

#### LEARNING OBJECTIVES

1) Explore the factors which influenced the experiences of autistic children and their parents in a diagnostic imaging department. 2) Discuss various types of dementia and how to identify patients who may have dementia. 3) Discuss lessons learned and recommend strategies to enhance patient and family centered care for neuro diverse individuals.\*Course Description Neurodiverse individuals have cognitive differences that affects how their brain works, resulting in unique strengths and challenges. These individuals may experience barriers in healthcare related to access, communication, sensory challenges, and provider knowledge, which can affect their experiences in medical imaging settings. This presentation will explore the experiences of autistic children and patients with dementia in medical imaging departments and discuss strategies to enhance patient-centered care for individuals with neuro diverse needs.

#### COURSE DESCRIPTION

Neurodiverse individuals have cognitive differences that affects how their brain works, resulting in unique strengths and challenges. These individuals may experience barriers in healthcare related to access, communication, sensory challenges, and provider knowledge, which can affect their experiences in medical imaging settings. This presentation will explore the experiences of autistic children and patients with dementia in medical imaging departments and discuss strategies to enhance patient-centered care for individuals with neuro diverse needs.

#### Sub-Events

##### T1-CAS07 Moderator

Participants

Charlotte Beardmore, MBA, London, United Kingdom (*Moderator*) Nothing to Disclose

##### T1-CAS07 Moderator

Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### T1-CAS07 Exploring the Experiences of Autistic Children Within Radiology

Participants

Jane Harvey Lloyd, PhD, MSc, (*Presenter*) Nothing to Disclose

##### T1-CAS07 Caring for Patients with Dementia Within Radiology

Participants

Miranda Hurley, ARRT,BS,RT, Milwaukee, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CBR06

**Moderator**

### **Participants**

Katja Pinker-Domenig, MD, PhD, New York, NY (*Moderator*) Speakers Bureau, European Society of Breast Imaging; Speakers Bureau, Siemens AG; Speakers Bureau, IDKD; Speakers Bureau, Canon Medical Systems Corporation; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Merantix Healthcare; Consultant, AURA Health

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CBR06

### Diagnostic Practice with MRI

#### Participants

Katja Pinker-Domenig, MD, PhD, New York, NY (*Presenter*) Speakers Bureau, European Society of Breast Imaging; Speakers Bureau, Siemens AG; Speakers Bureau, IDKD; Speakers Bureau, Canon Medical Systems Corporation; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Merantix Healthcare; Consultant, AURA Health

#### LEARNING OBJECTIVES

1) To have a basic knowledge of the advantages and limitations of x-ray-based breast imaging methods. 2) To understand when to do ultrasound in symptomatic breast practice and in what situations add-on US techniques are useful. 3) To have a basic understanding of breast MRI techniques, indications, reporting and consequent management recommendations.\*Course Description This educational course will explain the technique and indications of breast ultrasound, digital breast tomosynthesis and breast MRI and summarize its indications in clinical breast imaging. Upon completion of this course participants will understand the current clinical applications and limitations of the methods.

#### COURSE DESCRIPTION

This educational course will explain the technique and indications of breast ultrasound, digital breast tomosynthesis and breast MRI and summarize its indications in clinical breast imaging. Upon completion of this course participants will understand the current clinical applications and limitations of the methods.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CBR06

### Diagnostic Practice with US

#### Participants

Jocelyn Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CBR06

### Diagnostic Practice with Tomo

#### Participants

Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Alphabet Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CBR06

### Essentials of Breast Imaging

#### Sub-Events

##### T1-CBR06 Moderator

###### Participants

Katja Pinker-Domenig, MD, PhD, New York, NY (*Moderator*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health

##### T1-CBR06 Diagnostic Practice with MRI

###### Participants

Katja Pinker-Domenig, MD, PhD, New York, NY (*Presenter*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health

#### LEARNING OBJECTIVES

1) To have a basic knowledge of the advantages and limitations of x-ray-based breast imaging methods. 2) To understand when to do ultrasound in symptomatic breast practice and in what situations add-on US techniques are useful. 3) To have a basic understanding of breast MRI techniques, indications, reporting and consequent management recommendations.\*Course Description This educational course will explain the technique and indications of breast ultrasound, digital breast tomosynthesis and breast MRI and summarize its indications in clinical breast imaging. Upon completion of this course participants will understand the current clinical applications and limitations of the methods.

#### COURSE DESCRIPTION

This educational course will explain the technique and indications of breast ultrasound, digital breast tomosynthesis and breast MRI and summarize its indications in clinical breast imaging. Upon completion of this course participants will understand the current clinical applications and limitations of the methods.

##### T1-CBR06 Diagnostic Practice with US

###### Participants

Jocelyn Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company

##### T1-CBR06 Diagnostic Practice with Tomo

###### Participants

Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc;Research Grant, Alphabet Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CCA03

**Moderator**

### **Participants**

Dominique DaBreo, MD, FRCPC, KINGSTON, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CCA03

**Moderator**

### **Participants**

Bradley Allen, MD, MS, Evanston, IL (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc; Speaker, WebMD LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CCA03

### Differentiating Hypertrophic Heart Diseases

#### Participants

Bradley Allen, MD, MS, Evanston, IL (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc; Speaker, WebMD LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CCA03

### Restrictive Cardiomyopathy: Causes and Imaging Appearance

#### Participants

Jadranka Stojanovska, MD, MS, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CCA03

### Systemic Diseases Affecting the Heart

#### Participants

Karen Ordovas, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CCA03

### The Heart of the Matter: MRI Case Based Review in Nonischemic Cardiomyopathies (Supported in part by an Independent Medical Education Grant from Pfizer, Inc.)

#### LEARNING OBJECTIVES

1) Review current best-practices for CMR evaluation of non-ischemic cardiomyopathy. 2) Demonstrate through cases the role of CMR in non-ischemic cardiomyopathy for diagnosis and risk-stratification. 3) Highlight areas of uncertainty in the current imaging approach and when other modalities can be used to aid in diagnosis.\*Course Description Cardiac MRI (CMR) is an important tool for providing accurate diagnosis and risk-stratification for non-ischemic cardiomyopathies. In this course, learners will be presented with a broad overview of the current state-of-the-art for CMR evaluation of multiple non-ischemic cardiomyopathies. Topics will be presented in a case-based lecture format highlighting relevant CMR acquisitions and interpretation approaches, with a data-driven focus on current best-practices.

#### COURSE DESCRIPTION

Cardiac MRI (CMR) is an important tool for providing accurate diagnosis and risk-stratification for non-ischemic cardiomyopathies. In this course, learners will be presented with a broad overview of the current state-of-the-art for CMR evaluation of multiple non-ischemic cardiomyopathies. Topics will be presented in a case-based lecture format highlighting relevant CMR acquisitions and interpretation approaches, with a data-driven focus on current best-practices.

#### Sub-Events

##### T1-CCA03 Moderator

Participants  
Dominique DaBreo, MD, FRCPC, KINGSTON, ON (*Moderator*) Nothing to Disclose

##### T1-CCA03 Moderator

Participants  
Bradley Allen, MD, MS, Evanston, IL (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

##### T1-CCA03 Differentiating Hypertrophic Heart Diseases

Participants  
Bradley Allen, MD, MS, Evanston, IL (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

##### T1-CCA03 Restrictive Cardiomyopathy: Causes and Imaging Appearance

Participants  
Jadranka Stojanovska, MD, MS, New York, NY (*Presenter*) Nothing to Disclose

##### T1-CCA03 Systemic Diseases Affecting the Heart

Participants  
Karen Ordovas, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CER09

### Critical Musculoskeletal Trauma in the ER- A Case Based Approach

#### Sub-Events

##### T1-CER09 Moderator

###### Participants

Susanna C. Spence, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### T1-CER09 Wrist

###### Participants

Susanna C. Spence, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Learn to identify several critical "not to miss" findings on ER musculoskeletal cases via an engaging joint by joint case-based. 2) Identify subtle injuries and recognize the clinical implications of musculoskeletal injuries.\*Course Description Join our panel of experts in the field for a overview of a variety of musculoskeletal trauma cases, with key features to look out for, pitfalls, and how best to image and evaluate the cases in question.

#### COURSE DESCRIPTION

Join our panel of experts in the field for a overview of a variety of musculoskeletal trauma cases, with key features to look out for, pitfalls, and how best to image and evaluate the cases in question.

##### T1-CER09 Shoulder

###### Participants

Claire Sandstrom, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### T1-CER09 Ankle and Foot

###### Participants

Sameer Raniga, MD, FRCR, Muscat, Oman (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CER09

**Moderator**

### Participants

Susanna C. Spence, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CER09

### Wrist

#### Participants

Susanna C. Spence, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Learn to identify several critical "hot to miss" findings on ER musculoskeletal cases via an engaging joint by joint case-based. 2) Identify subtle injuries and recognize the clinical implications of musculoskeletal injuries.\*Course Description Join our panel of experts in the field for a overview of a variety of musculoskeletal trauma cases, with key features to look out for, pitfalls, and how best to image and evaluate the cases in question.

#### COURSE DESCRIPTION

Join our panel of experts in the field for a overview of a variety of musculoskeletal trauma cases, with key features to look out for, pitfalls, and how best to image and evaluate the cases in question.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CER09

### Shoulder

#### Participants

Claire Sandstrom, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CER09

### Ankle and Foot

#### Participants

Sameer Raniga, MD, FRCR, Muscat, Oman (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### Prostate MRI and Molecular Imaging: Core and Advanced Applications

#### Sub-Events

#### T1-CGU02 Moderator

##### Participants

Aytekin Oto, MD, Chicago, IL (*Moderator*) Research Grant, Koninklijke Philips NV; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; Co-founder, Qmis LLC; Co-owner, Qmis LLC

#### T1-CGU02 Prostate MR Update: What is in the Horizon?

##### Participants

Aytekin Oto, MD, Chicago, IL (*Presenter*) Research Grant, Koninklijke Philips NV; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; Co-founder, Qmis LLC; Co-owner, Qmis LLC

#### LEARNING OBJECTIVES

1) Learn about the latest updates on prostate imaging with special emphasis on MRI and PET imaging. 2) Review the quality control efforts for prostate MR and explain the current and future applications of artificial intelligence on prostate imaging. 3) Understand the potential roles and added value of PSMA PET and PET MR in the management of patients with prostate cancer. 4) Identify how MRI could be optimized for and be used to mitigate the harm of prostate cancer screening.\*Course Description This session aims to provide a comprehensive update on the latest developments in prostate imaging with a special focus on MRI and PET imaging. The presentations are well-balanced and broad in scope, from practical updated tips for optimized prostate MR acquisition and interpretation to new techniques such as PET-MRI and PSMA-PET imaging. The role in the management of prostate cancer patients will be reviewed in addition to other hot topics including molecular imaging impacts, quality control, artificial intelligence applications, screening and disparities in prostate imaging.

#### COURSE DESCRIPTION

This session aims to provide a comprehensive update on the latest developments in prostate imaging with a special focus on MRI and PET imaging. The presentations are well-balanced and broad in scope, from practical updated tips for optimized prostate MR acquisition and interpretation to new techniques such as PET-MRI and PSMA-PET imaging. The role in the management of prostate cancer patients will be reviewed in addition to other hot topics including molecular imaging impacts, quality control, artificial intelligence applications, screening and disparities in prostate imaging.

#### T1-CGU02 Molecular Imaging of Prostate Cancer for Biochemical Recurrence and Metastatic Disease

##### Participants

Delphine Chen, MD, (*Presenter*) Grant, Telix Pharmaceuticals Limited; Speaker, Telix Pharmaceuticals Limited

#### T1-CGU02 AI in Prostate MRI: Clinical Performance Expectations and Limitations

##### Participants

Baris Turkbey, MD, (*Presenter*) Nothing to Disclose

#### T1-CGU02 MRI for Prostate Cancer Screening - Getting Ready

##### Participants

Anwar Padhani, MBBS, FRCR, Northwood, United Kingdom (*Presenter*) Advisory Board, Siemens AG; Speakers Bureau, Siemens AG; Advisory Board, Lucida Medical Ltd; Stockholder, Lucida Medical Ltd

#### T1-CGU02 Healthcare Disparities in Prostate Cancer Imaging

##### Participants

Judy Gichoya, MBChB, MS, Atlanta, GA (*Presenter*) Consultant, Softbrew Digital LTD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### AI in Prostate MRI: Clinical Performance Expectations and Limitations

#### Participants

Baris Turkbey, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### MRI for Prostate Cancer Screening - Getting Ready

#### Participants

Anwar Padhani, MBBS, FRCR, Northwood, United Kingdom (*Presenter*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### Healthcare Disparities in Prostate Cancer Imaging

#### Participants

Judy Gichoya, MBChB,MS, Atlanta, GA (*Presenter*) Consultant, Softbrew Digital LTD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

**Moderator**

### **Participants**

Aytekin Oto, MD, Chicago, IL (*Moderator*) Research Grant, Koninklijke Philips NV; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; Co-founder, Qmis LLC; Co-owner, Qmis LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### Prostate MR Update: What is in the Horizon?

#### Participants

Aytekin Oto, MD, Chicago, IL (*Presenter*) Research Grant, Koninklijke Philips NV; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; Co-founder, Qmis LLC; Co-owner, Qmis LLC

#### LEARNING OBJECTIVES

1) Learn about the latest updates on prostate imaging with special emphasis on MRI and PET imaging. 2) Review the quality control efforts for prostate MR and explain the current and future applications of artificial intelligence on prostate imaging. 3) Understand the potential roles and added value of PSMA PET and PET MR in the management of patients with prostate cancer. 4) Identify how MRI could be optimized for and be used to mitigate the harm of prostate cancer screening.\*Course Description This session aims to provide a comprehensive update on the latest developments in prostate imaging with a special focus on MRI and PET imaging. The presentations are well-balanced and broad in scope, from practical updated tips for optimized prostate MR acquisition and interpretation to new techniques such as PET-MRI and PSMA-PET imaging. The role in the management of prostate cancer patients will be reviewed in addition to other hot topics including molecular imaging impacts, quality control, artificial intelligence applications, screening and disparities in prostate imaging.

#### COURSE DESCRIPTION

This session aims to provide a comprehensive update on the latest developments in prostate imaging with a special focus on MRI and PET imaging. The presentations are well-balanced and broad in scope, from practical updated tips for optimized prostate MR acquisition and interpretation to new techniques such as PET-MRI and PSMA-PET imaging. The role in the management of prostate cancer patients will be reviewed in addition to other hot topics including molecular imaging impacts, quality control, artificial intelligence applications, screening and disparities in prostate imaging.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CGU02

### Molecular Imaging of Prostate Cancer for Biochemical Recurrence and Metastatic Disease

#### Participants

Delphine Chen, MD, (*Presenter*) Grant, Telix Pharmaceuticals Limited; *Speaker*, Telix Pharmaceuticals Limited

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CIN17

### Best Practices for AI Model Deployment

#### LEARNING OBJECTIVES

1) To identify the key areas of consideration when deploying AI into clinical radiology practice. 2) To explore the approaches to change management and governance in AI. 3) Outline the key technological considerations in deploying AI into real world practice.\*Course Description This one hour session is an overview of the key areas essential to the safe, responsible and effective deployment of artificial intelligence (AI) into clinical radiological practice. The session is split into three lectures - change management strategies, AI governance considerations and an overview of the technological decision making process in AI deployment. This session is important for any radiologists, allied health professionals and medical imaging managers interested in incorporating AI into their practice.

#### COURSE DESCRIPTION

This one hour session is an overview of the key areas essential to the safe, responsible and effective deployment of artificial intelligence (AI) into clinical radiological practice. The session is split into three lectures - change management strategies, AI governance considerations and an overview of the technological decision making process in AI deployment. This session is important for any radiologists, allied health professionals and medical imaging managers interested in incorporating AI into their practice.

#### Sub-Events

##### **T1-CIN17 Moderator**

Participants

Catherine M. Jones, MBBS, Brisbane, Australia (*Moderator*) Researcher, Annalise-AI Pty Ltd

##### **T1-CIN17 Change Management: An Approach to Widespread AI Deployment**

Participants

Catherine M. Jones, MBBS, Brisbane, Australia (*Presenter*) Researcher, Annalise-AI Pty Ltd

##### **T1-CIN17 The Governance Around AI Deployment**

Participants

Ameena Elahi, MS,ARRT, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### **T1-CIN17 The Technical Side of AI Deployment**

Participants

R. Kent Hutson JR, MD, Palmer Lake, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CIN17

**Moderator**

### **Participants**

Catherine M. Jones, MBBS, Brisbane, Australia (*Moderator*) Researcher, Annalise-AI Pty Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CIN17

### Change Management: An Approach to Widespread AI Deployment

#### Participants

Catherine M. Jones, MBBS, Brisbane, Australia (*Presenter*) Researcher, Annalise-AI Pty Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CIN17

### The Governance Around AI Deployment

#### Participants

Ameena Elahi, MS,ARRT, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CIN17

### The Technical Side of AI Deployment

#### Participants

R. Kent Hutson JR, MD, Palmer Lake, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

**Moderator**

### Participants

Donna Blankenbaker, MD, Fitchburg, WI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

### Throwing Injuries

#### Participants

Donna Blankenbaker, MD, Fitchburg, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

### Nerve Entrapments about the Elbow

#### Participants

Jeffrey J. Peterson, MD, Neptune Beach, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CMK02

### Elbow Fractures: What is Important?

#### Participants

Stacy E. Smith, MD, Weston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

### Imaging Biceps and Triceps Injuries

#### Participants

Kirkland Davis, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

### Elbow Instability

#### Participants

Bethany Casagranda, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMK02

### Elbow Imaging in the Athlete

#### LEARNING OBJECTIVES

1) Explain the mechanism and imaging features of tendon and ligament injuries. 2) Identify elbow fractures and the importance of these injuries. 3) Differentiate and explain the imaging appearance of nerve entrapments.\*Course Description This course will review elbow anatomy and the injury patterns in the patient presenting with elbow pain. Various aspects of sport injuries will be discussed in the acute, subacute, and chronic setting.

#### COURSE DESCRIPTION

This course will review elbow anatomy and the injury patterns in the patient presenting with elbow pain. Various aspects of sport injuries will be discussed in the acute, subacute, and chronic setting.

#### Sub-Events

##### T1-CMK02 Moderator

Participants

Donna Blankenbaker, MD, Fitchburg, WI (*Moderator*) Nothing to Disclose

##### T1-CMK02 Throwing Injuries

Participants

Donna Blankenbaker, MD, Fitchburg, WI (*Presenter*) Nothing to Disclose

##### T1-CMK02 Nerve Entrapments about the Elbow

Participants

Jeffrey J. Peterson, MD, Neptune Beach, FL (*Presenter*) Nothing to Disclose

##### T1-CMK02 Elbow Fractures: What is Important?

Participants

Stacy E. Smith, MD, Weston, MA (*Presenter*) Nothing to Disclose

##### T1-CMK02 Imaging Biceps and Triceps Injuries

Participants

Kirkland Davis, MD, (*Presenter*) Nothing to Disclose

##### T1-CMK02 Elbow Instability

Participants

Bethany Casagrande, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMS06

### Head to Toe Tumor Challenging Cases: Lessons Learned

#### LEARNING OBJECTIVES

1) Understand key principles in radiologic-pathologic correlation as applicable to a variety of head & neck, thoracic, abdominal and musculoskeletal malignancies. 2) Formulate a focused differential diagnosis for head & neck, thoracic, abdominal, and musculoskeletal malignancies based on these principles. 3) The differential diagnoses would cover cases with infection, inflammation, and hemorrhage.\*Course Description This course will use a case-based format and highlight the role of imaging in the diagnosis of challenging oncology cases using a multimodality approach. The session will focus on a variety of head and neck, pediatric, chest, musculoskeletal, and abdominal malignancies. Clinical presentation and pathological correlations will be provided when possible. Differential diagnoses will include infection, inflammation, neoplasm, ischemia, hemorrhage. The session will provide a broad update in imaging advances that help to make the correct diagnosis.

#### COURSE DESCRIPTION

This course will use a case-based format and highlight the role of imaging in the diagnosis of challenging oncology cases using a multimodality approach. The session will focus on a variety of head and neck, pediatric, chest, musculoskeletal, and abdominal malignancies. Clinical presentation and pathological correlations will be provided when possible. Differential diagnoses will include infection, inflammation, neoplasm, ischemia, hemorrhage. The session will provide a broad update in imaging advances that help to make the correct diagnosis.

#### Sub-Events

##### T1-CMS06 Moderator

Participants

Rachna Madan, MD, Boston, MA (*Moderator*) Nothing to Disclose

##### T1-CMS06 Challenging Chest Oncology Cases: Practical Tips and Pitfalls in the Interpretation

Participants

Rachna Madan, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### T1-CMS06 Challenging Musculoskeletal Soft Tissue Tumors in Pediatrics

Participants

Jack A. Porrino JR, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### T1-CMS06 Challenging Oncology Cases: Gastrointestinal Tumors

Participants

Maria Manning, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

##### T1-CMS06 Challenging Neuroradiology Tumor Cases

Participants

Alexander Kessler, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMS06

**Moderator**

### Participants

Rachna Madan, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMS06

### Challenging Chest Oncology Cases: Practical Tips and Pitfalls in the Interpretation

#### Participants

Rachna Madan, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMS06

### Challenging Neuroradiology Tumor Cases

#### Participants

Alexander Kessler, MD, Pittsford, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CMS06

### Challenging Musculoskeletal Soft Tissue Tumors in Pediatrics

#### Participants

Jack A. Porrino JR, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CMS06

### Challenging Oncology Cases: Gastrointestinal Tumors

#### Participants

Maria Manning, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNMMI09

### Case-based Review of PET/CT: Brain, Head, Neck

#### Sub-Events

##### T1-CNMMI09 Moderator

###### Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Moderator*) Consultant, Konica Minolta, Inc; Consultant, Amgen Inc; Consultant, Blue Earth Diagnostics Ltd; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Speaker, Novartis AG; Consultant, Chimerix, Inc; Consultant, Fusion Pharmaceuticals Inc; Consultant, Bayer AG; Consultant, General Electric Company; Speaker, General Electric Company; Research Grant, General Electric Company; Speaker, Digital Science Press, Inc; Consultant, Radionetics; Former Employee, Konica Minolta, Inc

##### T1-CNMMI09 Dementia

###### Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Presenter*) Consultant, Konica Minolta, Inc; Consultant, Amgen Inc; Consultant, Blue Earth Diagnostics Ltd; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Speaker, Novartis AG; Consultant, Chimerix, Inc; Consultant, Fusion Pharmaceuticals Inc; Consultant, Bayer AG; Consultant, General Electric Company; Speaker, General Electric Company; Research Grant, General Electric Company; Speaker, Digital Science Press, Inc; Consultant, Radionetics; Former Employee, Konica Minolta, Inc

#### LEARNING OBJECTIVES

1) Understand best clinical practices for use and interpretation of dementia PET imaging. 2) Understand best clinical practices for use and interpretation of PET/CT in patients with head/neck cancer.\*Course Description The head/neck is as area of high anatomic and metabolic complexity. In this session, experts on dementia imaging and PET/CT for head/neck malignancy will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

#### COURSE DESCRIPTION

The head/neck is as area of high anatomic and metabolic complexity. In this session, experts on dementia imaging and PET/CT for head/neck malignancy will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

##### T1-CNMMI09 Head and Neck Cancer

###### Participants

Lawrence E. Ginsberg, MD, BA, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNMMI09

### Moderator

#### Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Moderator*) Consultant, Konica Minolta, Inc; Consultant, Amgen Inc; Consultant, Blue Earth Diagnostics Ltd; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Speaker, Novartis AG; Consultant, Chimerix, Inc; Consultant, Fusion Pharmaceuticals Inc; Consultant, Bayer AG; Consultant, General Electric Company; Speaker, General Electric Company; Research Grant, General Electric Company; Speaker, Digital Science Press, Inc; Consultant, Radionetics; Former Employee, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNMMI09

### Dementia

#### Participants

Phillip Kuo, MD, PhD, Tucson, AZ (*Presenter*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc

#### LEARNING OBJECTIVES

1) Understand best clinical practices for use and interpretation of dementia PET imaging. 2) Understand best clinical practices for use and interpretation of PET/CT in patients with head/neck cancer.\*Course Description The head/neck is as area of high anatomic and metabolic complexity. In this session, experts on dementia imaging and PET/CT for head/neck malignancy will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

#### COURSE DESCRIPTION

The head/neck is as area of high anatomic and metabolic complexity. In this session, experts on dementia imaging and PET/CT for head/neck malignancy will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNMMI09

### Head and Neck Cancer

#### Participants

Lawrence E. Ginsberg, MD, BA, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNR11

### Demystifying Postoperative Spine Imaging: Imaging Techniques and Case Based Review

#### LEARNING OBJECTIVES

1) Identify imaging optimization techniques for postoperative spine imaging with MRI and CT. 2) Understand common surgical approaches to the spine, expected postoperative changes, and surgical complications.\*Course Description Postoperative spine imaging is challenging with varied surgical approaches, instrumentation hardware, and related imaging artifact. This interactive case-based course will cover techniques to optimize postoperative spine imaging on both CT and MRI. Surgical techniques, hardware malplacement, postoperative collections, and neurovascular complications will be reviewed.

#### COURSE DESCRIPTION

Postoperative spine imaging is challenging with varied surgical approaches, instrumentation hardware, and related imaging artifact. This interactive case-based course will cover techniques to optimize postoperative spine imaging on both CT and MRI. Surgical techniques, hardware malplacement, postoperative collections, and neurovascular complications will be reviewed.

#### Sub-Events

##### T1-CNR11 Moderator

Participants

J. Levi Chazen, MD, New York, NY (*Moderator*) Nothing to Disclose

##### T1-CNR11 Post-Op Spine MRI and CT Imaging Optimization

Participants

Vinil Shah, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

##### T1-CNR11 Surgical Approaches and Misadventures in Instrumentation

Participants

Mary Kristen Jesse, MD, Aurora, CO (*Presenter*) Faculty, Medtronic plc

##### T1-CNR11 Collections, Pseudomeningoceles, and Seromas

Participants

J. Levi Chazen, MD, New York, NY (*Presenter*) Nothing to Disclose

##### T1-CNR11 Surgical Complications and Long-Term Failure

Participants

Wende Gibbs, MD, MA, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNR11

### Surgical Complications and Long-Term Failure

#### Participants

Wende Gibbs, MD, MA, Scottsdale, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CNR11

**Moderator**

### Participants

J. Levi Chazen, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNR11

### Post-Op Spine MRI and CT Imaging Optimization

#### Participants

Vinil Shah, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNR11

### Surgical Approaches and Misadventures in Instrumentation

#### Participants

Mary Kristen Jesse, MD, Aurora, CO (*Presenter*) Faculty, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CNR11

### Collections, Pseudomeningoceles, and Seromas

#### Participants

J. Levi Chazen, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CRO10

### CNS Case Based Multidisciplinary Review

#### Sub-Events

##### T1-CRO10 Moderator

###### Participants

Soonmee Cha, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

##### T1-CRO10 Recent Advances in Systemic Treatment of Brain Tumors

###### Participants

Roger Stupp, MD, Chicago, IL (*Presenter*) Research Consultant, Carthera; Research Grant, Carthera; Scientific Advisory Board, Alpheus Medical Inc; Scientific Advisory Board, Hemispherian AS; Consultant, GT Medical Technologies, Inc; Consultant, Triact Therapeutics Inc; Research Consultant, AstraZeneca PLC; Research Consultant, Boston Scientific Corporation

##### T1-CRO10 Neuroimaging Associated with Local, Adjuvant Neurosurgical Treatment

###### Participants

Clark Chen, PhD, Minneapolis, MN (*Presenter*) Consultant, Medtronic plc; Consultant, MRI Interventions, Inc; Consultant, GT Medical Technologies, Inc

##### T1-CRO10 Comprehensive Review of Radiotherapy for Brain Tumors

###### Participants

Christina Tsien, MD, Washington, DC (*Presenter*) Advisory Board, Blue Earth Diagnostics Ltd; Speakers Bureau, Agilent Technologies, Inc; Consultant, Carl Zeiss AG

##### T1-CRO10 Latest Update on Brain Tumor Imaging: What All Radiologists Must Know

###### Participants

Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating CNS malignancies. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CRO10

### Comprehensive Review of Radiotherapy for Brain Tumors

#### Participants

Christina Tsien, MD, Washington, DC (*Presenter*) Advisory Board, Blue Earth Diagnostics Ltd;Speakers Bureau, Agilent Technologies, Inc;Consultant, Carl Zeiss AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CRO10

**Moderator**

### Participants

Soonmee Cha, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CRO10

### Recent Advances in Systemic Treatment of Brain Tumors

#### Participants

Roger Stupp, MD, Chicago, IL (*Presenter*) Research Consultant, Carthera; Research Grant, Carthera; Scientific Advisory Board, Alpheus Medical Inc; Scientific Advisory Board, Hemispherian AS; Consultant, GT Medical Technologies, Inc; Consultant, Triact Therapeutics Inc; Research Consultant, AstraZeneca PLC; Research Consultant, Boston Scientific Corporation

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T1-CRO10

### Neuroimaging Associated with Local, Adjuvant Neurosurgical Treatment

#### Participants

Clark Chen, PhD, Minneapolis, MN (*Presenter*) Consultant, Medtronic plc; Consultant, MRI Interventions, Inc; Consultant, GT Medical Technologies, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T1-CRO10

### Latest Update on Brain Tumor Imaging: What All Radiologists Must Know

#### Participants

Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating CNS malignancies. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Jessica Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Shadi Aminololama-Shakeri, MD, Sacramento, CA (*Presenter*) Consultant, Becton, Dickinson and Company; Consultant, Izotropic Corporation; Stock options, Izotropic Corporation

#### LEARNING OBJECTIVES

1) Attendees will review various needle biopsy devices for ultrasound guided procedures along with opportunity to perform needle biopsy procedures under the supervision of breast radiologists. 2) Review of cyst aspiration and wire localization procedures will be performed along with clip placement.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Hands on opportunity for cyst aspiration, needle biopsy and wire localization procedures under ultrasound guidance and direct supervision by expert radiologists. Didactic lecture on the performance of the most common biopsy procedures in the breast followed by hands on opportunity to perform procedures.

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Hands on opportunity for cyst aspiration, needle biopsy and wire localization procedures under ultrasound guidance and direct supervision by expert radiologists. Didactic lecture on the performance of the most common biopsy procedures in the breast followed by hands on opportunity to perform procedures.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Erin Neuschler, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Georgia Spear, MD, Park Ridge, IL (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, General Electric Company; Scientific Advisory Board, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Sub-Events

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Sarah Pittman, MD, FRCPC, Stanford, CA (*Presenter*) Nothing to Disclose

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Georgia Spear, MD, Park Ridge, IL (*Presenter*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company;Scientific Advisory Board, Hologic, Inc

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Erin Neuschler, MD, Chicago, IL (*Presenter*) Nothing to Disclose

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Liane E. Philpotts, MD, Madison, CT (*Presenter*) Nothing to Disclose

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Laurie Margolies, MD, New York, NY (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Regina J. Hooley, MD, Weston, CT (*Presenter*) Consultant, Hologic, Inc

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Maria Helena S. Mendonca, PhD, Sao Paulo, Brazil (*Presenter*) Expert Advisory Committee, Guerbet SA

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Phan Huynh, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Paula B. Gordon, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc;Stockholder, Volpara Health Technologies Limited;Scientific Advisor, Besins Healthcare SA

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Tanya W. Moseley, MD, PhD, Houston, TX (*Presenter*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC

#### **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

##### Participants

Marcio Saito, MD, Salvador, Brazil (*Presenter*) Speaker, General Electric Company



## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Gary Whitman, MD, Houston, TX (*Presenter*) Consultant, Siemens AG;Editor, Wolters Kluwer nv

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Gloria Palazuelos, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Beatriz Adrada, MD, Houston, TX (*Presenter*) Nothing to Disclose

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Athina Vourtsi, MD, Athens, Greece (*Presenter*) Research Consultant, General Electric Company;Research Grant, General Electric Company;Educator, Arbutus Biopharma Corporation;Research collaboration, ScreenPoint Medical BV;Medical Advisory Board, Volpara Health Technologies Limited

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Stamatia Destounis, MD, Rochester, NY (*Presenter*) Medical Advisory Board, iCad, Inc

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Michael Linver, MD, Alexandria, VA (*Presenter*) Medical Advisory Board, Three Palm Software LLC;Scientific Advisory Board, Seno Medical Instruments, Inc

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Marcela Uchida, MD, (*Presenter*) Nothing to Disclose

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Linda J. Warren, MD, Vancouver, BC (*Presenter*) Shareholder, Hologic, Inc

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Norran Said, MD, FRCR, Cairo, Egypt (*Presenter*) Nothing to Disclose

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Shadi Aminololama-Shakeri, MD, Sacramento, CA (*Presenter*) Consultant, Becton, Dickinson and Company;Consultant, Izotropic Corporation;Stock options, Izotropic Corporation

## **LEARNING OBJECTIVES**

1) Attendees will review various needle biopsy devices for ultrasound guided procedures along with opportunity to perform needle biopsy procedures under the supervision of breast radiologists. 2) Review of cyst aspiration and wire localization procedures will be performed along with clip placement.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Hands on opportunity for cyst aspiration, needle biopsy and wire localization procedures under ultrasound guidance and direct supervision by expert radiologists. Didactic lecture on the performance of the most common biopsy procedures in the breast followed by hands on opportunity to perform procedures.

## **COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.Hands on opportunity for cyst aspiration, needle biopsy and wire localization procedures under ultrasound guidance and direct supervision by expert radiologists. Didactic lecture on the performance of the most common biopsy procedures in the breast followed by hands on opportunity to perform procedures.

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Richard G. Barr, MD, PhD, Canfield, OH (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

## **T2-CBR15 RSNA Hands-On Lab: Breast US Biopsy**

Participants

Jessica Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

**T2-CBR15 Moderator**

Participants

Stamatia Destounis, MD, Rochester, NY (*Moderator*) Medical Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**Moderator**

### **Participants**

Stamatia Destounis, MD, Rochester, NY (*Moderator*) Medical Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Liane E. Philpotts, MD, Madison, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Phan Huynh, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Paula B. Gordon, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc; Stockholder, Volpara Health Technologies Limited; Scientific Advisor, Besins Healthcare SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Tanya W. Moseley, MD, PhD, Houston, TX (*Presenter*) Consultant, Hologic, Inc; Consultant, Merit Medical Systems, Inc; Owner, TW Moseley, LLC; CEO, TW Moseley, LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Marcio Saito, MD, Salvador, Brazil (*Presenter*) Speaker, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Gary Whitman, MD, Houston, TX (*Presenter*) Consultant, Siemens AG; Editor, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Gloria Palazuelos, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Beatriz Adrada, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Athina Vourtsi, MD, Athens, Greece (*Presenter*) Research Consultant, General Electric Company; Research Grant, General Electric Company; Educator, Arbutus Biopharma Corporation; Research collaboration, ScreenPoint Medical BV; Medical Advisory Board, Volpara Health Technologies Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Stamatia Destounis, MD, Rochester, NY (*Presenter*) Medical Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Michael Linver, MD, Alexandria, VA (*Presenter*) Medical Advisory Board, Three Palm Software LLC; Scientific Advisory Board, Seno Medical Instruments, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Marcela Uchida, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Linda J. Warren, MD, Vancouver, BC (*Presenter*) Shareholder, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Norran Said, MD, FRCR, Cairo, Egypt (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Sarah Pittman, MD, FRCPC, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Maria Helena S. Mendonca, PhD, Sao Paulo, Brazil (*Presenter*) Expert Advisory Committee, Guerbet SA

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T2-CBR15

**RSNA Hands-On Lab: Breast US Biopsy**

### Participants

Laurie Margolies, MD, New York, NY (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T2-CBR15

### RSNA Hands-On Lab: Breast US Biopsy

#### Participants

Regina J. Hooley, MD, Weston, CT (*Presenter*) Consultant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CAS08

### Diversity in Access to Breast Imaging (Sponsored by the RSNA Associated Sciences Consortium)

#### Sub-Events

##### T3-CAS08 Moderator

#### Participants

Brandy Reed, MBA, RT, Houston, TX (*Moderator*) Nothing to Disclose

##### T3-CAS08 Diversity, Women, Minority Platform in the Imaging World

#### Participants

Wei Yang, MD, FRCR, Houston, TX (*Presenter*) Royalties, Reed Elsevier; Advisory Board, Lux Capital

#### LEARNING OBJECTIVES

1) Understand the barriers to access in breast imaging that are related to diversity. 2) Describe data reflecting breast cancer screening center element disparities. 3) Describe potential solutions for addressing diversity-related barriers to breast imaging access.\*Course Description Asymmetries in health care access related to health care disparities have been amplified through and after the COVID pandemic. This course will include two interactive presentations (lectures) reviewing diversity-related barriers to access in breast imaging. Barriers reviewed include costs of care as a function of household income and insurance carriers, national screening guideline inconsistencies and variability, patient education and awareness, geocoding indicators of social determinants of health. Data on screening center element disparities will be described. Potential solutions and strategic plans to address this widening asymmetry in access to breast imaging care across vulnerable populations will be discussed.

#### COURSE DESCRIPTION

Asymmetries in health care access related to health care disparities have been amplified through and after the COVID pandemic. This course will include two interactive presentations (lectures) reviewing diversity-related barriers to access in breast imaging. Barriers reviewed include costs of care as a function of household income and insurance carriers, national screening guideline inconsistencies and variability, patient education and awareness, geocoding indicators of social determinants of health. Data on screening center element disparities will be described. Potential solutions and strategic plans to address this widening asymmetry in access to breast imaging care across vulnerable populations will be discussed.

##### T3-CAS08 Diversity in Breast Imaging

#### Participants

Miral Patel, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CAS08

**Moderator**

### Participants

Brandy Reed, MBA, RT, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CAS08

### Diversity, Women, Minority Platform in the Imaging World

#### Participants

Wei Yang, MD, FRCR, Houston, TX (*Presenter*) Royalties, Reed Elsevier; Advisory Board, Lux Capital

#### LEARNING OBJECTIVES

1) Understand the barriers to access in breast imaging that are related to diversity. 2) Describe data reflecting breast cancer screening center element disparities. 3) Describe potential solutions for addressing diversity-related barriers to breast imaging access.\*Course Description Asymmetries in health care access related to health care disparities have been amplified through and after the COVID pandemic. This course will include two interactive presentations (lectures) reviewing diversity-related barriers to access in breast imaging. Barriers reviewed include costs of care as a function of household income and insurance carriers, national screening guideline inconsistencies and variability, patient education and awareness, geocoding indicators of social determinants of health. Data on screening center element disparities will be described. Potential solutions and strategic plans to address this widening asymmetry in access to breast imaging care across vulnerable populations will be discussed.

#### COURSE DESCRIPTION

Asymmetries in health care access related to health care disparities have been amplified through and after the COVID pandemic. This course will include two interactive presentations (lectures) reviewing diversity-related barriers to access in breast imaging. Barriers reviewed include costs of care as a function of household income and insurance carriers, national screening guideline inconsistencies and variability, patient education and awareness, geocoding indicators of social determinants of health. Data on screening center element disparities will be described. Potential solutions and strategic plans to address this widening asymmetry in access to breast imaging care across vulnerable populations will be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CAS08

### Diversity in Breast Imaging

#### Participants

Miral Patel, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CCH05

**Moderator**

### **Participants**

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Moderator*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CCH05

### DAD and AFOP

#### Participants

Anu Brixey, MD, Portland, OR (*Presenter*) Research support, 4D Medical

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CCH05

**EVALI**

### Participants

Travis Henry, MD, Durham, NC (*Presenter*) Advisor, Aer Therapeutics, Inc; Stockholder, Aer Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CCH05

### Thoracic Emergencies in Oncology Patients

#### Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CCH05

### ECMO Imaging

#### Participants

Demetrios Raptis, MD, Frontenac, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CCH05

### Acute Lung Injury

#### LEARNING OBJECTIVES

1) To evaluate appearances of acute lung injury and their clinical/pathological correlates. 2) To understand specific lung injuries in inhalation disorders and oncological patients. 3) Imaging assessment of patients with lung injury treated by ECMO.\*Course Description Lecture format with 4 lectures: 1. Differentiating diffuse alveolar damage and acute fibrinous and organizing pneumonia, radiology and pathology. 2. E-cigarette or vaping use-associated lung injury (EVALI). 3. Oncological lung emergencies: common and uncommon imaging scenarios to be aware of. 4. Assessing expected appearances and complications in ICU extracorporeal membrane oxygenation (ECMO) patients.

#### COURSE DESCRIPTION

Lecture format with 4 lectures: 1. Differentiating diffuse alveolar damage and acute fibrinous and organizing pneumonia, radiology and pathology. 2. E-cigarette or vaping use-associated lung injury (EVALI). 3. Oncological lung emergencies: common and uncommon imaging scenarios to be aware of. 4. Assessing expected appearances and complications in ICU extracorporeal membrane oxygenation (ECMO) patients.

#### Sub-Events

##### T3-CCH05 Moderator

Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Moderator*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd;

##### T3-CCH05 DAD and AFOP

Participants

Anu Brixey, MD, Portland, OR (*Presenter*) Research support, 4D Medical

##### T3-CCH05 EVALI

Participants

Travis Henry, MD, Durham, NC (*Presenter*) Advisor, Aer Therapeutics, Inc; Stockholder, Aer Therapeutics, Inc

##### T3-CCH05 Thoracic Emergencies in Oncology Patients

Participants

Ioannis Vlahos, MBBS, FRCR, Houston, TX (*Presenter*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd;

##### T3-CCH05 ECMO Imaging

Participants

Demetrios Raptis, MD, Frontenac, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### Challenges and Opportunities in LI-RADS Reporting

#### Participants

Alexandra Roudenko, MD, Ossining, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Apply the updated LI-RADS guidelines in the interpretation and reporting of liver imaging studies, ensuring accurate identification, and characterization of liver lesions. 2) Evaluate treatment response of liver lesions using CEUS techniques within the LI-RADS framework, enabling participants to assess therapeutic outcomes effectively. 3) Discuss challenging areas encountered in CT/MRI interpretation according to LI-RADS guidelines, enhancing participants' proficiency, and confidence in the assessment of liver lesions.\*Course Description This course is meticulously designed to keep radiologists informed and updated on the latest developments in LI-RADS (Liver Imaging Reporting and Data System) through focused educational sessions. Esteemed experts will deliver an all-encompassing overview of the latest advancements in LI-RADS assessment and reporting. This course is an opportunity to cultivate practical skills for accurately interpreting liver imaging studies by leveraging the latest guidelines, assessing treatment response with CEUS, and adeptly managing complex areas in CT/MRI interpretation. This training aims to elevate your proficiency and instill confidence in LI-RADS reporting, thereby promoting standardized and superior-quality reports. We invite you to join us, expand your understanding of LI-RADS, stay abreast of current developments, and polish your proficiency in liver imaging.

#### COURSE DESCRIPTION

This course is meticulously designed to keep radiologists informed and updated on the latest developments in LI-RADS (Liver Imaging Reporting and Data System) through focused educational sessions. Esteemed experts will deliver an all-encompassing overview of the latest advancements in LI-RADS assessment and reporting. This course is an opportunity to cultivate practical skills for accurately interpreting liver imaging studies by leveraging the latest guidelines, assessing treatment response with CEUS, and adeptly managing complex areas in CT/MRI interpretation. This training aims to elevate your proficiency and instill confidence in LI-RADS reporting, thereby promoting standardized and superior-quality reports. We invite you to join us, expand your understanding of LI-RADS, stay abreast of current developments, and polish your proficiency in liver imaging.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### Moderator

#### Participants

Jeong Min Lee, MD, PhD, (*Moderator*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### LI-RADS Treatment Response Assessment with CEUS

#### Participants

David Fetzer, MD, Dallas, TX (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Research support, Siemens AG; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### Difficult Areas in CT/MRI LI-RADS

#### Participants

Victoria Chernyak, MD, MS, Bronx, NY (*Presenter*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### Updates on HCC Surveillance with US LI-RADS

#### Participants

Shuchi K. Rodgers, MD, Cherry Hill, NJ (*Presenter*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### Prognostic Imaging Features of HCC: Emerging Evidence

#### Participants

Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG; Research support, General Electric Company; Research Grant, Pfizer Inc; Institutional Grant, MEDIAN Technologies; Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CGI08

### LIRADS

#### Sub-Events

##### T3-CGI08 Moderator

#### Participants

Jeong Min Lee, MD, PhD, (*Moderator*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

##### T3-CGI08 LI-RADS Treatment Response Assessment with CEUS

#### Participants

David Fetzer, MD, Dallas, TX (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Research support, Siemens AG; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, General Electric Company

##### T3-CGI08 Difficult Areas in CT/MRI LI-RADS

#### Participants

Victoria Chernyak, MD, MS, Bronx, NY (*Presenter*) Consultant, Bayer AG

##### T3-CGI08 Updates on HCC Surveillance with US LI-RADS

#### Participants

Shuchi K. Rodgers, MD, Cherry Hill, NJ (*Presenter*) Royalties, RELX

##### T3-CGI08 Prognostic Imaging Features of HCC: Emerging Evidence

#### Participants

Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG; Research support, General Electric Company; Research Grant, Pfizer Inc; Institutional Grant, MEDIAN Technologies; Consultant, General Electric Company

##### T3-CGI08 Challenges and Opportunities in LI-RADS Reporting

#### Participants

Alexandra Roudenko, MD, Ossining, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Apply the updated LI-RADS guidelines in the interpretation and reporting of liver imaging studies, ensuring accurate identification, and characterization of liver lesions. 2) Evaluate treatment response of liver lesions using CEUS techniques within the LI-RADS framework, enabling participants to assess therapeutic outcomes effectively. 3) Discuss challenging areas encountered in CT/MRI interpretation according to LI-RADS guidelines, enhancing participants' proficiency, and confidence in the assessment of liver lesions.\*Course Description This course is meticulously designed to keep radiologists informed and updated on the latest developments in LI-RADS (Liver Imaging Reporting and Data System) through focused educational sessions. Esteemed experts will deliver an all-encompassing overview of the latest advancements in LI-RADS assessment and reporting. This course is an opportunity to cultivate practical skills for accurately interpreting liver imaging studies by leveraging the latest guidelines, assessing treatment response with CEUS, and adeptly managing complex areas in CT/MRI interpretation. This training aims to elevate your proficiency and instill confidence in LI-RADS reporting, thereby promoting standardized and superior-quality reports. We invite you to join us, expand your understanding of LI-RADS, stay abreast of current developments, and polish your proficiency in liver imaging.

#### COURSE DESCRIPTION

This course is meticulously designed to keep radiologists informed and updated on the latest developments in LI-RADS (Liver Imaging Reporting and Data System) through focused educational sessions. Esteemed experts will deliver an all-encompassing overview of the latest advancements in LI-RADS assessment and reporting. This course is an opportunity to cultivate practical skills for accurately interpreting liver imaging studies by leveraging the latest guidelines, assessing treatment response with CEUS, and adeptly managing complex areas in CT/MRI interpretation. This training aims to elevate your proficiency and instill confidence in LI-RADS reporting, thereby promoting standardized and superior-quality reports. We invite you to join us, expand your understanding of LI-RADS, stay abreast of current developments, and polish your proficiency in liver imaging.



## Abstract Archives of the RSNA, 2023

T3-CIN06

### Change (People) Management

#### Participants

Peter S. Liu, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss challenges and considerations of integrating disparate radiology technology systems (EHR, RIS, PACS, Dictation systems) during merger and acquisitions. 2) Discuss radiology operational challenges and change management which go hand in hand when integrating technology from different organizations.\*Course Description Mergers and acquisitions (M & As) are becoming a common practice in healthcare. For M & As to be successful, the IT teams are usually asked to integrate the (often) disparate technologies across the different organizations. A successful integration is not only dependant on technological integration but also on change management and addressing operational considerations. In this course, we will discuss challenges and considerations for all three pillars of a successful IT integration - technology, people and processes, along with post go live optimization strategies.

#### COURSE DESCRIPTION

Mergers and acquisitions (M & As) are becoming a common practice in healthcare. For M & As to be successful, the IT teams are usually asked to integrate the (often) disparate technologies across the different organizations. A successful integration is not only dependant on technological integration but also on change management and addressing operational considerations. In this course, we will discuss challenges and considerations for all three pillars of a successful IT integration - technology, people and processes, along with post go live optimization strategies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN06

### People, Process and Technology: 3 Pillars for Successful Rad IT Integration

#### Sub-Events

##### **T3-CIN06 Moderator**

Participants

Namita S. Gandhi, MD, MSc, (*Moderator*) Nothing to Disclose

##### **T3-CIN06 Challenges and Considerations with Radiology Technology Integration (EHR, RIS, PACS, Dictation Systems)**

Participants

Namita S. Gandhi, MD, MSc, (*Presenter*) Nothing to Disclose

##### **T3-CIN06 Operational Challenges and Considerations for Radiology Processes**

Participants

Amy Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### **T3-CIN06 Post Go-Live Optimization**

Participants

Stacy D. O'Connor, MD, MPH, Carrboro, NC (*Presenter*) Nothing to Disclose

##### **T3-CIN06 Change (People) Management**

Participants

Peter S. Liu, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss challenges and considerations of integrating disparate radiology technology systems (EHR, RIS, PACS, Dictation systems) during merger and acquisitions. 2) Discuss radiology operational challenges and change management which go hand in hand when integrating technology from different organizations.\*Course Description Mergers and acquisitions (M & As) are becoming a common practice in healthcare. For M & As to be successful, the IT teams are usually asked to integrate the (often) disparate technologies across the different organizations. A successful integration is not only dependant on technological integration but also on change management and addressing operational considerations. In this course, we will discuss challenges and considerations for all three pillars of a successful IT integration - technology, people and processes, along with post go live optimization strategies.

#### COURSE DESCRIPTION

Mergers and acquisitions (M & As) are becoming a common practice in healthcare. For M & As to be successful, the IT teams are usually asked to integrate the (often) disparate technologies across the different organizations. A successful integration is not only dependant on technological integration but also on change management and addressing operational considerations. In this course, we will discuss challenges and considerations for all three pillars of a successful IT integration - technology, people and processes, along with post go live optimization strategies.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN06

**Moderator**

### Participants

Namita S. Gandhi, MD, MSc, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN06

**Challenges and Considerations with Radiology Technology Integration (EHR, RIS, PACS, Dictation Systems)**

### Participants

Namita S. Gandhi, MD, MSc, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN06

### Operational Challenges and Considerations for Radiology Processes

#### Participants

Amy Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN06

### Post Go-Live Optimization

#### Participants

Stacy D. O'Connor, MD, MPH, Carrboro, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN18

**Moderator**

### **Participants**

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Moderator*) Grant, Independence Blue Cross; Speaker, Sectra AB;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN18

### Educating the Care Team and Our Patients About AI

#### Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Grant, Independence Blue Cross; *Speaker*, Sectra AB;

#### LEARNING OBJECTIVES

1) Introduce the concept of an educational framework, and how to educate radiologists and residents on AI. 2) Demonstrate how to concretely show radiologists the value of AI beyond the hype, and how it can integrate into the imaging workflow. 3) Discuss strategies for educating the entire care team (including our technologists and referring clinicians) as well as our patients about AI.\*  
Course Description AI isn't just coming; it's here. Do you know how you'll educate your fellow radiologists or our future colleagues about AI? What about our technologists, referring clinicians, and patients? In this didactic session, three experts will discuss best practices for AI education across the care continuum.

#### COURSE DESCRIPTION

AI isn't just coming; it's here. Do you know how you'll educate your fellow radiologists or our future colleagues about AI? What about our technologists, referring clinicians, and patients? In this didactic session, three experts will discuss best practices for AI education across the care continuum.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CIN18

### Educating Radiologists and Residents on AI

#### Participants

Catherine M. Jones, MBBS, Brisbane, Australia (*Presenter*) Researcher, Annalise-AI Pty Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN18

### Best Practices for AI Education

#### Sub-Events

#### **T3-CIN18 Moderator**

##### Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Moderator*) Grant, Independence Blue Cross; Speaker, Sectra AB;

#### **T3-CIN18 Educating the Care Team and Our Patients About AI**

##### Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Grant, Independence Blue Cross; Speaker, Sectra AB;

#### LEARNING OBJECTIVES

1) Introduce the concept of an educational framework, and how to educate radiologists and residents on AI. 2) Demonstrate how to concretely show radiologists the value of AI beyond the hype, and how it can integrate into the imaging workflow. 3) Discuss strategies for educating the entire care team (including our technologists and referring clinicians) as well as our patients about AI.\*Course Description AI isn't just coming; it's here. Do you know how you'll educate your fellow radiologists or our future colleagues about AI? What about our technologists, referring clinicians, and patients? In this didactic session, three experts will discuss best practices for AI education across the care continuum.

#### COURSE DESCRIPTION

AI isn't just coming; it's here. Do you know how you'll educate your fellow radiologists or our future colleagues about AI? What about our technologists, referring clinicians, and patients? In this didactic session, three experts will discuss best practices for AI education across the care continuum.

#### **T3-CIN18 Educating Radiologists and Residents on AI**

##### Participants

Catherine M. Jones, MBBS, Brisbane, Australia (*Presenter*) Researcher, Annalise-AI Pty Ltd

#### **T3-CIN18 AI Throughout the Imaging Workflow: Value Over Hype**

##### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CIN18

### AI Throughout the Imaging Workflow: Value Over Hype

#### Participants

Kirti Magudia, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNMMI10

**Moderator**

### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Moderator*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNMMI10

**Breast Cancer - FDG PET**

### Participants

Maxine S. Jochelson, MD, (*Presenter*) Speaker, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNMMI10

### Breast Cancer - FES PET

#### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNMMI10

### Case-based Review of PET/CT: Breast Cancer

#### LEARNING OBJECTIVES

1) Understand best clinical practices for use and interpretation of PET imaging in patient with lung cancer. 2) Understand best clinical practices for use and interpretation of FES PET/CT in patients with breast cancer.\*Course Description PET/CT has greatly impacted the imaging and therapy of chest malignancies, including longstanding value for staging of lung cancer, as well as novel Estrogen Receptor targeted imaging for breast cancer. In this session, experts on lung and breast cancers will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of FES (Cerianna) PET.

#### COURSE DESCRIPTION

PET/CT has greatly impacted the imaging and therapy of chest malignancies, including longstanding value for staging of lung cancer, as well as novel Estrogen Receptor targeted imaging for breast cancer. In this session, experts on lung and breast cancers will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of FES (Cerianna) PET.

#### Sub-Events

##### T3-CNMMI10 Moderator

###### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Moderator*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

##### T3-CNMMI10 Breast Cancer - FDG PET

###### Participants

Maxine S. Jochelson, MD, (*Presenter*) Speaker, General Electric Company

##### T3-CNMMI10 Breast Cancer - FES PET

###### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

### Errors in Radiology: The Human Factor is the X-Factor (Sponsored by the RSNA Professionalism Committee)

#### Sub-Events

##### T3-CNPM03 Moderator

###### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

##### T3-CNPM03 Moderator

###### Participants

Michael K. Atalay, MD, PhD, (*Moderator*) Nothing to Disclose

##### T3-CNPM03 The Scope of Human Factors: What are They and Why are They Important?

###### Participants

Grainne Murphy, MBBCh, MMedSc, Birmingham, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To identify and reduce or eliminate causes of human error. 2) To enhance productivity and system efficiency. 3) To improve safety, health, and well-being of both patients and care providers.\*Course Description The goals of this course will be to understand the salient features of human factors, why they occur, how they lead to errors in radiology, and strategies for managing them and reducing their adverse effects.

#### COURSE DESCRIPTION

The goals of this course will be to understand the salient features of human factors, why they occur, how they lead to errors in radiology, and strategies for managing them and reducing their adverse effects.

##### T3-CNPM03 Types and Causes of Errors in Radiology

###### Participants

Michael A. Bruno, MD, MS, Hummelstown, PA (*Presenter*) Nothing to Disclose

##### T3-CNPM03 Errors in Radiology Due to Perception, Judgment, and Noise

###### Participants

Michael K. Atalay, MD, PhD, (*Presenter*) Nothing to Disclose

##### T3-CNPM03 Solutions and Strategies for Error Reduction

###### Participants

Elizabeth A. Krupinski, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CNPM03

### Types and Causes of Errors in Radiology

#### Participants

Michael A. Bruno, MD, MS, Hummelstown, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

### Errors in Radiology Due to Perception, Judgment, and Noise

#### Participants

Michael K. Atalay, MD, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

### Solutions and Strategies for Error Reduction

#### Participants

Elizabeth A. Krupinski, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

**Moderator**

### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

**Moderator**

### Participants

Michael K. Atalay, MD, PhD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CNPM03

### The Scope of Human Factors: What are They and Why are They Important?

#### Participants

Grainne Murphy, MBBCh, MMedSc, Birmingham, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To identify and reduce or eliminate causes of human error. 2) To enhance productivity and system efficiency. 3) To improve safety, health, and well-being of both patients and care providers.\*Course Description The goals of this course will be to understand the salient features of human factors, why they occur, how they lead to errors in radiology, and strategies for managing them and reducing their adverse effects.

#### COURSE DESCRIPTION

The goals of this course will be to understand the salient features of human factors, why they occur, how they lead to errors in radiology, and strategies for managing them and reducing their adverse effects.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPD07

### Pediatric Thoracic Abnormalities: Congenital and Acquired

#### LEARNING OBJECTIVES

1) Develop the appropriate imaging approach in children to be able to characterize vascular rings and slings, lung lucencies as well as disorders of the diaphragm and chest wall.\*Course Description The types of thoracic disorders as well as the imaging approach to best characterize may be unique in the pediatric population. In this didactic session, four pediatric imaging experts will focus on four different regions of the chest: the lungs, vascular system, chest wall and diaphragm and discuss relevant, often commonly encountered disorders. Objectives include gaining an understanding of the benefits and challenges with imaging approaches for regional thoracic disorders and enhancing the ability to characterize abnormalities especially for guiding clinical management.

#### COURSE DESCRIPTION

The types of thoracic disorders as well as the imaging approach to best characterize may be unique in the pediatric population. In this didactic session, four pediatric imaging experts will focus on four different regions of the chest: the lungs, vascular system, chest wall and diaphragm and discuss relevant, often commonly encountered disorders. Objectives include gaining an understanding of the benefits and challenges with imaging approaches for regional thoracic disorders and enhancing the ability to characterize abnormalities especially for guiding clinical management.

#### Sub-Events

##### T3-CPD07 Moderator

Participants  
Donald Frush, MD, Durham, NC (*Moderator*) Nothing to Disclose

##### T3-CPD07 Lung Lucencies and Bubbles in the Chest: What to do?

Participants  
Bernard Laya, MD, DO, (*Presenter*) Nothing to Disclose

##### T3-CPD07 Diaphragmatic Ultrasound: Technique and Interpretation

Participants  
Ailish Coblenz, MD, Toronto, ON (*Presenter*) Nothing to Disclose

##### T3-CPD07 Pediatric Thoracic Wall Abnormalities

Participants  
R. Paul Guillerman, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### T3-CPD07 Vascular Rings and Slings: Imaging Tips and Tricks

Participants  
LaDonna Malone, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPD07

### Vascular Rings and Slings: Imaging Tips and Tricks

#### Participants

LaDonna Malone, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CPD07

**Moderator**

### Participants

Donald Frush, MD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPD07

### Lung Lucencies and Bubbles in the Chest: What to do?

#### Participants

Bernard Laya, MD, DO, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPD07

### Diaphragmatic Ultrasound: Technique and Interpretation

#### Participants

Ailish Coblentz, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPD07

### Pediatric Thoracic Wall Abnormalities

#### Participants

R. Paul Guillerman, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPH09

**Moderator**

### Participants

Lifeng Yu, PhD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPH09

### Deep Learning in CT Image Reconstruction

#### Participants

Guang-Hong Chen, PhD, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe deep learning applications in CT image formation process, including image reconstruction and artifact reduction. 2) Explain current clinical implementations of deep learning reconstruction methods on CT scanners and how to evaluate these methods.\*Course Description This course will provide an overview of deep learning applications in CT image formation, including image reconstruction and artifact correction. It will also summarize current clinical implementations of deep learning-based image reconstruction and noise reduction methods on CT scanners and describe how to appropriately evaluate these methods. Potential pitfalls of deep learning methods in CT image formation will be described. There are three lectures in this course:(1) Deep learning in CT reconstruction(2) Deep learning in CT artifact correction(3) Clinical implementation and evaluation

#### COURSE DESCRIPTION

This course will provide an overview of deep learning applications in CT image formation, including image reconstruction and artifact correction. It will also summarize current clinical implementations of deep learning-based image reconstruction and noise reduction methods on CT scanners and describe how to appropriately evaluate these methods. Potential pitfalls of deep learning methods in CT image formation will be described. There are three lectures in this course:(1) Deep learning in CT reconstruction(2) Deep learning in CT artifact correction(3) Clinical implementation and evaluation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPH09

### Deep Learning in CT Artifacts Correction

#### Participants

Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CPH09

### Deep Learning in CT Image Quality Assessment

#### Participants

Lifeng Yu, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-CPH09

### Deep Learning in CT Image Formation

#### Sub-Events

#### T3-CPH09 Moderator

##### Participants

Lifeng Yu, PhD, Rochester, MN (*Moderator*) Nothing to Disclose

#### T3-CPH09 Deep Learning in CT Image Reconstruction

##### Participants

Guang-Hong Chen, PhD, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe deep learning applications in CT image formation process, including image reconstruction and artifact reduction. 2) Explain current clinical implementations of deep learning reconstruction methods on CT scanners and how to evaluate these methods.\*Course Description This course will provide an overview of deep learning applications in CT image formation, including image reconstruction and artifact correction. It will also summarize current clinical implementations of deep learning-based image reconstruction and noise reduction methods on CT scanners and describe how to appropriately evaluate these methods. Potential pitfalls of deep learning methods in CT image formation will be described. There are three lectures in this course:(1) Deep learning in CT reconstruction(2) Deep learning in CT artifact correction(3) Clinical implementation and evaluation

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#### T3-CPH09 Deep Learning in CT Artifacts Correction

##### Participants

Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

#### T3-CPH09 Deep Learning in CT Image Quality Assessment

##### Participants

Lifeng Yu, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

### Principles and Applications of 4D Flow MRI

#### Sub-Events

#### T3-CVA03 Moderator

##### Participants

Jordi Broncano, MD, Cordoba, Spain (*Moderator*) Nothing to Disclose

#### T3-CVA03 Moderator

##### Participants

Christopher Francois, MD, Rochester, MN (*Moderator*) Nothing to Disclose

#### T3-CVA03 4D Flow MRI: Technical Principles and Solutions

##### Participants

Michael Markl, PhD, Chicago, IL (*Presenter*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc

#### LEARNING OBJECTIVES

1) Explain strategies for acquiring 4D Flow MRI and addressing challenges in its acquisition. 2) Describe methods for implementing 4D Flow MRI into routine clinical cardiovascular MRI studies. 3) Identify indications for including 4D Flow MRI in assessment of aorta, abdominal vascular, and congenital heart diseases.\*Course Description In this course, attendees will learn how to acquire and analyzed 4D Flow MRI. This will include a summary of approaches to acquiring 4D Flow MRI and addressing technical challenges in performing 4D Flow MRI. Recommendations for integrating 4D Flow MRI into routine clinical workflows will be provided. The use of 4D Flow MRI in evaluating aortic, abdominal vascular, and congenital heart diseases will be highlighted.

#### COURSE DESCRIPTION

In this course, attendees will learn how to acquire and analyzed 4D Flow MRI. This will include a summary of approaches to acquiring 4D Flow MRI and addressing technical challenges in performing 4D Flow MRI. Recommendations for integrating 4D Flow MRI into routine clinical workflows will be provided. The use of 4D Flow MRI in evaluating aortic, abdominal vascular, and congenital heart diseases will be highlighted.

#### T3-CVA03 4D Flow MRI: Clinical Workflow and Implementation

##### Participants

Albert Hsiao, MD, PhD, (*Presenter*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

#### T3-CVA03 4D Flow MRI: Aortic and Abdominal Imaging Applications

##### Participants

Scott Reeder, MD, PhD, Madison, WI (*Presenter*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Celectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;

#### T3-CVA03 Congenital Heart Disease 4D flow MRI Applications

##### Participants

Melany Atkins, MD, Fairfax, VA (*Presenter*) Consultant, General Electric Company;Speaker, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

**Moderator**

### **Participants**

Jordi Broncano, MD, Cordoba, Spain (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

**Moderator**

### Participants

Christopher Francois, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

### 4D Flow MRI: Technical Principles and Solutions

#### Participants

Michael Markl, PhD, Chicago, IL (*Presenter*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc

#### LEARNING OBJECTIVES

1) Explain strategies for acquiring 4D Flow MRI and addressing challenges in its acquisition. 2) Describe methods for implementing 4D Flow MRI into routine clinical cardiovascular MRI studies. 3) Identify indications for including 4D Flow MRI in assessment of aorta, abdominal vascular, and congenital heart diseases.\*Course Description In this course, attendees will learn how to acquire and analyzed 4D Flow MRI. This will include a summary of approaches to acquiring 4D Flow MRI and addressing technical challenges in performing 4D Flow MRI. Recommendations for integrating 4D Flow MRI into routine clinical workflows will be provided. The use of 4D Flow MRI in evaluating aortic, abdominal vascular, and congenital heart diseases will be highlighted.

#### COURSE DESCRIPTION

In this course, attendees will learn how to acquire and analyzed 4D Flow MRI. This will include a summary of approaches to acquiring 4D Flow MRI and addressing technical challenges in performing 4D Flow MRI. Recommendations for integrating 4D Flow MRI into routine clinical workflows will be provided. The use of 4D Flow MRI in evaluating aortic, abdominal vascular, and congenital heart diseases will be highlighted.

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## Abstract Archives of the RSNA, 2023

T3-CVA03

### 4D Flow MRI: Clinical Workflow and Implementation

#### Participants

Albert Hsiao, MD, PhD, (*Presenter*) Co-founder, Arterys Inc; Shareholder, Arterys Inc; Co-founder, Vektor.AI; Shareholder, Vektor.AI; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, KA Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

### 4D Flow MRI: Aortic and Abdominal Imaging Applications

#### Participants

Scott Reeder, MD, PhD, Madison, WI (*Presenter*) Owner, Calimetrix; Owner, Reveal Pharmaceuticals; Owner, Celectar Biosciences, Inc; Owner, Elucent Medical; Owner, HeartVista, Inc;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-CVA03

### Congenital Heart Disease 4D flow MRI Applications

#### Participants

Melany Atkins, MD, Fairfax, VA (*Presenter*) Consultant, General Electric Company; *Speaker*, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-RCP01

### Is Colorblindness Doing More Harm Than Good in Combatting Racial Health Disparities

#### Participants

Jessica Wen, MD, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

### Teaching Future Radiologists: What's In It For Me?

#### Participants

Kara Gaetke-Udager, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

**MORE: Mentoring, Outreach, Resources for Equity**

### Participants

Anne Williams Darrow, MD, Evanston, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

### AI Needs to Know What It Doesn't Know

#### Participants

Cooper Gamble, BS, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

### X-rays on Mount Everest

#### Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

**Moderator**

### Participants

Angel Gomez-Cintron, MD, MPH, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP01

**Fast 5**

### Sub-Events

#### **T3-RCP01 Moderator**

Participants

Angel Gomez-Cintron, MD, MPH, (*Moderator*) Nothing to Disclose

#### **T3-RCP01 Teaching Future Radiologists: What's In It For Me?**

Participants

Kara Gaetke-Udager, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### **T3-RCP01 MORE: Mentoring, Outreach, Resources for Equity**

Participants

Anne Williams Darrow, MD, Evanston, IL (*Presenter*) Nothing to Disclose

#### **T3-RCP01 AI Needs to Know What It Doesn't Know**

Participants

Cooper Gamble, BS, Rochester, MN (*Presenter*) Nothing to Disclose

#### **T3-RCP01 X-rays on Mount Everest**

Participants

Saurabh Jha, MRCS, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### **T3-RCP01 Is Colorblindness Doing More Harm Than Good in Combatting Racial Health Disparities**

Participants

Jessica Wen, MD, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### Singapore Presents: Radiology in the Lion City - The Pursuit of Excellence Within 284 Square Miles

#### Sub-Events

##### **T3-RCP02 Moderator**

###### Participants

Swee T. Quek, MBBS, FRCR, Singapore, Singapore (*Moderator*) Nothing to Disclose

##### **T3-RCP02 Introduction to Singapore's Healthcare System**

###### Participants

Charles Goh, FRCR, MMed, Singapore, Singapore (*Presenter*) Nothing to Disclose

##### **T3-RCP02 Radiology Research Landscape in Singapore**

###### Participants

Ling Ling Chan, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

##### **T3-RCP02 Future Singapore Radiology Workforce- From Evolution to Revolution**

###### Participants

Lionel Cheng, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

##### **T3-RCP02 Current and Emerging Trends for Radiology in Singapore**

###### Participants

Cher Heng Tan, MBBS, FRCR, (*Presenter*) Nothing to Disclose

##### **T3-RCP02 IR Practice in the Far East: Status Quo and Future Directions**

###### Participants

Uei Pua, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain insight into the evolving Singapore healthcare structure and financing. 2) Understand the current and emerging trends in Singapore Radiology. 3) Appreciate how the future Singapore Radiology workforce may evolve. 4) Know key Radiology research interests and Interventional Radiology practices in the Singapore context.\*Course Description This course provides an overview of the Singapore healthcare system as a prelude to understanding how recent trends have impacted the practice of Radiology in our country, including the drive towards value-based imaging and shift towards population health in the face of an ageing population. The challenges placed on the Radiology workforce and how it may evolve in response to these demands are also discussed. Finally, we share highlights of Radiology research and future directions of Interventional Radiology practice in our country.

#### COURSE DESCRIPTION

This course provides an overview of the Singapore healthcare system as a prelude to understanding how recent trends have impacted the practice of Radiology in our country, including the drive towards value-based imaging and shift towards population health in the face of an ageing population. The challenges placed on the Radiology workforce and how it may evolve in response to these demands are also discussed. Finally, we share highlights of Radiology research and future directions of Interventional Radiology practice in our country.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-RCP02

**Moderator**

### Participants

Swee T. Quek, MBBS, FRCR, Singapore, Singapore (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### Introduction to Singapore's Healthcare System

#### Participants

Charles Goh, FRCR, MMed, Singapore, Singapore (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### Radiology Research Landscape in Singapore

#### Participants

Ling Ling Chan, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### Future Singapore Radiology Workforce- From Evolution to Revolution

#### Participants

Lionel Cheng, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### Current and Emerging Trends for Radiology in Singapore

#### Participants

Cher Heng Tan, MBBS, FRCR, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP02

### IR Practice in the Far East: Status Quo and Future Directions

#### Participants

Uei Pua, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain insight into the evolving Singapore healthcare structure and financing. 2) Understand the current and emerging trends in Singapore Radiology. 3) Appreciate how the future Singapore Radiology workforce may evolve. 4) Know key Radiology research interests and Interventional Radiology practices in the Singapore context.\*Course Description This course provides an overview of the Singapore healthcare system as a prelude to understanding how recent trends have impacted the practice of Radiology in our country, including the drive towards value-based imaging and shift towards population health in the face of an ageing population. The challenges placed on the Radiology workforce and how it may evolve in response to these demands are also discussed. Finally, we share highlights of Radiology research and future directions of Interventional Radiology practice in our country.

#### COURSE DESCRIPTION

This course provides an overview of the Singapore healthcare system as a prelude to understanding how recent trends have impacted the practice of Radiology in our country, including the drive towards value-based imaging and shift towards population health in the face of an ageing population. The challenges placed on the Radiology workforce and how it may evolve in response to these demands are also discussed. Finally, we share highlights of Radiology research and future directions of Interventional Radiology practice in our country.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP15

### Practical Tips on Publishing Radiology Research

#### Participants

Simon Lennartz, MD, Cologne, Germany (*Presenter*) Nothing to Disclose

Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP15

### Practical Tips on Publishing Cardiothoracic Imaging Research

#### Participants

Domenico Mastrodicasa, MD, Palo Alto, IL (*Presenter*) Stockholder, Segmed, Inc; Consultant, Segmed, Inc  
Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T3-RCP15

### Practical Tips on Publishing Cancer Imaging Research

#### Participants

Xiaoyang Liu, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

Domenico Mastrodicasa, MD, Palo Alto, IL (*Presenter*) Stockholder, Segmed, Inc; Consultant, Segmed, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP15

### Practical Tips on Publishing Artificial Intelligence Research

#### Participants

Xiaoyang Liu, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP15

### How To's of Publishing Your Research: Ask the Trainee Editors

#### LEARNING OBJECTIVES

1) Describe the the editorial training opportunities for residents, fellows, graduate students, and postdocs offered by the Radiology suite of journals. 2) Understand the manuscript submission and peer review process. 3) Identify resources to assist with research and publishing in imaging.\*Course Description This interactive panel discussion is intended familiarize radiology residents, fellows, graduate students, and postdocs on the process of journal publishing. The panel will be comprised of members of the trainee editorial boards of the RSNA suite of journals (Radiology, Radiology Imaging Cancer, Radiology Artificial Intelligence, Radiology Cardiothoracic) and moderated by the journal editors. Each panel member will present a brief introduction of their journal's trainee activities and how it contributes to career development. This will be followed by a Q&A discussion where questions from the audience will be encouraged. Sample questions from past sessions include "How do you select the right journal?" "How do you handle peer reviewer comments?" "Should I publish first in a preprint server?" "How do I become a peer reviewer for a journal?" Resources and platforms available to authors for writing, statistical analysis, graphics design, and reporting criteria will be discussed.

#### COURSE DESCRIPTION

This interactive panel discussion is intended familiarize radiology residents, fellows, graduate students, and postdocs on the process of journal publishing. The panel will be comprised of members of the trainee editorial boards of the RSNA suite of journals (Radiology, Radiology Imaging Cancer, Radiology Artificial Intelligence, Radiology Cardiothoracic) and moderated by the journal editors. Each panel member will present a brief introduction of their journal's trainee activities and how it contributes to career development. This will be followed by a Q&A discussion where questions from the audience will be encouraged. Sample questions from past sessions include "How do you select the right journal?" "How do you handle peer reviewer comments?" "Should I publish first in a preprint server?" "How do I become a peer reviewer for a journal?" Resources and platforms available to authors for writing, statistical analysis, graphics design, and reporting criteria will be discussed.

#### Sub-Events

##### T3-RCP15 Moderator

Participants

Gary Luker, MD, Ann Arbor, MI (*Moderator*) Institutional Research Grant, Polyphor, Ltd

##### T3-RCP15 Practical Tips on Publishing Cardiothoracic Imaging Research

Participants

Domenico Mastrodicasa, MD, Palo Alto, IL (*Presenter*) Stockholder, Segmed, Inc;Consultant, Segmed, Inc  
Susanna Lee, MD, PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

##### T3-RCP15 Practical Tips on Publishing Cancer Imaging Research

Participants

Xiaoyang Liu, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose  
Domenico Mastrodicasa, MD, Palo Alto, IL (*Presenter*) Stockholder, Segmed, Inc;Consultant, Segmed, Inc

##### T3-RCP15 Practical Tips on Publishing Artificial Intelligence Research

Participants

Xiaoyang Liu, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose  
Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS

##### T3-RCP15 Practical Tips on Publishing Radiology Research

Participants

Simon Lennartz, MD, Cologne, Germany (*Presenter*) Nothing to Disclose  
Iwan Paolucci, PhD, Houston, TX (*Presenter*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T3-RCP15

**Moderator**

### Participants

Gary Luker, MD, Ann Arbor, MI (*Moderator*) Institutional Research Grant, Polyphor, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CIN19

### Model Evaluation Best Practices

#### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CIN19

### Governance for Medical Imaging Deployment

#### Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc; Research Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CIN19

### Best Practices for Continuous AI Model Evaluation

#### Sub-Events

#### T4-CIN19 Moderator

##### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Moderator*) Advisor, Segmed, Inc; Shareholder, Segmed, Inc; Advisor, Bunkerhill Health; Shareholder, Bunkerhill Health; Employee, Microsoft Corporation

#### T4-CIN19 Post Deployment Monitoring

##### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Presenter*) Advisor, Segmed, Inc; Shareholder, Segmed, Inc; Advisor, Bunkerhill Health; Shareholder, Bunkerhill Health; Employee, Microsoft Corporation

#### LEARNING OBJECTIVES

1) Understand the necessity and significance of continuous AI model evaluation in the field of radiology. 2) Identify key performance indicators for AI model monitoring, and learn strategies for their ongoing tracking and evaluation. 3) Gain insights into best practices for validation, recalibration, and adjustment of AI models to ensure their robustness and relevance over time. 4) Recognize ethical considerations and regulatory guidelines related to the application of AI in radiology, contributing to the responsible use of these technologies. 5) Apply practical techniques for continuous AI model evaluation in their own clinical or research context, enhancing the effectiveness of AI implementation in radiology.\*Course Description With the surge in the application of Artificial Intelligence (AI) in radiology, maintaining the performance of these models becomes paramount. This course will focus on the strategies and techniques required to continuously evaluate and improve AI models in order to maintain their reliability, safety, and efficacy in radiological practice. Drawing from a wealth of expertise and research, attendees will learn the key principles of AI model lifecycle management, performance monitoring, validation, recalibration techniques, and the ethics and regulations surrounding AI in radiology. Attendees will leave the session equipped with practical knowledge and resources that they can apply to their own AI models and radiological practices. This session is perfect for radiologists, AI researchers, clinicians, data scientists, and healthcare professionals who are leveraging or planning to leverage AI in their work and want to ensure the optimum performance of their AI models over time. With a blend of theory and practice, the session will provide essential knowledge and tools to help you navigate the rapidly evolving landscape of AI in radiology.

#### COURSE DESCRIPTION

With the surge in the application of Artificial Intelligence (AI) in radiology, maintaining the performance of these models becomes paramount. This course will focus on the strategies and techniques required to continuously evaluate and improve AI models in order to maintain their reliability, safety, and efficacy in radiological practice. Drawing from a wealth of expertise and research, attendees will learn the key principles of AI model lifecycle management, performance monitoring, validation, recalibration techniques, and the ethics and regulations surrounding AI in radiology. Attendees will leave the session equipped with practical knowledge and resources that they can apply to their own AI models and radiological practices. This session is perfect for radiologists, AI researchers, clinicians, data scientists, and healthcare professionals who are leveraging or planning to leverage AI in their work and want to ensure the optimum performance of their AI models over time. With a blend of theory and practice, the session will provide essential knowledge and tools to help you navigate the rapidly evolving landscape of AI in radiology.

#### T4-CIN19 Model Evaluation Best Practices

##### Participants

Walter Wiggins, MD, PhD, Durham, NC (*Presenter*) Advisor, Qure.ai;

#### T4-CIN19 Governance for Medical Imaging Deployment

##### Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc; Research Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CIN19

### Moderator

#### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Moderator*) Advisor, Segmed, Inc;Shareholder, Segmed, Inc;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health;Employee, Microsoft Corporation

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T4-CIN19

### Post Deployment Monitoring

#### Participants

Matthew P. Lungren, MD, Palo Alto, CA (*Presenter*) Advisor, Segmed, Inc; Shareholder, Segmed, Inc; Advisor, Bunkerhill Health; Shareholder, Bunkerhill Health; Employee, Microsoft Corporation

#### LEARNING OBJECTIVES

1) Understand the necessity and significance of continuous AI model evaluation in the field of radiology. 2) Identify key performance indicators for AI model monitoring, and learn strategies for their ongoing tracking and evaluation. 3) Gain insights into best practices for validation, recalibration, and adjustment of AI models to ensure their robustness and relevance over time. 4) Recognize ethical considerations and regulatory guidelines related to the application of AI in radiology, contributing to the responsible use of these technologies. 5) Apply practical techniques for continuous AI model evaluation in their own clinical or research context, enhancing the effectiveness of AI implementation in radiology.\*Course Description With the surge in the application of Artificial Intelligence (AI) in radiology, maintaining the performance of these models becomes paramount. This course will focus on the strategies and techniques required to continuously evaluate and improve AI models in order to maintain their reliability, safety, and efficacy in radiological practice. Drawing from a wealth of expertise and research, attendees will learn the key principles of AI model lifecycle management, performance monitoring, validation, recalibration techniques, and the ethics and regulations surrounding AI in radiology. Attendees will leave the session equipped with practical knowledge and resources that they can apply to their own AI models and radiological practices. This session is perfect for radiologists, AI researchers, clinicians, data scientists, and healthcare professionals who are leveraging or planning to leverage AI in their work and want to ensure the optimum performance of their AI models over time. With a blend of theory and practice, the session will provide essential knowledge and tools to help you navigate the rapidly evolving landscape of AI in radiology.

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With the surge in the application of Artificial Intelligence (AI) in radiology, maintaining the performance of these models becomes paramount. This course will focus on the strategies and techniques required to continuously evaluate and improve AI models in order to maintain their reliability, safety, and efficacy in radiological practice. Drawing from a wealth of expertise and research, attendees will learn the key principles of AI model lifecycle management, performance monitoring, validation, recalibration techniques, and the ethics and regulations surrounding AI in radiology. Attendees will leave the session equipped with practical knowledge and resources that they can apply to their own AI models and radiological practices. This session is perfect for radiologists, AI researchers, clinicians, data scientists, and healthcare professionals who are leveraging or planning to leverage AI in their work and want to ensure the optimum performance of their AI models over time. With a blend of theory and practice, the session will provide essential knowledge and tools to help you navigate the rapidly evolving landscape of AI in radiology.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

### What Does Climate Change Have to do With Radiology? Impetus for Change and a Call to Action (Sponsored by the RSNA Professionalism Committee)

#### LEARNING OBJECTIVES

1) Discuss climate change and radiology. 2) Describe the impact of medical imaging on climate change and highlight opportunities for change. 3) Discuss research considerations with respect to studying the energy expenditure and other contributions to greenhouse gas emissions in radiology including the impact of interventions to mitigate emissions from our departments. 4) Evaluate actions that we can all take to address climate change outside of work in our personal lives including lighting, diet, and waste.\*Course Description The purpose of this course is to discuss the impact of radiology on climate change, impetus for change, and outline actionable steps we can take to address climate change in our personal and professional lives linked to the anticipated impact.

#### COURSE DESCRIPTION

The purpose of this course is to discuss the impact of radiology on climate change, impetus for change, and outline actionable steps we can take to address climate change in our personal and professional lives linked to the anticipated impact.

#### Sub-Events

##### T4-CNPM02 Moderator

Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### T4-CNPM02 Climate Change and Planetary Health

Participants

Reed Omary, MD, MS, (*Presenter*) Nothing to Disclose

##### T4-CNPM02 What Does Radiology Have to do With Climate Change?

Participants

Jonathan Gross, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### T4-CNPM02 How can Radiologists Address the Climate Crisis at in our Departments and Relationships with Vendors

Participants

Julia Schoen, MD, MS, Winston Salem, NC (*Presenter*) Stockholder, Merck & Co, Inc;Stockholder, Moderna, Inc;Stockholder, Aurinia Pharmaceuticals Inc;Speaker, Koninklijke Philips NV

##### T4-CNPM02 Research in Climate Change and Radiology

Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

##### T4-CNPM02 Actions and Opportunities to Address Climate Change Outside of Work

Participants

Maura Brown, MD, FRCPC, Vancouver, BC (*Presenter*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

**Moderator**

### Participants

Kate Hanneman, MD, MPH, (*Moderator*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

### Climate Change and Planetary Health

#### Participants

Reed Omary, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

### What Does Radiology Have to do With Climate Change?

#### Participants

Jonathan Gross, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

**How can Radiologists Address the Climate Crisis at in our Departments and Relationships with Vendors**

### Participants

Julia Schoen, MD, MS, Winston Salem, NC (*Presenter*) Stockholder, Merck & Co, Inc; Stockholder, Moderna, Inc; Stockholder, Aurinia Pharmaceuticals Inc; Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

### Research in Climate Change and Radiology

#### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CNPM02

### Actions and Opportunities to Address Climate Change Outside of Work

#### Participants

Maura Brown, MD, FRCPC, Vancouver, BC (*Presenter*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T4-CRT01

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CRT01

**ASRT@RSNA: Strategies to Reduce Retraumatization in Medical Imaging and Radiation Therapy**

### Participants

Kevin Clark, RT, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-CRT01

### ASRT@RSNA: Strategies to Reduce Retraumatization in Medical Imaging and Radiation Therapy

#### LEARNING OBJECTIVES

1) Recognize challenges when caring for trauma patients in imaging and therapy departments. 2) Identify potential triggers for retraumatization in medical imaging and radiation therapy. 3) Apply trauma-informed interventions in a sexual assault case study.\*Course Description Delivery of health care often involves assessment and interventions in locations on the patient's body where trauma has previously occurred, increasing the probability of retraumatization and manifestation of signs and symptoms of trauma. Considering professionals providing imaging studies and radiation therapy treatment for patients who may have a high probability of a history of trauma, specific interventions should be employed to reduce retraumatizing a patient. This lecture offers strategies to provide quality care to a patient who has been unintentionally retraumatized in medical imaging and radiation therapy.

#### COURSE DESCRIPTION

Delivery of health care often involves assessment and interventions in locations on the patient's body where trauma has previously occurred, increasing the probability of retraumatization and manifestation of signs and symptoms of trauma. Considering professionals providing imaging studies and radiation therapy treatment for patients who may have a high probability of a history of trauma, specific interventions should be employed to reduce retraumatizing a patient. This lecture offers strategies to provide quality care to a patient who has been unintentionally retraumatized in medical imaging and radiation therapy.

#### Sub-Events

##### T4-CRT01 Moderator

Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### T4-CRT01 ASRT@RSNA: Strategies to Reduce Retraumatization in Medical Imaging and Radiation Therapy

Participants

Kevin Clark, RT, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

**Building a Quantitative Imaging Research Study - How to Make it Work (Experiences, Best Practices and Opportunities based on NCI NCTN)**

### Participants

Michael V. Knopp, MD, PhD, Cincinnati, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

### Building a Quantitative Imaging Research Study (Sponsored by the RSNA Quantitative Imaging Biomarkers Alliance)

#### LEARNING OBJECTIVES

1) To understand what is needed to start an imaging research study. 2) To learn about imaging hypothesis generation. 3) To learn about basic statistical consideration for such a study. 4) To learn about imaging based measurements and its validation. 5) To understand how the above comes together with legal, ethical, clinical and other considerations to make an imaging study a reality.\*Course Description This course is intended to encourage you to start your own imaging research study. All necessary elements are discussed using a real life example. Experienced experts will share their insights. An interactive component is included in the workshop.

#### COURSE DESCRIPTION

This course is intended to encourage you to start your own imaging research study. All necessary elements are discussed using a real life example. Experienced experts will share their insights. An interactive component is included in the workshop.

#### Sub-Events

##### T4-RCP19 Moderator

Participants  
Gudrun Zahlmann, PhD, Neumarkt, Germany (*Moderator*) Nothing to Disclose

##### T4-RCP19 Building a Quantitative Imaging Research Study - Introduction

Participants  
Gudrun Zahlmann, PhD, Neumarkt, Germany (*Presenter*) Nothing to Disclose

##### T4-RCP19 Building a Quantitative Imaging Research Study - Real Life Study Description and Hypothesis Generation

Participants  
Laure Fournier, MD,PhD, Paris, France (*Presenter*) Nothing to Disclose

##### T4-RCP19 Building a Quantitative Imaging Research Study - Making the Measurement

Participants  
Angel Alberich-Bayarri, PhD, Valencia, Spain (*Presenter*) Co-founder, Quibim SL;CEO, Quibim SL

##### T4-RCP19 Building a Quantitative Imaging Research Study - Statistical Considerations

Participants  
Nancy Obuchowski, PhD, MS, Cleveland, OH (*Presenter*) Research Consultant, Siemens AG;Research Consultant, IBM Corporation;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Takeda Pharmaceutical Company Limited

##### T4-RCP19 Building a Quantitative Imaging Research Study - How to Make it Work (Experiences, Best Practices and Opportunities based on NCI NCTN)

Participants  
Michael V. Knopp, MD, PhD, Cincinnati, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

**Moderator**

### Participants

Gudrun Zahlmann, PhD, Neumarkt, Germany (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

### Building a Quantitative Imaging Research Study - Introduction

#### Participants

Gudrun Zahlmann, PhD, Neumarkt, Germany (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

**Building a Quantitative Imaging Research Study - Real Life Study Description and Hypothesis Generation**

### Participants

Laure Fournier, MD,PhD, Paris, France (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T4-RCP19

### Building a Quantitative Imaging Research Study - Making the Measurement

#### Participants

Angel Alberich-Bayarri, PhD, Valencia, Spain (*Presenter*) Co-founder, Quibim SL; CEO, Quibim SL

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-RCP19

### Building a Quantitative Imaging Research Study - Statistical Considerations

#### Participants

Nancy Obuchowski, PhD, MS, Cleveland, OH (*Presenter*) Research Consultant, Siemens AG; Research Consultant, IBM Corporation; Research Consultant, Elucid Bioimaging Inc; Research Consultant, Takeda Pharmaceutical Company Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CBR07

### New Techniques in Breast MRI

#### Sub-Events

##### T6-CBR07 Moderator

###### Participants

Christiane Kuhl, PhD, Bonn, Germany (*Moderator*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG

##### T6-CBR07 Breast MRI: Role of Abbreviated MRI

###### Participants

Christiane Kuhl, PhD, Bonn, Germany (*Presenter*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG

#### LEARNING OBJECTIVES

1) Explain the theoretical background of abbreviated breast MRI. 2) Identify strategies to translate abbreviated breast MRI into a busy clinical practice. 3) List the different technical approaches to abbreviated breast MRI.\*Course Description This course will review the current evidence on the use of new breast MRI techniques with a focus on abbreviated breast MRI and its different subtypes.

#### COURSE DESCRIPTION

This course will review the current evidence on the use of new breast MRI techniques with a focus on abbreviated breast MRI and its different subtypes.

##### T6-CBR07 Breast MRI: Ultrafast MRI

###### Participants

Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV

##### T6-CBR07 Breast MRI: Role of Multiparametric MRI

###### Participants

Pascal A. Baltzer, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CBR07

### Breast MRI: Role of Abbreviated MRI

#### Participants

Christiane Kuhl, PhD, Bonn, Germany (*Presenter*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG

#### LEARNING OBJECTIVES

1) Explain the theoretical background of abbreviated breast MRI. 2) Identify strategies to translate abbreviated breast MRI into a busy clinical practice. 3) List the different technical approaches to abbreviated breast MRI.\*Course Description This course will review the current evidence on the use of new breast MRI techniques with a focus on abbreviated breast MRI and its different subtypes.

#### COURSE DESCRIPTION

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CBR07

### Breast MRI: Ultrafast MRI

#### Participants

Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CBR07

### Breast MRI: Role of Multiparametric MRI

#### Participants

Pascal A. Baltzer, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CBR07

**Moderator**

### **Participants**

Christiane Kuhl, PhD, Bonn, Germany (*Moderator*) Advisory Board, Guerbet SA; Speaker, Bracco Group; Speaker, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CCA04

**Moderator**

### Participants

Carole Dennie, MD, FRCPC, Ottawa, ON (*Moderator*) Research Consultant, AstraZeneca PLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CCA04

### Toolbelt of Cardiac Devices: X-ray and CT Appearance

#### Participants

Byoung Wook Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify and describe the X-ray and CT appearances of different cardiac devices used in heart failure patients. 2) Recognize and overcome technical challenges in CT imaging of severe heart failure to optimize image quality and diagnostic accuracy. 3) Understand the imaging considerations, protocols, and potential complications associated with left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD).\*Course Description This educational session is a comprehensive exploration of cardiac devices and their imaging appearances in heart failure patients. The session consists of three lectures that cover essential aspects of cardiac device imaging, including X-ray and CT appearances, technical challenges in CT imaging of severe heart failure, and imaging of left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD). The session aims to enhance participants' knowledge and proficiency in imaging heart failure patients with various cardiac devices, ultimately improving patient care and diagnostic accuracy.

#### COURSE DESCRIPTION

This educational session is a comprehensive exploration of cardiac devices and their imaging appearances in heart failure patients. The session consists of three lectures that cover essential aspects of cardiac device imaging, including X-ray and CT appearances, technical challenges in CT imaging of severe heart failure, and imaging of left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD). The session aims to enhance participants' knowledge and proficiency in imaging heart failure patients with various cardiac devices, ultimately improving patient care and diagnostic accuracy.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CCA04

### Technical Challenges in CT: Imaging Severe Heart Failure

#### Participants

Carole Dennie, MD, FRCPC, Ottawa, ON (*Presenter*) Research Consultant, AstraZeneca PLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CCA04

### Who Needs Assistance? Imaging of LVAD RVAD

#### Participants

Daniel Vargas, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CCA04

### What Cardiac Device is That? Interactive Session On Imaging Heart Failure Patients

#### Sub-Events

#### T6-CCA04 Moderator

##### Participants

Byoung Wook Choi, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

#### T6-CCA04 Moderator

##### Participants

Carole Dennie, MD, FRCPC, Ottawa, ON (*Moderator*) Research Consultant, AstraZeneca PLC

#### T6-CCA04 Toolbelt of Cardiac Devices: X-ray and CT Appearance

##### Participants

Byoung Wook Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify and describe the X-ray and CT appearances of different cardiac devices used in heart failure patients. 2) Recognize and overcome technical challenges in CT imaging of severe heart failure to optimize image quality and diagnostic accuracy. 3) Understand the imaging considerations, protocols, and potential complications associated with left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD).\*Course Description This educational session is a comprehensive exploration of cardiac devices and their imaging appearances in heart failure patients. The session consists of three lectures that cover essential aspects of cardiac device imaging, including X-ray and CT appearances, technical challenges in CT imaging of severe heart failure, and imaging of left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD). The session aims to enhance participants' knowledge and proficiency in imaging heart failure patients with various cardiac devices, ultimately improving patient care and diagnostic accuracy.

#### COURSE DESCRIPTION

This educational session is a comprehensive exploration of cardiac devices and their imaging appearances in heart failure patients. The session consists of three lectures that cover essential aspects of cardiac device imaging, including X-ray and CT appearances, technical challenges in CT imaging of severe heart failure, and imaging of left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD). The session aims to enhance participants' knowledge and proficiency in imaging heart failure patients with various cardiac devices, ultimately improving patient care and diagnostic accuracy.

#### T6-CCA04 Technical Challenges in CT: Imaging Severe Heart Failure

##### Participants

Carole Dennie, MD, FRCPC, Ottawa, ON (*Presenter*) Research Consultant, AstraZeneca PLC

#### T6-CCA04 Who Needs Assistance? Imaging of LVAD RVAD

##### Participants

Daniel Vargas, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CCA04

**Moderator**

### Participants

Byoung Wook Choi, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CER10

**Moderator**

### Participants

Melissa Davis, MD, MBA, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CER10

**Human to AI, and Back**

### Participants

Anjali Agrawal, MD, Delhi, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CER10

### The Expanding Role of AI in the Emergency and Trauma Department

#### Participants

Sabeena Jalal, MSc, Vancouver, BC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CER10

### New Tools and Developments for the Emergent Radiologist

#### Participants

David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CER10

### Role of AI in Emergency Radiology-What you need to know in 2023

#### LEARNING OBJECTIVES

1) Understand the impact of AI tools within emergent radiology. 2) Gain insight on new tools within the emergent radiology space. \*Course Description AI tools have become increasingly common within the emergency radiology space. In this session we will discuss the impact of those tools including how they may and/or may not be useful, how they are expanding throughout our departments and new tools on the horizon.

#### COURSE DESCRIPTION

AI tools have become increasingly common within the emergency radiology space. In this session we will discuss the impact of those tools including how they may and/or may not be useful, how they are expanding throughout our departments and new tools on the horizon.

#### Sub-Events

##### **T6-CER10 Moderator**

Participants  
Melissa Davis, MD, MBA, Atlanta, GA (*Moderator*) Nothing to Disclose

##### **T6-CER10 Human to AI, and Back**

Participants  
Anjali Agrawal, MD, Delhi, India (*Presenter*) Nothing to Disclose

##### **T6-CER10 The Expanding Role of AI in the Emergency and Trauma Department**

Participants  
Sabeena Jalal, MSc, Vancouver, BC (*Presenter*) Nothing to Disclose

##### **T6-CER10 New Tools and Developments for the Emergent Radiologist**

Participants  
David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

### Focused/Fast Abdomino-Pelvic MRI Protocols

#### LEARNING OBJECTIVES

1) Explain developments in artificial intelligence that enable fast acquisitions and opportunities to maximize efficiency in the reporting of abbreviated MRI exams. 2) Understand opportunities and challenges of implementing abbreviated and fast MRI techniques in clinical practice. 3) Identify the clinical, financial, and medico-legal implications of abbreviated MRI exams.\*Course Description Indications for fast/focused MRI in abdomino-pelvic conditions continue to increase. We review challenges and opportunities to maximize the efficiency in the implementation of such protocols in a busy clinical practice.

#### COURSE DESCRIPTION

Indications for fast/focused MRI in abdomino-pelvic conditions continue to increase. We review challenges and opportunities to maximize the efficiency in the implementation of such protocols in a busy clinical practice.

#### Sub-Events

##### **T6-CGI05 Moderator**

#### Participants

Hersh Chandarana, MD, MBA, Scarsdale, NY (*Moderator*) Institutional research agreement, Siemens AG; Equipment support, Siemens AG; Software support, Siemens AG

##### **T6-CGI05 Artificial Intelligence to Empower Focused/Fast Abdomino Pelvis MRI**

#### Participants

Hersh Chandarana, MD, MBA, Scarsdale, NY (*Presenter*) Institutional research agreement, Siemens AG; Equipment support, Siemens AG; Software support, Siemens AG

##### **T6-CGI05 Clinical Opportunities for Abbreviated MRI Low vs High Risk Patients**

#### Participants

Pari V. Pandharipande, MD, MPH, Bexley, OH (*Presenter*) I serve as a member of the Association of University Radiologists (AUR) General Electric (GE) Radiology Research Academic Fellowship (GERRAF) Board of Review (term: 7/1/22-2/28/23).

##### **T6-CGI05 From Image Acquisition to Report: How to Maximize Efficiency with Focused/Fast MRI Protocols**

#### Participants

Ivan Pedrosa, MD, PhD, Dallas, TX (*Presenter*) Scientific Advisor, Health Tech International; Scientific Advisor, Merck & Co, Inc

##### **T6-CGI05 Financial and Medicolegal Implications of Focused/Fast Abdominopelvic MRI Exams**

#### Participants

Jonathan Mezrich, MD, JD, Guilford, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

**Moderator**

### **Participants**

Hersh Chandarana, MD, MBA, Scarsdale, NY (*Moderator*) Institutional research agreement, Siemens AG; Equipment support, Siemens AG; Software support, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

### Artificial Intelligence to Empower Focused/Fast Abdomino Pelvis MRI

#### Participants

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

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### Participants

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CGI05

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#### Participants

Jonathan Mezrich, MD, JD, Guilford, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CIN24

**Moderator**

### Participants

Hanna M. Zafar, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIN24

### Intents and Technical Requirements of Dashboards

#### Participants

Keith D. Hentel, MD, MS, Briarcliff, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIN24

### Financial Dashboards

#### Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Pamela T. Johnson, MD, Baltimore, MD (*Presenter*) Institutional license agreement, AgileMD, Inc; Royalties, AgileMD, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIN24

### Data Science Monitoring Dashboards

#### Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Christina Geatrakas, MD, East Falmouth, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIN24

### State of the Art Analytics and Dashboarding: Quality, Finance, and AI

#### LEARNING OBJECTIVES

1) Discuss the key metrics to follow on value-based care, quality, financial, and AI analytics and dashboards. 2) Learn how to integrate analytics and dashboards into retrospective process improvement and prospective daily and strategic planning.\*Course Description The session will include 30 minutes of traditional didactics and 30 minutes of Ask the Experts case-based discussion. Lectures will include best practices for creation, metrics to follow, and methods of dashboard utilization.

#### COURSE DESCRIPTION

The session will include 30 minutes of traditional didactics and 30 minutes of Ask the Experts case-based discussion. Lectures will include best practices for creation, metrics to follow, and methods of dashboard utilization.

#### Sub-Events

##### **T6-CIN24 Moderator**

Participants

Hanna M. Zafar, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

##### **T6-CIN24 Intents and Technical Requirements of Dashboards**

Participants

Keith D. Hentel, MD, MS, Briarcliff, NY (*Presenter*) Nothing to Disclose

##### **T6-CIN24 Financial Dashboards**

Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Pamela T. Johnson, MD, Baltimore, MD (*Presenter*) Institutional license agreement, AgileMD, Inc; Royalties, AgileMD, Inc

##### **T6-CIN24 Data Science Monitoring Dashboards**

Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Christina Geatrakas, MD, East Falmouth, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIR07

### What IRs Need to Know about Medical Management of Portal Hypertension

#### Participants

Anjana Pillai, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIR07

**Moderator**

### Participants

Juan Camacho, MD, Sarasota, FL (*Moderator*) Research Grant, Elesta Echolaser

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIR07

### Management of Portal Hypertension

#### LEARNING OBJECTIVES

1) Review the medical management of portal hypertension. 2) Understand the pathophysiology of portal hypertension. 3) Discuss recent advancement in imaging of portal hypertension. 4) Discuss the role of interventional radiology in portal hypertension, from TIPSS creation to portosystemic collaterals embolization with especial attention to complications that IRs can encounter during specific therapies.\*Course Description In the last few decades, there have been significant advancements in understanding the pathophysiology of portal hypertension. This knowledge has led to the development of safer and more effective minimally invasive approaches. The main objective is to provide alternatives to prevent life-threatening complications from clinically significant portal hypertension and to allow the continuation of treatments that would otherwise be stopped. Clinicians involved in portal hypertension care should be aware of risk factors, associated complications, and management of portal hypertension. Interventional radiology offers minimally invasive alternatives that play a central role in improving clinical outcomes and survival of these patients.

#### COURSE DESCRIPTION

In the last few decades, there have been significant advancements in understanding the pathophysiology of portal hypertension. This knowledge has led to the development of safer and more effective minimally invasive approaches. The main objective is to provide alternatives to prevent life-threatening complications from clinically significant portal hypertension and to allow the continuation of treatments that would otherwise be stopped. Clinicians involved in portal hypertension care should be aware of risk factors, associated complications, and management of portal hypertension. Interventional radiology offers minimally invasive alternatives that play a central role in improving clinical outcomes and survival of these patients.

#### Sub-Events

##### **T6-CIR07 Moderator**

###### Participants

Juan Camacho, MD, Sarasota, FL (*Moderator*) Research Grant, Elesta Echolaser

##### **T6-CIR07 Advances in TIPSS/DIPSS Creation: IVUS, Trans Splenic Approach and PVR Recanalization**

###### Participants

Juan Camacho, MD, Sarasota, FL (*Presenter*) Research Grant, Elesta Echolaser

##### **T6-CIR07 Management of Ascites and Pleural Effusion in the Setting of Portal Hypertension**

###### Participants

David C. Madoff, MD, New Haven, CT (*Presenter*) Advisory Board, Zimmer Biomet Holdings, Inc;Consultant, General Electric Company;Consultant, Guerbet SA;Consultant, Merck & Co, Inc;Consultant, Sirtex Medical Ltd;Consultant, Boston Scientific Corporation;Consultant, Johnson & Johnson;Consultant, Siemens AG

##### **T6-CIR07 Portosystemic Shunt Embolization: When and How to do it**

###### Participants

Jens Rieke, MD, PhD, Munich, Germany (*Presenter*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation

##### **T6-CIR07 Complications during Portal Hypertension Interventions: What to Avoid and How to Save Yourself**

###### Participants

Bartley Thornburg, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### **T6-CIR07 Advances in Non Invasive Imaging of Portal Hypertension**

###### Participants

Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company

##### **T6-CIR07 What IRs Need to Know about Medical Management of Portal Hypertension**

###### Participants

Anjana Pillai, Chicago, IL (*Presenter*) Nothing to Disclose



## Abstract Archives of the RSNA, 2023

T6-CIR07

**Advances in TIPSS/DIPSS Creation: IVUS, Trans Splenic Approach and PVR Recanalization**

### Participants

Juan Camacho, MD, Sarasota, FL (*Presenter*) Research Grant, Elesta Echolaser

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIR07

### Management of Ascites and Pleural Effusion in the Setting of Portal Hypertension

#### Participants

David C. Madoff, MD, New Haven, CT (*Presenter*) Advisory Board, Zimmer Biomet Holdings, Inc; Consultant, General Electric Company; Consultant, Guerbet SA; Consultant, Merck & Co, Inc; Consultant, Sirtex Medical Ltd; Consultant, Boston Scientific Corporation; Consultant, Johnson & Johnson; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CIR07

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## Abstract Archives of the RSNA, 2023

T6-CIR07

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Printed on: 04/12/24

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T6-CIR07

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Kathryn Fowler, MD, San Diego, CA (*Presenter*) Consultant, Bayer AG; Research support, General Electric Company; Research Grant, Pfizer Inc; Institutional Grant, MEDIAN Technologies; Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

### Hands on Demo

#### Participants

Mark Cresswell, MBBCh, BSc, Vancouver, BC (*Presenter*) Consultant, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

**Moderator**

### Participants

Rob Campbell, MBChB, FRCR, Liverpool, United Kingdom (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

**PPT**

### Participants

Linda Probyn, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CMK10

### Hands on Demo

#### Participants

Viviane Khoury, BSc, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

### Hands on Demo

#### Participants

Jon Jacobson, MD, Ann Arbor, MI (*Presenter*) Research Consultant, BioClinica, Inc; Advisory Board, Koninklijke Philips NV; Royalties, RELX; Contactor, POCUS PRO

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

**PPT**

### Participants

Marnix Van Holsbeeck, MD, Northville, MI (*Presenter*) Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder, MedEd3D

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

**PPT**

### Participants

Etienne Cardinal, MD, BSc, Montreal, QC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CMK10

### Musculoskeletal Ultrasound: Normal Appearances, Pathologic Conditions and Hands-on Demo (Elbow, Ankle, Peripheral Nerves of the Upper Extremity)

#### LEARNING OBJECTIVES

1) Learn the relevant US anatomy for each of the 3 body areas. 2) Gain knowledge of techniques to optimally visualise the relevant anatomical structures. 3) Apply that knowledge to be able to perform US examination of clinical cases. 4) Understand the limitations of US and when to consider alternative image modalities.\*Course Description The 90-minute Ultrasound module will include the following topics: - The elbow- The ankle - Peripheral nerves of the upper limbEach 30-minute section will comprise a "live demonstration" of normal US anatomy followed by a case-based presentation of pathological cases discussing the utility of MSK Ultrasound in clinical practice. This session will provide a basis on which to develop your skills in MSK US.

#### COURSE DESCRIPTION

The 90-minute Ultrasound module will include the following topics: - The elbow- The ankle - Peripheral nerves of the upper limbEach 30-minute section will comprise a "live demonstration" of normal US anatomy followed by a case-based presentation of pathological cases discussing the utility of MSK Ultrasound in clinical practice. This session will provide a basis on which to develop your skills in MSK US.

#### Sub-Events

##### T6-CMK10 Moderator

Participants

Rob Campbell, MBChB, FRCR, Liverpool, United Kingdom (*Moderator*) Nothing to Disclose

##### T6-CMK10 PPT

Participants

Linda Probyn, MD, (*Presenter*) Nothing to Disclose

##### T6-CMK10 Hands on Demo

Participants

Viviane Khoury, BSc, MD, (*Presenter*) Nothing to Disclose

##### T6-CMK10 Hands on Demo

Participants

Jon Jacobson, MD, Ann Arbor, MI (*Presenter*) Research Consultant, BioClinica, Inc; Advisory Board, Koninklijke Philips NV; Royalties, RELX; Contactor, POCUS PRO

##### T6-CMK10 PPT

Participants

Mamix Van Holsbeeck, MD, Northville, MI (*Presenter*) Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder, MedEd3D

##### T6-CMK10 PPT

Participants

Etienne Cardinal, MD, BSc, Montreal, QC (*Presenter*) Nothing to Disclose

##### T6-CMK10 Hands on Demo

Participants

Mark Cresswell, MBChB, BSc, Vancouver, BC (*Presenter*) Consultant, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNMMI11

**Moderator**

### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Moderator*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNMMI11

### PSMA PET: Pearls and Pitfalls

#### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG; Speaker, Lantheus Holdings; Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Lantheus Holdings; Research support, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNMMI11

### PSMA PET: Tips from the SNMMI Reader Training

#### Participants

Steven Rowe, MD, PhD, Baldwin, MD (*Presenter*) Consultant, Lantheus Holdings; Research support, Lantheus Holdings; Stockholder, D&D Pharmatech; Consultant, D&D Pharmatech; Research support, D&D Pharmatech; Stockholder, PlenaryAI, Inc; Research support, PlenaryAI, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CNMMI11

### Case-based Review of PET/CT: Genitourinary Cancers

#### LEARNING OBJECTIVES

1) Understand the limitations urinary excretion of PET tracers can cause for interpretation of images around the kidneys, ureters, and bladder. 2) Understand best clinical practices for use of PSMA-targeted PET/CT for patients with prostate cancer.\*Course Description Novel PET/CT agents are revolutionizing the imaging and therapy of patients with prostate cancer. In this session, experts on 18F-fluciclovine (Axumin) and PSMA-targeted PET/CT will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

#### COURSE DESCRIPTION

Novel PET/CT agents are revolutionizing the imaging and therapy of patients with prostate cancer. In this session, experts on 18F-fluciclovine (Axumin) and PSMA-targeted PET/CT will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of these studies.

#### Sub-Events

##### T6-CNMMI11 Moderator

###### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Moderator*) Speaker, Siemens AG;Speaker,Lantheus Holdings;Research support, General Electric Company;Research support, F. Hoffmann-La Roche Ltd;Research support, Lantheus Holdings;Research support, Novartis AG

##### T6-CNMMI11 PSMA PET: Pearls and Pitfalls

###### Participants

Gary Ulaner, MD, PhD, Irvine, CA (*Presenter*) Speaker, Siemens AG;Speaker,Lantheus Holdings;Research support, General Electric Company;Research support, F. Hoffmann-La Roche Ltd;Research support, Lantheus Holdings;Research support, Novartis AG

##### T6-CNMMI11 PSMA PET: Tips from the SNMMI Reader Training

###### Participants

Steven Rowe, MD, PhD, Baldwin, MD (*Presenter*) Consultant, Lantheus Holdings;Research support, Lantheus Holdings;Stockholder, D&D Pharmatech;Consultant, D&D Pharmatech;Research support, D&D Pharmatech;Stockholder, PlenaryAI, Inc;Research support, PlenaryAI, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNPM16

**Moderator**

### Participants

Stephen D. Brown, MD, Boston, MA (*Moderator*) Stockholder, GSK plc ;Stockholder, Johnson & Johnson;Stockholder, AbbVie Inc;Stockholder, Merck & Co, Inc;Stockholder, CVS Health Corporation;Stockholder, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNPM16

### Error Disclosure: Legal Perspective

#### Participants

Kelly Yousem, JD, Owings Mills, MD (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify systems processes that facilitate open communication with patients and families about medical errors. 2) Understand practical legal perspectives regarding open communication with patients and families about medical errors. 3) Describe executive level considerations regarding the implementation of coordinated enterprise-wide open communication practices around medical errors.\*Course Description This course will explore several timely issues relevant to communication with patients and families about adverse events and errors. 1) Process Considerations: Responsibly discussing medical errors with patients and families requires the implementation of principled, coordinated, enterprise-wide processes that support both patients and providers. This presentation, by a pediatric radiologist with extensive experience speaking on ethics, communication, professionalism, and error disclosure, will discuss systems processes that facilitate open communication with patients and families about medical errors. 3) Legal Perspective: Lofty ideals about "doing the right thing" in communicating honestly and transparently with patients and families about preventable adverse events feel unattainable to many physicians fearful of the legal consequences. This presentation, by an attorney with extensive malpractice expertise, will offer perspectives about the practical realities involved and consequences for physicians when considering whether and how to bring open communication about errors to patients and families. 3) Executive Perspective: Establishing institutional expectations regarding direct, transparent communication with patients and families about medical errors requires top-down leadership articulation of priorities, principles, and culture, coupled with integration of a complex web of stakeholders including insurers and risk managers, offices of legal counsel, quality and safety leaders, patient and personnel support systems, and front-line staff. The speaker, a senior academic radiologist and healthcare system executive, will present perspectives and experiences regarding management of disclosure processes at the broad enterprise level.

#### COURSE DESCRIPTION

This course will explore several timely issues relevant to communication with patients and families about adverse events and errors. 1) Process Considerations: Responsibly discussing medical errors with patients and families requires the implementation of principled, coordinated, enterprise-wide processes that support both patients and providers. This presentation, by a pediatric radiologist with extensive experience speaking on ethics, communication, professionalism, and error disclosure, will discuss systems processes that facilitate open communication with patients and families about medical errors. 3) Legal Perspective: Lofty ideals about "doing the right thing" in communicating honestly and transparently with patients and families about preventable adverse events feel unattainable to many physicians fearful of the legal consequences. This presentation, by an attorney with extensive malpractice expertise, will offer perspectives about the practical realities involved and consequences for physicians when considering whether and how to bring open communication about errors to patients and families. 3) Executive Perspective: Establishing institutional expectations regarding direct, transparent communication with patients and families about medical errors requires top-down leadership articulation of priorities, principles, and culture, coupled with integration of a complex web of stakeholders including insurers and risk managers, offices of legal counsel, quality and safety leaders, patient and personnel support systems, and front-line staff. The speaker, a senior academic radiologist and healthcare system executive, will present perspectives and experiences regarding management of disclosure processes at the broad enterprise level.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNPM16

### Error Disclosure: Process Considerations

#### Participants

Stephen D. Brown, MD, Boston, MA (*Presenter*) Stockholder, GSK plc ;Stockholder, Johnson & Johnson;Stockholder, AbbVie Inc;Stockholder, Merck & Co, Inc;Stockholder, CVS Health Corporation;Stockholder, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNPM16

### Medicolegal Updates: What Radiologists Should Know About Error Disclosure

#### Sub-Events

#### T6-CNPM16 Moderator

##### Participants

Stephen D. Brown, MD, Boston, MA (*Moderator*) Stockholder, GSK plc ;Stockholder, Johnson & Johnson;Stockholder, AbbVie Inc;Stockholder, Merck & Co, Inc;Stockholder, CVS Health Corporation;Stockholder, Pfizer Inc

#### T6-CNPM16 Error Disclosure: Legal Perspective

##### Participants

Kelly Yousem, JD, Owings Mills, MD (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify systems processes that facilitate open communication with patients and families about medical errors. 2) Understand practical legal perspectives regarding open communication with patients and families about medical errors. 3) Describe executive level considerations regarding the implementation of coordinated enterprise-wide open communication practices around medical errors.\*Course Description This course will explore several timely issues relevant to communication with patients and families about adverse events and errors. 1) Process Considerations: Responsibly discussing medical errors with patients and families requires the implementation of principled, coordinated, enterprise-wide processes that support both patients and providers. This presentation, by a pediatric radiologist with extensive experience speaking on ethics, communication, professionalism, and error disclosure, will discuss systems processes that facilitate open communication with patients and families about medical errors. 3) Legal Perspective: Lofty ideals about "doing the right thing" in communicating honestly and transparently with patients and families about preventable adverse events feel unattainable to many physicians fearful of the legal consequences. This presentation, by an attorney with extensive malpractice expertise, will offer perspectives about the practical realities involved and consequences for physicians when considering whether and how to bring open communication about errors to patients and families. 3) Executive Perspective: Establishing institutional expectations regarding direct, transparent communication with patients and families about medical errors requires top-down leadership articulation of priorities, principles, and culture, coupled with integration of a complex web of stakeholders including insurers and risk managers, offices of legal counsel, quality and safety leaders, patient and personnel support systems, and front-line staff. The speaker, a senior academic radiologist and healthcare system executive, will present perspectives and experiences regarding management of disclosure processes at the broad enterprise level.

#### COURSE DESCRIPTION

This course will explore several timely issues relevant to communication with patients and families about adverse events and errors. 1) Process Considerations: Responsibly discussing medical errors with patients and families requires the implementation of principled, coordinated, enterprise-wide processes that support both patients and providers. This presentation, by a pediatric radiologist with extensive experience speaking on ethics, communication, professionalism, and error disclosure, will discuss systems processes that facilitate open communication with patients and families about medical errors. 3) Legal Perspective: Lofty ideals about "doing the right thing" in communicating honestly and transparently with patients and families about preventable adverse events feel unattainable to many physicians fearful of the legal consequences. This presentation, by an attorney with extensive malpractice expertise, will offer perspectives about the practical realities involved and consequences for physicians when considering whether and how to bring open communication about errors to patients and families. 3) Executive Perspective: Establishing institutional expectations regarding direct, transparent communication with patients and families about medical errors requires top-down leadership articulation of priorities, principles, and culture, coupled with integration of a complex web of stakeholders including insurers and risk managers, offices of legal counsel, quality and safety leaders, patient and personnel support systems, and front-line staff. The speaker, a senior academic radiologist and healthcare system executive, will present perspectives and experiences regarding management of disclosure processes at the broad enterprise level.

#### T6-CNPM16 Error Disclosure: Process Considerations

##### Participants

Stephen D. Brown, MD, Boston, MA (*Presenter*) Stockholder, GSK plc ;Stockholder, Johnson & Johnson;Stockholder, AbbVie Inc;Stockholder, Merck & Co, Inc;Stockholder, CVS Health Corporation;Stockholder, Pfizer Inc

#### T6-CNPM16 Error Disclosure: Executive Perspective

##### Participants

Jonathan S. Lewin, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

## Abstract Archives of the RSNA, 2023

T6-CNPM16

### Error Disclosure: Executive Perspective

#### Participants

Jonathan S. Lewin, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNR09

### The Future of Radiomics in Neuroimaging

#### Participants

Reza Forghani, MD, PhD, Newberry, FL (*Presenter*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Intel Corporation; Research Grant, Toronto-Dominion Bank; Research Grant, McGill University Health Centre Foundation; President, Montreal Imaging Experts Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNR09

### The Pediatric Brain Meets AI

#### Participants

Susan Sotardi, MD, MEng, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CNR09

### Machine Learning Applications in Spine Imaging

#### Participants

Nathan M. Cross, MD, MS, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNR09

**Moderator**

### Participants

Yvonne Lui, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNR09

### Advances in Deep Learning Approaches in Brain MRI Reconstruction

#### Participants

Yvonne Lui, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CNR09

### AI - Applications of Neuroradiology

#### LEARNING OBJECTIVES

1. Understand the breadth of neuroimaging applications being addressed by machine learning approaches including less-talked about applications in spine imaging and pediatric neuroradiology. 2. Know the current state-of-the-art in terms of machine learning in MR image reconstruction. 3. Have a basic, working knowledge of the use of machine learning in radiomics for brain tumors. \*Course Description What's the buzz? Get yourself up-to-date on deep learning and Neuroradiology! This course will cover cutting-edge advances in neuroimaging applications of machine learning from image reconstruction to radiogenomics to practical clinical advances including in pediatric populations. The course will cover state-of-the-art techniques and approaches in an accessible way and give you an easily digestible update overview on the topic. This course will equip you with relevant information to engage with colleagues, referring physicians, scientists, and vendors on this topic.

#### COURSE DESCRIPTION

What's the buzz? Get yourself up-to-date on deep learning and Neuroradiology! This course will cover cutting-edge advances in neuroimaging applications of machine learning from image reconstruction to radiogenomics to practical clinical advances including in pediatric populations. The course will cover state-of-the-art techniques and approaches in an accessible way and give you an easily digestible update overview on the topic. This course will equip you with relevant information to engage with colleagues, referring physicians, scientists, and vendors on this topic.

#### Sub-Events

##### T6-CNR09 Moderator

Participants  
Yvonne Lui, MD, New York, NY (*Moderator*) Nothing to Disclose

##### T6-CNR09 Advances in Deep Learning Approaches in Brain MRI Reconstruction

Participants  
Yvonne Lui, MD, New York, NY (*Presenter*) Nothing to Disclose

##### T6-CNR09 The Pediatric Brain Meets AI

Participants  
Susan Sotardi, MD, MEng, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### T6-CNR09 Machine Learning Applications in Spine Imaging

Participants  
Nathan M. Cross, MD, MS, Seattle, WA (*Presenter*) Nothing to Disclose

##### T6-CNR09 The Future of Radiomics in Neuroimaging

Participants  
Reza Forghani, MD, PhD, Newberry, FL (*Presenter*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Intel Corporation; Research Grant, Toronto-Dominion Bank; Research Grant, McGill University Health Centre Foundation; President, Montreal Imaging Experts Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CPD04

### Small Parts Ultrasound in Children: A Roadmap to Appropriate Biopsy

#### Sub-Events

##### T6-CPD04 Moderator

#### Participants

Claudia M. Martinez Rios Arellano, MD, Ottawa, ON (*Moderator*) Nothing to Disclose

##### T6-CPD04 Lesions in the Pediatric Breast: Differential Diagnosis and When to Biopsy

#### Participants

Tess Chapman, MD, MA, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss how to recognize the sonographic features of solid pediatric breast masses and how to apply an appropriate lexicon. 2) Learn how to appreciate features of the normal breast to avoid iatrogenic injury to the developing breast and how to differentiate benign from concerning breast masses in children to guide an appropriate management. 3) Discuss sonographic appearances of pediatric thyroid nodules, using a practical approach for characterization and management. 4) Provide detailed explanations of various lumps and bumps encountered in children, describing the sonographic technique, highlighting the role of ultrasound and the clinical information when assessing these lesions, that can help to differentiate those that are best to watch versus those that should be removed. \*Course Description This lecture course will address the sonographic features of lesions of the breast, thyroid and various lumps and bumps in children. Lesions of these small parts in children can be benign or malignant, and reaching a final diagnosis based on imaging alone can be challenging. Awareness of the distinct imaging features of these lesions, can help in guiding a management approach, deciding when it is best to biopsy or to watch.

#### COURSE DESCRIPTION

This lecture course will address the sonographic features of lesions of the breast, thyroid and various lumps and bumps in children. Lesions of these small parts in children can be benign or malignant, and reaching a final diagnosis based on imaging alone can be challenging. Awareness of the distinct imaging features of these lesions, can help in guiding a management approach, deciding when it is best to biopsy or to watch.

##### T6-CPD04 Practical Approach to Pediatric Thyroid Nodules

#### Participants

Ricardo Restrepo, MD, Miami, FL (*Presenter*) Nothing to Disclose

##### T6-CPD04 Pediatric Lumps and Bumps: When Watchful Waiting is the Right Plan

#### Participants

Oscar M. Navarro, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CPD04

**Moderator**

### Participants

Claudia M. Martinez Rios Arellano, MD, Ottawa, ON (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CPD04

### Lesions in the Pediatric Breast: Differential Diagnosis and When to Biopsy

#### Participants

Tess Chapman, MD, MA, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Discuss how to recognize the sonographic features of solid pediatric breast masses and how to apply an appropriate lexicon. 2) Learn how to appreciate features of the normal breast to avoid iatrogenic injury to the developing breast and how to differentiate benign from concerning breast masses in children to guide an appropriate management. 3) Discuss sonographic appearances of pediatric thyroid nodules, using a practical approach for characterization and management. 4) Provide detailed explanations of various lumps and bumps encountered in children, describing the sonographic technique, highlighting the role of ultrasound and the clinical information when assessing these lesions, that can help to differentiate those that are best to watch versus those that should be removed. \*Course Description This lecture course will address the sonographic features of lesions of the breast, thyroid and various lumps and bumps in children. Lesions of these small parts in children can be benign or malignant, and reaching a final diagnosis based on imaging alone can be challenging. Awareness of the distinct imaging features of these lesions, can help in guiding a management approach, deciding when it is best to biopsy or to watch.

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This lecture course will address the sonographic features of lesions of the breast, thyroid and various lumps and bumps in children. Lesions of these small parts in children can be benign or malignant, and reaching a final diagnosis based on imaging alone can be challenging. Awareness of the distinct imaging features of these lesions, can help in guiding a management approach, deciding when it is best to biopsy or to watch.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CPD04

### Practical Approach to Pediatric Thyroid Nodules

#### Participants

Ricardo Restrepo, MD, Miami, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-CPD04

### **Pediatric Lumps and Bumps: When Watchful Waiting is the Right Plan**

#### **Participants**

Oscar M. Navarro, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CRT08

### ASRT@RSNA: Combatting Exclusive Behaviors in the Workplace

#### LEARNING OBJECTIVES

1) Recognize the subtle and covert ways that exclusionary behaviors are conveyed through speech and behavior. 2) Understand the impact that exclusionary behaviors have in the workplace. 3) Implement strategies to pro-actively address exclusionary behaviors.\*Course Description Inclusive workplaces are associated with improved job satisfaction, reduced turnover, and increased organizational commitment. Creating an inclusive workplace requires leaders, teams, and individuals to pay attention to the subtle ways in which they may exclude team members. This course includes a practical lecture focused on equipping radiology professionals with discrete tools and resources to identify and pro-actively address exclusionary behaviors.

#### COURSE DESCRIPTION

Inclusive workplaces are associated with improved job satisfaction, reduced turnover, and increased organizational commitment. Creating an inclusive workplace requires leaders, teams, and individuals to pay attention to the subtle ways in which they may exclude team members. This course includes a practical lecture focused on equipping radiology professionals with discrete tools and resources to identify and pro-actively address exclusionary behaviors.

#### Sub-Events

##### T6-CRT08 Moderator

Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### T6-CRT08 ASRT@RSNA: Combatting Microaggressions in the Workplace

Participants

Anand Narayan, MD, PhD, Verona, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CRT08

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-CRT08

**ASRT@RSNA: Combatting Microaggressions in the Workplace**

### Participants

Anand Narayan, MD, PhD, Verona, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-RCP17

### Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)

#### Participants

Gezzer Ortega, MD,MPH, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Participants will be competent to describe the concept of health equity from a radiology perspective and its importance of addressing disparities seen in healthcare organizations. 2) Participants will gain insight about key policies set by the Joint Commission and the CMS, learning about their requirements and the evolving national frameworks used to advance health equity. 3) Participants will learn how to employ existing quality tools and metrics to identify healthcare gaps measure progress in programs aimed to improve health equity within radiology. 4) Participants will be gain an understanding of the application of cultural dexterity in radiology to promote an organizations' accountability towards improving health equity. 5) Participants will be equipped to understand the implications of health equity-based payment models within radiology departments. They will be confident to align existing efforts made in the radiology departments with these new models to ensure readiness for change.\*Course Description Health equity is a vehicle for organizational change and a catalyst for personalized care. This growing role has resulted in an increase attention by national quality and safety organizations, private and public payors, and government and industry collaborators. Radiology continues to play a central role in patient care and are poised to lead health equity efforts at their respective institutions. Therefore, it is paramount that radiologists are equipped with a knowledge toolkit that will enable them to lead institutional readiness efforts to successfully comply with the evolving accountability requirements to reduce health disparities and future equity-based payment models. Beyond the increasing focus on health equity by healthcare and academic institutions and industry collaborators, addressing health care disparities has become a quality and safety priority in radiology. New and revised requirements to reduce health care disparities will apply to radiology practices and health organizations as part of the Joint Commission's accreditation requirements. Additionally, the Centers for Medicare and Medicaid Services (CMS) have updated their framework to further advance health equity, and the President's Cancer Panel and the Cancer Moonshot have made health equity in cancer screening a key pillar of these efforts. These frameworks set the foundation and priorities to eliminate health disparities and drive structural change with evolving payment models that will impact all health care systems and radiology practices. Therefore, it is vital that radiologists are equipped with a knowledge toolkit to lead healthcare institutional readiness efforts to ensure radiology practices and healthcare systems are compliant with these evolving requirements. Leveraging the CMS framework for health equity and the Department of Health and Human Services Health People 2030, the purpose of this session is to discuss high-yield topics that will provide practical examples and on how to lead data-driven institutional efforts and system-wide outcomes measures that will support organizational readiness to advance health equity. The topics covered will be discussed with national radiology leaders and will include the following: 1. Effective standardization of sociodemographic data collection and root cause analyses to identify care gaps in radiology. 2. Building capacity by enhancing diversity efforts in radiology. 3. Understanding and successfully navigating the health equity Joint Commission requirements 4. Developing and implementing system-wide outcomes metrics to measure progress in disparities. 5. Aligning radiology efforts to ensure readiness for evolving payment models.

#### COURSE DESCRIPTION

Health equity is a vehicle for organizational change and a catalyst for personalized care. This growing role has resulted in an increase attention by national quality and safety organizations, private and public payors, and government and industry collaborators. Radiology continues to play a central role in patient care and are poised to lead health equity efforts at their respective institutions. Therefore, it is paramount that radiologists are equipped with a knowledge toolkit that will enable them to lead institutional readiness efforts to successfully comply with the evolving accountability requirements to reduce health disparities and future equity-based payment models. Beyond the increasing focus on health equity by healthcare and academic institutions and industry collaborators, addressing health care disparities has become a quality and safety priority in radiology. New and revised requirements to reduce health care disparities will apply to radiology practices and health organizations as part of the Joint Commission's accreditation requirements. Additionally, the Centers for Medicare and Medicaid Services (CMS) have updated their framework to further advance health equity, and the President's Cancer Panel and the Cancer Moonshot have made health equity in cancer screening a key pillar of these efforts. These frameworks set the foundation and priorities to eliminate health disparities and drive structural change with evolving payment models that will impact all health care systems and radiology practices. Therefore, it is vital that radiologists are equipped with a knowledge toolkit to lead healthcare institutional readiness efforts to ensure radiology practices and healthcare systems are compliant with these evolving requirements. Leveraging the CMS framework for health equity and the Department of Health and Human Services Health People 2030, the purpose of this session is to discuss high-yield topics that will provide practical examples and on how to lead data-driven institutional efforts and system-wide outcomes measures that will support organizational readiness to advance health equity. The topics covered will be discussed with national radiology leaders and will include the following: 1. Effective standardization of sociodemographic data collection and root cause analyses to identify care gaps in radiology. 2. Building capacity by enhancing diversity efforts in radiology. 3. Understanding and successfully navigating the health equity Joint Commission requirements 4. Developing and implementing system-wide outcomes metrics to measure progress in disparities. 5. Aligning radiology efforts to ensure readiness for evolving payment models.

## Abstract Archives of the RSNA, 2023

T6-RCP17

**Moderator**

### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-RCP17

**Moderator**

### Participants

Efren J. Flores, MD, Boston, MA (*Moderator*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-RCP17

### Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)

#### Sub-Events

##### T6-RCP17 Moderator

#### Participants

Efren J. Flores, MD, Boston, MA (*Moderator*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

##### T6-RCP17 Moderator

#### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Moderator*) Nothing to Disclose

##### T6-RCP17 Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)

#### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

##### T6-RCP17 Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)

#### Participants

Carolyn Meltzer, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

##### T6-RCP17 Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)

#### Participants

Gezzer Ortega, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Participants will be competent to describe the concept of health equity from a radiology perspective and its importance of addressing disparities seen in healthcare organizations. 2) Participants will gain insight about key policies set by the Joint Commission and the CMS, learning about their requirements and the evolving national frameworks used to advance health equity. 3) Participants will learn how to employ existing quality tools and metrics to identify healthcare gaps measure progress in programs aimed to improve health equity within radiology. 4) Participants will be gain an understanding of the application of cultural dexterity in radiology to promote an organizations' accountability towards improving health equity. 5) Participants will be equipped to understand the implications of health equity-based payment models within radiology departments. They will be confident to align existing efforts made in the radiology departments with these new models to ensure readiness for change.\*Course Description Health equity is a vehicle for organizational change and a catalyst for personalized care. This growing role has resulted in an increase attention by national quality and safety organizations, private and public payors, and government and industry collaborators. Radiology continues to play a central role in patient care and are poised to lead health equity efforts at their respective institutions. Therefore, it is paramount that radiologists are equipped with a knowledge toolkit that will enable them to lead institutional readiness efforts to successfully comply with the evolving accountability requirements to reduce health disparities and future equity-based payment models. Beyond the increasing focus on health equity by healthcare and academic institutions and industry collaborators, addressing health care disparities has become a quality and safety priority in radiology. New and revised requirements to reduce health care disparities will apply to radiology practices and health organizations as part of the Joint Commission's accreditation requirements. Additionally, the Centers for Medicare and Medicaid Services (CMS) have updated their framework to further advance health equity, and the President's Cancer Panel and the Cancer Moonshot have made health equity in cancer screening a key pillar of these efforts. These frameworks set the foundation and priorities to eliminate health disparities and drive structural change with evolving payment models that will impact all health care systems and radiology practices. Therefore, it is vital that radiologists are equipped with a knowledge toolkit to lead healthcare institutional readiness efforts to ensure radiology practices and healthcare systems are compliant with these evolving requirements. Leveraging the CMS framework for health equity and the Department of Health and Human Services Health People 2030, the purpose of this session is to discuss high-yield topics that will provide practical examples and on how to lead data-driven institutional efforts and system-wide outcomes measures that will support organizational readiness to advance health equity. The topics covered will be discussed with national radiology leaders and will include the following: 1. Effective standardization of sociodemographic data collection and root cause analyses to identify care gaps in radiology. 2. Building capacity by enhancing diversity efforts in radiology. 3. Understanding and successfully navigating the health equity Joint Commission requirements 4. Developing and implementing system-wide outcomes metrics to measure progress in disparities. 5. Aligning radiology efforts to ensure readiness for evolving payment models.

#### COURSE DESCRIPTION

Health equity is a vehicle for organizational change and a catalyst for personalized care. This growing role has resulted in an



increase attention by national quality and safety organizations, private and public payors, and government and industry collaborators. Radiology continues to play a central role in patient care and are poised to lead health equity efforts at their respective institutions. Therefore, it is paramount that radiologists are equipped with a knowledge toolkit that will enable them to lead institutional readiness efforts to successfully comply with the evolving accountability requirements to reduce health disparities and future equity-based payment models. Beyond the increasing focus on health equity by healthcare and academic institutions and industry collaborators, addressing health care disparities has become a quality and safety priority in radiology. New and revised requirements to reduce health care disparities will apply to radiology practices and health organizations as part of the Joint Commission's accreditation requirements. Additionally, the Centers for Medicare and Medicaid Services (CMS) have updated their framework to further advance health equity, and the President's Cancer Panel and the Cancer Moonshot have made health equity in cancer screening a key pillar of these efforts. These frameworks set the foundation and priorities to eliminate health disparities and drive structural change with evolving payment models that will impact all health care systems and radiology practices. Therefore, it is vital that radiologists are equipped with a knowledge toolkit to lead healthcare institutional readiness efforts to ensure radiology practices and healthcare systems are compliant with these evolving requirements. Leveraging the CMS framework for health equity and the Department of Health and Human Services Health People 2030, the purpose of this session is to discuss high-yield topics that will provide practical examples and on how to lead data-driven institutional efforts and system-wide outcomes measures that will support organizational readiness to advance health equity. The topics covered will be discussed with national radiology leaders and will include the following: 1. Effective standardization of sociodemographic data collection and root cause analyses to identify care gaps in radiology. 2. Building capacity by enhancing diversity efforts in radiology. 3. Understanding and successfully navigating the health equity Joint Commission requirements 4. Developing and implementing system-wide outcomes metrics to measure progress in disparities. 5. Aligning radiology efforts to ensure readiness for evolving payment models.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T6-RCP17

**Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)**

### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T6-RCP17

**Framing Health Equity Through the Lens of Organizational Readiness and Accountability (Sponsored by the RSNA Health Equity Committee)**

### **Participants**

Carolyn Meltzer, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CCH06

### Pulmonary Vascular Imaging: CTEPH/Pulmonary Hypertension

#### Sub-Events

##### T7-CCH06 Moderator

###### Participants

Ann N. Leung, MD, Stanford, CA (*Moderator*) Nothing to Disclose

##### T7-CCH06 Introduction to CTEPH/PH

###### Participants

Ann N. Leung, MD, Stanford, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize and diagnose CTEPH on imaging studies. 2) Distinguish CTEPH from other conditions that affect the pulmonary vasculature.\*Course Description Chronic thromboembolic pulmonary hypertension (CTEPH) is a potentially curable form of pulmonary hypertension that develops in approximately 3% of patients with pulmonary embolism. CTEPH is a dual vascular disorder characterized by obstruction of the pulmonary vasculature by organized thromboembolic material and a secondary arteriopathic process affecting small resistance vessels. Untreated, CTEPH can lead to right heart failure and death. Diagnosis of CTEPH is made on the basis of imaging. This course presented in lecture-style format will discuss the relative strengths and weaknesses of the different diagnostic modality options as well as the characteristic imaging features of CTEPH on each. The session will include a case-based review to reinforce the imaging appearance of CTEPH and allow its differentiation from mimics.

#### COURSE DESCRIPTION

Chronic thromboembolic pulmonary hypertension (CTEPH) is a potentially curable form of pulmonary hypertension that develops in approximately 3% of patients with pulmonary embolism. CTEPH is a dual vascular disorder characterized by obstruction of the pulmonary vasculature by organized thromboembolic material and a secondary arteriopathic process affecting small resistance vessels. Untreated, CTEPH can lead to right heart failure and death. Diagnosis of CTEPH is made on the basis of imaging. This course presented in lecture-style format will discuss the relative strengths and weaknesses of the different diagnostic modality options as well as the characteristic imaging features of CTEPH on each. The session will include a case-based review to reinforce the imaging appearance of CTEPH and allow its differentiation from mimics.

##### T7-CCH06 Diagnosis of CTEPH/PH

###### Participants

Martine J. Remy-Jardin, MD,PhD, Lille, France (*Presenter*) Research Grant, Siemens AG;Speaker, Siemens AG

##### T7-CCH06 Imaging Findings of CTEPH

###### Participants

Seth J. Kligerman, MD, San Diego, CA (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH;Consultant, Riverain Technologies, LLC;Consultant, Bayer AG

##### T7-CCH06 CTEPH/PH Case Review

###### Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CCH06

**Moderator**

### Participants

Ann N. Leung, MD, Stanford, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CCH06

### Introduction to CTEPH/PH

#### Participants

Ann N. Leung, MD, Stanford, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize and diagnose CTEPH on imaging studies. 2) Distinguish CTEPH from other conditions that affect the pulmonary vasculature.\*Course Description Chronic thromboembolic pulmonary hypertension (CTEPH) is a potentially curable form of pulmonary hypertension that develops in approximately 3% of patients with pulmonary embolism. CTEPH is a dual vascular disorder characterized by obstruction of the pulmonary vasculature by organized thromboembolic material and a secondary arteriopathic process affecting small resistance vessels. Untreated, CTEPH can lead to right heart failure and death. Diagnosis of CTEPH is made on the basis of imaging. This course presented in lecture-style format will discuss the relative strengths and weaknesses of the different diagnostic modality options as well as the characteristic imaging features of CTEPH on each. The session will include a case-based review to reinforce the imaging appearance of CTEPH and allow its differentiation from mimics.

#### COURSE DESCRIPTION

Chronic thromboembolic pulmonary hypertension (CTEPH) is a potentially curable form of pulmonary hypertension that develops in approximately 3% of patients with pulmonary embolism. CTEPH is a dual vascular disorder characterized by obstruction of the pulmonary vasculature by organized thromboembolic material and a secondary arteriopathic process affecting small resistance vessels. Untreated, CTEPH can lead to right heart failure and death. Diagnosis of CTEPH is made on the basis of imaging. This course presented in lecture-style format will discuss the relative strengths and weaknesses of the different diagnostic modality options as well as the characteristic imaging features of CTEPH on each. The session will include a case-based review to reinforce the imaging appearance of CTEPH and allow its differentiation from mimics.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CCH06

### Diagnosis of CTEPH/PH

#### Participants

Martine J. Remy-Jardin, MD,PhD, Lille, France (*Presenter*) Research Grant, Siemens AG;Speaker, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CCH06

### Imaging Findings of CTEPH

#### Participants

Seth J. Kligerman, MD, San Diego, CA (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Consultant, Riverain Technologies, LLC; Consultant, Bayer AG

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-CCH06

### CTEPH/PH Case Review

#### Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

**Kidney**

### Participants

Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

### Bladder/Ureters

#### Participants

Tristan Barrett, MBBS, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

**Prostate**

### Participants

Tharakeswara Bathala, MD, MS, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

### Benign Gynecology

#### Participants

Lori Mankowski Gettle, MD, Madison, WI (*Presenter*) Stockholder, Elucent Medical; Research support, General Electric Company; Research support, HistoSonics, Inc; Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

### Malignant Gynecology

#### Participants

Bahar Mansoori, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

**Moderator**

### **Participants**

Tharakeswara Bathala, MD, MS, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CGU03

### GU Essentials! A Case-Based Audience Participation Session

#### LEARNING OBJECTIVES

1) Develop a systematic approach to assess genitourinary imaging studies, accurately identifying anatomical structures, abnormalities, and pathology. 2) Apply advanced imaging techniques and protocols for the evaluation of various genitourinary disorders. 3) Differentiate between benign and malignant genitourinary lesions based on imaging characteristics and implement appropriate management strategies. 4) Incorporate evidence-based guidelines and best practices into clinical practice, ensuring accurate diagnoses, appropriate patient selection, and timely interventions in genitourinary imaging. 5) Evaluate the limitations and potential pitfalls of genitourinary imaging techniques, enabling participants to make informed decisions and prevent diagnostic errors.\*Course Description "GU Essentials! A Case-Based Audience Participation Session" is an engaging and interactive lecture series designed to provide a comprehensive understanding of genitourinary imaging for radiologists, trainees, and healthcare professionals involved in diagnosing and managing genitourinary conditions. Through dynamic case-based discussions and active audience participation, this series aims to enhance participants' interpretation skills and provide valuable insights into genitourinary imaging studies.

#### COURSE DESCRIPTION

"GU Essentials! A Case-Based Audience Participation Session" is an engaging and interactive lecture series designed to provide a comprehensive understanding of genitourinary imaging for radiologists, trainees, and healthcare professionals involved in diagnosing and managing genitourinary conditions. Through dynamic case-based discussions and active audience participation, this series aims to enhance participants' interpretation skills and provide valuable insights into genitourinary imaging studies.

#### Sub-Events

##### T7-CGU03 Moderator

Participants  
Tharakeswara Bathala, MD, MS, Houston, TX (*Moderator*) Nothing to Disclose

##### T7-CGU03 Kidney

Participants  
Andrew Smith, MD, PhD, Birmingham, AL (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

##### T7-CGU03 Bladder/Ureters

Participants  
Tristan Barrett, MBBS, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

##### T7-CGU03 Prostate

Participants  
Tharakeswara Bathala, MD, MS, Houston, TX (*Presenter*) Nothing to Disclose

##### T7-CGU03 Benign Gynecology

Participants  
Lori Mankowski Gettle, MD, Madison, WI (*Presenter*) Stockholder, Elucent Medical;Research support, General Electric Company;Research support, HistoSonics, Inc;Royalties, RELX

##### T7-CGU03 Malignant Gynecology

Participants  
Bahar Mansoori, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-CNMMI12

**Moderator**

### Participants

Lisa Bodei, MD, PhD, New York, NY (*Moderator*) Consultant, Novartis AG ;Speaker, Novartis AG;Research Grant, Novartis AG;Consultant, Ipsen SA;Consultant, ITM Isotopen Technologien Muenchen AG;Speaker, ITM Isotopen Technologien Muenchen AG;Consultant, Clovis Oncology, Inc;Consultant, Ion Beam Applications, SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNMMI12

### Response Assessment after PRRT

#### Participants

Lisa Bodei, MD, PhD, New York, NY (*Presenter*) Consultant, Novartis AG ;Speaker, Novartis AG;Research Grant, Novartis AG;Consultant, Ipsen SA;Consultant, ITM Isotopen Technologien Muenchen AG;Speaker, ITM Isotopen Technologien Muenchen AG;Consultant, Clovis Oncology, Inc;Consultant, Ion Beam Applications, SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNMMI12

### Update on Neuroendocrine Tumor Imaging

#### Participants

Nadine Mallak, MD, Portland, OR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNMMI12

### Case-based Review of PET/CT: Neuroendocrine Cancers

#### LEARNING OBJECTIVES

1) Understand best clinical practices for use and interpretation of PET/CT in patients with neuroendocrine tumors. 2) Compared and contrast Ga68-Dotatate with 64Cu-Dotatate.\*Course Description PET/CT has greatly impacted the imaging and therapy of neuroendocrine malignancies, including continuing improvements in somatostatin receptor-targeted PET. In this session, experts on neuroendocrine tumors will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of PET studies.

#### COURSE DESCRIPTION

PET/CT has greatly impacted the imaging and therapy of neuroendocrine malignancies, including continuing improvements in somatostatin receptor-targeted PET. In this session, experts on neuroendocrine tumors will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of PET studies.

#### Sub-Events

##### T7-CNMMI12 Moderator

###### Participants

Lisa Bodei, MD, PhD, New York, NY (*Moderator*) Consultant, Novartis AG ;Speaker, Novartis AG;Research Grant, Novartis AG;Consultant, Ipsen SA;Consultant, ITM Isotopen Technologien Muenchen AG;Speaker, ITM Isotopen Technologien Muenchen AG;Consultant, Clovis Oncology, Inc;Consultant, Ion Beam Applications, SA

##### T7-CNMMI12 Response Assessment after PRRT

###### Participants

Lisa Bodei, MD, PhD, New York, NY (*Presenter*) Consultant, Novartis AG ;Speaker, Novartis AG;Research Grant, Novartis AG;Consultant, Ipsen SA;Consultant, ITM Isotopen Technologien Muenchen AG;Speaker, ITM Isotopen Technologien Muenchen AG;Consultant, Clovis Oncology, Inc;Consultant, Ion Beam Applications, SA

##### T7-CNMMI12 Update on Neuroendocrine Tumor Imaging

###### Participants

Nadine Mallak, MD, Portland, OR (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNR12

### Spine Imaging - Core Concepts & Cutting Edge

#### LEARNING OBJECTIVES

1) Review core concepts essential for all radiologists interpreting spine imaging: adjacent-segment degeneration and imaging of painful facet joints. 2) Explain cutting-edge techniques that will shape spine imaging in the future: AI and CSF-venous fistula imaging.\*Course Description This session will consist of 4 lectures targeted to both general practice radiologists and spine imaging specialists. Content will include two lectures addressing core concepts of that are commonly encountered in practice, and are crucial to understand how spine imaging interfaces with clinical decision-making. In addition, two lectures will address cutting-edge topics expected to influence spine imaging and shape changes in practice in the near future.

#### COURSE DESCRIPTION

This session will consist of 4 lectures targeted to both general practice radiologists and spine imaging specialists. Content will include two lectures addressing core concepts of that are commonly encountered in practice, and are crucial to understand how spine imaging interfaces with clinical decision-making. In addition, two lectures will address cutting-edge topics expected to influence spine imaging and shape changes in practice in the near future.

#### Sub-Events

##### T7-CNR12 Moderator

Participants  
Peter G. Kranz, MD, Durham, NC (*Moderator*) Nothing to Disclose

##### T7-CNR12 Core Concept: Adjacent Segment Degeneration

Participants  
Marin McDonald, MD, PhD, San Diego, CA (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation

##### T7-CNR12 Core Concept: Imaging of Painful Facet Joints

Participants  
Lubdh Shah, MD, MSc, Salt Lake Cty, UT (*Presenter*) Nothing to Disclose

##### T7-CNR12 Cutting Edge: CSF-Venous Fistula Imaging

Participants  
Peter G. Kranz, MD, Durham, NC (*Presenter*) Nothing to Disclose

##### T7-CNR12 Cutting Edge: Spine AI Bone MRI

Participants  
Amish Doshi, MD, (*Presenter*) Speaker, Becton, Dickinson and Company; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNR12

**Core Concept: Imaging of Painful Facet Joints**

### Participants

Lubdha Shah, MD, MSc, Salt Lake Cty, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNR12

### Cutting Edge: CSF-Venous Fistula Imaging

#### Participants

Peter G. Kranz, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNR12

### Cutting Edge: Spine AI Bone MRI

#### Participants

Amish Doshi, MD, (*Presenter*) Speaker, Becton, Dickinson and Company; Consultant, Siemens AG

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-CNR12

**Moderator**

### Participants

Peter G. Kranz, MD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CNR12

**Core Concept: Adjacent Segment Degeneration**

### Participants

Marin McDonald, MD, PhD, San Diego, CA (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-COB01

### Endometriosis: US, MR, and Surgical Correlations

#### LEARNING OBJECTIVES

1) Understand the MR appearance of endometriosis phenotypes: superficial endometriosis, endometrioma, and deep endometriosis. 2) Learn the sonographic appearance of common sites of deep endometriosis, how to acquire high-yield ultrasound images of DE in the posterior compartment, and how to report DE on augmented routine pelvic ultrasound in compliance with Society of Radiologists in Ultrasound (SRU) Consensus Statement on ultrasound of endometriosis. 3) Understand the utility of preoperative imaging in the management and resection of advanced-stage endometriosis.\*Course Description Endometriosis is a prevalent condition affecting approximately 10% of individuals, especially during reproductive age. Currently, affected persons undergo significant diagnostic delay and suboptimal medical and surgical treatment due to a lack of awareness. Imaging plays an increasingly vital role in diagnosis and management. Lecturers will provide critical information on how to decrease diagnostic delay, improve communication of important imaging observations, and the impact of imaging information on surgical treatment and medical management.

#### COURSE DESCRIPTION

Endometriosis is a prevalent condition affecting approximately 10% of individuals, especially during reproductive age. Currently, affected persons undergo significant diagnostic delay and suboptimal medical and surgical treatment due to a lack of awareness. Imaging plays an increasingly vital role in diagnosis and management. Lecturers will provide critical information on how to decrease diagnostic delay, improve communication of important imaging observations, and the impact of imaging information on surgical treatment and medical management.

#### Sub-Events

##### T7-COB01 Moderator

Participants  
Scott Young, MD, Phoenix, AZ (*Moderator*) Nothing to Disclose

##### T7-COB01 Endometriosis: US, MR Surgical Correlation

Participants  
Rosanne Kho, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

##### T7-COB01 MR of Endometriosis: Hiding in Plain Site

Participants  
Nancy Kim, MD, Washington, DC (*Presenter*) Nothing to Disclose

##### T7-COB01 Endometriosis: Ultrasound and the New SRU Consensus Conference Guidelines

Participants  
Scott Young, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-COB01

**Moderator**

### Participants

Scott Young, MD, Phoenix, AZ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-COB01

### Endometriosis: US, MR Surgical Correlation

#### Participants

Rosanne Kho, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-COB01

### MR of Endometriosis: Hiding in Plain Site

#### Participants

Nancy Kim, MD, Washington, DC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-COB01

**Endometriosis: Ultrasound and the New SRU Consensus Conference Guidelines**

### Participants

Scott Young, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CRT03

**ASRT@RSNA: AI for Good: How Collaboration Should Inform Responsible Future Practice (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc.)**

### LEARNING OBJECTIVES

1) Appreciate the ways in which AI is poised to impact medical imaging and radiation therapy practice from a clinical, technical, professional, and ethical lens. 2) Champion the value of equipping medical radiation technologists (MRTs) to be literate in relevant technologies, data, and system level considerations. 3) Leverage the unique perspective and expertise of MRTs to inform an AI-enabled future through advocacy and collaboration.\*Course Description Artificial intelligence (AI) is emerging as an important tool in medical imaging and radiation therapy – but it should only ever be considered exactly that – a tool, leveraged to inform responsible and high quality care. To realize a desired future state that makes most appropriate use of technology and most effective use of diverse skill sets within the interprofessional team, it is important that medical radiation technologists (MRTs) equip themselves to be part of relevant conversations and decisions. Education, advocacy, and collaboration are all necessary as we build towards AI-enabled medical imaging and radiation therapy practice. This presentation will highlight the diverse applications of AI, and the considerations for responsible implementation from the perspective of MRTs as members of the interprofessional team, at both the practice and system level.

### COURSE DESCRIPTION

Artificial intelligence (AI) is emerging as an important tool in medical imaging and radiation therapy – but it should only ever be considered exactly that – a tool, leveraged to inform responsible and high quality care. To realize a desired future state that makes most appropriate use of technology and most effective use of diverse skill sets within the interprofessional team, it is important that medical radiation technologists (MRTs) equip themselves to be part of relevant conversations and decisions. Education, advocacy, and collaboration are all necessary as we build towards AI-enabled medical imaging and radiation therapy practice. This presentation will highlight the diverse applications of AI, and the considerations for responsible implementation from the perspective of MRTs as members of the interprofessional team, at both the practice and system level.

### Sub-Events

#### T7-CRT03 Moderator

Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

#### T7-CRT03 **ASRT@RSNA: AI for Good: How Collaboration Should Inform Responsible Future Practice**

Participants

Caitlin Gillan, PhD, MEd, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-CRT03

**Moderator**

### **Participants**

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CRT03

**ASRT@RSNA: AI for Good: How Collaboration Should Inform Responsible Future Practice**

### Participants

Caitlin Gillan, PhD, MEd, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

### Visceral Vascular Imaging

#### Sub-Events

#### T7-CVA05 Moderator

##### Participants

Jody Shen, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose

#### T7-CVA05 Moderator

##### Participants

Iain D. Kirkpatrick, MD, FRCPC, Winnipeg, MB (*Moderator*) Nothing to Disclose

#### T7-CVA05 Mesenteric Ischemia

##### Participants

Iain D. Kirkpatrick, MD, FRCPC, Winnipeg, MB (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe how to optimize CT protocols for the diagnosis of acute mesenteric ischemia or the localization of gastrointestinal hemorrhage, and the imaging findings most helpful in making a diagnosis. 2) Identify which imaging modalities are most appropriate for the investigation of pelvic congestion syndrome or renal arterial pathology in 2023, and associated radiologic findings. \*Course Description Abdominal vascular pathology crosses subspecialties and can be challenging for general radiologists, the abdominal radiologist who rarely interprets CT/MR angiography or the cardiovascular radiologist/interventionalist who is less familiar with visceral abdominal imaging. This Refresher Course consists of four lectures covering the vascular and visceral findings seen in acute mesenteric ischemia, gastrointestinal hemorrhage, renal arterial disease and pelvic congestion syndrome, as well as the appropriate selection of imaging modalities and protocols for these constantly evolving diagnoses. At the end of the course, attendees should feel comfortable prescribing and interpreting studies for all of these indications.

#### COURSE DESCRIPTION

Abdominal vascular pathology crosses subspecialties and can be challenging for general radiologists, the abdominal radiologist who rarely interprets CT/MR angiography or the cardiovascular radiologist/interventionalist who is less familiar with visceral abdominal imaging. This Refresher Course consists of four lectures covering the vascular and visceral findings seen in acute mesenteric ischemia, gastrointestinal hemorrhage, renal arterial disease and pelvic congestion syndrome, as well as the appropriate selection of imaging modalities and protocols for these constantly evolving diagnoses. At the end of the course, attendees should feel comfortable prescribing and interpreting studies for all of these indications.

#### T7-CVA05 Renal Artery Imaging

##### Participants

Nicole Keefe, MD, Raleigh, NC (*Presenter*) Nothing to Disclose

#### T7-CVA05 Pelvic Congestion Syndrome

##### Participants

Rebecca Rakow-Penner, MD, PhD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Consultant, Human Longevity Inc; Stockholder, CureMetrix, Inc; Stock options, CorTechs Labs, Inc

#### T7-CVA05 Gastrointestinal Bleeding

##### Participants

Avneesh Gupta, MD, Boston, MA (*Presenter*) Speaker, Koninklijke Philips NV;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

**Moderator**

### Participants

Jody Shen, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

**Moderator**

### Participants

Iain D. Kirkpatrick, MD, FRCPC, Winnipeg, MB (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

### Mesenteric Ischemia

#### Participants

Iain D. Kirkpatrick, MD, FRCPC, Winnipeg, MB (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe how to optimize CT protocols for the diagnosis of acute mesenteric ischemia or the localization of gastrointestinal hemorrhage, and the imaging findings most helpful in making a diagnosis. 2) Identify which imaging modalities are most appropriate for the investigation of pelvic congestion syndrome or renal arterial pathology in 2023, and associated radiologic findings. \*Course Description Abdominal vascular pathology crosses subspecialties and can be challenging for general radiologists, the abdominal radiologist who rarely interprets CT/MR angiography or the cardiovascular radiologist/interventionalist who is less familiar with visceral abdominal imaging. This Refresher Course consists of four lectures covering the vascular and visceral findings seen in acute mesenteric ischemia, gastrointestinal hemorrhage, renal arterial disease and pelvic congestion syndrome, as well as the appropriate selection of imaging modalities and protocols for these constantly evolving diagnoses. At the end of the course, attendees should feel comfortable prescribing and interpreting studies for all of these indications.

#### COURSE DESCRIPTION

Abdominal vascular pathology crosses subspecialties and can be challenging for general radiologists, the abdominal radiologist who rarely interprets CT/MR angiography or the cardiovascular radiologist/interventionalist who is less familiar with visceral abdominal imaging. This Refresher Course consists of four lectures covering the vascular and visceral findings seen in acute mesenteric ischemia, gastrointestinal hemorrhage, renal arterial disease and pelvic congestion syndrome, as well as the appropriate selection of imaging modalities and protocols for these constantly evolving diagnoses. At the end of the course, attendees should feel comfortable prescribing and interpreting studies for all of these indications.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

### Renal Artery Imaging

#### Participants

Nicole Keefe, MD, Raleigh, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-CVA05

### Pelvic Congestion Syndrome

#### Participants

Rebecca Rakow-Penner, MD, PhD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Consultant, Human Longevity Inc; Stockholder, CureMetrix, Inc; Stock options, CorTechs Labs, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-CVA05

### Gastrointestinal Bleeding

#### Participants

Avneesh Gupta, MD, Boston, MA (*Presenter*) Speaker, Koninklijke Philips NV;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

### Italy Presents: Radiology in the NextGenerationEU Plan

#### LEARNING OBJECTIVES

1) Vision and transformation of an historical scientific society born in 1913 and now representing more than 12,000 members in Italy. 2) Italy best practices for success stories such as its main journal, La Radiologia Medica, which hit an IF of 6.313 in 2021. 3) Italian radiologists' contributions to the National Recovery and Resilience Plan, a Similar Marshall plan post- pandemic. 4) Evolution of society reflecting in the scientific and professional area: How to embrace diversity and inclusion to express radiologists' full potential. The Italian initiatives to strengthen connections and synergies among regions. 5) Insight into the Italian College of Interventional radiology: SIRM's role in guiding and training young IR residents. 6) An innovative partnership between radiology and the Italian Winter Olympic games 2026: Among the branches of sports medicines radiology can excel to become an ally of winter sport athletes.\*Course Description Giovanni Malagò – CONI President - Italian National Olympic CommitteeDiana Bianchedi - Olympic Champion, Milanocortina 2026 Olympic Winter Games Project Director, Doctor in Sport MedicineMaria Rosario Squeo - Institute of Sports Medicine, Head of the Olympic AreaThis course is structured to provide an overview of the Italian Society of Medical and Interventional Radiology, one of the largest Italian and European scientific societies which experienced an accelerated growth in recent years (up to 12K members, 46% are women and 49% of members belong to the young age groups, 25-44y, that is progressively increasing). The pandemic experience brought a new perspective on the structure of educational activities, opening to a multidisciplinary approach and involving younger radiologist to take an active part in the society. The National Recovery and Resilience Plan (PNRR) is part of an extraordinary post-pandemic European funding program involving the Italian university system in the field of Precision Medicine. The contributions of the Italian radiologists involved in the project in the development of pre clinical studies and clinical trials for new therapeutic approaches will be presented. The project includes 12 universities, the Italian National Institute of Health, 5 scientific research and treatment institutes (IRCCS), 6 companies and a research foundation, and represents the first national network of scientists, technologists and young researchers who, with holistic and multidisciplinary approach, they share and develop knowledge, research and innovative technologies in order to bring the National Health System into the contemporary era of Precision Medicine. SIRM has a long-standing commitment to supporting IR education and making resources available to interventional radiologists. SIRM have played an important role in this framework by establishing high-quality standards in the training and practice of IRs throughout country. Several activities will be described to support IR residents throughout their careers and are regularly revised by IR experts to ensure that they reflect the most up-to-date techniques and technologies. A recent partnership with the National Olympic Committee at last 2022 SIRM Annual Meeting opened to a new form of collaboration between Italian radiology and the sports universe, showing the importance of diagnostic imaging not just in health but also in sports medicine.

#### COURSE DESCRIPTION

Giovanni Malagò – CONI President - Italian National Olympic CommitteeDiana Bianchedi - Olympic Champion, Milanocortina 2026 Olympic Winter Games Project Director, Doctor in Sport MedicineMaria Rosario Squeo - Institute of Sports Medicine, Head of the Olympic AreaThis course is structured to provide an overview of the Italian Society of Medical and Interventional Radiology, one of the largest Italian and European scientific societies which experienced an accelerated growth in recent years (up to 12K members, 46% are women and 49% of members belong to the young age groups, 25-44y, that is progressively increasing). The pandemic experience brought a new perspective on the structure of educational activities, opening to a multidisciplinary approach and involving younger radiologist to take an active part in the society. The National Recovery and Resilience Plan (PNRR) is part of an extraordinary post-pandemic European funding program involving the Italian university system in the field of Precision Medicine. The contributions of the Italian radiologists involved in the project in the development of pre clinical studies and clinical trials for new therapeutic approaches will be presented. The project includes 12 universities, the Italian National Institute of Health, 5 scientific research and treatment institutes (IRCCS), 6 companies and a research foundation, and represents the first national network of scientists, technologists and young researchers who, with holistic and multidisciplinary approach, they share and develop knowledge, research and innovative technologies in order to bring the National Health System into the contemporary era of Precision Medicine. SIRM has a long-standing commitment to supporting IR education and making resources available to interventional radiologists. SIRM have played an important role in this framework by establishing high-quality standards in the training and practice of IRs throughout country. Several activities will be described to support IR residents throughout their careers and are regularly revised by IR experts to ensure that they reflect the most up-to-date techniques and technologies. A recent partnership with the National Olympic Committee at last 2022 SIRM Annual Meeting opened to a new form of collaboration between Italian radiology and the sports universe, showing the importance of diagnostic imaging not just in health but also in sports medicine.

#### Sub-Events

##### T7-RCP03 Moderator

#### Participants

Andrea Giovagnoni, MD, Ancona, Italy (*Moderator*) Nothing to Disclose

##### T7-RCP03 Moderator

#### Participants

Emanuele Neri, MD, Pisa, Italy (*Moderator*) Speakers Bureau, General Electric Company

##### T7-RCP03 From Past to the Future: New Horizons for SIRM

Participants

Andrea Giovagnoni, MD, Ancona, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 "La Radiologia Medica" The SIRM Journal: A Success Story**

Participants

Antonio Barile, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 NextGenerationEU: The National Plan of Recover and Resilience in Radiology**

Participants

Carlo Catalano, MD, Rome, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 Diversity, Equity, Inclusion: A New Project for Italian Radiologists**

Participants

Stefania Montemezzi, MD, Verona, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 Disequality, Equity, Inclusion: A New Project for Italian Radiologists**

Participants

Nicoletta Gandolfo, MD, Genova, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 The Italian College of Interventional Radiology: Old Tradition for Next Generation**

Participants

Gianpaolo Carrafiello, PhD, Varese, Italy (*Presenter*) Nothing to Disclose

**T7-RCP03 Radiology at the Italian Winter Olympic Games 2026: A SIRM Project with the National Olympic Committee**

Participants

Ettore Squillaci, MD, PhD, Rome, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

### Diversity, Equity, Inclusion: A New Project for Italian Radiologists

#### Participants

Stefania Montemezzi, MD, Verona, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

### Disequality, Equity, Inclusion: A New Project for Italian Radiologists

#### Participants

Nicoletta Gandolfo, MD, Genova, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

### The Italian College of Interventional Radiology: Old Tradition for Next Generation

#### Participants

Gianpaolo Carrafiello, PhD, Varese, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

**Radiology at the Italian Winter Olympic Games 2026: A SIRM Project with the National Olympic Committee**

### Participants

Ettore Squillaci, MD, PhD, Rome, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

**Moderator**

### Participants

Andrea Giovagnoni, MD, Ancona, Italy (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T7-RCP03

**Moderator**

### **Participants**

Emanuele Neri, MD, Pisa, Italy (*Moderator*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

### From Past to the Future: New Horizons for SIRM

#### Participants

Andrea Giovagnoni, MD, Ancona, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

**"La Radiologia Medica" The SIRM Journal: A Success Story**

### Participants

Antonio Barile, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP03

**NextGenerationEU: The National Plan of Recover and Resilience in Radiology**

### Participants

Carlo Catalano, MD, Rome, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP28

### Planning for Your Future: How to Minimize Taxes and Create Your Legacy

#### LEARNING OBJECTIVES

1) What you need for a solid estate plan. 2) How to save on taxes and be charitable at the same time. 3) Popular ways to leave a legacy at R&E Foundation.\*Course Description In today's uncertain economic environment, creating a solid estate plan can be a challenge. It can be difficult to determine how to manage your assets to save on taxes, protect your loved ones, and support the future of organizations important to you such as the R&E Foundation. Many RSNA members are motivated to "give back" to our field by making a legacy gift to R&E Foundation to help us support the next generation of radiologists. In addition to the comprehensive discussion outlined above, the session will include ample opportunity for Q&A at the end of the session.

#### COURSE DESCRIPTION

In today's uncertain economic environment, creating a solid estate plan can be a challenge. It can be difficult to determine how to manage your assets to save on taxes, protect your loved ones, and support the future of organizations important to you such as the R&E Foundation. Many RSNA members are motivated to "give back" to our field by making a legacy gift to R&E Foundation to help us support the next generation of radiologists. In addition to the comprehensive discussion outlined above, the session will include ample opportunity for Q&A at the end of the session.

#### Sub-Events

#### **T7-RCP28 Planning for Your Future: How to Minimize Taxes and Create Your Legacy**

#### Participants

Lynn Gaumer, JD, Des Moines, IA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T7-RCP28

### Planning for Your Future: How to Minimize Taxes and Create Your Legacy

#### Participants

Lynn Gaumer, JD, Des Moines, IA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CBR08

**Moderator**

### **Participants**

Maxine S. Jochelson, MD, (*Moderator*) Speaker, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CBR08

### Case Based Breast Review: Focus on CEM MRI US

#### Participants

Maxine S. Jochelson, MD, (*Presenter*) Speaker, General Electric Company

#### LEARNING OBJECTIVES

1) Identify the differences in accuracy when using pure anatomic imaging compared to anatomic imaging plus vascular imaging. 2) Demonstrate the best approach to interpreting DBT, US, CEM and breast MRI\*Course Description During this session, the three presenters Drs. Jochelson, Lewin and Bitencourt will lecture on various breast imaging modalities and show clinical examples of cases imaged by Digital Breast Tomosynthesis (DBT), Breast Ultrasound, Contrast Enhanced Mammography (CEM) and MRI to demonstrate interpretive pearls of wisdom, utility of these modalities and limitations of these modalities. This course is important as it will address the pros and cons of breast imaging using anatomic imaging technology vs vascular imaging as well as the best approaches to imaging in various clinical situations.

#### COURSE DESCRIPTION

During this session, the three presenters Drs. Jochelson, Lewin and Bitencourt will lecture on various breast imaging modalities and show clinical examples of cases imaged by Digital Breast Tomosynthesis (DBT), Breast Ultrasound, Contrast Enhanced Mammography (CEM) and MRI to demonstrate interpretive pearls of wisdom, utility of these modalities and limitations of these modalities. This course is important as it will address the pros and cons of breast imaging using anatomic imaging technology vs vascular imaging as well as the best approaches to imaging in various clinical situations.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CBR08

### Case Based Breast Review: Focus on CEM MRI

#### Participants

John Lewin, MD, Guilford, CT (*Presenter*) Officer, Novian Health Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CBR08

### Case Based Breast Review: Focus on CEM Mammography Including Tomosynthesis

#### Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CBR08

### Case-based Review of Breast Modalities

#### Sub-Events

##### T8-CBR08 Moderator

###### Participants

Maxine S. Jochelson, MD, (*Moderator*) Speaker, General Electric Company

##### T8-CBR08 Case Based Breast Review: Focus on CEM MRI US

###### Participants

Maxine S. Jochelson, MD, (*Presenter*) Speaker, General Electric Company

#### LEARNING OBJECTIVES

1) Identify the differences in accuracy when using pure anatomic imaging compared to anatomic imaging plus vascular imaging. 2) Demonstrate the best approach to interpreting DBT, US, CEM and breast MRI\*Course Description During this session, the three presenters Drs. Jochelson, Lewin and Bitencourt will lecture on various breast imaging modalities and show clinical examples of cases imaged by Digital Breast Tomosynthesis (DBT), Breast Ultrasound, Contrast Enhanced Mammography (CEM) and MRI to demonstrate interpretive pearls of wisdom, utility of these modalities and limitations of these modalities. This course is important as it will address the pros and cons of breast imaging using anatomic imaging technology vs vascular imaging as well as the best approaches to imaging in various clinical situations.

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##### T8-CBR08 Case Based Breast Review: Focus on CEM MRI

###### Participants

John Lewin, MD, Guilford, CT (*Presenter*) Officer, Novian Health Inc

##### T8-CBR08 Case Based Breast Review: Focus on CEM Mammography Including Tomosynthesis

###### Participants

Almir Bitencourt, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CCA06

**Moderator**

### **Participants**

Marly Van Assen, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CCA06

**Moderator**

### Participants

Albert Hsiao, MD, PhD, (*Moderator*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CCA06

### AI in Cardiac MRI Pipeline: From Protocol to Classification

#### Participants

Albert Hsiao, MD, PhD, (*Presenter*) Co-founder, Arterys Inc; Shareholder, Arterys Inc; Co-founder, Vektor.AI; Shareholder, Vektor.AI; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, KA Imaging

#### LEARNING OBJECTIVES

1) Identify current opportunities for artificial intelligence (AI) to improve clinical workflows and diagnostic capabilities in cardiac imaging. 2) Apply foundational concepts necessary for evaluation of new AI technologies. 3) Recognize fields of interest for future AI development to improve diagnosis and management of cardiovascular disease.\*Course Description This course will provide practical examples of the daily application of artificial intelligence (AI) technologies to clinical practice of cardiac imaging, including cardiac MRI and CT. We will review the rapid advancement of new technologies that have become necessary components of every day practice and clinical workflows at several institutions, current data supporting their effectiveness, and opportunities ahead for AI and related technologies to improve the diagnosis and management of cardiovascular disease.

#### COURSE DESCRIPTION

This course will provide practical examples of the daily application of artificial intelligence (AI) technologies to clinical practice of cardiac imaging, including cardiac MRI and CT. We will review the rapid advancement of new technologies that have become necessary components of every day practice and clinical workflows at several institutions, current data supporting their effectiveness, and opportunities ahead for AI and related technologies to improve the diagnosis and management of cardiovascular disease.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CCA06

### AI in Cardiac CT: Are We There Yet?

#### Participants

Damini Dey, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CCA06

### Gazing at the Crystal Ball: Risk Prediction With AI and Radiomics in Cardiac Imaging

#### Participants

Carlo N. De Cecco, MD, PhD, Atlanta, GA (*Presenter*) Research Grant, Siemens AG; Consultant, Covanos, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CCA06

### The Future is Here: Artificial Intelligence in Cardiovascular Imaging

#### Sub-Events

#### T8-CCA06 Moderator

##### Participants

Marly Van Assen, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

#### T8-CCA06 Moderator

##### Participants

Albert Hsiao, MD, PhD, (*Moderator*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

#### T8-CCA06 AI in Cardiac MRI Pipeline: From Protocol to Classification

##### Participants

Albert Hsiao, MD, PhD, (*Presenter*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

#### LEARNING OBJECTIVES

1) Identify current opportunities for artificial intelligence (AI) to improve clinical workflows and diagnostic capabilities in cardiac imaging. 2) Apply foundational concepts necessary for evaluation of new AI technologies. 3) Recognize fields of interest for future AI development to improve diagnosis and management of cardiovascular disease.\*Course Description This course will provide practical examples of the daily application of artificial intelligence (AI) technologies to clinical practice of cardiac imaging, including cardiac MRI and CT. We will review the rapid advancement of new technologies that have become necessary components of every day practice and clinical workflows at several institutions, current data supporting their effectiveness, and opportunities ahead for AI and related technologies to improve the diagnosis and management of cardiovascular disease.

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#### T8-CCA06 AI in Cardiac CT: Are We There Yet?

##### Participants

Damini Dey, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### T8-CCA06 Gazing at the Crystal Ball: Risk Prediction With AI and Radiomics in Cardiac Imaging

##### Participants

Carlo N. De Cecco, MD, PhD, Atlanta, GA (*Presenter*) Research Grant, Siemens AG;Consultant, Covanos, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

### Musculoskeletal Emergent Applications

#### Participants

Adnan Sheikh, MD, Vancouver, BC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

**Moderator**

### **Participants**

Savvas Nicolaou, MD, FRCPC, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

### Photon Counting CT Introduction and Neuroradiology Applications

#### Participants

Michael D. Malinzak, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

### Oncological Applications

#### Participants

Myrna C. Godoy, MD, PhD, Houston, TX (*Presenter*) Siemens Healthineers Research Grant

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

### Practical Multi-Energy CT in the ER

#### LEARNING OBJECTIVES

1) Demonstrate proficient understanding of multi-energy CT principles and technical aspects, enabling participants to effectively utilize this advanced imaging technique in emergency medicine. 2) Apply knowledge of multi-energy CT image interpretation and analysis to accurately diagnose and triage emergency conditions, resulting in improved patient care and optimized treatment planning. 3) Collaborate with radiologists and other healthcare professionals in a multidisciplinary approach, leveraging multi-energy CT findings to enhance decision-making, and facilitate seamless communication in emergency scenarios.\*Course Description Course Description:Join us for an engaging educational session on Practical Multi-Energy CT in the ER, where we delve into the powerful applications of this cutting-edge imaging technology in emergency medicine. This course is designed to equip healthcare professionals with the knowledge and skills to harness the full potential of multi-energy CT, enabling them to deliver enhanced patient care and expedite critical decision-making in emergency scenarios.Through a combination of dynamic lectures, interactive discussions, hands-on training, and case-based workshops, participants will gain a comprehensive understanding of multi-energy CT principles, technical aspects, and clinical applications. This course addresses the crucial need for accurate and efficient diagnostic imaging in the emergency room, providing valuable insights into the optimized use of multi-energy CT for prompt and precise diagnosis, treatment planning, and triage.Educational Format:• Engaging lectures led by renowned experts in the field of emergency radiology• Interactive discussions and case-based workshops for collaborative learning• Hands-on training sessions on multi-energy CT scanner operation and image acquisition optimization• Utilization of advanced post-processing techniques and software tools through practical demonstrations• Integration of real-life emergency scenarios for enhanced learning and skill applicationExpected Outcome:By the end of this educational session, participants will have acquired a solid foundation in multi-energy CT imaging, enabling them to:• Understand the principles and technical aspects of multi-energy CT• Identify and differentiate energy levels for specific emergency conditions• Optimize image acquisition parameters for accurate diagnostic imaging• Interpret multi-energy CT images to facilitate prompt and precise diagnoses• Apply advanced post-processing techniques to enhance image analysis• Collaborate effectively with radiologists and other healthcare professionals in emergency management• Overcome challenges and limitations associated with multi-energy CT• Stay updated with the latest advancements in the fieldCourse Structure and Subspecialties:Module 1: Introduction to Multi-Energy CT in the Emergency Room• Understanding the principles and physics of multi-energy CT• Clinical advantages and applications of multi-energy CT in emergency medicine• Role of multi-energy CT in trauma assessment and triageModule 2: Technical Aspects and Image Acquisition• Multi-energy CT scanner technology and workflow• Selection of appropriate energy levels and protocols for different emergency scenarios• Optimization of image acquisition parametersModule 3: Image Interpretation and Diagnosis• Evaluation and interpretation of multi-energy CT images in emergency cases• Identification of acute pathologies and critical findings• Case-based discussions and interactive sessionsModule 4: Advanced Post-Processing Techniques• Utilizing advanced post-processing tools for accurate image analysis• Virtual monoenergetic imaging and material decomposition techniques• 3D visualization and volume rendering in emergency medicineModule 5: Clinical Applications in Specific Emergency Subspecialties• Multi-energy CT in

#### COURSE DESCRIPTION

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to reinforce learningModule 7: Multidisciplinary Approach and Collaborationo Effective communication and collaboration with radiologists and other healthcare professionals in em

#### **Sub-Events**

##### **T8-CER11 Moderator**

Participants

Savvas Nicolaou, MD, FRCPC, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG;Stockholder, Canada Diagnostic Centres

##### **T8-CER11 Photon Counting CT Introduction and Neuroradiology Applications**

Participants

Michael D. Malinzak, MD,PhD, Durham, NC (*Presenter*) Nothing to Disclose

##### **T8-CER11 Oncological Applications**

Participants

Myrna C. Godoy, MD, PhD, Houston, TX (*Presenter*) Siemens Healthineers Research Grant

##### **T8-CER11 Musculoskeletal Emergent Applications**

Participants

Adnan Sheikh, MD, Vancouver, BC (*Presenter*) Nothing to Disclose

##### **T8-CER11 Acute Abdominal Emergencies**

Participants

Lakshmi Ananthakrishnan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CER11

### Acute Abdominal Emergencies

#### Participants

Lakshmi Ananthakrishnan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CGI09

### GI Post-Operative Imaging

#### LEARNING OBJECTIVES

1) Understand the common GI surgical interventions. 2) Be able to identify typical post-surgical imaging findings and complications.\*Course Description This course is designed to be an "all you need to know" course that covers the typical post-surgical findings following common hepatic, pancreatic, bariatric and gastrointestinal surgeries. Topics will be discussed through a multimodality approach with CT, MR, US, and fluoroscopy findings highlighted throughout the session. With continued advances in surgical interventions and institutional variations in surgical technique, radiologists are expected to have a broad understanding of the post-surgical abdomen. Throughout the four didactic lectures, participants should be familiar with common gastrointestinal surgical interventions and the typical post-surgical findings and complications.

#### COURSE DESCRIPTION

This course is designed to be an "all you need to know" course that covers the typical post-surgical findings following common hepatic, pancreatic, bariatric and gastrointestinal surgeries. Topics will be discussed through a multimodality approach with CT, MR, US, and fluoroscopy findings highlighted throughout the session. With continued advances in surgical interventions and institutional variations in surgical technique, radiologists are expected to have a broad understanding of the post-surgical abdomen. Throughout the four didactic lectures, participants should be familiar with common gastrointestinal surgical interventions and the typical post-surgical findings and complications.

#### Sub-Events

##### T8-CGI09 Moderator

Participants

Lauren M. Burke, MD, (*Moderator*) Nothing to Disclose

##### T8-CGI09 Liver

Participants

So Yeon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

##### T8-CGI09 Whipple

Participants

Atif Zaheer, MD, (*Presenter*) Nothing to Disclose

##### T8-CGI09 GI Track

Participants

Kristina Flicek, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### T8-CGI09 Bariatric Surgery

Participants

Lauren M. Burke, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CGI09

**Moderator**

### Participants

Lauren M. Burke, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CGI09

**Liver**

### Participants

So Yeon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CGI09

**Whipple**

### Participants

Atif Zaheer, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CGI09

**GI Track**

### Participants

Kristina Flicek, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CGI09

### Bariatric Surgery

#### Participants

Lauren M. Burke, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Imaging of Sinonasal Tumors

#### Participants

Luke Ledbetter, MD, Los Angeles, CA (*Presenter*) Royalties, RELX

#### LEARNING OBJECTIVES

1) Review the key imaging findings in evaluation of head and neck cancer patients, including at staging, treatment response and surveillance time points. 2) Recognize the important imaging findings that impact clinical management of patients with head and neck cancer. \*Course Description In this "Best of" head and neck imaging session, attendees will hear short talks from experts focusing on the key information the multidisciplinary tumor board (surgeons, radiation oncologists and oncologists) needs to know from the imaging at diagnosis and follow-up of tumors in the head and neck. Speakers will emphasize imaging pearls and important clinical management considerations with which radiologists should be familiar. These talks will be followed by a case-based discussion by a panel of experts in a simulated tumor board session. Sample cases will be presented and discussed by radiologists, a head and neck cancer surgeon and a radiation oncologist. This session offers attendees a real world glimpse into how imaging interpretation impacts decision-making in the clinical management of head and neck cancer patients.

#### COURSE DESCRIPTION

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Imaging of Oropharyngeal Squamous Cell Carcinoma

#### Participants

Kristen L. Baugnon, MD, Brookhaven, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CHN06

### Imaging of Squamous Cell Carcinoma of the Larynx

#### Participants

Hilda E. Stambuk, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Post-Treatment Imaging: NI-RADS

#### Participants

Ashley H. Aiken, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Tumor Board Case Discussion from the Surgeon's Perspective

#### Participants

Mihir Patel, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Tumor Board Case Discussion from the Radiation Oncologist's Perspective

#### Participants

Sue S. Yom, MD, PhD, San Francisco, CA (*Presenter*) Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Merck & Co, Inc; Research Grant, Bristol-Myers Squibb Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

### Head and Neck Cancer: Read Like the Experts and Tumor Board Discussion

#### Sub-Events

#### T8-CHN06 Imaging of Sinonasal Tumors

##### Participants

Luke Ledbetter, MD, Los Angeles, CA (*Presenter*) Royalties, RELX

#### LEARNING OBJECTIVES

1) Review the key imaging findings in evaluation of head and neck cancer patients, including at staging, treatment response and surveillance time points. 2) Recognize the important imaging findings that impact clinical management of patients with head and neck cancer. \*Course Description In this "Best of" head and neck imaging session, attendees will hear short talks from experts focusing on the key information the multidisciplinary tumor board (surgeons, radiation oncologists and oncologists) needs to know from the imaging at diagnosis and follow-up of tumors in the head and neck. Speakers will emphasize imaging pearls and important clinical management considerations with which radiologists should be familiar. These talks will be followed by a case-based discussion by a panel of experts in a simulated tumor board session. Sample cases will be presented and discussed by radiologists, a head and neck cancer surgeon and a radiation oncologist. This session offers attendees a real world glimpse into how imaging interpretation impacts decision-making in the clinical management of head and neck cancer patients.

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#### T8-CHN06 Imaging of Oropharyngeal Squamous Cell Carcinoma

##### Participants

Kristen L. Bagnon, MD, Brookhaven, GA (*Presenter*) Nothing to Disclose

#### T8-CHN06 Imaging of Squamous Cell Carcinoma of the Larynx

##### Participants

Hilda E. Stambuk, MD, New York, NY (*Presenter*) Nothing to Disclose

#### T8-CHN06 Post-Treatment Imaging: NI-RADS

##### Participants

Ashley H. Aiken, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### T8-CHN06 Tumor Board Case Discussion from the Surgeon's Perspective

##### Participants

Mihir Patel, Atlanta, GA (*Presenter*) Nothing to Disclose

#### T8-CHN06 Tumor Board Case Discussion from the Radiation Oncologist's Perspective

##### Participants

Sue S. Yom, MD, PhD, San Francisco, CA (*Presenter*) Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Merck & Co, Inc; Research Grant, Bristol-Myers Squibb Company

#### T8-CHN06 Moderator

##### Participants

Kristen L. Bagnon, MD, Brookhaven, GA (*Moderator*) Nothing to Disclose

#### T8-CHN06 Moderator

##### Participants

Ashley H. Aiken, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

## Abstract Archives of the RSNA, 2023

T8-CHN06

**Moderator**

### Participants

Kristen L. Baugnon, MD, Brookhaven, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CHN06

**Moderator**

### Participants

Ashley H. Aiken, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### MIDRC: Using a Massive Multi-Institutional Open Imaging Data Commons for Machine Learning Research

#### LEARNING OBJECTIVES

1) Become familiar with MIDRC, including how to contribute and how to use its open medical imaging data. 2) Understand the need for appropriate data curation processes and annotation in order to train and test AI algorithms. 3) Realize the potential for biases in AI systems and means with which to mitigate them. 4) Understand the benefit of a sequestered imaging data commons in effectively and efficiently enabling translation of AI algorithms through regulatory for public health.\*Course Description This course will describe the Medical Imaging and Data Resource Center (<https://www.midrc.org/>), the first and only national COVID-19 image repository in the United States, which has collected over 300,000 studies from dozens of sites around the country. MIDRC is a collaborative project between the Radiological Society of North America (RSNA), the American College of Radiology (ACR), and the American Association of Physicists in Medicine (AAPM), funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB). Its underlying technology can support repositories for other diseases. We will describe how you can use its open medical data, and how to contribute new data. We will discuss the challenges and opportunities presented by such a national imaging research repository and review its role in supporting machine learning research.

#### COURSE DESCRIPTION

This course will describe the Medical Imaging and Data Resource Center (<https://www.midrc.org/>), the first and only national COVID-19 image repository in the United States, which has collected over 300,000 studies from dozens of sites around the country. MIDRC is a collaborative project between the Radiological Society of North America (RSNA), the American College of Radiology (ACR), and the American Association of Physicists in Medicine (AAPM), funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB). Its underlying technology can support repositories for other diseases. We will describe how you can use its open medical data, and how to contribute new data. We will discuss the challenges and opportunities presented by such a national imaging research repository and review its role in supporting machine learning research.

#### Sub-Events

##### T8-CIN11 Moderator

###### Participants

Maryellen Giger, PhD, Chicago, IL (*Moderator*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

##### T8-CIN11 MIDRC Overview and Long COVID

###### Participants

Curtis Langlotz, PhD, Menlo Park, CA (*Presenter*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

##### T8-CIN11 Contributing Data, MIDRC as a Data Source, Cohort Building, and Annotations

###### Participants

Carol C. Wu, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### T8-CIN11 Algorithmic Approaches to Reduce Bias

###### Participants

Akshay Chaudhari, PhD, Stanford, CA (*Presenter*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research Consultant, Subtle Medical, Inc

##### T8-CIN11 Multi-Omics Research Through Interoperability as a User

###### Participants

Heather Whitney, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

##### T8-CIN11 Moderator

###### Participants

Curtis Langlotz, PhD, Menlo Park, CA (*Moderator*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

##### T8-CIN11 Introduction

###### Participants

Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights,



Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CIN11

### Introduction

#### Participants

Maryellen Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc; Royalties, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Co-founder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Royalties, General Electric Company; Royalties, Median Technologies; Royalties, Riverain Technologies, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### Moderator

#### Participants

Curtis Langlotz, PhD, Menlo Park, CA (*Moderator*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CIN11

**Moderator**

### **Participants**

Maryellen Giger, PhD, Chicago, IL (*Moderator*) Stockholder, Hologic, Inc; Royalties, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Co-founder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Royalties, General Electric Company; Royalties, Median Technologies; Royalties, Riverain Technologies, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### MIDRC Overview and Long COVID

#### Participants

Curtis Langlotz, PhD, Menlo Park, CA (*Presenter*) Stockholder, whiterabbit.ai; Advisor, whiterabbit.ai; Stockholder, Galileo CDS, Inc; Advisor, Galileo CDS, Inc; Stockholder, Bunker Hill, Inc; Board of Directors, Bunker Hill, Inc; Stockholder, Sirona Medical, Inc; Advisor, Sirona Medical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### Contributing Data, MIDRC as a Data Source, Cohort Building, and Annotations

#### Participants

Carol C. Wu, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### Algorithmic Approaches to Reduce Bias

#### Participants

Akshay Chaudhari, PhD, Stanford, CA (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Research Consultant, Subtle Medical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIN11

### Multi-Omics Research Through Interoperability as a User

#### Participants

Heather Whitney, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CIR08

### Interventional Radiology Residency

#### Sub-Events

#### **T8-CIR08 Getting Certified in IR by the ABR**

##### Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

#### LEARNING OBJECTIVES

1) Review the current options to obtain IR/DR certification. 2) Understand controversies in the ESIR pathway, the potential merits of additional post-residency training options, and the T32 pathway for research during residency.\*Course Description IR/DR became a primary specialty in 2012 and there are several options for candidates to achieve ABR certification. The purpose of this course is to provide an update on the status of the IR/DR training pathways and highlight current challenges and opportunities.

#### COURSE DESCRIPTION

IR/DR became a primary specialty in 2012 and there are several options for candidates to achieve ABR certification. The purpose of this course is to provide an update on the status of the IR/DR training pathways and highlight current challenges and opportunities.

#### **T8-CIR08 Moderator**

##### Participants

Anne M. Covey, MD, New York, NY (*Moderator*) Stockholder, Amgen Inc

#### **T8-CIR08 6 Years of IR Residency - Where do we stand?**

##### Participants

John Kaufman, MD, Portland, OR (*Presenter*) Consultant, Argon Medical Devices, Inc;Consultant, OptiMed Technologies, Inc;Consultant, Shape Medical Systems, Inc;Co-owner, AUXETICS, INC;Co-owner, Hatch Medical LLC;Co-owner, VuMedi, Inc;Co-owner, EndoShape, Inc;Research Grant, Cook Group Incorporated;Royalties, Reed Elsevier;Editor, Reed Elsevier ;;

#### **T8-CIR08 ESIR and the Independent IR Residency - The Case Against**

##### Participants

Douglas Silin, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### **T8-CIR08 ESIR and the Independent IR Residency - The Case In Favor**

##### Participants

Jennifer Gould, MD, Saint Louis, MO (*Presenter*) Spouse, Consultant, Entellus Medical, Inc;Spouse, Speaker, Entellus Medical, Inc;Spouse, Researcher, Entellus Medical, Inc;Spouse, Investor, Frontenac Surgery Center;Spouse, Investor, Twin Cities Surgery Center;Royalties, Reed Elsevier

#### **T8-CIR08 A Case for the IO Fellowship**

##### Participants

Michael Soulen, MD, Lafayette Hill, PA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd;Consultant, Guerbet SA;Consultant, AstraZeneca PLC;Research support, Guerbet SA;Research support, Sirtex Medical Ltd;Research support, Pfizer Inc

#### **T8-CIR08 T32 Track and Research during IR Residency - Challenges and Opportunities**

##### Participants

Terence Gade, MD, PhD, Philadelphia, PA (*Presenter*) Scientific Advisory Board, TriSalus Life Sciences;Research Consultant, Instylla, Inc;Research Grant, Instylla, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIR08

### Getting Certified in IR by the ABR

#### Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

#### LEARNING OBJECTIVES

1) Review the current options to obtain IR/DR certification. 2) Understand controversies in the ESIR pathway, the potential merits of additional post-residency training options, and the T32 pathway for research during residency.\*Course Description IR/DR became a primary specialty in 2012 and there are several options for candidates to achieve ABR certification. The purpose of this course is to provide an update on the status of the IR/DR training pathways and highlight current challenges and opportunities.

#### COURSE DESCRIPTION

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## Abstract Archives of the RSNA, 2023

T8-CIR08

**Moderator**

### **Participants**

Anne M. Covey, MD, New York, NY (*Moderator*) Stockholder, Amgen Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIR08

### 6 Years of IR Residency - Where do we stand?

#### Participants

John Kaufman, MD, Portland, OR (*Presenter*) Consultant, Argon Medical Devices, Inc; Consultant, OptiMed Technologies, Inc; Consultant, Shape Medical Systems, Inc; Co-owner, AUXETICS, INC; Co-owner, Hatch Medical LLC; Co-owner, VuMedi, Inc; Co-owner, EndoShape, Inc; Research Grant, Cook Group Incorporated; Royalties, Reed Elsevier; Editor, Reed Elsevier ;;

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## Abstract Archives of the RSNA, 2023

T8-CIR08

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Douglas Silin, MD, New Haven, CT (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

T8-CIR08

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#### Participants

Jennifer Gould, MD, Saint Louis, MO (*Presenter*) Spouse, Consultant, Entellus Medical, Inc; Spouse, Speaker, Entellus Medical, Inc; Spouse, Researcher, Entellus Medical, Inc; Spouse, Investor, Frontenac Surgery Center; Spouse, Investor, Twin Cities Surgery Center; Royalties, Reed Elsevier

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## Abstract Archives of the RSNA, 2023

T8-CIR08

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Michael Soulen, MD, Lafayette Hill, PA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Guerbet SA; Consultant, AstraZeneca PLC; Research support, Guerbet SA; Research support, Sirtex Medical Ltd; Research support, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CIR08

### T32 Track and Research during IR Residency - Challenges and Opportunities

#### Participants

Terence Gade, MD, PhD, Philadelphia, PA (*Presenter*) Scientific Advisory Board, TriSalus Life Sciences; Research Consultant, Instylla, Inc; Research Grant, Instylla, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CMK06

### Ankle: The Common, Uncommon and Easily Overlooked

#### Sub-Events

##### T8-CMK06 Moderator

###### Participants

Reto Sutter, MD, Zurich, Switzerland (*Moderator*) Nothing to Disclose

##### T8-CMK06 Disease Mimickers and Variants

###### Participants

Reto Sutter, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify common abnormalities and normal variants of ankle imaging. 2) Describe easily overlooked features of ankle pathologies and how to recognize them on imaging.\*Course Description Imaging the ankle can be easy and difficult at the same time. Some pathologies are very common and are easily recognized, while others are uncommon or easily overlooked. This course will shine spotlights on various aspects of ankle imaging, including common abnormalities and normal variants as well as less common and easily overlooked pathologies that are important to keep in mind and should not be missed.

#### COURSE DESCRIPTION

Imaging the ankle can be easy and difficult at the same time. Some pathologies are very common and are easily recognized, while others are uncommon or easily overlooked. This course will shine spotlights on various aspects of ankle imaging, including common abnormalities and normal variants as well as less common and easily overlooked pathologies that are important to keep in mind and should not be missed.

##### T8-CMK06 Manifestations of Arthritis

###### Participants

Girish Gandikota, MD, (*Presenter*) Nothing to Disclose

##### T8-CMK06 Nerve Entrapment of the Foot

###### Participants

Anne Cotten, MD, (*Presenter*) Nothing to Disclose

##### T8-CMK06 Chopart and Lisfranc Joint

###### Participants

Jenny T. Bencardino, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### T8-CMK06 Ultrasound

###### Participants

Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Presenter*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOTEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

**Moderator**

### **Participants**

Reto Sutter, MD, Zurich, Switzerland (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

### Disease Mimickers and Variants

#### Participants

Reto Sutter, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify common abnormalities and normal variants of ankle imaging. 2) Describe easily overlooked features of ankle pathologies and how to recognize them on imaging.\*Course Description Imaging the ankle can be easy and difficult at the same time. Some pathologies are very common and are easily recognized, while others are uncommon or easily overlooked. This course will shine spotlights on various aspects of ankle imaging, including common abnormalities and normal variants as well as less common and easily overlooked pathologies that are important to keep in mind and should not be missed.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

### Manifestations of Arthritis

#### Participants

Girish Gandikota, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

### Nerve Entrapment of the Foot

#### Participants

Anne Cotten, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

### Chopart and Lisfranc Joint

#### Participants

Jenny T. Bencardino, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMK06

### Ultrasound

#### Participants

Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Presenter*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOTEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSD

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMS08

### Viral and Bacterial Induced Malignancies: Multimodality Imaging Spectrum

#### Participants

Venkata Katabathina, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CMS08

### Chest/Cardiac Infection induced Malignancies

#### Participants

Jonathan Revels, DO, Albuquerque, NM (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMS08

### Infection induced Malignancy after Transplant

#### Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMS08

### Infection Induced Malignancy in Abdomen

#### Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMS08

**Moderator**

### Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CMS08

### Infection Induced Tumors and Tumorlike Conditions Multimodality Imaging and Complications

#### LEARNING OBJECTIVES

1) Discuss the increased risk of cancer in transplant patients. 2) Review infection-induced malignancies in the chest, abdomen, and pelvis. 3) Discuss the spectrum of imaging appearances of post-transplant lymphoproliferative disease in the abdomen/pelvis. 4) Review common tumor mimics in the abdomen and pelvis.\*Course Description Lecturers discuss infection-induced malignancies infectious and malignant complications after transplant, and tumor mimics in body imaging using illustrative cases and teaching points.

#### COURSE DESCRIPTION

Lecturers discuss infection-induced malignancies infectious and malignant complications after transplant, and tumor mimics in body imaging using illustrative cases and teaching points.

#### Sub-Events

##### **T8-CMS08 Moderator**

Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

##### **T8-CMS08 Infection Induced Malignancy in Abdomen**

Participants

Vincent M. Mellnick, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### **T8-CMS08 Infection induced Malignancy after Transplant**

Participants

Meghan G. Lubner, MD, Madison, WI (*Presenter*) Spouse, Consultant, Elephas Bio

##### **T8-CMS08 Chest/Cardiac Infection induced Malignancies**

Participants

Jonathan Revels, DO, Albuquerque, NM (*Presenter*) Nothing to Disclose

##### **T8-CMS08 Viral and Bacterial Induced Malignancies: Multimodality Imaging Spectrum**

Participants

Venkata Katabathina, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CNPM08

### Culture as Learning Health System Infrastructure

#### Participants

Alexandra Vinson, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CNPM08

**Moderator**

### **Participants**

Jeffrey Jarvik, MD,MPH, Seattle, WA (*Moderator*) Royalties, Mannheim Media;Co-editor, Mannheim Media;Travel support, General Electric Company;Author with royalties, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CNPM08

**Moderator**

### Participants

Marta Heilbrun, MS, Murray, UT (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CNPM08

### Fundamentals of Learning Health Systems: Special Considerations for Radiology

#### Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc

#### LEARNING OBJECTIVES

1) Review fundamentals of learning healthcare systems and special considerations for radiology. 2) Discuss the strengths and limitations of leveraging your organizational electronic medical record for clinical operational quality improvement initiatives and clinical research studies. 3) Introduce the concept of culture as learning healthcare system infrastructure and why buy-in from teams and key stakeholders is critical for successful implementation.\*Course Description Radiologists have little exposure to the ideas that are fundamental to learning healthcare systems (LHS). This course will introduce radiologists to key concepts underlying LHS, and explain why LHS are important to radiologists and their health systems, clinicians, patients, and researchers. We will focus on special considerations for radiology LHS. We will focus on leveraging the electronic medical record and why addressing the culture of the system, by getting a commitment from teams and individuals to integrate the LHS framework into routine care processes, is important.

#### COURSE DESCRIPTION

Radiologists have little exposure to the ideas that are fundamental to learning healthcare systems (LHS). This course will introduce radiologists to key concepts underlying LHS, and explain why LHS are important to radiologists and their health systems, clinicians, patients, and researchers. We will focus on special considerations for radiology LHS. We will focus on leveraging the electronic medical record and why addressing the culture of the system, by getting a commitment from teams and individuals to integrate the LHS framework into routine care processes, is important.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CNPM08

### Leveraging Your Organizational Electronic Medical Record

#### Participants

Sean Mooney, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CNPM08

### **Nuts and Bolts: Essentials of Building a Radiology Learning Healthcare System (Sponsored by the RSNA Research Development Committee)**

#### **Sub-Events**

##### **T8-CNPM08 Moderator**

###### Participants

Jeffrey Jarvik, MD,MPH, Seattle, WA (*Moderator*) Royalties, Mannheim Media;Co-editor, Mannheim Media;Travel support, General Electric Company;Author with royalties, Wolters Kluwer nv

##### **T8-CNPM08 Moderator**

###### Participants

Marta Heilbrun, MS, Murray, UT (*Moderator*) Nothing to Disclose

##### **T8-CNPM08 Fundamentals of Learning Health Systems: Special Considerations for Radiology**

###### Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc

#### **LEARNING OBJECTIVES**

1) Review fundamentals of learning healthcare systems and special considerations for radiology. 2) Discuss the strengths and limitations of leveraging your organizational electronic medical record for clinical operational quality improvement initiatives and clinical research studies. 3) Introduce the concept of culture as learning healthcare system infrastructure and why buy-in from teams and key stakeholders is critical for successful implementation.\*Course Description Radiologists have little exposure to the ideas that are fundamental to learning healthcare systems (LHS). This course will introduce radiologists to key concepts underlying LHS, and explain why LHS are important to radiologists and their health systems, clinicians, patients, and researchers. We will focus on special considerations for radiology LHS. We will focus on leveraging the electronic medical record and why addressing the culture of the system, by getting a commitment from teams and individuals to integrate the LHS framework into routine care processes, is important.

#### **COURSE DESCRIPTION**

Radiologists have little exposure to the ideas that are fundamental to learning healthcare systems (LHS). This course will introduce radiologists to key concepts underlying LHS, and explain why LHS are important to radiologists and their health systems, clinicians, patients, and researchers. We will focus on special considerations for radiology LHS. We will focus on leveraging the electronic medical record and why addressing the culture of the system, by getting a commitment from teams and individuals to integrate the LHS framework into routine care processes, is important.

##### **T8-CNPM08 Leveraging Your Organizational Electronic Medical Record**

###### Participants

Sean Mooney, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

##### **T8-CNPM08 Culture as Learning Health System Infrastructure**

###### Participants

Alexandra Vinson, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPD03

**Moderator**

### Participants

Lisa J. States, MD, Plymouth Mtng, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPD03

### Marbles in the Belly: Spectrum of Gynecologic Tumors in the Pediatric Population

#### Participants

Domen Plut, MD, Ljubljana, Slovenia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPD03

### Is It A Tumor? Pediatric Body and Skeletal Neoplasms Made Easy

#### LEARNING OBJECTIVES

1) List the common and uncommon solid and cystic focal liver lesions that occur in children. 2) Recognize the key imaging features that enable differentiation of pediatric gynecological tumors. 3) Identify imaging features of pediatric bone lesions requiring biopsy.\*Course Description This lecture-based session will provide learners with an in depth understanding of the differential diagnosis of tumors that occur in children with a focus on lesions found in the liver, pediatric female pelvis, and bones. Updates in diagnostic tools, protocols and techniques will be provided for each topic. After this session, the participant will be able to formulate a focused differential and recommend an approach to diagnosis, as well as be able to update current protocols to create a state-of-the art practice for pediatric patients.

#### COURSE DESCRIPTION

This lecture-based session will provide learners with an in depth understanding of the differential diagnosis of tumors that occur in children with a focus on lesions found in the liver, pediatric female pelvis, and bones. Updates in diagnostic tools, protocols and techniques will be provided for each topic. After this session, the participant will be able to formulate a focused differential and recommend an approach to diagnosis, as well as be able to update current protocols to create a state-of-the art practice for pediatric patients.

#### Sub-Events

##### T8-CPD03 Moderator

Participants

Lisa J. States, MD, Plymouth Mtng, PA (*Moderator*) Nothing to Disclose

##### T8-CPD03 Marbles in the Belly: Spectrum of Gynecologic Tumors in the Pediatric Population

Participants

Domen Plut, MD, Ljubljana, Slovenia (*Presenter*) Nothing to Disclose

##### T8-CPD03 Diagnosing Pediatric Liver Lesions: Role of MRI in Problem-solving

Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

##### T8-CPD03 Bone Tumors of the Child: When Tumor is the Rumor, Tissue is the Issue

Participants

Ranu Shailam, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPD03

### Diagnosing Pediatric Liver Lesions: Role of MRI in Problem-solving

#### Participants

Jonathan Dillman, MSc, (*Presenter*) Research Grant, Perspectum Ltd; Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation; Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Motilent Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPD03

**Bone Tumors of the Child: When Tumor is the Rumor, Tissue is the Issue**

### Participants

Ranu Shailam, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CPH05

### VCT in Service of Device Assessment

#### Participants

Aldo Badano, PhD, Silver Spring, MD (*Presenter*) Research Grant, Barco nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPH05

### VCT and Its Role in Radiology

#### Participants

Ehsan Samei, PhD, MEng, Durham, NC (*Presenter*) Research Grant, General Electric Company; Advisory Board, General Electric Company; Research Grant, Siemens AG; Advisory Board, Siemens AG; Advisory Board, medInt Holdings, LLC; Advisory Board, Metis Health Analytics; Research Consultant, Nanox Imaging Ltd; Royalties, General Electric Company; Royalties, medInt Holdings, LLC; Royalties, 12 Sigma Technologies; Royalties, Mirion Technologies, Inc; Royalties, Cambridge University Press; Royalties, John Wiley & Sons, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPH05

### VCT in Service of Clinical Practice

#### Participants

Hilde Bosmans, PhD, Leuven, Belgium (*Presenter*) Stockholder, Qaelum NV; Research Grant, Siemens AG; Research Grant, General Electric Company

#### LEARNING OBJECTIVES

1) Understand the role of virtual trials in medicine and in radiology. 2) Understand the components of virtual imaging trials. 3) Understand the research, clinical, and regulatory potentials of virtual trials.\*Course Description The complexity and diversity of medical imaging technologies have continued to accelerate, outpacing our ability to optimize their use. This has become a significant challenge across the spectra of scientific inquires, product designs, and clinical applications. New imaging technology has been traditionally evaluated through clinical trials. However, such trials are often not feasible or even definitive due to ethical limitations, expense, time requirements, difficulty in accruing enough subjects - especially with low prevalence conditions, or the fundamental lack of ground truth. Virtual Clinical Trials (VCT) provide a new paradigm to assess the impact of medical imaging innovations on patient care. VCTs offer a new disease-known approach to conduct medical trials that can be clinically relevant, timely, and accurate while reflecting the variabilities of human subjects and disease, as well as the complexities of technologies, providing answers that would otherwise be impractical to obtain or simply unattainable. A VCT consists of 1) realistic populations of computational patients spanning ages and a range of phenotypical characteristics including sex and race with realistic models of disease, 2) detailed models of clinical imaging systems, and 3) computational models of the image interpretation processes. This session offers a summary of VCT methods and processes in the field of radiology and highlights applications in clinical practice and in the regulatory assessment of imaging products.

#### COURSE DESCRIPTION

The complexity and diversity of medical imaging technologies have continued to accelerate, outpacing our ability to optimize their use. This has become a significant challenge across the spectra of scientific inquires, product designs, and clinical applications. New imaging technology has been traditionally evaluated through clinical trials. However, such trials are often not feasible or even definitive due to ethical limitations, expense, time requirements, difficulty in accruing enough subjects - especially with low prevalence conditions, or the fundamental lack of ground truth. Virtual Clinical Trials (VCT) provide a new paradigm to assess the impact of medical imaging innovations on patient care. VCTs offer a new disease-known approach to conduct medical trials that can be clinically relevant, timely, and accurate while reflecting the variabilities of human subjects and disease, as well as the complexities of technologies, providing answers that would otherwise be impractical to obtain or simply unattainable. A VCT consists of 1) realistic populations of computational patients spanning ages and a range of phenotypical characteristics including sex and race with realistic models of disease, 2) detailed models of clinical imaging systems, and 3) computational models of the image interpretation processes. This session offers a summary of VCT methods and processes in the field of radiology and highlights applications in clinical practice and in the regulatory assessment of imaging products.

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## Abstract Archives of the RSNA, 2023

T8-CPH05

### Moderator

#### Participants

Ehsan Samei, PhD, MEng, Durham, NC (*Moderator*) Research Grant, General Electric Company; Advisory Board, General Electric Company; Research Grant, Siemens AG; Advisory Board, Siemens AG; Advisory Board, medInt Holdings, LLC; Advisory Board, Metis Health Analytics; Research Consultant, Nanox Imaging Ltd; Royalties, General Electric Company; Royalties, medInt Holdings, LLC; Royalties, 12 Sigma Technologies; Royalties, Mirion Technologies, Inc; Royalties, Cambridge University Press; Royalties, John Wiley & Sons, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CPH05

### Virtual Clinical Trial

#### Sub-Events

#### T8-CPH05 Moderator

##### Participants

Ehsan Samei, PhD, MEng, Durham, NC (*Moderator*) Research Grant, General Electric Company; Advisory Board, General Electric Company; Research Grant, Siemens AG; Advisory Board, Siemens AG; Advisory Board, medInt Holdings, LLC; Advisory Board, Metis Health Analytics; Research Consultant, Nanox Imaging Ltd; Royalties, General Electric Company; Royalties, medInt Holdings, LLC; Royalties, 12 Sigma Technologies; Royalties, Mirion Technologies, Inc; Royalties, Cambridge University Press; Royalties, John Wiley & Sons, Inc

#### T8-CPH05 VCT in Service of Clinical Practice

##### Participants

Hilde Bosmans, PhD, Leuven, Belgium (*Presenter*) Stockholder, Qaelum NV; Research Grant, Siemens AG; Research Grant, General Electric Company

#### LEARNING OBJECTIVES

1) Understand the role of virtual trials in medicine and in radiology. 2) Understand the components of virtual imaging trials. 3) Understand the research, clinical, and regulatory potentials of virtual trials. \*Course Description The complexity and diversity of medical imaging technologies have continued to accelerate, outpacing our ability to optimize their use. This has become a significant challenge across the spectra of scientific inquires, product designs, and clinical applications. New imaging technology has been traditionally evaluated through clinical trials. However, such trials are often not feasible or even definitive due to ethical limitations, expense, time requirements, difficulty in accruing enough subjects - especially with low prevalence conditions, or the fundamental lack of ground truth. Virtual Clinical Trials (VCT) provide a new paradigm to assess the impact of medical imaging innovations on patient care. VCTs offer a new disease-known approach to conduct medical trials that can be clinically relevant, timely, and accurate while reflecting the variabilities of human subjects and disease, as well as the complexities of technologies, providing answers that would otherwise be impractical to obtain or simply unattainable. A VCT consists of 1) realistic populations of computational patients spanning ages and a range of phenotypical characteristics including sex and race with realistic models of disease, 2) detailed models of clinical imaging systems, and 3) computational models of the image interpretation processes. This session offers a summary of VCT methods and processes in the field of radiology and highlights applications in clinical practice and in the regulatory assessment of imaging products.

#### COURSE DESCRIPTION

The complexity and diversity of medical imaging technologies have continued to accelerate, outpacing our ability to optimize their use. This has become a significant challenge across the spectra of scientific inquires, product designs, and clinical applications. New imaging technology has been traditionally evaluated through clinical trials. However, such trials are often not feasible or even definitive due to ethical limitations, expense, time requirements, difficulty in accruing enough subjects - especially with low prevalence conditions, or the fundamental lack of ground truth. Virtual Clinical Trials (VCT) provide a new paradigm to assess the impact of medical imaging innovations on patient care. VCTs offer a new disease-known approach to conduct medical trials that can be clinically relevant, timely, and accurate while reflecting the variabilities of human subjects and disease, as well as the complexities of technologies, providing answers that would otherwise be impractical to obtain or simply unattainable. A VCT consists of 1) realistic populations of computational patients spanning ages and a range of phenotypical characteristics including sex and race with realistic models of disease, 2) detailed models of clinical imaging systems, and 3) computational models of the image interpretation processes. This session offers a summary of VCT methods and processes in the field of radiology and highlights applications in clinical practice and in the regulatory assessment of imaging products.

#### T8-CPH05 VCT in Service of Device Assessment

##### Participants

Aldo Badano, PhD, Silver Spring, MD (*Presenter*) Research Grant, Barco nv

#### T8-CPH05 VCT and Its Role in Radiology

##### Participants

Ehsan Samei, PhD, MEng, Durham, NC (*Presenter*) Research Grant, General Electric Company; Advisory Board, General Electric Company; Research Grant, Siemens AG; Advisory Board, Siemens AG; Advisory Board, medInt Holdings, LLC; Advisory Board, Metis Health Analytics; Research Consultant, Nanox Imaging Ltd; Royalties, General Electric Company; Royalties, medInt Holdings, LLC; Royalties, 12 Sigma Technologies; Royalties, Mirion Technologies, Inc; Royalties, Cambridge University Press; Royalties, John Wiley & Sons, Inc

## Abstract Archives of the RSNA, 2023

T8-CRO01

### Pancreatic Cancer Case Based Multidisciplinary Review

#### Participants

Daniel King, MD, PhD, Lake Success, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CRO01

### Pancreatic Cancer Case Based Multidisciplinary Review

#### Participants

Spencer C. Behr, MD, San Francisco, CA (*Presenter*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CRO01

**Moderator**

### Participants

Ann Raldow, MD, MPH, Los Angeles, CA (*Moderator*) Consultant, ViewRay, Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-CRO01

### Pancreatic Cancer Case Based Multidisciplinary Review

#### Participants

Katelyn Atkins, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating pancreatic cancer. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description This comprehensive course aims to provide attendees with a multidisciplinary understanding of pancreatic cancer diagnosis and management. Through interactive discussions, expert opinions, and case studies, participants will gain valuable insights into the integration of various disciplines in the treatment of this challenging disease. The course will focus on the critical role of imaging findings, their impact on staging and treatment decisions, and the specific information that should be included in reports to guide management.

#### COURSE DESCRIPTION

This comprehensive course aims to provide attendees with a multidisciplinary understanding of pancreatic cancer diagnosis and management. Through interactive discussions, expert opinions, and case studies, participants will gain valuable insights into the integration of various disciplines in the treatment of this challenging disease. The course will focus on the critical role of imaging findings, their impact on staging and treatment decisions, and the specific information that should be included in reports to guide management.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CRO01

### Pancreatic Cancer Case Based Multidisciplinary Review

#### Sub-Events

#### T8-CRO01 Moderator

##### Participants

Ann Raldow, MD, MPH, Los Angeles, CA (*Moderator*) Consultant, ViewRay, Inc

#### T8-CRO01 Pancreatic Cancer Case Based Multidisciplinary Review

##### Participants

Katelyn Atkins, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Expose the attendees to multidisciplinary discussion when treating pancreatic cancer. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly affect prognosis and management.\*Course Description This comprehensive course aims to provide attendees with a multidisciplinary understanding of pancreatic cancer diagnosis and management. Through interactive discussions, expert opinions, and case studies, participants will gain valuable insights into the integration of various disciplines in the treatment of this challenging disease. The course will focus on the critical role of imaging findings, their impact on staging and treatment decisions, and the specific information that should be included in reports to guide management.

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This comprehensive course aims to provide attendees with a multidisciplinary understanding of pancreatic cancer diagnosis and management. Through interactive discussions, expert opinions, and case studies, participants will gain valuable insights into the integration of various disciplines in the treatment of this challenging disease. The course will focus on the critical role of imaging findings, their impact on staging and treatment decisions, and the specific information that should be included in reports to guide management.

#### T8-CRO01 Pancreatic Cancer Case Based Multidisciplinary Review

##### Participants

Spencer C. Behr, MD, San Francisco, CA (*Presenter*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo

#### T8-CRO01 Pancreatic Cancer Case Based Multidisciplinary Review

##### Participants

Danielle DePeralta, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

#### T8-CRO01 Pancreatic Cancer Case Based Multidisciplinary Review

##### Participants

Daniel King, MD, PhD, Lake Success, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-CRO01

### Pancreatic Cancer Case Based Multidisciplinary Review

#### Participants

Danielle DePeralta, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

### Vice Chair of DEI? What does that Mean? (Sponsored by the RSNA Committee on Diversity, Equity & Inclusion)

#### LEARNING OBJECTIVES

1) Discuss selection criteria for DEI leaders. 2) Share strategies for Departmental and Institutional Support. 3) Discuss metrics to assess the success and impact of your DEI leader and program. 4) Share early experiences of DEI leaders.\*Course Description As the position of Vice Chair of DEI is a relatively new position in leadership of Radiology Departments, the session will offer information and guidance on how to craft this position to reflect the needs of your individual Departments.

#### COURSE DESCRIPTION

As the position of Vice Chair of DEI is a relatively new position in leadership of Radiology Departments, the session will offer information and guidance on how to craft this position to reflect the needs of your individual Departments.

#### Sub-Events

##### **T8-RCP27 Moderator**

Participants

Jinel A. Scott, MD, Brooklyn, NY (*Moderator*) Nothing to Disclose

##### **T8-RCP27 Moderator**

Participants

Maureen Kohi, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

##### **T8-RCP27 Selection Criteria for DEI Vice Chair/Director**

Participants

Reed Omary, MD, MS, (*Presenter*) Nothing to Disclose

##### **T8-RCP27 Getting Departmental Buy In**

Participants

Kemi T. Babagbemi, MD, New York, NY (*Presenter*) Author, Reed Elsevier

##### **T8-RCP27 Key Metrics (What Does Success Look Like?)**

Participants

Marques Bradshaw, MD, MS, Nashville, TN (*Presenter*) Nothing to Disclose

##### **T8-RCP27 Early Experiences of DEI Vice Chairs (What Works, What Doesn't?)**

Participants

Gloria Salazar, MD, Chapel Hill, NC (*Presenter*) Consultant, Speakers Bureau, Medtronic plc; Consultant, Boston Scientific Corporation; Speakers Bureau, Boston Scientific Corporation; Speakers Bureau, Cook Group Incorporated; Consultant, Avail Medsystems, Inc; Consultant, Mentice AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

**Moderator**

### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

**Moderator**

### Participants

Maureen Kohi, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

### Selection Criteria for DEI Vice Chair/Director

#### Participants

Reed Omary, MD, MS, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

### Getting Departmental Buy In

#### Participants

Kemi T. Babagbemi, MD, New York, NY (*Presenter*) Author, Reed Elsevier

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

T8-RCP27

### Key Metrics (What Does Success Look Like?)

#### Participants

Marques Bradshaw, MD, MS, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T8-RCP27

### Early Experiences of DEI Vice Chairs (What Works, What Doesn't?)

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Gloria Salazar, MD, Chapel Hill, NC (*Presenter*) Consultant, Speakers Bureau, Medtronic plc; Consultant, Boston Scientific Corporation; Speakers Bureau, Boston Scientific Corporation; Speakers Bureau, Cook Group Incorporated; Consultant, Avail Medsystems, Inc; Consultant, Mentice AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CBR09

**Moderator**

### **Participants**

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Moderator*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CBR09

### Management of Elevated Risk Breast Lesions: European View

#### Participants

Husain Sattar, MD, BA, Chicago, IL (*Presenter*) Nothing to Disclose

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Presenter*) Consultant, Bayer AG

#### LEARNING OBJECTIVES

1) Gain an understanding of the nature of high risk breast lesions. 2) Appreciate the differing strategies to manage these lesions from an international perspective.\*Course Description This course will review the management of high risk breast lesions, which are diagnosed through breast core needle biopsy. High risk lesions are a heterogeneous group of pathologies which, while not malignant, are associated with malignancy, either synchronous or metachronous. This series of three lectures will discuss the challenges in diagnosing these lesions and the differing management approaches in the USA and Europe.

#### COURSE DESCRIPTION

This course will review the management of high risk breast lesions, which are diagnosed through breast core needle biopsy. High risk lesions are a heterogeneous group of pathologies which, while not malignant, are associated with malignancy, either synchronous or metachronous. This series of three lectures will discuss the challenges in diagnosing these lesions and the differing management approaches in the USA and Europe.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CBR09

### Management of Elevated Risk Breast Lesions: USA View

#### Participants

Peter Eby, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CBR09

### Management of Elevated Risk Breast Lesions: Lessons Learned from Pathology

#### Participants

Husain Sattar, MD, BA, Chicago, IL (*Presenter*) Nothing to Disclose

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Presenter*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CBR09

### Management of Elevated Risk Breast Lesions

#### Sub-Events

#### W1-CBR09 Moderator

##### Participants

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Moderator*) Consultant, Bayer AG

#### W1-CBR09 Management of Elevated Risk Breast Lesions: European View

##### Participants

Husain Sattar, MD, BA, Chicago, IL (*Presenter*) Nothing to Disclose

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Presenter*) Consultant, Bayer AG

#### LEARNING OBJECTIVES

1) Gain an understanding of the nature of high risk breast lesions. 2) Appreciate the differing strategies to manage these lesions from an international perspective.\*Course Description This course will review the management of high risk breast lesions, which are diagnosed through breast core needle biopsy. High risk lesions are a heterogeneous group of pathologies which, while not malignant, are associated with malignancy, either synchronous or metachronous. This series of three lectures will discuss the challenges in diagnosing these lesions and the differing management approaches in the USA and Europe.

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#### W1-CBR09 Management of Elevated Risk Breast Lesions: USA View

##### Participants

Peter Eby, MD, Seattle, WA (*Presenter*) Nothing to Disclose

#### W1-CBR09 Management of Elevated Risk Breast Lesions: Lessons Learned from Pathology

##### Participants

Husain Sattar, MD, BA, Chicago, IL (*Presenter*) Nothing to Disclose

Sarah J. Vinnicombe, FRCR, MRCP, Cheltenham, United Kingdom (*Presenter*) Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCA08

**Moderator**

### Participants

Amar B. Shah, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CCA08

**Moderator**

### **Participants**

Michael F. Morris, MD, Paradise Valley, AZ (*Moderator*) Educator, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCA08

### Efficient Cardiac CT Protocols for High Throughput

#### Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG; Consultant, Koninklijke Philips NV; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCA08

### Virtual or Live 3D Lab: The Solution to all Your Problems

#### Participants

Michael F. Morris, MD, Paradise Valley, AZ (*Presenter*) Educator, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCA08

### Cardiac Imaging in Private Practice: Maximizing Efficiency with Quality

#### LEARNING OBJECTIVES

1) Understand how CT protocols can drive output. 2) Explore how blending imaging modalities in cardiovascular imaging can provide customized and optimized care to the patient. 3) Discuss the role of a 3D Lab can solve imaging problems.\*Course Description As the utilization of Cardiac CTA increase, imagers are challenged to expand services while maintaining a high standard of image quality, accuracy and identify the ideal use of the technology to optimize patient care. The speakers in the session will review imaging protocol tips, the role of complementary imaging modalities and how technology processing teams and labs can support a program and drive quality care.

#### COURSE DESCRIPTION

As the utilization of Cardiac CTA increase, imagers are challenged to expand services while maintaining a high standard of image quality, accuracy and identify the ideal use of the technology to optimize patient care. The speakers in the session will review imaging protocol tips, the role of complementary imaging modalities and how technology processing teams and labs can support a program and drive quality care.

#### Sub-Events

##### W1-CCA08 Moderator

Participants

Amar B. Shah, MD, New York, NY (*Moderator*) Nothing to Disclose

##### W1-CCA08 Moderator

Participants

Michael F. Morris, MD, Paradise Valley, AZ (*Moderator*) Educator, Medtronic plc

##### W1-CCA08 Efficient Cardiac CT Protocols for High Throughput

Participants

Brian B. Ghoshhajra, MD, MBA, Boston, MA (*Presenter*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG

##### W1-CCA08 Virtual or Live 3D Lab: The Solution to all Your Problems

Participants

Michael F. Morris, MD, Paradise Valley, AZ (*Presenter*) Educator, Medtronic plc

##### W1-CCA08 Multimodality and Multidisciplinary Imaging Practice: The Secret to High Quality Care

Participants

Joao Cavalcante, , IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCA08

### Multimodality and Multidisciplinary Imaging Practice: The Secret to High Quality Care

#### Participants

Joao Cavalcante, , IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCH07

### Pragmatic Thoracic AI/Data Science Implementations and the Near Future

#### Participants

Carol C. Wu, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCH07

**Moderator**

### Participants

Carol C. Wu, MD, Houston, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCH07

### AI, Machine Learning and the Rest: A Guide for All of Us

#### Participants

Chi Wan Koo, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CCH07

### Understanding Radiomics and Trial Outcomes

#### Participants

Anastasia Oikonomou, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CCH07

### Understanding Thoracic AI/Radiomics: Where Are We and Where We Are Going?

#### LEARNING OBJECTIVES

1) Compare and contrast artificial intelligence (AI) and machine learning strategies used in thoracic imaging. 2) Interpret radiomics research trial outcomes. 3) Explain the benefits and pitfalls of applications of AI in thoracic imaging.\*Course Description Artificial intelligence (AI) and radiomics are increasingly used in thoracic imaging research and clinical practice. This session aims to provide attendees a basic understanding of these tools and their applications in thoracic imaging. The knowledge should facilitate appropriate interpretation and utilization of the results generated by these techniques.

#### COURSE DESCRIPTION

Artificial intelligence (AI) and radiomics are increasingly used in thoracic imaging research and clinical practice. This session aims to provide attendees a basic understanding of these tools and their applications in thoracic imaging. The knowledge should facilitate appropriate interpretation and utilization of the results generated by these techniques.

#### Sub-Events

##### W1-CCH07 Moderator

Participants

Carol C. Wu, MD, Houston, TX (*Moderator*) Nothing to Disclose

##### W1-CCH07 AI, Machine Learning and the Rest: A Guide for All of Us

Participants

Chi Wan Koo, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### W1-CCH07 Understanding Radiomics and Trial Outcomes

Participants

Anastasia Oikonomou, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

##### W1-CCH07 Pragmatic Thoracic AI/Data Science Implementations and the Near Future

Participants

Carol C. Wu, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CER04

### Non-Traumatic Thoracic Emergencies

#### Sub-Events

##### W1-CER04 Moderator

Participants

Felipe Munera, MD, Key Biscayne, FL (*Moderator*) Nothing to Disclose

##### W1-CER04 Acute PE: Becoming a Pro on Call

Participants

Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Advisory Board, Precisa Gravimetrics AG

##### W1-CER04 Ascending Order: Making Sense of the Type of Aortic Dissections and Variants

Participants

Felipe Munera, MD, Key Biscayne, FL (*Presenter*) Nothing to Disclose

##### W1-CER04 Challenges for the Radiologist in the Emergency Room: The Heart and its Vessels

Participants

Monique Brink, MD, PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CER04

**Moderator**

### **Participants**

Felipe Munera, MD, Key Biscayne, FL (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CER04

**Ascending Order: Making Sense of the Type of Aortic Dissections and Variants**

### Participants

Felipe Munera, MD, Key Biscayne, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CER04

### Acute PE: Becoming a Pro on Call

#### Participants

Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Advisory Board, Precisa Gravimetrics AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CER04

### Challenges for the Radiologist in the Emergency Room: The Heart and its Vessels

#### Participants

Monique Brink, MD, PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Essentials of GI Imaging

#### LEARNING OBJECTIVES

1) Identify common and uncommon imaging findings in patients with biliary disease, diverticulitis, and small bowel obstruction. 2) Review the imaging appearance of liver lesions in non-cirrhotic patients. 3) Describe fluoroscopic imaging techniques.\*Course Description This session will include lectures describing imaging findings in patients with biliary disease, diverticulitis, and small bowel obstruction. The imaging appearances of liver lesions in non-cirrhotic patients will be reviewed. Gastrointestinal fluoroscopic techniques will also be discussed.

#### COURSE DESCRIPTION

This session will include lectures describing imaging findings in patients with biliary disease, diverticulitis, and small bowel obstruction. The imaging appearances of liver lesions in non-cirrhotic patients will be reviewed. Gastrointestinal fluoroscopic techniques will also be discussed.

#### Sub-Events

##### W1-CGI10 Moderator

Participants  
Courtney Moreno, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

##### W1-CGI10 Biliary Imaging

Participants  
Courtney Moreno, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

##### W1-CGI10 Diverticulitis

Participants  
Mark Sugi, MD, San Francisco, CA (*Presenter*) Consultant, Nextrast, Inc; Author with royalties, RELX

##### W1-CGI10 Liver Lesions in Noncirrhotic Patients

Participants  
Silvia D. Chang, MD, FRCPC, Vancouver, BC (*Presenter*) Nothing to Disclose

##### W1-CGI10 Fluoroscopic Imaging

Participants  
David DiSantis, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### W1-CGI10 Small Bowel Obstruction Including Internal Hernia

Participants  
Anil Dasyam, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CGI10

**Moderator**

### Participants

Courtney Moreno, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Biliary Imaging

#### Participants

Courtney Moreno, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Diverticulitis

#### Participants

Mark Sugi, MD, San Francisco, CA (*Presenter*) Consultant, Nextrast, Inc; Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Liver Lesions in Noncirrhotic Patients

#### Participants

Silvia D. Chang, MD, FRCPC, Vancouver, BC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Fluoroscopic Imaging

#### Participants

David DiSantis, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGI10

### Small Bowel Obstruction Including Internal Hernia

#### Participants

Anil Dasyam, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

### Prostate Case

#### Participants

Angela Tong, MD, New York, NY (*Presenter*) Equipment support, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

### Bladder and Upper Tract Pathology

#### Participants

Kristen Olinger, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CGU04

### Adrenal Gland Case

#### Participants

Anugayathri Jawahar, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

### GU Emergency

#### Participants

Priyanka Jha, MBBS, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

### Case-Based Audience Participation Peer-Learning

#### LEARNING OBJECTIVES

1) Learn hard-to-diagnose or interesting misdiagnosed GU-related disease from emergency to oncology.\*Course Description This course is a case-based learning session focusing on GU-cases that are difficult to diagnose or easily missed. There will be cases of renal masses, prostate, bladder and upper urinary tract, adrenal glands, and GU emergencies. All presentations will encourage audience participation, and pearls will be presented after each case. This course is designed for all levels, including trainees and attendings.

#### COURSE DESCRIPTION

This course is a case-based learning session focusing on GU-cases that are difficult to diagnose or easily missed. There will be cases of renal masses, prostate, bladder and upper urinary tract, adrenal glands, and GU emergencies. All presentations will encourage audience participation, and pearls will be presented after each case. This course is designed for all levels, including trainees and attendings.

#### Sub-Events

##### W1-CGU04 Moderator

Participants  
Luyao Shen, MD, Sunnyvale, CA (*Moderator*) Nothing to Disclose

##### W1-CGU04 Renal Masses

Participants  
Luyao Shen, MD, Sunnyvale, CA (*Presenter*) Nothing to Disclose

##### W1-CGU04 Prostate Case

Participants  
Angela Tong, MD, New York, NY (*Presenter*) Equipment support, Siemens AG

##### W1-CGU04 Bladder and Upper Tract Pathology

Participants  
Kristen Olinger, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

##### W1-CGU04 Adrenal Gland Case

Participants  
Anugayathri Jawahar, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### W1-CGU04 GU Emergency

Participants  
Priyanka Jha, MBBS, San Francisco, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

**Moderator**

### Participants

Luyao Shen, MD, Sunnyvale, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CGU04

### Renal Masses

#### Participants

Luyao Shen, MD, Sunnyvale, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIN03

### Structured Reporting - Why, How, and Future Directions

#### Sub-Events

#### W1-CIN03 Moderator

##### Participants

Patricia Balthazar, MD, Atlanta, GA (*Moderator*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

#### W1-CIN03 Common Data Elements, FHIR Observations, and the Future of Radiology Reports

##### Participants

Tarik Alkasab, MD, PhD, Boston, MA (*Presenter*) Consultant, Nuance Communications, Inc; Medical Advisory Board, Nuance Communications, Inc

#### LEARNING OBJECTIVES

1) Understand the importance and benefits of using structured reporting templates. 2) Acquire practical knowledge on how to create and use structured reporting to maximize efficiency, quality and compliance with real-life examples. 3) Discuss future applications of structured reporting.\*Course Description This course explores the importance, creation, and future implementation of structured reporting in radiology. Speakers will delve into key topics including the use of structured report templates and macros, the influence of radiology report elements on patient care, and the evolving future of radiology reports in the context of Common Data Elements and FHIR observations. Participants can anticipate an engaging format combining lectures and interactive panel discussion. The vital role structured reporting plays in enhancing clinical decision-making, improving communication, promoting standardization, and improving quality of care will be discussed with real-life examples. The expected outcome is for attendees to gain an enriched understanding of structured reporting and the capability to implement learned strategies into their practices for enhanced patient outcomes.

#### COURSE DESCRIPTION

This course explores the importance, creation, and future implementation of structured reporting in radiology. Speakers will delve into key topics including the use of structured report templates and macros, the influence of radiology report elements on patient care, and the evolving future of radiology reports in the context of Common Data Elements and FHIR observations. Participants can anticipate an engaging format combining lectures and interactive panel discussion. The vital role structured reporting plays in enhancing clinical decision-making, improving communication, promoting standardization, and improving quality of care will be discussed with real-life examples. The expected outcome is for attendees to gain an enriched understanding of structured reporting and the capability to implement learned strategies into their practices for enhanced patient outcomes.

#### W1-CIN03 Radiology Report Elements do Drive Care: Real Examples From a Learning Health System

##### Participants

Marta Heilbrun, MS, Murray, UT (*Presenter*) Nothing to Disclose

#### W1-CIN03 Structured Report Templates and Macros: Why, How, Tips and Tricks"

##### Participants

Patricia Balthazar, MD, Atlanta, GA (*Presenter*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIN03

### Structured Report Templates and Macros: Why, How, Tips and Tricks"

#### Participants

Patricia Balthazar, MD, Atlanta, GA (*Presenter*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIN03

**Moderator**

### **Participants**

Patricia Balthazar, MD, Atlanta, GA (*Moderator*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CIN03

### Common Data Elements, FHIR Observations, and the Future of Radiology Reports

#### Participants

Tarik Alkasab, MD, PhD, Boston, MA (*Presenter*) Consultant, Nuance Communications, Inc; Medical Advisory Board, Nuance Communications, Inc

#### LEARNING OBJECTIVES

1) Understand the importance and benefits of using structured reporting templates. 2) Acquire practical knowledge on how to create and use structured reporting to maximize efficiency, quality and compliance with real-life examples. 3) Discuss future applications of structured reporting.\*Course Description This course explores the importance, creation, and future implementation of structured reporting in radiology. Speakers will delve into key topics including the use of structured report templates and macros, the influence of radiology report elements on patient care, and the evolving future of radiology reports in the context of Common Data Elements and FHIR observations. Participants can anticipate an engaging format combining lectures and interactive panel discussion. The vital role structured reporting plays in enhancing clinical decision-making, improving communication, promoting standardization, and improving quality of care will be discussed with real-life examples. The expected outcome is for attendees to gain an enriched understanding of structured reporting and the capability to implement learned strategies into their practices for enhanced patient outcomes.

#### COURSE DESCRIPTION

This course explores the importance, creation, and future implementation of structured reporting in radiology. Speakers will delve into key topics including the use of structured report templates and macros, the influence of radiology report elements on patient care, and the evolving future of radiology reports in the context of Common Data Elements and FHIR observations. Participants can anticipate an engaging format combining lectures and interactive panel discussion. The vital role structured reporting plays in enhancing clinical decision-making, improving communication, promoting standardization, and improving quality of care will be discussed with real-life examples. The expected outcome is for attendees to gain an enriched understanding of structured reporting and the capability to implement learned strategies into their practices for enhanced patient outcomes.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIN03

### Radiology Report Elements do Drive Care: Real Examples From a Learning Health System

#### Participants

Marta Heilbrun, MS, Murray, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

### Moderator

#### Participants

Kazim Narsinh, MD, Pacific Palisades, CA (*Moderator*) Nothing to Disclose  
Alan A. Sag, MD, Durham, NC (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

### IR for Benign Disease of the Head and Neck

#### Participants

Alan A. Sag, MD, Durham, NC (*Presenter*) Nothing to Disclose  
Auh-Whan Park, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

### Advanced MSK, Head & Neck Interventions

#### LEARNING OBJECTIVES

1) Identify scenarios where Interventional Radiology modalities (embolization, ablation) can enable and complement surgical and medical treatment plans for benign and malignant head and neck conditions. 2) Understand vertebroplasty, including devices that are yet to become available in the United States. 3) Understand novel musculoskeletal interventional image guidance platforms. 4) Understand the approach to Desmoid tumors including NCCN guideline updates.\*Course Description With major updates to the NCCN Guidelines completed (MSK) and to the ATA guidelines imminent in 2023-2024 (Thyroid) this session aims to provide advanced pearls for Interventional Radiologists entering the MSKIR and ThyroidIR domains.

#### COURSE DESCRIPTION

With major updates to the NCCN Guidelines completed (MSK) and to the ATA guidelines imminent in 2023-2024 (Thyroid) this session aims to provide advanced pearls for Interventional Radiologists entering the MSKIR and ThyroidIR domains.

#### Sub-Events

##### W1-CIR04 New MSK Devices In Use in Europe Not Yet Available in the USA

Participants

Stefano Marcia, MD, Cagliari, Italy (*Presenter*) Consultant, Techlamed Srl;Consultant, Spineart SA;Consultant, Stryker Corporation

##### W1-CIR04 Novel Image Guidance Platforms for MSK Interventions

Participants

Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson

##### W1-CIR04 Vertebroplasty Blitz

Participants

Sean Tutton, MD, Milwaukee, WI (*Presenter*) Consultant, Boston Scientific Corporation;Consultant, Galil Medical Ltd;Consultant, Stryker Corporation;Consultant, Siemens AG;

##### W1-CIR04 IR for Malignant Disease of the Head and Neck

Participants

Kazim Narsinh, MD, Pacific Palisades, CA (*Presenter*) Nothing to Disclose

##### W1-CIR04 Desmoid Tumors: NCCN Guideline update, Radiologic Workup, Approach, and Follow-up

Participants

Gina Landinez, MD, Tiburon, CA (*Presenter*) Nothing to Disclose

##### W1-CIR04 Moderator

Participants

Kazim Narsinh, MD, Pacific Palisades, CA (*Moderator*) Nothing to Disclose  
Alan A. Sag, MD, Durham, NC (*Moderator*) Nothing to Disclose

##### W1-CIR04 IR for Benign Disease of the Head and Neck

Participants

Alan A. Sag, MD, Durham, NC (*Presenter*) Nothing to Disclose  
Auh-Whan Park, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

**New MSK Devices In Use in Europe Not Yet Available in the USA**

### Participants

Stefano Marcia, MD, Cagliari, Italy (*Presenter*) Consultant, Techlamed Srl; Consultant, Spineart SA; Consultant, Stryker Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

### Novel Image Guidance Platforms for MSK Interventions

#### Participants

Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Consultant, Medtronic plc; Speaker, Medtronic plc; Consultant, Merit Medical Systems, Inc; Speaker, Merit Medical Systems, Inc; Consultant, Landauer Inc; Speaker, Johnson & Johnson

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

### Vertebroplasty Blitz

#### Participants

Sean Tutton, MD, Milwaukee, WI (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Galil Medical Ltd; Consultant, Stryker Corporation; Consultant, Siemens AG;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CIR04

**IR for Malignant Disease of the Head and Neck**

### Participants

Kazim Narsinh, MD, Pacific Palisades, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CIR04

**Desmoid Tumors: NCCN Guideline update, Radiologic Workup, Approach, and Follow-up**

### Participants

Gina Landinez, MD, Tiburon, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

### Arthritis and Body Composition: How Imaging Influences Clinical Decision Making

#### LEARNING OBJECTIVES

1) Describe how imaging findings can influence the choice of drugs and assess their effectiveness in patients with rheumatoid arthritis and seronegative spondyloarthropathies. 2) Explain the impact of imaging for predicting natural history and prognosticating disease course in patients with arthritis and disorders of body composition. 3) Discuss the role of imaging in disease surveillance for arthritis and disorders of body composition.\*Course Description This lecture-based educational course will review how imaging findings influence clinical decision-making for patients with osteoarthritis, rheumatoid arthritis, seronegative spondyloarthritis, and disorders of body composition. Presenters will use case-examples and data from the literature to emphasize the ways in which advanced imaging informs management decisions, disease surveillance, prognostication, and assessment of drug responses, remission, and progression.

#### COURSE DESCRIPTION

This lecture-based educational course will review how imaging findings influence clinical decision-making for patients with osteoarthritis, rheumatoid arthritis, seronegative spondyloarthritis, and disorders of body composition. Presenters will use case-examples and data from the literature to emphasize the ways in which advanced imaging informs management decisions, disease surveillance, prognostication, and assessment of drug responses, remission, and progression.

#### Sub-Events

##### W1-CMK14 Moderator

Participants

David A. Rubin, MD, Saint Louis, MO (*Moderator*) Scientific Advisory Board, ImageBiopsy Lab

##### W1-CMK14 Axial Spondyloarthropathy

Participants

Robert Lambert, MBBCh, FRCPC, Edmonton, AB (*Presenter*) Nothing to Disclose

##### W1-CMK14 Osteoarthritis

Participants

Thomas Link, MD, PhD, San Francisco, CA (*Presenter*) Research Consultant, General Electric Company

##### W1-CMK14 BMD Body Composition

Participants

Miriam A. Bredella, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

##### W1-CMK14 Rheumatoid Arthritis

Participants

Monique Reijnierse, MD, PhD, Leiden, Netherlands (*Presenter*) Research Consultant, ASAS Group, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

### Osteoarthritis

#### Participants

Thomas Link, MD, PhD, San Francisco, CA (*Presenter*) Research Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

### **BMD Body Composition**

#### **Participants**

Miriam A. Bredella, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

### Rheumatoid Arthritis

#### Participants

Monique Reijnierse, MD, PhD, Leiden, Netherlands (*Presenter*) Research Consultant, ASAS Group, LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

**Moderator**

### Participants

David A. Rubin, MD, Saint Louis, MO (*Moderator*) Scientific Advisory Board, ImageBiopsy Lab

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CMK14

### Axial Spondyloarthritis

#### Participants

Robert Lambert, MBBCh, FRCPC, Edmonton, AB (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CNR07

### Neuroradiologists Under Pressure – Global Perspectives

#### LEARNING OBJECTIVES

1) To review the diversity or similarity of burden of health delivery workload on practicing neuroradiologists in different parts of the world: including emerging trends/challenges in clinical/academic/reimbursement issues. 2) To understand what steps neuroradiologists are taking to relieve the pressure, and if this is working, if this is generalizable. 3) To discuss how to balance clinical workload and academic mission for neuroradiologists.\*Course Description Post-pandemic, clinical workload for neuroradiologists has increased, exacerbating pre-existing difficult working conditions; but is this increased pressure on us the same around the world? There's a sense that the altruistic, ethical and academic missions are under threat, to the detriment of our patients. This session will explore problems and possible solutions in diverse parts of the world.

#### COURSE DESCRIPTION

Post-pandemic, clinical workload for neuroradiologists has increased, exacerbating pre-existing difficult working conditions; but is this increased pressure on us the same around the world? There's a sense that the altruistic, ethical and academic missions are under threat, to the detriment of our patients. This session will explore problems and possible solutions in diverse parts of the world.

#### Sub-Events

##### W1-CNR07 Moderator

###### Participants

C. C. Tchoyoson Lim, MMedSc, MBBS, Singapore, Singapore (*Moderator*) Research Consultant, Hanalytics Pte Ltd; Research Consultant, Iota MedTech Pte Ltd; Royalties from intellectual property; Research Grant, PI

##### W1-CNR07 Under Pressure: US Perspectives

###### Participants

Suyash Mohan, MD, Philadelphia, PA (*Presenter*) Research Grant, NovoCure Ltd; Research Grant, Galileo CDS, Inc; Consultant, Northwest Biotherapeutics, Inc; Consultant, AIRS Medical Inc; Consultant, Qynapse SAS

##### W1-CNR07 UK Perspectives: Life in the NHS

###### Participants

Anoma Lalani Carlton Jones, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

##### W1-CNR07 Under Pressure: Singapore Style

###### Participants

C. C. Tchoyoson Lim, MMedSc, MBBS, Singapore, Singapore (*Presenter*) Research Consultant, Hanalytics Pte Ltd; Research Consultant, Iota MedTech Pte Ltd; Royalties from intellectual property; Research Grant, PI

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CNR07

**Moderator**

### Participants

C. C. Tchoyoson Lim, MMedSc, MBBS, Singapore, Singapore (*Moderator*) Research Consultant, Hanalytics Pte Ltd; Research Consultant, Iota MedTech Pte Ltd; Royalties from intellectual property; Research Grant, PI

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CNR07

### Under Pressure: US Perspectives

#### Participants

Suyash Mohan, MD, Philadelphia, PA (*Presenter*) Research Grant, NovoCure Ltd; Research Grant, Galileo CDS, Inc; Consultant, Northwest Biotherapeutics, Inc; Consultant, AIRS Medical Inc; Consultant, Qynapse SAS

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CNR07

**UK Perspectives: Life in the NHS**

### Participants

Anoma Lalani Carlton Jones, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CNR07

### Under Pressure: Singapore Style

#### Participants

C. C. Tchoyoson Lim, MMedSc, MBBS, Singapore, Singapore (*Presenter*) Research Consultant, Hanalytics Pte Ltd; Research Consultant, Iota MedTech Pte Ltd; Royalties from intellectual property; Research Grant, PI

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-COB03

### Integrating US and MR O-RADS in your Practice

#### Sub-Events

##### W1-COB03 Moderator

#### Participants

Elizabeth A. Sadowski, MD, Madison, WI (*Moderator*) Nothing to Disclose

##### W1-COB03 O-RADS MRI Cases: When MRI adds Value

#### Participants

Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Learn how the O-RADS US and MRI risk stratification system can be incorporated into clinical practice. 2) Understand which lesions may be adequately characterized with US. 3) Identify lesions that would benefit from further assessment on MRI before definitive management.\*Course Description This series of lectures will review how the O-RADS US and MRI risk stratification system can be incorporated into your practice, with a focus on when US is enough and when MRI adds value.

#### COURSE DESCRIPTION

This series of lectures will review how the O-RADS US and MRI risk stratification system can be incorporated into your practice, with a focus on when US is enough and when MRI adds value.

##### W1-COB03 O-RADS US Cases: When US is Enough

#### Participants

Loretta Strachowski, MD, MD, San Francisco, CA (*Presenter*) Royalties, RELX;Speaker, World Class CME

##### W1-COB03 O-RADS: Ready for Prime Time

#### Participants

Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Researcher, General Electric Company;Research funded, General Electric Company;Researcher, Canon Medical Systems Corporation;Research funded, Canon Medical Systems Corporation;Research funded, Hologic, Inc;Research funded, Siemens AG;Research funded, Guerbet SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-COB03

**Moderator**

### Participants

Elizabeth A. Sadowski, MD, Madison, WI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-COB03

### O-RADS MRI Cases: When MRI adds Value

#### Participants

Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Learn how the O-RADS US and MRI risk stratification system can be incorporated into clinical practice. 2) Understand which lesions may be adequately characterized with US. 3) Identify lesions that would benefit from further assessment on MRI before definitive management.\*Course Description This series of lectures will review how the O-RADS US and MRI risk stratification system can be incorporated into your practice, with a focus on when US is enough and when MRI adds value.

#### COURSE DESCRIPTION

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Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-COB03

### O-RADS US Cases: When US is Enough

#### Participants

Loretta Strachowski, MD, MD, San Francisco, CA (*Presenter*) Royalties, RELX;Speaker, World Class CME

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-COB03

### O-RADS: Ready for Prime Time

#### Participants

Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Researcher, General Electric Company; Research funded, General Electric Company; Researcher, Canon Medical Systems Corporation; Research funded, Canon Medical Systems Corporation; Research funded, Hologic, Inc; Research funded, Siemens AG; Research funded, Guerbet SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CPH06

**Moderator**

### Participants

Shuai Leng, PhD, Rochester, MN (*Moderator*) License agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CPH06

### Clinical Applications of Photon Counting CT

#### Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) License agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CPH06

### Basic Principles of Photon Counting CT

#### Participants

Ke Li, PhD, Madison, WI (*Presenter*) Research Consultant, Pulmera Inc.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CPH06

### Photon Counting CT

#### LEARNING OBJECTIVES

1) Understand principles of photon counting detector (PCD) and PCD-CT. 2) Explore benefits of PCD-CT in comparison with energy integrating detector CT. 3) Identify potential applications of PCD-CT in various clinical areas.\*Course Description Photon counting detector (PCD) has been an active research area in recent years. Commercial PCD-CT has been available for routine clinical use since the FDA cleared the first PCD-CT in late 2021, representing a major imaging device advancement for CT. In this lecture, we will discuss the fundamental principles of PCD and explain major benefits of this technology relative to energy integrating detectors which are used on most commercial CT scanners. History and current status of PCD-CT will also be discussed. Potential applications in various clinical areas will be demonstrated using sample phantom and patient images. Challenges and opportunities will also be discussed.

#### COURSE DESCRIPTION

Photon counting detector (PCD) has been an active research area in recent years. Commercial PCD-CT has been available for routine clinical use since the FDA cleared the first PCD-CT in late 2021, representing a major imaging device advancement for CT. In this lecture, we will discuss the fundamental principles of PCD and explain major benefits of this technology relative to energy integrating detectors which are used on most commercial CT scanners. History and current status of PCD-CT will also be discussed. Potential applications in various clinical areas will be demonstrated using sample phantom and patient images. Challenges and opportunities will also be discussed.

#### Sub-Events

##### W1-CPH06 Moderator

Participants

Shuai Leng, PhD, Rochester, MN (*Moderator*) License agreement, Siemens AG

##### W1-CPH06 Clinical Applications of Photon Counting CT

Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) License agreement, Siemens AG

##### W1-CPH06 Basic Principles of Photon Counting CT

Participants

Ke Li, PhD, Madison, WI (*Presenter*) Research Consultant, Pulmera Inc.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CRT04

**Moderator**

### **Participants**

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-CRT04

**ASRT@RSNA: Shaping the Future of Imaging: Quality Initiatives for Enhanced Effectiveness and Efficiency**

### Sub-Events

#### W1-CRT04 Moderator

##### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

#### W1-CRT04 **ASRT@RSNA: Shaping the Future of Imaging: Quality Initiatives for Enhanced Effectiveness and Efficiency**

##### Participants

Taylor Ward, PhD, Ogden, UT (*Presenter*) Nothing to Disclose

Fredrick Lee II, MBA, MPH, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-CRT04

**ASRT@RSNA: Shaping the Future of Imaging: Quality Initiatives for Enhanced Effectiveness and Efficiency**

### Participants

Taylor Ward, PhD, Ogden, UT (*Presenter*) Nothing to Disclose  
Fredrick Lee II, MBA, MPH, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

### The Basics of MR Imaging in Neurodegeneration

#### Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

### The Basics of Molecular Imaging in Neurodegeneration

#### Participants

Javier Arbizu Lostao, MD, PhD, Pamplona, Spain (*Presenter*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Novartis AG;Speaker, General Electric Company;Research Grant, Siemens AG;Speaker, Life Molecular Imaging GmbH;Speaker, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

### RSNA/ESR Symposium: Imaging of Neurodegenerative Disorders - Basics of Neuroimaging in Neurodegeneration

#### LEARNING OBJECTIVES

1) To understand the standard MR Imaging protocol, normal aging findings, as well as Alzheimer disease mimic on structural brain MR imaging. 2) To become familiar with existing and new molecular imaging tracers for dementia and parkinsonian disorders. 3) To comprehend the evolving role of imaging biomarkers in standard clinical practice as well as trials (including imaging of side effects such as ARIA). \*Course Description Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This first educational session will discuss the basics of MRI and PET imaging, choices of imaging protocols, PET tracers and MR sequences, changes that occur with normal aging and other mimics, and what the role is of imaging biomarkers in general in clinical practice versus trials. At the end of the course, the participants will better understand the basics of molecular and structural imaging in neurodegenerative disorders.

#### COURSE DESCRIPTION

Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This first educational session will discuss the basics of MRI and PET imaging, choices of imaging protocols, PET tracers and MR sequences, changes that occur with normal aging and other mimics, and what the role is of imaging biomarkers in general in clinical practice versus trials. At the end of the course, the participants will better understand the basics of molecular and structural imaging in neurodegenerative disorders.

#### Sub-Events

##### W1-RCP05 Moderator

Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

##### W1-RCP05 The Basics of MR Imaging in Neurodegeneration

Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### W1-RCP05 The Basics of Molecular Imaging in Neurodegeneration

Participants

Javier Arbizu Lostao, MD, PhD, Pamplona, Spain (*Presenter*) Speaker, F. Hoffmann-La Roche Ltd; Speaker, Novartis AG; Speaker, General Electric Company; Research Grant, Siemens AG; Speaker, Life Molecular Imaging GmbH; Speaker, Biogen Idec Inc

##### W1-RCP05 Role of Imaging Biomarkers for Dementia in Clinical Routine and Trials

Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

##### W1-RCP05 Moderator

Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ; Research support, Life Molecular Imaging; Research support, General Electric Company; Research support, Eli Lilly and Company; Research support, Eisai Co, Ltd; Consultant, Siemens AG ; Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

**Moderator**

### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

### Role of Imaging Biomarkers for Dementia in Clinical Routine and Trials

#### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP05

### Moderator

#### Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP14

**Moderator**

### Participants

Zi Zhang, MD, Fort Washington, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W1-RCP14

### Ensuring Patient Safety and Workflow Efficiency in Radiology

#### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Ensuring patient safety and workflow efficiency in radiology. This lecture will discuss strategies to optimize and standardize radiology workflow to improve patient safety, eases pressure on radiologists and supporting staff. 2) Investing in education to mobilize and develop our imaging workforce. This lecture will discuss learning and development initiatives to engage and upskill the radiology staff to improve work quality and patient safety. 3) Improving recruitment and retention in radiology. This lecture will address reasons behind the "Great Resignation" and discuss strategies to create an enjoyable workplace in radiology practice to improve recruitment and retention of clinical staff. 4) Implementing artificial intelligence in different aspects of radiology practice. This lecture will discuss appropriate clinical implications of artificial intelligence in different aspects of radiology practice, such as patient scheduling, image acquisition and reporting, to increase work efficiency and improve patient safety.\*Course Description The shortage of healthcare staff is becoming the nation's top patient safety concern. The prompt and accurate results of imaging studies can be the difference between life and death. Yet shortage of practicing radiologists in the United States is projected to worsen while demands for radiology services continue to grow. Radiology practices have been experiencing staff shortages across various positions, struggling to both maintain staffing and bring in new talent. Thus, many patients have been forced to endure long wait when seeking care in radiology. The goal of our course is to discuss strategies to ensure patient safety and address workforce challenges facing radiology.

#### COURSE DESCRIPTION

The shortage of healthcare staff is becoming the nation's top patient safety concern. The prompt and accurate results of imaging studies can be the difference between life and death. Yet shortage of practicing radiologists in the United States is projected to worsen while demands for radiology services continue to grow. Radiology practices have been experiencing staff shortages across various positions, struggling to both maintain staffing and bring in new talent. Thus, many patients have been forced to endure long wait when seeking care in radiology. The goal of our course is to discuss strategies to ensure patient safety and address workforce challenges facing radiology.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP14

### Investing in Education to Mobilize and Develop our Imaging Workforce

#### Participants

Pari V. Pandharipande, MD, MPH, Bexley, OH (*Presenter*) I serve as a member of the Association of University Radiologists (AUR) General Electric (GE) Radiology Research Academic Fellowship (GERRAF) Board of Review (term: 7/1/22-2/28/23).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP14

### Improving Recruitment and Retention in Radiology

#### Participants

Geraldine McGinty, MD, MBA, New York, NY (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP14

### Implementing Artificial Intelligence in different Aspects of Radiology Practice

#### Participants

Zi Zhang, MD, Fort Washington, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP14

### Overcoming Staff Shortages in Radiology: How to Ensure Patient Safety during the "Great Resignation"?

#### Sub-Events

##### W1-RCP14 Moderator

###### Participants

Zi Zhang, MD, Fort Washington, PA (*Moderator*) Nothing to Disclose

##### W1-RCP14 Ensuring Patient Safety and Workflow Efficiency in Radiology

###### Participants

Michael Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Ensuring patient safety and workflow efficiency in radiology. This lecture will discuss strategies to optimize and standardize radiology workflow to improve patient safety, eases pressure on radiologists and supporting staff. 2) Investing in education to mobilize and develop our imaging workforce. This lecture will discuss learning and development initiatives to engage and upskill the radiology staff to improve work quality and patient safety. 3) Improving recruitment and retention in radiology. This lecture will address reasons behind the "Great Resignation" and discuss strategies to create an enjoyable workplace in radiology practice to improve recruitment and retention of clinical staff. 4) Implementing artificial intelligence in different aspects of radiology practice. This lecture will discuss appropriate clinical implications of artificial intelligence in different aspects of radiology practice, such as patient scheduling, image acquisition and reporting, to increase work efficiency and improve patient safety.\*Course Description The shortage of healthcare staff is becoming the nation's top patient safety concern. The prompt and accurate results of imaging studies can be the difference between life and death. Yet shortage of practicing radiologists in the United States is projected to worsen while demands for radiology services continue to grow. Radiology practices have been experiencing staff shortages across various positions, struggling to both maintain staffing and bring in new talent. Thus, many patients have been forced to endure long wait when seeking care in radiology. The goal of our course is to discuss strategies to ensure patient safety and address workforce challenges facing radiology.

#### COURSE DESCRIPTION

The shortage of healthcare staff is becoming the nation's top patient safety concern. The prompt and accurate results of imaging studies can be the difference between life and death. Yet shortage of practicing radiologists in the United States is projected to worsen while demands for radiology services continue to grow. Radiology practices have been experiencing staff shortages across various positions, struggling to both maintain staffing and bring in new talent. Thus, many patients have been forced to endure long wait when seeking care in radiology. The goal of our course is to discuss strategies to ensure patient safety and address workforce challenges facing radiology.

##### W1-RCP14 Investing in Education to Mobilize and Develop our Imaging Workforce

###### Participants

Pari V. Pandharipande, MD, MPH, Bexley, OH (*Presenter*) I serve as a member of the Association of University Radiologists (AUR) General Electric (GE) Radiology Research Academic Fellowship (GERRAF) Board of Review (term: 7/1/22-2/28/23).

##### W1-RCP14 Improving Recruitment and Retention in Radiology

###### Participants

Geraldine McGinty, MD, MBA, New York, NY (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

##### W1-RCP14 Implementing Artificial Intelligence in different Aspects of Radiology Practice

###### Participants

Zi Zhang, MD, Fort Washington, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP20

### Who is Paying for Radiology Education? (Sponsored by the American Association for Women in Radiology)

#### LEARNING OBJECTIVES

1) Discuss who is and who should pay for radiology education. 2) Consider whether our current compensation models are disincentivizing radiologists from pursuing careers in academics. 3) Examine the potential impact of under-funding radiology education on the gender pay-gap in radiology.\*Course Description The demand for medical imaging is outstripping the supply of radiologists. From 2010 to 2020, the number of DR trainees entering the workforce increased just 2.5% (1), compared to a 180% increase in the number of CT and US examinations in the same decade. (2) On March 29, 2023, the Resident Physician Shortage Reduction Act of 2023 was proposed; if passed, it would expand the number of Medicare-supported medical residency positions by 14,000 over seven years. A similar bill was proposed in 2021 but did not pass. As lawmakers struggle to provide additional funding for medical workforce education, medical trainees in the United States continue to take on debt for medical education and training. As of 2018, early-career radiologists owed an average of \$190,000 after graduate programs. (3) Once trained, early-career radiologists encounter a decision regarding whether to choose academics or to enter private practice. If they choose academics, they will earn an average of \$141,628 less per year than their private practice counterparts. (4) Radiology education does not end with employment. All radiologists must participate in continuing medical education (CME). The average CME allowance of a physician was \$3,691 in 2022 (5), which is typically considered part of a physician's overall compensation package. Providing and paying for CME is big business. The worldwide sales of academic publishing will exceed 19 billion dollars in 2023 and Elsevier, a leader in academic publishing, has a profit margin approaching 40%, which is higher than that of Microsoft, Google and Coca Cola. (6) Academic radiologists are expected to author, review, and edit articles for these academic journals for nominal, if any, compensation. Similarly, many radiologists earn CME at radiology conferences, typically organized, and staffed by academic radiologists for nominal, if any, compensation. Please join us as we discuss these observations and the question of who is and who should pay for radiology education. This question particularly impacts women in radiology, since, while the percentage of women in radiology has hovered around 25% since 2007 (7), there is a greater percentage of women in academic radiology (34.7%). (8) Please join us as we consider whether our current compensation models are disincentivizing radiologists from pursuing careers in academics; examine what impact, if any, the under-funding of radiology education has on the gender pay-gap in radiology; and contemplate how we as a field can overcome these challenges. References 1. Radiology Facing a Global Shortage. <https://www.rsna.org/news/2022/may/global-radiologist-shortage>. Accessed 6/8/2023. 2. Winder M, Owczarek AJ, Chudek J, Pilch-Kowalczyk J, Baron J. Are We Overdoing It? Changes in Diagnostic Imaging Workload during the Years 2010-2020 including the Impact of the SARS-CoV-2 Pandemic. *Healthcare (Basel)*. 2021 Nov 16;9(11):1557. doi: 10.3390/healthcare9111557. PMID: 34828603; PMCID: PMC8621920. 3. 4 ways early-career radiologists can get a handle on student debt. <https://radiologybusiness.com/topics/healthcare-management/healthcare-economics/4-ways-early-career-radiologists-can-get-handle>. Accessed 6/8/2023. 4. A dramatic shift: New survey highlights salaries and staffing concerns in radiology. <https://radiologybusiness.com/topics/healthcare-management/radiologist-salary/dramatic-shift-new-survey-highlights-salaries-and>. Access 6/8/2023. 5. How to Get the Most Out of Your CME Allowance. <https://www.cmemeeting.org/cme-info/making-the-most-of-your-cme-allowance#:~:text=Is%20%243%2C691%20enough%20to%20cover,offered%20to%20physicians%20was%20%243%2C3>

#### COURSE DESCRIPTION

The demand for medical imaging is outstripping the supply of radiologists. From 2010 to 2020, the number of DR trainees entering the workforce increased just 2.5% (1), compared to a 180% increase in the number of CT and US examinations in the same decade. (2) On March 29, 2023, the Resident Physician Shortage Reduction Act of 2023 was proposed; if passed, it would expand the number of Medicare-supported medical residency positions by 14,000 over seven years. A similar bill was proposed in 2021 but did not pass. As lawmakers struggle to provide additional funding for medical workforce education, medical trainees in the United States continue to take on debt for medical education and training. As of 2018, early-career radiologists owed an average of \$190,000 after graduate programs. (3) Once trained, early-career radiologists encounter a decision regarding whether to choose academics or to enter private practice. If they choose academics, they will earn an average of \$141,628 less per year than their private practice counterparts. (4) Radiology education does not end with employment. All radiologists must participate in continuing medical education (CME). The average CME allowance of a physician was \$3,691 in 2022 (5), which is typically considered part of a physician's overall compensation package. Providing and paying for CME is big business. The worldwide sales of academic publishing will exceed 19 billion dollars in 2023 and Elsevier, a leader in academic publishing, has a profit margin approaching 40%, which is higher than that of Microsoft, Google and Coca Cola. (6) Academic radiologists are expected to author, review, and edit articles for these academic journals for nominal, if any, compensation. Similarly, many radiologists earn CME at radiology conferences, typically organized, and staffed by academic radiologists for nominal, if any, compensation. Please join us as we discuss these observations and the question of who is and who should pay for radiology education. This question particularly impacts women in radiology, since, while the percentage of women in radiology has hovered around 25% since 2007 (7), there is a greater percentage of women in academic radiology (34.7%). (8) Please join us as we consider whether our current compensation models are disincentivizing radiologists from pursuing careers in academics; examine what impact, if any, the under-funding of radiology education has on the gender pay-gap in radiology; and contemplate how we as a field can overcome these challenges. References 1. Radiology Facing a Global Shortage. <https://www.rsna.org/news/2022/may/global-radiologist-shortage>. Accessed 6/8/2023. 2. Winder M, Owczarek AJ, Chudek J, Pilch-Kowalczyk J, Baron J. Are We Overdoing It? Changes in Diagnostic Imaging Workload during the Years 2010-2020 including the Impact of the SARS-CoV-2 Pandemic. *Healthcare (Basel)*. 2021 Nov 16;9(11):1557. doi: 10.3390/healthcare9111557. PMID: 34828603; PMCID: PMC8621920. 3. 4 ways early-career radiologists can get a handle on student debt. <https://radiologybusiness.com/topics/healthcare-management/healthcare-economics/4-ways-early-career-radiologists-can-get-handle>. Accessed 6/8/2023. 4. A dramatic shift: New survey highlights salaries and staffing concerns in radiology. <https://radiologybusiness.com/topics/healthcare-management/radiologist-salary/dramatic-shift-new-survey-highlights-salaries-and>. Access 6/8/2023. 5. How to Get the Most Out of Your CME Allowance. <https://www.cmemeeting.org/cme-info/making-the-most-of>



## Abstract Archives of the RSNA, 2023

W1-RCP20

### Moderator

#### Participants

Kristin Porter, MD, PhD, (*Moderator*) Stockholder, Pfizer Inc; Medical Advisory Board, Bracco Group

Printed on: 04/12/24





## Abstract Archives of the RSNA, 2023

W1-RCP20

**Who is Paying for Radiology Education? (Sponsored by the American Association for Women in Radiology)**

### Participants

Alexander M. Norbash, MD, MS, San Diego, CA (*Presenter*) Co-founder, Boston Imaging Core Lab, LLC; Stockholder, Boston Imaging Core Lab, LLC;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP20

**Who is Paying for Radiology Education? (Sponsored by the American Association for Women in Radiology)**

### Participants

Carolyn Meltzer, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W1-RCP20

**Who is Paying for Radiology Education? (Sponsored by the American Association for Women in Radiology)**

### Participants

Kristin Porter, MD, PhD, (*Presenter*) Stockholder, Pfizer Inc; Medical Advisory Board, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Stephen C. O'Connor, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Kevin Paul, BS, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

**Moderator**

### Participants

Carolyn L. Wang, MD, Mercer Island, WA (*Moderator*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Carolyn L. Wang, MD, Mercer Island, WA (*Presenter*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

**RSNA Hands-On Lab: Contrast Reaction Management**

### Participants

Carina Yang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Alisa Sumkin, DO, Pittsburgh, PA (*Presenter*) Speaker, Siemens AG; Speaker, Devicor Medical Products, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Melissa Picard, MD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Benjamin Mervak, MD, Carrboro, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Erik Soloff, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Kirk G. Banerian, BS, MD, Bloomfield Hills, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Anup Alexander, MD, Maywood, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Rekha Mody, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Andrew Williams, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W2-CMS10

**RSNA Hands-On Lab: Contrast Reaction Management**

### Participants

Michael Zhang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Lindsay Yang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Mohamed Shaif Yusufishaq, MD, BEng, Des Plaines, IL (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Recognize various types of contrast reactions and the proper management of various types of contrast reactions through simulation-based training. 2) Learn with hands-on practice the proper administration of various routes of epinephrine as well as other medications to treat the more common allergic-like contrast reactions. 3) Recognize and manage a contrast reaction in a sedated patient. 4) Recognize and manage a contrast reaction in a pediatric patient 5) Recognize and practice team communication skills necessary for high stress infrequent scenarios using simulation-based training.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Through hands-on high-fidelity simulation scenario training, learners will practice recognizing and managing various types of contrast reactions. Following a brief lecture, learners will rotate through multiple stations during the course to gain individual hands-on experience. To enhance the learner's experience and allow for more time in the hands-on stations, we ask all learners for the course to watch this short 15 min. video on contrast reaction management prior to the course [https://youtu.be/9r-\\_E8dmJ0A](https://youtu.be/9r-_E8dmJ0A).

#### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Through hands-on high-fidelity simulation scenario training, learners will practice recognizing and managing various types of contrast reactions. Following a brief lecture, learners will rotate through multiple stations during the course to gain individual hands-on experience. To enhance the learner's experience and allow for more time in the hands-on stations, we ask all learners for the course to watch this short 15 min. video on contrast reaction management prior to the course [https://youtu.be/9r-\\_E8dmJ0A](https://youtu.be/9r-_E8dmJ0A).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Participants

Senta Berggruen, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-CMS10

### RSNA Hands-On Lab: Contrast Reaction Management

#### Sub-Events

##### W2-CMS10 Moderator

###### Participants

Carolyn L. Wang, MD, Mercer Island, WA (*Moderator*) Research Grant, General Electric Company

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Carolyn L. Wang, MD, Mercer Island, WA (*Presenter*) Research Grant, General Electric Company

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Carina Yang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Alisa Sumkin, DO, Pittsburgh, PA (*Presenter*) Speaker, Siemens AG;Speaker, Devicor Medical Products, Inc

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Melissa Picard, MD, Nashville, TN (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Benjamin Mervak, MD, Carrboro, NC (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Erik Soloff, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Kirk G. Banerian, BS, MD, Bloomfield Hills, MI (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Anup Alexander, MD, Maywood, IL (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Rekha Mody, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Kevin Paul, BS, Chicago, IL (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Stephen C. O'Connor, MD, (*Presenter*) Nothing to Disclose

##### W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management

###### Participants

Mohamed Shaif Yusufishaq, MD, BEng, Des Plaines, IL (*Presenter*) Nothing to Disclose

## LEARNING OBJECTIVES

1) Recognize various types of contrast reactions and the proper management of various types of contrast reactions through simulation-based training. 2) Learn with hands-on practice the proper administration of various routes of epinephrine as well as other medications to treat the more common allergic-like contrast reactions. 3) Recognize and manage a contrast reaction in a sedated patient. 4) Recognize and manage a contrast reaction in a pediatric patient 5) Recognize and practice team communication skills necessary for high stress infrequent scenarios using simulation-based training.\*Course Description In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Through hands-on high-fidelity simulation scenario training, learners will practice recognizing and managing various types of contrast reactions. Following a brief lecture, learners will rotate through multiple stations during the course to gain individual hands-on experience. To enhance the learner's experience and allow for more time in the hands-on stations, we ask all learners for the course to watch this short 15 min. video on contrast reaction management prior to the course [https://youtu.be/9r-\\_E8dmJ0A](https://youtu.be/9r-_E8dmJ0A).

## COURSE DESCRIPTION

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### **W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management**

Participants

Senta Berggruen, MD, (*Presenter*) Nothing to Disclose

### **W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management**

Participants

Andrew Williams, Chicago, IL (*Presenter*) Nothing to Disclose

### **W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management**

Participants

Michael Zhang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

### **W2-CMS10 RSNA Hands-On Lab: Contrast Reaction Management**

Participants

Lindsay Yang, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CHN03

**Moderator**

### Participants

Elizabeth George, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CHN03

### Imaging Workup of Eye Pain

#### Participants

Blair Winegar, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the imaging algorithm and search patterns for patients presenting with eye pain, diplopia, and vision loss. 2) Understand the imaging algorithm and search patterns in the pediatric orbit.\*Course Description In this Head and Neck session devoted to the orbit, attendees will review the imaging approach and will be presented with clinical case examples of patients with eye pain, diplopia, and vision loss. Attendees will also review the imaging approaches and pathologies in the pediatric orbit. Speakers will emphasize pearls for imaging evaluation and differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

#### COURSE DESCRIPTION

In this Head and Neck session devoted to the orbit, attendees will review the imaging approach and will be presented with clinical case examples of patients with eye pain, diplopia, and vision loss. Attendees will also review the imaging approaches and pathologies in the pediatric orbit. Speakers will emphasize pearls for imaging evaluation and differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-CHN03

### Imaging Workup of Diplopia

#### Participants

Paul Bunch, MD, Winston Salem, NC (*Presenter*) Research Grant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CHN03

### Imaging Workup of Vision Loss

#### Participants

Mari Hagiwara, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CHN03

### Imaging and Pathology in the Pediatric Orbit

#### Participants

Karen K. Moeller, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CHN03

### The Eyes Have It: Essentials in Orbital Imaging

#### Sub-Events

#### W3-CHN03 Imaging Workup of Eye Pain

##### Participants

Blair Winegar, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the imaging algorithm and search patterns for patients presenting with eye pain, diplopia, and vision loss. 2) Understand the imaging algorithm and search patterns in the pediatric orbit.\*Course Description In this Head and Neck session devoted to the orbit, attendees will review the imaging approach and will be presented with clinical case examples of patients with eye pain, diplopia, and vision loss. Attendees will also review the imaging approaches and pathologies in the pediatric orbit. Speakers will emphasize pearls for imaging evaluation and differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

#### COURSE DESCRIPTION

In this Head and Neck session devoted to the orbit, attendees will review the imaging approach and will be presented with clinical case examples of patients with eye pain, diplopia, and vision loss. Attendees will also review the imaging approaches and pathologies in the pediatric orbit. Speakers will emphasize pearls for imaging evaluation and differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

#### W3-CHN03 Imaging Workup of Diplopia

##### Participants

Paul Bunch, MD, Winston Salem, NC (*Presenter*) Research Grant, General Electric Company

#### W3-CHN03 Imaging Workup of Vision Loss

##### Participants

Mari Hagiwara, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

#### W3-CHN03 Imaging and Pathology in the Pediatric Orbit

##### Participants

Karen K. Moeller, MD, (*Presenter*) Nothing to Disclose

#### W3-CHN03 Moderator

##### Participants

Elizabeth George, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNMMI07

### Prostate Theranostics

#### LEARNING OBJECTIVES

1) To review clinical interpretation of PET/CT with PSMA-targeting agents. 2) To discuss how to do PSMA targeted-therapy.\*Course Description This course will provide an update on molecular imaging and targeted therapy for prostate cancer. We will include clinical pearls and pitfalls and illustrative case examples.

#### COURSE DESCRIPTION

This course will provide an update on molecular imaging and targeted therapy for prostate cancer. We will include clinical pearls and pitfalls and illustrative case examples.

#### Sub-Events

##### **W3- CNMMI07** Moderator

Participants  
Don Yoo, MD, (*Moderator*) Consultant, Konica Minolta, Inc

##### **W3- CNMMI07** Introduction and Unusual Pitfalls in PSMA PET/CT

Participants  
Don Yoo, MD, (*Presenter*) Consultant, Konica Minolta, Inc

##### **W3- CNMMI07** PSMA PET/CT Imaging

Participants  
Terence Z. Wong, MD, PhD, Durham, NC (*Presenter*) Consultant, General Electric Company

##### **W3- CNMMI07** PSMA Therapy

Participants  
Andrei Iagaru, MD, Stanford, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Lantheus Holdings; Research Grant, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNMMI07

**Moderator**

### Participants

Don Yoo, MD, (*Moderator*) Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNMMI07

### Introduction and Unusual Pitfalls in PSMA PET/CT

#### Participants

Don Yoo, MD, (*Presenter*) Consultant, Konica Minolta, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNMMI07

### PSMA PET/CT Imaging

#### Participants

Terence Z. Wong, MD, PhD, Durham, NC (*Presenter*) Consultant, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-CNMMI07

### PSMA Therapy

#### Participants

Andrei Iagaru, MD, Stanford, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Lantheus Holdings; Research Grant, Novartis AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

### Radiology Dashboarding 2.0 (Sponsored by the RSNA Quality Improvement Committee)

#### Sub-Events

##### W3-CNPM09 Moderator

###### Participants

Matthew E. Zygmunt, MD, (*Moderator*) Nothing to Disclose

##### W3-CNPM09 Moderator

###### Participants

Melissa Davis, MD, MBA, Atlanta, GA (*Moderator*) Nothing to Disclose

##### W3-CNPM09 My Radiologist Performance Metrics Dashboard- What Makes the Most Sense

###### Participants

Michael M. Moore, MD, Hummelstown, PA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To describe sensible radiologist performance metrics. 2) To weigh the role of metrics use in achieving health equity. 3) To implement dashboarding in your practice.\*Course Description Dashboards help us understand how our departments function. It is important for radiologists to know how to leverage these tools to make decisions within their practices. In this session we will discuss how to leverage dashboards in our operations, educational initiatives, and in regard to equitable decision making.

#### COURSE DESCRIPTION

Dashboards help us understand how our departments function. It is important for radiologists to know how to leverage these tools to make decisions within their practices. In this session we will discuss how to leverage dashboards in our operations, educational initiatives, and in regard to equitable decision making.

##### W3-CNPM09 Education Program Metrics: Meeting Goals and Driving Improvements

###### Participants

Matthew E. Zygmunt, MD, (*Presenter*) Nothing to Disclose

##### W3-CNPM09 Equity Metrics: Opportunities and Barriers

###### Participants

Melissa Davis, MD, MBA, Atlanta, GA (*Presenter*) Nothing to Disclose

##### W3-CNPM09 Dashboarding Tools: Easy Peasy

###### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

**Moderator**

### Participants

Melissa Davis, MD, MBA, Atlanta, GA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

### My Radiologist Performance Metrics Dashboard- What Makes the Most Sense

#### Participants

Michael M. Moore, MD, Hummelstown, PA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To describe sensible radiologist performance metrics. 2) To weigh the role of metrics use in achieving health equity. 3) To implement dashboarding in your practice.\*Course Description Dashboards help us understand how our departments function. It is important for radiologists to know how to leverage these tools to make decisions within their practices. In this session we will discuss how to leverage dashboards in our operations, educational initiatives, and in regard to equitable decision making.

#### COURSE DESCRIPTION

Dashboards help us understand how our departments function. It is important for radiologists to know how to leverage these tools to make decisions within their practices. In this session we will discuss how to leverage dashboards in our operations, educational initiatives, and in regard to equitable decision making.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

### Education Program Metrics: Meeting Goals and Driving Improvements

#### Participants

Matthew E. Zygmunt, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

### Equity Metrics: Opportunities and Barriers

#### Participants

Melissa Davis, MD, MBA, Atlanta, GA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

### **Dashboarding Tools: Easy Peasy**

#### **Participants**

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CNPM09

**Moderator**

### Participants

Matthew E. Zygmunt, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-CPD06

**Moderator**

### Participants

Kirsten Ecklund, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPD06

### The Limping Child: Etiologies and Appropriate Imaging

#### Participants

Arthur B. Meyers, MD, Cincinnati, OH (*Presenter*) Author with royalties, Reed Elsevier; Editor with royalties, Reed Elsevier

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPD06

### Pediatric Musculoskeletal Imaging: Cutting-edge Updates for Common Conditions

#### LEARNING OBJECTIVES

1) Understand perfusion imaging and current applications of artificial intelligence (AI) in evaluation of hip dysplasia. 2) Construct an imaging algorithm for the work up of the limping child and recognize common and uncommon etiologies of acute limp. 3) Define updated imaging protocols for evaluation of pediatric musculoskeletal infections with an emphasis on high resolution US, vascular imaging, and MR DWI.\*Course Description This 3-lecture session will review state-of-the-art, updated multimodality techniques for imaging common pediatric musculoskeletal conditions at diagnosis and during follow-up.

#### COURSE DESCRIPTION

This 3-lecture session will review state-of-the-art, updated multimodality techniques for imaging common pediatric musculoskeletal conditions at diagnosis and during follow-up.

#### Sub-Events

##### W3-CPD06 Moderator

Participants

Kirsten Ecklund, MD, Boston, MA (*Moderator*) Nothing to Disclose

##### W3-CPD06 The Limping Child: Etiologies and Appropriate Imaging

Participants

Arthur B. Meyers, MD, Cincinnati, OH (*Presenter*) Author with royalties, Reed Elsevier;Editor with royalties, Reed Elsevier

##### W3-CPD06 MSK Infection: New Techniques for Well-known Pathologies

Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### W3-CPD06 Developmental Dysplasia of the Hip: Updates in Imaging Protocols

Participants

Michael F. Fadell II, MD, Aurora, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPD06

### Developmental Dysplasia of the Hip: Updates in Imaging Protocols

#### Participants

Michael F. Fadell II, MD, Aurora, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPD06

### MSK Infection: New Techniques for Well-known Pathologies

#### Participants

Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPH07

### AI in Ultrasound Imaging

#### Sub-Events

#### W3-CPH07 Moderator

##### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Moderator*) Royalties, Hologic, Inc

#### W3-CPH07 Incorporating Ultrasound Imaging Physics into Artificial Intelligence

##### Participants

Jeremy J. Dahl, PhD, Durham, NC (*Presenter*) Technical Advisory Board, MAUI Imaging, Inc; Technical Advisory Board, Cephasonics Ultrasound; Technical Advisor, Vortex Imaging

#### LEARNING OBJECTIVES

1) Ultrasonic imaging modalities and devices, methods for ultrasonic beamforming, image reconstruction, speckle reduction, and image artifact removal. 2) Robotics and ultrasound-guided interventions. 3) Ultrasound image analysis for detection, diagnosis, and prognosis of disease.\*Course Description This updated course will consist of 3 lectures that will inform the audience on new developments in all aspects of AI for medical ultrasound from high-quality image generation, including beam formation, image reconstruction, and microbubbles, to robotics, to ultrasound image analysis intended as a decision aid to radiologists in clinical practice.

#### COURSE DESCRIPTION

This updated course will consist of 3 lectures that will inform the audience on new developments in all aspects of AI for medical ultrasound from high-quality image generation, including beam formation, image reconstruction, and microbubbles, to robotics, to ultrasound image analysis intended as a decision aid to radiologists in clinical practice.

#### W3-CPH07 AI and Robotics for Ultrasound Guided Interventions

##### Participants

Laura Brattain, Lexington, MA (*Presenter*) Nothing to Disclose

#### W3-CPH07 AI in Medical Image Analysis: Ultrasound Imaging for Detection, Diagnosis, and Prognosis of Disease

##### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPH07

**Moderator**

### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Moderator*) Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPH07

### Incorporating Ultrasound Imaging Physics into Artificial Intelligence

#### Participants

Jeremy J. Dahl, PhD, Durham, NC (*Presenter*) Technical Advisory Board, MAUI Imaging, Inc; Technical Advisory Board, Cephasonics Ultrasound; Technical Advisor, Vortex Imaging

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1) Ultrasonic imaging modalities and devices, methods for ultrasonic beamforming, image reconstruction, speckle reduction, and image artifact removal. 2) Robotics and ultrasound-guided interventions. 3) Ultrasound image analysis for detection, diagnosis, and prognosis of disease.\*Course Description This updated course will consist of 3 lectures that will inform the audience on new developments in all aspects of AI for medical ultrasound from high-quality image generation, including beam formation, image reconstruction, and microbubbles, to robotics, to ultrasound image analysis intended as a decision aid to radiologists in clinical practice.

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Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-CPH07

### AI and Robotics for Ultrasound Guided Interventions

#### Participants

Laura Brattain, Lexington, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CPH07

**AI in Medical Image Analysis: Ultrasound Imaging for Detection, Diagnosis, and Prognosis of Disease**

### Participants

Karen Drukker, PhD, MBA, Chicago, IL (*Presenter*) Royalties, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRO04

### Pediatric MDC Review

#### Participants

Jessica Clymer, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRO04

### Pediatric MDC Review

#### Sub-Events

#### W3-CRO04 Moderator

##### Participants

Hesham Elhalawani, MD, MSc, Boston, MA (*Moderator*) Nothing to Disclose

#### W3-CRO04 Moderator

##### Participants

Camilo Jaimes Cobos, MD, Boston, MA (*Moderator*) Nothing to Disclose

#### W3-CRO04 Pediatric MDC Review

##### Participants

Michael S. Gee, MD, PhD, Boston, MA (*Presenter*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC

#### LEARNING OBJECTIVES

1) Engage in a multidisciplinary discussion concerning three complex pediatric oncology cases, focusing on their clinical and imaging characteristics. 2) Present recommendations from the COG/SPR consensus papers pertaining to image acquisition and interpretation. 3) Examine the role of radiation therapy in these cases, emphasizing strategic planning, and delivery considerations.\*Course Description This interactive panel discussion will delve into three complex pediatric oncology cases. The panel, composed of two pediatric radiologists, a radiation oncologist, and a medical oncologist, will guide the conversation. Each case will be introduced through its clinical presentation and initial imaging. The medical oncologist will provide insights into the biology of the tumor, its staging, and the standard medical management. Following this, the radiation oncologist will discuss treatment alternatives, intricacies of radiation planning, and crucial aspects of delivery. The discussion will emphasize key aspects of medical imaging for each case, drawing on the recent recommendations from the Children's Oncology Group (COG)/Society for Pediatric Radiology (SPR) guidelines.

#### COURSE DESCRIPTION

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#### W3-CRO04 Pediatric MDC Review

##### Participants

Jessica Clymer, MD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRO04

**Moderator**

### Participants

Hesham Elhalawani, MD, MSc, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRO04

**Moderator**

### **Participants**

Camilo Jaimes Cobos, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRO04

### Pediatric MDC Review

#### Participants

Michael S. Gee, MD, PhD, Boston, MA (*Presenter*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC

#### LEARNING OBJECTIVES

1) Engage in a multidisciplinary discussion concerning three complex pediatric oncology cases, focusing on their clinical and imaging characteristics. 2) Present recommendations from the COG/SPR consensus papers pertaining to image acquisition and interpretation. 3) Examine the role of radiation therapy in these cases, emphasizing strategic planning, and delivery considerations.\*Course Description This interactive panel discussion will delve into three complex pediatric oncology cases. The panel, composed of two pediatric radiologists, a radiation oncologist, and a medical oncologist, will guide the conversation. Each case will be introduced through its clinical presentation and initial imaging. The medical oncologist will provide insights into the biology of the tumor, its staging, and the standard medical management. Following this, the radiation oncologist will discuss treatment alternatives, intricacies of radiation planning, and crucial aspects of delivery. The discussion will emphasize key aspects of medical imaging for each case, drawing on the recent recommendations from the Children's Oncology Group (COG)/Society for Pediatric Radiology (SPR) guidelines.

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Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRT05

### ASRT@RSNA: Cybersecurity Primer for Radiology Professionals

#### LEARNING OBJECTIVES

1) Recognize the sources of cyber threats and how our equipment and people make us vulnerable. 2) Prepare in advance of cyberattacks. 3) Describe the business continuity and recovery processes in the hours and days after an attack.\*Course Description Cybersecurity is relevant to all modern industries – especially radiology, as imaging is leading the way as the first truly digital specialty, fully dependent on networked computer systems. We all need to take a thoughtful and systematic approach to preventing cyberattack, including all radiology infrastructure and staff. This effort must include investment in technology, deployment, and management. We must practice good "cyber hygiene" to protect infrastructure and ensure that staff are educated and aware of the threats. The human element is one of the most common points of failure against cyberattacks. This lecture will cover the most likely sources of cyber threats, how to prepare for these attacks in advance, and how to maintain business continuity in the event of an attack.

#### COURSE DESCRIPTION

Cybersecurity is relevant to all modern industries – especially radiology, as imaging is leading the way as the first truly digital specialty, fully dependent on networked computer systems. We all need to take a thoughtful and systematic approach to preventing cyberattack, including all radiology infrastructure and staff. This effort must include investment in technology, deployment, and management. We must practice good "cyber hygiene" to protect infrastructure and ensure that staff are educated and aware of the threats. The human element is one of the most common points of failure against cyberattacks. This lecture will cover the most likely sources of cyber threats, how to prepare for these attacks in advance, and how to maintain business continuity in the event of an attack.

#### Sub-Events

##### W3-CRT05 Moderator

Participants  
Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### W3-CRT05 ASRT@RSNA: Cybersecurity Primer for Radiology Professionals

Participants  
Christoph Wald, MD, MBA, Nahant, MA (*Presenter*) Nothing to Disclose

##### W3-CRT05 ASRT@RSNA: Cybersecurity Primer for Radiology Professionals

Participants  
Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

##### W3-CRT05 ASRT@RSNA: Cybersecurity Primer for Radiology Professionals

Participants  
Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-CRT05

**Moderator**

### **Participants**

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRT05

**ASRT@RSNA: Cybersecurity Primer for Radiology Professionals**

### Participants

Christoph Wald, MD, MBA, Nahant, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRT05

**ASRT@RSNA: Cybersecurity Primer for Radiology Professionals**

### Participants

Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-CRT05

**ASRT@RSNA: Cybersecurity Primer for Radiology Professionals**

### Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP06

### RSNA/ESR Symposium: Imaging of Neurodegenerative Disorders - Dementia: Towards an Aetiologic Diagnosis

#### LEARNING OBJECTIVES

1) Explain the current use of MRI for etiologic dementia diagnosis. 2) Explain the current use of molecular imaging for etiologic dementia diagnosis. 3) Demonstrate structured selection and assessment of imaging exams through cases.\*Course Description Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This second educational session will discuss how in current clinical practice imaging modalities such as MRI and molecular imaging techniques can be used to support an etiologic diagnosis of dementia. This session will give general radiologists and those interested in neuroradiology and nuclear medicine/molecular imaging the knowledge needed for appropriate selection and structured assessment of imaging exams in diagnostic work-up of dementia. The session format consist of in part lectures, followed by an interactive case-based discussion.

#### COURSE DESCRIPTION

Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This second educational session will discuss how in current clinical practice imaging modalities such as MRI and molecular imaging techniques can be used to support an etiologic diagnosis of dementia. This session will give general radiologists and those interested in neuroradiology and nuclear medicine/molecular imaging the knowledge needed for appropriate selection and structured assessment of imaging exams in diagnostic work-up of dementia. The session format consist of in part lectures, followed by an interactive case-based discussion.

#### Sub-Events

##### W3-RCP06 Moderator

###### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

##### W3-RCP06 Moderator

###### Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

##### W3-RCP06 MR Imaging in Dementia Aetiology: Patterns of Atrophy and Vascular Lesions

###### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

##### W3-RCP06 Molecular Imaging in Dementia Aetiology: Current Concepts

###### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

##### W3-RCP06 Dementia Etiology: Interactive Case Discussion

###### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

##### W3-RCP06 Dementia Etiology: Interactive Case Discussion

###### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

## Abstract Archives of the RSNA, 2023

W3-RCP06

**Moderator**

### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP06

**Moderator**

### Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP06

### MR Imaging in Dementia Aetiology: Patterns of Atrophy and Vascular Lesions

#### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-RCP06

### Molecular Imaging in Dementia Aetiology: Current Concepts

#### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP06

### Dementia Etiology: Interactive Case Discussion

#### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP06

### Dementia Etiology: Interactive Case Discussion

#### Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

### RadioGraphics: Editor's Picks/Choice over the Years

#### Sub-Events

##### W3-RCP13 Moderator

###### Participants

Mark Hammer, MD, (*Moderator*) Nothing to Disclose

##### W3-RCP13 Moderator

###### Participants

Cooky Menias, MD, Phoenix, AZ (*Moderator*) Royalties, RELX

##### W3-RCP13 Moderator

###### Participants

Antonio Luna, MD, PhD, Jaen, Spain (*Moderator*) Speaker, General Electric Company

##### W3-RCP13 Coronary Artery Calcium Scoring: Current Status and Future Directions

###### Participants

Amit Gupta, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify and comprehend the key characteristics of different disease entities discussed in top RadioGraphics papers from the past year. 2) Correlate anatomic, pathologic, and imaging findings for a variety of pathologic conditions relevant to clinical radiology practice. 3) Understand the clinical significance and management implications of diseases from select RadioGraphics papers from the past year.\*Course Description RadioGraphics: Editor's Choice course will highlight 4 published papers from the last year, where authors will summarize key points from their manuscripts highlighting the significance of imaging findings, clinical significance and management implications to the wider radiology community

#### COURSE DESCRIPTION

RadioGraphics: Editor's Choice course will highlight 4 published papers from the last year, where authors will summarize key points from their manuscripts highlighting the significance of imaging findings, clinical significance and management implications to the wider radiology community

##### W3-RCP13 Pancreatic Cystic Lesions and Malignancy: Assessment, Guidelines, and the Field Defect

###### Participants

Frank H. Miller, MD, Chicago, IL (*Presenter*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA

Amit Gupta, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

##### W3-RCP13 Benign-appearing Incidental Adnexal Cysts at US, CT, and MRI: Putting the ACR, O-RADS, and SRU Guidelines All Together

###### Participants

Frank H. Miller, MD, Chicago, IL (*Presenter*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA

Peter S. Wang, MD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV

##### W3-RCP13 Interstitial Lung Abnormalities at CT: Subtypes, Clinical Significance, and Associations with Lung Cancer

###### Participants

Peter S. Wang, MD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV

Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

## Abstract Archives of the RSNA, 2023

W3-RCP13

**Moderator**

### Participants

Mark Hammer, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

**Moderator**

### Participants

Cooky Menias, MD, Phoenix, AZ (*Moderator*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

**Moderator**

### Participants

Antonio Luna, MD, PhD, Jaen, Spain (*Moderator*) Speaker, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

### Coronary Artery Calcium Scoring: Current Status and Future Directions

#### Participants

Amit Gupta, MD, Cleveland, OH (*Presenter*) Nothing to Disclose  
Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify and comprehend the key characteristics of different disease entities discussed in top RadioGraphics papers from the past year. 2) Correlate anatomic, pathologic, and imaging findings for a variety of pathologic conditions relevant to clinical radiology practice. 3) Understand the clinical significance and management implications of diseases from select RadioGraphics papers from the past year.\*Course Description RadioGraphics: Editor's Choice course will highlight 4 published papers from the last year , where authors will summarize key points from their manuscripts highlighting the significance of imaging findings, clinical significance and management implications to the wider radiology community

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RadioGraphics: Editor's Choice course will highlight 4 published papers from the last year , where authors will summarize key points from their manuscripts highlighting the significance of imaging findings, clinical significance and management implications to the wider radiology community

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W3-RCP13

### **Pancreatic Cystic Lesions and Malignancy: Assessment, Guidelines, and the Field Defect**

#### **Participants**

Frank H. Miller, MD, Chicago, IL (*Presenter*) Advisory Board, Bayer AG; Advisory Board, Guerbet SA  
Amit Gupta, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

### **Benign-appearing Incidental Adnexal Cysts at US, CT, and MRI: Putting the ACR, O-RADS, and SRU Guidelines All Together**

#### **Participants**

Frank H. Miller, MD, Chicago, IL (*Presenter*) Advisory Board, Bayer AG; Advisory Board, Guerbet SA  
Peter S. Wang, MD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W3-RCP13

### Interstitial Lung Abnormalities at CT: Subtypes, Clinical Significance, and Associations with Lung Cancer

#### Participants

Peter S. Wang, MD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV  
Akinori Hata, PhD, Suita, Japan (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CIN05

### Informatics Strategy and Initiatives to Enhance the Pre Imaging Exam Journey

#### Participants

Namita S. Gandhi, MD, MSc, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Informatics strategy and initiatives to enhance the pre imaging exam journey. 2) Informatics strategy and challenges with patient friendly report. 3) Informatics strategies for patient friendly image exchange. 4) Informatics considerations for patient reported outcomes.\*Course Description Patient journey refers to patient's experience throughout an episode of care; for radiology this begins at the time when an imaging order is placed and carries through till the patients receive their imaging reports. The reports impact further patient care and outcomes. Traditionally, strategies to improve patient experience and care in radiology are focused on enhancing only the radiology encounter. This course will focus on the entire episode of care (pre and post radiology encounter) in a patient's imaging journey and discuss informatics strategies and considerations to enhance the entire journey. The session will be organized as short presentations by the speakers followed by a panel discussion at the end. The panel will be available for audience questions.

#### COURSE DESCRIPTION

Patient journey refers to patient's experience throughout an episode of care; for radiology this begins at the time when an imaging order is placed and carries through till the patients receive their imaging reports. The reports impact further patient care and outcomes. Traditionally, strategies to improve patient experience and care in radiology are focused on enhancing only the radiology encounter. This course will focus on the entire episode of care (pre and post radiology encounter) in a patient's imaging journey and discuss informatics strategies and considerations to enhance the entire journey. The session will be organized as short presentations by the speakers followed by a panel discussion at the end. The panel will be available for audience questions.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CIN05

### Informatics Strategy and Challenges with Patient Friendly Reports

#### Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CIN05

### Patient Friendly Image Access

#### Participants

Marc Kohli, MD, San Francisco, CA (*Presenter*) Founder, Alara Imaging; Stockholder, Alara Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CIN05

### Patient Reported Outcomes and Lung Cancer Screening

#### Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc; Research Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CIN05

**Moderator**

### Participants

Namita S. Gandhi, MD, MSc, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-CIN05

**Through the Looking Glass (Informatics Lens); Enhancing Patient Journey Through Imaging (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc.)**

### Sub-Events

#### W4-CIN05 Moderator

Participants

Namita S. Gandhi, MD, MSc, (*Moderator*) Nothing to Disclose

#### W4-CIN05 Informatics Strategy and Initiatives to Enhance the Pre Imaging Exam Journey

Participants

Namita S. Gandhi, MD, MSc, (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Informatics strategy and initiatives to enhance the pre imaging exam journey. 2) Informatics strategy and challenges with patient friendly report. 3) Informatics strategies for patient friendly image exchange. 4) Informatics considerations for patient reported outcomes.\*Course Description Patient journey refers to patient's experience throughout an episode of care; for radiology this begins at the time when an imaging order is placed and carries through till the patients receive their imaging reports. The reports impact further patient care and outcomes. Traditionally, strategies to improve patient experience and care in radiology are focused on enhancing only the radiology encounter. This course will focus on the entire episode of care (pre and post radiology encounter) in a patient's imaging journey and discuss informatics strategies and considerations to enhance the entire journey. The session will be organized as short presentations by the speakers followed by a panel discussion at the end. The panel will be available for audience questions.

### COURSE DESCRIPTION

Patient journey refers to patient's experience throughout an episode of care; for radiology this begins at the time when an imaging order is placed and carries through till the patients receive their imaging reports. The reports impact further patient care and outcomes. Traditionally, strategies to improve patient experience and care in radiology are focused on enhancing only the radiology encounter. This course will focus on the entire episode of care (pre and post radiology encounter) in a patient's imaging journey and discuss informatics strategies and considerations to enhance the entire journey. The session will be organized as short presentations by the speakers followed by a panel discussion at the end. The panel will be available for audience questions.

#### W4-CIN05 Informatics Strategy and Challenges with Patient Friendly Reports

Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

#### W4-CIN05 Patient Friendly Image Access

Participants

Marc Kohli, MD, San Francisco, CA (*Presenter*) Founder, Alara Imaging; Stockholder, Alara Imaging

#### W4-CIN05 Patient Reported Outcomes and Lung Cancer Screening

Participants

Dania Daye, MD, PhD, (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc.; Research Consultant, Medtronic plc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CNPM14

**Moderator**

### **Participants**

Richard Heller III, MD, Chicago, IL (*Moderator*) Consultant, Gerson Lehrman Group, Inc;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-CNPM14

### Radiology Reimbursement in the Academic Setting: What Comes Next?

#### Participants

Geraldine McGinty, MD, MBA, New York, NY (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CNPM14

### US Radiology Reimbursement in Context: What Comes Next?

#### LEARNING OBJECTIVES

1) Identify the macroeconomic forces that are influencing reimbursement for radiology services. 2) Identify actions that private, commercial health insurance companies are taking that influence reimbursement for radiology services. 3) Explain the challenges facing radiology under the Medicare Physician Fee Schedule. 4) List actions that medical practices and physicians can take to help protect patients' access to high quality medical imaging. \*Course Description The session will focus on the future of radiology reimbursement within the broader context of health care reform and macroeconomic forces in the United States. This includes value-based payment, Medicare and the physician fee schedule, private payor issues, digital medicine and others. This will be a hybrid session, pairing presentations with moderated dialogue and Q/A.

#### COURSE DESCRIPTION

The session will focus on the future of radiology reimbursement within the broader context of health care reform and macroeconomic forces in the United States. This includes value-based payment, Medicare and the physician fee schedule, private payor issues, digital medicine and others. This will be a hybrid session, pairing presentations with moderated dialogue and Q/A.

#### Sub-Events

##### W4-CNPM14 Moderator

Participants

Richard Heller III, MD, Chicago, IL (*Moderator*) Consultant, Gerson Lehrman Group, Inc;

##### W4-CNPM14 Radiology Reimbursement in the Academic Setting: What Comes Next?

Participants

Geraldine McGinty, MD, MBA, New York, NY (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

##### W4-CNPM14 Private Practice Radiology: Challenges, Opportunities, and Uncertainties

Participants

Ezequiel Silva III, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

##### W4-CNPM14 The Future Economics of Health Care in the US: Doing More for Less

Participants

David Meltzer, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CNPM14

### The Future Economics of Health Care in the US: Doing More for Less

#### Participants

David Meltzer, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CNPM14

### Private Practice Radiology: Challenges, Opportunities, and Uncertainties

#### Participants

Ezequiel Silva III, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CRT06

### ASRT@RSNA: Interventional Radiology & Pediatric Care: The Changing Role of the Technologist/Radiographer

#### Sub-Events

##### W4-CRT06 Moderator

#### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### W4-CRT06 ASRT@RSNA: Topic: Interventional Radiology: The Technologists/ Radiographers Changing Role Changing Techniques in Pediatric Care

#### Participants

Emma Rose, MSc, BSc, London, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain an overview of Pediatric Interventional Radiology. 2) Learn about advanced practice roles within Interventional Radiology and how these could be applied to their own clinical practice. 3) Learn how advanced practice roles benefit patients, and the wider healthcare system.\*Course Description This session will provide an overview of interventional procedures performed for pediatric patients, including recent innovations. It will also examine the technologist/radiographer role in Interventional Radiology and how this is developing to include advanced roles.

#### COURSE DESCRIPTION

This session will provide an overview of interventional procedures performed for pediatric patients, including recent innovations. It will also examine the technologist/radiographer role in Interventional Radiology and how this is developing to include advanced roles.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-CRT06

### ASRT@RSNA: Topic: Interventional Radiology: The Technologists/ Radiographers Changing Role Changing Techniques in Pediatric Care

#### Participants

Emma Rose, MSc, BSc, London, United Kingdom (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain an overview of Pediatric Interventional Radiology. 2) Learn about advanced practice roles within Interventional Radiology and how these could be applied to their own clinical practice. 3) Learn how advanced practice roles benefit patients, and the wider healthcare system.\*Course Description This session will provide an overview of interventional procedures performed for pediatric patients, including recent innovations. It will also examine the technologist/radiographer role in Interventional Radiology and how this is developing to include advanced roles.

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This session will provide an overview of interventional procedures performed for pediatric patients, including recent innovations. It will also examine the technologist/radiographer role in Interventional Radiology and how this is developing to include advanced roles.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-CRT06

**Moderator**

### **Participants**

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CBR10

**Moderator**

### **Participants**

Wendie A. Berg, MD, PhD, Gibsonia, PA (*Moderator*) Institutional Research Grant, Koios Medical, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CBR10

### Breast Screening with US: Should We Do It?

#### Participants

Wendie A. Berg, MD, PhD, Gibsonia, PA (*Presenter*) Institutional Research Grant, Koios Medical, Inc

#### LEARNING OBJECTIVES

1) Identify patients who should have breast screening beyond mammography. 2) Describe expected results from MRI screening. 3) Discuss alternatives to MRI screening for those recommended for it but unable to tolerate it, including ultrasound or, potentially, contrast-enhanced mammography.\*Course Description This session will detail which people meet current guidelines for supplemental breast cancer screening beyond mammography based on risk, including ages to start and stop screening. The latest ACR, NCCN, and EUSOBI guidelines will be discussed.

#### COURSE DESCRIPTION

This session will detail which people meet current guidelines for supplemental breast cancer screening beyond mammography based on risk, including ages to start and stop screening. The latest ACR, NCCN, and EUSOBI guidelines will be discussed.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CBR10

### Factors Influencing Breast Cancer Risk on Imaging

#### Participants

Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Research Grant, Hologic, Inc;Advisory Panel, Hologic, Inc;Research Grant, OM1, Inc;Research Grant, iCad, Inc;Advisory Panel, iCad, Inc;Speaker, WebMD LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CBR10

### Breast Screening with MRI

#### Participants

Christopher E. Comstock, MD, New York, NY (*Presenter*) Speakers Bureau, Bracco Group; Advisory Board, Guerbet SA; Consultant, Bayer AG; Speaker, Northwest Imaging Forums, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CBR10

### Breast Screening and Breast Cancer Risk

#### Sub-Events

#### W6-CBR10 Moderator

##### Participants

Wendie A. Berg, MD, PhD, Gibsonia, PA (*Moderator*) Institutional Research Grant, Koios Medical, Inc

#### W6-CBR10 Breast Screening with US: Should We Do It?

##### Participants

Wendie A. Berg, MD, PhD, Gibsonia, PA (*Presenter*) Institutional Research Grant, Koios Medical, Inc

#### LEARNING OBJECTIVES

1) Identify patients who should have breast screening beyond mammography. 2) Describe expected results from MRI screening. 3) Discuss alternatives to MRI screening for those recommended for it but unable to tolerate it, including ultrasound or, potentially, contrast-enhanced mammography.\*Course Description This session will detail which people meet current guidelines for supplemental breast cancer screening beyond mammography based on risk, including ages to start and stop screening. The latest ACR, NCCN, and EUSOBI guidelines will be discussed.

#### COURSE DESCRIPTION

This session will detail which people meet current guidelines for supplemental breast cancer screening beyond mammography based on risk, including ages to start and stop screening. The latest ACR, NCCN, and EUSOBI guidelines will be discussed.

#### W6-CBR10 Factors Influencing Breast Cancer Risk on Imaging

##### Participants

Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Research Grant, Hologic, Inc;Advisory Panel, Hologic, Inc;Research Grant, OM1, Inc;Research Grant, iCad, Inc;Advisory Panel, iCad, Inc;Speaker, WebMD LLC

#### W6-CBR10 Breast Screening with MRI

##### Participants

Christopher E. Comstock, MD, New York, NY (*Presenter*) Speakers Bureau, Bracco Group;Advisory Board, Guerbet SA;Consultant, Bayer AG;Speaker, Northwest Imaging Forums, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCA09

**Moderator**

### Participants

Jill Jacobs, MD, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCA09

**Moderator**

### **Participants**

Pamela Woodard, MD, Saint Louis, MO (*Moderator*) Researcher, Siemens AG; Consulting, Medtronic plc; Researcher, Bayer AG; Patent, Washington University

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CCA09

### Strengths and Limitations of Coronary CT for Assessment of Heart Disease in Women

#### Participants

Luba Frank, MD, Friendswood, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCA09

### Truth and Myths About CT FFR - A Decade of Experience

#### Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG; Research Grant, Bracco Group; Research Grant, Elucid BioImaging Inc; Consultant, Elucid BioImaging Inc; Research Grant: General Electric Company; Research Grant, Guerbet SA; Research Grant, Heartflow, Inc; Speakers Bureau, Heartflow Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCA09

### Quantitative Atherosclerotic Plaque Imaging: Pushing the Limits with CAD RAD 2.0

#### Participants

Geoffrey D. Rubin, MD, MBA, Tucson, AZ (*Presenter*) Consultant, Fovia, Inc;Advisor, HeartFlow, Inc;Advisor, Nano-X Imaging Ltd;Advisor, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCA09

### Hot Topics in Coronary CTA in 2023

#### LEARNING OBJECTIVES

1) Identify the strengths and limitations of using CCTA to assess CAD in women. 2) Understand some of the advantages and challenges of using CTFFR for assessing coronary stenosis. 3) Explore the concept of quantitative plaque assessment using CADRAD 2.0.\*Course Description This course will explore some of the current hot topics in CCTA: the strengths and limitations of its use for assessing CAD in women, the advantages and challenges of utilizing CTFFR when assessing coronary stenosis, and quantitative plaque assessment and reporting with CADRAD 2.0.

#### COURSE DESCRIPTION

This course will explore some of the current hot topics in CCTA: the strengths and limitations of its use for assessing CAD in women, the advantages and challenges of utilizing CTFFR when assessing coronary stenosis, and quantitative plaque assessment and reporting with CADRAD 2.0.

#### Sub-Events

##### W6-CCA09 Moderator

Participants

Jill Jacobs, MD, New York, NY (*Moderator*) Nothing to Disclose

##### W6-CCA09 Moderator

Participants

Pamela Woodard, MD, Saint Louis, MO (*Moderator*) Researcher, Siemens AG;Consulting, Medtronic plc;Researcher, Bayer AG;Patent, Washington University

##### W6-CCA09 Strengths and Limitations of Coronary CT for Assessment of Heart Disease in Women

Participants

Luba Frank, MD, Friendswood, TX (*Presenter*) Nothing to Disclose

##### W6-CCA09 Truth and Myths About CT FFR - A Decade of Experience

Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc

##### W6-CCA09 Quantitative Atherosclerotic Plaque Imaging: Pushing the Limits with CAD RAD 2.0

Participants

Geoffrey D. Rubin, MD, MBA, Tucson, AZ (*Presenter*) Consultant, Fovia, Inc;Advisor, HeartFlow, Inc;Advisor, Nano-X Imaging Ltd;Advisor, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCH08

**Moderator**

### Participants

Lea Azour, MD, (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCH08

### Update on MRI for Acute PE

#### Participants

Christopher Francois, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCH08

### Update on Mediastinal Mass Imaging

#### Participants

Lea Azour, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCH08

**Technical Update: Recent Innovations in Thoracic PET-CT**

### Participants

Osama R. Mawlawi, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CCH08

**Technical Update: Photon Counting CT for Thoracic Imaging**

### Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) License agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CCH08

### Chest MRI, PET-CT and Photon Counting CT Updates

#### LEARNING OBJECTIVES

1) Describe updates in Chest MRI for Acute PE and Mediastinal Mass Evaluation. 2) Review recent innovations in thoracic PET/CT. 3) Illustrate applications of photon counting CT in the chest.\*Course Description This course will highlight practical, and clinically applied advances in thoracic cross-sectional imaging spanning MRI for pulmonary artery and mediastinal evaluation, PET/CT, and photon-counting CT.

#### COURSE DESCRIPTION

This course will highlight practical, and clinically applied advances in thoracic cross-sectional imaging spanning MRI for pulmonary artery and mediastinal evaluation, PET/CT, and photon-counting CT.

#### Sub-Events

##### W6-CCH08 Moderator

Participants

Lea Azour, MD, (*Moderator*) Nothing to Disclose

##### W6-CCH08 Update on MRI for Acute PE

Participants

Christopher Francois, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### W6-CCH08 Update on Mediastinal Mass Imaging

Participants

Lea Azour, MD, (*Presenter*) Nothing to Disclose

##### W6-CCH08 Technical Update: Recent Innovations in Thoracic PET-CT

Participants

Osama R. Mawlawi, PhD, Houston, TX (*Presenter*) Nothing to Disclose

##### W6-CCH08 Technical Update: Photon Counting CT for Thoracic Imaging

Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) License agreement, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

### Pediatric Trauma: A Case-Based Approach

#### LEARNING OBJECTIVES

1) Explain common mechanisms of injury in the child. 2) Become familiar with normal developmental anatomic changes in the child and understand how these can mimic pathology and will result in different patterns of injury compared to an adult. 3) Review optimized imaging strategies for the pediatric patient.\*Course Description A sampling of common and/or critical injuries will be covered in a case-based format with attention to the pediatric spine, extremities, and thoraco-abdominal regions. This will include brief reviews of key developmental features that can mimic pathology by imaging and alter the results of trauma applied to these levels as compared to adults. Both accidental and nonaccidental traumatic mechanisms will be discussed, and imaging strategies appropriate to the pediatric patient will be shared.

#### COURSE DESCRIPTION

A sampling of common and/or critical injuries will be covered in a case-based format with attention to the pediatric spine, extremities, and thoraco-abdominal regions. This will include brief reviews of key developmental features that can mimic pathology by imaging and alter the results of trauma applied to these levels as compared to adults. Both accidental and nonaccidental traumatic mechanisms will be discussed, and imaging strategies appropriate to the pediatric patient will be shared.

#### Sub-Events

##### W6-CER08 Moderator

Participants

Arnold Merrow JR, MD, Cincinnati, OH (*Moderator*) Consultant, RELX; Author with royalties, RELX

##### W6-CER08 Spinal Trauma

Participants

Birgit Ertl-Wagner, MD, PhD, Toronto, ON (*Presenter*) Spouse, Employee, Siemens AG

##### W6-CER08 Non-Accidental Trauma

Participants

Sara E. Lay, MD, Fishers, IN (*Presenter*) Nothing to Disclose

##### W6-CER08 Chest Trauma

Participants

Summer Kaplan, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### W6-CER08 Abdominal Trauma

Participants

Arnold Merrow JR, MD, Cincinnati, OH (*Presenter*) Consultant, RELX; Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

**Moderator**

### Participants

Arnold Merrow JR, MD, Cincinnati, OH (*Moderator*) Consultant, RELX; Author with royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

### Spinal Trauma

#### Participants

Birgit Ertl-Wagner, MD, PhD, Toronto, ON (*Presenter*) Spouse, Employee, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

### Non-Accidental Trauma

#### Participants

Sara E. Lay, MD, Fishers, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

### Chest Trauma

#### Participants

Summer Kaplan, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CER08

### Abdominal Trauma

#### Participants

Arnold Merrow JR, MD, Cincinnati, OH (*Presenter*) Consultant, RELX; Author with royalties, RELX

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CGI07

### Liver Diffuse Disease

#### LEARNING OBJECTIVES

1) Understand the principles and clinical applications of MR elastography and US elastography in evaluating liver fibrosis and diffuse liver diseases. 2) Recognize new fat quantification techniques in liver imaging to accurately assess and monitor hepatic steatosis. 3) Utilize iron quantification methods in liver imaging to evaluate and monitor iron overload disorders. 4) Integrate these advanced imaging techniques into clinical practice to improve the diagnosis and management of patients with diffuse liver diseases.\*Course Description This educational session aims to provide participants with a comprehensive understanding of advanced imaging techniques for evaluating diffuse liver diseases, with a focus on MR elastography, US elastography, fat quantification, and iron quantification. The session will delve into the principles, clinical applications, advantages, and limitations of each technique, enabling radiologists (participants) to make informed decisions about their use in clinical practice

#### COURSE DESCRIPTION

This educational session aims to provide participants with a comprehensive understanding of advanced imaging techniques for evaluating diffuse liver diseases, with a focus on MR elastography, US elastography, fat quantification, and iron quantification. The session will delve into the principles, clinical applications, advantages, and limitations of each technique, enabling radiologists (participants) to make informed decisions about their use in clinical practice

#### Sub-Events

##### W6-CGI07 Moderator

Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

##### W6-CGI07 MR Elastography

Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

##### W6-CGI07 US Elastography

Participants

Jeong Hee Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Speaker, Bayer AG; Grant, Koninklijke Philips NV

##### W6-CGI07 Fat Quantification

Participants

Claude Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Gilead Sciences, Inc; Research collaboration, Gilead Sciences, Inc; Research Grant, Koninklijke Philips NV; Research Grant, Pfizer Inc; Equipment support, General Electric Company; Consultant, Pfizer Inc; Consultant, AMRA AB; Consultant, Guerbet SA; Officer, Livivos, Inc; Advisor, Quantix Bio LLC

##### W6-CGI07 Iron Quantification

Participants

Takeshi Yokoo, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGI07

**Moderator**

### Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGI07

### MR Elastography

#### Participants

Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGI07

### US Elastography

#### Participants

Jeong Hee Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Speaker, Bayer AG; Grant, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGI07

### Fat Quantification

#### Participants

Claude Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Gilead Sciences, Inc; Research collaboration, Gilead Sciences, Inc; Research Grant, Koninklijke Philips NV; Research Grant, Pfizer Inc; Equipment support, General Electric Company; Consultant, Pfizer Inc; Consultant, AMRA AB; Consultant, Guerbet SA; Officer, Livivos, Inc; Advisor, Quantix Bio LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGI07

### Iron Quantification

#### Participants

Takeshi Yokoo, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGU05

### GU Tumor Boards: How to Bring Value and Become Indispensable

#### LEARNING OBJECTIVES

1) Use case-based format to identify key imaging features that significantly impact management. 2) Understand the common pitfalls in imaging assessment of GU tumors. 3) Improve communication with referring providers to help improve outcomes.\*Course Description With advances in oncology, the role of radiologist in management of GU cancers is rapidly evolving. At GU tumor boards, the radiologist plays a key role in diagnosis, staging, and clinical decision-making. This course guides the attendees through the various challenges and pitfalls faced by the radiologist at the GU tumor boards to successfully guide patient management.

#### COURSE DESCRIPTION

With advances in oncology, the role of radiologist in management of GU cancers is rapidly evolving. At GU tumor boards, the radiologist plays a key role in diagnosis, staging, and clinical decision-making. This course guides the attendees through the various challenges and pitfalls faced by the radiologist at the GU tumor boards to successfully guide patient management.

#### Sub-Events

##### W6-CGU05 Moderator

Participants

Atul Shinagare, MD, Boston, MA (*Moderator*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

##### W6-CGU05 Radiologist at the GU Tumor Boards: Speaking the Common Language

Participants

Atul Shinagare, MD, Boston, MA (*Presenter*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

##### W6-CGU05 Renal Masses: What the Urologists Need to Know

Participants

Matthew Davenport, MD, (*Presenter*) Royalties, Wolters Kluwer nv

##### W6-CGU05 Common Pitfalls in Imaging Assessment of Prostate Cancer

Participants

Antonio Westphalen, MD, PhD, (*Presenter*) Shareholder, ScanMed, LLC; Research funded, BotImage, Inc

##### W6-CGU05 Gynecologic Malignancies: Radiologist Guiding the Way

Participants

Krupa Patel-Lippmann, MD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGU05

**Moderator**

### Participants

Atul Shinagare, MD, Boston, MA (*Moderator*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CGU05

### Radiologist at the GU Tumor Boards: Speaking the Common Language

#### Participants

Atul Shinagare, MD, Boston, MA (*Presenter*) Consultant, VirtualScopics, Inc; Consultant, Imaging Endpoints

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGU05

### Renal Masses: What the Urologists Need to Know

#### Participants

Matthew Davenport, MD, (*Presenter*) Royalties, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGU05

### Common Pitfalls in Imaging Assessment of Prostate Cancer

#### Participants

Antonio Westphalen, MD, PhD, (*Presenter*) Shareholder, ScanMed, LLC; Research funded, BotImage, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CGU05

### Gynecologic Malignancies: Radiologist Guiding the Way

#### Participants

Krupa Patel-Lippmann, MD, Nashville, TN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CIN23

### Ransomware: Principles, Detection, and Recovery

#### LEARNING OBJECTIVES

1) Evaluate the growing impact of ransomware. 2) Describe how to detect early signs of compromise from a cyberattack. 3) Describe the lessons learned from recovery after a ransomware attack.\*Course Description Cybercrime against healthcare institutions has exploded in recent years. Seven years ago, the Hollywood Presbyterian Medical Center paid a \$17,000 ransom to regain access to its medical records blocked by ransomware. In 2021, more than 1 in 3 organizations, and in 2022, more than 2 in 3 organizations reported being hit by ransomware. The Russia-tied Ryuk group hit over 235 healthcare facilities, raking in more than \$100 million in ransoms. Although paying ever-increasing ransoms can be costly for medical centers, refusing to pay them often leads to even bigger losses. The University of Vermont Health system lost \$50 million and Universal Health System lost \$67 million for refusing to pay ransoms in 2020. The Scripps Institute was recently victim of a ransomware attack and lost \$100 million in revenue in the recovery process. The situation has been considerably worsened by the pandemic, which produced a triple threat for healthcare systems: (1) a rapid expansion of internet-connected technologies and services causing an expanded attack surface, (2) an increase in many types of cyberattacks, and (3) fewer available resources to defend against cyberattacks. Recently, the zero-day vulnerability Log4j in Apache software has been leading to hundreds of cyber-attacks around the world since December 2021. Cybersecurity has become an important part of healthcare, and we must address this topic at RSNA since every radiology practice can become a victim of a cyber-attack. This explosion in cyber-attacks against medical centers is the result of (1) the increased connectivity of hospitals through medical devices and networks, (2) the commoditization of cyber-attack tools, and (3) the US Justice System penalizing cyber-attack victims, rather than going after the perpetrators. In this refresher course, we will provide an update on ransomware on hospitals, how to recover from it and the increased interconnectivity of medical devices which worsens the consequences of these attacks. In more details: The status of ransomware in 2023. This will be discussed by Dr Desjardins, an academic radiologist and ex-hacker and specialist in cybersecurity in healthcare. He will not only describe the evolution of ransomware over the past several years, but also explain the basic operating principles of ransomware and how ransomware attacks against hospitals are getting more prevalent and costly. He will also provide an overview of national initiatives to defend against ransomware. Detecting compromise and attacks against medical devices. This will be discussed by Prof Fu, a well-known leader in the cybersecurity of medical devices, who just finished his term as Acting Director of Medical Device Cybersecurity at the FDA. He will not only describe the common, easily avoided, cybersecurity design problems in medical devices, but how to detect early signs of compromise from a pending cyberattack, and how to improve the security of medical devices. Lessons learned from hospital ransomware recovery and planning considerations. This will be discussed by Dr Chen from the Cleveland Clinic. One of the facilities in Cleveland Clinic's network was recently victim of a huge ransomware attack, and Dr Chen published a great overview of lessons learned from this attack and developed a four-phase plan for the recovery from such a cyberattack (J Digit Imaging. 2021 Jun). He will provide a practical overview of these lessons and plan. This refresher course will bring the radiology community up to date on the exponentially growing threat of ransomware affecting healthcare, including recent attacks, and techniques of defense. The course will be presented by radiologists and top cybersecurity experts. The information technology issues will be addressed.

#### COURSE DESCRIPTION

Cybercrime against healthcare institutions has exploded in recent years. Seven years ago, the Hollywood Presbyterian Medical Center paid a \$17,000 ransom to regain access to its medical records blocked by ransomware. In 2021, more than 1 in 3 organizations, and in 2022, more than 2 in 3 organizations reported being hit by ransomware. The Russia-tied Ryuk group hit over 235 healthcare facilities, raking in more than \$100 million in ransoms. Although paying ever-increasing ransoms can be costly for medical centers, refusing to pay them often leads to even bigger losses. The University of Vermont Health system lost \$50 million and Universal Health System lost \$67 million for refusing to pay ransoms in 2020. The Scripps Institute was recently victim of a ransomware attack and lost \$100 million in revenue in the recovery process. The situation has been considerably worsened by the pandemic, which produced a triple threat for healthcare systems: (1) a rapid expansion of internet-connected technologies and services causing an expanded attack surface, (2) an increase in many types of cyberattacks, and (3) fewer available resources to defend against cyberattacks. Recently, the zero-day vulnerability Log4j in Apache software has been leading to hundreds of cyber-attacks around the world since December 2021. Cybersecurity has become an important part of healthcare, and we must address this topic at RSNA since every radiology practice can become a victim of a cyber-attack. This explosion in cyber-attacks against medical centers is the result of (1) the increased connectivity of hospitals through medical devices and networks, (2) the commoditization of cyber-attack tools, and (3) the US Justice System penalizing cyber-attack victims, rather than going after the perpetrators. In this refresher course, we will provide an update on ransomware on hospitals, how to recover from it and the increased interconnectivity of medical devices which worsens the consequences of these attacks. In more details: The status of ransomware in 2023. This will be discussed by Dr Desjardins, an academic radiologist and ex-hacker and specialist in cybersecurity in healthcare. He will not only describe the evolution of ransomware over the past several years, but also explain the basic operating principles of ransomware and how ransomware attacks against hospitals are getting more prevalent and costly. He will also provide an overview of national initiatives to defend against ransomware. Detecting compromise and attacks against medical devices. This will be discussed by Prof Fu, a well-known leader in the cybersecurity of medical devices, who just finished his term as Acting Director of Medical Device Cybersecurity at the FDA. He will not only describe the common, easily avoided, cybersecurity design problems in medical devices, but how to detect early signs of compromise from a pending cyberattack, and how to improve the security of medical devices. Lessons learned from hospital ransomware recovery and planning considerations. This will be discussed by Dr Chen from the Cleveland Clinic. One of the facilities in Cleveland Clinic's network was recently victim of a huge ransomware attack, and Dr Chen published a great overview of lessons learned from this attack and developed a four-phase plan for the recovery from such a cyberattack (J Digit Imaging. 2021 Jun). He will provide a practical overview of these lessons and plan. This refresher course will bring the radiology community up to date on the exponentially growing threat of ransomware

affecting healthcare, including recent attacks, and techniques of defense. The course will be presented by radiologists and top cybersecurity experts. The information technology issues will be addressed at a technical level appropriate for the radiology community at large, to make the community aware of this growing era of digital warfare and its implications for radiology practices. Our refresher course will have

**Sub-Events**

**W6-CIN23 Moderator**

Participants

Benoit Desjardins, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

**W6-CIN23 The Status of Ransomware in 2023**

Participants

Benoit Desjardins, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

**W6-CIN23 Lessons Learned from Hospital Ransomware Recovery and Planning Considerations**

Participants

Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

**W6-CIN23 Detecting Compromise and Attacks Against Medical Devices**

Participants

Richard Staynings, MS, MA, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CIN23

### Detecting Compromise and Attacks Against Medical Devices

#### Participants

Richard Staynings, MS, MA, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CIN23

**Moderator**

### **Participants**

Benoit Desjardins, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CIN23

### The Status of Ransomware in 2023

#### Participants

Benoit Desjardins, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CIN23

### Lessons Learned from Hospital Ransomware Recovery and Planning Considerations

#### Participants

Howard Chen, MD, MBA, Cleveland, OH (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

**Moderator**

### **Participants**

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Moderator*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

### Partial Thickness Cruciate Tears

#### Participants

Bruce Forster, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, Canada Diagnostic Centres

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

### Challenges of Imaging the Menisci

#### Participants

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Presenter*) Speakers Bureau, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

### Imaging the Posterolateral Corner

#### Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

### Patellofemoral Joint Assessment: What Matters

#### Participants

Jan Fritz, MD, (*Presenter*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd

#### LEARNING OBJECTIVES

1) Understand areas of knee imaging and intervention that offer particular challenges to the radiologist. 2) Develop strategies to review and report knee MRI that avoid these challenging pitfalls. 3) Understand techniques and their rationale for the imaging guided intervention of patellar tendon disease.\*Course Description The knee is one of the most commonly imaged peripheral joints. However, advances in surgical techniques and our understanding of the functional anatomy of the knee mean that new challenges to the radiologist exist. This course aims to highlight particularly challenging areas in the interpretation of knee imaging studies. It will primarily focus on MRI, but an additional presentation will discuss the role that radiology has in the management of patellar tendon disease.

#### COURSE DESCRIPTION

The knee is one of the most commonly imaged peripheral joints. However, advances in surgical techniques and our understanding of the functional anatomy of the knee mean that new challenges to the radiologist exist. This course aims to highlight particularly challenging areas in the interpretation of knee imaging studies. It will primarily focus on MRI, but an additional presentation will discuss the role that radiology has in the management of patellar tendon disease.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CMK05

### Intervention for Patellar Tendinosis

#### Participants

Kenneth Lee, MD, MBA, Madison, WI (*Presenter*) Grant, NFL; Research support, Hologic, Inc; Royalties, RELX

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CMK05

### Challenges in Imaging the Knee

#### Sub-Events

##### W6-CMK05 Moderator

###### Participants

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Moderator*) Speakers Bureau, General Electric Company

##### W6-CMK05 Challenges of Imaging the Menisci

###### Participants

Andrew J. Grainger, MD, Cambridge, United Kingdom (*Presenter*) Speakers Bureau, General Electric Company

##### W6-CMK05 Partial Thickness Cruciate Tears

###### Participants

Bruce Forster, MD, FRCPC, Vancouver, BC (*Presenter*) Stockholder, Canada Diagnostic Centres

##### W6-CMK05 Imaging the Posterolateral Corner

###### Participants

Dyan V. Flores, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

##### W6-CMK05 Patellofemoral Joint Assessment: What Matters

###### Participants

Jan Fritz, MD, (*Presenter*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd

#### LEARNING OBJECTIVES

1) Understand areas of knee imaging and intervention that offer particular challenges to the radiologist. 2) Develop strategies to review and report knee MRI that avoid these challenging pitfalls. 3) Understand techniques and their rationale for the imaging guided intervention of patellar tendon disease.\*Course Description The knee is one of the most commonly imaged peripheral joints. However, advances in surgical techniques and our understanding of the functional anatomy of the knee mean that new challenges to the radiologist exist. This course aims to highlight particularly challenging areas in the interpretation of knee imaging studies. It will primarily focus on MRI, but an additional presentation will discuss the role that radiology has in the management of patellar tendon disease.

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##### W6-CMK05 Intervention for Patellar Tendinosis

###### Participants

Kenneth Lee, MD, MBA, Madison, WI (*Presenter*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

**Moderator**

### Participants

Anand Narayan, MD, PhD, Verona, WI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

**Moderator**

### Participants

Marissa Lawson, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

### Special Considerations for Reporting Race and Ethnicity in Radiology Research

#### Participants

Anand Narayan, MD, PhD, Verona, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

**Incorporating Social Determinants of Health into Radiology Research” or How to Incorporate Social Determinants of Health into Your Research**

### **Participants**

Marissa Lawson, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

### Accounting for Diversity in Medical Imaging and Artificial Intelligence Research

#### Participants

Antonio Porras Perez, PhD, Washington, DC (*Presenter*) Nothing to Disclose

Antonio Porras Perez, PhD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

### **Creation of a Radiology Health Equity Laboratory: Raising Awareness and Promoting Action to Reduce Disparities in Care**

#### **Participants**

Joseph R. Osborne, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNPM10

### Health Equity in Radiology: Research (Sponsored by the RSNA Research Development Committee and the RSNA Health Equity Committee)

#### LEARNING OBJECTIVES

1) Implement best practices in the use and reporting of race and ethnicity in radiology research studies. 2) Incorporate social determinants of health data in health services research. 3) Reduce biases and improve fairness in the design and use of artificial intelligence methods in medical imaging. 4) Develop a research proposal or action plan that addresses health equity issues.\*Course Description As a result of participation in this course, radiology researchers will be able to incorporate best practices in health equity and inclusive writing into their own clinical research studies. The course will include practical, high yield, lectures focused on equipping radiology researchers with discrete tools and resources for their own research studies.

#### COURSE DESCRIPTION

As a result of participation in this course, radiology researchers will be able to incorporate best practices in health equity and inclusive writing into their own clinical research studies. The course will include practical, high yield, lectures focused on equipping radiology researchers with discrete tools and resources for their own research studies.

#### Sub-Events

##### W6-CNPM10 Moderator

Participants  
Anand Narayan, MD, PhD, Verona, WI (*Moderator*) Nothing to Disclose

##### W6-CNPM10 Moderator

Participants  
Marissa Lawson, MD, Seattle, WA (*Moderator*) Nothing to Disclose

##### W6-CNPM10 Special Considerations for Reporting Race and Ethnicity in Radiology Research

Participants  
Anand Narayan, MD, PhD, Verona, WI (*Presenter*) Nothing to Disclose

##### W6-CNPM10 Incorporating Social Determinants of Health into Radiology Research” or How to Incorporate Social Determinants of Health into Your Research

Participants  
Marissa Lawson, MD, Seattle, WA (*Presenter*) Nothing to Disclose

##### W6-CNPM10 Accounting for Diversity in Medical Imaging and Artificial Intelligence Research

Participants  
Antonio Porras Perez, PhD, Washington, DC (*Presenter*) Nothing to Disclose  
Antonio Porras Perez, PhD, (*Presenter*) Nothing to Disclose

##### W6-CNPM10 Creation of a Radiology Health Equity Laboratory: Raising Awareness and Promoting Action to Reduce Disparities in Care

Participants  
Joseph R. Osborne, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CNR04

### Rapid Fire Neuroradiology Emergency Cases

#### Participants

Brent D. Weinberg, MD, PhD, Atlanta, GA (*Presenter*) Research Consultant, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNR04

**Moderator**

### **Participants**

Jason F. Talbott, MD, PhD, Novato, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNR04

### Emergency Neuroimaging: Pearls and Pitfalls from Coccyx to Vertex

#### Sub-Events

#### W6-CNR04 Spine Emergencies--An Algorithmic Approach

##### Participants

Jason F. Talbott, MD, PhD, Novato, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain familiarity with key CT and MRI findings and up-to-date classification systems in the setting of spine, head and neck, and intracranial emergencies. 2) Review appropriate indications for obtaining MRI and key MRI imaging findings in patients with acute spine emergency. 3) Review an algorithmic approach for evaluating spinal, head and neck, and intracranial imaging findings in the setting of suspected neurological emergencies. \*Course Description The radiologist plays a critical role in the evaluation, triage, and management planning for patients with neurological emergencies. Often, subtle imaging findings on CT and MRI are important for accurate diagnosis, timely triage, and appropriate management of patients with neurological emergencies. The primary focus of this session is to familiarize the radiologist with the spectrum of imaging findings that must be included in the search pattern for CT and MRI exams of the head, neck, and spine in the setting of non-traumatic neurologic emergency. A case-based approach will be utilized implementing up-to-date classification systems for a variety of neurological emergencies. Evidenced-based indications for obtaining follow-up and/or advanced imaging such as MRI for subtle CT findings will also be emphasized.

#### COURSE DESCRIPTION

The radiologist plays a critical role in the evaluation, triage, and management planning for patients with neurological emergencies. Often, subtle imaging findings on CT and MRI are important for accurate diagnosis, timely triage, and appropriate management of patients with neurological emergencies. The primary focus of this session is to familiarize the radiologist with the spectrum of imaging findings that must be included in the search pattern for CT and MRI exams of the head, neck, and spine in the setting of non-traumatic neurologic emergency. A case-based approach will be utilized implementing up-to-date classification systems for a variety of neurological emergencies. Evidenced-based indications for obtaining follow-up and/or advanced imaging such as MRI for subtle CT findings will also be emphasized.

#### W6-CNR04 Lessons Learned: A Career of Neuroradiology Intracranial Emergencies in 15 Minutes!

##### Participants

Nancy J. Fischbein, MD, Stanford, CA (*Presenter*) Nothing to Disclose

#### W6-CNR04 Head and Neck Emergencies: Fallor Ergo Sum!

##### Participants

Richard H. Wiggins III, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### W6-CNR04 Rapid Fire Neuroradiology Emergency Cases

##### Participants

Brent D. Weinberg, MD, PhD, Atlanta, GA (*Presenter*) Research Consultant, Canon Medical Systems Corporation

#### W6-CNR04 Moderator

##### Participants

Jason F. Talbott, MD, PhD, Novato, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNR04

### Head and Neck Emergencies: Fallor Ergo Sum!

#### Participants

Richard H. Wiggins III, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CNR04

### Spine Emergencies--An Algorithmic Approach

#### Participants

Jason F. Talbott, MD, PhD, Novato, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Gain familiarity with key CT and MRI findings and up-to-date classification systems in the setting of spine, head and neck, and intracranial emergencies. 2) Review appropriate indications for obtaining MRI and key MRI imaging findings in patients with acute spine emergency. 3) Review an algorithmic approach for evaluating spinal, head and neck, and intracranial imaging findings in the setting of suspected neurological emergencies. \*Course Description The radiologist plays a critical role in the evaluation, triage, and management planning for patients with neurological emergencies. Often, subtle imaging findings on CT and MRI are important for accurate diagnosis, timely triage, and appropriate management of patients with neurological emergencies. The primary focus of this session is to familiarize the radiologist with the spectrum of imaging findings that must be included in the search pattern for CT and MRI exams of the head, neck, and spine in the setting of non-traumatic neurologic emergency. A case-based approach will be utilized implementing up-to-date classification systems for a variety of neurological emergencies. Evidenced-based indications for obtaining follow-up and/or advanced imaging such as MRI for subtle CT findings will also be emphasized.

#### COURSE DESCRIPTION

The radiologist plays a critical role in the evaluation, triage, and management planning for patients with neurological emergencies. Often, subtle imaging findings on CT and MRI are important for accurate diagnosis, timely triage, and appropriate management of patients with neurological emergencies. The primary focus of this session is to familiarize the radiologist with the spectrum of imaging findings that must be included in the search pattern for CT and MRI exams of the head, neck, and spine in the setting of non-traumatic neurologic emergency. A case-based approach will be utilized implementing up-to-date classification systems for a variety of neurological emergencies. Evidenced-based indications for obtaining follow-up and/or advanced imaging such as MRI for subtle CT findings will also be emphasized.

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## Abstract Archives of the RSNA, 2023

W6-CNR04

**Lessons Learned: A Career of Neuroradiology Intracranial Emergencies in 15 Minutes!**

### Participants

Nancy J. Fischbein, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CPD08

### Real Time MRI in Pediatric Radiology

#### Participants

Franz Wolfgang Hirsch, 04103 Leipzig \_germany, AK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CPD08

### Photocounting CT: How Can we Best use it in Children?

#### Participants

Kelly Horst, MD, Rochester, MN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CPD08

### Pediatric Radiology Protocols: Everyday and Advanced Techniques

#### LEARNING OBJECTIVES

1) Recognize indications suitable for real-time MRI in children. 2) Explain technical parameters of photon counting CT using different scan modes, as well as their limitations. 3) Illustrate state-of-the-art cartilage imaging in children.\*Course Description This session will review everyday and advanced imaging techniques in children. Real-time MRI will be discussed as an entirely new imaging option for children, which can significantly reduce the need for sedation. State-of-the-art imaging of pediatric cartilage disorders will be illustrated. Best uses of photon counting CT in children will also be discussed, including technical parameters and protocol details.

#### COURSE DESCRIPTION

This session will review everyday and advanced imaging techniques in children. Real-time MRI will be discussed as an entirely new imaging option for children, which can significantly reduce the need for sedation. State-of-the-art imaging of pediatric cartilage disorders will be illustrated. Best uses of photon counting CT in children will also be discussed, including technical parameters and protocol details.

#### Sub-Events

##### W6-CPD08 Moderator

Participants  
Lauren W. Averill, MD, Wilmington, DE (*Moderator*) Nothing to Disclose

##### W6-CPD08 Pediatric Cartilage Disorders: Not Always so Smooth

Participants  
Diego Jaramillo, MPH, New York, NY (*Presenter*) Pfizer Consultant in a trial

##### W6-CPD08 Photocounting CT: How Can we Best use it in Children?

Participants  
Kelly Horst, MD, Rochester, MN (*Presenter*) Nothing to Disclose

##### W6-CPD08 Real Time MRI in Pediatric Radiology

Participants  
Franz Wolfgang Hirsch, 04103 Leipzig \_germany, AK (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CPD08

**Moderator**

### Participants

Lauren W. Averill, MD, Wilmington, DE (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CPD08

### Pediatric Cartilage Disorders: Not Always so Smooth

#### Participants

Diego Jaramillo, MPH, New York, NY (*Presenter*) Pfizer Consultant in a trial

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRO05

### Prostate Cancer Case Based Multidisciplinary Review

#### Participants

Andrei S. Puryško, MD, Westlake, OH (*Presenter*) Contract, Profound Medical Inc; Research support, Blue Earth Diagnostics Ltd; Consultant, KOELIS;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRO05

### Prostate Cancer Case Based Multidisciplinary Review

#### Participants

Michael Leapman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRO05

**Moderator**

### Participants

Tristan Barrett, MBBS, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CR005

### Prostate Cancer Case Based Multidisciplinary Review

#### LEARNING OBJECTIVES

1) To understand the typical imaging findings of prostate cancer on mpMRI. 2) To assess the impact of MRI on staging prostate cancer in a multidisciplinary setting. 3) To assess the role of imaging in the diagnosis of prostate cancer through case examples.\*Course Description This course uses a case-based approach to diagnostic and management decision making in the work-up of patients presenting with prostate cancer. The panel includes radiologists, urologists and radiation oncologists.

#### COURSE DESCRIPTION

This course uses a case-based approach to diagnostic and management decision making in the work-up of patients presenting with prostate cancer. The panel includes radiologists, urologists and radiation oncologists.

#### Sub-Events

##### W6-CR005 Moderator

###### Participants

Tristan Barrett, MBBS, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose

##### W6-CR005 Prostate Cancer Case Based Multidisciplinary Review

###### Participants

Michael Leapman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### W6-CR005 Prostate Cancer Case Based Multidisciplinary Review

###### Participants

Andrei S. Purysko, MD, Westlake, OH (*Presenter*) Contract, Profound Medical Inc; Research support, Blue Earth Diagnostics Ltd; Consultant, KOELIS;

##### W6-CR005 Prostate Cancer Case Based Multidisciplinary Review

###### Participants

Tyler Seibert, MD, PhD, La Jolla, CA (*Presenter*) Research Consultant, Cortechs.ai; Scientific Advisory Board, Cortechs.ai; Stock options, Cortechs.ai; Travel support, Siemens AG; Speaker, Siemens AG; Institutional research agreement, General Electric Company

##### W6-CR005 Prostate Cancer Case Based Multidisciplinary Review

###### Participants

Angela Jia, MD, PhD, Ellicott City, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRO05

### Prostate Cancer Case Based Multidisciplinary Review

#### Participants

Tyler Seibert, MD, PhD, La Jolla, CA (*Presenter*) Research Consultant, Cortechs.ai;Scientific Advisory Board, Cortechs.ai;Stock options, Cortechs.ai;Travel support, Siemens AG;Speaker, Siemens AG;Institutional research agreement, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CRO05

### Prostate Cancer Case Based Multidisciplinary Review

#### Participants

Angela Jia, MD, PhD, Ellicott City, MD (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRT07

**Moderator**

### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRT07

**ASRT@RSNA: Reflection in Practice: An Approach for Reducing Patients' Radiation Dose (Supported in part by an Independent Medical Education Grant from Bayer HealthCare Pharmaceuticals Inc.)**

### LEARNING OBJECTIVES

1) Explain reflective practice, its purpose, and the reflective cycle. 2) Discuss the three components of reflective practice and four levels of individual reflection. 3) Apply reflection before, during, and after practice.\*Course Description Reflective practice is a term coined by Donald Schon in the 1980s, which is based in the idea that practitioners should think about what they are doing while they are doing it. Reflective practice is based on identifying a problem and devising ways to address the problem, thereby formulating best practice. It results in the development of profession practice into professional artistry. The reflective cycle, along with the application of the reflection before, during, and after practice, lends the ability to evaluate one's practice critically, thereby reducing errors. This approach can be used to reduce patients' radiation dose. This lecture will address practical applications of reflective practice.

### COURSE DESCRIPTION

Reflective practice is a term coined by Donald Schon in the 1980s, which is based in the idea that practitioners should think about what they are doing while they are doing it. Reflective practice is based on identifying a problem and devising ways to address the problem, thereby formulating best practice. It results in the development of profession practice into professional artistry. The reflective cycle, along with the application of the reflection before, during, and after practice, lends the ability to evaluate one's practice critically, thereby reducing errors. This approach can be used to reduce patients' radiation dose. This lecture will address practical applications of reflective practice.

### Sub-Events

#### W6-CRT07 Moderator

##### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

#### W6-CRT07 ASRT@RSNA: Reflection in Practice: An Approach for Reducing Patients? Radiation Dose

##### Participants

Sean Richardson, RT, PhD, Plainfield, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CRT07

**ASRT@RSNA: Reflection in Practice: An Approach for Reducing Patients? Radiation Dose**

### Participants

Sean Richardson, RT, PhD, Plainfield, NJ (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

**Moderator**

**Participants**

Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research Grant, Siemens AG;Stockholder, iSchemaView, Inc;Stockholder, Segmed, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

**Moderator**

### Participants

Dominika Sucha, MD, PhD, Stanford, Netherlands (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

### How Imaging Enables Endovascular Treatment in Peripheral Artery Disease

#### Participants

Jeffrey D. Jaskolka, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

### Thoracic Outlet Syndrome

#### Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-CVA04

### Upper and Lower Extremity CTA

#### Participants

Richard L. Hallett II, MD, Carmel, IN (*Presenter*) Consultant, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

### Peripheral Vascular Imaging

#### LEARNING OBJECTIVES

1) Understand the principles, techniques, and roles of peripheral vascular CTA and MRA. 2) Characterize vascular pathologies in thoracic outlet syndrome (TOS) and peripheral arterial disease (PAD). 3) Understand clinical implications and applications of peripheral vascular imaging in endovascular treatment planning.\*Course Description This educational course emphasizes the importance of peripheral vascular imaging in diagnosing and characterizing vascular conditions affecting the upper and lower extremities and highlights how vascular imaging contributes to endovascular treatment planning. Global peripheral vascular disease burden is high and substantially contributes to major cardiovascular event rate. With increasing endovascular treatment options, anatomic assessment is important. Imaging peripheral vessels, however, presents significant challenges, requiring a comprehensive understanding of acquisition techniques for optimal patient assessment. Participate and gain insights to support clinical decisions effectively.

#### COURSE DESCRIPTION

This educational course emphasizes the importance of peripheral vascular imaging in diagnosing and characterizing vascular conditions affecting the upper and lower extremities and highlights how vascular imaging contributes to endovascular treatment planning. Global peripheral vascular disease burden is high and substantially contributes to major cardiovascular event rate. With increasing endovascular treatment options, anatomic assessment is important. Imaging peripheral vessels, however, presents significant challenges, requiring a comprehensive understanding of acquisition techniques for optimal patient assessment. Participate and gain insights to support clinical decisions effectively.

#### Sub-Events

##### W6-CVA04 Moderator

###### Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research Grant, Siemens AG; Stockholder, iSchemaView, Inc; Stockholder, Segmed, Inc

##### W6-CVA04 Moderator

###### Participants

Dominika Sucha, MD, PhD, Stanford, Netherlands (*Moderator*) Nothing to Disclose

##### W6-CVA04 Thoracic Outlet Syndrome

###### Participants

Constantine Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

##### W6-CVA04 Upper and Lower Extremity CTA

###### Participants

Richard L. Hallett II, MD, Carmel, IN (*Presenter*) Consultant, Bracco Group

##### W6-CVA04 Upper and Lower Extremity MRA

###### Participants

Nanda Deepa Thimmappa, MD, Columbia, MO (*Presenter*) Nothing to Disclose

##### W6-CVA04 How Imaging Enables Endovascular Treatment in Peripheral Artery Disease

###### Participants

Jeffrey D. Jaskolka, MD, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-CVA04

### Upper and Lower Extremity MRA

#### Participants

Nanda Deepa Thimmappa, MD, Columbia, MO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

### RSNA/ESR Symposium: Imaging of Neurodegenerative Disorders - Movement Disorders

#### LEARNING OBJECTIVES

1) Explain the current use of MRI in Lewy body disease and movement disorders. 2) Explain the current use of molecular imaging in Lewy body disease and movement disorders. 3) Demonstrate structured selection and assessment of imaging exams through cases.\*Course Description Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This third educational session will discuss how MRI and molecular imaging techniques can be used to understand the underlying pathology in patients with Parkinson's Disease, atypical parkinsonism and other movement disorders. This session will give general radiologists and those interested in neuroradiology and nuclear medicine/molecular imaging the knowledge needed for appropriate selection and structured assessment of imaging exams in diagnostic work-up of movement disorders. The session format consists of in part lectures, followed by an interactive case-based discussion.

#### COURSE DESCRIPTION

Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This third educational session will discuss how MRI and molecular imaging techniques can be used to understand the underlying pathology in patients with Parkinson's Disease, atypical parkinsonism and other movement disorders. This session will give general radiologists and those interested in neuroradiology and nuclear medicine/molecular imaging the knowledge needed for appropriate selection and structured assessment of imaging exams in diagnostic work-up of movement disorders. The session format consists of in part lectures, followed by an interactive case-based discussion.

#### Sub-Events

##### W6-RCP07 Moderator

Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

##### W6-RCP07 Moderator

Participants

Kejal Kantarci, MD, Rochester, MN (*Moderator*) Research support, Eli Lilly and Company;Consultant, Biogen Idec Inc

##### W6-RCP07 MR Imaging in Movement Disorders

Participants

Stephane Lehericy, MD, PhD, Paris, France (*Presenter*) Research Grant, Biogen Idec Inc;Consultant, F. Hoffmann-La Roche Ltd

##### W6-RCP07 Molecular Imaging in Movement Disorders

Participants

Kejal Kantarci, MD, Rochester, MN (*Presenter*) Research support, Eli Lilly and Company;Consultant, Biogen Idec Inc

##### W6-RCP07 Movement Disorders: Interactive Case Discussion

Participants

Stephane Lehericy, MD, PhD, Paris, France (*Presenter*) Research Grant, Biogen Idec Inc;Consultant, F. Hoffmann-La Roche Ltd

##### W6-RCP07 Movement Disorders: Interactive Case Discussion

Participants

Kejal Kantarci, MD, Rochester, MN (*Presenter*) Research support, Eli Lilly and Company;Consultant, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

**Moderator**

### Participants

Meike W. Vernooij, MD, PhD, Rotterdam, Netherlands (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

**Moderator**

### **Participants**

Kejal Kantarci, MD, Rochester, MN (*Moderator*) Research support, Eli Lilly and Company; Consultant, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

### MR Imaging in Movement Disorders

#### Participants

Stephane Lehericy, MD, PhD, Paris, France (*Presenter*) Research Grant, Biogen Idec Inc; Consultant, F. Hoffmann-La Roche Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

### Molecular Imaging in Movement Disorders

#### Participants

Kejal Kantarci, MD, Rochester, MN (*Presenter*) Research support, Eli Lilly and Company; Consultant, Biogen Idec Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W6-RCP07

### Movement Disorders: Interactive Case Discussion

#### Participants

Stephane Lehericy, MD, PhD, Paris, France (*Presenter*) Research Grant, Biogen Idec Inc; Consultant, F. Hoffmann-La Roche Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-RCP07

### Movement Disorders: Interactive Case Discussion

#### Participants

Kejal Kantarci, MD, Rochester, MN (*Presenter*) Research support, Eli Lilly and Company; Consultant, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

### Dysarthria: Hypoglossal Nerve Palsy

#### Participants

Xin Wu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify various causes of cranial nerve deficits based on clinical features and imaging findings.\*  
\*Course Description This lecture series will explore various clinical imaging scenarios with special focus on cranial neuropathies. Several classic entities as well as more rare pathologies will be shared on this whirlwind through the skull base! Come join us to deepen your understanding (and enjoyment) of Head & Neck imaging!

#### COURSE DESCRIPTION

This lecture series will explore various clinical imaging scenarios with special focus on cranial neuropathies. Several classic entities as well as more rare pathologies will be shared on this whirlwind through the skull base! Come join us to deepen your understanding (and enjoyment) of Head & Neck imaging!

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

**Moderator**

### Participants

Remy Lobo, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

### Anosmia

#### Participants

Katie S. Traylor, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

### Hoarseness Plus?: Upper vs. Lower Vagal Neuropathy

#### Participants

Alok A. Bhatt, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

**Tinnitus**

### Participants

Katherine Reinshagen, MD, FRCPC, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CHN04

### Cranial Nerve Deficits - A Symptom Based Session

#### Sub-Events

##### W7-CHN04 Moderator

###### Participants

Remy Lobo, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

##### W7-CHN04 Anosmia

###### Participants

Katie S. Traylor, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

##### W7-CHN04 Hoarseness Plus?: Upper vs. Lower Vagal Neuropathy

###### Participants

Alok A. Bhatt, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

##### W7-CHN04 Tinnitus

###### Participants

Katherine Reinshagen, MD, FRCPC, Boston, MA (*Presenter*) Nothing to Disclose

##### W7-CHN04 Dysarthria: Hypoglossal Nerve Palsy

###### Participants

Xin Wu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Identify various causes of cranial nerve deficits based on clinical features and imaging findings.\*Course Description This lecture series will explore various clinical imaging scenarios with special focus on cranial neuropathies. Several classic entities as well as more rare pathologies will be shared on this whirlwind through the skull base! Come join us to deepen your understanding (and enjoyment) of Head & Neck imaging!

#### COURSE DESCRIPTION

This lecture series will explore various clinical imaging scenarios with special focus on cranial neuropathies. Several classic entities as well as more rare pathologies will be shared on this whirlwind through the skull base! Come join us to deepen your understanding (and enjoyment) of Head & Neck imaging!

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-CIN25

**Moderator**

### Participants

Ali Tejani, MD, Frisco, TX (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Key Elements of an Imaging AI Abstract

#### Participants

Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Applying the CLAIM Guideline

#### Participants

John Mayfield, MD, MS, Lithia, FL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Identifying Gaps in Imaging AI Abstracts

#### Participants

Merel Huisman, MD, PhD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Improving Your Skills as a Reviewer

#### Participants

Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Critical Thinking: Putting it all Together

#### Participants

Charles Kahn JR, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIN25

### Writing AI Abstracts: Tips for Success

#### LEARNING OBJECTIVES

1) Understand key elements of an abstract on artificial intelligence (AI) in imaging. 2) Learn to structure an abstract using pertinent components of the Checklist for Artificial Intelligence in Medical Imaging (CLAIM). 3) Identify and correct errors in example imaging AI abstracts. 4) Evaluate example abstracts to augment one's skills as a reviewer.\*Course Description It can be daunting to write a concise, yet sufficiently detailed abstract about a radiology artificial intelligence (AI) application. Abstracts often lack key information that allows readers to determine the quality and reproducibility of the submitted work. This session will help participants improve the quality of abstracts they submit to journals and conferences. Presenters will introduce the Checklist for Artificial Intelligence in Medical Imaging (CLAIM), share their experiences as AI abstract reviewers, describe best practices, and identify frequently seen errors. Participants will be equipped to build upon this course's lessons to write high-quality abstracts and to serve as abstract reviewers. This session will feature both a discussion with an expert panel and an interactive session to allow participants to evaluate and edit intentionally flawed AI abstracts.

#### COURSE DESCRIPTION

It can be daunting to write a concise, yet sufficiently detailed abstract about a radiology artificial intelligence (AI) application. Abstracts often lack key information that allows readers to determine the quality and reproducibility of the submitted work. This session will help participants improve the quality of abstracts they submit to journals and conferences. Presenters will introduce the Checklist for Artificial Intelligence in Medical Imaging (CLAIM), share their experiences as AI abstract reviewers, describe best practices, and identify frequently seen errors. Participants will be equipped to build upon this course's lessons to write high-quality abstracts and to serve as abstract reviewers. This session will feature both a discussion with an expert panel and an interactive session to allow participants to evaluate and edit intentionally flawed AI abstracts.

#### Sub-Events

##### W7-CIN25 Moderator

Participants  
Ali Tejani, MD, Frisco, TX (*Moderator*) Nothing to Disclose

##### W7-CIN25 Key Elements of an Imaging AI Abstract

Participants  
Ali Tejani, MD, Frisco, TX (*Presenter*) Nothing to Disclose

##### W7-CIN25 Applying the CLAIM Guideline

Participants  
John Mayfield, MD, MS, Lithia, FL (*Presenter*) Nothing to Disclose

##### W7-CIN25 Identifying Gaps in Imaging AI Abstracts

Participants  
Merel Huisman, MD, PhD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose

##### W7-CIN25 Improving Your Skills as a Reviewer

Participants  
Linda Moy, MD, New York, NY (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

##### W7-CIN25 Critical Thinking: Putting it all Together

Participants  
Charles Kahn JR, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Criteria for Resectability for Metastatic Disease of the Liver

#### Participants

Kiran Turaga, New Haven, CT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain current criteria used to determine whether patients with liver metastases can undergo surgical resection. 2) Explain how hepatic venous deprivation is performed and when it should be used to induce pre-operative liver hypertrophy. 3) Be familiar with current clinical outcome data for thermal ablation, TACE, and Y90-TARE used to treat intrahepatic cholangiocarcinoma and colorectal liver metastases. 4) Explain how Interventional Radiology treatments are used in locally-advanced and metastatic pancreatic cancer.\*Course Description Interventional and surgical treatments for cholangiocarcinoma, hepatic colorectal metastases, and pancreatic cancer can lead to good clinical outcomes in well-selected patients. This lecture-based course will review how Interventional Oncology, Surgery, and Combined approaches are applied in these cancers, and the current clinical data in each of these diseases. Attendees of this course will learn how interventional radiology and surgery can be used and combined to achieve optimal patient outcomes, and will be familiar with the most recent literature on these approaches.

#### COURSE DESCRIPTION

Interventional and surgical treatments for cholangiocarcinoma, hepatic colorectal metastases, and pancreatic cancer can lead to good clinical outcomes in well-selected patients. This lecture-based course will review how Interventional Oncology, Surgery, and Combined approaches are applied in these cancers, and the current clinical data in each of these diseases. Attendees of this course will learn how interventional radiology and surgery can be used and combined to achieve optimal patient outcomes, and will be familiar with the most recent literature on these approaches.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-CIR10

**Moderator**

### Participants

Muneeb Ahmed, MD, Boston, MA (*Moderator*) Stockholder, Agile Devices, Inc;Scientific Advisory Board, Agile Devices, Inc;Consultant, Canon Medical Systems Corporation;Consultant, RevOps Health, Inc;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Portal Vein Embolization and Liver-Venous Deprivation

#### Participants

Muneeb Ahmed, MD, Boston, MA (*Presenter*) Stockholder, Agile Devices, Inc;Scientific Advisory Board, Agile Devices, Inc;Consultant, Canon Medical Systems Corporation;Consultant, RevOps Health, Inc;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Ablative Therapy in Cholangiocarcinoma

#### Participants

Alda Tam, MD, Houston, TX (*Presenter*) Consultant, Johnson & Johnson; Research Grant, Boston Scientific Corporation; Research Grant, Johnson & Johnson; Consultant, AstraZeneca PLC; Consultant, Endocare, Inc;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Embolotherapy in Cholangiocarcinoma

#### Participants

Nima Kokabi, MD, Atlanta, GA (*Presenter*) Research support, Sirtex Medical Ltd; Consultant, Sirtex Medical Ltd;;

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Colorectal Cancer Metastases

#### Participants

Nadine Abi-Jaoudeh, MD, Orange, CA (*Presenter*) Institutional research collaboration, Koninklijke Philips NV; Institutional research collaboration, Teclison Limited; Intellectual property, Bruin Biosciences Inc; Owner, Bruin Biosciences Inc; Institutional research collaboration, Sirtex Medical Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Locally Advanced and Metastatic Pancreatic Cancer

#### Participants

Govindarajan Narayanan, MD, Miami, FL (*Presenter*) Consultant, AngioDynamics, Inc; Consultant, Boston Scientific Corporation; Consultant, Stryker Corporation; Consultant, Agilent Technologies, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CIR10

### Cholangiocarcinoma and Oligometastatic Disease

#### Sub-Events

##### W7-CIR10 Moderator

###### Participants

Muneeb Ahmed, MD, Boston, MA (*Moderator*) Stockholder, Agile Devices, Inc;Scientific Advisory Board, Agile Devices, Inc;Consultant, Canon Medical Systems Corporation;Consultant, RevOps Health, Inc;

##### W7-CIR10 Portal Vein Embolization and Liver-Venous Deprivation

###### Participants

Muneeb Ahmed, MD, Boston, MA (*Presenter*) Stockholder, Agile Devices, Inc;Scientific Advisory Board, Agile Devices, Inc;Consultant, Canon Medical Systems Corporation;Consultant, RevOps Health, Inc;

##### W7-CIR10 Ablative Therapy in Cholangiocarcinoma

###### Participants

Alda Tam, MD, Houston, TX (*Presenter*) Consultant, Johnson & Johnson;Research Grant, Boston Scientific Corporation;Research Grant, Johnson & Johnson;Consultant, AstraZeneca PLC;Consultant, Endocare, Inc;

##### W7-CIR10 Embolotherapy in Cholangiocarcinoma

###### Participants

Nima Kokabi, MD, Atlanta, GA (*Presenter*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;

##### W7-CIR10 Colorectal Cancer Metastases

###### Participants

Nadine Abi-Jaoudeh, MD, Orange, CA (*Presenter*) Institutional research collaboration, Koninklijke Philips NV;Institutional research collaboration, Teclison Limited;Intellectual property, Bruin Biosciences Inc;Owner, Bruin Biosciences Inc;Institutional research collaboration, Sirtex Medical Ltd

##### W7-CIR10 Locally Advanced and Metastatic Pancreatic Cancer

###### Participants

Govindarajan Narayanan, MD, Miami, FL (*Presenter*) Consultant, AngioDynamics, Inc;Consultant, Boston Scientific Corporation;Consultant, Stryker Corporation;Consultant, Agilent Technologies, Inc

##### W7-CIR10 Criteria for Resectability for Metastatic Disease of the Liver

###### Participants

Kiran Turaga, New Haven, CT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Explain current criteria used to determine whether patients with liver metastases can undergo surgical resection. 2) Explain how hepatic venous deprivation is performed and when it should be used to induce pre-operative liver hypertrophy. 3) Be familiar with current clinical outcome data for thermal ablation, TACE, and Y90-TARE used to treat intrahepatic cholangiocarcinoma and colorectal liver metastases. 4) Explain how Interventional Radiology treatments are used in locally-advanced and metastatic pancreatic cancer.\*Course Description Interventional and surgical treatments for cholangiocarcinoma, hepatic colorectal metastases, and pancreatic cancer can lead to good clinical outcomes in well-selected patients. This lecture-based course will review how Interventional Oncology, Surgery, and Combined approaches are applied in these cancers, and the current clinical data in each of these diseases. Attendees of this course will learn how interventional radiology and surgery can be used and combined to achieve optimal patient outcomes, and will be familiar with the most recent literature on these approaches.

#### COURSE DESCRIPTION

Interventional and surgical treatments for cholangiocarcinoma, hepatic colorectal metastases, and pancreatic cancer can lead to good clinical outcomes in well-selected patients. This lecture-based course will review how Interventional Oncology, Surgery, and Combined approaches are applied in these cancers, and the current clinical data in each of these diseases. Attendees of this course will learn how interventional radiology and surgery can be used and combined to achieve optimal patient outcomes, and will be familiar with the most recent literature on these approaches.

## Abstract Archives of the RSNA, 2023

W7-CMS04

**Contrast Enhanced Ultrasound (CEUS) - A Problem-Solving Tool (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)**

### Sub-Events

#### W7-CMS04 Moderator

##### Participants

Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Moderator*) Royalties, RELX; Speaker, General Electric Company; Consultant, General Electric Company; Research support, General Electric Company; Consultant, BioClinica, Inc; Consultant, WCC, Inc; Consultant, Bracco Group; Advisory Board, Bracco Group

#### W7-CMS04 Interventional CEUS

##### Participants

Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Presenter*) Royalties, RELX; Speaker, General Electric Company; Consultant, General Electric Company; Research support, General Electric Company; Consultant, BioClinica, Inc; Consultant, WCC, Inc; Consultant, Bracco Group; Advisory Board, Bracco Group

#### LEARNING OBJECTIVES

1) Explain the current clinical applications of contrast-enhanced ultrasound in radiology.\*Course Description Identify learning strategies to translate contrast-enhanced ultrasound applications into clinical practice.

#### COURSE DESCRIPTION

Identify learning strategies to translate contrast-enhanced ultrasound applications into clinical practice.

#### W7-CMS04 Vascular CEUS

##### Participants

John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

#### W7-CMS04 Scrotal CEUS

##### Participants

Paul S. Sidhu, BSc, FRCR, London, United Kingdom (*Presenter*) Consultant, Samsung Electronics Co, Ltd; Speaker, Samsung Electronics Co, Ltd; Speaker, Bracco Group; Consultant, Itreas Ltd; Speaker, Siemens AG

#### W7-CMS04 Liver and Renal Nonvascular CEUS

##### Participants

David Fetzter, MD, Dallas, TX (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Research support, Siemens AG; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, General Electric Company

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-CMS04

### Vascular CEUS

#### Participants

John Pellerito, MD, Syosset, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CMS04

### Scrotal CEUS

#### Participants

Paul S. Sidhu, BSc, FRCR, London, United Kingdom (*Presenter*) Consultant, Samsung Electronics Co, Ltd;Speaker, Samsung Electronics Co, Ltd;Speaker, Bracco Group;Consultant, Itreas Ltd;Speaker, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CMS04

### Liver and Renal Nonvascular CEUS

#### Participants

David Fetzer, MD, Dallas, TX (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Research support, Siemens AG; Consultant, Koninklijke Philips NV; Advisory Board, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CMS04

### Interventional CEUS

#### Participants

Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Presenter*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group

#### LEARNING OBJECTIVES

1) Explain the current clinical applications of contrast-enhanced ultrasound in radiology.\*Course Description Identify learning strategies to translate contrast-enhanced ultrasound applications into clinical practice.

#### COURSE DESCRIPTION

Identify learning strategies to translate contrast-enhanced ultrasound applications into clinical practice.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CMS04

### Moderator

#### Participants

Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Moderator*) Royalties, RELX; Speaker, General Electric Company; Consultant, General Electric Company; Research support, General Electric Company; Consultant, BioClinica, Inc; Consultant, WCC, Inc; Consultant, Bracco Group; Advisory Board, Bracco Group

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNMMI06

**Moderator**

### Participants

Terence Z. Wong, MD, PhD, Durham, NC (*Moderator*) Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNMMI06

### Molecular Imaging and Therapy for Neuroendocrine Neoplasms

#### Participants

Delphine Chen, MD, (*Presenter*) Grant, Telix Pharmaceuticals Limited; *Speaker*, Telix Pharmaceuticals Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNMMI06

### Molecular Imaging and Therapy of Pheochromocytoma and Paraganglioma

#### Participants

Amir Iravani, MD, Issaquah, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-CNMMI06

### Neuroendocrine Theranostics

#### LEARNING OBJECTIVES

- 1) Learn applications, pitfalls, and recommendations for imaging neuroendocrine neoplasms with DOTATATE and MIBG radiotracers.
- 2) Understand clinical applications, patient selection, and the different practical aspects of treating patients with <sup>177</sup>Lu-DOTATATE and <sup>131</sup>I-MIBG radiopharmaceuticals.\*Course Description This course will include two lectures followed by a panel discussion. Theranostic approaches have been used to treat neuroendocrine tumors for decades, first using MIBG for imaging and therapy, and more recently somatostatin receptor based imaging and therapy with DOTATATE. This course will provide an update on the imaging and patient selection as well as practical aspects of providing these treatments.

#### COURSE DESCRIPTION

This course will include two lectures followed by a panel discussion. Theranostic approaches have been used to treat neuroendocrine tumors for decades, first using MIBG for imaging and therapy, and more recently somatostatin receptor based imaging and therapy with DOTATATE. This course will provide an update on the imaging and patient selection as well as practical aspects of providing these treatments.

#### Sub-Events

##### **W7- CNMMI06** Moderator

Participants

Terence Z. Wong, MD, PhD, Durham, NC (*Moderator*) Consultant, General Electric Company

##### **W7- CNMMI06** Molecular Imaging and Therapy for Neuroendocrine Neoplasms

Participants

Delphine Chen, MD, (*Presenter*) Grant, Telix Pharmaceuticals Limited; *Speaker*, Telix Pharmaceuticals Limited

##### **W7- CNMMI06** Molecular Imaging and Therapy of Pheochromocytoma and Paraganglioma

Participants

Amir Iravani, MD, Issaquah, WA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

**Moderator**

### Participants

Stella Kang, MD, MSc, New York, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

### A Brief Introduction to Economic Evaluation for Imaging

#### Participants

Stella Kang, MD, MSc, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe principles of cost effectiveness analysis, one of the major forms of economic evaluation. 2) Identify economic tools and methods to convey programmatic costs and projected impact on desired clinical goals. 3) Understand the role of economic evaluation in shaping policies and clinical practice internationally. \*Course Description How do we allocate resources towards programs and strategies that will make the biggest impact on gains in health? In this course, participants will understand principles underlying economic evaluation for healthcare. We will describe cost effectiveness analysis and its roots in outcomes as well as costs (both as an input and as an output reflecting downstream effects). We will also explore the forms of economic analyses that influence health policy and practices, both by government and locally by decision-makers of health systems. Practical tools and applications for imagers will be a major emphasis of the session.

#### COURSE DESCRIPTION

How do we allocate resources towards programs and strategies that will make the biggest impact on gains in health? In this course, participants will understand principles underlying economic evaluation for healthcare. We will describe cost effectiveness analysis and its roots in outcomes as well as costs (both as an input and as an output reflecting downstream effects). We will also explore the forms of economic analyses that influence health policy and practices, both by government and locally by decision-makers of health systems. Practical tools and applications for imagers will be a major emphasis of the session.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

### Cost-Effectiveness Analysis: How it Works in Imaging

#### Participants

Pari V. Pandharipande, MD, MPH, Bexley, OH (*Presenter*) I serve as a member of the Association of University Radiologists (AUR) General Electric (GE) Radiology Research Academic Fellowship (GERRAF) Board of Review (term: 7/1/22-2/28/23).

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

**How Do Health Systems and Payers Use Cost Effectiveness to Inform Health Care Decisions about Imaging?**

### Participants

Bart Ferket, PhD, New York, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

### Evaluating Economic Favorability and Outcomes of Imaging: Cost Effectiveness and Beyond

#### Sub-Events

##### W7-CNPM17 Moderator

###### Participants

Stella Kang, MD, MSc, New York, NY (*Moderator*) Nothing to Disclose

##### W7-CNPM17 A Brief Introduction to Economic Evaluation for Imaging

###### Participants

Stella Kang, MD, MSc, New York, NY (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe principles of cost effectiveness analysis, one of the major forms of economic evaluation. 2) Identify economic tools and methods to convey programmatic costs and projected impact on desired clinical goals. 3) Understand the role of economic evaluation in shaping policies and clinical practice internationally. \*Course Description How do we allocate resources towards programs and strategies that will make the biggest impact on gains in health? In this course, participants will understand principles underlying economic evaluation for healthcare. We will describe cost effectiveness analysis and its roots in outcomes as well as costs (both as an input and as an output reflecting downstream effects). We will also explore the forms of economic analyses that influence health policy and practices, both by government and locally by decision-makers of health systems. Practical tools and applications for imagers will be a major emphasis of the session.

#### COURSE DESCRIPTION

How do we allocate resources towards programs and strategies that will make the biggest impact on gains in health? In this course, participants will understand principles underlying economic evaluation for healthcare. We will describe cost effectiveness analysis and its roots in outcomes as well as costs (both as an input and as an output reflecting downstream effects). We will also explore the forms of economic analyses that influence health policy and practices, both by government and locally by decision-makers of health systems. Practical tools and applications for imagers will be a major emphasis of the session.

##### W7-CNPM17 Cost-Effectiveness Analysis: How it Works in Imaging

###### Participants

Pari V. Pandharipande, MD, MPH, Bexley, OH (*Presenter*) I serve as a member of the Association of University Radiologists (AUR) General Electric (GE) Radiology Research Academic Fellowship (GERRAF) Board of Review (term: 7/1/22-2/28/23).

##### W7-CNPM17 How Do Health Systems and Payers Use Cost Effectiveness to Inform Health Care Decisions about Imaging?

###### Participants

Bart Ferket, PhD, New York, NY (*Presenter*) Nothing to Disclose

##### W7-CNPM17 LungPlan: Financial Planning for Your Lung Cancer Screening and Incidental Lung Nodule Programs

###### Participants

Ella Kazerooni, MD, MS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CNPM17

### LungPlan: Financial Planning for Your Lung Cancer Screening and Incidental Lung Nodule Programs

#### Participants

Ella Kazerooni, MD, MS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CRT02

### ASRT@RSNA: Leading and Developing Remote Imaging in a Radiology Department

#### Sub-Events

##### W7-CRT02 Moderator

#### Participants

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

##### W7-CRT02 Leading and Developing Remote Imaging in a Radiology Department

#### Participants

Paul McElvogue, ARRT, Gold Canyon, AZ (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the general challenges and benefits of remote imaging. 2) Identify safety and regulatory aspects of remote imaging. 3) Develop and implement a plan to incorporate remote technology in your radiology department or imaging center.\*Course Description Remote Scanning or Remote Imaging has been an increasingly important topic of radiology meetings and discussion boards, especially regarding CT and MRI. With the technical improvements over the years, it has become feasible to image a patient from a remote location. This session will discuss the overall challenges and benefits of remote scanning in the radiology department, as well as the various leadership perceptions of remote scanning, from vendor solutions to the technologists' implementation of the technology. Our discussion will also include the important safety aspects of remote scanning in general terms for radiology and more specific details of safety regulations with CT and MRI. Other topics will include how remote imaging currently and, in the future, can serve as an adjunct in supporting leaders' ability to increase staff coverage, competence, retention, and improved department safety profiles.

#### COURSE DESCRIPTION

Remote Scanning or Remote Imaging has been an increasingly important topic of radiology meetings and discussion boards, especially regarding CT and MRI. With the technical improvements over the years, it has become feasible to image a patient from a remote location. This session will discuss the overall challenges and benefits of remote scanning in the radiology department, as well as the various leadership perceptions of remote scanning, from vendor solutions to the technologists' implementation of the technology. Our discussion will also include the important safety aspects of remote scanning in general terms for radiology and more specific details of safety regulations with CT and MRI. Other topics will include how remote imaging currently and, in the future, can serve as an adjunct in supporting leaders' ability to increase staff coverage, competence, retention, and improved department safety profiles.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-CRT02

**Moderator**

### **Participants**

Susie Moseley, MS, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-CRT02

### Leading and Developing Remote Imaging in a Radiology Department

#### Participants

Paul McElvogue, ARRT, Gold Canyon, AZ (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Understand the general challenges and benefits of remote imaging. 2) Identify safety and regulatory aspects of remote imaging. 3) Develop and implement a plan to incorporate remote technology in your radiology department or imaging center.\*Course Description Remote Scanning or Remote Imaging has been an increasingly important topic of radiology meetings and discussion boards, especially regarding CT and MRI. With the technical improvements over the years, it has become feasible to image a patient from a remote location. This session will discuss the overall challenges and benefits of remote scanning in the radiology department, as well as the various leadership perceptions of remote scanning, from vendor solutions to the technologists' implementation of the technology. Our discussion will also include the important safety aspects of remote scanning in general terms for radiology and more specific details of safety regulations with CT and MRI. Other topics will include how remote imaging currently and, in the future, can serve as an adjunct in supporting leaders' ability to increase staff coverage, competence, retention, and improved department safety profiles.

#### COURSE DESCRIPTION

Remote Scanning or Remote Imaging has been an increasingly important topic of radiology meetings and discussion boards, especially regarding CT and MRI. With the technical improvements over the years, it has become feasible to image a patient from a remote location. This session will discuss the overall challenges and benefits of remote scanning in the radiology department, as well as the various leadership perceptions of remote scanning, from vendor solutions to the technologists' implementation of the technology. Our discussion will also include the important safety aspects of remote scanning in general terms for radiology and more specific details of safety regulations with CT and MRI. Other topics will include how remote imaging currently and, in the future, can serve as an adjunct in supporting leaders' ability to increase staff coverage, competence, retention, and improved department safety profiles.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

**Moderator**

### **Participants**

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

### The Future of your Dementia Imaging Practice: MRI

#### Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To describe the changing role of anatomical and molecular imaging for patients with neurodegenerative disorders, and the shift from nosological diagnosis to a biomarker-defined diagnosis. 2) To identify newest developments in PET tracers for specific neurodegenerative diseases. 3) To explain the role of advances in AI and imaging hardware in the diagnosis of neurodegenerative disease.\*Course Description Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This final educational session will give a broader perspective of in which direction the field of imaging in neurodegeneration is moving, including biomarker-based diagnoses, advanced hardware and software applications for novel imaging and AI-based diagnoses.

#### COURSE DESCRIPTION

Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This final educational session will give a broader perspective of in which direction the field of imaging in neurodegeneration is moving, including biomarker-based diagnoses, advanced hardware and software applications for novel imaging and AI-based diagnoses.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

### The Future of your Dementia Imaging Practice: PET

#### Participants

Javier Arbizu Lostao, MD, PhD, Pamplona, Spain (*Presenter*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Novartis AG;Speaker, General Electric Company;Research Grant, Siemens AG;Speaker, Life Molecular Imaging GmbH;Speaker, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

**To Infinity and Beyond: Disruptive Software and Hardware Developments for Imaging Neurodegeneration**

### Participants

Ciprian Catana, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

**Moderator**

### Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP08

### RSNA/ESR Symposium: Imaging of Neurodegenerative Disorder - The Next Frontier in Imaging in Neurodegeneration

#### Sub-Events

##### W7-RCP08 Moderator

#### Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research support, Siemens AG ;Research support, Life Molecular Imaging;Research support, General Electric Company;Research support, Eli Lilly and Company;Research support, Eisai Co, Ltd;Consultant, Siemens AG ;Consultant, General Electric Company

##### W7-RCP08 Moderator

#### Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Moderator*) Nothing to Disclose

##### W7-RCP08 The Future of your Dementia Imaging Practice: MRI

#### Participants

Yoshimi Anzai, MD, MPH, Salt Lake City, UT (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) To describe the changing role of anatomical and molecular imaging for patients with neurodegenerative disorders, and the shift from nosological diagnosis to a biomarker-defined diagnosis. 2) To identify newest developments in PET tracers for specific neurodegenerative diseases. 3) To explain the role of advances in AI and imaging hardware in the diagnosis of neurodegenerative disease.\*Course Description Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This final educational session will give a broader perspective of in which direction the field of imaging in neurodegeneration is moving, including biomarker-based diagnoses, advanced hardware and software applications for novel imaging and AI-based diagnoses.

#### COURSE DESCRIPTION

Structural MRI and molecular imaging techniques are key modalities in the diagnosis (and increasingly also in early detection) of neurodegenerative disorders. This session is part of an educational ESR-RSNA transatlantic course (of 4 sessions in total) that discusses imaging in neurodegeneration, from basics to advanced applications. This final educational session will give a broader perspective of in which direction the field of imaging in neurodegeneration is moving, including biomarker-based diagnoses, advanced hardware and software applications for novel imaging and AI-based diagnoses.

##### W7-RCP08 The Future of your Dementia Imaging Practice: PET

#### Participants

Javier Arbizu Lostao, MD, PhD, Pamplona, Spain (*Presenter*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Novartis AG;Speaker, General Electric Company;Research Grant, Siemens AG;Speaker, Life Molecular Imaging GmbH;Speaker, Biogen Idec Inc

##### W7-RCP08 To Infinity and Beyond: Disruptive Software and Hardware Developments for Imaging Neurodegeneration

#### Participants

Ciprian Catana, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W7-RCP16

**Moderator**

### Participants

Efren J. Flores, MD, Boston, MA (*Moderator*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP16

**Moderator**

### Participants

Somiah Almeky, MD, Boston, MA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP16

### Opportunities for Community Engagement in Radiology Research

#### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Participants will learn the best practices to foster trust and longitudinal relationships to establish meaningful partnerships between key community members and enhance effectiveness of collaborations. 2) Participants will be able to identify how to effectively engage with patients and community members to identify the social determinants of health that influence access to radiology care in their practice. 3) Participants will learn to bring in a cultural lens to community engagement to foster bi-directional learning, learn to acknowledge and respect the distinctive values of individuals coming from diverse communities. 4) Participants will be able to describe the importance of Community-Based Participatory Research in health equity efforts and other community-based grass roots efforts and outreach that can be employed in the advancement of program development to advance health equity.\*Course Description In many instances, radiologists are seeking opportunities to learn practical ways to engage in community outreach in their practices. This session will provide participants with an opportunity to participate in an interactive session with radiologists and community organizations that have successfully established meaningful partnerships that foster trust and longitudinal partnerships to advance health equity and care delivery transformation in radiology. Radiology practices and the communities of the patients they serve are directly impacted by the social determinants of health that influence their radiology care. Radiology is a leader in healthcare innovation and care delivery transformation, but often the communities served are not included in the creative process or implementation of novel care models and technologies aimed to benefit them. Therefore, the implementation of new technologies in radiology without the input of the community creates a disconnect that ultimately results in the health disparities we see in our radiology practices. Meaningful community engagement requires working transdisciplinary collaborations that breaks silos between healthcare, public health, and community health sectors. This type of engagement is one that foster trusts and sustainable relationships that result in community partnerships and coalitions across healthcare organizations to serve as catalysts for transformational change in radiology. Thus, the purpose of this session is to engage in an interactive session with the audience and members of the panel in a discussion on how to successfully form community partnerships between radiologists and community organizations. The Chicago Southwest Organizing Project (SWOP) is a local transdisciplinary community organization that is collaborating with the RSNA Health Equity Committee representative members will be invited to participate in this session as well as radiologists that have successfully established community relationships in their practices and improve access to care. Leveraging the National Academy of Medicine framework for Health Equity and Community Engagement, topics to be covered will include: 1. Strengthening Community Partnerships Through Diversity, Inclusion and Trust 2. Designing and Implementing community-aligned programs to increase access to care. 3. Culturally-centered, sustainable partnerships to foster bi-directional learning 4. The role of community-based participatory research in guiding health equity efforts. 5. Transforming the radiology education experience and fostering well-being through community outreach experiences.

#### COURSE DESCRIPTION

In many instances, radiologists are seeking opportunities to learn practical ways to engage in community outreach in their practices. This session will provide participants with an opportunity to participate in an interactive session with radiologists and community organizations that have successfully established meaningful partnerships that foster trust and longitudinal partnerships to advance health equity and care delivery transformation in radiology. Radiology practices and the communities of the patients they serve are directly impacted by the social determinants of health that influence their radiology care. Radiology is a leader in healthcare innovation and care delivery transformation, but often the communities served are not included in the creative process or implementation of novel care models and technologies aimed to benefit them. Therefore, the implementation of new technologies in radiology without the input of the community creates a disconnect that ultimately results in the health disparities we see in our radiology practices. Meaningful community engagement requires working transdisciplinary collaborations that breaks silos between healthcare, public health, and community health sectors. This type of engagement is one that foster trusts and sustainable relationships that result in community partnerships and coalitions across healthcare organizations to serve as catalysts for transformational change in radiology. Thus, the purpose of this session is to engage in an interactive session with the audience and members of the panel in a discussion on how to successfully form community partnerships between radiologists and community organizations. The Chicago Southwest Organizing Project (SWOP) is a local transdisciplinary community organization that is collaborating with the RSNA Health Equity Committee representative members will be invited to participate in this session as well as radiologists that have successfully established community relationships in their practices and improve access to care. Leveraging the National Academy of Medicine framework for Health Equity and Community Engagement, topics to be covered will include: 1. Strengthening Community Partnerships Through Diversity, Inclusion and Trust 2. Designing and Implementing community-aligned programs to increase access to care. 3. Culturally-centered, sustainable partnerships to foster bi-directional learning 4. The role of community-based participatory research in guiding health equity efforts. 5. Transforming the radiology education experience and fostering well-being through community outreach experiences.

## Abstract Archives of the RSNA, 2023

W7-RCP16

### Creating Inclusive Spaces and Community Engagement through Art

#### Participants

Daniel Chonde, MD, PhD, Boston, MA (*Presenter*) Stockholder, Alkermes plc Stockholder, Biogen Idec Inc Stockholder, Hologic, Inc Stockholder, Jaguar Health Stockholder, Mylan NV Stockholder, Myomo Inc Stockholder, Novartis AG Stockholder, Nuance Communications, Inc Stockholder, Resmed Stockholder, Teladoc Health Stockholder, Teva Pharmaceutical Industries Ltd Stockholder, Uniqure NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP16

### Improving Cancer Screening Access in Rural Communities

#### Participants

Gwendolyn M. Bryant-Smith, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP16

### Achieving Health Equity and Care Delivery Through Sustainable Community Partnerships in Radiology (Sponsored by the RSNA Health Equity Committee)

#### Sub-Events

##### W7-RCP16 Moderator

#### Participants

Efren J. Flores, MD, Boston, MA (*Moderator*) Speaker, WebMD LLC; Speaker, Consulting Medical Associates, Inc

##### W7-RCP16 Moderator

#### Participants

Somiah Almekey, MD, Boston, MA (*Moderator*) Nothing to Disclose

##### W7-RCP16 Opportunities for Community Engagement in Radiology Research

#### Participants

Lucy Spalluto, MD, MPH, Nashville, TN (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Participants will learn the best practices to foster trust and longitudinal relationships to establish meaningful partnerships between key community members and enhance effectiveness of collaborations. 2) Participants will be able to identify how to effectively engage with patients and community members to identify the social determinants of health that influence access to radiology care in their practice. 3) Participants will learn to bring in a cultural lens to community engagement to foster bi-directional learning, learn to acknowledge and respect the distinctive values of individuals coming from diverse communities. 4) Participants will be able to describe the importance of Community-Based Participatory Research in health equity efforts and other community-based grass roots efforts and outreach that can be employed in the advancement of program development to advance health equity.\*Course Description In many instances, radiologists are seeking opportunities to learn practical ways to engage in community outreach in their practices. This session will provide participants with an opportunity to participate in an interactive session with radiologists and community organizations that have successfully established meaningful partnerships that foster trust and longitudinal partnerships to advance health equity and care delivery transformation in radiology. Radiology practices and the communities of the patients they serve are directly impacted by the social determinants of health that influence their radiology care. Radiology is a leader in healthcare innovation and care delivery transformation, but often the communities served are not included in the creative process or implementation of novel care models and technologies aimed to benefit them. Therefore, the implementation of new technologies in radiology without the input of the community creates a disconnect that ultimately results in the health disparities we see in our radiology practices. Meaningful community engagement requires working transdisciplinary collaborations that breaks silos between healthcare, public health, and community health sectors. This type of engagement is one that fosters trusts and sustainable relationships that result in community partnerships and coalitions across healthcare organizations to serve as catalysts for transformational change in radiology. Thus, the purpose of this session is to engage in an interactive session with the audience and members of the panel in a discussion on how to successfully form community partnerships between radiologists and community organizations. The Chicago Southwest Organizing Project (SWOP) is a local transdisciplinary community organization that is collaborating with the RSNA Health Equity Committee representative members will be invited to participate in this session as well as radiologists that have successfully established community relationships in their practices and improve access to care. Leveraging the National Academy of Medicine framework for Health Equity and Community Engagement, topics to be covered will include: 1. Strengthening Community Partnerships Through Diversity, Inclusion and Trust 2. Designing and Implementing community-aligned programs to increase access to care. 3. Culturally-centered, sustainable partnerships to foster bi-directional learning 4. The role of community-based participatory research in guiding health equity efforts. 5. Transforming the radiology education experience and fostering well-being through community outreach experiences.

#### COURSE DESCRIPTION

In many instances, radiologists are seeking opportunities to learn practical ways to engage in community outreach in their practices. This session will provide participants with an opportunity to participate in an interactive session with radiologists and community organizations that have successfully established meaningful partnerships that foster trust and longitudinal partnerships to advance health equity and care delivery transformation in radiology. Radiology practices and the communities of the patients they serve are directly impacted by the social determinants of health that influence their radiology care. Radiology is a leader in healthcare innovation and care delivery transformation, but often the communities served are not included in the creative process or implementation of novel care models and technologies aimed to benefit them. Therefore, the implementation of new technologies in radiology without the input of the community creates a disconnect that ultimately results in the health disparities we see in our radiology practices. Meaningful community engagement requires working transdisciplinary collaborations that breaks silos between healthcare, public health, and community health sectors. This type of engagement is one that fosters trusts and sustainable relationships that result in community partnerships and coalitions across healthcare organizations to serve as catalysts for transformational change in radiology. Thus, the purpose of this session is to engage in an interactive session with the audience and members of the panel in a discussion on how to successfully form community partnerships between radiologists and community organizations. The Chicago Southwest Organizing Project (SWOP) is a local transdisciplinary community organization that is collaborating with the RSNA Health Equity Committee representative members will be invited to participate in this session as well as

radiologists that have successfully established community relationships in their practices and improve access to care. Leveraging the National Academy of Medicine framework for Health Equity and Community Engagement, topics to be covered will include:1. Strengthening Community Partnerships Through Diversity, Inclusion and Trust2. Designing and Implementing community-aligned programs to increase access to care.3. Culturally-centered, sustainable partnerships to foster bi-directional learning4. The role of community-based participatory research in guiding health equity efforts. 5. Transforming the radiology education experience and fostering well-being through community outreach experiences.

#### **W7-RCP16 Creating Inclusive Spaces and Community Engagement through Art**

Participants

Daniel Chonde, MD,PhD, Boston, MA (*Presenter*) Stockholder, Alkermes plcStockholder, Biogen Idec IncStockholder, Hologic, IncStockholder, Jaguar HealthStockholder, Mylan NVStockholder, Myomo IncStockholder, Novartis AGStockholder, Nuance Communications, IncStockholder, ResmedStockholder, Teladoc HealthStockholder, Teva Pharmaceutical Industries LtdStockholder, Uniqure NV

#### **W7-RCP16 Improving Cancer Screening Access in Rural Communities**

Participants

Gwendolyn M. Bryant-Smith, MD, (*Presenter*) Nothing to Disclose

#### **W7-RCP16 Leveraging your Power to Build Health Equity with Communities**

Participants

Priyanka Reddy, MD, MPH, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W7-RCP16

**Leveraging your Power to Build Health Equity with Communities**

### Participants

Priyanka Reddy, MD, MPH, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CBR11

### Case Based Review: Challenging Cases with focus on US

#### Participants

Athina Vourtsi, MD, Athens, Greece (*Presenter*) Research Consultant, General Electric Company; Research Grant, General Electric Company; Educator, Arbutus Biopharma Corporation; Research collaboration, ScreenPoint Medical BV; Medical Advisory Board, Volpara Health Technologies Limited

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CBR11

**Moderator**

### **Participants**

Steven P. Poplack, MD, Redwood City, CA (*Moderator*) Faculty, Ultimate Opinions in Medicine LLC; Speaker, Efficiency Learning Systems Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CBR11

### Case Based Review: Challenging Cases with Focus on DBT

#### Participants

Steven P. Poplack, MD, Redwood City, CA (*Presenter*) Faculty, Ultimate Opinions in Medicine LLC; Speaker, Efficiency Learning Systems Inc

#### LEARNING OBJECTIVES

1) Recognize digital tomosynthesis artifacts that mimic breast cancer. 2) Define the role of breast ultrasound in personalized breast cancer screening. 3) Understand when and how MRI can help manage patients presenting with breast symptoms.\*Course Description This is a case-based interactive educational session focused on challenging breast imaging cases. Each presentation will highlight diagnostic challenges and / or potential pitfalls inherent to each modality (DBT, US, MRI). This is relevant to clinical practice, wherein recognition of interpretive challenges is critical to establishing appropriate differential diagnosis and management. Whenever possible speakers will relate discussion and learning points to accepted peer reviewed standards. We look forward to a thought provoking session with active audience participation.

#### COURSE DESCRIPTION

This is a case-based interactive educational session focused on challenging breast imaging cases. Each presentation will highlight diagnostic challenges and / or potential pitfalls inherent to each modality (DBT, US, MRI). This is relevant to clinical practice, wherein recognition of interpretive challenges is critical to establishing appropriate differential diagnosis and management. Whenever possible speakers will relate discussion and learning points to accepted peer reviewed standards. We look forward to a thought provoking session with active audience participation.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CBR11

**Case Based Review: Challenging Cases with Focus on MRI**

### Participants

Priscilla Slanetz, MD, MPH, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CBR11

### Multimodality Challenging Breast Cases

#### Sub-Events

##### W8-CBR11 Moderator

#### Participants

Steven P. Poplack, MD, Redwood City, CA (*Moderator*) Faculty, Ultimate Opinions in Medicine LLC; Speaker, Efficiency Learning Systems Inc

##### W8-CBR11 Case Based Review: Challenging Cases with Focus on DBT

#### Participants

Steven P. Poplack, MD, Redwood City, CA (*Presenter*) Faculty, Ultimate Opinions in Medicine LLC; Speaker, Efficiency Learning Systems Inc

#### LEARNING OBJECTIVES

1) Recognize digital tomosynthesis artifacts that mimic breast cancer. 2) Define the role of breast ultrasound in personalized breast cancer screening. 3) Understand when and how MRI can help manage patients presenting with breast symptoms.\*Course Description This is a case-based interactive educational session focused on challenging breast imaging cases. Each presentation will highlight diagnostic challenges and / or potential pitfalls inherent to each modality (DBT, US, MRI). This is relevant to clinical practice, wherein recognition of interpretive challenges is critical to establishing appropriate differential diagnosis and management. Whenever possible speakers will relate discussion and learning points to accepted peer reviewed standards. We look forward to a thought provoking session with active audience participation.

#### COURSE DESCRIPTION

This is a case-based interactive educational session focused on challenging breast imaging cases. Each presentation will highlight diagnostic challenges and / or potential pitfalls inherent to each modality (DBT, US, MRI). This is relevant to clinical practice, wherein recognition of interpretive challenges is critical to establishing appropriate differential diagnosis and management. Whenever possible speakers will relate discussion and learning points to accepted peer reviewed standards. We look forward to a thought provoking session with active audience participation.

##### W8-CBR11 Case Based Review: Challenging Cases with Focus on MRI

#### Participants

Priscilla Slanetz, MD, MPH, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv

##### W8-CBR11 Case Based Review: Challenging Cases with focus on US

#### Participants

Athina Vourtsi, MD, Athens, Greece (*Presenter*) Research Consultant, General Electric Company; Research Grant, General Electric Company; Educator, Arbutus Biopharma Corporation; Research collaboration, ScreenPoint Medical BV; Medical Advisory Board, Volpara Health Technologies Limited

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCA10

### The Cardiac Debate: Where on The Map is Parametric Mapping

#### Sub-Events

##### W8-CCA10 Moderator

###### Participants

Jacobo Kirsch, MD, MBA, (*Moderator*) Medical Advisory Board, Zebra Medical Vision Ltd

##### W8-CCA10 Parametric Mapping is all I Need

###### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

##### W8-CCA10 Parametric Mapping: Is It Necessary?

###### Participants

Elsie Nguyen, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCA10

### Parametric Mapping: Is It Necessary?

#### Participants

Elsie Nguyen, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCA10

**Moderator**

### Participants

Jacobo Kirsch, MD, MBA, (*Moderator*) Medical Advisory Board, Zebra Medical Vision Ltd

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CCA10

### Parametric Mapping is all I Need

#### Participants

Kate Hanneman, MD, MPH, (*Presenter*) Speaker, Groupe Sanofi; Speaker, Amicus Therapeutics, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

### Imaging Patients Post Lung Transplantation

#### Participants

Micheal McInnis, MD, Toronto, ON (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

### Imaging Patients with Cardiac Devices

#### Participants

Claudio Silva, MD, MBA, Santiago, Chile (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

### Imaging Adults with Congenital Cardiac Disease

#### Participants

Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Advisory Board, Precisa Gravimetrics AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

**Moderator**

### **Participants**

Santiago Rossi, MD, Buenos Aires City, Argentina (*Moderator*) Speaker, Boehringer Ingelheim GmbH

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

### Imaging Patients Post Lung Surgery

#### Participants

Girish S. Shroff, MD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CCH09

### Thoracic Imaging in Select Populations

#### LEARNING OBJECTIVES

1) Improve knowledge and skills relevant to clinical practice. 2) Review new imaging concepts.\*Course Description The course will review imaging in both post transplantation and post lung surgery. It will also cover cardiac devices and congenital cardiac disease in adult population

#### COURSE DESCRIPTION

The course will review imaging in both post transplantation and post lung surgery. It will also cover cardiac devices and congenital cardiac disease in adult population

#### Sub-Events

##### **W8-CCH09 Moderator**

Participants

Santiago Rossi, MD, Buenos Aires City, Argentina (*Moderator*) Speaker, Boehringer Ingelheim GmbH

##### **W8-CCH09 Imaging Patients Post Lung Surgery**

Participants

Girish S. Shroff, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **W8-CCH09 Imaging Patients Post Lung Transplantation**

Participants

Micheal McInnis, MD, Toronto, ON (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Bayer AG

##### **W8-CCH09 Imaging Patients with Cardiac Devices**

Participants

Claudio Silva, MD, MBA, Santiago, Chile (*Presenter*) Nothing to Disclose

##### **W8-CCH09 Imaging Adults with Congenital Cardiac Disease**

Participants

Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Advisory Board, Precisa Gravimetrics AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CER15

### Emergency Radiology Practice Management in 2023: Health Equity, Sustainability, and Cost in the US and Europe

#### Sub-Events

##### W8-CER15 Moderator

#### Participants

Suzanne Chong, MD, MS, Superior Township, MI (*Moderator*) Nothing to Disclose

##### W8-CER15 A New National Patient Safety Goal: Department of Radiology

#### Participants

Suzanne Chong, MD, MS, Superior Township, MI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe health equity as a Joint Commission national patient safety goal. 2) Explore ways in which radiology practices can contribute to achieving health equity. 3) Understand state of the EU for ER and discuss challenges to its growth and success. 4) Discuss sustainability and explore the business case for growing a thriving ER practice. 5) Realize the shared goals, values, and mission of ER in the US and Europe.\*Course Description As Emergency Radiology continues its growth and expansion in the US and around the world, its singular vantage point at the intersection of healthcare for all and 24/7 service provision highlights unique challenges in the domains of quality and sustainability, and sparks debate on the costs of doing business. In this session, we focus on health equity as a national patient safety goal, discuss the challenges facing our European colleagues as the global mandate for emergency radiology marches onward, and explore the business case for sustainability in successful ER practices.

#### COURSE DESCRIPTION

As Emergency Radiology continues its growth and expansion in the US and around the world, its singular vantage point at the intersection of healthcare for all and 24/7 service provision highlights unique challenges in the domains of quality and sustainability, and sparks debate on the costs of doing business. In this session, we focus on health equity as a national patient safety goal, discuss the challenges facing our European colleagues as the global mandate for emergency radiology marches onward, and explore the business case for sustainability in successful ER practices.

##### W8-CER15 ER in Europe: Challenges and Opportunities

#### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

##### W8-CER15 Sustainability and Cost: Building the Business Case for a Successful ER Practice

#### Participants

Raffaella Basilico, Chieti, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24





## Abstract Archives of the RSNA, 2023

W8-CER15

**Moderator**

### **Participants**

Suzanne Chong, MD, MS, Superior Township, MI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CER15

### A New National Patient Safety Goal: Department of Radiology

#### Participants

Suzanne Chong, MD, MS, Superior Township, MI (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Describe health equity as a Joint Commission national patient safety goal. 2) Explore ways in which radiology practices can contribute to achieving health equity. 3) Understand state of the EU for ER and discuss challenges to its growth and success. 4) Discuss sustainability and explore the business case for growing a thriving ER practice. 5) Realize the shared goals, values, and mission of ER in the US and Europe.\*Course Description As Emergency Radiology continues its growth and expansion in the US and around the world, its singular vantage point at the intersection of healthcare for all and 24/7 service provision highlights unique challenges in the domains of quality and sustainability, and sparks debate on the costs of doing business. In this session, we focus on health equity as a national patient safety goal, discuss the challenges facing our European colleagues as the global mandate for emergency radiology marches onward, and explore the business case for sustainability in successful ER practices.

#### COURSE DESCRIPTION

As Emergency Radiology continues its growth and expansion in the US and around the world, its singular vantage point at the intersection of healthcare for all and 24/7 service provision highlights unique challenges in the domains of quality and sustainability, and sparks debate on the costs of doing business. In this session, we focus on health equity as a national patient safety goal, discuss the challenges facing our European colleagues as the global mandate for emergency radiology marches onward, and explore the business case for sustainability in successful ER practices.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CER15

### ER in Europe: Challenges and Opportunities

#### Participants

Jinel A. Scott, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CER15

**Sustainability and Cost: Building the Business Case for a Successful ER Practice**

### Participants

Raffaella Basilio, Chieti, Italy (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

### Case-Based Review of GI

#### LEARNING OBJECTIVES

1) Review a series of cases using interactive technology with the audience of various challenging patients. 2) Review a variety of disorders of the biliary tract, of COVID in the abdomen, or fluoroscopy applications and demonstration of disorders in the abdomen, and of the spleen and pancreas. 3) Understand the differential diagnosis of these conditions, if there is one, and the implications for patient management.\*Course Description Case-based interactive review of patients at various levels of difficult on various imaging modalities of the abdomen will be reviewed by experienced faculty for several organs/organ systems in the abdomen, with review of the current relevant literature. The expected outcome is that the learner/attendee will understand the differential diagnosis - if there is one (some of the cases may have just one diagnosis), and the implications for patient management.

#### COURSE DESCRIPTION

Case-based interactive review of patients at various levels of difficult on various imaging modalities of the abdomen will be reviewed by experienced faculty for several organs/organ systems in the abdomen, with review of the current relevant literature. The expected outcome is that the learner/attendee will understand the differential diagnosis - if there is one (some of the cases may have just one diagnosis), and the implications for patient management.

#### Sub-Events

##### W8-CGI11 Biliary Cases

Participants  
Jorge Soto, MD, (*Presenter*) Nothing to Disclose

##### W8-CGI11 COVID Cases

Participants  
Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

##### W8-CGI11 Fluoroscopy

Participants  
Linda Morimoto, MD, Stanford, CA (*Presenter*) Nothing to Disclose

##### W8-CGI11 Spleen

Participants  
Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

##### W8-CGI11 Pancreas

Participants  
Abraham Fourie Bezuidenhout, MD, Boston, MA (*Presenter*) Nothing to Disclose

##### W8-CGI11 Moderator

Participants  
Douglas Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

**Moderator**

### Participants

Douglas Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

### Biliary Cases

#### Participants

Jorge Soto, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

### COVID Cases

#### Participants

Douglas Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CGI11

### Fluoroscopy

#### Participants

Linda Morimoto, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

### Spleen

#### Participants

Khaled M. Elsayes, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CGI11

**Pancreas**

### Participants

Abraham Fourie Bezuidenhout, MD, Boston, MA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

**Moderator**

### Participants

Brad Genereaux, Santa Clara, CA (*Moderator*) Employee, NVIDIA Corporation Faculty, Johns Hopkins University

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

### Introduction

#### Participants

Seetharam Chadalavada, MS, Cincinnati, OH (*Presenter*) Consultant, Cook Group Incorporated; Grant, Cook Group Incorporated; Speaker, Cook Group Incorporated; Consultant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

### Insight-Driven Orders Workflows

#### Participants

R. Kent Hutson JR, MD, Palmer Lake, CO (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

### Computer Vision-Augmented Acquisition and Smart Modality Workflow

#### Participants

Kevin O'Donnell, Pacifica, CA (*Presenter*) Employee, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

### AI-Augmented Reporting Workflow

#### Participants

Kinson Ho, MSc, Waterloo, ON (*Presenter*) Employee, McKesson Corporation

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CIN20

### Enterprise Imaging and Distribution Workflow

#### Participants

Ameena Elahi, MS,ARRT, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CIN20

### Connecting Imaging Systems, Workflows, and AI: An Overview of IHE Radiology

#### LEARNING OBJECTIVES

1) Appreciate the role that IHE plays in connecting systems in the radiology technology ecosystem. 2) Understand the types of profiles and how they coherently form clinical working solutions. 3) Understand the constructs within IHE to quickly find the most pertinent information necessary to solve local business and clinical needs.\*Course Description

#### Sub-Events

##### W8-CIN20 Moderator

Participants

Brad Genereaux, Santa Clara, CA (*Moderator*) Employee, NVIDIA Corporation Faculty, Johns Hopkins University

##### W8-CIN20 Introduction

Participants

Seetharam Chadalavada, MS, Cincinnati, OH (*Presenter*) Consultant, Cook Group Incorporated; Grant, Cook Group Incorporated; Speaker, Cook Group Incorporated; Consultant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

##### W8-CIN20 Insight-Driven Orders Workflows

Participants

R. Kent Hutson JR, MD, Palmer Lake, CO (*Presenter*) Nothing to Disclose

##### W8-CIN20 Computer Vision-Augmented Acquisition and Smart Modality Workflow

Participants

Kevin O'Donnell, Pacifica, CA (*Presenter*) Employee, Canon Medical Systems Corporation

##### W8-CIN20 AI-Augmented Reporting Workflow

Participants

Kinson Ho, MSc, Waterloo, ON (*Presenter*) Employee, McKesson Corporation

##### W8-CIN20 Enterprise Imaging and Distribution Workflow

Participants

Ameena Elahi, MS, ARRT, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

### Small Joints-Big Problems: Imaging of the Hands and Feet

#### Sub-Events

##### W8-CMK13 Moderator

###### Participants

Tetyana A. Gorbachova, MD, Huntingdon Valley, PA (*Moderator*) Nothing to Disclose

##### W8-CMK13 Triangular Fibrocartilage Complex: Complex, but Not Triangular

###### Participants

Donald L. Resnick, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review imaging features and technical and interpretational pitfalls in the diagnosis of the abnormalities of the small joints of the hand, wrist, and foot. 2) Analyze the biomechanics and clinical significance of injuries to the small joints of the upper and lower extremity. \*Course Description This course is composed of a series of lectures focused on imaging of the joints of the hand, wrist and foot, in a format of short didactic lectures and Q&A. Individual lectures will highlight the tips and pitfalls of imaging diagnosis of common conditions that occur in clinical practice.

#### COURSE DESCRIPTION

This course is composed of a series of lectures focused on imaging of the joints of the hand, wrist and foot, in a format of short didactic lectures and Q&A. Individual lectures will highlight the tips and pitfalls of imaging diagnosis of common conditions that occur in clinical practice.

##### W8-CMK13 Lesser Metatarsophalangeal Joints: Such Little Joints, so Much to Learn!

###### Participants

Hilary R. Umans, MD, Ardsley, NY (*Presenter*) Nothing to Disclose

##### W8-CMK13 Lisfranc Joint Complex: Where is the Key?

###### Participants

Yulia Melenevsky, MD, Vestavia, AL (*Presenter*) Nothing to Disclose

##### W8-CMK13 MRI of the Thumb: Is it all about Stener Lesion?

###### Participants

Tetyana A. Gorbachova, MD, Huntingdon Valley, PA (*Presenter*) Nothing to Disclose

##### W8-CMK13 Turf Toe: What is your Turf on Imaging it?

###### Participants

Corrie M. Yablon, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

### **MRI of the Thumb: Is it all about Stener Lesion?**

#### **Participants**

Tetyana A. Gorbachova, MD, Huntingdon Valley, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

**Turf Toe: What is your Turf on Imaging it?**

### Participants

Corrie M. Yablon, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

**Moderator**

### **Participants**

Tetyana A. Gorbachova, MD, Huntingdon Valley, PA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

### Triangular Fibrocartilage Complex: Complex, but Not Triangular

#### Participants

Donald L. Resnick, MD, (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) Review imaging features and technical and interpretational pitfalls in the diagnosis of the abnormalities of the small joints of the hand, wrist, and foot. 2) Analyze the biomechanics and clinical significance of injuries to the small joints of the upper and lower extremity. \*Course Description This course is composed of a series of lectures focused on imaging of the joints of the hand, wrist and foot, in a format of short didactic lectures and Q&A. Individual lectures will highlight the tips and pitfalls of imaging diagnosis of common conditions that occur in clinical practice.

#### COURSE DESCRIPTION

This course is composed of a series of lectures focused on imaging of the joints of the hand, wrist and foot, in a format of short didactic lectures and Q&A. Individual lectures will highlight the tips and pitfalls of imaging diagnosis of common conditions that occur in clinical practice.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CMK13

**Lesser Metatarsophalangeal Joints: Such Little Joints, so Much to Learn!**

### Participants

Hilary R. Umans, MD, Ardsley, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CMK13

### Lisfranc Joint Complex: Where is the Key?

#### Participants

Yulia Melenevsky, MD, Vestavia, AL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

### CRASH COURSE! Traumatic Injuries of the Brain, Cerebrovasculature, Orbits, and Skull Base

#### LEARNING OBJECTIVES

1) Review the primary injury patterns of traumatic brain injuries and secondary injuries that can occur as complications of mass effect and herniation. When to use advanced neuroimaging as well as Identify and describe the mechanism associated with traumatic cerebrovascular injuries. 2) Review the imaging manifestations of various traumatic injuries of the orbits, potential complications, and the current imaging approach for evaluation. 3) Review the imaging manifestations of various traumatic injuries of the temporal bones, potential complications, and the current imaging approach for evaluation.\*Course Description This session is comprised of 4 high-yield lectures focused on the spectrum of traumatic imaging findings related to the brain, cerebrovasculature, orbits, and temporal bones. Discussion will address the relevant anatomy, interesting cases, potential complications, and current imaging strategies for evaluating these injuries.

#### COURSE DESCRIPTION

This session is comprised of 4 high-yield lectures focused on the spectrum of traumatic imaging findings related to the brain, cerebrovasculature, orbits, and temporal bones. Discussion will address the relevant anatomy, interesting cases, potential complications, and current imaging strategies for evaluating these injuries.

#### Sub-Events

##### W8-CNR06 Moderator

Participants  
Nancy Pham, MD, Stanford, CA (*Moderator*) Nothing to Disclose

##### W8-CNR06 Coup, Contrecoup, and Contusions

Participants  
Christopher T. Whitlow, MD, PhD, Winston Salem, NC (*Presenter*) Consultant, Biogen Idec Inc

##### W8-CNR06 The Seatbelt Sign?

Participants  
Nancy Pham, MD, Stanford, CA (*Presenter*) Nothing to Disclose

##### W8-CNR06 Fix this Blow Out and Flat Tire

Participants  
Tabassum A. Kennedy, MD, Madison, WI (*Presenter*) Nothing to Disclose

##### W8-CNR06 I was T-boned on the Petrous Ridge

Participants  
Osamu Sakai, MD, PhD, Boston, MA (*Presenter*) Consultant, Boston Imaging Core Lab LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

### Fix this Blow Out and Flat Tire

#### Participants

Tabassum A. Kennedy, MD, Madison, WI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

### I was T-boned on the Petrous Ridge

#### Participants

Osamu Sakai, MD, PhD, Boston, MA (*Presenter*) Consultant, Boston Imaging Core Lab LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

**Moderator**

### Participants

Nancy Pham, MD, Stanford, CA (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

### Coup, Contrecoup, and Contusions

#### Participants

Christopher T. Whitlow, MD, PhD, Winston Salem, NC (*Presenter*) Consultant, Biogen Idec Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CNR06

### The Seatbelt Sign?

#### Participants

Nancy Pham, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CPH08

**Moderator**

### **Participants**

Nicole Seiberlich, PhD, Ann Arbor, MI (*Moderator*) Royalties, Siemens AG; Research support, Siemens AG

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-CPH08

### Image Contrast in MRI

#### Participants

Jesse Hamilton, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CPH08

### Resolution in MRI

#### Participants

Walter Witschey, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CPH08

### Managing Basic Artifacts

#### Participants

Catherine Moran, PhD, San Jose, CA (*Presenter*) Research support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-CPH08

### Practical Aspects of MRI

#### LEARNING OBJECTIVES

1) Describe how differences in contrast can be induced by the selection of particular pulse sequence settings to differentiate tissues using MRI. 2) Explain how data collection in MRI is related to image resolution and scan time, and make practical tradeoffs between these factors. 3) Describe several common artifacts encountered in MRI, what causes them, and how to mitigate them.\*Course Description In this course, comprised of three 20-minute lectures, practical aspects of deploying Magnetic Resonance Imaging will be discussed. The aim of this course is to help radiologists to better understand the basics of MRI, and why clinical MRI exams are structured the way that they are. A detailed understanding of MRI physics is not required. MRI is complex due to the large number of parameters that can be adjusted and the unexpected artifacts that can arise, especially in the presence of motion. Determining an appropriate protocol for a clinical question balances the need for contrast between healthy and diseased tissue, the speed of the individual sequences, exam length, and the incremental diagnostic utility provided by adding to the protocol. This course will tackle these questions by focusing on three topics: 1) image contrast, and how it is generated and used to discriminate different tissues; 2) image resolution and how it relates to data collection, and 3) common artifacts, their causes, and how to mitigate them.

#### COURSE DESCRIPTION

In this course, comprised of three 20-minute lectures, practical aspects of deploying Magnetic Resonance Imaging will be discussed. The aim of this course is to help radiologists to better understand the basics of MRI, and why clinical MRI exams are structured the way that they are. A detailed understanding of MRI physics is not required. MRI is complex due to the large number of parameters that can be adjusted and the unexpected artifacts that can arise, especially in the presence of motion. Determining an appropriate protocol for a clinical question balances the need for contrast between healthy and diseased tissue, the speed of the individual sequences, exam length, and the incremental diagnostic utility provided by adding to the protocol. This course will tackle these questions by focusing on three topics: 1) image contrast, and how it is generated and used to discriminate different tissues; 2) image resolution and how it relates to data collection, and 3) common artifacts, their causes, and how to mitigate them.

#### Sub-Events

##### W8-CPH08 Moderator

Participants

Nicole Seiberlich, PhD, Ann Arbor, MI (*Moderator*) Royalties, Siemens AG; Research support, Siemens AG

##### W8-CPH08 Image Contrast in MRI

Participants

Jesse Hamilton, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### W8-CPH08 Resolution in MRI

Participants

Walter Witschey, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

##### W8-CPH08 Managing Basic Artifacts

Participants

Catherine Moran, PhD, San Jose, CA (*Presenter*) Research support, General Electric Company

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-RCP26

### Radiology: Cardiothoracic Imaging

#### Participants

Suhny Abbara, MD, Dallas, TX (*Presenter*) Royalties, RELX

#### LEARNING OBJECTIVES

1) To identify latest scientific trends and current and future developments in cardiothoracic Imaging. 2) Identify key topics of interest and educational and research opportunities in the fields of chest imaging, cardiovascular CT and cardiac MRI. 3) To give the editor's perspective on scholarly publishing trends and future needs in the field of cardiovascular and thoracic imaging.\*Course Description This program has Editors from several cardiovascular imaging journals share the latest and most impactful published science and educational articles in their respective journals and discuss current priorities and future directions and initiatives in their respective fields. The represented journals include Radiology CTI (RSNA), JCCT (SCCT Cardiac CT), JCMR (SCMR cardiovascular MRI) and JTI (STR Thoracic Imaging)

#### COURSE DESCRIPTION

This program has Editors from several cardiovascular imaging journals share the latest and most impactful published science and educational articles in their respective journals and discuss current priorities and future directions and initiatives in their respective fields. The represented journals include Radiology CTI (RSNA), JCCT (SCCT Cardiac CT), JCMR (SCMR cardiovascular MRI) and JTI (STR Thoracic Imaging)

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-RCP26

**Journal of Cardiovascular Computed Tomography**

### **Participants**

Armin A. Zadeh, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-RCP26

### Journal of Thoracic Imaging

#### Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG; Research Grant, Bracco Group; Research Grant, Elucid BioImaging Inc; Consultant, Elucid BioImaging Inc; Research Grant: General Electric Company; Research Grant, Guerbet SA; Research Grant, Heartflow, Inc; Speakers Bureau, Heartflow Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-RCP26

### Cardiothoracic Imaging What Drives the Field - Editor's Perspectives

#### Sub-Events

##### W8-RCP26 Moderator

###### Participants

Fernando U. Kay, MD, PhD, Farmers Branch, TX (*Moderator*) Research Grant, Edwards Lifesciences Corporation

##### W8-RCP26 Moderator

###### Participants

Suhny Abbara, MD, Dallas, TX (*Moderator*) Royalties, RELX

##### W8-RCP26 Radiology: Cardiothoracic Imaging

###### Participants

Suhny Abbara, MD, Dallas, TX (*Presenter*) Royalties, RELX

#### LEARNING OBJECTIVES

1) To identify latest scientific trends and current and future developments in cardiothoracic Imaging. 2) Identify key topics of interest and educational and research opportunities in the fields of chest imaging, cardiovascular CT and cardiac MRI. 3) To give the editor's perspective on scholarly publishing trends and future needs in the field of cardiovascular and thoracic imaging.\*Course Description This program has Editors from several cardiovascular imaging journals share the latest and most impactful published science and educational articles in their respective journals and discuss current priorities and future directions and initiatives in their respective fields. The represented journals include Radiology CTI (RSNA), JCCT (SCCT Cardiac CT), JCMR (SCMR cardiovascular MRI) and JTI (STR Thoracic Imaging)

#### COURSE DESCRIPTION

This program has Editors from several cardiovascular imaging journals share the latest and most impactful published science and educational articles in their respective journals and discuss current priorities and future directions and initiatives in their respective fields. The represented journals include Radiology CTI (RSNA), JCCT (SCCT Cardiac CT), JCMR (SCMR cardiovascular MRI) and JTI (STR Thoracic Imaging)

##### W8-RCP26 Journal of Cardiovascular Magnetic Resonance

###### Participants

Tim Leiner, MD, PhD, Rochester, MN (*Presenter*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA

##### W8-RCP26 Journal of Cardiovascular Computed Tomography

###### Participants

Armin A. Zadeh, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Canon Medical Systems Corporation

##### W8-RCP26 Journal of Thoracic Imaging

###### Participants

U. Joseph Schoepf, MD, PhD, Charleston, SC (*Presenter*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W8-RCP26

**Moderator**

### Participants

Fernando U. Kay, MD, PhD, Farmers Branch, TX (*Moderator*) Research Grant, Edwards Lifesciences Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-RCP26

**Moderator**

### **Participants**

Suhny Abbara, MD, Dallas, TX (*Moderator*) Royalties, RELX

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W8-RCP26

**Journal of Cardiovascular Magnetic Resonance**

### Participants

Tim Leiner, MD, PhD, Rochester, MN (*Presenter*) Research support, Pie Medical Imaging BV; Advisory Board, Cart-Tech BV; Advisory Board, AI4MedImaging; Advisor, Quantib BV; Consultant, Guerbet SA

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-PL02

### Leading Through Technology: Valuing Artificial and Human Intelligence

#### Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M4-PL02

**Plenary Session: Leading Through Technology: Valuing Artificial and Human Intelligence**

### Sub-Events

**M4-PL02    Leading Through Technology: Valuing Artificial and Human Intelligence**

#### Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

### Image Interpretation Session

#### Sub-Events

##### **M8-PL03 Moderator**

Participants

C. Douglas Phillips, MD, Asbury Park, NJ (*Moderator*) Nothing to Disclose

##### **M8-PL03 Neuroradiology**

Participants

Majda Thurnher, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) View a few interesting cases and hear them discussed by experts. 2) Learn a bit about some fellow RSNA members. 3) Learn some differential diagnostic points.

#### COURSE DESCRIPTION

Teaching through reviewing problematic and interesting cases from the prior year.

##### **M8-PL03 Head Neck Radiology**

Participants

Richard H. Wiggins III, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

##### **M8-PL03 Abdominal Imaging**

Participants

Aya Kamaya, MD, Mountain View, CA (*Presenter*) Royalties, RELX; Research Grant, Canon Medical Systems Corporation

##### **M8-PL03 Musculoskeletal Radiology**

Participants

Behrang Amini, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

##### **M8-PL03 Cardiothoracic Radiology**

Participants

Prachi P. Agarwal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

**Moderator**

### Participants

C. Douglas Phillips, MD, Asbury Park, NJ (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

### Neuroradiology

#### Participants

Majda Thurnher, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

#### LEARNING OBJECTIVES

1) View a few interesting cases and hear them discussed by experts. 2) Learn a bit about some fellow RSNA members. 3) Learn some differential diagnostic points.

#### COURSE DESCRIPTION

Teaching through reviewing problematic and interesting cases from the prior year.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M8-PL03

### Head Neck Radiology

#### Participants

Richard H. Wiggins III, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

### Abdominal Imaging

#### Participants

Aya Kamaya, MD, Mountain View, CA (*Presenter*) Royalties, RELX; Research Grant, Canon Medical Systems Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

### Musculoskeletal Radiology

#### Participants

Behrang Amini, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M8-PL03

### Cardiothoracic Radiology

#### Participants

Prachi P. Agarwal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-PL07

### Total Body PET Imaging

#### Participants

Ramsey Badawi, PhD, Sacramento, CA (*Presenter*) Research Grant, Shanghai United Imaging Healthcare Co, Ltd; Institutional research agreement, Shanghai United Imaging Healthcare Co, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-PL07

### RSNA/AAPM Symposium: Together We Can Make A Difference

#### Sub-Events

##### R4-PL07 Moderator

###### Participants

Guang-Hong Chen, PhD, Madison, WI (*Moderator*) Nothing to Disclose

##### R4-PL07 Total Body PET Imaging (Technical)

###### Participants

Simon R. Cherry, PhD, Davis, CA (*Presenter*) Research Grant, Canon Medical Systems Corporation; Researcher, Shanghai United Imaging Healthcare Co, Ltd; Support, Shanghai United Imaging Healthcare Co, Ltd;

#### LEARNING OBJECTIVES

1) Explain how the technological developers can work with clinical radiologists to impact current and future clinical care.

#### COURSE DESCRIPTION

Radiologists employ innovative imaging technologies to conduct clinical diagnoses, while developers specializing in medical physics and biomedical imaging relentlessly introduce new concepts and techniques to optimize patient care. However, outstanding ideas and technological notions do not always translate into clinically viable products for real-world practice. Consequently, technological innovators and clinicians must collaborate synergistically to realize a shared goal: enhancing patient care. For the past three years, this objective has been the focal point of the RSNA/AAPM Plenary sessions. This year, we aim to showcase another successful collaboration that brought total-body PET imaging to clinical practices.

##### R4-PL07 Total Body PET Imaging (Clinical)

###### Participants

Lorenzo Nardo, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

##### R4-PL07 Total Body PET Imaging

###### Participants

Ramsey Badawi, PhD, Sacramento, CA (*Presenter*) Research Grant, Shanghai United Imaging Healthcare Co, Ltd; Institutional research agreement, Shanghai United Imaging Healthcare Co, Ltd

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-PL07

**Moderator**

### Participants

Guang-Hong Chen, PhD, Madison, WI (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R4-PL07

### Total Body PET Imaging (Clinical)

#### Participants

Lorenzo Nardo, MD, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R4-PL07

### Total Body PET Imaging (Technical)

#### Participants

Simon R. Cherry, PhD, Davis, CA (*Presenter*) Research Grant, Canon Medical Systems Corporation; Researcher, Shanghai United Imaging Healthcare Co, Ltd; Support, Shanghai United Imaging Healthcare Co, Ltd;

#### LEARNING OBJECTIVES

1) Explain how the technological developers can work with clinical radiologists to impact current and future clinical care.

#### COURSE DESCRIPTION

Radiologists employ innovative imaging technologies to conduct clinical diagnoses, while developers specializing in medical physics and biomedical imaging relentlessly introduce new concepts and techniques to optimize patient care. However, outstanding ideas and technological notions do not always translate into clinically viable products for real-world practice. Consequently, technological innovators and clinicians must collaborate synergistically to realize a shared goal: enhancing patient care. For the past three years, this objective has been the focal point of the RSNA/AAPM Plenary sessions. This year, we aim to showcase another successful collaboration that brought total-body PET imaging to clinical practices.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S6-PL01

### History Never Repeats Itself, But It Does Often Rhyme

#### Participants

Howard B. Chrisman, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S6-PL01

### President's Address and Opening Session

#### Sub-Events

#### **S6-PL01**    **Leading Through Change**

##### Participants

Matthew Mauro, MD, Chapel Hill, NC (*Presenter*) Board Member, Boston Scientific Corporation; Investor, Medtronic plc; Investor, Bayer AG

#### **S6-PL01**    **History Never Repeats Itself, But It Does Often Rhyme**

##### Participants

Howard B. Chrisman, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S6-PL01

### Leading Through Change

#### Participants

Matthew Mauro, MD, Chapel Hill, NC (*Presenter*) Board Member, Boston Scientific Corporation; Investor, Medtronic plc; Investor, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-PL04

**Plenary Session: The Future of Healthcare Delivery: Considerations for Patients and Providers**

### Sub-Events

**T4-PL04 The Future of Healthcare Delivery: Considerations for Patients and Providers**

Participants

Vin Gupta, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T4-PL04

### The Future of Healthcare Delivery: Considerations for Patients and Providers

#### Participants

Vin Gupta, MD, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

### Plenary Session Game Show: Oncology Imaging and Interventions: The Radiology Jeopardy

#### LEARNING OBJECTIVES

1) Explore the latest advancements in oncology imaging modalities: Understand the recent breakthroughs in imaging technologies and their application in the diagnosis and staging of various malignancies. 2) Stay updated on evidence-based practice in radiation oncology: Review recent clinical trials that have influenced the standard of care and the implications of these findings on treatment decision-making and patient outcomes. 3) Gain insights into functional and molecular imaging: Learn about novel imaging techniques, including diffusion-weighted imaging (DWI), perfusion imaging, spectroscopy, and radiomics, and understand their utility in evaluating tumor heterogeneity, angiogenesis, metabolic activity, and treatment response. 4) Identify emerging trends in image-guided interventions: Discover the evolving role of interventional oncology in minimally invasive tumor treatments and understand the current challenges and future prospects in this domain. 5) Discuss the multidisciplinary approach to oncology imaging and interventions: Recognize the importance of collaboration among radiologists, oncologists, surgeons, and pathologists to optimize patient care through integrated imaging protocols, clinical decision support systems, and standardized reporting.

#### COURSE DESCRIPTION

The plenary session is a comprehensive educational opportunity that focuses on the latest developments, cutting-edge technologies, and emerging trends in the field of oncology imaging and intervention. Attendees will be provided with a rich learning experience that explores innovative imaging techniques and their impact on cancer diagnosis, treatment planning, and therapies presented in a game-show format with participation of leading experts in the fields of Diagnostic Radiology, Interventional Radiology, Radiation Oncology and Nuclear Medicine.

#### Sub-Events

##### W4-PL05 Moderator

###### Participants

Julius Chapiro, MD, PhD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG

##### W4-PL05 Moderator

###### Participants

Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose

##### W4-PL05 Judge

###### Participants

Nikitha Murali, MD, Chicago, IL (*Presenter*) Nothing to Disclose

##### W4-PL05 Judge

###### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### W4-PL05 Judge

###### Participants

Mansur Ghani, MD, San Diego, CA (*Presenter*) Nothing to Disclose

##### W4-PL05 Team 1

###### Participants

Suresh K. Mukherji, MD, MBA, Carmel, IN (*Presenter*) Nothing to Disclose

##### W4-PL05 Team 1

###### Participants

Riad Salem, MBA, Chicago, IL (*Presenter*) Consultant, Boston Scientific Corporation;Consultant, Eisai Co, Ltd;Consultant, Sirtex Medical Ltd;Consultant, Cook Group Incorporated;Consultant, Siemens AG

##### W4-PL05 Team 1

###### Participants

Richard L. Wahl, MD, Saint Louis, MO (*Presenter*) Investigator, Siemens AG;Researcher, Siemens AG;Consultant, Clarity Pharmaceuticals;Scientific Advisory Board, Clarity Pharmaceuticals;Stock Options, Clarity Pharmaceuticals;Scientific Advisory Board, Seno Medical Instruments, Inc;Speaker, ITM Instruments Inc;Researcher, ITM Instruments Inc;Investigator, ITM Instruments Inc;Investigator, Bayer AG;Researcher, Bayer AG;Scientific Advisory Board, Voximetry Incorporated;Stock Options, Voximetry

Incorporated

**W4-PL05 Team 1**

Participants

Jeffrey A. Bogart, MD, Syracuse, NY (*Presenter*) Shareholder, Mobius Imaging

**W4-PL05 Team 2**

Participants

Ann Raldow, MD, MPH, Los Angeles, CA (*Presenter*) Consultant, ViewRay, Inc

**W4-PL05 Team 2**

Participants

Elliot Fishman, MD, Owings Mills, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

**W4-PL05 Team 2**

Participants

Michael Soulen, MD, Lafayette Hill, PA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Guerbet SA; Consultant, AstraZeneca PLC; Research support, Guerbet SA; Research support, Sirtex Medical Ltd; Research support, Pfizer Inc

**W4-PL05 Team 2**

Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

**W4-PL05 Team 3**

Participants

Linda B. Haramati, MD, MS, New Rochelle, NY (*Presenter*) Nothing to Disclose

**W4-PL05 Team 3**

Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

**W4-PL05 Team 3**

Participants

Simon Lo, MBChB, (*Presenter*) Committee member, Elekta AB

**W4-PL05 Team 3**

Participants

Mishal Mendiratta-Lala, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 1**

### Participants

Suresh K. Mukherji, MD, MBA, Carmel, IN (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 1**

### Participants

Riad Salem, MBA, Chicago, IL (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Eisai Co, Ltd; Consultant, Sirtex Medical Ltd; Consultant, Cook Group Incorporated; Consultant, Siemens AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

### Team 1

#### Participants

Richard L. Wahl, MD, Saint Louis, MO (*Presenter*) Investigator, Siemens AG;Researcher, Siemens AG;Consultant, Clarity Pharmaceuticals;Scientific Advisory Board, Clarity Pharmaceuticals;Stock Options, Clarity Pharmaceuticals;Scientific Advisory Board, Seno Medical Instruments, Inc;Speaker, ITM Instruments Inc;Researcher, ITM Instruments Inc;Investigator, ITM Instruments Inc;Investigator, Bayer AG;Researcher, Bayer AG;Scientific Advisory Board, Voximetry Incorporated;Stock Options, Voximetry Incorporated

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 1**

### Participants

Jeffrey A. Bogart, MD, Syracuse, NY (*Presenter*) Shareholder, Mobius Imaging

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 2**

### Participants

Ann Raldow, MD, MPH, Los Angeles, CA (*Presenter*) Consultant, ViewRay, Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 2**

### Participants

Elliot Fishman, MD, Owings Mills, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 2**

### Participants

Michael Soulen, MD, Lafayette Hill, PA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Guerbet SA; Consultant, AstraZeneca PLC; Research support, Guerbet SA; Research support, Sirtex Medical Ltd; Research support, Pfizer Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 2**

### Participants

Helen Nadel, MD, FRCPC, Menlo Park, CA (*Presenter*) Consultant, ICON plc;;

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 3**

### Participants

Linda B. Haramati, MD, MS, New Rochelle, NY (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 3**

### Participants

Anne M. Covey, MD, New York, NY (*Presenter*) Stockholder, Amgen Inc

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 3**

### Participants

Simon Lo, MBChB, (*Presenter*) Committee member, Elekta AB

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Team 3**

### Participants

Mishal Mendiratta-Lala, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Moderator**

### **Participants**

Julius Chapiro, MD, PhD, New Haven, CT (*Moderator*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Boston Scientific Corporation; Consultant, AstraZeneca PLC; Consultant, Bayer AG

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Moderator**

### Participants

Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Judge**

### Participants

Mansur Ghani, MD, San Diego, CA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W4-PL05

**Judge**

### Participants

Nikitha Murali, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W4-PL05

**Judge**

### Participants

Anne Sailer, MD, New Haven, CT (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-PL06

### Understanding and Revitalizing the Radiology Workforce

#### Participants

Jocelyn Chertoff, MD, MS, Lebanon, NH (*Presenter*) Director, Varex Imaging Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W6-PL06

**Plenary Session: Understanding and Revitalizing the Radiology Workforce**

### Sub-Events

**W6-PL06 Understanding and Revitalizing the Radiology Workforce**

#### Participants

Jocelyn Chertoff, MD, MS, Lebanon, NH (*Presenter*) Director, Varex Imaging Corporation

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-QI

### Quality Improvement Reports Monday Poster Discussions

#### Sub-Events

#### **M2-QI-1 Expanded Scope of Practice Fellowships for Radiologists: a Survey of Interest Amongst Current Canadian Radiology Residents**

##### Participants

Nick Maizlin, MD, London, ON (*Presenter*) Nothing to Disclose

##### **METHODS**

Using the Canadian family medicine Enhanced Skills Program as a model, we conducted a Canada-wide survey of radiology residents to assess interest in additional fellowship training to expand their scope of practice. We undertook a national survey of radiology residents in Canada to determine their interest in completing further fellowship training in expanded scope of practice fellowships (referred to herein as "clinical fellowship"). We define a "clinical fellowship" as distinct from traditional diagnostic imaging and interventional fellowships and include low risk anesthesia, non-surgical breast disease, cancer screening, chronic pain, clinician scholar, diabetes and wound care, emergency medicine, hospital medicine, incidentaloma management, low risk obstetrics, medical oncology, palliative care, public or environmental health, renal stone disease, sports and exercise medicine, vascular/atherosclerosis medicine and "other", where we queried resident's interest.

##### **RESULTS**

Our results indicate that a majority of residents (69.2%) would like to routinely see patients in clinic and more than half (52%) are willing to undergo an additional year of fellowship to enhance their skill set. The most popular choices for such fellowships were sports medicine (22.8%), emergency medicine (19.6%) and vascular medicine (18.5%). In addition, a majority (52.9%) of residents felt capable of offering incidentaloma clinics without additional training beyond their core radiology residency. \*Discussion Traditional diagnostic and interventional radiology fellowships must be reconsidered to reflect the interests and capabilities of modern radiology trainees. Expansion of training options into the domain of direct patient management will likely prove popular among current residents.

#### **M2-QI-2 Effect of standardization on time spent by patients in recovery nursing units after interventional radiology procedures**

##### Participants

Ashok Srinivasan, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

##### **METHODS**

Post procedural recovery units at our institution cater to 3 cohorts of patients: Vascular interventional radiology (VIR), Neurointerventional Radiology (NIR) and Neurodiagnostic Radiology (NDR). A list of all procedures performed in each of the 3 areas was compiled and sent to the respective services to create a consensus list for recovery times per procedure. The final list was circulated to the proceduralist teams and nursing teams in recovery units for implementation. We monitored the overall time spent by patients in recovery units in each cohort before and after implementation. We also monitored risk reports prior to and after implementation to determine if there was any change in number or types of complications. Lastly, informal surveys of the nursing staff were conducted to understand whether standardization changed the frequency of phone calls to clarify orders.

##### **RESULTS**

Pre implementation spanned Jan-Dec 2021 and post implementation Jan-Dec 2022. Our data demonstrated the following pre and post implementation recovery times (in minutes): - MEDIAN: Overall (56 vs 49), NIR (140 vs 134), NDR (123 vs 61), VIR (45 vs 45) AVERAGE: Overall (85 vs 73), NIR (154 vs 143), NDR (119 vs 61), VIR (69 vs 66) There were no changes in the number of risk reports related to post procedural complications after implementation. Informal surveys of the nursing staff post implementation revealed a significant drop in phone calls placed for order clarification. \*Discussion Post implementation, greater than 10% reduction in average and median times was achieved overall for all procedures. The largest effect was seen in NDR procedures with nearly 50% reduction (both median average) whereas the change in NIR procedures was 4/8% (median/average) and VIR procedures was 0/4% (median/average). Our results probably indicate that standardization can work in reducing variations but have limitations as well; the impact may be different from segment to segment based on the degree of pre-existing variations. However, even in areas where standardization did not change the times substantially, there was tangible benefit in terms of eliminating many phone calls for order clarification.

#### **M2-QI-3 Quality Improvement of Transcatheter Aortic Valve Replacement With Femoral Access: Identifying The Femoral Artery Bifurcation Using CT and 3D Modeling**

##### **METHODS**

The protocol involved radiologists identifying the location of the femoral artery bifurcation relative to the inguinal ligament using CT with contrast and communicating it to interventional cardiologists through a report on eRecord as well as a visual representation from the university's 3D lab. The interventional cardiologists then used this information to determine whether there was an access

site of adequate length for femoral access or if the femoral bifurcation was too high. In this scenario, they would avoid the femoral vessel.

## RESULTS

The implementation of the protocol led to greater confidence with femoral vessel access among cardiac proceduralists by adding an extra check to the existing methods of physical exam and ultrasound to prevent retroperitoneal bleeds. It led to a reduction in the incidence of retroperitoneal hematomas during TAVR procedures using femoral access with 0.47% of procedures resulting in a retroperitoneal hematoma from 2012 to 2016 compared to 0.29% from 2017 to 2023, representing a marked improvement in patient safety. Proceduralists at the institution continue to rely on the model between multidisciplinary meetings and the day of the procedure to inform their choice of access.\*Discussion The implementation of the protocol highlights the importance of effective communication and collaboration between radiologists and interventional cardiologists during TAVR procedures using femoral access. By ensuring clear communication between radiologists and proceduralists and creating 3D visual models as reference, patients can receive safer care with more safety measures to prevent retroperitoneal bleeds in TAVR procedures. This protocol can serve as a model for improving planning and reducing complications during other vascular procedures.

### M2-QI-4 Assessment Driven Approach to Integrating Volumetric Software for MRI in Dementia

Participants

Michelle Pisa, DO, Andover, MA (*Presenter*) Nothing to Disclose

## METHODS

We used an AI platform (Blackford) to sequentially enable QR from two different software vendors, Cortechs.ai (NeuroQuant Age-related Atrophy) and Icometrix (Icobrain DM). For both products, the manufacturer-specified imaging sequence was incorporated into our existing MRI Dementia protocol. The routine MR images were interpreted by 1 of 6 CAQ-certified Neuroradiologists. Several months later, they were presented with the corresponding QR, asked to re-review the MRI exam in context, and prompted with a questionnaire to assess the impact of the QR on their original interpretation. The QR was also sent to 1 of 4 participating Neurologists, who were asked to review the routine MR images, the QR, and prompted with a questionnaire to assess the impact of the QR on the imaging interpretation and their clinical management.

## RESULTS

For Radiologists and Neurologists, the QR presented from both products affected the interpretation of the conventional MRI imaging in 1 of every 4/5 cases (19-29%). The most frequently reported change was the detection of atrophy, in particular hippocampal atrophy. For both products, and compared with Radiologists, the Neurologists indicated increased confidence in both the imaging exam and the interpretation with the addition of the QR. For both products, Neurologists indicated the influence of QR on their clinical interpretation in 9 out of 10 cases (90-97%), with a strong influence in 1 out of 3 cases (27-37%). Neurologists also indicated a change in management in 1 of 3 cases (27-34%) based on the input of QR.\*Discussion Addition of QR affected the MR imaging interpretation for both Neurologists and Neuroradiologists, mainly with regard to hippocampal atrophy. Neurologists indicated a stronger influence of the additional data on their interpretation of the MRI and on clinical management. Assessment data was used to inform the purchasing decision, establish interpretation standards, and outline a clinical workflow.

### M2-QI-5 Implementation of a structured observership program for improving recruitment of radiology trainees: A novel analysis

## METHODS

Over the course of one year, our department of radiology ran a programme for rotating junior doctors. A feedback form was distributed. Candidates were asked multiple of questions, including ranking options on a Likert scale and free text responses.

## RESULTS

A total of 22 responses were obtained. 100% met their aims. The experience influenced the likelihood of applying to radiology in 92% of respondents; 4% were less likely to apply, 88% were more likely to apply for a radiology program. All sessions were well received. Interventional radiology was the highest rated activity (83% very satisfied), followed by emergency room duty radiology (75% very satisfied) and acute CT reporting (69% very satisfied). Free text comments suggested that participants found the MDT difficult to engage with and experienced lower levels of satisfaction compared to other activities.\*Discussion All participants met their aim. A total of 88% of participants were more likely to apply for Radiology, supporting the evidence that an observership is an influential factor in specialty selection. The high satisfaction with IR demonstrates that practical opportunities were very well received. The same trend was not observed for ultrasound. Simulation offers a potential adjunctive solution. Generally, participants were most satisfied with one-to-one sessions. This highlights the importance of a named mentor, and adds further support that role models are a crucial part of the experience. The MDT content was too advanced their level, highlighting an educational gap. Future work should identify strategies to improve engagement with this activity e.g. virtual MDTs to present practice cases. In conclusion, providing high value educational opportunities is vital to ensure future recruitment to radiology. To our knowledge, our study is the first to analyse the activities within an observership week. Maximising engagement and participation as well as role models are crucial in these settings.

### M2-QI-6 Reducing Unnecessary OR Calls Related to Specimen Imaging

Participants

Shannon Lanzo, MD, Stanford, CA (*Presenter*) Nothing to Disclose

Uzma Waheed, MD, (*Presenter*) Consultant, Becton, Dickinson and Company

## METHODS

At our center, specimen imaging is performed in the OR by surgical staff on a dedicated specimen x-ray unit. Surgical staff transfer tissue to the specimen radiograph unit, select the correct patient/accession number, obtain the image, which is sent to PACS, and call the breast imaging on-call phone to discuss results with the breast radiologist. Should technical issues arise during this process, the OR staff calls the lead breast imaging technologist for assistance. During 5-day data collection periods, the breast radiologists and lead breast imaging technologist completed a standardized form when they received unnecessary phone calls including: images not available in PACS, images in the wrong accession number, or calling the wrong phone number for image interpretation. These forms were compiled and reviewed, and a root cause analysis was performed. Unnecessary calls were categorized into workflow error and equipment error. We then designed and implemented interventions targeted to address these causes including updated signage, and easy to read operating instructions for specimen radiograph units.

## RESULTS

Pre-intervention data showed 17 OR specimen radiographs were ordered in a 5-day period. 35% (6/17) of OR specimen had unnecessary phone calls. 83% (5/6) of calls were workflow related and 17% (1/6) were equipment error. Our interventions were aimed at improving workflow by (1) providing clear, written instructions for OR staff and (2) promoting engagement with OR staff, (3) creating reference user-guides posted in the OR and (4) providing OR technologist in-service training. These interventions reduced unnecessary OR specimen phone calls from 35% to 0% between December 2022 and April 2023.\*Discussion With multidisciplinary engagement and basic interventions, we were able to reduce unnecessary interruptions in our department from 35% to 0%. These interventions enabled OR staff to independently troubleshoot prior to engaging with the breast imaging department.Limitations: Our OR specimen workflow may not be consistent with all breast imaging/surgery departments. Our data collection periods were short (5 days) with a small sample size. We did not directly measure time savings achieved by workflow improvements.

### **M2-QI-7 New Approach to Staff Performance Evaluation- A Proof of Concept Pilot**

Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

## METHODS

Context and Intervention: The new performance evaluation system was piloted throughout 2022 at one of our Healthcare System sites ("test site"). Staff are evaluated on a number of metrics reflecting various experience levels (Figure 1).Study of the Intervention: We compared retention rates and distribution of performance categories between the test site and another site ("comparison site") from 2020 through 2022.Measures/Metrics: Retention rates, Percent of performance ratings in the categories: (1) Needs improvement, (2) Meets expectations, (3) Does NOT meet expectations, (4) Exceeds expectations, (5) Commendable.Analysis: We used staff retention rates and staff engagement scores and simple descriptive statistics

## RESULTS

Retention rates: After a significant decrease in staff retention in 2020 and 2021, the test site almost completely recovered to pre-pandemic retention rates in 2022. The comparison site experienced only a minimal decrease in the retention rate in 2021, but a dramatic drop in 2022. Performance categories in 2022: The test site added a new performance category of "commendable" and almost 10% of staff met the criteria for this category, the comparison site did not have this category. Staff at the test site met the criteria for "exceeds expectations" in almost 35%, while this category was met by only 21% of staff at the comparison site. The "needs improvement" category applied to 4% at the test site versus 11% at the comparison site. In addition, the staff engagement scores (maximum score 5.0), unavailable for 2020) continuously improved at the test site (2019: 3.65, 2021:4.16, 2022: 4.25) while they trended downward at the comparison site (2019: 4.04, 2021: 3.83, 2022: 3.78).\*Discussion We successfully piloted a new performance evaluation system at one of our radiology service sites. We developed a set of performance metrics with definitions and explanations on how performance is measured and that was shared with our staff. The data has us hypothesize that the new process may have an effect on higher retention and that it may serve as a driver for better employee performance. Engagement scores at the test site are more favorable, which could, at least in part, be attributed to the new performance evaluation system.

### **M2-QI-8HC Enhanced Detection of Brain Aneurysm on CT angiography using an AI solution in a private practice outpatient setting**

Participants

Bruno Rocha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

### **M2-QI-9 Improving In-patients Access to MRI Through Enhanced Communication and Optimized Scheduling Process- A Tertiary Hospital Experience**

Participants

Abrar Hlwani, MSc, BSc, Jeddah, Saudi Arabia (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-QI-1

### Expanded Scope of Practice Fellowships for Radiologists: a Survey of Interest Amongst Current Canadian Radiology Residents

#### Participants

Nick Maizlin, MD, London, ON (*Presenter*) Nothing to Disclose

#### METHODS

Using the Canadian family medicine Enhanced Skills Program as a model, we conducted a Canada-wide survey of radiology residents to assess interest in additional fellowship training to expand their scope of practice. We undertook a national survey of radiology residents in Canada to determine their interest in completing further fellowship training in expanded scope of practice fellowships (referred to herein as "clinical fellowship"). We define a "clinical fellowship" as distinct from traditional diagnostic imaging and interventional fellowships and include low risk anesthesia, non-surgical breast disease, cancer screening, chronic pain, clinician scholar, diabetes and wound care, emergency medicine, hospital medicine, incidentaloma management, low risk obstetrics, medical oncology, palliative care, public or environmental health, renal stone disease, sports and exercise medicine, vascular/atherosclerosis medicine and "other", where we queried resident's interest.

#### RESULTS

Our results indicate that a majority of residents (69.2%) would like to routinely see patients in clinic and more than half (52%) are willing to undergo an additional year of fellowship to enhance their skill set. The most popular choices for such fellowships were sports medicine (22.8%), emergency medicine (19.6%) and vascular medicine (18.5%). In addition, a majority (52.9%) of residents felt capable of offering incidentaloma clinics without additional training beyond their core radiology residency.\*Discussion Traditional diagnostic and interventional radiology fellowships must be reconsidered to reflect the interests and capabilities of modern radiology trainees. Expansion of training options into the domain of direct patient management will likely prove popular among current residents.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

M2-QI-2

### Effect of standardization on time spent by patients in recovery nursing units after interventional radiology procedures

#### Participants

Ashok Srinivasan, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

#### METHODS

Post procedural recovery units at our institution cater to 3 cohorts of patients: Vascular interventional radiology (VIR), Neurointerventional Radiology (NIR) and Neurodiagnostic Radiology (NDR). A list of all procedures performed in each of the 3 areas was compiled and sent to the respective services to create a consensus list for recovery times per procedure. The final list was circulated to the proceduralist teams and nursing teams in recovery units for implementation. We monitored the overall time spent by patients in recovery units in each cohort before and after implementation. We also monitored risk reports prior to and after implementation to determine if there was any change in number or types of complications. Lastly, informal surveys of the nursing staff were conducted to understand whether standardization changed the frequency of phone calls to clarify orders.

#### RESULTS

Pre implementation spanned Jan-Dec 2021 and post implementation Jan-Dec 2022. Our data demonstrated the following pre and post implementation recovery times (in minutes): - MEDIAN: Overall (56 vs 49), NIR (140 vs 134), NDR (123 vs 61), VIR (45 vs 45) AVERAGE: Overall (85 vs 73), NIR (154 vs 143), NDR (119 vs 61), VIR (69 vs 66) There were no changes in the number of risk reports related to post procedural complications after implementation. Informal surveys of the nursing staff post implementation revealed a significant drop in phone calls placed for order clarification. \*Discussion Post implementation, greater than 10% reduction in average and median times was achieved overall for all procedures. The largest effect was seen in NDR procedures with nearly 50% reduction (both median average) whereas the change in NIR procedures was 4/8% (median/average) and VIR procedures was 0/4% (median/average). Our results probably indicate that standardization can work in reducing variations but have limitations as well; the impact may be different from segment to segment based on the degree of pre-existing variations. However, even in areas where standardization did not change the times substantially, there was tangible benefit in terms of eliminating many phone calls placed for order clarification.

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## Abstract Archives of the RSNA, 2023

M2-QI-3

### Quality Improvement of Transcatheter Aortic Valve Replacement With Femoral Access: Identifying The Femoral Artery Bifurcation Using CT and 3D Modeling

#### METHODS

The protocol involved radiologists identifying the location of the femoral artery bifurcation relative to the inguinal ligament using CT with contrast and communicating it to interventional cardiologists through a report on eRecord as well as a visual representation from the university's 3D lab . The interventional cardiologists then used this information to determine whether there was an access site of adequate length for femoral access or if the femoral bifurcation was too high. In this scenario, they would avoid the femoral vessel.

#### RESULTS

The implementation of the protocol led to greater confidence with femoral vessel access among cardiac proceduralists by adding an extra check to the existing methods of physical exam and ultrasound to prevent retroperitoneal bleeds. It led to a reduction in the incidence of retroperitoneal hematomas during TAVR procedures using femoral access with 0.47% of procedures resulting in a retroperitoneal hematoma from 2012 to 2016 compared to 0.29% from 2017 to 2023, representing a marked improvement in patient safety. Proceduralists at the institution continue to rely on the model between multidisciplinary meetings and the day of the procedure to inform their choice of access.\*Discussion The implementation of the protocol highlights the importance of effective communication and collaboration between radiologists and interventional cardiologists during TAVR procedures using femoral access. By ensuring clear communication between radiologists and proceduralists and creating 3D visual models as reference, patients can receive safer care with more safety measures to prevent retroperitoneal bleeds in TAVR procedures. This protocol can serve as a model for improving planning and reducing complications during other vascular procedures.

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## Abstract Archives of the RSNA, 2023

M2-QI-4

### Assessment Driven Approach to Integrating Volumetric Software for MRI in Dementia

#### Participants

Michelle Pisa, DO, Andover, MA (*Presenter*) Nothing to Disclose

#### METHODS

We used an Ai platform (Blackford) to sequentially enable QR from two different software vendors, Cortechs.ai (NeuroQuant Age-related Atrophy) and Icometrix (Icobrain DM). For both products, the manufacturer-specified imaging sequence was incorporated into our existing MRI Dementia protocol. The routine MR images were interpreted by 1 of 6 CAQ-certified Neuroradiologists. Several months later, they were presented with the corresponding QR, asked to re-review the MRI exam in context, and prompted with a questionnaire to assess the impact of the QR on their original interpretation. The QR was also sent to 1 of 4 participating Neurologists, who were asked to review the routine MR images, the QR, and prompted with a questionnaire to assess the impact of the QR on the imaging interpretation and their clinical management.

#### RESULTS

For Radiologists and Neurologists, the QR presented from both products affected the interpretation of the conventional MRI imaging in 1 of every 4/5 cases (19-29%). The most frequently reported change was the detection of atrophy, in particular hippocampal atrophy. For both products, and compared with Radiologists, the Neurologists indicated increased confidence in both the imaging exam and the interpretation with the addition of the QR. For both products, Neurologists indicated the influence of QR on their clinical interpretation in 9 out of 10 cases (90-97%), with a strong influence in 1 out of 3 cases (27-37%). Neurologists also indicated a change in management in 1 of 3 cases (27-34%) based on the input of QR.\*Discussion Addition of QR affected the MR imaging interpretation for both Neurologists and Neuroradiologists, mainly with regard to hippocampal atrophy. Neurologists indicated a stronger influence of the additional data on their interpretation of the MRI and on clinical management. Assessment data was used to inform the purchasing decision, establish interpretation standards, and outline a clinical workflow.

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## Abstract Archives of the RSNA, 2023

M2-QI-5

### Implementation of a structured observership program for improving recruitment of radiology trainees: A novel analysis

#### METHODS

Over the course of one year, our department of radiology ran a programme for rotating junior doctors. A feedback form was distributed. Candidates were asked multiple of questions, including ranking options on a Likert scale and free text responses.

#### RESULTS

A total of 22 responses were obtained. 100% met their aims. The experience influenced the likelihood of applying to radiology in 92% of respondents; 4% were less likely to apply, 88% were more likely to apply for a radiology program. All sessions were well received. Interventional radiology was the highest rated activity (83% very satisfied), followed by emergency room duty radiology (75% very satisfied) and acute CT reporting (69% very satisfied). Free text comments suggested that participants found the MDT difficult to engage with and experienced lower levels of satisfaction compared to other activities. \*Discussion All participants met their aim. A total of 88% of participants were more likely to apply for Radiology, supporting the evidence that an observership is an influential factor in specialty selection. The high satisfaction with IR demonstrates that practical opportunities were very well received. The same trend was not observed for ultrasound. Simulation offers a potential adjunctive solution. Generally, participants were most satisfied with one-to-one sessions. This highlights the importance of a named mentor, and adds further support that role models are a crucial part of the experience. The MDT content was too advanced their level, highlighting an educational gap. Future work should identify strategies to improve engagement with this activity e.g. virtual MDTs to present practice cases. In conclusion, providing high value educational opportunities is vital to ensure future recruitment to radiology. To our knowledge, our study is the first to analyse the activities within an observership week. Maximising engagement and participation as well as role models are crucial in these settings.

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## Abstract Archives of the RSNA, 2023

M2-QI-6

### Reducing Unnecessary OR Calls Related to Specimen Imaging

#### Participants

Shannon Lanzo, MD, Stanford, CA (*Presenter*) Nothing to Disclose  
Uzma Waheed, MD, (*Presenter*) Consultant, Becton, Dickinson and Company

#### METHODS

At our center, specimen imaging is performed in the OR by surgical staff on a dedicated specimen x-ray unit. Surgical staff transfer tissue to the specimen radiograph unit, select the correct patient/accession number, obtain the image, which is sent to PACS, and call the breast imaging on-call phone to discuss results with the breast radiologist. Should technical issues arise during this process, the OR staff calls the lead breast imaging technologist for assistance. During 5-day data collection periods, the breast radiologists and lead breast imaging technologist completed a standardized form when they received unnecessary phone calls including: images not available in PACS, images in the wrong accession number, or calling the wrong phone number for image interpretation. These forms were compiled and reviewed, and a root cause analysis was performed. Unnecessary calls were categorized into workflow error and equipment error. We then designed and implemented interventions targeted to address these causes including updated signage, and easy to read operating instructions for specimen radiograph units.

#### RESULTS

Pre-intervention data showed 17 OR specimen radiographs were ordered in a 5-day period. 35% (6/17) of OR specimen had unnecessary phone calls. 83% (5/6) of calls were workflow related and 17% (1/6) were equipment error. Our interventions were aimed at improving workflow by (1) providing clear, written instructions for OR staff and (2) promoting engagement with OR staff, (3) creating reference user-guides posted in the OR and (4) providing OR technologist in-service training. These interventions reduced unnecessary OR specimen phone calls from 35% to 0% between December 2022 and April 2023.\*Discussion With multidisciplinary engagement and basic interventions, we were able to reduce unnecessary interruptions in our department from 35% to 0%. These interventions enabled OR staff to independently troubleshoot prior to engaging with the breast imaging department. Limitations: Our OR specimen workflow may not be consistent with all breast imaging/surgery departments. Our data collection periods were short (5 days) with a small sample size. We did not directly measure time savings achieved by workflow improvements.

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## Abstract Archives of the RSNA, 2023

M2-QI-7

### New Approach to Staff Performance Evaluation- A Proof of Concept Pilot

#### Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### METHODS

**Context and Intervention:** The new performance evaluation system was piloted throughout 2022 at one of our Healthcare System sites ("test site"). Staff are evaluated on a number of metrics reflecting various experience levels (Figure 1).  
**Study of the Intervention:** We compared retention rates and distribution of performance categories between the test site and another site ("comparison site") from 2020 through 2022.  
**Measures/Metrics:** Retention rates, Percent of performance ratings in the categories: (1) Needs improvement, (2) Meets expectations, (3) Does NOT meet expectations, (4) Exceeds expectations, (5) Commendable.  
**Analysis:** We used staff retention rates and staff engagement scores and simple descriptive statistics

#### RESULTS

**Retention rates:** After a significant decrease in staff retention in 2020 and 2021, the test site almost completely recovered to pre-pandemic retention rates in 2022. The comparison site experienced only a minimal decrease in the retention rate in 2021, but a dramatic drop in 2022.  
**Performance categories in 2022:** The test site added a new performance category of "commendable" and almost 10% of staff met the criteria for this category, the comparison site did not have this category. Staff at the test site met the criteria for "exceeds expectations" in almost 35%, while this category was met by only 21% of staff at the comparison site. The "needs improvement" category applied to 4% at the test site versus 11% at the comparison site. In addition, the staff engagement scores (maximum score 5.0), unavailable for 2020) continuously improved at the test site (2019: 3.65, 2021:4.16, 2022: 4.25) while they trended downward at the comparison site (2019: 4.04, 2021: 3.83, 2022: 3.78).  
**\*Discussion** We successfully piloted a new performance evaluation system at one of our radiology service sites. We developed a set of performance metrics with definitions and explanations on how performance is measured and that was shared with our staff. The data has us hypothesize that the new process may have an effect on higher retention and that it may serve as a driver for better employee performance. Engagement scores at the test site are more favorable, which could, at least in part, be attributed to the new performance evaluation system.

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## Abstract Archives of the RSNA, 2023

M2-QI-8HC

**Enhanced Detection of Brain Aneurysm on CT angiography using an AI solution in a private practice outpatient setting**

### Participants

Bruno Rocha, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

M2-QI-9

### Improving In-patients Access to MRI Through Enhanced Communication and Optimized Scheduling Process- A Tertiary Hospital Experience

#### Participants

Abrar Hlwani, MSc, BSc, Jeddah, Saudi Arabia (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

M5A-QI

### Quality Improvement Reports Monday Poster Discussions I

#### Sub-Events

#### M5A-QI-1 Revamping Feedback from Radiologists to Technologists

##### Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

##### METHODS

**Context and Intervention:** The study was performed in an academic pediatric radiology department. New feedback categories were developed iteratively using a team approach. **Study of the Intervention:** A proposed feedback system containing various feedback categories specific to each modality along with examples for each category and a survey were sent to radiologist modality champions, leaders, technologists, modality managers, and members of the quality team. Respondents rated each category and explanation and were able to submit feedback. **Measures/Metrics:** Survey response rates, agreement rates, and qualitative feedback. **Analysis:** Descriptive statistics were used to analyze survey responses.

##### RESULTS

The survey was sent to 40 members of the department and here were 36 responses inclusive of all imaging modalities, the response rate was 90%. We received 8 suggestions for improvement that were incorporated in the final version of the feedback categories and explanations, otherwise respondents agreed with the proposed categories and explanations/examples. After incorporation of the suggestions from the survey, the final feedback system covers six modalities (CT, MRI, radiography, Ultrasound, fluoroscopy and nuclear medicine) (Table 1). **\*Discussion** We used an iterative interprofessional approach to develop modality specific feedback categories and examples that can be implemented through our electronic medical record system, where each feedback category can be selected as a button, hovering the mouse over the button gives examples for that category, and an open comment box invites the radiologist to add more detail. Technologists felt strongly that the "Excellent!" feedback should be included, but should be defined more clearly. In addition, technologists requested that radiologists can submit interesting learning cases for technologists. The new feedback categories and process reflect a change in our culture that emphasizes learning, coaching, and quality improvement. As a result, our departmental performance assessment policy for technologists was revised.

#### M5A-QI-2 Effect of Financial Incentive on Radiologist Compliance with Quality Metric Placement in Knee Radiograph Reports

##### Participants

Shuda Xia, Plano, TX (*Presenter*) Nothing to Disclose

##### METHODS

Knee x-ray reports stored in our PACS system were searched to determine the percentages of all knee radiograph reports that contained KL grading with standardized follow-up recommendations before and after introduction of the new quality-based incentive bonus. The radiologists were made aware of the new incentive plan in May 2022 during the general faculty meeting and again in June 2022 during the MSK divisional meeting. We compared compliance rates during the first six months of 2022 to the last six months of the same year. Rates of compliance by musculoskeletal radiologists were compared to rates of compliance by general radiologists.

##### RESULTS

There was a 10% increase in KL grading statement compliance by MSK radiologists during the three months immediately after the introduction of the new incentive bonus. Both musculoskeletal radiologists and general radiologists demonstrated steady improvement in compliance over time before and after introduction of incentive plan averaging 2% of improvement per month. Musculoskeletal radiologists' rates of compliance were on average 24% higher than general radiologists. **\*Discussion** Introduction of financial incentives results in accelerated adoption of the required QA practice with steady and progressive improvements, more so among MSK than the non-incentivized general radiologists.

#### M5A-QI-3 Online teaching promotes equity in radiology education by improving outreach and reducing disparity

##### Participants

Akshay Baheti, MD, Mumbai, India (*Presenter*) Nothing to Disclose

##### METHODS

The webinars were conducted on Zoom™ platform as triweekly one-hour sessions (Wednesday, Saturday and Sunday evenings). A national speaker spoke every Wednesday and an international speaker every Sunday, while an interactive case-based session was conducted on Saturdays. No pre-registration was required. The schedule was made available on website, email, Whatsapp, Facebook, Telegram and Twitter. Majority sessions had two-four panelists (speaker and moderators). Attendance related data from the last 307 consecutive webinars was available on Zoom and was downloaded as a .csv file. Unique viewers were defined as those who viewed the webinar via their computers; phone logins were excluded. Attendees who logged in multiple times or using multiple devices were counted only once. Maximum concurrent viewers were defined as the maximum viewers logged in at the same time,



excluding panelists. Country wise login data was available for analysis. The data was analyzed using descriptive statistics.

## RESULTS

307 consecutive webinars by 236 different speakers were conducted between Oct 2020 - Apr 2023. The webinars had a median of 256 unique attendees (mean: 278.5; range: 67-654). They had a median of 194 maximum concurrent viewers (mean: 212.6; range: 46-514). Overall, viewers from a median of 28 countries (mean: 27.6; range:14-41) across all six continents attended the webinars.\*Discussion Our webinars had a median of 256 unique and 194 maximum concurrent attendees from 28 countries. More granular level data as for example audience feedback and duration of attendance per attendee was not available for analysis. Regular online webinars are a sustainable model of radiology education and cut across local, national and international barriers. The individual and country-wise attendance per session exceeds that of most conferences. Educators should consider focusing more on the webinar model of education.

### **M5A-QI-4 Frequency and impact of using incomplete information when assessing patients with active implants for MR scanning**

#### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

#### METHODS

A workflow management system for active implant scanning was implemented in April of 2020. Information in each patient (including vendor device manual) is collected by the MR Safety Officer and sent to the MR Safety Expert for analysis and determination. Summary statistics related to percentage of cases where information was incomplete was determined. Further, whether the incomplete data impacted decisions or scanning was determined. Finally, on December 27th of 2021, a "two-click" option for the MR safety officer to collect the most recent information was implemented. Success of this intervention is determined.

#### RESULTS

The MR safety Officer report was assessed for 755 cases (518 unique patients). The assessing physicist recorded incomplete or incorrect data in 122 cases (16.2%). Of the 122 cases with incomplete/incorrect data 109 cases (89.3%) recorded the reason. Of the cases with a recorded reason 81 cases (74.3%) were due to upload of an outdated manual. The system recorded whether the error/omission could impact decision or scanning in 66 cases (54.1%). Of those, 31 cases (47%) could have impacted decisions or scanning. An improvement to ease access to the most recent manual was implemented. Initially the completion rate plummeted due to increased surveillance of old manuals, but quickly recovered and improved.\*Discussion This project reports rates of incomplete information being used for assessment of MR active implant patients. While the percentage is low, does indicate a potential issue. It identified the largest source of incomplete data (old device manuals) and implemented a method to make pulling manuals easier. The intervention resulted in improvement in of the completion percentage once the new methods diffused through the pool of MR Safety Officers.

### **M5A-QI-5 The Implementation and Impact of a Medical-Student Reading Room Assistant Program**

#### METHODS

Jan 2020- Jun 2020 was utilized to document the extent of interruptions for the Radiology residents. Jun 2020- Aug 2021 was spent creating the RRA position and training modules. Six medical students were selected for the position in Fall 2021 with training completed by May 2022. RRAs worked 5-hour segments on the busiest weekend shifts; data was collected on the position over a subsequent 10-month period. Interruptions, scans protocolled by RRAs, and brief medical student RRA feedback was collected in a survey at the end of each RRA shift. Further feedback on the position was collected from the RRAs 10 months into the program. Data and responses were analyzed.

#### RESULTS

During Jan 2020- Jun 2020, on-call residents were interrupted an average of 10.3 times per hour by incoming pages and clinician calls, technologist questions, protocol requests, and outgoing pages. Over the 10-month data collection period, RRAs responded to 854 incoming calls, 474 pages, 765 technologist questions, and made 688 outgoing calls. They also protocolled 3681 chest CTs, 145 neuro MRIs, and 169 abdominal CTs. Per resident survey responses, 100% reported being better physicians while working with an RRA and preferred the RRA program to continue. The majority of medical student RRAs reported in a survey being "Extremely likely" to apply to Radiology residency positions following involvement with the program. Respondents reported the most valuable aspects of the program to be exposure to Radiology, learning the flow of the reading room, and getting to know the residents.\*Discussion The implementation of the RRA program at our institution was successful and valuable as medical students were able to significantly decrease interruptions, protocol thousands of non-contrast CT and MRI exams, and improve resident reported quality of work. Further, this program allowed medical student RRAs to explore their interest in Radiology and has the benefit of attracting hard-working, motivated candidates to the field.

### **M5A-QI-6 Communicating Urgent Discrepancies Between Preliminary and Final Reports: Increasing Trust Between Radiology and Emergency Departments.**

#### Participants

Andrew Johnston, MD, MBA, Palo Alto, CA (*Presenter*) Nothing to Disclose

#### METHODS

A team of stakeholders from radiology and emergency medicine developed an improvement process via a guided quality improvement curriculum. The team performed a detailed analysis of the current state and identified potential root causes and key drivers. We documented our analysis using a structured problem-solving tool. All radiology reports for studies ordered through the emergency department during the intervention period were queried via the PowerScribe web API and categorized according to modality (cross-sectional or plain film) and type of report discrepancy (no change, non-urgent change, or urgent change). Key drivers and interventions were developed and refined through Plan-Do-Study-Act cycles. Interventions implemented during this project included linking a secure messaging system to our PACS, adding options for multiple methods of communication to our standard reporting template, and educating radiologists about the process for communicating report discrepancies.

#### RESULTS

The run chart shows an increase in the percentage of documented communication events for urgent changes of cross-sectional

study reports from 75% to 90.6%. Additionally, the interventions increased the percentage of documented communication events for all report discrepancies from 6.6% to 7.0%.\*Discussion Our study showed an increased rate of communication for urgent changes between preliminary and final reports of cross-sectional studies. Limitations of the study include variation in opinions of what constitutes an urgent or non-urgent change, interventions were performed with a small subset of the radiology department, and our reliance on report text to identify communication events may underestimate the true volume of communication. The next steps for our project aim to increase communication across all study types and urgency levels. We will do this by developing a reliable process for rapidly identifying report discrepancies not communicated, organizing focused interdepartmental meetings to operationalize the definition of urgent and non-urgent changes, and incorporating a review of communication errors into peer learning meetings.

## **M5A-QI-7 QI Bootcamp - A Novel Approach to Engage Radiology Residents in QI**

### **METHODS**

1st and 4th year DR, IR and NM residents were emailed to voluntarily sign up for a 4.5-hour "QI Bootcamp" in March 2023. We invited 1st and 4th year residents as they tend to have the most time available for a QI project. The QI bootcamp was led by a 1st year QI Track resident (QI Track is one of the several tracks available to trainees to enhance their skills beyond clinical radiology) and by the Interim Medical Director for Quality in Radiology. A list of potential QI projects, and agenda was emailed to attendees in advance. Measures We administered a pre- and post-knowledge assessment survey. Post survey included supplemental questions to assess bootcamp objectives. Survey data was analyzed using Microsoft Excel.

### **RESULTS**

19 residents signed up and 13 attended the session. 13 residents completed the pre-survey and 12 completed the post-survey resulting in a 92% response rate. In aggregate, correct response to knowledge items improved from 55% to 74% pre and post-survey respectively. A detailed review showed baseline proficiency with Lean concepts (waste, value add vs. non-value add, and process mapping) where 92% of the respondents selected correct responses. Residents were less knowledgeable of driver diagram, fishbone diagram, run charts and change management for which the pre-survey correct response rate ranged from 15-50%. However, residents made the most improvement in those concepts after the didactics. Pre and post-survey analysis showed resident QI project participation improved from 31% to 82%, respectively. Analysis of the feedback questions indicated that 85% of respondents rated the bootcamp favorably. Review of "what went well?" and "what could be improved?" questions gave perspective for future improvement.\*Discussion The QI bootcamp was well perceived and is probably best suited for R1 and R4. The event resulted in increased knowledge and a higher number of residents committed to a QI project. Group activities were most popular, especially brainstorming QI project ideas.

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## Abstract Archives of the RSNA, 2023

M5A-QI-1

### Revamping Feedback from Radiologists to Technologists

#### Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### METHODS

**Context and Intervention:** The study was performed in an academic pediatric radiology department. New feedback categories were developed iteratively using a team approach. **Study of the Intervention:** A proposed feedback system containing various feedback categories specific to each modality along with examples for each category and a survey were sent to radiologist modality champions, leaders, technologists, modality managers, and members of the quality team. Respondents rated each category and explanation and were able to submit feedback. **Measures/Metrics:** Survey response rates, agreement rates, and qualitative feedback. **Analysis:** Descriptive statistics were used to analyze survey responses.

#### RESULTS

The survey was sent to 40 members of the department and there were 36 responses inclusive of all imaging modalities, the response rate was 90%. We received 8 suggestions for improvement that were incorporated in the final version of the feedback categories and explanations, otherwise respondents agreed with the proposed categories and explanations/examples. After incorporation of the suggestions from the survey, the final feedback system covers six modalities (CT, MRI, radiography, Ultrasound, fluoroscopy and nuclear medicine) (Table 1). **Discussion** We used an iterative interprofessional approach to develop modality specific feedback categories and examples that can be implemented through our electronic medical record system, where each feedback category can be selected as a button, hovering the mouse over the button gives examples for that category, and an open comment box invites the radiologist to add more detail. Technologists felt strongly that the "Excellent!" feedback should be included, but should be defined more clearly. In addition, technologists requested that radiologists can submit interesting learning cases for technologists. The new feedback categories and process reflect a change in our culture that emphasizes learning, coaching, and quality improvement. As a result, our departmental performance assessment policy for technologists was revised.

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## Abstract Archives of the RSNA, 2023

M5A-QI-2

### Effect of Financial Incentive on Radiologist Compliance with Quality Metric Placement in Knee Radiograph Reports

#### Participants

Shuda Xia, Plano, TX (*Presenter*) Nothing to Disclose

#### METHODS

Knee x-ray reports stored in our PACS system were searched to determine the percentages of all knee radiograph reports that contained KL grading with standardized follow-up recommendations before and after introduction of the new quality-based incentive bonus. The radiologists were made aware of the new incentive plan in May 2022 during the general faculty meeting and again in June 2022 during the MSK divisional meeting. We compared compliance rates during the first six months of 2022 to the last six months of the same year. Rates of compliance by musculoskeletal radiologists were compared to rates of compliance by general radiologists.

#### RESULTS

There was a 10% increase in KL grading statement compliance by MSK radiologists during the three months immediately after the introduction of the new incentive bonus. Both musculoskeletal radiologists and general radiologists demonstrated steady improvement in compliance over time before and after introduction of incentive plan averaging 2% of improvement per month. Musculoskeletal radiologists' rates of compliance were on average 24% higher than general radiologists.\*Discussion Introduction of financial incentives results in accelerated adoption of the required QA practice with steady and progressive improvements, more so among MSK than the non-incentivized general radiologists.

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## Abstract Archives of the RSNA, 2023

M5A-QI-3

### Online teaching promotes equity in radiology education by improving outreach and reducing disparity

#### Participants

Akshay Baheti, MD, Mumbai, India (*Presenter*) Nothing to Disclose

#### METHODS

The webinars were conducted on Zoom™ platform as triweekly one-hour sessions (Wednesday, Saturday and Sunday evenings). A national speaker spoke every Wednesday and an international speaker every Sunday, while an interactive case-based session was conducted on Saturdays. No pre-registration was required. The schedule was made available on website, email, Whatsapp, Facebook, Telegram and Twitter. Majority sessions had two-four panelists (speaker and moderators). Attendance related data from the last 307 consecutive webinars was available on Zoom and was downloaded as a .csv file. Unique viewers were defined as those who viewed the webinar via their computers; phone logins were excluded. Attendees who logged in multiple times or using multiple devices were counted only once. Maximum concurrent viewers were defined as the maximum viewers logged in at the same time, excluding panelists. Country wise login data was available for analysis. The data was analyzed using descriptive statistics.

#### RESULTS

307 consecutive webinars by 236 different speakers were conducted between Oct 2020 - Apr 2023. The webinars had a median of 256 unique attendees (mean: 278.5; range: 67-654). They had a median of 194 maximum concurrent viewers (mean: 212.6; range: 46-514). Overall, viewers from a median of 28 countries (mean: 27.6; range:14-41) across all six continents attended the webinars.\*Discussion Our webinars had a median of 256 unique and 194 maximum concurrent attendees from 28 countries. More granular level data as for example audience feedback and duration of attendance per attendee was not available for analysis. Regular online webinars are a sustainable model of radiology education and cut across local, national and international barriers. The individual and country-wise attendance per session exceeds that of most conferences. Educators should consider focusing more on the webinar model of education.

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## Abstract Archives of the RSNA, 2023

M5A-QI-4

### Frequency and impact of using incomplete information when assessing patients with active implants for MR scanning

#### Participants

William Sensakovic, PhD, Cave Creek, AZ (*Presenter*) Nothing to Disclose

#### METHODS

A workflow management system for active implant scanning was implemented in April of 2020. Information in each patient (including vendor device manual) is collected by the MR Safety Officer and sent to the MR Safety Expert for analysis and determination. Summary statistics related to percentage of cases where information was incomplete was determined. Further, whether the incomplete data impacted decisions or scanning was determined. Finally, on December 27th of 2021, a "two-click" option for the MR safety officer to collect the most recent information was implemented. Success of this intervention is determined.

#### RESULTS

The MR safety Officer report was assessed for 755 cases (518 unique patients). The assessing physician recorded incomplete or incorrect data in 122 cases (16.2%). Of the 122 cases with incomplete/incorrect data 109 cases (89.3%) recorded the reason. Of the cases with a recorded reason 81 cases (74.3%) were due to upload of an outdated manual. The system recorded whether the error/omission could impact decision or scanning in 66 cases (54.1%). Of those, 31 cases (47%) could have impacted decisions or scanning. An improvement to ease access to the most recent manual was implemented. Initially the completion rate plummeted due to increased surveillance of old manuals, but quickly recovered and improved.\*Discussion This project reports rates of incomplete information being used for assessment of MR active implant patients. While the percentage is low, does indicate a potential issue. It identified the largest source of incomplete data (old device manuals) and implemented a method to make pulling manuals easier. The intervention resulted in improvement in of the completion percentage once the new methods diffused through the pool of MR Safety Officers.

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## Abstract Archives of the RSNA, 2023

M5A-QI-5

### The Implementation and Impact of a Medical-Student Reading Room Assistant Program

#### METHODS

Jan 2020- Jun 2020 was utilized to document the extent of interruptions for the Radiology residents. Jun 2020- Aug 2021 was spent creating the RRA position and training modules. Six medical students were selected for the position in Fall 2021 with training completed by May 2022. RRAs worked 5-hour segments on the busiest weekend shifts; data was collected on the position over a subsequent 10-month period. Interruptions, scans protocolled by RRAs, and brief medical student RRA feedback was collected in a survey at the end of each RRA shift. Further feedback on the position was collected from the RRAs 10 months into the program. Data and responses were analyzed.

#### RESULTS

During Jan 2020- Jun 2020, on-call residents were interrupted an average of 10.3 times per hour by incoming pages and clinician calls, technologist questions, protocol requests, and outgoing pages. Over the 10-month data collection period, RRAs responded to 854 incoming calls, 474 pages, 765 technologist questions, and made 688 outgoing calls. They also protocolled 3681 chest CTs, 145 neuro MRIs, and 169 abdominal CTs. Per resident survey responses, 100% reported being better physicians while working with an RRA and preferred the RRA program to continue. The majority of medical student RRAs reported in a survey being "Extremely likely" to apply to Radiology residency positions following involvement with the program. Respondents reported the most valuable aspects of the program to be exposure to Radiology, learning the flow of the reading room, and getting to know the residents.\*Discussion The implementation of the RRA program at our institution was successful and valuable as medical students were able to significantly decrease interruptions, protocol thousands of non-contrast CT and MRI exams, and improve resident reported quality of work. Further, this program allowed medical student RRAs to explore their interest in Radiology and has the benefit of attracting hard-working, motivated candidates to the field.

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## Abstract Archives of the RSNA, 2023

M5A-QI-6

### Communicating Urgent Discrepancies Between Preliminary and Final Reports: Increasing Trust Between Radiology and Emergency Departments.

#### Participants

Andrew Johnston, MD, MBA, Palo Alto, CA (*Presenter*) Nothing to Disclose

#### METHODS

A team of stakeholders from radiology and emergency medicine developed an improvement process via a guided quality improvement curriculum. The team performed a detailed analysis of the current state and identified potential root causes and key drivers. We documented our analysis using a structured problem-solving tool. All radiology reports for studies ordered through the emergency department during the intervention period were queried via the PowerScribe web API and categorized according to modality (cross-sectional or plain film) and type of report discrepancy (no change, non-urgent change, or urgent change). Key drivers and interventions were developed and refined through Plan-Do-Study-Act cycles. Interventions implemented during this project included linking a secure messaging system to our PACS, adding options for multiple methods of communication to our standard reporting template, and educating radiologists about the process for communicating report discrepancies.

#### RESULTS

The run chart shows an increase in the percentage of documented communication events for urgent changes of cross-sectional study reports from 75% to 90.6%. Additionally, the interventions increased the percentage of documented communication events for all report discrepancies from 6.6% to 7.0%.\*Discussion Our study showed an increased rate of communication for urgent changes between preliminary and final reports of cross-sectional studies. Limitations of the study include variation in opinions of what constitutes an urgent or non-urgent change, interventions were performed with a small subset of the radiology department, and our reliance on report text to identify communication events may underestimate the true volume of communication. The next steps for our project aim to increase communication across all study types and urgency levels. We will do this by developing a reliable process for rapidly identifying report discrepancies not communicated, organizing focused interdepartmental meetings to operationalize the definition of urgent and non-urgent changes, and incorporating a review of communication errors into peer learning meetings.

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## Abstract Archives of the RSNA, 2023

M5A-QI-7

### QI Bootcamp - A Novel Approach to Engage Radiology Residents in QI

#### METHODS

1st and 4th year DR, IR and NM residents were emailed to voluntarily sign up for a 4.5-hour "QI Bootcamp" in March 2023. We invited 1st and 4th year residents as they tend to have the most time available for a QI project. The QI bootcamp was led by a 1st year QI Track resident (QI Track is one of the several tracks available to trainees to enhance their skills beyond clinical radiology) and by the Interim Medical Director for Quality in Radiology. A list of potential QI projects, and agenda was emailed to attendees in advance. We administered a pre- and post-knowledge assessment survey. Post survey included supplemental questions to assess bootcamp objectives. Survey data was analyzed using Microsoft Excel.

#### RESULTS

19 residents signed up and 13 attended the session. 13 residents completed the pre-survey and 12 completed the post-survey resulting in a 92% response rate. In aggregate, correct response to knowledge items improved from 55% to 74% pre and post-survey respectively. A detailed review showed baseline proficiency with Lean concepts (waste, value add vs. non-value add, and process mapping) where 92% of the respondents selected correct responses. Residents were less knowledgeable of driver diagram, fishbone diagram, run charts and change management for which the pre-survey correct response rate ranged from 15-50%. However, residents made the most improvement in those concepts after the didactics. Pre and post-survey analysis showed resident QI project participation improved from 31% to 82%, respectively. Analysis of the feedback questions indicated that 85% of respondents rated the bootcamp favorably. Review of "what went well?" and "what could be improved?" questions gave perspective for future improvement.\*Discussion The QI bootcamp was well perceived and is probably best suited for R1 and R4. The event resulted in increased knowledge and a higher number of residents committed to a QI project. Group activities were most popular, especially brainstorming QI project ideas.

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## Abstract Archives of the RSNA, 2023

M5B-QI

### Quality Improvement Reports Monday Poster Discussions II

#### Sub-Events

#### M5B-QI-1 Reducing radiation dose of routine CT chest scan to healthcare cluster recommendation

##### METHODS

This study was conducted from Nov 2020 to Dec 2022. Study team members went through the statistic meeting report to determine the root cause. Team had decided to select Routine CT Chest protocol as a region to be improved first due to its high feasibility of improvement based on previous plain low dose CT chest project. Consultation with both scanner application specialist and radiologist were done. A total of 3 PDSA cycles was carried out during study period with the image quality being closely monitored to achieve the best possible protocol to use for this study. First improvement was targeted to reduce scan coverage length. Instead of scanning up to adrenals in routine scan, scan will clear lung base only. This is done as an updated management for cancer patients where if lung cancer is found, only then proper CT abdomen or nuclear imaging will be done for staging purpose. Preliminary test was performed on phantom with dose indicators CTDI and DLP found to be reduced from 3 to 15%. Second improvement was on adjusting scanning parameter which is the Standard Deviation(SD). Bigger actual sample size of 10 for each scanner was collated with SD adjusted from 10.5 to 12.5. Radiologist was requested to check on the image quality. Third improvement was to further amend the scanning parameter by adjusting SD to 13.5 as patient weighing above 70kg was still exceeding the recommended dose. For this phase, sample size was collected regardless of patient's body weight. CT chest scanning protocol in the different scanners was then updated. Radiographers were informed to utilise the updated protocols. Data on the number of modified scan performed, dose in CTDIvol, DLP, and effective dose were collected. Image quality was rated by two radiologists and image audit was monitored continuously.

##### RESULTS

The effective dose was successfully reduced ranging from 39-48% (Figure 2). Image quality was scored = 3 for all image quality criteria. The modified protocol had no significant different image quality scores compared to the standard protocol.\*Discussion This modified lower radiation dose CT chest protocol produced similar diagnostic capability to previous routine chest protocol when applied on patients with different body weight.

#### M5B-QI-2 Improving Workflow in Nuclear Medicine to Ensure Correct Radiopharmaceutical Injection

##### METHODS

The study was carried out from February 2020 to February 2023. In early Jan 2020, a wrong radiopharmaceutical injection happened when the staff who prepared the bone radiopharmaceutical syringe injected it into a cardiac patient. A team was immediately set up to rectify the problem. We used root-cause analysis and plan-do-study-act to identify the best solution. The first PDSA is to have staff carry a laptop for verification purposes before injection. However, this method was not promising as they need to handle both the laptop and syringe at the same time which may compromise the hygiene. The second PDSA introduces the tagging of patient sticky labels on the radiopharmaceutical syringes. The label contains the patient's name, identity card number, and type of scan which could help in the verification process before injection. This method is further improved with a second staff verifying the information on the radiopharmaceutical syringe and the patient's sticky label against the patient before injection. Both staffs needs to ensure the correct patient's two identifiers, type of scan, type of radiopharmaceutical, and radioactivity. The training was done for all the staff working in Nuclear Medicine. Measurements on the number of wrongful injections, the confidence level of staff when performing injections, and the compliance rate to the changed workflow were collected as the success indicators.

##### RESULTS

The results showed that there have been zero wrong radiopharmaceutical injections since the implementation of the patient label and the second verifier. Random audits were performed and found that 100% of the staff complied since the chances were implemented. A survey was conducted among 38 Nuclear Medicine staff (5 radiographers, 2 doctors, 11 cardiac technologists, and 1 other) on their confidence level in performing injections. It showed that the average confidence level for the patient label with a second verifier scored the highest (8.11) and with a 100% compliance rate\*Discussion This improved workflow has ensured the correct radiopharmaceutical injection is performed by the staff at all times. Having a patient label tag on syringes and the presence of a second verifier do minimize the possibility of selecting the wrong syringe.

#### M5B-QI-3 Quality Assessment of Fluoroscopic Imaging Obtained during Neonatal Contrast Enema Exams

##### Participants

Devyn Rigsby, Philadelphia, PA (Presenter) Nothing to Disclose

##### METHODS

Image database review identified all CE exams performed on children = 2 days old at our institution from February 2019 to August 2022. 6 subjective and 7 objective quality assurance criteria for CE exams were defined. Two pediatric radiologists conducted independent review of CE imaging and reports for subjective quality criteria. One radiologist also assessed for objective quality metrics. Data were summarized as counts and percentages for each reviewer. Observed inter-reviewer agreement po was calculated for metrics evaluated by two readers.

## RESULTS

70 neonatal CEs met inclusion criteria and were reviewed. For the objective quality metrics: 83% of CEs included a scout image. Lateral rectal imaging included visualization of the sacrum in 91% of cases. Radiation dose and fluoroscopy time were documented in 90% of cases. 63% of cases were performed without direct exposures, and 70% included a post-evacuation film. Complications were not documented for any CE. For the subjective quality criteria: A small-caliber rectal catheter was used in 93% (R1) to 94% (R2) of cases. 96-97% of exams included a true lateral rectal view; this view was obtained at early filling in 83-86% of cases. The rectosigmoid index was readily assessed in nearly all studies (100% R1; 97% R2). The entirety of the colon was visualized through to the cecum in 87% of studies. In 74-76% of cases, the appendix and/or terminal ileum were visualized. Observed inter-reader agreement was substantial for all metrics, ranging from 83% to 97%.\*Discussion Lateral rectal imaging generally met quality metrics, though further education regarding imaging timing at early filling may be warranted. Although the majority of studies included a scout image, radiation dose, fluoroscopy time, and post-evacuation film, operators should be reminded to collect and store these basic components for every exam. Similarly, while most cases used an appropriately small rectal catheter, staff should be aware to do so in every exam. Approximately one-fourth of studies did not include visualization of the appendix and/or terminal ileum, which may reflect the difficulty of obtaining these views for certain pathologic entities in neonatal practice. Finally, although ACR-SPR guidelines discourage direct exposures during CE exams, 37% of cases included such images; promoting use of last-image hold instead of direct exposure can reduce patient radiation dose.

### M5B-QI-4 Radiographers' Perceptions regarding establishing a self regulatory body

#### METHODS

A qualitative, exploratory and descriptive research approach was undertaken. Radiographers currently registered and practicing in Eswatini were purposively selected and invited to participate. Data was collected using semi-structured interviews. Audiotapes and field notes were used. Audio taped interviews were transcribed verbatim and then analyzed using qualitative content analysis.

#### RESULTS

Six themes emerged from the analysis of data, namely; a) awareness of the need for QC tests, b) radiation protection and safety in the radiography departments, c) radiographers' responsibility towards radiation protection, d) education and training in radiation safety for radiographers and other stakeholders, e) support from governmental and management structures and f) the need for the self-regulatory body in the radiography departments.\*Discussion The study demonstrated that there is awareness among radiographers in Eswatini that radiation safety practices are necessary in the radiography departments. Continuous education and training were deemed as imperative to improve radiation safety in the radiography departments. There is also support for the idea of establishing the self-regulatory body. Implications for practice: The need for monitoring structures in order to ensure radiation safety in the radiography departments is highlighted in this study. Government officials and hospital management are crucial in ensuring radiation safety in radiography departments.

### M5B-QI-5 More Bang for the Healthcare Buck: Addressing the Emergency and Urgent Care Elephant in Pulmonary Nodule Follow-up Loss with Smart HL7 Workflow

#### Participants

Kyle Jackson, BSc, MSc, Norcross, GA (*Presenter*) Nothing to Disclose

#### METHODS

Monitoring at a southeastern academic medical center interpreting 1.2M imaging exams annually revealed most (71%) lost pulmonary nodule follow-up exams were from ED and UC settings. We previously reported on a LSTM AI model recognizing pulmonary nodule follow-up recommendations (1,970 retrospectively annotated reports, 60/20/20% training/validation/test split, accuracy 94%). To generate ED/UC-capable workflow, we paired this LSTM with a knowledge-based AI to assign patients into follow-up intervals: high risk (= 3 months), medium risk (> 3 months but = 6 months), and low risk (> 6 months and = 12 months). Clinical performance was assessed by retrospective manual validation of 200 reports (CT 85, XR 16, US 3, uncategorized 96) followed by key word inclusion/exclusion modifications. Real-time clinical performance was again assessed by prospective manual validation of 200 reports (CT 125, XR 64, MR 6, US 5). Fleischner Society Guidelines and logic governing NLP system-to-EMR communication were leveraged to develop risk-stratified ED/UC-capable HL7-based workflow.

#### RESULTS

The macro-averaged F0.5 score for retrospective performance was 0.79 (accuracy by risk class: high risk 94.5%, medium risk 99%, low risk 97%) and for prospective performance was 0.93 (accuracy by risk class: high risk 98.5%, medium risk 100%, low risk 95%). F0.5 score was selected to optimize clinical practice performance by penalizing false positives more than false negatives, where false reminders would undermine provider system use. Knowledge-based AI modifications resulted in 14% improvement in prospective performance.\*Discussion There are no published automated system workflows addressing the safety gap presented by ED/UC settings. The proposed ED/UC-capable HL7 logic and knowledge-based AI can help hospitals implement tracking and reminder systems capable of capturing the overwhelming majority of lost follow-up and meet ACR-issued Closing the Recommendations Follow-Up Loop measures. High-level clinical performance evaluation underscored the validity of this approach.

### M5B-QI-6 Reinterpretation of Hepatopancreaticobiliary Imaging Exams by Subspecialty Radiologists: Assessment of Clinical Impact, Radiologist Peer Learning, and Referring Physician Satisfaction

#### METHODS

This quality improvement project included HPB CT and MRI exams that were reinterpreted by two subspecialty radiologists between March 2021 to August 2022. Agreement with the primary report was categorized using the American College of Radiology RADPEER system. Electronic medical records were reviewed for information regarding change in management (yes/no/unavailable). Separate surveys using 5-point Likert scale questions were sent to radiologists who issued primary reports and referring physicians. Quantitative results were reported using descriptive statistics.

#### RESULTS

250 imaging exams (122 CT, 128 MRI) reported by 96 radiologists were reinterpreted as requested by 19 referring physicians. RADPEER scores 1-3 distribution was 131/250 (52%), 86/250 (34%) and 33/250 (13%), respectively. Of 213 cases with adequate clinical data, 75/213 (35%) were associated with a change in management; of these, 71/75 (95%) were RADPEER 2 or 3. Survey response rates were 34/86 (40%) for radiologists and 7/18 (39%) for referring physicians practicing in the region. Most radiologists

agreed or strongly agreed with the following: prefer to receive reinterpretations (32/34, 94%); reinterpretations changed reporting practices (22/34, 65%); and reinterpretations support peer learning and quality assurance (32/34, 94%). Referring physicians agreed or strongly agreed that reinterpretations assist complex HPB disease management (7/7, 100%) and subspecialty radiologists should reinterpret more cases (6/7, 86%).\*Discussion Our study found a high discrepancy rate with HPB imaging reinterpretations, congruent with the literature. A change in clinical management was found in over one-third of cases. Reinterpretation reports were almost unanimously well received by radiologists and referring physicians. Strengths of this study include the large sample size and good survey response rates. Limitations include the retrospective design and potential lack of generalizability. In conclusion, radiologists and referring physicians are in strong agreement that HPB imaging reinterpretations support peer learning and patient management, respectively.

#### **M5B-QI-7 The Sliding Sign Initiative: Facilitating Earlier Detection of Deep Endometriosis in an Academic Ultrasound Department.**

Participants

Emily Pang, MD,FRCPC, Vancouver, BC (*Presenter*) Nothing to Disclose

#### **METHODS**

Plan-Do-Study-Act (PDSA) methodology was used for this project, which took place in the ultrasound department of a tertiary-care teaching hospital between Oct 2021 and May 2023. The reports and imaging for pelvic ultrasounds performed in patients meeting inclusion criteria were reviewed by two ultrasound experts in consensus during a baseline period and during each intervention to assess for 1) whether the SS was performed and 2) whether SS results were reported and interpreted correctly. Additionally, in patients for whom follow-up was available, confirmation of a new endometriosis diagnosis was recorded. Initial planning involved consultation with gynecology, radiology and sonographer stakeholders. For the first PDSA cycle, a protocol was distributed by e-mail alongside an educational campaign which included in-service training and grand rounds. PDSA cycle 2 involved an updated protocol emailed and posted in the staff lounge, as well as a reminder poster displayed in the probe sanitation room. For PDSA cycle 3, the posters were revised to improve readability in low-lighting conditions and displayed in individual ultrasound rooms. Sonographer worksheets were modified to include a SS field.

#### **RESULTS**

The SS was not performed on any patients at baseline prior to the initiative. The number of eligible patients per month ranged from n=28 to 52. On average, the SS was performed on 57.7%, 68.2% and 85.2% of eligible patients and reported and interpreted correctly 66.7%, 83.3% and 73.9% of the time after PDSA cycles 1, 2, and 3 respectively. All abnormal SS cases were reported. Over a period of 1 year for which 6 month follow-up data was available (Oct 2021-Oct 2022), a total of 22 patients had a new confirmed diagnosis of endometriosis as a result of the initiative, with 2 false positives.\*Discussion The sliding sign initiative is a relatively simple protocol modification but has made a significant impact on the early diagnosis of endometriosis, allowing for earlier treatment and improved quality of life. Interventions aimed at increasing consistent performance of the SS amongst sonographers have proven successful. Limitations included difficulties performing the SS in retroverted uteri, variable buy-in/familiarity with the SS amongst radiologists, and lack of follow-up data on every patient. Additional interventions targeting reporting radiologists will be needed for future work.

#### **M5B-QI-8HC Improving Outpatient CT Access by Reducing CT Backlogs**

Participants

Ben C. Wandtke, MD, MS, Rochester, NY (*Presenter*) Clinical Advisory Board, CAK Tech, Inc

#### **M5B-QI-9HC Impact of Early Direct Patient Notification of Non-Urgent Incidental Radiology Findings Requiring Follow-up**

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## Abstract Archives of the RSNA, 2023

M5B-QI-1

### Reducing radiation dose of routine CT chest scan to healthcare cluster recommendation

#### METHODS

This study was conducted from Nov 2020 to Dec 2022. Study team members went through the statistic meeting report to determine the root cause. Team had decided to select Routine CT Chest protocol as a region to be improved first due to its high feasibility of improvement based on previous plain low dose CT chest project. Consultation with both scanner application specialist and radiologist were done. A total of 3 PDSA cycles was carried out during study period with the image quality being closely monitored to achieve the best possible protocol to use for this study. First improvement was targeted to reduce scan coverage length. Instead of scanning up to adrenals in routine scan, scan will clear lung base only. This is done as an updated management for cancer patients where if lung cancer is found, only then proper CT abdomen or nuclear imaging will be done for staging purpose. Preliminary test was performed on phantom with dose indicators CTDI and DLP found to be reduced from 3 to 15%. Second improvement was on adjusting scanning parameter which is the Standard Deviation(SD). Bigger actual sample size of 10 for each scanner was collated with SD adjusted from 10.5 to 12.5. Radiologist was requested to check on the image quality. Third improvement was to further amend the scanning parameter by adjusting SD to 13.5 as patient weighing above 70kg was still exceeding the recommended dose. For this phase, sample size was collected regardless of patient's body weight. CT chest scanning protocol in the different scanners was then updated. Radiographers were informed to utilise the updated protocols. Data on the number of modified scan performed, dose in CTDIvol, DLP, and effective dose were collected. Image quality was rated by two radiologists and image audit was monitored continuously.

#### RESULTS

The effective dose was successfully reduced ranging from 39-48% (Figure 2). Image quality was scored = 3 for all image quality criteria. The modified protocol had no significant different image quality scores compared to the standard protocol.\*Discussion This modified lower radiation dose CT chest protocol produced similar diagnostic capability to previous routine chest protocol when applied on patients with different body weight.

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## Abstract Archives of the RSNA, 2023

M5B-QI-2

### Improving Workflow in Nuclear Medicine to Ensure Correct Radiopharmaceutical Injection

#### METHODS

The study was carried out from February 2020 to February 2023. In early Jan 2020, a wrong radiopharmaceutical injection happened when the staff who prepared the bone radiopharmaceutical syringe injected it into a cardiac patient. A team was immediately set up to rectify the problem. We used root-cause analysis and plan-do-study-act to identify the best solution. The first PDSA is to have staff carry a laptop for verification purposes before injection. However, this method was not promising as they need to handle both the laptop and syringe at the same time which may compromise the hygiene. The second PDSA introduces the tagging of patient sticky labels on the radiopharmaceutical syringes. The label contains the patient's name, identity card number, and type of scan which could help in the verification process before injection. This method is further improved with a second staff verifying the information on the radiopharmaceutical syringe and the patient's sticky label against the patient before injection. Both staffs need to ensure the correct patient's two identifiers, type of scan, type of radiopharmaceutical, and radioactivity. The training was done for all the staff working in Nuclear Medicine. Measurements on the number of wrongful injections, the confidence level of staff when performing injections, and the compliance rate to the changed workflow were collected as the success indicators.

#### RESULTS

The results showed that there have been zero wrong radiopharmaceutical injections since the implementation of the patient label and the second verifier. Random audits were performed and found that 100% of the staff complied since the changes were implemented. A survey was conducted among 38 Nuclear Medicine staff (5 radiographers, 2 doctors, 11 cardiac technologists, and 1 other) on their confidence level in performing injections. It showed that the average confidence level for the patient label with a second verifier scored the highest (8.11) and with a 100% compliance rate. Discussion This improved workflow has ensured the correct radiopharmaceutical injection is performed by the staff at all times. Having a patient label tag on syringes and the presence of a second verifier do minimize the possibility of selecting the wrong syringe.

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## Abstract Archives of the RSNA, 2023

M5B-QI-3

### Quality Assessment of Fluoroscopic Imaging Obtained during Neonatal Contrast Enema Exams

#### Participants

Devyn Rigsby, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### METHODS

Image database review identified all CE exams performed on children = 2 days old at our institution from February 2019 to August 2022. 6 subjective and 7 objective quality assurance criteria for CE exams were defined. Two pediatric radiologists conducted independent review of CE imaging and reports for subjective quality criteria. One radiologist also assessed for objective quality metrics. Data were summarized as counts and percentages for each reviewer. Observed inter-reviewer agreement po was calculated for metrics evaluated by two readers.

#### RESULTS

70 neonatal CEs met inclusion criteria and were reviewed. For the objective quality metrics: 83% of CEs included a scout image. Lateral rectal imaging included visualization of the sacrum in 91% of cases. Radiation dose and fluoroscopy time were documented in 90% of cases. 63% of cases were performed without direct exposures, and 70% included a post-evacuation film. Complications were not documented for any CE. For the subjective quality criteria: A small-caliber rectal catheter was used in 93% (R1) to 94% (R2) of cases. 96-97% of exams included a true lateral rectal view; this view was obtained at early filling in 83-86% of cases. The rectosigmoid index was readily assessed in nearly all studies (100% R1; 97% R2). The entirety of the colon was visualized through to the cecum in 87% of studies. In 74-76% of cases, the appendix and/or terminal ileum were visualized. Observed inter-reader agreement was substantial for all metrics, ranging from 83% to 97%.\*Discussion Lateral rectal imaging generally met quality metrics, though further education regarding imaging timing at early filling may be warranted. Although the majority of studies included a scout image, radiation dose, fluoroscopy time, and post-evacuation film, operators should be reminded to collect and store these basic components for every exam. Similarly, while most cases used an appropriately small rectal catheter, staff should be aware to do so in every exam. Approximately one-fourth of studies did not include visualization of the appendix and/or terminal ileum, which may reflect the difficulty of obtaining these views for certain pathologic entities in neonatal practice. Finally, although ACR-SPR guidelines discourage direct exposures during CE exams, 37% of cases included such images; promoting use of last-image hold instead of direct exposure can reduce patient radiation dose.

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## Abstract Archives of the RSNA, 2023

M5B-QI-4

### Radiographers' Perceptions regarding establishing a self regulatory body

#### METHODS

A qualitative, exploratory and descriptive research approach was undertaken. Radiographers currently registered and practicing in Eswatini were purposively selected and invited to participate. Data was collected using semi-structured interviews. Audiotapes and field notes were used. Audio taped interviews were transcribed verbatim and then analyzed using qualitative content analysis.

#### RESULTS

Six themes emerged from the analysis of data, namely; a) awareness of the need for QC tests, b) radiation protection and safety in the radiography departments, c) radiographers' responsibility towards radiation protection, d) education and training in radiation safety for radiographers and other stakeholders, e) support from governmental and management structures and f) the need for the self-regulatory body in the radiography departments.\*Discussion The study demonstrated that there is awareness among radiographers in Eswatini that radiation safety practices are necessary in the radiography departments. Continuous education and training were deemed as imperative to improve radiation safety in the radiography departments. There is also support for the idea of establishing the self- regulatory body. Implications for practice: The need for monitoring structures in order to ensure radiation safety in the radiography departments is highlighted in this study. Government officials and hospital management are crucial in ensuring radiation safety in radiography departments.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

M5B-QI-5

### More Bang for the Healthcare Buck: Addressing the Emergency and Urgent Care Elephant in Pulmonary Nodule Follow-up Loss with Smart HL7 Workflow

#### Participants

Kyle Jackson, BSc, MSc, Norcross, GA (*Presenter*) Nothing to Disclose

#### METHODS

Monitoring at a southeastern academic medical center interpreting 1.2M imaging exams annually revealed most (71%) lost pulmonary nodule follow-up exams were from ED and UC settings. We previously reported on a LSTM AI model recognizing pulmonary nodule follow-up recommendations (1,970 retrospectively annotated reports, 60/20/20% training/validation/test split, accuracy 94%). To generate ED/UC-capable workflow, we paired this LSTM with a knowledge-based AI to assign patients into follow-up intervals: high risk (= 3 months), medium risk (> 3 months but = 6 months), and low risk (> 6 months and = 12 months). Clinical performance was assessed by retrospective manual validation of 200 reports (CT 85, XR 16, US 3, uncategorized 96) followed by key word inclusion/exclusion modifications. Real-time clinical performance was again assessed by prospective manual validation of 200 reports (CT 125, XR 64, MR 6, US 5). Fleischner Society Guidelines and logic governing NLP system-to-EMR communication were leveraged to develop risk-stratified ED/UC-capable HL7-based workflow.

#### RESULTS

The macro-averaged F0.5 score for retrospective performance was 0.79 (accuracy by risk class: high risk 94.5%, medium risk 99%, low risk 97%) and for prospective performance was 0.93 (accuracy by risk class: high risk 98.5%, medium risk 100%, low risk 95%). F0.5 score was selected to optimize clinical practice performance by penalizing false positives more than false negatives, where false reminders would undermine provider system use. Knowledge-based AI modifications resulted in 14% improvement in prospective performance.\*Discussion There are no published automated system workflows addressing the safety gap presented by ED/UC settings. The proposed ED/UC-capable HL7 logic and knowledge-based AI can help hospitals implement tracking and reminder systems capable of capturing the overwhelming majority of lost follow-up and meet ACR-issued Closing the Recommendations Follow-Up Loop measures. High-level clinical performance evaluation underscored the validity of this approach.

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## Abstract Archives of the RSNA, 2023

M5B-QI-6

### Reinterpretation of Hepatopancreaticobiliary Imaging Exams by Subspecialty Radiologists: Assessment of Clinical Impact, Radiologist Peer Learning, and Referring Physician Satisfaction

#### METHODS

This quality improvement project included HPB CT and MRI exams that were reinterpreted by two subspecialty radiologists between March 2021 to August 2022. Agreement with the primary report was categorized using the American College of Radiology RADPEER system. Electronic medical records were reviewed for information regarding change in management (yes/no/unavailable). Separate surveys using 5-point Likert scale questions were sent to radiologists who issued primary reports and referring physicians. Quantitative results were reported using descriptive statistics.

#### RESULTS

250 imaging exams (122 CT, 128 MRI) reported by 96 radiologists were reinterpreted as requested by 19 referring physicians. RADPEER scores 1-3 distribution was 131/250 (52%), 86/250 (34%) and 33/250 (13%), respectively. Of 213 cases with adequate clinical data, 75/213 (35%) were associated with a change in management; of these, 71/75 (95%) were RADPEER 2 or 3. Survey response rates were 34/86 (40%) for radiologists and 7/18 (39%) for referring physicians practicing in the region. Most radiologists agreed or strongly agreed with the following: prefer to receive reinterpretations (32/34, 94%); reinterpretations changed reporting practices (22/34, 65%); and reinterpretations support peer learning and quality assurance (32/34, 94%). Referring physicians agreed or strongly agreed that reinterpretations assist complex HPB disease management (7/7, 100%) and subspecialty radiologists should reinterpret more cases (6/7, 86%).\*Discussion Our study found a high discrepancy rate with HPB imaging reinterpretations, congruent with the literature. A change in clinical management was found in over one-third of cases. Reinterpretation reports were almost unanimously well received by radiologists and referring physicians. Strengths of this study include the large sample size and good survey response rates. Limitations include the retrospective design and potential lack of generalizability. In conclusion, radiologists and referring physicians are in strong agreement that HPB imaging reinterpretations support peer learning and patient management, respectively.

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## Abstract Archives of the RSNA, 2023

M5B-QI-7

### The Sliding Sign Initiative: Facilitating Earlier Detection of Deep Endometriosis in an Academic Ultrasound Department.

#### Participants

Emily Pang, MD, FRCPC, Vancouver, BC (*Presenter*) Nothing to Disclose

#### METHODS

Plan-Do-Study-Act (PDSA) methodology was used for this project, which took place in the ultrasound department of a tertiary-care teaching hospital between Oct 2021 and May 2023. The reports and imaging for pelvic ultrasounds performed in patients meeting inclusion criteria were reviewed by two ultrasound experts in consensus during a baseline period and during each intervention to assess for 1) whether the SS was performed and 2) whether SS results were reported and interpreted correctly. Additionally, in patients for whom follow-up was available, confirmation of a new endometriosis diagnosis was recorded. Initial planning involved consultation with gynecology, radiology and sonographer stakeholders. For the first PDSA cycle, a protocol was distributed by e-mail alongside an educational campaign which included in-service training and grand rounds. PDSA cycle 2 involved an updated protocol emailed and posted in the staff lounge, as well as a reminder poster displayed in the probe sanitation room. For PDSA cycle 3, the posters were revised to improve readability in low-lighting conditions and displayed in individual ultrasound rooms. Sonographer worksheets were modified to include a SS field.

#### RESULTS

The SS was not performed on any patients at baseline prior to the initiative. The number of eligible patients per month ranged from n=28 to 52. On average, the SS was performed on 57.7%, 68.2% and 85.2% of eligible patients and reported and interpreted correctly 66.7%, 83.3% and 73.9% of the time after PDSA cycles 1, 2, and 3 respectively. All abnormal SS cases were reported. Over a period of 1 year for which 6 month follow-up data was available (Oct 2021-Oct 2022), a total of 22 patients had a new confirmed diagnosis of endometriosis as a result of the initiative, with 2 false positives. \*Discussion The sliding sign initiative is a relatively simple protocol modification but has made a significant impact on the early diagnosis of endometriosis, allowing for earlier treatment and improved quality of life. Interventions aimed at increasing consistent performance of the SS amongst sonographers have proven successful. Limitations included difficulties performing the SS in retroverted uteri, variable buy-in/familiarity with the SS amongst radiologists, and lack of follow-up data on every patient. Additional interventions targeting reporting radiologists will be needed for future work.

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## Abstract Archives of the RSNA, 2023

M5B-QI-8HC

### Improving Outpatient CT Access by Reducing CT Backlogs

#### Participants

Ben C. Wandtke, MD, MS, Rochester, NY (*Presenter*) Clinical Advisory Board, CAK Tech, Inc

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## **Abstract Archives of the RSNA, 2023**

M5B-QI-9HC

**Impact of Early Direct Patient Notification of Non-Urgent Incidental Radiology Findings Requiring Follow-up**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R2-Q1

### Quality Improvement Reports Thursday Poster Discussions

#### Sub-Events

#### **R2-QI-1 Switching Neutral Oral contrast from VoLumen® to Breeza® to improve patient tolerance and acceptability of MRE (Magnetic Resonance Enterography) and CTE (Computed tomography enterography)**

##### Participants

Sindhura Tadisetty, MBBS, Lexington, KY (*Presenter*) Nothing to Disclose

##### **METHODS**

Adult patients undergoing MRE and CTE at our institution were given both contrast media along with a questionnaire for each media; they were asked to choose one for their exam. The questionnaire contained questions such as "How do you rate the taste and texture of the contrast given to you?", "Would you be willing to consume this contrast again" and "What is your perceived state of health post consuming the contrast." Their choice of contrast was also noted. We analyzed the answers to these questions to determine which contrast was better tolerated. Patient registered-Arrives at MR/CT waiting room-MRI Screening- Labs checked-Peripheral IV placed-Oral contrast administration in Zone II -Questionnaire to assess the taste perseveres and comfort level post oral contrast> MRE/CTE protocol- patient returns to the clinic/inpatient or ER room.

##### **RESULTS**

We recruited 20 patients undergoing MRE and CTE between March 15th, 2023, to April 15th, 2023. Among them, 19 patients chose Breeza® over Volumen®, which is a 95% acceptance rate for Breeza®. Among the people who chose Breeza®, the taste, and texture were ranked superior to Volumen®. None of the patients who chose Breeza® had problems consuming the contrast and keeping it down.\*Discussion Breeza® has shown to have increased tolerance and better taste and texture profile when compared to Volumen®. We advocate for the shift to Breeza as the preferred contrast in adult patients who undergo CTE and MRE. We did not compare the image quality of studies performed with Breeza® and those performed with Volumen® in the short duration. We intend to perform this comparison in the coming months.

#### **R2-QI-2 Structured Computed Tomography Quality Assurance Program in Neuroradiology**

##### Participants

Kayla Nakashima, BS, La Mirada, CA (*Presenter*) Nothing to Disclose

##### **METHODS**

This study was conducted in the Department of Radiology at UC Irvine Medical Center, an academic hospital. The QA process proceeds as follows: first, a radiologist flags an error in the Picture Archiving and Communication System (PACS) with (1) a categorization of either "protocol," "technique," "reconstruction," "scanner," or "other," (2) a severity of "0" or "1" (0 patient care is not affected; 1 patient care is affected), and (3) comments. Next, the Quality Nurse collects this information and also acquires the following data: date performed, patient information, study description, scanner, radiologist, and technologist. This data is logged using a HIPAA compliant tracker. This tracker is sent to CT leadership (CT supervisor and Senior CT Technologist), who discusses each QA flag with the technologists. To ensure change and accountability, each technologist with a QA flag is emailed an explanation of the issue and how to improve that must be acknowledged within one week. Additionally, CT leadership anonymizes and discusses common QA trends at department group huddles and during one-on-one technologist training. To increase communication with the neuroradiologists, a group message between CT leadership and the neuroradiologists was created to discuss day to day questions about study protocols. Additionally, CT leadership and the neuroradiologists meet monthly to review each QA flag to identify trends and develop resolutions efficiently. This process was repeated monthly for the past year.

##### **RESULTS**

The number of QA flags per month decreased after implementation of the QA process. The number of QA flags per category each month.\*Discussion The marking of QA flags, followed by the implementation of structured documentation and action toward reducing errors, has increased technologist and radiologist engagement and improved image quality. By creating a multidisciplinary approach to standardizing CT scans, radiologists can use automated feedback to enhance image quality, ultimately contributing to better patient care. Although continued research is needed, the goal is to use this form of standard documentation and quality assurance program for image quality improvement in all radiology sections.

#### **R2-QI-3 Improving Quantitative Report turn-around time using Digital Technology for clinical trials**

##### Participants

Ceylan Taslicay, MD, Houston, TX (*Presenter*) Nothing to Disclose

##### **METHODS**

The automated digital alert was deployed to decrease submitted to finalized-SOF of QIAC reports, i.e. the TAT for expedited and non-expedited cases. IRS preliminary report submitted time and the radiologist report finalized time was recorded digitally in the database. Data before and after implementing the digital system was extracted from the QIAC digital database. TAT time was

calculated in hours by comparing the pre-deployment (12193 reports) and post-deployment (6504 reports). TAT was summarized using mean, standard deviation, median, Q1 (25th) and Q3 (75th) quantiles. Comparison between pre and post-deployment was performed using Wilcoxon Rank Sum test. The categorical time difference was summarized using frequencies and percentages. P-value less than 0.05 was considered statistically significant. Statistical analyses were conducted using R-version 3.6.3 R Development Core Team, Vienna, Austria.

## RESULTS

Distribution of TAT was heavily right-skewed and close to an exponential distribution, with a mean of 33.2 (SD = 76.8) for post-deployment and a mean of 83.4 (SD = 166.9) for pre-deployment. There was a statistically significant difference in TAT between the pre-deployment and post-deployment of the digital alert system. TAT was significantly less post-deployment than pre-deployment overall ( $p=0.0016$ ). For expedited reports,  $p<0.020$ , and for non-expedited  $p<0.001$ . The digital alert system significantly decreased mean TAT from 44.9 hours to 16.4 hours for expedited cases  $p=0.0022$  (Table 1 Graph 1). Discussion There were several limitations. While deploying the alerts it was challenging to track if the radiologist were out of the office, on paid time off, or on a rotation where they were away from their computers and could not sign the reports. It was thus difficult to account for these unforeseen consequences and may have caused a delay in signing the reports despite the digital alert. However, using the digital alert system, the TAT for all reports decreased whether they were expedited or non-expedited providing the QIAC reports in time for patient appointments and facilitating better therapeutic decision-making and clinical care.

### R2-QI-4 Enhancing patient safety by implementing a digital centralized dose management program within a large-scale healthcare organization across 13 countries and 120 CT scanners

## METHODS

A DMP was launched in 2014 in a European Healthcare Organization and has been gradually deployed in 13 countries. The dose management process uses a list of 104 CT protocols per anatomical area and clinical indication, mapped to a RadLex Playbook radiology lexicon code (RPID) with established Organizational Diagnostic Reference Levels (DRLs). A unique RDIM system (DoseWatch, GE) is connected to 120 CT scanners and is used to collect exam data. Exams performed with mapped CT protocols are considered standardized while those performed with dose within DRLs are considered optimized. Data is monitored on local and global level using a business intelligence tool (Imaging Insights, GE). Dose Optimization is achieved by creating a culture of dose awareness, training of people involved, data analysis and CT protocol parameters optimization. A multidisciplinary team in center, country and group level collaborates to achieve best practice. Program's success is monitored using a set of Key Performance Indicators (KPIs): Standardization >75% and Optimization >70%. More than 70,000 exams are collected monthly, allowing for analysis at Group, country and center level and gives the ability for targeted improvement actions. Patient safety is ensured by real time monitoring of standardization and optimization of CT practice.

## RESULTS

For each country, data were collected for 30 days for benchmarking. During this period, several educational sessions were organized while best practice from other countries was shared. CT protocol parameters were adjusted to reduce dose while preserve image quality. As a result of the DMP implementation the percentage of standard exams across 13 countries and 120 centers is 90% while the percentage of exams performed with dose within DRLs is 71%. Discussion The implementation of a DMP within a large-scale organization allows practice unification, best practice sharing and optimized dose across countries. Results analysis leads to improvement initiatives like training on Dose Management and optimization of CT protocol parameters. Knowledge, experience, and image quality feedback is shared between different countries to achieve optimum results to enhance patient safety.

### R2-QI-5 Strategies to improve communication in Clinical Imaging in Manaus - AM during Covid-19 pandemic

#### Participants

Aline Souza, MD, MSc, Manaus, Brazil (Presenter) Nothing to Disclose

## METHODS

This cross-sectional study consisted of theoretical-practical training with realistic simulation and formative evaluation, aimed at professionals who work in imaging clinic in Brazil. The training took place between 2020 and 2021, in small groups of 8 people, following the recommendation of The Brazil Ministry of Health. In January 2021, during the peak of the COVID-19 pandemic in Manaus, face to face training was replaced by remote training.

## RESULTS

A total of 111 (one hundred and eleven) employees participated, representing 82% of the staff. The study occurred in two parts. In the first, participants attended an interactive 60 minutes lecture, which included video demonstration and encouraged participation. At this stage, two tools were presented to improve communication: SBAR (Situation, Background, Assessment and Recommendation), to improve communication between the healthcare team, and AIDET® (Acknowledge, Introduce, Duration, Explanation and Thank You), to improve communication between healthcare professionals and patient/families. In the second part of the training, professionals were individually evaluated according to Table 1, by two evaluators (Picture 1). At the end, they received feedback on their performance, and those who obtained the highest scores in the formative evaluation were awarded. As a product of the training, a small book was created with recommendation for best practices, addressing communication with the patient and among the work team, communication with the requestor physician and value-based radiology. Discussion The implementation of SBAR and AIDET protocols proved effective in improving communication between healthcare teams and patients/families in imaging clinic. Despite the difficulties imposed by the COVID-19 pandemic, the training had significant adherence from the participants. However, further studies are needed to evaluate the effectiveness in developing specific communication skills for radiology. The book with best practice recommendations offers a useful source of information and can encourage professionals in the field to adopt a new behavior, with patient-centered actions.

### R2-QI-6 My Attending Really Wants it! Manual Clinical Decision Support Adjudicating the Better Look" Inpatient MRI at an Academic Medical Center

#### Participants

Ashlesha Udare, MBBS, MD, Philadelphia, PA (Presenter) Nothing to Disclose

## METHODS

To address overutilization of inpatient body MRI, a 9-item questionnaire was incorporated into our protocoling process to gather

information about clinical decision making and necessity of inpatient MRI orders and the final disposition was recorded and compared with the baseline cancellation rate of 0.6%. The percentage of orders with no appropriate indication, orders recommended by consultants or radiology reports and reasons why MRI cannot be performed as an outpatient were recorded.

## **RESULTS**

Among 846 orders, 112 (13%) had no specific clinical question. 582 (69%) were recommended by non-radiology consulting services and 136 (16%) were recommended in radiology reports. 144 (17%) were considered appropriate for and 197 (23%) were considered possibly appropriate for outpatient imaging. The most frequent reason cited for inpatient imaging was "attending really wants it" (34%), followed by potential to be "lost to follow-up" (13%) and patient/family pressure (2%). 27% were not associated with an urgent procedure or inpatient management decision. Responses to whether the MRI could be performed after discharge were: No (60%), Maybe (23%), and Yes (17%). Final dispositions for the orders included routine inpatient study (68%), urgent inpatient study (18%), outpatient imaging (5%), on hold pending more information (5%), and study not performed (4%).\*Discussion The questionnaire served a consultative role by prompting discussion between radiology and the clinical services to assess appropriateness and appropriately triage inpatient orders. The implementation of the questionnaire resulted in a reduction of inpatient body MRI utilization up to 8% (from 0.6% cancellation to 9% cancellation + conversion). 85% of orders were recommended by consultants (69%) and radiology reports (16%) and frequent lack of understanding of the indication by the ordering clinician was evident. Limitations of our study include absent data on the disposition of "on hold" orders, the manual approach not sustainable in most practices and the retrospective analysis. Our study shows limited understanding of inpatient MRI appropriateness and potential for reducing utilization and outpatient conversion.

### **R2-QI-8 Patient Friendly Reporting for Lung Cancer Screening CTs**

Participants

Austin Fullenkamp, BS, MD, Charleston, SC (*Presenter*) Nothing to Disclose

### **R2-QI-9HC Improving Lung Cancer Screening Utilization**

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## Abstract Archives of the RSNA, 2023

R2-QI-1

### Switching Neutral Oral contrast from VoLumen® to Breeza® to improve patient tolerance and acceptability of MRE (Magnetic Resonance Enterography) and CTE (Computed tomography enterography)

#### Participants

Sindhura Tadisetty, MBBS, Lexington, KY (*Presenter*) Nothing to Disclose

#### METHODS

Adult patients undergoing MRE and CTE at our institution were given both contrast media along with a questionnaire for each media; they were asked to choose one for their exam. The questionnaire contained questions such as "How do you rate the taste and texture of the contrast given to you?", "Would you be willing to consume this contrast again" and "What is your perceived state of health post consuming the contrast." Their choice of contrast was also noted. We analyzed the answers to these questions to determine which contrast was better tolerated. Patient registered-Arrives at MR/CT waiting room-MRI Screening- Labs checked-Peripheral IV placed-Oral contrast administration in Zone II -Questionnaire to assess the taste perseveres and comfort level post oral contrast> MRE/CTE protocol- patient returns to the clinic/inpatient or ER room.

#### RESULTS

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## Abstract Archives of the RSNA, 2023

R2-QI-2

### Structured Computed Tomography Quality Assurance Program in Neuroradiology

#### Participants

Kayla Nakashima, BS, La Mirada, CA (*Presenter*) Nothing to Disclose

#### METHODS

This study was conducted in the Department of Radiology at UC Irvine Medical Center, an academic hospital. The QA process proceeds as follows: first, a radiologist flags an error in the Picture Archiving and Communication System (PACS) with (1) a categorization of either "protocol," "technique," "reconstruction," "scanner," or "other," (2) a severity of "0" or "1" (0 patient care is not affected; 1 patient care is affected), and (3) comments. Next, the Quality Nurse collects this information and also acquires the following data: date performed, patient information, study description, scanner, radiologist, and technologist. This data is logged using a HIPAA compliant tracker. This tracker is sent to CT leadership (CT supervisor and Senior CT Technologist), who discusses each QA flag with the technologists. To ensure change and accountability, each technologist with a QA flag is emailed an explanation of the issue and how to improve that must be acknowledged within one week. Additionally, CT leadership anonymizes and discusses common QA trends at department group huddles and during one-on-one technologist training. To increase communication with the neuroradiologists, a group message between CT leadership and the neuroradiologists was created to discuss day to day questions about study protocols. Additionally, CT leadership and the neuroradiologists meet monthly to review each QA flag to identify trends and develop resolutions efficiently. This process was repeated monthly for the past year.

#### RESULTS

The number of QA flags per month decreased after implementation of the QA process. The number of QA flags per category each month.\*Discussion The marking of QA flags, followed by the implementation of structured documentation and action toward reducing errors, has increased technologist and radiologist engagement and improved image quality. By creating a multidisciplinary approach to standardizing CT scans, radiologists can use automated feedback to enhance image quality, ultimately contributing to better patient care. Although continued research is needed, the goal is to use this form of standard documentation and quality assurance program for image quality improvement in all radiology sections.

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## Abstract Archives of the RSNA, 2023

R2-Q1-3

### Improving Quantitative Report turn-around time using Digital Technology for clinical trials

#### Participants

Ceylan Taslicay, MD, Houston, TX (*Presenter*) Nothing to Disclose

#### METHODS

The automated digital alert was deployed to decrease submitted to finalized-SOF of QIAC reports, i.e. the TAT for expedited and non-expedited cases. IRS preliminary report submitted time and the radiologist report finalized time was recorded digitally in the database. Data before and after implementing the digital system was extracted from the QIAC digital database. TAT time was calculated in hours by comparing the pre-deployment (12193 reports) and post-deployment (6504 reports). TAT was summarized using mean, standard deviation, median, Q1 (25th) and Q3 (75th) quantiles. Comparison between pre and post-deployment was performed using Wilcoxon Rank Sum test. The categorical time difference was summarized using frequencies and percentages. P-value less than 0.05 was considered statistically significant. Statistical analyses were conducted using R-version 3.6.3 R Development Core Team, Vienna, Austria.

#### RESULTS

Distribution of TAT was heavily right-skewed and close to an exponential distribution, with a mean of 33.2 (SD = 76.8) for post-deployment and a mean of 83.4 (SD = 166.9) for pre-deployment. There was a statistically significant difference in TAT between the pre-deployment and post-deployment of the digital alert system. TAT was significantly less post-deployment than pre-deployment overall ( $p=0.0016$ ). For expedited reports,  $p<0.020$ , and for non-expedited  $p<0.001$ . The digital alert system significantly decreased mean TAT from 44.9 hours to 16.4 hours for expedited cases  $p=0.0022$  (Table 1 Graph 1). \*Discussion There were several limitations. While deploying the alerts it was challenging to track if the radiologist were out of the office, on paid time off, or on a rotation where they were away from their computers and could not sign the reports. It was thus difficult to account for these unforeseen consequences and may have caused a delay in signing the reports despite the digital alert. However, using the digital alert system, the TAT for all reports decreased whether they were expedited or non-expedited providing the QIAC reports in time for patient appointments and facilitating better therapeutic decision-making and clinical care.

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## Abstract Archives of the RSNA, 2023

R2-QI-4

### Enhancing patient safety by implementing a digital centralized dose management program within a large-scale healthcare organization across 13 countries and 120 CT scanners

#### METHODS

A DMP was launched in 2014 in a European Healthcare Organization and has been gradually deployed in 13 countries. The dose management process uses a list of 104 CT protocols per anatomical area and clinical indication, mapped to a RadLex Playbook radiology lexicon code (RPID) with established Organizational Diagnostic Reference Levels (DRLs). A unique RDIM system (DoseWatch, GE) is connected to 120 CT scanners and is used to collect exam data. Exams performed with mapped CT protocols are considered standardized while those performed with dose within DRLs are considered optimized. Data is monitored on local and global level using a business intelligence tool (Imaging Insights, GE). Dose Optimization is achieved by creating a culture of dose awareness, training of people involved, data analysis and CT protocol parameters optimization. A multidisciplinary team in center, country and group level collaborates to achieve best practice. Program's success is monitored using a set of Key Performance Indicators (KPIs): Standardization >75% and Optimization >70%. More than 70.000 exams are collected monthly, allowing for analysis at Group, country and center level and gives the ability for targeted improvement actions. Patient safety is ensured by real time monitoring of standardization and optimization of CT practice.

#### RESULTS

For each country, data were collected for 30 days for benchmarking. During this period, several educational sessions were organized while best practice from other countries was shared. CT protocol parameters were adjusted to reduce dose while preserve image quality. As a result of the DMP implementation the percentage of standard exams across 13 countries and 120 centers is 90% while the percentage of exams performed with dose within DRLs is 71%.\*Discussion The implementation of a DMP within a large-scale organization allows practice unification, best practice sharing and optimized dose across countries. Results analysis leads to improvement initiatives like training on Dose Management and optimization of CT protocol parameters. Knowledge, experience, and image quality feedback is shared between different countries to achieve optimum results to enhance patient safety.

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## Abstract Archives of the RSNA, 2023

R2-QI-5

### Strategies to improve communication in Clinical Imaging in Manaus - AM during Covid-19 pandemic

#### Participants

Aline Souza, MD, MSc, Manaus, Brazil (*Presenter*) Nothing to Disclose

#### METHODS

This cross-sectional study consisted of theoretical-practical training with realistic simulation and formative evaluation, aimed at professionals who work in imaging clinic in Brazil. The training took place between 2020 and 2021, in small groups of 8 people, following the recommendation of The Brazil Ministry of Health. In January 2021, during the peak of the COVID-19 pandemic in Manaus, face to face training was replaced by remote training.

#### RESULTS

A total of 111 (one hundred and eleven) employees participated, representing 82% of the staff. The study occurred in two parts. In the first, participants attended an interactive 60 minutes lecture, which included video demonstration and encouraged participation. At this stage, two tools were presented to improve communication: SBAR (Situation, Background, Assessment and Recommendation), to improve communication between the healthcare team, and AIDET® (Acknowledge, Introduce, Duration, Explanation and Thank You), to improve communication between healthcare professionals and patient/families. In the second part of the training, professionals were individually evaluated according to Table 1, by two evaluators (Picture 1). At the end, they received feedback on their performance, and those who obtained the highest scores in the formative evaluation were awarded. As a product of the training, a small book was created with recommendation for best practices, addressing communication with the patient and among the work team, communication with the requesting physician and value-based radiology.\*Discussion The implementation of SBAR and AIDET protocols proved effective in improving communication between healthcare teams and patients/families in imaging clinic. Despite the difficulties imposed by the COVID-19 pandemic, the training had significant adherence from the participants. However, further studies are needed to evaluate the effectiveness in developing specific communication skills for radiology. The book with best practice recommendations offers a useful source of information and can encourage professionals in the field to adopt a new behavior, with patient-centered actions.

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## Abstract Archives of the RSNA, 2023

R2-QI-6

### My Attending Really Wants it!" Manual Clinical Decision Support Adjudicating the Better Look" Inpatient MRI at an Academic Medical Center

#### Participants

Ashlesha Udare, MBBS, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

#### METHODS

To address overutilization of inpatient body MRI, a 9-item questionnaire was incorporated into our protocoling process to gather information about clinical decision making and necessity of inpatient MRI orders and the final disposition was recorded and compared with the baseline cancellation rate of 0.6%. The percentage of orders with no appropriate indication, orders recommended by consultants or radiology reports and reasons why MRI cannot be performed as an outpatient were recorded.

#### RESULTS

Among 846 orders, 112 (13%) had no specific clinical question. 582 (69%) were recommended by non-radiology consulting services and 136 (16%) were recommended in radiology reports. 144 (17%) were considered appropriate for and 197 (23%) were considered possibly appropriate for outpatient imaging. The most frequent reason cited for inpatient imaging was "attending really wants it" (34%), followed by potential to be "lost to follow-up" (13%) and patient/family pressure (2%). 27% were not associated with an urgent procedure or inpatient management decision. Responses to whether the MRI could be performed after discharge were: No (60%), Maybe (23%), and Yes (17%). Final dispositions for the orders included routine inpatient study (68%), urgent inpatient study (18%), outpatient imaging (5%), on hold pending more information (5%), and study not performed (4%).\*Discussion The questionnaire served a consultative role by prompting discussion between radiology and the clinical services to assess appropriateness and appropriately triage inpatient orders. The implementation of the questionnaire resulted in a reduction of inpatient body MRI utilization up to 8% (from 0.6% cancellation to 9% cancellation + conversion). 85% of orders were recommended by consultants (69%) and radiology reports (16%) and frequent lack of understanding of the indication by the ordering clinician was evident. Limitations of our study include absent data on the disposition of "on hold" orders, the manual approach not sustainable in most practices and the retrospective analysis. Our study shows limited understanding of inpatient MRI appropriateness and potential for reducing utilization and outpatient conversion.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R2-QI-8

### Patient Friendly Reporting for Lung Cancer Screening CTs

#### Participants

Austin Fullenkamp, BS, MD, Charleston, SC (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## **Abstract Archives of the RSNA, 2023**

R2-QI-9HC

**Improving Lung Cancer Screening Utilization**

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

R5A-QI

### Quality Improvement Reports Thursday Poster Discussions I

#### Sub-Events

#### **R5A-QI-1 Anesthesia and MRI Safety: Burning Questions and the Road to Better Practice**

##### Participants

Hamilton Shoji, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

##### METHODS

Review of the current literature of proposed mechanisms of burns in the MRI and strategies to avoid them. Redesign the workflow (from scheduling to patient positioning and monitoring) to capitalize on opportunities to clear known risks.

##### RESULTS

Decrease in the proportion of MRI under full anesthesia (100% to 59,9%). Increase in the proportion of MRI under mild sedation or anxiolysis (0 to 31%), or fully awoken (from 0 to 7,5%). Decrease in continuous scanning time in patients under anesthesia, both with reduced or optimized protocols (19%), or by withdrawals of segments for examination. Register of a checklist for patient positioning with special attention to correct padding and isolation of wires, cables and other devices. Register of patient temperatures monitoring during scan. Register of skin conditions prior and after the examinations.\*Discussion Although known as a safe procedure and with more widespread use of Choosing Wisely based strategies for diagnostic imaging that shifts CT to other methods, the MRI may impose health risks that are not fully understood. We hope that a deeper knowledge of the mechanisms involved in adverse events will help to avoid serious complications. Until then, we are focused on honing our workflow to decrease incidents to a minimum, without limiting access to adequate diagnostic testing.

#### **R5A-QI-2 Patient safety in diagnostic imaging: proposal to mitigate identification errors**

##### Participants

Aline Souza, MD, MSc, Manaus, Brazil (*Presenter*) Nothing to Disclose

##### METHODS

Design Thinking, as an approach to solving complex problems. The following steps were taken: 1) Discovery of the problem, through a questionnaire about the safety culture, process mapping and event notification. 2) Summary, registration of the NSP at ANVISA and development of the action plan. 3) Ideation, which consisted into the creation of the electronic notification model and 4) Prototyping, system validation and standardization of successful strategies.

##### RESULTS

In 18 months, 608 events were reported. Near miss represented 68.6% (n=417), event without harm 28.1% (n=171) and adverse event 3.3% (n=20). The most reported isolated error was the patient's name, corresponding to 20.6% (n=125). When classified by categories, document errors represented 44.2% (n=269) and patient identification 29.4% (n=179). The number of events corresponded to 0.36% of all exams performed and adverse events represented 0.01% of them. The highest percentage of errors was in MRI scans (0.88%, n=227), CT scans (0.67%, n=122) and x-rays (0.49% n=101), that correspond to the exams most performed in the organization. After adoption of healthcare policies, there was a reduction in events related to patient identification, from 13.6% to 4.8%; the sum of type, side and site errors from 21.2% to 7.6% and procedural error from 28.8% to 12.4% (Table 1).\*Discussion The association of an electronic notification system, process improvement and training reduced 64,7% patient identification errors. Additionally, there was also a 64,1% reduction in the sum of type, side and site exam errors, and 56,9% in procedural errors.

#### **R5A-QI-3 Quality process design to change radiodiagnostic equipment to minimize the impact on waiting lists in a public health imaging diagnostic provider**

##### Participants

Virginia Benavente, Barcelona, Spain (*Presenter*) Nothing to Disclose

##### METHODS

The process involves the radiological protection area (RPA) and the infrastructure area (AU). As it can be seen in Figure 1, it involves equipment deregistration (in orange) and installation (in blue) with tasks requiring the collaboration between RPA, IA and external stakeholders. Before the redesigning it took 117 days to complete the process. The process redesign was focused on all administrative procedures. To this end, a digital documentation structure and workflow were implemented for each work team depending on members roles, the step of the process and deadlines and milestones to meet.

##### RESULTS

The new process takes 95 days after the redesigning (Figure 2). The actions implemented were the following:\*Discussion This redesigned process involving actions on the administrative tasks to improve communication and team building is useful and allows us to reduce the whole process of deregistration, removal, installation and start-up in 22 days. Compliance with this new working

procedure is key to obtaining optimal results and reducing the impact on waiting lists. The critical point of this procedure is the interdependence between the parts involved. Most of documentation required also depends on the external companies and it can affect the flow of the process.

#### **R5A-QI-4 Improving overnight turn-around-time and restoring on-call resident responsibility in an Academic Medical Center**

##### **METHODS**

To review resident contribution (No Contribution, Draft, Prelim) over our phased transition, we summarize weekly call data for 2 categories of cross-sectional exams - adult Non-Neuro (Body, Chest, CVI, MSK) and adult Neuro. No Contribution indicates a fellow/attending reported the exam directly. Draft indicates a resident created an initial draft without publishing. Prelim indicates a resident published a preliminary report. Attending-signed final reports (final TAT) were expected within 90 minutes of the end of an exam. Data included studies between the hours of 8:45 PM - 7:30 AM 7-days a week. Baseline (12/2018 - 12/2019): Fellows publish prelims overnight, residents draft reports (discouraged from publishing prelims). Final reports followed in the morning. 1st Intervention (01/2020): Instituted neuro attending finals overnight, residents encouraged but not required to publish prelims. 2nd Intervention (11/2021): Instituted non-neuro teleradiology attending finals overnight, residents encouraged but not required to publish prelims. To accommodate increased volume, an additional swing resident (5 PM - 2 AM) was added 07/2020.

##### **RESULTS**

At baseline, median final TAT was around 6-10 hours. Residents issued drafts for 75% and 90% of Neuro and Non-Neuro ED studies, and 40% and 50% of Neuro and Non-Neuro IP studies, rarely publishing prelims. After implementation of Neuro attending overnight final reads, median Neuro final TAT decreased to 60 minutes (excluding weeks with 1st year fellow coverage). Resident publication of prelim reports for Neuro ED studies increased: 30% (early 2020), 70% (early 2021), 84% (early 2022), and 65% (early 2023). After implementation of Non-Neuro teleradiology to provide overnight attending final reads, median Non-Neuro final TAT decreased to 40 minutes. Residents published prelim reports for most Non-Neuro ED studies (90%). No increase in ED-reported safety events arising from overread changes was seen despite increases in resident published preliminary reports. No increase in preliminary TAT. \*Discussion Providing attending overnight coverage improved final TAT for ED reports. This change also facilitated resident comfort with voluntarily publishing preliminary reports, a marker of call autonomy, while mitigating patient risk.

#### **R5A-QI-5 Applying Lean Six Sigma Techniques to Patient Flow in the Breast Imaging Service: A Tertiary Center's Experience and Process of Improvement**

##### **Participants**

Nader Ashraf, MD, Riyadh, Saudi Arabia (*Presenter*) Nothing to Disclose

##### **METHODS**

An electronic medical record integrated system was put in place to track the TTR from the time the screening study is input until diagnostic resolution is reached. A baseline audit followed by a post-implementation audit were conducted. Multidisciplinary meetings, alongside a study of patient complaint data, were utilized to identify issues that were causing prolonged TTR leading to patient flow inefficiencies. The resulting sources of variability were recognized and analyzed using an Ishikawa fishbone diagram to classify sources of variation. To address these root causes, possible solutions were proposed and implemented. Significant differences in TTR were assessed using the Mann-Whitney-U test.

##### **RESULTS**

During the baseline audit of 8 months, 589 cases of mammographic recalls (BI-RADS 0) were recruited. The average TTR for this group was 86.3 days. To reflect the required change in the mindset to adopt a patient-centric approach instead of the traditional exam/modality-focused one, there will be proposed improvement plans. Due to the lack of funding received for this project, some gaps, like staff shortages, were not able to be addressed. During the post-implementation period of 3 months, 370 cases of mammographic recalls (BI-RADS 0) were made. The average TTR for this group was 36.0 days. After applying LSSM, we managed to significantly reduce our TTR by at least 58% ( $P < 0.01$ ). \*Discussion With the application of LSSM in our breast imaging service, we managed to reduce our TTR by 58%. This was mainly related to the effect of training the coordinators to capture the screening recalls and schedule the recommended examinations. Moreover, there was an observed increase in the numbers of same-day nonscheduled targeted US generated and performed by the radiologist due to their commitment to embracing patient-centered care. These changes should be there to stay, incorporated into our culture, to facilitate continuous improvement and cost reduction. As the need for healthcare resources grows in the future, LSSM may play an increasingly essential role in enhancing healthcare service delivery.

#### **R5A-QI-6 Lateral Knee Radiograph Quality Improvement Project**

##### **METHODS**

Intervention: Initial assessment included a survey of 50 lateral knee images with the scoring rubric. A fishbone diagram was used to identify potential causes contributing to a gap in quality. The potential causes identified were: Incorrect position, rotation, radiation techniques and missing required elements like marking and measuring tools. A staff satisfaction survey was given to the participating staff as a balancing measure. Then, education was implemented focusing on positioning, marking, centering and techniques. Also, standardization of image marking supplies were reviewed and replenished. Study of the intervention: The Define Measure Analyze Improve Control (DMAIC) method of quality improvement was used for this project. Initial assessment found that 62% of images surveyed were above the 11-point threshold. Measures: A scoring rubric was used to analyze each image. Points are given for technical aspects of the image. The staff survey was used to ensure the staff did not feel the education measures were punitive. Analysis: Post intervention, 59 lateral knee images were surveyed. A second staff satisfaction survey was provided and analyzed.

##### **RESULTS**

Post intervention, 90% of the lateral knee radiographs surveyed scored 11 points or more. Lateral knee images scoring more than 11 points had an increase of 28%. The survey of job satisfaction initially scored an average of 50%. The post intervention survey scored an average of 73%. In addition, lateral knee examination times were reduced by 15.9 minutes per month due to a decrease in repeat radiographs. \*Discussion Continuous education for technologists is critical for maintaining image quality. The score of the post intervention staff satisfaction survey proved that the techs were appreciative of the education and desired to improve the image quality for their patients.

## **R5A-QI-7 Minimising Claustrophobia and Scanxiety in Radiology**

Participants

Kenneth Jacob, Oxford, United Kingdom (*Presenter*) Nothing to Disclose

### **METHODS**

Total scanning time can be reduced by customising scan parameters according to the need of the patients, balancing the quality vs time. Position of the patient in the scanner also plays a key role in reducing claustrophobia. In some cases feet first is a more preferred position for claustrophobic patients. If the patient prefers the eye mask and headphones with relaxing music also helps calm patients with claustrophobia and helps them tolerate a scan.

### **RESULTS**

Our analysis indicates up to a 50% reduction in the number of abandoned MRI scans since the introduction of new technology. We assess this as occurring across the period of time that wider bores and faster scans were introduced.\*Discussion Many studies conducted show that patients with claustrophobic anxiety are more likely to be frightened and experience a feeling of confinement or being closed in during imaging (BMC Med Imaging 2011 Feb).A Research study at our site is underway to test a virtual tour of the PET-CT procedure and environment to reduce anxiety in claustrophobic patients. Wider bore scanners reduce claustrophobia to a limit however training patients prior to a scan is the most successful method, which could also be done using VR headset under testing which could enable the patient to experience the whole procedure in a safe and immersive way before the real scan and potentially help utilise the scanner and staff time more efficiently. If this is successful in PET then we can test this in the MRI environment.

## **R5A-QI-8HC Ebbinghaus Forgetting Curve Based on OBE Theory Application to Clinical Practice in Imaging Technology**

## **R5A-QI-9HC Fake It Till You Make It-Preparing Radiology Residents to Manage Contrast Reactions Using High-Fidelity Simulation**

Participants

Anna Menezes, MBBS, Bangalore, India (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5A-QI-1

### Anesthesia and MRI Safety: Burning Questions and the Road to Better Practice

#### Participants

Hamilton Shoji, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

#### METHODS

Review of the current literature of proposed mechanisms of burns in the MRI and strategies to avoid them. Redesign the workflow (from scheduling to patient positioning and monitoring) to capitalize on opportunities to clear known risks.

#### RESULTS

Decrease in the proportion of MRI under full anesthesia (100% to 59,9%). Increase in the proportion of MRI under mild sedation or anxiolysis (0 to 31%), or fully awoken (from 0 to 7,5%). Decrease in continuous scanning time in patients under anesthesia, both with reduced or optimized protocols (19%), or by withdrawals of segments for examination. Register of a checklist for patient positioning with special attention to correct padding and isolation of wires, cables and other devices. Register of patient temperatures monitoring during scan. Register of skin conditions prior and after the examinations.\*Discussion Although known as a safe procedure and with more widespread use of Choosing Wisely based strategies for diagnostic imaging that shifts CT to other methods, the MRI may impose health risks that are not fully understood. We hope that a deeper knowledge of the mechanisms involved in adverse events will help to avoid serious complications. Until then, we are focused on honing our workflow to decrease incidents to a minimum, without limiting access to adequate diagnostic testing.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5A-QI-2

### Patient safety in diagnostic imaging: proposal to mitigate identification errors

#### Participants

Aline Souza, MD, MSc, Manaus, Brazil (*Presenter*) Nothing to Disclose

#### METHODS

Design Thinking, as an approach to solving complex problems. The following steps were taken: 1) Discovery of the problem, through a questionnaire about the safety culture, process mapping and event notification. 2) Summary, registration of the NSP at ANVISA and development of the action plan. 3) Ideation, which consisted into the creation of the electronic notification model and 4) Prototyping, system validation and standardization of successful strategies.

#### RESULTS

In 18 months, 608 events were reported. Near miss represented 68.6% (n=417), event without harm 28.1% (n=171) and adverse event 3.3% (n=20). The most reported isolated error was the patient's name, corresponding to 20.6% (n=125). When classified by categories, document errors represented 44.2% (n=269) and patient identification 29.4% (n=179). The number of events corresponded to 0.36% of all exams performed and adverse events represented 0.01% of them. The highest percentage of errors was in MRI scans (0.88%, n=227), CT scans (0.67%, n=122) and x-rays (0.49% n=101), that correspond to the exams most performed in the organization. After adoption of healthcare policies, there was a reduction in events related to patient identification, from 13.6% to 4.8%; the sum of type, side and site errors from 21.2% to 7.6% and procedural error from 28.8% to 12.4% (Table 1). \*Discussion The association of an electronic notification system, process improvement and training reduced 64,7% patient identification errors. Additionally, there was also a 64,1% reduction in the sum of type, side and site exam errors, and 56,9% in procedural errors.

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## Abstract Archives of the RSNA, 2023

R5A-QI-3

### Quality process design to change radiodiagnostic equipment to minimize the impact on waiting lists in a public health imaging diagnostic provider

#### Participants

Virginia Benavente, Barcelona, Spain (*Presenter*) Nothing to Disclose

#### METHODS

The process involves the radiological protection area (RPA) and the infrastructure area (AU). As it can be seen in Figure 1, it involves equipment deregistration (in orange) and installation (in blue) with tasks requiring the collaboration between RPA, IA and external stakeholders. Before the redesigning it took 117 days to complete the process. The process redesign was focused on all administrative procedures. To this end, a digital documentation structure and workflow were implemented for each work team depending on members roles, the step of the process and deadlines and milestones to meet.

#### RESULTS

The new process takes 95 days after the redesigning (Figure 2). The actions implemented were the following: \*Discussion This redesigned process involving actions on the administrative tasks to improve communication and team building is useful and allows us to reduce the whole process of deregistration, removal, installation and start-up in 22 days. Compliance with this new working procedure is key to obtaining optimal results and reducing the impact on waiting lists. The critical point of this procedure is the interdependence between the parts involved. Most of documentation required also depends on the external companies and it can affect the flow of the process.

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## Abstract Archives of the RSNA, 2023

R5A-QI-4

### Improving overnight turn-around-time and restoring on-call resident responsibility in an Academic Medical Center

#### METHODS

To review resident contribution (No Contribution, Draft, Prelim) over our phased transition, we summarize weekly call data for 2 categories of cross-sectional exams - adult Non-Neuro (Body, Chest, CVI, MSK) and adult Neuro. No Contribution indicates a fellow/attending reported the exam directly. Draft indicates a resident created an initial draft without publishing. Prelim indicates a resident published a preliminary report. Attending-signed final reports (final TAT) were expected within 90 minutes of the end of an exam. Data included studies between the hours of 8:45 PM - 7:30 AM 7-days a week. Baseline (12/2018 - 12/2019): Fellows publish prelims overnight, residents draft reports (discouraged from publishing prelims). Final reports followed in the morning. 1st Intervention (01/2020): Instituted neuro attending finals overnight, residents encouraged but not required to publish prelims. 2nd Intervention (11/2021): Instituted non-neuro teleradiology attending finals overnight, residents encouraged but not required to publish prelims. To accommodate increased volume, an additional swing resident (5 PM - 2 AM) was added 07/2020.

#### RESULTS

At baseline, median final TAT was around 6-10 hours. Residents issued drafts for 75% and 90% of Neuro and Non-Neuro ED studies, and 40% and 50% of Neuro and Non-Neuro IP studies, rarely publishing prelims. After implementation of Neuro attending overnight final reads, median Neuro final TAT decreased to 60 minutes (excluding weeks with 1st year fellow coverage). Resident publication of prelim reports for Neuro ED studies increased: 30% (early 2020), 70% (early 2021), 84% (early 2022), and 65% (early 2023). After implementation of Non-Neuro teleradiology to provide overnight attending final reads, median Non-Neuro final TAT decreased to 40 minutes. Residents published prelim reports for most Non-Neuro ED studies (90%). No increase in ED-reported safety events arising from overread changes was seen despite increases in resident published preliminary reports. No increase in preliminary TAT. \*Discussion Providing attending overnight coverage improved final TAT for ED reports. This change also facilitated resident comfort with voluntarily publishing preliminary reports, a marker of call autonomy, while mitigating patient risk.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5A-QI-5

### Applying Lean Six Sigma Techniques to Patient Flow in the Breast Imaging Service: A Tertiary Center's Experience and Process of Improvement

#### Participants

Nader Ashraf, MD, Riyadh, Saudi Arabia (*Presenter*) Nothing to Disclose

#### METHODS

An electronic medical record integrated system was put in place to track the TTR from the time the screening study is input until diagnostic resolution is reached. A baseline audit followed by a post-implementation audit were conducted. Multidisciplinary meetings, alongside a study of patient complaint data, were utilized to identify issues that were causing prolonged TTR leading to patient flow inefficiencies. The resulting sources of variability were recognized and analyzed using an Ishikawa fishbone diagram to classify sources of variation. To address these root causes, possible solutions were proposed and implemented. Significant differences in TTR were assessed using the Mann-Whitney-U test.

#### RESULTS

During the baseline audit of 8 months, 589 cases of mammographic recalls (BI-RADS 0) were recruited. The average TTR for this group was 86.3 days. To reflect the required change in the mindset to adopt a patient-centric approach instead of the traditional exam/modality-focused one, there will be proposed improvement plans. Due to the lack of funding received for this project, some gaps, like staff shortages, were not able to be addressed. During the post-implementation period of 3 months, 370 cases of mammographic recalls (BI-RADS 0) were made. The average TTR for this group was 36.0 days. After applying LSSM, we managed to significantly reduce our TTR by at least 58% ( $P < 0.01$ ). \*Discussion With the application of LSSM in our breast imaging service, we managed to reduce our TTR by 58%. This was mainly related to the effect of training the coordinators to capture the screening recalls and schedule the recommended examinations. Moreover, there was an observed increase in the numbers of same-day nonscheduled targeted US generated and performed by the radiologist due to their commitment to embracing patient-centered care. These changes should be there to stay, incorporated into our culture, to facilitate continuous improvement and cost reduction. As the need for healthcare resources grows in the future, LSSM may play an increasingly essential role in enhancing healthcare service delivery.

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## Abstract Archives of the RSNA, 2023

R5A-QI-6

### Lateral Knee Radiograph Quality Improvement Project

#### METHODS

Intervention: Initial assessment included a survey of 50 lateral knee images with the scoring rubric. A fishbone diagram was used to identify potential causes contributing to a gap in quality. The potential causes identified were: Incorrect position, rotation, radiation techniques and missing required elements like marking and measuring tools. A staff satisfaction survey was given to the participating staff as a balancing measure. Then, education was implemented focusing on positioning, marking, centering and techniques. Also, standardization of image marking supplies were reviewed and replenished. Study of the intervention: The Define Measure Analyze Improve Control (DMAIC) method of quality improvement was used for this project. Initial assessment found that 62% of images surveyed were above the 11-point threshold. Measures: A scoring rubric was used to analyze each image. Points are given for technical aspects of the image. The staff survey was used to ensure the staff did not feel the education measures were punitive. Analysis: Post intervention, 59 lateral knee images were surveyed. A second staff satisfaction survey was provided and analyzed.

#### RESULTS

Post intervention, 90% of the lateral knee radiographs surveyed scored 11 points or more. Lateral knee images scoring more than 11 points had an increase of 28%. The survey of job satisfaction initially scored an average of 50%. The post intervention survey scored an average of 73%. In addition, lateral knee examination times were reduced by 15.9 minutes per month due to a decrease in repeat radiographs.\*Discussion Continuous education for technologists is critical for maintaining image quality. The score of the post intervention staff satisfaction survey proved that the techs were appreciative of the education and desired to improve the image quality for their patients.

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## Abstract Archives of the RSNA, 2023

R5A-QI-7

### Minimising Claustrophobia and Scanxiety in Radiology

#### Participants

Kenneth Jacob, Oxford, United Kingdom (*Presenter*) Nothing to Disclose

#### METHODS

Total scanning time can be reduced by customising scan parameters according to the need of the patients, balancing the quality vs time. Position of the patient in the scanner also plays a key role in reducing claustrophobia. In some cases feet first is a more preferred position for claustrophobic patients. If the patient prefers the eye mask and headphones with relaxing music also helps calm patients with claustrophobia and helps them tolerate a scan.

#### RESULTS

Our analysis indicates up to a 50% reduction in the number of abandoned MRI scans since the introduction of new technology. We assess this as occurring across the period of time that wider bores and faster scans were introduced.\*Discussion Many studies conducted show that patients with claustrophobic anxiety are more likely to be frightened and experience a feeling of confinement or being closed in during imaging (BMC Med Imaging 2011 Feb).A Research study at our site is underway to test a virtual tour of the PET-CT procedure and environment to reduce anxiety in claustrophobic patients. Wider bore scanners reduce claustrophobia to a limit however training patients prior to a scan is the most successful method, which could also be done using VR headset under testing which could enable the patient to experience the whole procedure in a safe and immersive way before the real scan and potentially help utilise the scanner and staff time more efficiently. If this is successful in PET then we can test this in the MRI environment.

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## **Abstract Archives of the RSNA, 2023**

R5A-QI-8HC

**Ebbinghaus Forgetting Curve Based on OBE Theory Application to Clinical Practice in Imaging Technology**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5A-QI-9HC

### **Fake It Till You Make It-Preparing Radiology Residents to Manage Contrast Reactions Using High-Fidelity Simulation**

#### **Participants**

Anna Menezes, MBBS, Bangalore, India (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

R5B-QI

### Quality Improvement Reports Thursday Poster Discussions II

#### Sub-Events

#### **R5B-QI-1 A Novel Contrast extravasation intake form To Foster Standardized Data Collection and Quality Improvement**

##### **METHODS**

Review current reporting system - Safety Net, and identify shortages of reporting system to 1) create standardized and mandatory data collecting system; 2) reduce data input time; 3) better track risk factors; 4) facilitate future data retrieval, analysis quality improvement; 5) improve patient care safety.

##### **RESULTS**

Feedback from circulating novel input form: 1) Data/information being collected: satisfactory 2) Mostly quick-input process 3) Risk factor collection: thorough inclusive 4) Educational intake form 5) Informative form\* Discussion Quality improvement activities include: 1) Frequent small improvement efforts conducted in close association with the management front-line technicians, as well as spreadsheet design constant improvement 2) Dedicated improvement projects: To identify potential risk factors reduce contrast extravasation rate. 3) Regular follow-up 4) Frequent visit to the CT/MRI scan room 5) Forming a project team 6) Project Leader 7) Project Coach

#### **R5B-QI-10HC Implementation and Assessment of a Novel Online Cardiac MRI Anatomy Atlas: A Quality Improvement Project in Cardiac Radiology Trainee Education**

#### **R5B-QI-2 Machine learning for identification of acute adverse reactions to iodinated contrast media using routine clinical and laboratory data in cancer patients**

##### Participants

Qiong Li, Guangzhou, China (*Presenter*) Nothing to Disclose

##### **METHODS**

Between January 2019 to December 2021, a total of 208035 cancer patients who underwent ICM administration were enrolled from our hospital. Their demographic information, clinical and laboratory data, CT scan protocol and AARs of iodinated contrast media were collected. Several machine learning methods were performed to construct the prediction model. We also used feature selection and analysis techniques to identify risk factors that predict occurrence of AAR.

##### **RESULTS**

Among 208035 cancer patients who underwent ICM administration, the overall prevalence of AARs was 0.205%. A CatBoost model was more accurate than other machine learning models, with an AUC of 0.959, a sensitivity of 0.929. Several variables significantly associated with AARs were history of hypersensitivity reaction to ICM, iopromide, immunotherapy, excessive MRI enhancement scan, and younger age.\* Discussion A large number of radiological examinations, mainly contrast-enhanced CT scans, are conducted worldwide each year, especially in cancer patients. A machine-learning model was more accurate for predict the occurrence of AARs associated with iodinated contrast media, which can offer useful guidance to clinicians and patients for individually adjuvant therapy. This result indicates that radiologists need to pay greater attention to a patient's cancer history, especially with regard to current antineoplastic treatments.

#### **R5B-QI-3 Improving on-time starts for pediatric cardiac magnetic resonance imaging (cMRI)**

##### **METHODS**

A multidisciplinary team from Cardiac and Radiology Services utilized a local version of the Stanford RITE improvement methodology to target several process improvements to patient flow. We focused on understanding our current state by enhancing data visualization to easily identify where delays were occurring. Two key causes of delay were late outpatient arrival and variations in patient prep timing for anesthesia patients. Families were surveyed to identify reasons for late arrivals, which led to a standard script for pre-visit calls with detailed instructions for traffic, parking, and registration location. A patient-ready time stamp was utilized for anesthesia patients to better coordinate patient prep activities and timely induction. Finally, process mapping demonstrated a rework pattern that required a complete redesign of the scheduling and protocolling process steps. A new workflow that allows protocolling before scheduling has been developed and is currently in the testing phase.

##### **RESULTS**

Defining performance and visualizing it in a meaningful way created a slight Hawthorne effect with an increase in on-time starts from 10% to 21% during our current state analysis. Timing of standard script implementation right before Thanksgiving and through the winter holidays impacted our measurable improvement with significantly lower volumes. We attribute the "rebound" in January to the continued use of the script as well as the efforts to improve anesthesia patient prep times. Shared situational awareness of patient flow time points, equipment readiness, and efforts by the sedation team to orchestrate IV placement, physical examination, and the consent process brought our on-time starts to 34% by the end of the program.\* Discussion There was value in using a

systematic team approach to understanding and solving this problem. Team members were unaware of what the process looked like to our patients because they only knew their small piece of the larger workflow. Team members Gemba walked all areas of the process to gain perspective, build engagement, and facilitate teamwork. Areas of focus initially centered on low-effort interventions because redesigning the scheduling and protocolling steps of the process required more time and outside resources than expected. We anticipate this much-needed change will have a dramatic effect on our metric when we are able to go live.

#### **R5B-QI-4 Imaging Stewardship: Defining STAT exams in the Cardiac Intensive Care Unit**

##### **METHODS**

The team included clinicians from the Cardiac Intensive Care unit and Radiology. The Quality improvement approach used was Realizing Improvement through Team Empowerment (RITE) process improvement program. The program guides teams through didactic education and practical application of quality improvement tools. The tools used included a process map to understand the workflow. Gemba walks to see how the work is done and factors that contributed to the problem. The data collected was used to create fishbone diagrams and Pareto charts to quantify key causes of the problem. From that information the top key drivers for improvement were identified and included the need for technologist to have a consistent workflow, and the need for closed loop communications between clinicians and technologists. One of the most impactful communication interventions was the creation of the Clinical criteria for STAT priority exams. That and other interventions were tested using small test of change, Plan-Do-Study-Act cycles. Improvement was measured by quantifying the time from notice of exam need to the time of exam completion.

##### **RESULTS**

Using RITE methodology helped the team to decrease the turn-around time for STAT portable exams from a median of 24 minutes to a median of 15 minutes by the end of the six-month program. The key interventions that lead to this improvement were changing the notification from a phone call to a secure chat notification which allowed the Technologist to better triage STAT request. Also, development of the clinical criteria list decreased the number of STAT requests to those of the highest clinical priority.\*Discussion Development of a shared understanding between the Cardiac ICU and Radiology as to what makes an exam STAT and how we best communicate that to illicit a timely response was crucial. Using a systematic, team-based approach to improvement contributed to the success by improving communication between the two departments. Subsequently, the key interventions have been spread to the neonatal intensive care unit and improved data analysis methods of current performance are underway.

#### **R5B-QI-5 Teach The Mentor: A six week intensive program universally improves mentorship skills among a diverse group of faculty**

##### **Participants**

Hannah Milch, MD, (*Presenter*) Nothing to Disclose

##### **METHODS**

Faculty were recruited to participate in a mentorship course aimed at improving the pool of high quality mentors in the radiology department. Selection of participants focused on creating a balanced group with diverse backgrounds and levels of experience. The course curriculum was adopted from established predicates and was developed for clinician scientists, with prior proven success. Participants met weekly for two hours over 6 weeks in an informal and confidential setting. Participants completed a 19 question survey about mentorship skills before the first session (pre-test) and within one week following the last session (post-test). Respondents rated their mentorship skills based on a Likert scale ranging from 1 (not at all skilled) to 7 (highly skilled). Paired t-tests were performed to assess differences in mean responses.

##### **RESULTS**

Eleven faculty completed the course and their survey response rate was 100%. The group was gender balanced (six women and five men) and at varying career stages (4 Professors, 2 Associate Professors, and 5 Assistant Professors). Mean score for each of the 19 survey questions significantly increased on the post-test by an average of 2.22 points, from 3.78-6.00 ( $p < 0.001$ ). Scores demonstrated high reliability across all questions (Cronbach's alpha of 0.96). For 18 of the 19 questions there was no significant difference in score improvement between Professors and Associate/Assistant Professors. For a single question (Question 10: Working with trainees to set research goals), Professors demonstrated less improvement compared to Associate/Assistant Professors (mean score difference of 1 versus 3,  $p = 0.014$ ).\*Discussion By discussing provocative mentorship dilemmas in a confidential small group of peers, radiology faculty with all levels of experience reported a large improvement in mentorship skills after just six weekly sessions. Strengthening faculty mentorship through an in-person case-based course may help narrow gender and race disparities in radiology, improve departmental collegiality, and lead to greater overall job satisfaction and academic success.

#### **R5B-QI-6 Reimagining a Virtual Radiology QI Structured Problem Solving Program**

##### **Participants**

Amin Etemad, MBA, Stanford, CA (*Presenter*) Nothing to Disclose

##### **METHODS**

Opportunities for improvement were gathered by program managers through 1:1 interviews and surveys directed at stakeholders, which included modality leaders, department education leaders, operational leaders, and prior resident and staff participants. Based on the feedback, the following interventions were successfully implemented: 1. Modifying the program frequency to 3 cohorts per year, with cohorts lasting approximately 14 weeks. 2. Implemented virtual check-ins for project leaders, stakeholders, and program leaders. 3. Developing an "idea repository" for potential improvement projects. 4. Utilizing a committee of faculty division performance leaders to vet and approve project ideas submitted by trainees.

##### **RESULTS**

Following our QI efforts, participation increased from an average of 1.5 project proposals per cohort submitted at baseline after the COVID pandemic began to 4.5 proposals per cohort. The program included two multi-departmental projects: breast surgery partnered with mammography to reduce the number of unnecessary phone calls regarding specimen imaging questions, and orthopedic surgery partnered with diagnostic x-ray to reduce the number of incorrect orders being placed by referring providers. Resident participation in operations-led projects increased 65% since FY2021.\*Discussion Sustaining an intra-departmental project-based improvement program during and after the COVID pandemic required rethinking the fundamental aspects of program, with the goal of maintaining the outcomes of increasing improvement capability within the department and providing a structured venue for problem solving. Through stakeholder feedback, the program management team implemented changes that have allowed the

program to continue to serve as a valuable resource for the department, despite pandemic and post-pandemic related challenges.

### **R5B-QI-7 From Exclusion to Inclusion: Embracing Gender Diversity in Radiology Reports**

Participants

Waqas Ahmad I, MBBS, Vancouver, BC (*Presenter*) Nothing to Disclose

#### **METHODS**

A survey was conducted among radiologists across the hospital. It was designed to assess radiologists' attitudes towards gender-neutral language and their current practices in using it in their reports. The survey was administered online and consisted of three sections: demographics, attitudes towards gender-neutral language, and current practices. Age, gender, and practice setting, importance of gender-neutral language, familiarity with the concept, and potential barriers to implementation and current use of gender-neutral language in reports and whether they had received any training or guidance on the topic were included in the survey.

#### **RESULTS**

A total of 50 radiologists completed the survey. Regarding attitudes towards gender-neutral language, 85% of respondents believed it was important to use such language in radiology reports, while 15% did not think it was necessary. However, only 30% of respondents were familiar with the concept of gender-neutral language, indicating a need for further education on the topic. In terms of current practices, only 2% of respondents reported using gender-neutral language in their radiology reports. Among those who did not use gender-neutral language, the most common reason cited was a lack of guidance or training on the topic. Interestingly, gender did not appear to have a significant impact on whether radiologists used gender-neutral language in their reports. \*Discussion Many radiologists believe that gender-neutral language is important, there is still a lack of familiarity and implementation of such language in practice. There is need for education and training on the topic to promote more widespread adoption of gender-neutral language in radiology reports. Implementing gender-neutral language in radiology reports is the complexity of the medical terminology itself. Radiologists may be hesitant to adopt unfamiliar terms and may require additional resources and support to do so effectively. Despite challenges, it is crucial to promote the use of gender-neutral language in radiology reports to promote inclusivity and respect for all patients, regardless of gender identity. Radiologists can help create a more welcoming and equitable healthcare environment.

### **R5B-QI-8 Improving Radiologist Interpretation Confidence for Appendix Ultrasound through Standardized Performance and Reporting**

Participants

Harpreet Grewal, MD, Pensacola, FL (*Presenter*) Nothing to Disclose

#### **METHODS**

This project was performed in a combined adult and children's hospital in a suburban setting with two other affiliated FSEDs. A nationally standardized pediatric appendix ultrasound protocol, sonographer worksheet and reporting template were implemented after offering live training to all sonographers and radiologists in September 2021. In March of 2022 a 2-hour virtual training with CME was mandated for all reading radiologists and all sonographers. We tracked utilization of each component over time, additional imaging post-appendix ultrasound, length of stay, diagnostic accuracy and certainty of report impression defined as: positive for appendicitis, negative for appendicitis, equivocal (conflicting US findings), or merely descriptive. Seven radiologists (five pediatric and two body imagers) retrospectively reviewed the data from before live training (n=61), after live training (n= 159) and after virtual mandated training (n=63) for 285 patients requiring undergoing appendix ultrasound between December 2020 and June 2022.

#### **RESULTS**

Patients ranged in age from 1-70 years with a mean of 10.2 years for the before-training group, 13.6 years for the after-live training group and 11.9 years for the after-virtual training group. Fifteen-minute mean scan times were the same in all groups. There was a significant decrease in both descriptive and equivocal impressions following training (graph 1). Length of stay was not significantly different between the three groups, 15.5 hours before training, 38.8 hours after live training and 16.1 hours after mandatory training. There were 2 false positive cases before training, none after live training and one after virtual training. There was one false negative study in each of the groups. There was a 74 percent decrease in descriptive interpretations. \*Discussion While there was a 74 percent decrease in descriptive US impressions, we did not see any significant change in length of stay or post-appendix ultrasound imaging utilization in our care setting during this time frame. Limitations include undefined impact of Covid 19 pandemic on healthcare utilization and other variable.

### **R5B-QI-9HC Comparison of shielding effectiveness using microorganisms in X-ray diagnostic factors for shielding materials**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

R5B-QI-1

### A Novel Contrast extravasation intake form To Foster Standardized Data Collection and Quality Improvement

#### **METHODS**

Review current reporting system - Safety Net, and identify shortages of reporting system to 1) create standardized and mandatory data collecting system; 2) reduce data input time; 3) better track risk factors; 4) facilitate future data retrieval, analysis quality improvement; 5) improve patient care safety.

#### **RESULTS**

Feedback from circulating novel input form: 1) Data/information being collected: satisfactory 2) Mostly quick-input process 3) Risk factor collection: thorough inclusive 4) Educational intake form 5) Informative form\* Discussion Quality improvement activities include: 1) Frequent small improvement efforts conducted in close association with the management front-line technicians, as well as spreadsheet design constant improvement 2) Dedicated improvement projects: To identify potential risk factors reduce contrast extravasation rate. 3) Regular follow-up 4) Frequent visit to the CT/MRI scan room 5) Forming a project team 6) Project Leader 7) Project Coach

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## **Abstract Archives of the RSNA, 2023**

R5B-QI-10HC

**Implementation and Assessment of a Novel Online Cardiac MRI Anatomy Atlas: A Quality Improvement Project in Cardiac Radiology Trainee Education**

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## Abstract Archives of the RSNA, 2023

R5B-QI-2

### Machine learning for identification of acute adverse reactions to iodinated contrast media using routine clinical and laboratory data in cancer patients

#### Participants

Qiong Li, Guangzhou, China (*Presenter*) Nothing to Disclose

#### METHODS

Between January 2019 to December 2021, a total of 208035 cancer patients who underwent ICM administration were enrolled from our hospital. Their demographic information, clinical and laboratory data, CT scan protocol and AARs of iodinated contrast media were collected. Several machine learning methods were performed to construct the prediction model, We also used feature selection and analysis techniques to identify risk factors that predict occurrence of AAR.

#### RESULTS

Among 208035 cancer patients who underwent ICM administration, the overall prevalence of AARs was 0.205%. A CatBoost model was more accurate than other machine learning models, with an AUC of 0.959 , a sensitivity of 0.929. Several variates significantly associated with AARs were history of hypersensitivity reaction to ICM, iopromide , immunotherapy, excessive MRI enhancement scan, and younger age.\*Discussion A large number of radiological examinations, mainly contrast-enhanced CT scans, are conducted worldwide each year, especially in cancer patients. A machine-learning model was more accurate for predict the occurrence of AARs associated with iodinated contrast media, which can offer useful guidance to clinicians and patients for individually adjuvant therapy. This result indicates that radiologists need to pay greater attention to a patient's cancer history, especially with ragard to current antineoplastic treatments.

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## Abstract Archives of the RSNA, 2023

R5B-QI-3

### Improving on-time starts for pediatric cardiac magnetic resonance imaging (cMRI)

#### METHODS

A multidisciplinary team from Cardiac and Radiology Services utilized a local version of the Stanford RITE improvement methodology to target several process improvements to patient flow. We focused on understanding our current state by enhancing data visualization to easily identify where delays were occurring. Two key causes of delay were late outpatient arrival and variations in patient prep timing for anesthesia patients. Families were surveyed to identify reasons for late arrivals, which led to a standard script for pre-visit calls with detailed instructions for traffic, parking, and registration location. A patient-ready time stamp was utilized for anesthesia patients to better coordinate patient prep activities and timely induction. Finally, process mapping demonstrated a rework pattern that required a complete redesign of the scheduling and protocolling process steps. A new workflow that allows protocolling before scheduling has been developed and is currently in the testing phase.

#### RESULTS

Defining performance and visualizing it in a meaningful way created a slight Hawthorne effect with an increase in on-time starts from 10% to 21% during our current state analysis. Timing of standard script implementation right before Thanksgiving and through the winter holidays impacted our measurable improvement with significantly lower volumes. We attribute the "rebound" in January to the continued use of the script as well as the efforts to improve anesthesia patient prep times. Shared situational awareness of patient flow time points, equipment readiness, and efforts by the sedation team to orchestrate IV placement, physical examination, and the consent process brought our on-time starts to 34% by the end of the program.\*Discussion There was value in using a systematic team approach to understanding and solving this problem. Team members were unaware of what the process looked like to our patients because they only knew their small piece of the larger workflow. Team members Gemba walked all areas of the process to gain perspective, build engagement, and facilitate teamwork. Areas of focus initially centered on low-effort interventions because redesigning the scheduling and protocolling steps of the process required more time and outside resources than expected. We anticipate this much-needed change will have a dramatic effect on our metric when we are able to go live.

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## Abstract Archives of the RSNA, 2023

R5B-QI-4

### Imaging Stewardship: Defining STAT exams in the Cardiac Intensive Care Unit

#### METHODS

The team included clinicians from the Cardiac Intensive Care unit and Radiology. The Quality improvement approach used was Realizing Improvement through Team Empowerment (RITE) process improvement program. The program guides teams through didactic education and practical application of quality improvement tools. The tools used included a process map to understand the workflow. Gemba walks to see how the work is done and factors that contributed to the problem. The data collected was used to create fishbone diagrams and Pareto charts to quantify key causes of the problem. From that information the top key drivers for improvement were identified and included the need for technologist to have a consistent workflow, and the need for closed loop communications between clinicians and technologists. One of the most impactful communication interventions was the creation of the Clinical criteria for STAT priority exams. That and other interventions were tested using small test of change, Plan-Do-Study-Act cycles. Improvement was measured by quantifying the time from notice of exam need to the time of exam completion.

#### RESULTS

Using RITE methodology helped the team to decrease the turn-a-round time for STAT portable exams from a median of 24 minutes to a median of 15 minutes by the end of the six-month program. The key interventions that lead to this improvement were changing the notification from a phone call to a secure chat notification which allowed the Technologist to better triage STAT request. Also, development of the clinical criteria list decreased the number of STAT requests to those of the highest clinical priority.\*Discussion Development of a shared understanding between the Cardiac ICU and Radiology as to what makes an exam STAT and how we best communicate that to illicit a timely response was crucial. Using a systematic, team-based approach to improvement contributed to the success by improving communication between the two departments. Subsequently, the key interventions have been spread to the neonatal intensive care unit and improved data analysis methods of current performance are underway.

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## Abstract Archives of the RSNA, 2023

R5B-QI-5

### Teach The Mentor: A six week intensive program universally improves mentorship skills among a diverse group of faculty

#### Participants

Hannah Milch, MD, (Presenter) Nothing to Disclose

#### METHODS

Faculty were recruited to participate in a mentorship course aimed at improving the pool of high quality mentors in the radiology department. Selection of participants focused on creating a balanced group with diverse backgrounds and levels of experience. The course curriculum was adopted from established predicates and was developed for clinician scientists, with prior proven success. Participants met weekly for two hours over 6 weeks in an informal and confidential setting. Participants completed a 19 question survey about mentorship skills before the first session (pre-test) and within one week following the last session (post-test). Respondents rated their mentorship skills based on a Likert scale ranging from 1 (not at all skilled) to 7 (highly skilled). Paired t-tests were performed to assess differences in mean responses.

#### RESULTS

Eleven faculty completed the course and their survey response rate was 100%. The group was gender balanced (six women and five men) and at varying career stages (4 Professors, 2 Associate Professors, and 5 Assistant Professors). Mean score for each of the 19 survey questions significantly increased on the post-test by an average of 2.22 points, from 3.78-6.00 ( $p < 0.001$ ). Scores demonstrated high reliability across all questions (Cronbach's alpha of 0.96). For 18 of the 19 questions there was no significant difference in score improvement between Professors and Associate/Assistant Professors. For a single question (Question 10: Working with trainees to set research goals), Professors demonstrated less improvement compared to Associate/Assistant Professors (mean score difference of 1 versus 3,  $p = 0.014$ ). \*Discussion By discussing provocative mentorship dilemmas in a confidential small group of peers, radiology faculty with all levels of experience reported a large improvement in mentorship skills after just six weekly sessions. Strengthening faculty mentorship through an in-person case-based course may help narrow gender and race disparities in radiology, improve departmental collegiality, and lead to greater overall job satisfaction and academic success.

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## Abstract Archives of the RSNA, 2023

R5B-QI-6

### Reimagining a Virtual Radiology QI Structured Problem Solving Program

#### Participants

Amin Etemad, MBA, Stanford, CA (*Presenter*) Nothing to Disclose

#### METHODS

Opportunities for improvement were gathered by program managers through 1:1 interviews and surveys directed at stakeholders, which included modality leaders, department education leaders, operational leaders, and prior resident and staff participants. Based on the feedback, the following interventions were successfully implemented: 1. Modifying the program frequency to 3 cohorts per year, with cohorts lasting approximately 14 weeks. 2. Implemented virtual check-ins for project leaders, stakeholders, and program leaders. 3. Developing an "idea repository" for potential improvement projects. 4. Utilizing a committee of faculty division performance leaders to vet and approve project ideas submitted by trainees.

#### RESULTS

Following our QI efforts, participation increased from an average of 1.5 project proposals per cohort submitted at baseline after the COVID pandemic began to 4.5 proposals per cohort. The program included two multi-departmental projects: breast surgery partnered with mammography to reduce the number of unnecessary phone calls regarding specimen imaging questions, and orthopedic surgery partnered with diagnostic x-ray to reduce the number of incorrect orders being placed by referring providers. Resident participation in operations-led projects increased 65% since FY2021.\*Discussion Sustaining an intra-departmental project-based improvement program during and after the COVID pandemic required rethinking the fundamental aspects of program, with the goal of maintaining the outcomes of increasing improvement capability within the department and providing a structured venue for problem solving. Through stakeholder feedback, the program management team implemented changes that have allowed the program to continue to serve as a valuable resource for the department, despite pandemic and post-pandemic related challenges.

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## Abstract Archives of the RSNA, 2023

R5B-QI-7

### From Exclusion to Inclusion: Embracing Gender Diversity in Radiology Reports

#### Participants

Waqas Ahmad I, MBBS, Vancouver, BC (*Presenter*) Nothing to Disclose

#### METHODS

A survey was conducted among radiologists across the hospital. It was designed to assess radiologists' attitudes towards gender-neutral language and their current practices in using it in their reports. The survey was administered online and consisted of three sections: demographics, attitudes towards gender-neutral language, and current practices. Age, gender, and practice setting, importance of gender-neutral language, familiarity with the concept, and potential barriers to implementation and current use of gender-neutral language in reports and whether they had received any training or guidance on the topic were included in the survey.

#### RESULTS

A total of 50 radiologists completed the survey. Regarding attitudes towards gender-neutral language, 85% of respondents believed it was important to use such language in radiology reports, while 15% did not think it was necessary. However, only 30% of respondents were familiar with the concept of gender-neutral language, indicating a need for further education on the topic. In terms of current practices, only 2% of respondents reported using gender-neutral language in their radiology reports. Among those who did not use gender-neutral language, the most common reason cited was a lack of guidance or training on the topic. Interestingly, gender did not appear to have a significant impact on whether radiologists used gender-neutral language in their reports. \*Discussion Many radiologists believe that gender-neutral language is important, there is still a lack of familiarity and implementation of such language in practice. There is need for education and training on the topic to promote more widespread adoption of gender-neutral language in radiology reports. Implementing gender-neutral language in radiology reports is the complexity of the medical terminology itself. Radiologists may be hesitant to adopt unfamiliar terms and may require additional resources and support to do so effectively. Despite challenges, it is crucial to promote the use of gender-neutral language in radiology reports to promote inclusivity and respect for all patients, regardless of gender identity. Radiologists can help create a more welcoming and equitable healthcare environment.

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## Abstract Archives of the RSNA, 2023

R5B-QI-8

### Improving Radiologist Interpretation Confidence for Appendix Ultrasound through Standardized Performance and Reporting

#### Participants

Harpreet Grewal, MD, Pensacola, FL (*Presenter*) Nothing to Disclose

#### METHODS

This project was performed in a combined adult and children's hospital in a suburban setting with two other affiliated FSEDs. A nationally standardized pediatric appendix ultrasound protocol, sonographer worksheet and reporting template were implemented after offering live training to all sonographers and radiologists in September 2021. In March of 2022 a 2-hour virtual training with CME was mandated for all reading radiologists and all sonographers. We tracked utilization of each component over time, additional imaging post-appendix ultrasound, length of stay, diagnostic accuracy and certainty of report impression defined as: positive for appendicitis, negative for appendicitis, equivocal (conflicting US findings), or merely descriptive. Seven radiologists (five pediatric and two body imagers) retrospectively reviewed the data from before live training (n=61), after live training (n= 159) and after virtual mandated training (n=63) for 285 patients requiring undergoing appendix ultrasound between December 2020 and June 2022.

#### RESULTS

Patients ranged in age from 1-70 years with a mean of 10.2 years for the before-training group, 13.6 years for the after-live training group and 11.9 years for the after-virtual training group. Fifteen-minute mean scan times were the same in all groups. There was a significant decrease in both descriptive and equivocal impressions following training (graph 1). Length of stay was not significantly different between the three groups, 15.5 hours before training, 38.8 hours after live training and 16.1 hours after mandatory training. There were 2 false positive cases before training, none after live training and one after virtual training. There was one false negative study in each of the groups. There was a 74 percent decrease in descriptive interpretations.\*Discussion While there was a 74 percent decrease in descriptive US impressions, we did not see any significant change in length of stay or post-appendix ultrasound imaging utilization in our care setting during this time frame. Limitations include undefined impact of Covid 19 pandemic on healthcare utilization and other variable.

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## **Abstract Archives of the RSNA, 2023**

R5B-QI-9HC

**Comparison of shielding effectiveness using microorganisms in X-ray diagnostic factors for shielding materials**

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## Abstract Archives of the RSNA, 2023

S3A-QI

### Quality Improvement Reports Sunday Poster Discussions I

#### Sub-Events

#### **S3A-QI-1 Community Centered Process Mapping to Identify Breast Cancer Screening Barriers**

##### Participants

Arissa Milton, BS, Madison, WI (*Presenter*) Nothing to Disclose

##### **METHODS**

To develop the community centered process map, we included participants from the Wisconsin Network for Research Support (WINRS) Community Advisory on Research Design and Strategies (CARDS). CARDS participants are recruited from community centers and food banks that serve individuals from diverse racial, socioeconomic, and educational backgrounds. A community-centered process map describing the screening mammography process was developed from the lived experiences, concerns, and storytelling of community advisory group members. Patients, clinicians, and academic researchers were involved in the map development using structured quality improvement guidelines. After development of the process map, structured brainstorming exercises were conducted to facilitate divergent thinking. Barriers and potential solutions were identified by CARDS participants and categorized. Four 90-minute group meetings were held between May and September 2022. Members were compensated for their time and participation. All sessions were audio-recorded and transcribed verbatim by HIPAA-trained transcribers to prepare for analysis.

##### **RESULTS**

Community advisory focus group was composed of 22 adults from low-income neighborhoods in Madison, including 17 African Americans and 1 Latinx member. Community centered process mapping led to the creation of a mammography screening timeline (Figure 1). Steps in the mammography screening timeline included: 1) due for mammogram 2) schedule and prepare for mammogram 3) transportation to the breast center 4) check-in and waiting area 5) complete mammogram exam 6) results 7) billing. Top barriers (cited 6 times or more) were 1) pain/ discomfort 2) cost/coverage 3) fear/anxiety 4) lack of information/ unfamiliarity. Top solutions (cited 7 times or more) were 1) relationships, reassurance and safe or comforting physicians 2) reminders 3) more information 4) free/ low-cost mammograms.\*Discussion Community centered process maps can be used to create step by step breakdowns of the mammographic screening process. Multiple barriers and potential solutions were identified to improve access and adherence to mammography screening. Future studies will use structured quality improvement methods to test the impact of these potential interventions on improving mammography screening percentages.

#### **S3A-QI-2 The Impact of Online Self-Scheduling Platform Optimization on Patient Directed Access to Screening Mammography Appointments During the COVID-19 Pandemic**

##### Participants

Megan Kalambo, MD, Missouri City, TX (*Presenter*) Nothing to Disclose

##### **METHODS**

A retrospective review of online SM scheduling utilization between October 1, 2019, and December 31, 2022 was performed. The electronic health record (EHR) was queried to extract the total number of SMs performed, online scheduling, rescheduling and cancellation rates during the busiest screening mammography months of October through December in 2019 and 2022.

##### **RESULTS**

October to December online SM scheduling patient activity rose from 57 to 1481 patients when comparing 2019 and 2022 performance, representing a 26-fold increase in online platform utilization after EHR-tethered scheduling integration ( $p=0.013$ ). This resulted in a concurrent 16x fold reduction in patient access specialist SM scheduling engagement. Concurrently, SM scheduling automation resulted in increases in appointment rescheduling and cancellation rates, from 14% to 22% ( $p=0.005$ ) and 18% to 38% ( $p=0.000$ ), respectively.\*Discussion Optimization of our online self-scheduling platform with EHR integration resulted in a 26-fold increase in online self-scheduling patient utilization and a 16x fold reduction in DI-PAS hands on SM scheduling engagement. The rates of OSS patient appointment rescheduling and cancellation also increased but the overall net gain in self-scheduling automation should not deter continued use and implementation of this program.

#### **S3A-QI-3 Let It Shine! 5S + Safety: A Biopsy Training Equipment Quality Improvement Example**

##### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

##### **METHODS**

Utilizing the concepts of sort, set in order, shine, standardize, and sustain, the 5S project was undertaken. First, the stakeholders were identified and included in the process. A plan of action was devised, and a location was identified to consolidate the biopsy training material. Facilities workers were involved in the process since moving furniture was a necessary step. A cabinet was organized with biopsy probes, guide wires, wireless localizers, and commercial and institution-created breast phantoms. The sharps were decluttered and disposed of properly. Only the required biopsy probes and needles were maintained. Finally, a plan to sustain

the organized cabinet was devised. This included communicating to nurses and technologists not to dump sharps in the training area unless requested by the lead radiologists involved in the project.

## RESULTS

Before and after photographs documented the 5S project, labeled cabinets make it easy to identify the materials needed by trainees.\*Discussion Messines and clutter lead to mistakes and present a safety hazard. Therefore, a 6th S (safety) is often included in the 5S projects to decrease or eliminate risk. The success of a 5S depends on communication, standardization, and general cleanliness. The process included proper quantities of biopsy probes for training and eliminating unnecessary items. We keep only what is needed on hand, and those items are consolidated into one location accessible to the point of use. We also relied on visual labeling to make finding what is needed efficient. 5S involves SORT - throw away items that are not used, adjust the quantity to keep on hand only what is required, SET IN ORDER - even when the residents are unfamiliar with the space, they can find what they need. This is achieved by using labels/colors, arranging by frequency of use, and grouping like items together. SHINE - like it is new! That way, people feel comfortable in the environment (another safety item- mental health). STANDARDIZE - a regular cleaning schedule and audit are performed, and communication with our technologists not to dump expired or unused probes in the biopsy training cabinet has been vital to keeping the system going. SUSTAIN - ensure that everything is maintained by creating a plan and making 5S part of the culture. And the 6th S: SAFETY - in our example, numerous sharps hazards were decluttered and organized to create a safe environment.

### S3A-QI-4 Taking Time for Timing Out: An Improvement Initiative for Time-out Documentation

#### Participants

Kerry L. Thomas, MD, Chapel Hill, NC (*Presenter*) Stockholder, Medtronic plc;Stockholder, UnitedHealth Group;Stockholder, Amgen Inc;Stockholder, AbbVie Inc

## METHODS

A random audit time out documentation for procedures completed in the 3 months before intervention documented 61% compliance. Key stakeholder (physicians, nurses, technologists) focus group discussions were held to evaluate how different team members understood the required time-out processes. These discussions exposed barriers to adherence, including lack of nursing support or real time access to the EMR for documentation, no standard wording for dictated procedural reports, and no specific education of necessary components of the time out process. Several interventions were introduced to address barriers. A standardized time-out process was created and attending physicians were designated as the individual responsible for initiating the time out. Education on the standard process was provided to faculty and trainees as well as to technologist and nurse supervisors, who disseminated this material to their respective units. Computers with real time EMR access were placed in the procedure area. A dictation template was also created for facile inclusion to the procedural report. We performed monthly audits to assess compliance, with a goal of 100% compliance.

## RESULTS

Monthly auditing revealed successful response to interventions. Rate of documented time out completion increased from m 61% to 97% month following intervention. Improvement was sustained over the following months, reaching 100% at 5 months. Approximately 6 months after the interventions began, a status update was disseminated to the relevant stakeholders, which also served as a reminder for continued compliance.\*Discussion Our objective was to improve adherence to The Universal Protocol to reduce the risk of wrong site/wrong patient procedures in diagnostic radiology. Compliance after intervention was at or nearly at goal. Because multiple interventions were introduced simultaneously, it is difficult to discern which had greatest impact, which interventions worked synergistically, or if any were ineffective. It would be ideal to directly quantify the effect of this initiative on patient, but because wrong site/patient procedures are infrequent, this would rely on "near miss" documentation, which was unavailable.

### S3A-QI-5 Reducing Turnaround Time For Routine Neurology Inpatient MRIs to Improve Length of Stay

## METHODS

We developed a "demand signal" in the EMR to signify which inpatients could be discharged within 24 hours of receiving the imaging results back. The demand signal would help technologist and radiologists prioritize orders of these inpatients ahead of other routine inpatient studies. The target was to reduce turnaround time for routine Neuro inpatient and observation patients between MRI ordered, MRI performed, and results dictated for these patients. Our study excluded MRIs ordered for septic and obstetric patients. We measured the use of the demand signal from March 2022 through August 2022, annualized the results and compared to the baseline metrics from May 2020 through May 2021.

## RESULTS

Initial pilot data demonstrates over 50% of patients selected "pending discharge" were discharged in less than 24 hours and 70% were discharged within 48 hours. The average time reduction between scan ordered and scan begin, scan end to dictation, and dictation to discharge were all significantly reduced ( $p < 0.001$ ). The annualized data analysis shows that demand signal patients were associated with 300 inpatient days and 34.5 observation days less compared to controls, with variance annualized savings of \$170,595. The demand signal was used consistently across all campuses of our health system (Figure 5).\*Discussion Implementing the demand signal was associated with significant impact on LOS and reduced health care costs. This has other secondary effects such as reducing ED holds by opening bed faster, especially when systems are seeing record patient volumes. Next steps include identifying similar opportunities and scaling the demand signal to inpatients undergoing other imaging exams such as CT and ultrasound with the goal of achieving a larger impact for the health system.

### S3A-QI-6 Reducing Redundant Imaging Orders using a Targeted Best Practice Advisory

## METHODS

We developed a targeted best practice advisory (BPA) to alert ordering physicians of an existing CTA that had been completed within seven days and would likely address the diagnostic need. The BPA provided a live link bringing the provider directly to the existing CTA report. We measured the use of the BPA over a one-year period and calculated the BPA effectiveness . Our data was compared to a one-year control period. A BPA is considered effective with a minimum score of 35-40%. We determined the total labor cost per MRA head and MRA neck that can be utilized to estimate the potential reduction of cost.

## RESULTS

Control Period (n=100) BPA Score 100% (100/100) BPA Score 50-70% (50/70) BPA Score 35-40% (35/40) BPA Score 10-20% (10/20) BPA Score 0-10% (0/10)

Over a one-year period, the neuro BPA fired 247 times. For all BPA fires, 58.7% of orders were completely cancelled and 10.5% of orders were changed to a different study. Only 30.8% of original orders were performed. This resulted in a potential maximal direct financial impact of \$42,834 in one year based on total average cost per MRA. The data analysis shows the percentage of MRA studies performed on inpatients with recent CTA studies decreased from 5.8% to 3.01% ( $p < 0.009$ ). The calculated neuro MRA BPA effectiveness rate is 58.7%, which is well above the standard and even further above the average effectiveness rates of other physician-based BPAs in the Health System (=10%).\*Discussion The implementation of the BPA had a significant impact on reducing redundant MRA head/neck studies. A three-month pre and post BPA implementation analysis demonstrated significant reduction in reducing MRAs performed within seven days of a completed CTA ( $p=0.009$ ). The data shows that our highly targeted "non-nuisance" BPA achieved the intended impact and next steps include identifying other similar opportunities in the system.

### **S3A-QI-7 Trends in the Proportion of Female Presenters, Keynote Speakers and Award Recipients at the Radiology Society of North America Conferences from 2013 till 2019**

#### **METHODS**

Design, settings and participants This is a cross sectional study aiming at determining the gender of presenters, keynote speakers and award recipients at the RSNA conferences of the years 2013, 2015, 2017 and 2019. The validated genderize.io tool was used to find the gender of the radiologists. Main outcomes and measures Evaluate the trend over the years of the percentage of women presenting in educational versus scientific sessions, during the second day of the conference versus the last day and in conventional radiology versus interventional radiology.

#### **RESULTS**

Four RSNA conferences were evaluated for the years 2013, 2015, 2017 and 2019 with a total of 2049 presenters between scientific and educational sessions, 115 keynote speakers and 2225 award recipients. The proportion of female presenters significantly increased from 2013 to 2017 ( $p=0.001$ ). However women are still less represented with a maximum of female presenters of 35.9% reached for the year 2017. For keynote speakers and for awards recipients, the trends of female representation is not statistically significant, and women continue to be underrepresented reaching a maximum of 33.3% of keynote speakers in 2013 and around 35% for award recipients for the different years. The proportion of female presenting educational sessions significantly increased ( $p=0.01$ ) from 2013 (20.5%) to reach 40.6% in 2017. The proportion of female presenting scientific sessions also significantly increased ( $p=0.04$ ) from 2013 (26%) to 2015 (36.2%). It slightly dropped in 2017 to reach 32.5% and slightly increased again in 2019 to 33.9%. The proportion of women presenting for conventional radiology (34.8%) is significantly higher than those for interventional radiology (18.6%) in all years ( $p < 0.0001$ ). We found no significant change between day 2 and Day 7 in the proportion of females and males \*Discussion The proportion of female presenters increased over the years at the RSNA conferences, however women continue to be underrepresented as presenters in medical conferences. This disparity is noted for the radiology specialty in general and especially in the field of interventional radiology.

### **S3A-QI-8HC Radiology Reported Incidental Nodules: Improving Outcomes in Thoracic Oncology Service Line Through Data Mining**

#### Participants

William Mayfield, MD, Marietta, GA (Presenter) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

S3A-QI-1

### Community Centered Process Mapping to Identify Breast Cancer Screening Barriers

#### Participants

Arissa Milton, BS, Madison, WI (*Presenter*) Nothing to Disclose

#### METHODS

To develop the community centered process map, we included participants from the Wisconsin Network for Research Support (WINRS) Community Advisory on Research Design and Strategies (CARDS). CARDS participants are recruited from community centers and food banks that serve individuals from diverse racial, socioeconomic, and educational backgrounds. A community-centered process map describing the screening mammography process was developed from the lived experiences, concerns, and storytelling of community advisory group members. Patients, clinicians, and academic researchers were involved in the map development using structured quality improvement guidelines. After development of the process map, structured brainstorming exercises were conducted to facilitate divergent thinking. Barriers and potential solutions were identified by CARDS participants and categorized. Four 90-minute group meetings were held between May and September 2022. Members were compensated for their time and participation. All sessions were audio- recorded and transcribed verbatim by HIPAA-trained transcribers to prepare for analysis.

#### RESULTS

Community advisory focus group was composed of 22 adults from low-income neighborhoods in Madison, including 17 African Americans and 1 Latinx member. Community centered process mapping led to the creation of a mammography screening timeline (Figure 1). Steps in the mammography screening timeline included: 1) due for mammogram 2) schedule and prepare for mammogram 3) transportation to the breast center 4) check-in and waiting area 5) complete mammogram exam 6) results 7) billing. Top barriers (cited 6 times or more) were 1) pain/ discomfort 2) cost/coverage 3) fear/anxiety 4) lack of information/ unfamiliarity. Top solutions (cited 7 times or more) were 1) relationships, reassurance and safe or comforting physicians 2) reminders 3) more information 4) free/ low-cost mammograms.\*Discussion Community centered process maps can be used to create step by step breakdowns of the mammographic screening process. Multiple barriers and potential solutions were identified to improve access and adherence to mammography screening. Future studies will use structured quality improvement methods to test the impact of these potential interventions on improving mammography screening percentages.

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## Abstract Archives of the RSNA, 2023

S3A-QI-2

### The Impact of Online Self-Scheduling Platform Optimization on Patient Directed Access to Screening Mammography Appointments During the COVID-19 Pandemic

#### Participants

Megan Kalambo, MD, Missouri City, TX (*Presenter*) Nothing to Disclose

#### METHODS

A retrospective review of online SM scheduling utilization between October 1, 2019, and December 31, 2022 was performed. The electronic health record (EHR) was queried to extract the total number of SMs performed, online scheduling, rescheduling and cancellation rates during the busiest screening mammography months of October through December in 2019 and 2022.

#### RESULTS

October to December online SM scheduling patient activity rose from 57 to 1481 patients when comparing 2019 and 2022 performance, representing a 26-fold increase in online platform utilization after EHR-tethered scheduling integration ( $p=0.013$ ). This resulted in a concurrent 16x fold reduction in patient access specialist SM scheduling engagement. Concurrently, SM scheduling automation resulted in increases in appointment rescheduling and cancellation rates, from 14% to 22% ( $p=0.005$ ) and 18% to 38% ( $p=0.000$ ), respectively. \*Discussion Optimization of our online self-scheduling platform with EHR integration resulted in a 26-fold increase in online self-scheduling patient utilization and a 16x fold reduction in DI-PAS hands on SM scheduling engagement. The rates of OSS patient appointment rescheduling and cancellation also increased but the overall net gain in self-scheduling automation should not deter continued use and implementation of this program.

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## Abstract Archives of the RSNA, 2023

S3A-QI-3

### Let It Shine! 5S + Safety: A Biopsy Training Equipment Quality Improvement Example

#### Participants

Haydee Ojeda-Fournier, MD, San Diego, CA (*Presenter*) Research Consultant, View Point Medical, Inc; Stock options, CureMetrix, Inc

#### METHODS

Utilizing the concepts of sort, set in order, shine, standardize, and sustain, the 5S project was undertaken. First, the stakeholders were identified and included in the process. A plan of action was devised, and a location was identified to consolidate the biopsy training material. Facilities workers were involved in the process since moving furniture was a necessary step. A cabinet was organized with biopsy probes, guide wires, wireless localizers, and commercial and institution-created breast phantoms. The sharps were decluttered and disposed of properly. Only the required biopsy probes and needles were maintained. Finally, a plan to sustain the organized cabinet was devised. This included communicating to nurses and technologists not to dump sharps in the training area unless requested by the lead radiologists involved in the project.

#### RESULTS

Before and after photographs documented the 5S project, labeled cabinets make it easy to identify the materials needed by trainees. \*Discussion Messines and clutter lead to mistakes and present a safety hazard. Therefore, a 6th S (safety) is often included in the 5S projects to decrease or eliminate risk. The success of a 5S depends on communication, standardization, and general cleanliness. The process included proper quantities of biopsy probes for training and eliminating unnecessary items. We keep only what is needed on hand, and those items are consolidated into one location accessible to the point of use. We also relied on visual labeling to make finding what is needed efficient. 5S involves SORT - throw away items that are not used, adjust the quantity to keep on hand only what is required, SET IN ORDER - even when the residents are unfamiliar with the space, they can find what they need. This is achieved by using labels/colors, arranging by frequency of use, and grouping like items together. SHINE - like it is new! That way, people feel comfortable in the environment (another safety item- mental health). STANDARDIZE - a regular cleaning schedule and audit are performed, and communication with our technologists not to dump expired or unused probes in the biopsy training cabinet has been vital to keeping the system going. SUSTAIN - ensure that everything is maintained by creating a plan and making 5S part of the culture. And the 6th S: SAFETY - in our example, numerous sharps hazards were decluttered and organized to create a safe environment.

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## Abstract Archives of the RSNA, 2023

S3A-QI-4

### Taking Time for Timing Out: An Improvement Initiative for Time-out Documentation

#### Participants

Kerry L. Thomas, MD, Chapel Hill, NC (*Presenter*) Stockholder, Medtronic plc; Stockholder, UnitedHealth Group; Stockholder, Amgen Inc; Stockholder, AbbVie Inc

#### METHODS

A random audit time out documentation for procedures completed in the 3 months before intervention documented 61% compliance. Key stakeholder (physicians, nurses, technologists) focus group discussions were held to evaluate how different team members understood the required time-out processes. These discussions exposed barriers to adherence, including lack of nursing support or real time access to the EMR for documentation, no standard wording for dictated procedural reports, and no specific education of necessary components of the time out process. Several interventions were introduced to address barriers. A standardized time-out process was created and attending physicians were designated as the individual responsible for initiating the time out. Education on the standard process was provided to faculty and trainees as well as to technologist and nurse supervisors, who disseminated this material to their respective units. Computers with real time EMR access were placed in the procedure area. A dictation template was also created for facile inclusion to the procedural report. We performed monthly audits to assess compliance, with a goal of 100% compliance.

#### RESULTS

Monthly auditing revealed successful response to interventions. Rate of documented time out completion increased from 61% to 97% month following intervention. Improvement was sustained over the following months, reaching 100% at 5 months. Approximately 6 months after the interventions began, a status update was disseminated to the relevant stakeholders, which also served as a reminder for continued compliance.\*Discussion Our objective was to improve adherence to The Universal Protocol to reduce the risk of wrong site/wrong patient procedures in diagnostic radiology. Compliance after intervention was at or nearly at goal. Because multiple interventions were introduced simultaneously, it is difficult to discern which had greatest impact, which interventions worked synergistically, or if any were ineffective. It would be ideal to directly quantify the effect of this initiative on patient, but because wrong site/patient procedures are infrequent, this would rely on "near miss" documentation, which was unavailable.

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## Abstract Archives of the RSNA, 2023

S3A-QI-5

### Reducing Turnaround Time For Routine Neurology Inpatient MRIs to Improve Length of Stay

#### METHODS

We developed a "demand signal" in the EMR to signify which inpatients could be discharged within 24 hours of receiving the imaging results back. The demand signal would help technologist and radiologists prioritize orders of these inpatients ahead of other routine inpatient studies. The target was to reduce turnaround time for routine Neuro inpatient and observation patients between MRI ordered, MRI performed, and results dictated for these patients. Our study excluded MRIs ordered for septic and obstetric patients. We measured the use of the demand signal from March 2022 through August 2022, annualized the results and compared to the baseline metrics from May 2020 through May 2021.

#### RESULTS

Initial pilot data demonstrates over 50% of patients selected "pending discharge" were discharged in less than 24 hours and 70% were discharged within 48 hours. The average time reduction between scan ordered and scan begin, scan end to dictation, and dictation to discharge were all significantly reduced ( $p < 0.001$ ). The annualized data analysis shows that demand signal patients were associated with 300 inpatient days and 34.5 observation days less compared to controls, with variance annualized savings of \$170,595. The demand signal was used consistently across all campuses of our health system (Figure 5). \*Discussion Implementing the demand signal was associated with significant impact on LOS and reduced health care costs. This has other secondary effects such as reducing ED holds by opening bed faster, especially when systems are seeing record patient volumes. Next steps include identifying similar opportunities and scaling the demand signal to inpatients undergoing other imaging exams such as CT and ultrasound with the goal of achieving a larger impact for the health system.

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## Abstract Archives of the RSNA, 2023

S3A-QI-6

### Reducing Redundant Imaging Orders using a Targeted Best Practice Advisory

#### METHODS

We developed a targeted best practice advisory (BPA) to alert ordering physicians of an existing CTA that had been completed within seven days and would likely address the diagnostic need. The BPA provided a live link bringing the provider directly to the existing CTA report. We measured the use of the BPA over a one-year period and calculated the BPA effectiveness. Our data was compared to a one-year control period. A BPA is considered effective with a minimum score of 35-40%. We determined the total labor cost per MRA head and MRA neck that can be utilized to estimate the potential reduction of cost.

#### RESULTS

Over a one-year period, the neuro BPA fired 247 times. For all BPA fires, 58.7% of orders were completely cancelled and 10.5% of orders were changed to a different study. Only 30.8% of original orders were performed. This resulted in a potential maximal direct financial impact of \$42,834 in one year based on total average cost per MRA. The data analysis shows the percentage of MRA studies performed on inpatients with recent CTA studies decreased from 5.8% to 3.01% ( $p < 0.009$ ). The calculated neuro MRA BPA effectiveness rate is 58.7%, which is well above the standard and even further above the average effectiveness rates of other physician-based BPAs in the Health System (=10%).\*Discussion The implementation of the BPA had a significant impact on reducing redundant MRA head/neck studies. A three-month pre and post BPA implementation analysis demonstrated significant reduction in reducing MRAs performed within seven days of a completed CTA ( $p=0.009$ ). The data shows that our highly targeted "non- nuisance" BPA achieved the intended impact and next steps include identifying other similar opportunities in the system.

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## Abstract Archives of the RSNA, 2023

S3A-QI-7

### Trends in the Proportion of Female Presenters, Keynote Speakers and Award Recipients at the Radiology Society of North America Conferences from 2013 till 2019

#### METHODS

**Design, settings and participants** This is a cross sectional study aiming at determining the gender of presenters, keynote speakers and award recipients at the RSNA conferences of the years 2013, 2015, 2017 and 2019. The validated genderize.io tool was used to find the gender of the radiologists. **Main outcomes and measures** Evaluate the trend over the years of the percentage of women presenting in educational versus scientific sessions, during the second day of the conference versus the last day and in conventional radiology versus interventional radiology.

#### RESULTS

Four RSNA conferences were evaluated for the years 2013, 2015, 2017 and 2019 with a total of 2049 presenters between scientific and educational sessions, 115 keynote speakers and 2225 award recipients. The proportion of female presenters significantly increased from 2013 to 2017 ( $p=0.001$ ). However women are still less represented with a maximum of female presenters of 35.9% reached for the year 2017. For keynote speakers and for awards recipients, the trends of female representation is not statistically significant, and women continue to be underrepresented reaching a maximum of 33.3% of keynote speakers in 2013 and around 35% for award recipients for the different years. The proportion of female presenting educational sessions significantly increased ( $p=0.01$ ) from 2013 (20.5%) to reach 40.6% in 2017. The proportion of female presenting scientific sessions also significantly increased ( $p=0.04$ ) from 2013 (26%) to 2015 (36.2%). It slightly dropped in 2017 to reach 32,5% and slightly increased again in 2019 to 33.9%. The proportion of women presenting for conventional radiology (34.8%) is significantly higher than those for interventional radiology (18.6%) in all years ( $p<0.0001$ ). We found no significant change between day 2 and Day 7 in the proportion of females and males \*Discussion The proportion of female presenters increased over the years at the RSNA conferences, however women continue to be underrepresented as presenters in medical conferences. This disparity is noted for the radiology specialty in general and especially in the field of interventional radiology.

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## Abstract Archives of the RSNA, 2023

S3A-QI-8HC

### **Radiology Reported Incidental Nodules: Improving Outcomes in Thoracic Oncology Service Line Through Data Mining**

#### **Participants**

William Mayfield, MD, Marietta, GA (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

S3B-QI

### Quality Improvement Reports Sunday Poster Discussions II

#### Sub-Events

#### S3B-QI-1 A New Peer Learning Tool - Concepts, Iterative Improvement, and Scaling Up

##### Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

##### METHODS

**Context and Intervention:** This tool was developed in free-standing pediatric hospital with academic affiliation. A peer learning program was established for the neuroradiology group in 2021 and was scaled up to include pediatric body imaging in January 2023. There was no budget for this intervention.

##### RESULTS

**The Intervention:** We developed a PL tool using an existing research database tool (REDCap®) and set-up a workflow between existing members of our team, such a physician PL leader(s), radiologists, administrative assistants, and film library staff (Figure 1). A team approach was used to design and iteratively refine the PL tool. **Concepts:** Case submission: submit a wide variety of learning and improvement opportunities such as discrepancies, interesting cases, great catch, issues related to protocols, communication etc). **Clinical care:** accountability for providing appropriate clinical care lies with the radiologist submitting a case. **PL Conference preparation:** radiologists indicate whether the case is worth discussing in the PL conference. **PL Conference:** Each conference is recorded and can be viewed asynchronously. **Anonymized case review in PACS.** Program targets: case submissions per month per faculty and 50% attendance of PL sessions. **ACR Annual Reporting:** The database tool tracks case submissions per faculty per month. **PL Conference attendance** tracked by an administrative assistant. **Iterative Improvements:** most impactful was blinding who submitted a case in the feedback document that is sent to the original reviewer. **Scaling Up:** The tool was tested in the neuroradiology section for 1 year, then reviewed by the general pediatric imaging group, and adopted in January 2023. **Analysis:** For the neuroradiology faculty, there have been 147 case submissions in 2022, which represents a monthly submission average of 12 cases. After the final modification to the tool, blinding who submitted a case in the feedback document that is sent to the original reviewer, the monthly case submission average for this group in 2023 has increased to 29 cases. **Summary:** We used existing resources to build a PL tool as part of a PL process which facilitates clinical accountability, fosters individual and group learning through feedback and discussion, and meets the requirements for ACR accreditation under the PL pathway. **\*Discussion** We are working with OPPE to define qualitative/quantitative data stewardship for The Joint Commission reporting, and delineate the radiology process for monitoring radiologist competency/performance.

#### S3B-QI-2 Pre-appointment Texting for Screening Breast Exams- Impact on Reducing Patient No Shows and Improving Exam Completion

##### Participants

Jay K. Pahade, MD, Southport, IL (*Presenter*) Consultant, General Electric Company; Consultant, Clario Medical Imaging, Inc;

##### METHODS

A retrospective analysis was completed assessing same day cancellation / no show rate and number of screening or diagnostic breast imaging exams completed at our tertiary care center (5 independent locations) for 3 months prior (5/1 - 7/31/22) and 3 months after (9/1 - 11/30/22) the communication program was launched on 8/20/22. Chi square analysis was performed to assess change in rates. Breast biopsy procedures and breast MRI were excluded.

##### RESULTS

After launching the pre-appointment communication program, the mean no show/same day cancel rate for breast exams significantly declined from 13% to 6% (54% relative reduction,  $p < 0.001$ ). Overall response rate from patients was 49% (19103 reminders sent, 9435 responses). Most reminders were sent via text (14386/19103, 75%) and response rate with texting (59%) was greater than IVR (21%). Most reminders were in English (94% English, 6% Spanish). Of those that responded, 3% (290/9435) canceled their appointment electronically through the program. **\*Discussion** Creation of a pre-appointment communication program for screening breast imaging exams which incorporates exam reminders, exam preparation information, and way finding can significantly decrease (54% relative reduction) no show / same day cancel rates thereby reducing missed care opportunities for a critical important cancer detection program spearheaded by Radiology. Patient engagement with the messaging was high (49% overall response rate) with texting eliciting more patient responses compared to IVR.

#### S3B-QI-3 5-year Quality Improvement in Radiology Specialty Training At a UK Tertiary Cardiothoracic Centre

##### Participants

Monika Radike, MD, PhD, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

##### METHODS

To study the problem and intervene timely, simultaneous methods were applied: 1.A local post-placement feedback survey created; 2.Placement reorganisation: rotas revised based on training goals and Consultant-led clinical sessions with added hands-on cardiac

imaging training; pre-placement info and reading emailed; Journal Club start; pre-scheduled Consultant- /Radiographer-led teaching sessions; formal trainee encouragement for audit and academic activities; trainee study room optimisation; Consultants encouraged to train in supervision with protected time; a departmental education portal created; public publication board with trainees' academic output. 3.Unpaid Visiting Fellowships from 2018; 4.Salaried Clinical Fellowships from 2019. Alongside the project, the following were addressed: a)radiologists and radiographers recruited, b)regular departmental audit days scheduled. Regional ranking was monitored (available 2017-2019). Local feedback survey was distributed (2017-2022) and analysed (descriptive statistics).

## RESULTS

The site regionally ranked 9/19 in 2 years. 55 obtained local survey responses showed continuous improvement; cardiothoracic subspecialty interest increased after (37%) and before (23%) the placement; audit/academic project involvement increased (+36%). 14 Visiting and 6.5 1-year Clinical Fellowships completed. Consultant number increased (5 to 11), 8/11 trained as supervisors. Unintended consequences: per increased demand, compulsory posts were changed to motivation-based (2020). An additional salaried training post was offered by the deanery (2021). International externally funded Visiting Fellowships were agreed (2021). 5 Fellows were retained in the region as subspecialist consultants.\*Discussion Unexpected challenges: space and workstations (incl. trainee room) were lost/under-sourced with service expansion; no regional surveys since 2019, global pandemic. Regardless, the results were overwhelmingly positive with increase in the subspecialty interest and projected reputational effect. Local long-term survey was a sustainable data source in detecting improvement areas. Local improvement, along with rising regional ranking and reputation, showed increased national and international interest. Given the national radiologist shortage, the results show a positive impact of similar interventions including workforce retention/recruitment and thus improving patient care. Continuous feedback and QI maintenance are valuable to enhance training quality locally and beyond.

### S3B-QI-4 Improving First Case Start Times in the NORA IR Setting

Participants

Benjamin Tran, MONTGOMERY, AL (*Presenter*) Nothing to Disclose

## METHODS

A detailed table of time metrics was introduced into the perioperative workflow in January of 2023. The new workflow included time targets for the following elements: Patient arrival in registration, to pre-op time, IV placement and lab draws, CRNA assessment and MDA sign-off, Wheels in time, and Procedure start time. On time start data was collected for the 3 months prior to and 3 months following implementation (Oct 2022-March 2023). Primary metric for on time start was defined as Procedure start time for the First case of the day in all procedural rooms. All reasons for delay were categorized into Patient, Provider, or Process origins.

## RESULTS

All anesthesia-supported first start cases in our interventional radiology suite were included, totaling 124 across the study period. On-time first start percentage improved from around 34% pre-implementation to 55% post implementation, resulting from an 11-minute improvement in average procedure start time. However, the greatest on-time start percentage (~60%) was seen in the first two months after implementation, with a subsequent decrease (47%) in March. Improved on-time first starts were also coupled with an increase in room utilization (57% pre-intervention; 59% post-intervention), an increase in average monthly case count (62 pre-intervention; 69 post-intervention), and a decrease in average monthly end-of-day block overrun minutes (170 pre-intervention; 134 post-intervention).\*Discussion Development of more detailed time metrics to modify daily workflow improved overall on-time first start rate, particularly on non-Tuesdays. This improvement in efficiency and throughput results in increased room utilization, improved case throughput, and decreased block overrun times, all of which contribute toward increased revenues, decreased costs, and thus improved return on investment. Despite our successes, additional opportunities for sustained improvement remain beyond simply staff education and goal identification. Next steps include identification of barriers to each step of the delineated time table as well as a critical path analysis.

### S3B-QI-5 Design and Impact of an Imaging-Based Health Disparities Lecture in the Medical Student Radiology Curriculum

Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

## METHODS

A 45-minute teaching session was developed utilizing PowerPoint. Learning objectives focus on highlighting sources of imaging-based inequities through open-ended audience questions, clinical case examples with real imaging exams, and review of pertinent literature. In order to evaluate educational impact, pre- and post-session surveys are administered using a combination of multiple-choice questions and 5-point Likert scale questions to measure knowledge gain and improved student confidence with discussion of imaging-based disparities. The session was initially presented in March 2023, embedded in a highly subscribed introductory diagnostic radiology course in our medical school curriculum. As this new session is only recently implemented, sample size is currently low and statistical analysis is therefore not yet performed.

## RESULTS

Our session focuses on four disparity categories: (1) race, (2) social, cultural, and economic factors, (3) sexual orientation and gender identity, and (4) physical and mental disability. 11 students attended the initial learning session and completed pre-and-post surveys. For each category, students reported improved confidence in discussing examples following the lecture (Figure 1). The percentage of students selecting the correct answer on multiple-choice questions also improved for each question after completion of the teaching session.\*Discussion We developed an interactive learning session for medical students to promote understanding of potential imaging-based health care disparities and strategies to counteract them. Following the session, students felt more comfortable discussing examples of imaging-based health disparities across all four of our selected categories. Our results are limited by a low sample size. However, the session is being presented on a monthly basis; we anticipate data from approximately 100 participants as we approach the end of the calendar year. Based on the success of this initial work, the session may be expanded to our radiology resident curriculum.

### S3B-QI-6 Repurposing Radiological Data for Different Needs Using Interactive Multimedia Reporting

## METHODS

We developed an IMR system that works by recording key images and voice descriptions of radiological findings, tagging the information with metadata (i.e., anatomy, diagnosis, common data elements) from an ontology using natural language processing,

and assembling a composite multimedia report with related items linked in timelines to represent findings. Each finding is tagged with additional elements including a number indicating when it first appeared in the report, disease metrics, target lesion assignment (i.e., for use in disease response assessment such as RECIST), and user-defined labels. The ontology used to label findings includes attributes indicating to which physiological category a particular anatomical location belongs and common data elements to provide details about each diagnosis. The combination of tags/labels assigned to each radiological finding enables them to be dynamically sorted and displayed to meet the needs of different users, including arranging findings by an anatomical hierarchy to mimic a conventional report, sorting findings by physiological categories for use by clinical specialists, grouping findings by TNM (tumor, nodes, metastasis) to facilitate disease staging, or sorting findings by disease metrics or sequence of appearance in the report.

## **RESULTS**

The IMR system is in use at our institution where it supports 40 clinical trials with the purpose of performing disease response assessments. To date the system has generated 2,956 reports on 639 patients with a total of 50,563 items of information linked in timelines representing 17,157 findings. Radiologists typically use the anatomical presentation of findings when interpreting exams and linking new findings to prior reports, whereas clinicians prefer the TNM display of findings for disease staging.\*Discussion IMR represents a significant advance over conventional radiology reporting, especially as it can repurpose radiological data to meet the needs of different stakeholders. By tagging radiological findings with an array of metadata, findings can be sorted and presented in several ways, including by anatomical hierarchies, physiological groups, or TNM staging categories. IMR transforms a radiology report from a static document to a dynamic set of elements with greater utility.

### **S3B-QI-7 Strategies to get the most out of an Journal Club: our experience after ten years and more than two million visits**

Participants

Dario Herran de la Gala, MD, Santander, Spain (*Presenter*) Nothing to Disclose

## **METHODS**

Define the workflow strategies within CB SERAM. Analyze the statistics of CB SERAM since its creation (march 2013). Analyze the number of visits and the number of entries on CB SERAM's website and possible strategies for future improvement.

## **RESULTS**

A Journal Club with a peer-review based review process favors scientific writing but also constructive criticism between members. Monthly frequency of content seems to be ideal. Webinars about critical article review help members to better read scientific literature. Since its creation in 2013, the CB SERAM has had 155 reviewers from 54 different hospitals from 2 different countries (Spain and Argentina). The annual number of reviewers has grown progressively, being most notable during the COVID-19 pandemic. Web entries and published content has also increased, as well as the number of visits to our website, which now averages 4000 visits per month, mostly from the Spanish-speaking community. - The use of social network managers favors the dissemination of content.\*Discussion By participating in a journal club, members can learn about the latest research methodologies, experimental techniques, and findings in their field, as well as engage in meaningful discussions with peers about the implications of the research. This not only creates a supportive and inclusive environment but also encourages members to stay motivated and engaged in their work. The use of technology can make the journal club experience more interactive and engaging. With the help of virtual meeting platforms, members can join meetings from anywhere and discussions can take place in real-time. Keeping up-to-date with technology and social media trends is essential for journal clubs to increase their reach and appeal to medicine residents. By utilizing these tools, journal club experience can be more engaging, interactive, and accessible, ultimately improving the quality of medical education.

### **S3B-QI-8HC Leveraging Natural Language Processing Models for Improving Resident Education with Radiology Report Corrections**

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## Abstract Archives of the RSNA, 2023

S3B-QI-1

### A New Peer Learning Tool - Concepts, Iterative Improvement, and Scaling Up

#### Participants

Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

#### METHODS

**Context and Intervention:** This tool was developed in free-standing pediatric hospital with academic affiliation. A peer learning program was established for the neuroradiology group in 2021 and was scaled up to include pediatric body imaging in January 2023. There was no budget for this intervention.

#### RESULTS

**The Intervention:** We developed a PL tool using an existing research database tool (REDCap®) and set-up a workflow between existing members of our team, such a physician PL leader(s), radiologists, administrative assistants, and film library staff (Figure 1). A team approach was used to design and iteratively refine the PL tool. **Concepts:** Case submission: submit a wide variety of learning and improvement opportunities such as discrepancies, interesting cases, great catch, issues related to protocols, communication etc). **Clinical care:** accountability for providing appropriate clinical care lies with the radiologist submitting a case. **PL Conference preparation:** radiologists indicate whether the case is worth discussing in the PL conference. **PL Conference:** Each conference is recorded and can be viewed asynchronously. **Anonymized case review in PACS.** **Program targets:** case submissions per month per faculty and 50% attendance of PL sessions. **ACR Annual Reporting:** The database tool tracks case submissions per faculty per month. **PL Conference attendance** tracked by an administrative assistant. **Iterative Improvements:** most impactful was blinding who submitted a case in the feedback document that is sent to the original reviewer. **Scaling Up:** The tool was tested in the neuroradiology section for 1 year, then reviewed by the general pediatric imaging group, and adopted in January 2023. **Analysis:** For the neuroradiology faculty, there have been 147 case submissions in 2022, which represents a monthly submission average of 12 cases. After the final modification to the tool, blinding who submitted a case in the feedback document that is sent to the original reviewer, the monthly case submission average for this group in 2023 has increased to 29 cases. **Summary:** We used existing resources to build a PL tool as part of a PL process which facilitates clinical accountability, fosters individual and group learning through feedback and discussion, and meets the requirements for ACR accreditation under the PL pathway. **\*Discussion** We are working with OPPE to define qualitative/quantitative data stewardship for The Joint Commission reporting, and delineate the radiology process for monitoring radiologist competency/performance.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

S3B-QI-2

### Pre-appointment Texting for Screening Breast Exams- Impact on Reducing Patient No Shows and Improving Exam Completion

#### Participants

Jay K. Pahade, MD, Southport, IL (*Presenter*) Consultant, General Electric Company; Consultant, Clario Medical Imaging, Inc;

#### METHODS

A retrospective analysis was completed assessing same day cancelation / no show rate and number of screening or diagnostic breast imaging exams completed at our tertiary care center (5 independent locations) for 3 months prior (5/1 - 7/31/22) and 3 months after (9/1 - 11/30/22) the communication program was launched on 8/20/22. Chi square analysis was performed to assess change in rates. Breast biopsy procedures and breast MRI were excluded.

#### RESULTS

After launching the pre-appointment communication program, the mean no show/same day cancel rate for breast exams significantly declined from 13% to 6% (54% relative reduction,  $p < 0.001$ ). Overall response rate from patients was 49% (19103 reminders sent, 9435 responses). Most reminders were sent via text (14386/19103, 75%) and response rate with texting (59%) was greater than IVR (21%). Most reminders were in English (94% English, 6% Spanish). Of those that responded, 3% (290/9435) canceled their appointment electronically through the program.\*Discussion Creation of a pre-appointment communication program for screening breast imaging exams which incorporates exam reminders, exam preparation information, and way finding can significantly decrease (54% relative reduction) no show / same day cancel rates thereby reducing missed care opportunities for a critical important cancer detection program spearheaded by Radiology. Patient engagement with the messaging was high (49% overall response rate) with texting eliciting more patient responses compared to IVR .

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## Abstract Archives of the RSNA, 2023

S3B-QI-3

### 5-year Quality Improvement in Radiology Specialty Training At a UK Tertiary Cardiothoracic Centre

#### Participants

Monika Radike, MD, PhD, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

#### METHODS

To study the problem and intervene timely, simultaneous methods were applied: 1.A local post-placement feedback survey created; 2.Placement reorganisation: rotas revised based on training goals and Consultant-led clinical sessions with added hands-on cardiac imaging training; pre-placement info and reading emailed; Journal Club start; pre-scheduled Consultant- /Radiographer-led teaching sessions; formal trainee encouragement for audit and academic activities; trainee study room optimisation; Consultants encouraged to train in supervision with protected time; a departmental education portal created; public publication board with trainees' academic output. 3.Unpaid Visiting Fellowships from 2018; 4.Salaried Clinical Fellowships from 2019. Alongside the project, the following were addressed: a)radiologists and radiographers recruited, b)regular departmental audit days scheduled. Regional ranking was monitored (available 2017-2019). Local feedback survey was distributed (2017-2022) and analysed (descriptive statistics).

#### RESULTS

The site regionally ranked 9/19 in 2 years. 55 obtained local survey responses showed continuous improvement; cardiothoracic subspecialty interest increased after (37%) and before (23%) the placement; audit/academic project involvement increased (+36%). 14 Visiting and 6.5 1-year Clinical Fellowships completed. Consultant number increased (5 to 11), 8/11 trained as supervisors. Unintended consequences: per increased demand, compulsory posts were changed to motivation-based (2020). An additional salaried training post was offered by the deanery (2021). International externally funded Visiting Fellowships were agreed (2021). 5 Fellows were retained in the region as subspecialist consultants.\*Discussion Unexpected challenges: space and workstations (incl. trainee room) were lost/under-sourced with service expansion; no regional surveys since 2019, global pandemic. Regardless, the results were overwhelmingly positive with increase in the subspecialty interest and projected reputational effect. Local long-term survey was a sustainable data source in detecting improvement areas. Local improvement, along with rising regional ranking and reputation, showed increased national and international interest. Given the national radiologist shortage, the results show a positive impact of similar interventions including workforce retention/recruitment and thus improving patient care. Continuous feedback and QI maintenance are valuable to enhance training quality locally and beyond.

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## Abstract Archives of the RSNA, 2023

S3B-QI-4

### Improving First Case Start Times in the NORA IR Setting

#### Participants

Benjamin Tran, MONTGOMERY, AL (*Presenter*) Nothing to Disclose

#### METHODS

A detailed table of time metrics was introduced into the perioperative workflow in January of 2023. The new workflow included time targets for the following elements: Patient arrival in registration, to pre-op time, IV placement and lab draws, CRNA assessment and MDA sign-off, Wheels in time, and Procedure start time. On time start data was collected for the 3 months prior to and 3 months following implementation (Oct 2022-March 2023). Primary metric for on time start was defined as Procedure start time for the First case of the day in all procedural rooms. All reasons for delay were categorized into Patient, Provider, or Process origins.

#### RESULTS

All anesthesia-supported first start cases in our interventional radiology suite were included, totaling 124 across the study period. On-time first start percentage improved from around 34% pre-implementation to 55% post implementation, resulting from an 11-minute improvement in average procedure start time. However, the greatest on-time start percentage (~60%) was seen in the first two months after implementation, with a subsequent decrease (47%) in March. Improved on-time first starts were also coupled with an increase in room utilization (57% pre-intervention; 59% post-intervention), an increase in average monthly case count (62 pre-intervention; 69 post-intervention), and a decrease in average monthly end-of-day block overrun minutes (170 pre-intervention; 134 post-intervention). \*Discussion Development of more detailed time metrics to modify daily workflow improved overall on-time first start rate, particularly on non-Tuesdays. This improvement in efficiency and throughput results in increased room utilization, improved case throughput, and decreased block overrun times, all of which contribute toward increased revenues, decreased costs, and thus improved return on investment. Despite our successes, additional opportunities for sustained improvement remain beyond simply staff education and goal identification. Next steps include identification of barriers to each step of the delineated time table as well as a critical path analysis.

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## Abstract Archives of the RSNA, 2023

S3B-QI-5

### Design and Impact of an Imaging-Based Health Disparities Lecture in the Medical Student Radiology Curriculum

#### Participants

Siddhant Dogra, MD, New York, NY (*Presenter*) Nothing to Disclose

#### METHODS

A 45-minute teaching session was developed utilizing PowerPoint. Learning objectives focus on highlighting sources of imaging-based inequities through open-ended audience questions, clinical case examples with real imaging exams, and review of pertinent literature. In order to evaluate educational impact, pre- and post-session surveys are administered using a combination of multiple-choice questions and 5-point Likert scale questions to measure knowledge gain and improved student confidence with discussion of imaging-based disparities. The session was initially presented in March 2023, embedded in a highly subscribed introductory diagnostic radiology course in our medical school curriculum. As this new session is only recently implemented, sample size is currently low and statistical analysis is therefore not yet performed.

#### RESULTS

Our session focuses on four disparity categories: (1) race, (2) social, cultural, and economic factors, (3) sexual orientation and gender identity, and (4) physical and mental disability. 11 students attended the initial learning session and completed pre-and-post surveys. For each category, students reported improved confidence in discussing examples following the lecture (Figure 1). The percentage of students selecting the correct answer on multiple-choice questions also improved for each question after completion of the teaching session.\*Discussion We developed an interactive learning session for medical students to promote understanding of potential imaging-based health care disparities and strategies to counteract them. Following the session, students felt more comfortable discussing examples of imaging-based health disparities across all four of our selected categories. Our results are limited by a low sample size. However, the session is being presented on a monthly basis; we anticipate data from approximately 100 participants as we approach the end of the calendar year. Based on the success of this initial work, the session may be expanded to our radiology resident curriculum.

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## Abstract Archives of the RSNA, 2023

S3B-QI-6

### Repurposing Radiological Data for Different Needs Using Interactive Multimedia Reporting

#### METHODS

We developed an IMR system that works by recording key images and voice descriptions of radiological findings, tagging the information with metadata (i.e., anatomy, diagnosis, common data elements) from an ontology using natural language processing, and assembling a composite multimedia report with related items linked in timelines to represent findings. Each finding is tagged with additional elements including a number indicating when it first appeared in the report, disease metrics, target lesion assignment (i.e., for use in disease response assessment such as RECIST), and user-defined labels. The ontology used to label findings includes attributes indicating to which physiological category a particular anatomical location belongs and common data elements to provide details about each diagnosis. The combination of tags/labels assigned to each radiological finding enables them to be dynamically sorted and displayed to meet the needs of different users, including arranging findings by an anatomical hierarchy to mimic a conventional report, sorting findings by physiological categories for use by clinical specialists, grouping findings by TNM (tumor, nodes, metastasis) to facilitate disease staging, or sorting findings by disease metrics or sequence of appearance in the report.

#### RESULTS

The IMR system is in use at our institution where it supports 40 clinical trials with the purpose of performing disease response assessments. To date the system has generated 2,956 reports on 639 patients with a total of 50,563 items of information linked in timelines representing 17,157 findings. Radiologists typically use the anatomical presentation of findings when interpreting exams and linking new findings to prior reports, whereas clinicians prefer the TNM display of findings for disease staging.\*Discussion IMR represents a significant advance over conventional radiology reporting, especially as it can repurpose radiological data to meet the needs of different stakeholders. By tagging radiological findings with an array of metadata, findings can be sorted and presented in several ways, including by anatomical hierarchies, physiological groups, or TNM staging categories. IMR transforms a radiology report from a static document to a dynamic set of elements with greater utility.

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## Abstract Archives of the RSNA, 2023

S3B-QI-7

### Strategies to get the most out of an Journal Club: our experience after ten years and more than two million visits

#### Participants

Dario Herran de la Gala, MD, Santander, Spain (*Presenter*) Nothing to Disclose

#### METHODS

Define the workflow strategies within CB SERAM. Analyze the statistics of CB SERAM since its creation (march 2013). Analyze the number of visits and the number of entries on CB SERAM's website and possible strategies for future improvement.

#### RESULTS

A Journal Club with a peer-review based review process favors scientific writing but also constructive criticism between members. Monthly frequency of content seems to be ideal. Webinars about critical article review help members to better read scientific literature. Since its creation in 2013, the CB SERAM has had 155 reviewers from 54 different hospitals from 2 different countries (Spain and Argentina). The annual number of reviewers has grown progressively, being most notable during the COVID-19 pandemic. Web entries and published content has also increased, as well as the number of visits to our website, which now averages 4000 visits per month, mostly from the Spanish-speaking community. - The use of social network managers favors the dissemination of content.\*Discussion By participating in a journal club, members can learn about the latest research methodologies, experimental techniques, and findings in their field, as well as engage in meaningful discussions with peers about the implications of the research. This not only creates a supportive and inclusive environment but also encourages members to stay motivated and engaged in their work. The use of technology can make the journal club experience more interactive and engaging. With the help of virtual meeting platforms, members can join meetings from anywhere and discussions can take place in real-time. Keeping up-to-date with technology and social media trends is essential for journal clubs to increase their reach and appeal to medicine residents. By utilizing these tools, journal club experience can be more engaging, interactive, and accessible, ultimately improving the quality of medical education.

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## **Abstract Archives of the RSNA, 2023**

S3B-QI-8HC

**Leveraging Natural Language Processing Models for Improving Resident Education with Radiology Report Corrections**

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## Abstract Archives of the RSNA, 2023

T2-Q1

### Quality Improvement Reports Tuesday Poster Discussions

#### Sub-Events

#### **T2-QI-1 Development Of Structured Percutaneous Transhepatic Cholangial Drainage Tube Home Care Educational Curriculum For Malignant Obstructive Jaundice Patients**

#### **METHODS**

The initial framework of structured education for malignant obstructive jaundice after PTCd was revised by expert consultation. Based on the revised results, the curriculum was developed and modified to form a preliminary curriculum. The research team verified the clinical effect of the revised curriculum and completed the curriculum optimization. Then we recruited 20 patients with their main caregivers to participate in this curriculum, and have an examination (theoretical and operational) to test the understanding of this curriculum as well as its satisfaction and practicability.

#### **RESULTS**

The initial framework of structured education course for tube home care included 4 topics from 4 curriculum dimensions. Experts reached consensus on all 4 topics after consultation, and split "tube management" into 2 topics and put forward suggestions for modification, thus the optimized final version of the course identified 4 dimensions and a total of 5 topics. The scores of the theoretical test were 80-100 ( $93.90 \pm 4.07$ ), the scores of the operational test were 94-100 ( $97.40 \pm 1.53$ ). The degree of satisfaction and practicability of the course were evaluated by patients and their family members at 95% or above. \*Discussion This study successfully set up a structured education curriculum for the home care of patients after PTCd for malignant obstructive jaundice, which combined the Chinese cultural background and the characteristics of Chinese patients, and shown to be applicable under local medical, social, and cultural environment. The limitations of this study are as follows: First, the sample size is small; second, we haven't do the follow up study.

#### **T2-QI-2 Establishing Access to Obstetric Ultrasound Services in Remote Areas through a teleradiology platform for reporting**

#### **METHODS**

A 4-week curriculum was developed to train 3 midwives with no ultrasound experience. Midwives were selected from clinics at varying distances from the study centre to assess image transfer times and teleradiology system efficacy. After scanning patients, writing provisional reports and uploading these to the Philips website, radiologists were informed who then reviewed and validated the studies. Feedback was given to the midwives. Validated reports were released to the patient if no further imaging was needed. The study utilized Philips tablets, modems, computers, and a 3G network to connect the equipment. Initially, the images and reports that were uploaded to the website were not of diagnostic quality. Our challenge was to transfer lossless images which was achieved by modifying the teleradiology algorithm using a second network configured to connect the tablets to a PACS server. This allowed improved image quality for diagnosis.

#### **RESULTS**

282 ultrasound exams were performed and evaluated. Reporting accuracy was 99.63% for scans performed by midwives, confirming that the training was adequate. Data analysis also showed that no further imaging was necessary after radiologist review. Report validation took 15 minutes after scan completion. Study success was achieved with a 10-minute scan time and 35-minute maximum turnaround. No problem arose with the equipment and no difference in transmission time, or image quality deterioration occurred. \*Discussion This study was limited by small catchment area and suboptimal image quality on the website. Despite this, the sample size sufficiently powered the study. Cell phone communication between the radiologist and midwife was successful and connectivity was constant. Distance from the primary centre did not affect transmission time or image quality. Post-delivery tracing determined the final outcome for 220 patients, while 51 could not be contacted. Training midwives to perform obstetric ultrasound can help practically address the shortage of trained personnel in resource-limited countries. Collaborating with radiologists and using modern technology can be cost-effective and efficient. Future research should focus on scalability, sustainability, and long-term impact.

#### **T2-QI-3 Evaluation of Diagnostic Reference Levels and Achievable Doses for Digital Radiographic Images**

#### **METHODS**

The study utilized a Siemens DR Multix Fusion Max using the Siemens recommended PA chest protocol at 125 kVp, automatic exposure control (AEC), and 72" source to image distance (SID). The AP abdomen protocol was 81 kVp, AEC, and 40" SID. The digital detectors utilized were a PIXIIUM 4343 RCE for chest protocols and a PIXIIUM 3543 EZH for abdomen protocols. An aluminum block, 19 mm thick, and copper sheet, 1 mm thick, were used to simulate a 20 cm thick patient. Evaluation of high and low contrast resolution was performed with a Leeds Torr 18FG phantom. EAK measurements were taken with a RaySafe X2 RAD probe. Three mAs settings were used for EAK and image quality determinations, starting with the current protocol in use.

#### **RESULTS**

The initial EAK results, representing the techniques in clinical use were 0.132 mGy and 3.41 mGy for the chest and abdomen protocols respectively. The NCRP Report 172 PA Chest DRL is 0.15 mGy and AD is 0.11 mGy. The AP abdomen DRL is 3.4 mGy and



AD is 2.4 mGy. These results reveal current EAK values slightly lower than (chest) or the same (abdomen) as the referenced DRL but above the AD. The spatial resolution for the initial chest protocol technique was consistently 2.34-line pairs/mm. After reducing the mAs by 25% and 50%, the spatial resolution for the abdomen protocol reduced from 2.24 lp/mm to 2 lp/mm. Both protocols showed a reduction of low contrast detection from 1.7% to 2.2% as the EAK dropped.\*Discussion Following NCRP 172, the measured EAK values for the current clinical PA chest and AP abdomen protocols were slightly below or at the DRL, but above the AD, thus allowing further dose reduction with minimal impact on image quality. Based on the phantom image quality testing, the EAK can potentially be reduced by 25% or even 50% to be below the AD while maintaining essentially equivalent image quality. The limitations of these physics tests are that they aren't necessarily representative of real patients. The clinical image testing is ongoing with radiologist image quality evaluation. This quality improvement program is expected to also encompass lumbosacral spine EAK, DRL and AD.

## **T2-QI-4 How was My Experience? Well, Thanks for Asking!"**

Participants

Latasha Paige, MEng, RN, South Bend, IN (*Presenter*) Nothing to Disclose

### **METHODS**

The Kano Diagram technique explores 3 dimensions of customer needs along the axes of provided services and impact on customer satisfaction:1. Unspoken Basics - assumed basic services.2. Spoken Performers - articulated services seen as competitive advantages. 3. Unspoken Delighters - unexpected services that delight the customer.The Empathy Map technique gauges four dimensions of the Patient's persona:1. The observable: what the Patient:a. Does b. Says2. The non-observable: what the Patient:a. Thinksb. FeelsWe conducted 3 web-based interviews with patients who regularly experience the MRI process. We used the collaborative software LucidChart.

### **RESULTS**

1. Empathy map revealed that we are not:a. Informing patients of delays.b. Valuing Patient's time.c. Customer service oriented.d. Fixing wasteful processes.e. Addressing patients' frustrated-, annoyed-, anxious-, and overwhelmed feelings.2. Kano diagram revealed:a. Basics - wayfinding, customer service, efficient processes, and clean/organized environment.b. Performers - minimal waiting, excellent doctors, good overall experience.c. Delighters - timely results, rapport with physicians, and improving their experience.3. Technique Feedback:a. Found digital post its distracting. Asked to have conversation instead. b. Appreciative of us asking questions.c. Interested in improvements that would come from interviews.\*Discussion • Learn when and how to use the Empathy map and Kano diagram for patients as well as team members to create an improvement plan where all key stakeholders' perspectives are considered. • Learn how to respond to criticism from patients and team members. This is a skill set that for many is not developed because: oHCAHPS Press Ganey surveys do not provide the same level of personal and emotional feedback that the Kano and Empathy maps do.oHCAHPS Press Ganey also do not require direct conversations with patients and team members.

## **T2-QI-5 Patient Navigation Improves Diagnostic Imaging Timeliness Among Mammography Van Patients with BIRADS-0**

### **METHODS**

This IRB exempted study began with creating a Process Map and Driver Diagram, which identified possible barriers to timely BIRADS-0 follow-up, namely delay in patient communication, lack of patient education, and complexity of scheduling workflow. Baseline follow-up time (7/1/2021-6/30/2022) and variables including location of screening van were collected from Epic Hyperspace (Verona, WI) and internal database to validate hypotheses. Intervention on 8/16/2022 aimed to improve patient communication of abnormal results and increase scheduling ease. Patient at four pilot sites, who previously relied on local community health centers for follow-up arrangements, were instead outreach by institutional patient navigators to schedule follow-up. Outcome data (follow-up time in days) was collected for 6 months before and after the intervention and analyzed by Statistical Process Controlled (SPC) X Chart by Rule for Special Cause (QI Macro, Denver, CO). Percent of patients reached by institutional staff pre vs post intervention were collected as process data to ensure intervention's functionality.

### **RESULTS**

Baseline callback rate was 12.9% (239/1848). Mean follow-up time was 49.7 days (range = 6-345) with 62% of patients (148/239) with follow-up delay. Mean follow-up time at different van sites ranged 7-96 days. Four sites with mean follow-up time >49.7 days agreed to participate in the pilot. Six patients (3/period) were lost to follow-up and excluded. Pre intervention (2/1/2022-8/15/2022), 17% (6/35) of patients at piloted sites were contacted by patient navigators to schedule follow-up compared to 74% (23/31) post intervention (collected during 8/17/2022-2/28/2023; however, van did not service pilot sites during 2/1/2023-2/28/2023). SPC-X chart demonstrated significant (3s) downward trend in follow-up time after intervention (fig. 1), with decrease in mean follow-up time by 12.9 days (from 50.1 to 37.2) and decreased in patients with follow-up delays by 11% (from 66% to 55%).\*Discussion Patient outreach by language concordant, culturally competent, and knowledgeable navigators has potential to improve timely follow-up, a vital step in achieving equitable early cancer diagnosis. Planned future PDSA cycles include standardizing follow-up scheduling, synergizing with community health sites to streamline communication and patient education.

## **T2-QI-6 Increasing Provider Awareness and Adoption of a Health Information Exchange to Improve Patient Record Sharing and Reduce Burden of Repeat Imaging**

### **METHODS**

We performed interviews with local physicians to determine existing utilization and sentiment about the HIE. From the qualitative data collected, we partnered with physician leaders across multiple hospital and clinic systems, as well as the HIE leadership team, to increase provider awareness of the platform and promote provider registration.

### **RESULTS**

Interviews showed that providers were frustrated by not being able to access patient records from outside health systems. Examples include delays in appropriate diagnostic imaging as a result of waiting for external hospital records, providers driving to an outside hospital to request or retrieve records, and patients receiving duplicate CT or MRI scans. The majority of providers were not aware of the existence of this HIE and were surprised to find that the HIE contained patient records across the nine hospital and clinic systems in this county. Providers who were aware of the HIE noted multiple barriers to adoption, including a lengthy onboarding process and the lack of patient data from select hospitals that were part of the HIE. From this qualitative survey, we initiated efforts to increase provider awareness which resulted in the distribution of registration forms to all providers within two

health systems, with plans to begin similar efforts at other hospitals later this year.\*Discussion Studies have shown HIEs to be beneficial in driving cost savings by decreasing the need for repeat imaging and other diagnostic tests. This project highlights that the existence of a centralized HIE alone is insufficient. A successful HIE requires provider awareness and adoption, along with sufficient quality and quantity of patient data. Awareness and adoption of an HIE platform can facilitate improved information exchange and decrease the need for repeat imaging orders and diagnostics, increasing value-based decision making in a timely manner.

## **T2-QI-7 Evaluating the resident call structure in Canadian diagnostic radiology postgraduate medical education programs**

### **METHODS**

A questionnaire was distributed to the senior/chief/lead residents at each of the 16 Canadian DR residency programs. The questions pertained to: 1) Institutional information such as affiliated university and hospitals, city and catchment size, and resident body demographics; 2) Call structure including shift type, the start and end of independent call, and ability for home call/remote PACS access; 3) Call responsibilities such as modality and procedural responsibilities, preliminary report requirements, and protocoling responsibilities; 4) Call support by attendings, fellows, and technologists; 5) Preparation for call including dedicated resources and a summary of the "buddy call" system; and 5) Pre- and post-call including pre-call time off, and requirements for post-call review or performance evaluation.

### **RESULTS**

All 16 Canadian DR residency programs completed our questionnaire. The data collected reflects call structures in these programs as of December 2022. There is considerable heterogeneity across the 16 Canadian DR residency programs regarding call structure. Notably, 12 (75%) programs have call shifts that necessitate residents to work continuously for =24 hours. All programs cover CT and 15 (94%) cover ultrasound—out of the 15, eight (53%) have scanning responsibilities for residents. Nine (56%) institutions require residents dictate full reports. Although 7 (44%) programs allow remote PACS access, none allow residents to be on-call remotely. Seven (44%) programs require residents to stay post-call to review their cases with attendings in the morning.\*Discussion Independent call is a major stressor for DR residents. We hope this data can serve as a transparent and informative resource for Canadian DR residency programs to understand successful call structure strategies being implemented across the country and target areas for improvement at their home institution in the face of growing diagnostic imaging volumes and call burden nationwide. Future research directions include studying resident satisfaction after implementation of new call structure strategies.

## **T2-QI-8HC Reducing Length of Stay for Inpatients Awaiting MRI Exams**

## **T2-QI-9HC Natural Language Processing in EMR Systems: A Tool to Reduce Inappropriate Radiology Imaging and Expenditures**

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## Abstract Archives of the RSNA, 2023

T2-Q1-1

### Development Of Structured Percutaneous Transhepatic Cholangial Drainage Tube Home Care Educational Curriculum For Malignant Obstructive Jaundice Patients

#### METHODS

The initial framework of structured education for malignant obstructive jaundice after PTCB was revised by expert consultation. Based on the revised results, the curriculum was developed and modified to form a preliminary curriculum. The research team verified the clinical effect of the revised curriculum and completed the curriculum optimization. Then we recruited 20 patients with their main caregivers to participate in this curriculum, and have an examination (theoretical and operational) to test the understanding of this curriculum as well as its satisfaction and practicability.

#### RESULTS

The initial framework of structured education course for tube home care included 4 topics from 4 curriculum dimensions. Experts reached consensus on all 4 topics after consultation, and split "tube management" into 2 topics and put forward suggestions for modification, thus the optimized final version of the course identified 4 dimensions and a total of 5 topics. The scores of the theoretical test were 80-100 ( $93.90 \pm 4.07$ ), the scores of the operational test were 94-100 ( $97.40 \pm 1.53$ ). The degree of satisfaction and practicability of the course were evaluated by patients and their family members at 95% or above. \*Discussion This study successfully set up a structured education curriculum for the home care of patients after PTCB for malignant obstructive jaundice, which combined the Chinese cultural background and the characteristics of Chinese patients, and shown to be applicable under local medical, social, and cultural environment. The limitations of this study are as follows: First, the sample size is small; second, we haven't do the follow up study.

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## Abstract Archives of the RSNA, 2023

T2-QI-2

### Establishing Access to Obstetric Ultrasound Services in Remote Areas through a teleradiology platform for reporting

#### METHODS

A 4-week curriculum was developed to train 3 midwives with no ultrasound experience. Midwives were selected from clinics at varying distances from the study centre to assess image transfer times and teleradiology system efficacy. After scanning patients, writing provisional reports and uploading these to the Philips website, radiologists were informed who then reviewed and validated the studies. Feedback was given to the midwives. Validated reports were released to the patient if no further imaging was needed. The study utilized Philips tablets, modems, computers, and a 3G network to connect the equipment. Initially, the images and reports that were uploaded to the website were not of diagnostic quality. Our challenge was to transfer lossless images which was achieved by modifying the teleradiology algorithm using a second network configured to connect the tablets to a PACS server. This allowed improved image quality for diagnosis.

#### RESULTS

282 ultrasound exams were performed and evaluated. Reporting accuracy was 99.63% for scans performed by midwives, confirming that the training was adequate. Data analysis also showed that no further imaging was necessary after radiologist review. Report validation took 15 minutes after scan completion. Study success was achieved with a 10-minute scan time and 35-minute maximum turnaround. No problem arose with the equipment and no difference in transmission time, or image quality deterioration occurred.\*Discussion This study was limited by small catchment area and suboptimal image quality on the website. Despite this, the sample size sufficiently powered the study. Cell phone communication between the radiologist and midwife was successful and connectivity was constant. Distance from the primary centre did not affect transmission time or image quality. Post-delivery tracing determined the final outcome for 220 patients, while 51 could not be contacted. Training midwives to perform obstetric ultrasound can help practically address the shortage of trained personnel in resource-limited countries. Collaborating with radiologists and using modern technology can be cost-effective and efficient. Future research should focus on scalability, sustainability, and long-term impact.

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## Abstract Archives of the RSNA, 2023

T2-QI-3

### Evaluation of Diagnostic Reference Levels and Achievable Doses for Digital Radiographic Images

#### METHODS

The study utilized a Siemens DR Multix Fusion Max using the Siemens recommended PA chest protocol at 125 kVp, automatic exposure control (AEC), and 72" source to image distance (SID). The AP abdomen protocol was 81 kVp, AEC, and 40" SID. The digital detectors utilized were a PIXIUM 4343 RCE for chest protocols and a PIXIUM 3543 EZH for abdomen protocols. An aluminum blocks, 19 mm thick, and copper sheet, 1 mm thick, were used to simulate a 20 cm thick patient. Evaluation of high and low contrast resolution was performed with a Leeds Torr 18FG phantom. EAK measurements were taken with a RaySafe X2 RAD probe. Three mAs settings were used for EAK and image quality determinations, starting with the current protocol in use.

#### RESULTS

The initial EAK results, representing the techniques in clinical use were 0.132 mGy and 3.41 mGy for the chest and abdomen protocols respectively. The NCRP Report 172 PA Chest DRL is 0.15 mGy and AD is 0.11 mGy. The AP abdomen DRL is 3.4 mGy and AD is 2.4 mGy. These results reveal current EAK values slightly lower than (chest) or the same (abdomen) as the referenced DRL but above the AD. The spatial resolution for the initial chest protocol technique was consistently 2.34-line pairs/mm. After reducing the mAs by 25% and 50%, the spatial resolution for the abdomen protocol reduced from 2.24 lp/mm to 2 lp/mm. Both protocols showed a reduction of low contrast detection from 1.7% to 2.2% as the EAK dropped. \*Discussion Following NCRP 172, the measured EAK values for the current clinical PA chest and AP abdomen protocols were slightly below or at the DRL, but above the AD, thus allowing further dose reduction with minimal impact on image quality. Based on the phantom image quality testing, the EAK can potentially be reduced by 25% or even 50% to be below the AD while maintaining essentially equivalent image quality. The limitations of these physics tests are that they aren't necessarily representative of real patients. The clinical image testing is ongoing with radiologist image quality evaluation. This quality improvement program is expected to also encompass lumbosacral spine EAK, DRL and AD.

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## Abstract Archives of the RSNA, 2023

T2-QI-4

**How was My Experience? Well, Thanks for Asking!"**

### Participants

Latasha Paige, MEng, RN, South Bend, IN (*Presenter*) Nothing to Disclose

### METHODS

The Kano Diagram technique explores 3 dimensions of customer needs along the axes of provided services and impact on customer satisfaction: 1. Unspoken Basics - assumed basic services. 2. Spoken Performers - articulated services seen as competitive advantages. 3. Unspoken Delighters - unexpected services that delight the customer. The Empathy Map technique gauges four dimensions of the Patient's persona: 1. The observable: what the Patient: a. Does b. Says 2. The non-observable: what the Patient: a. Thinks b. Feels We conducted 3 web-based interviews with patients who regularly experience the MRI process. We used the collaborative software LucidChart.

### RESULTS

1. Empathy map revealed that we are not: a. Informing patients of delays. b. Valuing Patient's time. c. Customer service oriented. d. Fixing wasteful processes. e. Addressing patients' frustrated-, annoyed-, anxious-, and overwhelmed feelings. 2. Kano diagram revealed: a. Basics - wayfinding, customer service, efficient processes, and clean/organized environment. b. Performers - minimal waiting, excellent doctors, good overall experience. c. Delighters - timely results, rapport with physicians, and improving their experience. 3. Technique Feedback: a. Found digital post its distracting. Asked to have conversation instead. b. Appreciative of us asking questions. c. Interested in improvements that would come from interviews. \*Discussion • Learn when and how to use the Empathy map and Kano diagram for patients as well as team members to create an improvement plan where all key stakeholders' perspectives are considered. • Learn how to respond to criticism from patients and team members. This is a skill set that for many is not developed because: oHCAHPS Press Ganey surveys do not provide the same level of personal and emotional feedback that the Kano and Empathy maps do. oHCAHPS Press Ganey also do not require direct conversations with patients and team members.

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## Abstract Archives of the RSNA, 2023

T2-QI-5

### Patient Navigation Improves Diagnostic Imaging Timeliness Among Mammography Van Patients with BIRADS-0

#### METHODS

This IRB exempted study began with creating a Process Map and Driver Diagram, which identified possible barriers to timely BIRADS-0 follow-up, namely delay in patient communication, lack of patient education, and complexity of scheduling workflow. Baseline follow-up time (7/1/2021-6/30/2022) and variables including location of screening van were collected from Epic Hyperspace (Verona, WI) and internal database to validate hypotheses. Intervention on 8/16/2022 aimed to improve patient communication of abnormal results and increase scheduling ease. Patient at four pilot sites, who previously relied on local community health centers for follow-up arrangements, were instead outreach by institutional patient navigators to schedule follow-up. Outcome data (follow-up time in days) was collected for 6 months before and after the intervention and analyzed by Statistical Process Controlled (SPC) X Chart by Rule for Special Cause (QI Macro, Denver, CO). Percent of patients reached by institutional staff pre vs post intervention were collected as process data to ensure intervention's functionality.

#### RESULTS

Baseline callback rate was 12.9% (239/1848). Mean follow-up time was 49.7 days (range = 6-345) with 62% of patients (148/239) with follow-up delay. Mean follow-up time at different van sites ranged 7-96 days. Four sites with mean follow-up time >49.7 days agreed to participate in the pilot. Six patients (3/period) were lost to follow-up and excluded. Pre intervention (2/1/2022-8/15/2022), 17% (6/35) of patients at piloted sites were contacted by patient navigators to schedule follow-up compared to 74% (23/31) post intervention (collected during 8/17/2022-2/28/2023; however, van did not service pilot sites during 2/1/2023-2/28/2023). SPC-X chart demonstrated significant (3s) downward trend in follow-up time after intervention (fig. 1), with decrease in mean follow-up time by 12.9 days (from 50.1 to 37.2) and decreased in patients with follow-up delays by 11% (from 66% to 55%).\*Discussion Patient outreach by language concordant, culturally competent, and knowledgeable navigators has potential to improve timely follow-up, a vital step in achieving equitable early cancer diagnosis. Planned future PDSA cycles include standardizing follow-up scheduling, synergizing with community health sites to streamline communication and patient education.

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## Abstract Archives of the RSNA, 2023

T2-QI-6

### **Increasing Provider Awareness and Adoption of a Health Information Exchange to Improve Patient Record Sharing and Reduce Burden of Repeat Imaging**

#### **METHODS**

We performed interviews with local physicians to determine existing utilization and sentiment about the HIE. From the qualitative data collected, we partnered with physician leaders across multiple hospital and clinic systems, as well as the HIE leadership team, to increase provider awareness of the platform and promote provider registration.

#### **RESULTS**

Interviews showed that providers were frustrated by not being able to access patient records from outside health systems. Examples include delays in appropriate diagnostic imaging as a result of waiting for external hospital records, providers driving to an outside hospital to request or retrieve records, and patients receiving duplicate CT or MRI scans. The majority of providers were not aware of the existence of this HIE and were surprised to find that the HIE contained patient records across the nine hospital and clinic systems in this county. Providers who were aware of the HIE noted multiple barriers to adoption, including a lengthy onboarding process and the lack of patient data from select hospitals that were part of the HIE. From this qualitative survey, we initiated efforts to increase provider awareness which resulted in the distribution of registration forms to all providers within two health systems, with plans to begin similar efforts at other hospitals later this year.\*Discussion Studies have shown HIEs to be beneficial in driving cost savings by decreasing the need for repeat imaging and other diagnostic tests. This project highlights that the existence of a centralized HIE alone is insufficient. A successful HIE requires provider awareness and adoption, along with sufficient quality and quantity of patient data. Awareness and adoption of an HIE platform can facilitate improved information exchange and decrease the need for repeat imaging orders and diagnostics, increasing value-based decision making in a timely manner.

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## Abstract Archives of the RSNA, 2023

T2-QI-7

### Evaluating the resident call structure in Canadian diagnostic radiology postgraduate medical education programs

#### METHODS

A questionnaire was distributed to the senior/chief/lead residents at each of the 16 Canadian DR residency programs. The questions pertained to: 1) Institutional information such as affiliated university and hospitals, city and catchment size, and resident body demographics; 2) Call structure including shift type, the start and end of independent call, and ability for home call/remote PACS access; 3) Call responsibilities such as modality and procedural responsibilities, preliminary report requirements, and protocoling responsibilities; 4) Call support by attendings, fellows, and technologists; 5) Preparation for call including dedicated resources and a summary of the "buddy call" system; and 5) Pre- and post-call including pre-call time off, and requirements for post-call review or performance evaluation.

#### RESULTS

All 16 Canadian DR residency programs completed our questionnaire. The data collected reflects call structures in these programs as of December 2022. There is considerable heterogeneity across the 16 Canadian DR residency programs regarding call structure. Notably, 12 (75%) programs have call shifts that necessitate residents to work continuously for =24 hours. All programs cover CT and 15 (94%) cover ultrasound—out of the 15, eight (53%) have scanning responsibilities for residents. Nine (56%) institutions require residents dictate full reports. Although 7 (44%) programs allow remote PACS access, none allow residents to be on-call remotely. Seven (44%) programs require residents to stay post-call to review their cases with attendings in the morning.\*Discussion Independent call is a major stressor for DR residents. We hope this data can serve as a transparent and informative resource for Canadian DR residency programs to understand successful call structure strategies being implemented across the country and target areas for improvement at their home institution in the face of growing diagnostic imaging volumes and call burden nationwide. Future research directions include studying resident satisfaction after implementation of new call structure strategies.

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## **Abstract Archives of the RSNA, 2023**

T2-QI-8HC

**Reducing Length of Stay for Inpatients Awaiting MRI Exams**

Printed on: 04/12/24

## **Abstract Archives of the RSNA, 2023**

T2-QI-9HC

**Natural Language Processing in EMR Systems: A Tool to Reduce Inappropriate Radiology Imaging and Expenditures**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T5A-QI

### Quality Improvement Reports Tuesday Poster Discussions I

#### Sub-Events

**T5A-QI-1 Too Much Information? A clinical audit on patient access to a digital record system and discrepancies between clinical notes and radiology reports causing potential emotional harm to pediatric scoliosis patients**

#### METHODS

This study was done in the radiology department of an academic children's hospital. At our institution, pediatric scoliosis patients are followed by orthopedic surgeons where they receive a baseline radiograph, followed by serial radiographs to measure progression/ stability. A search was conducted on our local PACS system for all scoliosis radiographs from July to September 2022. The search was limited to patients < 18 years old. Post-surgical patients, curves described as "kyphosis", and studies that did not report measurements in the radiology report and/or orthopedic note were excluded. A total of 159 radiographs were reviewed. The corresponding radiology report and orthopedic clinic notes were reviewed. Patient identification numbers, ages and scoliosis measurements were recorded.

#### RESULTS

Out of 159 radiographs, 121 met inclusion criteria. In 53.7% of studies, the radiologist report and orthopedic clinic note differed by > 5 degrees. Of these 65 studies, 34 had additional differences in the vertebral levels of curves or the number of curves reported. The largest discrepancy found was 20 degrees with mean differences of 9.85, 6.79, and 13.25 for the upper, lower, and middle curves respectively.\*Discussion A large proportion of reported scoliosis radiographs differ from the corresponding orthopedic clinic note beyond the accepted standard. Even small differences in reports can induce patient anxiety and confusion particularly when measurements meet thresholds for changes in treatment. To improve patient experiences, recommendations include liaising with orthopedic surgeons to gauge patient feedback and review standard measurement protocols to improve consistency between orthopedics and radiology. Limitations of the study include its retrospective nature.

**T5A-QI-2 The Measure of Truth: Determining whether absolute values of leg lengths are incorrectly being measured and reported on pediatric teleoroentgenogram leg length studies: A clinical audit.**

#### METHODS

This study was conducted at an academic children's hospital. A search was conducted on our local PACS system for all teleoroentgenogram radiographs from April to May 2022. One hundred pediatric (age <18) lower limb teleoroentgenogram reports were reviewed. Patient identification numbers and ages were recorded. "Yes" or "No" was assigned and recorded based on whether there was inclusion of leg lengths on the report. For the studies in the "Yes" category, leg length measurements were recorded. On 4 of these teleoroentgenograms, a technologist added a ruler to confirm magnification error between the ruler measurement and the PACS system measurement tool. Results were analyzed using frequency counts.

#### RESULTS

Leg length measurements were included in 31/100 of teleoroentgenograms reports. Right leg lengths were reported in all 31 studies, whereas left leg lengths were only reported in 30 studies. There was only one case where the discrepancy was > 2 cm and therefore clinically significant. The PACS system measurement tool overestimated leg lengths by an average of 1.6 cm. The older the patient, the greater the overestimation with the highest difference being 2.2 cm.\*Discussion Absolute leg length values were included in 30% of leg length teleoroentgenogram reports. The literature has shown that teleoroentgenograms can have magnifications errors up to 5% when measuring leg lengths. While this seems insignificant, it can have implications for orthopedic management. Instead of providing absolute leg length measurements, we suggest reporting relative leg lengths; that is, the percentage difference between both legs. The goal of this would be to minimize inaccuracy in radiology reports while also including clinically relevant information. Study limitations include the small sample size. Although we preliminarily showed leg length measurement differed between teleoroentgenograms and orthoroentgenograms, further studies using a larger sample size can be performed to confirm this generally accepted notion

**T5A-QI-3 Patient Perspectives on AI Implementation in Radiology, From Generation to Generation**

#### METHODS

Surveys on AI usage in radiology were distributed to patients at an outpatient imaging center associated with an academic hospital. Survey questions provided scenarios and statements regarding AI in radiology in which the participant could pick 'Yes', 'No' or 'Neutral'. Descriptive statistics of the survey answers were calculated from total number of participants and with respect to cohorts. A Chi-square test of independence was done with each survey question to determine if a survey response had a significant association with a cohort.

#### RESULTS

Our ongoing survey has collected over 100 survey results to date, with 3% of responses from the Post-war generation, 50% from the Baby Boomer generation, 27% from Gen X, 18% from Millennial, and 2% from Gen Z. Initial results show that only 7% of all participants were not in favor of AI algorithms assisting the radiologist in daily practice (48% were in favor, 47% were neutral).

Moreover, 20% of those in favor were willing to pay extra for reports interpreted by both a radiologist and an AI algorithm, which increased to 52% if it was proven that less findings were missed with AI assistance. Only 14% are in favor of reports completely generated by AI. If there were diagnostic errors with AI implementation, 70% of participants would find the AI developer, the hospital, and the radiologist all at fault and legally liable, while only 5% would find just the radiologist at fault.\*Discussion Millennials were most aware that AI was already being used in radiology at our institution, having 55% of 'Yes' responses to the respective question. Currently, this is the only statistically significant association in our study. 60% of participants said 'Yes' to being asked if they wanted to learn more about how AI algorithms work in radiology, which did not have a significant association with a cohort. In fact, many written comments stated that the participant did not know enough about the subject to formulate a stance. These insights will aid discussions between the radiologist and patient regarding AI-incorporated imaging reports (and possibly AI generated follow-up recommendations), in outlining legal responsibilities of all parties involved, and in the design of educational material that will keep patients informed of the changing healthcare landscape.

#### **T5A-QI-4 Case-Based Intro to Radiology: Enhancing Radiology Education through an e-Learning Platform**

Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

#### **METHODS**

A "Case-Based Intro to Radiology" section with 80+ modules was developed on our departmental e-learning platform. Modules include patient history, physical findings, lab results, and guided learners through diagnosis, imaging selection, interpretation, and developing a working diagnosis, assessment, and disposition. Interactive features comprise immediate feedback, short videos, full Digital Imaging and Communications in Medicine (DICOM) image sets, learning points, and socioeconomic factors. A focus group of 20 MD, PA, PhD, and undergraduate students assessed module quality, educational content, and instructional methods through a survey. Descriptive statistics analyzed survey responses.

#### **RESULTS**

Most students agreed that the modules enhanced imaging interpretation, complemented curricula, encouraged critical thinking, and covered appropriate clinical and imaging details. They rated module quality, educational content, and videos as very good. Students preferred flipped classroom or proctored didactic approaches over traditional methods.\*Discussion The study relied on a small sample size and self-reported outcomes. More research is needed to determine the long-term impact on performance and clinical practice. The case-based e-learning platform section showed potential in improving radiology education for medical and PA students. Next steps involve integrating the platform into the PA school curriculum, completing 140 proposed cases, developing an educator and user guide, conducting external peer reviews, and performing outcome studies.

#### **T5A-QI-5 Developing an AI Model to Identify Malignancy Results on Imaging Reports to Delay Release to the Electronic Patient Portal**

Participants

Lucy Chow, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### **METHODS**

The dataset is comprised of approximately 61,000 multi-modality diagnostic imaging reports from 12/01/2022-12/31/2022, while procedure reports were excluded. Subsets from this dataset were extracted using two rule-based approaches to preprocess the training data. The first rule identified any report containing -RADS classification categories (i.e., BI-RADS), which yielded 8,345 reports. Of this set, 341 reports were identified to be withheld from immediate release based on predetermined criteria (i.e., BI-RADS=4). A second rule was applied to the remaining 53,000 reports, which identified approximately 4,500 reports that contained one of 12 malignancy-related keywords (i.e., cancer). This formed the training set for the NLP deep neural network (DNN) model, which was independently labeled by a group of 22 physician informaticists (PIs) as either 'withhold' or 'release.' Any indeterminate reports were discussed to reach consensus and develop labeling guidelines. Upon review, withholding scans demonstrating progressive malignancy became clinically necessary and rational. About 40% of the training set was reviewed, and 2,677 labeled reports were used for initial DNN model development. Subsequently, 49,318 reports generated between 01/19/2023- 02/12/2023 were analyzed for model validation.

#### **RESULTS**

In the model validation dataset, 293 reports (0.6%) contained the -RADS classification and 996 reports (2.0%) were identified from DNN, resulting in 1,289 reports (2.6%) withheld from immediate release. Preliminary results of the model performance yielded a 99.4% accuracy based on the final test set, consisting of 14,759 cases.\*Discussion The model has demonstrated promising results, and the existing IT infrastructure was leveraged to incorporate the functionality into the electronic health record. Both manual flagging by the radiologist and automated flagging by the AI algorithm will be implemented. Manually flagged reports will further train and refine the AI model's accuracy. The two methods will be compared to determine if manual flagging remains necessary for the workflow.

#### **T5A-QI-6 An Artificial Intelligence (AI) Boost to MRI Lumbar Spine Reporting**

#### **METHODS**

MRI lumbar spine studies of patients aged 18 and older performed for back pain from 1 to 10 December 2022 were randomly selected. These studies were initially read by four board-certified musculoskeletal and neuroradiologists with at least 8 years of consultant experience. Studies with instrumentation and scoliosis were excluded. The time taken to verify the radiology reports for each study was extracted from the RIS logs - this was deemed time taken without AI assistance. The DICOM data for these studies were processed by a commercial deep learning-based solution - Columbo (Smart Soft Healthcare, Bulgaria) on an AI orchestration platform (CARPL.AI, US). The AI solution segments, measures, and classifies MR images to provide suspected pathology descriptions, findings, and measurements. It then outputs annotated post-processed MRI images and an auto-generated report which is editable. These studies were randomly assigned to three final-year radiology residents who were blinded to the original finalized reports. The reporting time and corrections to the pre-populated report were logged. The time taken with and without AI assistance was documented and compared. A paired t-test was performed for the calculation of statistical significance.

#### **RESULTS**

A total of 31 MRI studies were processed. The mean interpretation time with AI assistance was significantly lower than without (8.47 ± 3.77 minutes versus 22.44 ± 10.90 minutes,  $p < 0.001$ ). The interquartile range (IQR) for interpretation time with AI

assistance was 4.78 minutes, while the IQR for interpretation time without AI assistance was 14.15 minutes. The smaller IQR indicates that the interpretation times were more consistent and less variable when radiologists used the AI-powered assistive tool. A paired t-test showed that the mean difference in interpretation times between the two groups was -13.97 minutes (95% CI: -16.66 to -11.28), which was statistically significant ( $p < 0.001$ ). Diagnostic accuracy (stenosis grading and incidental findings) was not significantly different between the two groups.\*Discussion AI assistance for MRI lumbar spine reporting resulted in a significant reduction in reporting time with equivalent diagnostic accuracy compared to experienced radiologists without AI assistance. The more objective and consistent AI evaluation also provides a more standardized report and reduces interobserver variation.

#### **T5A-QI-7 Learning styles and preferences of current generation of training radiologists: A survey analysis**

##### **METHODS**

Qualitative study was undertaken in 2022 targeting RT recent Board-certified radiologists(0-5 years experience). A questionnaire(Qn) of 10 questions consisted of understanding preferences for learning tools(LT) styles, problem solving(PS) skills, type of individual learner, preferences for teaching modules, awareness of their role in the department, preferences for exit-exam pattern was issued on social media. Each question had several choices (eg."which is most preferred mode of learning?" had responses such as textbook, teaching website(TW) etc). Each choice had a response option from least-likely to most-likely on a scale of 1to5(5 pointer Likert's scale). Of 119participants, 68were males, 50females 1 other category. Analysis of the responses was done by calculating percentage and weighted average. The association for age, gender, years of experience(YoE) practicing institute(PI) with every aspect of study Qn was assessed using Chi Square test. SPSS version 20 was used P-value lt0.05 was considered significant.

##### **RESULTS**

TW were most preferred mode of LT followed by textbooks among journals, conferences, lectures video media channels, latter being the least preferred. For PS, responders tend to prefer consulting teachers peers(60%) followed by utilising help of TW journals. In our survey, only 36% 1st RT preferred TW as compared to 81% of 4thyr RT, indicating increasing trend with increase YoE. However,63% of 4thyr. RT tend to prefer textbook among others. Majority(74%) of them consider to be visual-learners followed by logical kinaesthetic. Linguistic were only45%. However, no significant statistical difference was found for gender, YoE or PI. For preference in teaching modules, majority preferred interactive case-based discussions(CBD)(70%) followed by simulations. With increase in YoE, CBD flipped classroom(FC) were preferred. Preference for FC was significantly differed among type of PI.( $p < 0.05$ ) Statistically significant increasing trend was seen for awareness of curricular goals with gender age. In a preference for mode of exam, institutional exam(64%) was most favoured. Online exam was least preferred had no statistical difference among PI.\*Discussion Current GEN's learning styles are different from preceding GEN which relied on didactic lectures textbooks. However, they do require precise instructions, simulations mentoring. This requires consideration when framing radiology training curriculum. The limitation of study is the subjective nature of the assessment by the participants which needs to be validated by objective methods.

#### **T5A-QI-8HC Maximizing the Usefulness of limited aspirated synovial fluid samples in musculoskeletal fluoroscopy procedures: A Quality Improvement Approach for Optimal Lab Order Decision Making**

Participants

Aiah Alatoum, MBBS, Iowa City, IA (*Presenter*) Nothing to Disclose

#### **T5A-QI-9HC Standardization of incidental thyroid nodule characterization, follow-up recommendations, and patient education resources: A quality improvement project at an academic medical center**

Participants

Brandon Fields, MD, San Francisco, IL (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

T5A-QI-1

**Too Much Information? A clinical audit on patient access to a digital record system and discrepancies between clinical notes and radiology reports causing potential emotional harm to pediatric scoliosis patients**

### METHODS

This study was done in the radiology department of an academic children's hospital. At our institution, pediatric scoliosis patients are followed by orthopedic surgeons where they receive a baseline radiograph, followed by serial radiographs to measure progression/ stability. A search was conducted on our local PACS system for all scoliosis radiographs from July to September 2022. The search was limited to patients < 18 years old. Post-surgical patients, curves described as "kyphosis", and studies that did not report measurements in the radiology report and/or orthopedic note were excluded. A total of 159 radiographs were reviewed. The corresponding radiology report and orthopedic clinic notes were reviewed. Patient identification numbers, ages and scoliosis measurements were recorded.

### RESULTS

Out of 159 radiographs, 121 met inclusion criteria. In 53.7% of studies, the radiologist report and orthopedic clinic note differed by > 5 degrees. Of these 65 studies, 34 had additional differences in the vertebral levels of curves or the number of curves reported. The largest discrepancy found was 20 degrees with mean differences of 9.85, 6.79, and 13.25 for the upper, lower, and middle curves respectively.\*Discussion A large proportion of reported scoliosis radiographs differ from the corresponding orthopedic clinic note beyond the accepted standard. Even small differences in reports can induce patient anxiety and confusion particularly when measurements meet thresholds for changes in treatment. To improve patient experiences, recommendations include liaising with orthopedic surgeons to gauge patient feedback and review standard measurement protocols to improve consistency between orthopedics and radiology. Limitations of the study include its retrospective nature.

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## Abstract Archives of the RSNA, 2023

T5A-QI-2

**The Measure of Truth: Determining whether absolute values of leg lengths are incorrectly being measured and reported on pediatric teleoroentgenogram leg length studies: A clinical audit.**

### **METHODS**

This study was conducted at an academic children's hospital. A search was conducted on our local PACS system for all teleoroentgenogram radiographs from April to May 2022. One hundred pediatric (age <18) lower limb teleoroentgenogram reports were reviewed. Patient identification numbers and ages were recorded. "Yes" or "No" was assigned and recorded based on whether there was inclusion of leg lengths on the report. For the studies in the "Yes" category, leg length measurements were recorded. On 4 of these teleoroentgenograms, a technologist added a ruler to confirm magnification error between the ruler measurement and the PACS system measurement tool. Results were analyzed using frequency counts.

### **RESULTS**

Leg length measurements were included in 31/100 of teleoroentgenograms reports. Right leg lengths were reported in all 31 studies, whereas left leg lengths were only reported in 30 studies. There was only one case where the discrepancy was > 2 cm and therefore clinically significant. The PACS system measurement tool overestimated leg lengths by an average of 1.6 cm. The older the patient, the greater the overestimation with the highest difference being 2.2 cm.\*Discussion Absolute leg length values were included in 30% of leg length teleoroentgenogram reports. The literature has shown that teleoroentgenograms can have magnification errors up to 5% when measuring leg lengths. While this seems insignificant, it can have implications for orthopedic management. Instead of providing absolute leg length measurements, we suggest reporting relative leg lengths; that is, the percentage difference between both legs. The goal of this would be to minimize inaccuracy in radiology reports while also including clinically relevant information. Study limitations include the small sample size. Although we preliminarily showed leg length measurement differed between teleoroentgenograms and orthoroentgenograms, further studies using a larger sample size can be performed to confirm this generally accepted notion

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## Abstract Archives of the RSNA, 2023

T5A-QI-3

### Patient Perspectives on AI Implementation in Radiology, From Generation to Generation

#### METHODS

Surveys on AI usage in radiology were distributed to patients at an outpatient imaging center associated with an academic hospital. Survey questions provided scenarios and statements regarding AI in radiology in which the participant could pick 'Yes', 'No' or 'Neutral'. Descriptive statistics of the survey answers were calculated from total number of participants and with respect to cohorts. A Chi-square test of independence was done with each survey question to determine if a survey response had a significant association with a cohort.

#### RESULTS

Our ongoing survey has collected over 100 survey results to date, with 3% of responses from the Post-war generation, 50% from the Baby Boomer generation, 27% from Gen X, 18% from Millennial, and 2% from Gen Z. Initial results show that only 7% of all participants were not in favor of AI algorithms assisting the radiologist in daily practice (48% were in favor, 47% were neutral). Moreover, 20% of those in favor were willing to pay extra for reports interpreted by both a radiologist and an AI algorithm, which increased to 52% if it was proven that less findings were missed with AI assistance. Only 14% are in favor of reports completely generated by AI. If there were diagnostic errors with AI implementation, 70% of participants would find the AI developer, the hospital, and the radiologist all at fault and legally liable, while only 5% would find just the radiologist at fault.\*Discussion Millennials were most aware that AI was already being used in radiology at our institution, having 55% of 'Yes' responses to the respective question. Currently, this is the only statistically significant association in our study. 60% of participants said 'Yes' to being asked if they wanted to learn more about how AI algorithms work in radiology, which did not have a significant association with a cohort. In fact, many written comments stated that the participant did not know enough about the subject to formulate a stance. These insights will aid discussions between the radiologist and patient regarding AI-incorporated imaging reports (and possibly AI generated follow-up recommendations), in outlining legal responsibilities of all parties involved, and in the design of educational material that will keep patients informed of the changing healthcare landscape.

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## Abstract Archives of the RSNA, 2023

T5A-QI-4

### Case-Based Intro to Radiology: Enhancing Radiology Education through an e-Learning Platform

#### Participants

Kevin Pierre, Port Saint Lucie, FL (*Presenter*) Nothing to Disclose

#### METHODS

A "Case-Based Intro to Radiology" section with 80+ modules was developed on our departmental e-learning platform. Modules include patient history, physical findings, lab results, and guided learners through diagnosis, imaging selection, interpretation, and developing a working diagnosis, assessment, and disposition. Interactive features comprise immediate feedback, short videos, full Digital Imaging and Communications in Medicine (DICOM) image sets, learning points, and socioeconomic factors. A focus group of 20 MD, PA, PhD, and undergraduate students assessed module quality, educational content, and instructional methods through a survey. Descriptive statistics analyzed survey responses.

#### RESULTS

Most students agreed that the modules enhanced imaging interpretation, complemented curricula, encouraged critical thinking, and covered appropriate clinical and imaging details. They rated module quality, educational content, and videos as very good. Students preferred flipped classroom or proctored didactic approaches over traditional methods.\*Discussion The study relied on a small sample size and self-reported outcomes. More research is needed to determine the long-term impact on performance and clinical practice. The case-based e-learning platform section showed potential in improving radiology education for medical and PA students. Next steps involve integrating the platform into the PA school curriculum, completing 140 proposed cases, developing an educator and user guide, conducting external peer reviews, and performing outcome studies.

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## Abstract Archives of the RSNA, 2023

T5A-QI-5

### Developing an AI Model to Identify Malignancy Results on Imaging Reports to Delay Release to the Electronic Patient Portal

#### Participants

Lucy Chow, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

#### METHODS

The dataset is comprised of approximately 61,000 multi-modality diagnostic imaging reports from 12/01/2022-12/31/2022, while procedure reports were excluded. Subsets from this dataset were extracted using two rule-based approaches to preprocess the training data. The first rule identified any report containing -RADS classification categories (i.e., BI-RADS), which yielded 8,345 reports. Of this set, 341 reports were identified to be withheld from immediate release based on predetermined criteria (i.e., BI-RADS=4). A second rule was applied to the remaining 53,000 reports, which identified approximately 4,500 reports that contained one of 12 malignancy-related keywords (i.e., cancer). This formed the training set for the NLP deep neural network (DNN) model, which was independently labeled by a group of 22 physician informaticists (PIs) as either 'withhold' or 'release.' Any indeterminate reports were discussed to reach consensus and develop labeling guidelines. Upon review, withholding scans demonstrating progressive malignancy became clinically necessary and rational. About 40% of the training set was reviewed, and 2,677 labeled reports were used for initial DNN model development. Subsequently, 49,318 reports generated between 01/19/2023- 02/12/2023 were analyzed for model validation.

#### RESULTS

In the model validation dataset, 293 reports (0.6%) contained the -RADS classification and 996 reports (2.0%) were identified from DNN, resulting in 1,289 reports (2.6%) withheld from immediate release. Preliminary results of the model performance yielded a 99.4% accuracy based on the final test set, consisting of 14,759 cases.\*Discussion The model has demonstrated promising results, and the existing IT infrastructure was leveraged to incorporate the functionality into the electronic health record. Both manual flagging by the radiologist and automated flagging by the AI algorithm will be implemented. Manually flagged reports will further train and refine the AI model's accuracy. The two methods will be compared to determine if manual flagging remains necessary for the workflow.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T5A-QI-6

### An Artificial Intelligence (AI) Boost to MRI Lumbar Spine Reporting

#### METHODS

MRI lumbar spine studies of patients aged 18 and older performed for back pain from 1 to 10 December 2022 were randomly selected. These studies were initially read by four board-certified musculoskeletal and neuroradiologists with at least 8 years of consultant experience. Studies with instrumentation and scoliosis were excluded. The time taken to verify the radiology reports for each study was extracted from the RIS logs - this was deemed time taken without AI assistance. The DICOM data for these studies were processed by a commercial deep learning-based solution - CoLumbo (Smart Soft Healthcare, Bulgaria) on an AI orchestration platform (CARPL.AI, US). The AI solution segments, measures, and classifies MR images to provide suspected pathology descriptions, findings, and measurements. It then outputs annotated post-processed MRI images and an auto-generated report which is editable. These studies were randomly assigned to three final-year radiology residents who were blinded to the original finalized reports. The reporting time and corrections to the pre-populated report were logged. The time taken with and without AI assistance was documented and compared. A paired t-test was performed for the calculation of statistical significance.

#### RESULTS

A total of 31 MRI studies were processed. The mean interpretation time with AI assistance was significantly lower than without ( $8.47 \pm 3.77$  minutes versus  $22.44 \pm 10.90$  minutes,  $p < 0.001$ ). The interquartile range (IQR) for interpretation time with AI assistance was 4.78 minutes, while the IQR for interpretation time without AI assistance was 14.15 minutes. The smaller IQR indicates that the interpretation times were more consistent and less variable when radiologists used the AI-powered assistive tool. A paired t-test showed that the mean difference in interpretation times between the two groups was -13.97 minutes (95% CI: -16.66 to -11.28), which was statistically significant ( $p < 0.001$ ). Diagnostic accuracy (stenosis grading and incidental findings) was not significantly different between the two groups.\*Discussion AI assistance for MRI lumbar spine reporting resulted in a significant reduction in reporting time with equivalent diagnostic accuracy compared to experienced radiologists without AI assistance. The more objective and consistent AI evaluation also provides a more standardized report and reduces interobserver variation.

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## Abstract Archives of the RSNA, 2023

T5A-QI-7

### Learning styles and preferences of current generation of training radiologists: A survey analysis

#### METHODS

Qualitative study was undertaken in 2022 targeting RT recent Board-certified radiologists(0-5 years experience). A questionnaire(Qn) of 10 questions consisted of understanding preferences for learning tools(LT) styles, problem solving(PS) skills, type of individual learner, preferences for teaching modules, awareness of their role in the department, preferences for exit-exam pattern was issued on social media. Each question had several choices (eg."which is most preferred mode of learning?" had responses such as textbook, teaching website(TW) etc). Each choice had a response option from least-likely to most-likely on a scale of 1to5(5 pointer Likert's scale). Of 119participants, 68were males, 50females 1 other category. Analysis of the responses was done by calculating percentage and weighted average. The association for age, gender, years of experience(YoE) practicing institute(PI) with every aspect of study Qn was assessed using Chi Square test. SPSS version 20 was used P-value  $\leq 0.05$  was considered significant.

#### RESULTS

TW were most preferred mode of LT followed by textbooks among journals, conferences, lectures video media channels, latter being the least preferred. For PS, responders tend to prefer consulting teachers peers(60%) followed by utilising help of TW journals. In our survey, only 36% 1st RT preferred TW as compared to 81% of 4thyr RT, indicating increasing trend with increase YoE. However,63% of 4thyr. RT tend to prefer textbook among others. Majority(74%) of them consider to be visual-learners followed by logical kinaesthetic. Linguistic were only45%. However, no significant statistical difference was found for gender, YoE or PI. For preference in teaching modules, majority preferred interactive case-based discussions(CBD)(70%) followed by simulations. With increase in YoE, CBD flipped classroom(FC) were preferred. Preference for FC was significantly differed among type of PI.( $p < 0.05$ ) Statistically significant increasing trend was seen for awareness of curricular goals with gender age. In a preference for mode of exam, institutional exam(64%) was most favoured. Online exam was least preferred had no statistical difference among PI.\*Discussion Current GEN's learning styles are different from preceding GEN which relied on didactic lectures textbooks. However, they do require precise instructions, simulations mentoring. This requires consideration when framing radiology training curriculum. The limitation of study is the subjective nature of the assessment by the participants which needs to be validated by objective methods.

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## Abstract Archives of the RSNA, 2023

T5A-QI-8HC

**Maximizing the Usefulness of limited aspirated synovial fluid samples in musculoskeletal fluoroscopy procedures: A Quality Improvement Approach for Optimal Lab Order Decision Making**

### Participants

Aiah Alatoum, MBBS, Iowa City, IA (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T5A-QI-9HC

**Standardization of incidental thyroid nodule characterization, follow-up recommendations, and patient education resources: A quality improvement project at an academic medical center**

### Participants

Brandon Fields, MD, San Francisco, IL (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

T5B-QI

### Quality Improvement Reports Tuesday Poster Discussions II

#### Sub-Events

**T5B-QI-1 Criteria for placing extravasation sensor devices on patients to prevent massive extravasation of contrast material at contrast enhanced CT**

#### METHODS

This retrospective study included 144,277 patients who underwent CECT at our hospital between April 2012 and July 2022. We performed multivariate logistic regression analysis between patients with- (n = 350) and randomly-selected patients without CM extravasation (n = 350). The outcome variable was the presence or absence of extravasation; the explanatory variables were the age, sex, body mass index, hospitalization status, hemodialysis and diabetes mellitus, the use of anticancer drugs, total serum protein, the injection rate, catheter gauge, catheter location, use of existing catheters, and the years of nurse CT experience. We investigated the percentage of patients with sensor devices (50-100%, 5% steps) and their sensitivity for detecting extravasation using receiver-operating characteristic curve analysis.

#### RESULTS

The extravasation rate was 0.27%. The median estimated extravasation volume was 10 ml (range, 1-140 ml). Multivariate logistic regression analysis showed that the injection rate [odds ratio (OR) = 1.61; 95% confidence interval (CI): 1.33-1.95, p < 0.001], a small-diameter catheter gauge (OR = 3.86, 95% CI = 1.92-7.76; p < 0.001), the use of anticancer drugs (OR = 1.81, 95% CI = 1.32-2.50; p < 0.001), and existing catheters (OR = 1.52, 95% CI = 1.10-2.11; p = 0.009) were significantly associated with extravasation (Table 1). To achieve a sensitivity of 90-, 80-, 70-, 60-, and 50%; 80, 50, 40, and 28% of all patients required the placement of a sensor device (Table 2). \*Discussion Consistent with earlier reports, risk factors for extravasation were the injection rate, catheter gauge, and the use of anticancer drugs and of existing catheters. The sensitivity for detecting extravasation decreased as the proportion of patients with sensors decreased. The percentage of patients appropriately fit with sensors must consider the time required for their placement, their cost, and their sensitivity for detecting extravasation. We think that placing a sensor on 40% of patients, and a sensor sensitivity of 60% are reasonable in clinical practice.

**T5B-QI-2 Time-Cost Efficiencies and Experiences with Implementation of a Peer Learning System from a Tertiary Academic Center**

#### METHODS

Faculty radiologists (N = 27) of a multispecialty radiology group at a single tertiary academic center completed 5-point Likert scale surveys prior to and 1-year following the transition to the new peer learning system in June 2021. Eight questions inquired about the positive aspects of each system, while two questions inquired about the negative aspects. Differences in survey responses prior to and following intervention were evaluated by Mann-Whitney U test.

#### RESULTS

There was a significantly decreased amount of time per month used to complete the peer learning exercises versus the peer review exercises ( $1.71 \pm 1.84$  hours, N = 34 vs.  $0.76 \pm 0.45$  hours, N = 27, p = 0.011). The result was a difference of  $0.95 \pm 1.89$  hours per month ( $11.4 \pm 22.7$  hours per year), which translated to an estimated direct salary time-cost saving of \$1653.68 per year per radiologists and a direct productivity time-cost saving of \$3,469.39 per year per radiologist when utilizing the peer learning system. Percent differences between expected and actual case submissions for each subspecialty section were as follows: Abdominal (+33.3%), Breast (-10.0%), Chest (+73.3%), ED (-93.3%), Musculoskeletal (+6.7%), Neuroradiology (-36.7%), Nuclear Medicine (+23.3%), and Pediatric (-53.3%). All positive impacts were rated significantly higher for the peer learning system. There was a significantly lower rating with respect to workflow disruption for the peer learning system. There was no significant difference in rating with respect to negative impact on the radiologist as an individual. When asked directly which system they preferred, 70.4% (19 of 27) of radiologists preferred the new system, 25.9% (7 of 27) preferred the old system, and 3.7% (1 of 27) did not respond. \*Discussion There was a strongly positive perception of the new peer learning system; however, the level of participation in the system was highly dependent on subspecialty section. There was a substantial implied direct time-cost saving from the cost-neutral transition to the peer learning system.

**T5B-QI-3 Objective improvements in mammography image quality following individualized breast positioning training informed by artificial intelligence**

#### Participants

Melissa L. Hill, PHD, Issy les Moulineaux, France (*Presenter*) Consultant, Volpara Health Technologies Limited  
Sally Grady, Kettering, OH (*Presenter*) Nothing to Disclose

#### METHODS

The prospective study was conducted at 2 private breast imaging organizations, which had installations of commercially available Volpara Analytics™ AI software for >2 years prior to the study. Techs at the Intervention Site (55 Techs, 15 clinics; OH, USA) received individualized training from Mammography Educator trainers. The Control Site (45 Techs, 8 clinics; NC, AL IL, USA) continued to use the software as per usual. Five 30-day evaluation phases ran in parallel for both sites, including pre-training (Eval 12) and post-training (Eval 3-5). Prior to training, the IQ software's automated performance reports were used to create Targeted



Training Profiles for each Tech to identify breast positioning metrics to focus on in training. After excluding Techs who had not completed training (Intervention Site) or acquired >90 images per evaluation phase (both Sites), 33 and 22 Techs were included in final analyses. De-identified study data included exam and patient characteristics, automated Perfect/Good/Moderate/Inadequate (PGMI) scores, % images with target compression pressure (7-15 kPa), and Quality Score (QS; a weighted breast positioning and compression score from 0-4). Paired t-test was used to compare IQ between evaluation periods.

## RESULTS

A 4.8% relative increase in QS was observed for the Intervention Site Techs post-training (Eval 2-3, 2.29 to 2.4;  $p < 0.05$ ) and QS improvement was sustained for the remaining post-training phases (Eval 45, 2.4 to 2.38;  $p < 0.05$ ). The early post-training improvements were driven by an increase in %P+G (57.8 to 61.4 to 60.8%;  $p < 0.05$ ). Whereas the last evaluation period saw an increase in %target compression (55.6 to 58.3%,  $p < 0.05$ ). In the same period, no changes across any of the aggregated IQ metrics were observed for Control Site Techs (QS=2.12–2.11,  $p=0.96$ ; %P+G=53.6–54.1%,  $p=0.78$ ; %target compression=50.1–48.8%,  $p=0.85$ ). \*Discussion Personalized Tech training informed by AI IQ assessment resulted in significant and sustained improvements in QS. Although the QS increase remained 180 days post-training, the underlying drivers of quality improvement changed over time, suggesting monitoring is important to identify changing areas of focus and new training opportunities on an ongoing basis. Limitations include differences in gantry vendors between Sites, a lack of multivariate analysis, and use of a single AI IQ Software.

### **T5B-QI-4 Evaluating the Usefulness of Contrast Medium Injection Protocol Changes to Prevent Large Amounts of Air Injection in Contrast-enhanced CT Scans**

## METHODS

Nemoto Dual Shot Alpha 7 injector was used; it recognized that air was injected when the psi remained below 4 during the initial 10cc injection, and stopped the injection. In consideration of this, the protocol was altered by injecting a contrast medium for contrast enhancement after the injection of volume 10cc and the flow rate was 0.5, 1.0, and 1.5cc/sec; experiments were conducted by changing factors that could affect psi to reproduce the environment while injecting a contrast medium into actual patients. The syringe internal contrast medium, air ratio with the total amount being 100cc, contrast medium concentration was 350, 400 mgI/mL, needle gauge, and IV cannula angle was 45, 90 were finally tested by changing the upper and lower directions of the injector with regards to the pressure tube method. After measuring one time, the air inside the syringe was compressed to fully emit all of the air and air was injected again for this experiment.

## RESULTS

At the flow rate of 1.0cc/sec or lower, the injector recognized air injection, but not at 1.5cc/sec. Among other variables, only the ratio of the syringe's internal contrast medium and the air was a factor affecting psi, whereas other factors did not affect psi changes. In contrast to the air ratio, the higher the contrast medium ratio, the higher the psi, and the injection was not stopped at 7:3, 8:2, and 9:1. \*Discussion Initially, it was important to lower the pressure inside the syringe. At first, the psi remained low, then the air was compressed. Even when there was no ejection from the syringe, the psi rose and the injector did not recognize the air. Depending on the ratio of Syringe internal contrast medium to air, the injection stop system may sometimes not work, so it is recommended that the injector be used facing down. In addition, injecting 10cc of contrast medium first at a low flow rate before an injection can prevent an examiner's carelessness without affecting the contrast enhancement. Therefore, in the case of an injector that does not have an air detector and recognizes air injection based on psi, injecting first at a low flow rate before injecting a contrast medium can be useful to prevent a large amount of air injection.

### **T5B-QI-5 Improving the efficiency of a LVEF measurement service through adoption of AI auto-contouring for MUGA scans**

## METHODS

Algorithm development: 1793 historical MUGA images and associated 24-frame segmentations were used for algorithm training. An automated segmentation tool was created using an established network architecture (U-net). The algorithm was packaged as a DICOM service, configured to send segmented images to the NM server where users could check and edit results. Auditing: The time taken for 4 experienced users to process MUGA data using conventional manual methods (in commercial NM software) was assessed through self-reporting for 20 consecutive scans. Following AI tool implementation, the time taken for users to review, edit and approve AI-generated contours and associated LVEF results was automatically captured in a mysql database. The LVEF results generated from the AI contour alone and with the addition of human edits were automatically recorded in the same database. Database records were extracted 6 months after the introduction of AI-assisted processing. Records were screened in order to exclude cases where the outcome of processing wasn't clear.

## RESULTS

Mean processing time for the manual MUGA processing method was 9.7 min (SD 4.5 min). After the introduction of AI-assisted processing mean processing time reduced to 3.5 min (SD 2.5 min) across 92 cases (56 records were excluded). There was a mean absolute difference in LVEF of 2.1% (SD 2.1%) between MUGA processing with the AI contour alone and following user editing. \*Discussion An AI tool was successfully trained for segmentation of MUGA scans and was subsequently integrated in clinic. Results demonstrated a significant time saving for AI-assisted processing compared to manual processing (6.2 minutes saved per case). Results also showed that LVEF figures calculated from the AI contour alone were very similar to those recorded after user editing. This suggests that much less human interaction is now required for processing MUGA scans, reducing overall inter-operator variability. Results provide impetus for greater use of AI to increase efficiency, and show that it is possible to achieve noticeable performance gains from in-house developed and deployed algorithms.

### **T5B-QI-6 Improving Mammography Positioning at two Community Mammography Centers by Asking Why?**

Participants

Chirag R. Parghi, MD, MBA, (Presenter) Nothing to Disclose

## METHODS

Two imaging facilities within the same organization in non-contiguous states enrolled in the ACR Learning Collaborative focused on Mammographic Positioning with an emphasis on behavioral modification, which consisted of a 27-week improvement program. Both sites were part of the first cohort of this program and had previously passed all MQSA accreditations over the last 5 years. The collaborative developed a performance measure that consisted of 7 major and 6 minor positioning criteria. Each week, the teams

performed an internal audit of at least 45 screening mammograms (after an initial audit of 263 mammograms) according to the identified positioning criteria, and displayed aggregate results on a run chart. The teams participated in a structured improvement program to evaluate the current state, understand root causes of problems, develop and test various interventions and gauge improvement.

## RESULTS

The baseline audit revealed a pass rate of 55% of total screening mammograms at both facilities. An image auditing process that included participation from the frontline technologists was developed and shared at group and individual levels. Frontline staff empowerment yielded an increase to an 85% of images passing. That level of performance was sustained for 10 weeks through additional interventions such as improving tech and radiologist communication, standardization of new technologist onboarding, and structured and frequent feedback to the technologists.\*Discussion The binary (pass/fail) threshold of MQSA Accreditation is inadequate by itself for quality assessment. Mammography positioning is a dynamic target that is comprised of individual, varying attributes. Identifying root causes with heightened attention to behaviors and conditions can result in sustainable improvement in image quality. Given the success of the facilities that participated in the first cohort of the Mammography Positioning Improvement Collaborative, three additional sites from the same organization have enrolled in the second cohort of the collaborative, with goals of expanding the learnings across the Solis enterprise to over 100 clinics. Applying these lessons at scale requires maintaining the essence of the improvement collaborative while customizing the process in order to minimize resource redundancy.

### **T5B-QI-7 The impact of new Inflammatory Bowel Disease (IBD)-specific materials on patients' preparedness and image quality of MR Enterography (MRE).**

## METHODS

IBD patients with upcoming MRE scans were asked to participate and assigned to the control (Con) or intervention (Int) cohorts. The proportion of patients with unanswered questions was compared using the Chi-squared test. MRE images were reviewed by a blinded radiologist for image quality. Small bowel distention was scored between 0 (very poor distention) and 4 (excellent); respiratory motion artefact was graded between 0 (significant artefact) and 2 (no artefact) and compared with the Wilcoxon-sign test.

## RESULTS

152 patients were contacted, 78 Int, and 74 Con; response rate was 36% vs 45% ( $p = 0.35$ ). 36% of the Int cohort were attending their first MR vs 39% of Con ( $p = 0.98$ ). 75% of Int watched all videos before completing the survey. In both groups, =85% of questionnaire respondents read the information provided but in the Con group, 10 / 33 (30%) had unanswered questions compared to 1 / 28 (4%) in the Int group ( $p = 0.02$ ). Free text questions included what the mannitol was, taking medication and what happened following the scan. MRE images from 55 patients from the Int ( $N = 26$ ) or Con ( $N = 29$ ) groups, were included in the image quality analysis. Patients with prior small bowel resection ( $N = 13$ ) were excluded from the TI diameter measurements ( $N = 17$  intervention;  $N = 22$  control). The median (Q1; Q3) respiratory motion score was 2 'No artefact' (2; 2) in the Int and 2 'No artefact' (1; 2) in the Con groups ( $p = 0.49$ ). The median (Q1; Q3) distension score was 3 'Good' (2; 4) in the Int and 3 'Good' (3; 4) in the Con groups ( $p = 0.16$ ). The mean  $\pm$  S.D TI diameter was  $16 \pm 4$  mm in both groups ( $p = 0.85$ ).\*Discussion We had similar response rates across our groups. Our results indicate the new patient-focused materials reduced the number of unanswered questions patients had prior to scans. Given IBD patients have life-long imaging and continuous follow-up, educating them well early in the patient journey is vital for a positive experience. This may improve patient compliance with follow-up imaging, a potential area of study. There was no statistically significant difference seen in this gross assessment of scan quality on this particular study. We believe this is mostly due to methodological limitations including subjective assessment of distention, professional patient cohort (IBD patients for many years) and pathology on scans affecting TI measurements. Developing a validated and objective method to assess small bowel distention in an MR naive cohort as part of a longitudinal study would be useful.

### **T5B-QI-9HC How Radiology Dashboard Technology is Transforming Workflow: Enhancing Report Turnaround Time and Patient Satisfaction in Radiology**

Participants

Danilo Manuel Costa, MD, MBA, Lajinha, Brazil (Presenter) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

T5B-QI-1

### Criteria for placing extravasation sensor devices on patients to prevent massive extravasation of contrast material at contrast enhanced CT

#### METHODS

This retrospective study included 144,277 patients who underwent CECT at our hospital between April 2012 and July 2022. We performed multivariate logistic regression analysis between patients with- (n = 350) and randomly-selected patients without CM extravasation (n = 350). The outcome variable was the presence or absence of extravasation; the explanatory variables were the age, sex, body mass index, hospitalization status, hemodialysis and diabetes mellitus, the use of anticancer drugs, total serum protein, the injection rate, catheter gauge, catheter location, use of existing catheters, and the years of nurse CT experience. We investigated the percentage of patients with sensor devices (50-100%, 5% steps) and their sensitivity for detecting extravasation using receiver-operating characteristic curve analysis.

#### RESULTS

The extravasation rate was 0.27%. The median estimated extravasation volume was 10 ml (range, 1-140 ml). Multivariate logistic regression analysis showed that the injection rate [odds ratio (OR) = 1.61; 95% confidence interval (CI): 1.33-1.95, p < 0.001], a small-diameter catheter gauge (OR = 3.86, 95% CI = 1.92-7.76; p < 0.001), the use of anticancer drugs (OR = 1.81, 95% CI = 1.32-2.50; p < 0.001), and existing catheters (OR = 1.52, 95% CI = 1.10-2.11; p = 0.009) were significantly associated with extravasation (Table 1). To achieve a sensitivity of 90-, 80-, 70-, 60-, and 50%; 80, 50, 40, and 28% of all patients required the placement of a sensor device (Table 2). \*Discussion Consistent with earlier reports, risk factors for extravasation were the injection rate, catheter gauge, and the use of anticancer drugs and of existing catheters. The sensitivity for detecting extravasation decreased as the proportion of patients with sensors decreased. The percentage of patients appropriately fit with sensors must consider the time required for their placement, their cost, and their sensitivity for detecting extravasation. We think that placing a sensor on 40% of patients, and a sensor sensitivity of 60% are reasonable in clinical practice.

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## Abstract Archives of the RSNA, 2023

T5B-QI-2

### Time-Cost Efficiencies and Experiences with Implementation of a Peer Learning System from a Tertiary Academic Center

#### METHODS

Faculty radiologists (N = 27) of a multispecialty radiology group at a single tertiary academic center completed 5-point Likert scale surveys prior to and 1-year following the transition to the new peer learning system in June 2021. Eight questions inquired about the positive aspects of each system, while two questions inquired about the negative aspects. Differences in survey responses prior to and following intervention were evaluated by Mann-Whitney U test.

#### RESULTS

There was a significantly decreased amount of time per month used to complete the peer learning exercises versus the peer review exercises ( $1.71 \pm 1.84$  hours, N = 34 vs.  $0.76 \pm 0.45$  hours, N = 27,  $p = 0.011$ ). The result was a difference of  $0.95 \pm 1.89$  hours per month ( $11.4 \pm 22.7$  hours per year), which translated to an estimated direct salary time-cost saving of \$1653.68 per year per radiologists and a direct productivity time-cost saving of \$3,469.39 per year per radiologist when utilizing the peer learning system. Percent differences between expected and actual case submissions for each subspecialty section were as follows: Abdominal (+33.3%), Breast (-10.0%), Chest (+73.3%), ED (-93.3%), Musculoskeletal (+6.7%), Neuroradiology (-36.7%), Nuclear Medicine (+23.3%), and Pediatric (-53.3%). All positive impacts were rated significantly higher for the peer learning system. There was a significantly lower rating with respect to workflow disruption for the peer learning system. There was no significant difference in rating with respect to negative impact on the radiologist as an individual. When asked directly which system they preferred, 70.4% (19 of 27) of radiologists preferred the new system, 25.9% (7 of 27) preferred the old system, and 3.7% (1 of 27) did not respond.\*Discussion There was a strongly positive perception of the new peer learning system; however, the level of participation in the system was highly dependent on subspecialty section. There was a substantial implied direct time-cost saving from the cost-neutral transition to the peer learning system.

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## Abstract Archives of the RSNA, 2023

T5B-QI-3

### Objective improvements in mammography image quality following individualized breast positioning training informed by artificial intelligence

#### Participants

Melissa L. Hill, PHD, Issy les Moulineaux, France (*Presenter*) Consultant, Volpara Health Technologies Limited  
Sally Grady, Kettering, OH (*Presenter*) Nothing to Disclose

#### METHODS

The prospective study was conducted at 2 private breast imaging organizations, which had installations of commercially available Volpara Analytics™ AI software for >2 years prior to the study. Techs at the Intervention Site (55 Techs, 15 clinics; OH, USA) received individualized training from Mammography Educator trainers. The Control Site (45 Techs, 8 clinics; NC, AL IL, USA) continued to use the software as per usual. Five 30-day evaluation phases ran in parallel for both sites, including pre-training (Eval 1-2) and post-training (Eval 3-5). Prior to training, the IQ software's automated performance reports were used to create Targeted Training Profiles for each Tech to identify breast positioning metrics to focus on in training. After excluding Techs who had not completed training (Intervention Site) or acquired >90 images per evaluation phase (both Sites), 33 and 22 Techs were included in final analyses. De-identified study data included exam and patient characteristics, automated Perfect/Good/Moderate/Inadequate (PGMI) scores, % images with target compression pressure (7-15 kPa), and Quality Score (QS; a weighted breast positioning and compression score from 0-4). Paired t-test was used to compare IQ between evaluation periods.

#### RESULTS

A 4.8% relative increase in QS was observed for the Intervention Site Techs post-training (Eval 2-3, 2.29 to 2.4;  $p < 0.05$ ) and QS improvement was sustained for the remaining post-training phases (Eval 4-5, 2.4 to 2.38;  $p < 0.05$ ). The early post-training improvements were driven by an increase in %P+G (57.8 to 61.4 60.8%;  $p < 0.05$ ). Whereas the last evaluation period saw an increase in %target compression (55.6 to 58.3%,  $p < 0.05$ ). In the same period, no changes across any of the aggregated IQ metrics were observed for Control Site Techs (QS=2.12—2.11,  $p=0.96$ ; %P+G=53.6—54.1%,  $p=0.78$ ; %target compression=50.1—48.8%,  $p=0.85$ ). \*Discussion Personalized Tech training informed by AI IQ assessment resulted in significant and sustained improvements in QS. Although the QS increase remained 180 days post-training, the underlying drivers of quality improvement changed over time, suggesting monitoring is important to identify changing areas of focus and new training opportunities on an ongoing basis. Limitations include differences in gantry vendors between Sites, a lack of multivariate analysis, and use of a single AI IQ Software.

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## Abstract Archives of the RSNA, 2023

T5B-QI-4

### Evaluating the Usefulness of Contrast Medium Injection Protocol Changes to Prevent Large Amounts of Air Injection in Contrast-enhanced CT Scans

#### METHODS

Nemoto Dual Shot Alpha 7 injector was used; it recognized that air was injected when the psi remained below 4 during the initial 10cc injection, and stopped the injection. In consideration of this, the protocol was altered by injecting a contrast medium for contrast enhancement after the injection of volume 10cc and the flow rate was 0.5, 1.0, and 1.5cc/sec; experiments were conducted by changing factors that could affect psi to reproduce the environment while injecting a contrast medium into actual patients. The syringe internal contrast medium, air ratio with the total amount being 100cc, contrast medium concentration was 350, 400 mgI/mL, needle gauge, and IV cannula angle was 45, 90 were finally tested by changing the upper and lower directions of the injector with regards to the pressure tube method. After measuring one time, the air inside the syringe was compressed to fully emit all of the air and air was injected again for this experiment.

#### RESULTS

At the flow rate of 1.0cc/sec or lower, the injector recognized air injection, but not at 1.5cc/sec. Among other variables, only the ratio of the syringe's internal contrast medium and the air was a factor affecting psi, whereas other factors did not affect psi changes. In contrast to the air ratio, the higher the contrast medium ratio, the higher the psi, and the injection was not stopped at 7:3, 8:2, and 9:1.\*Discussion Initially, it was important to lower the pressure inside the syringe. At first, the psi remained low, then the air was compressed. Even when there was no ejection from the syringe, the psi rose and the injector did not recognize the air. Depending on the ratio of Syringe internal contrast medium to air, the injection stop system may sometimes not work, so it is recommended that the injector be used facing down. In addition, injecting 10cc of contrast medium first at a low flow rate before an injection can prevent an examiner's carelessness without affecting the contrast enhancement. Therefore, in the case of an injector that does not have an air detector and recognizes air injection based on psi, injecting first at a low flow rate before injecting a contrast medium can be useful to prevent a large amount of air injection.

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## Abstract Archives of the RSNA, 2023

T5B-QI-5

### Improving the efficiency of a LVEF measurement service through adoption of AI auto-contouring for MUGA scans

#### METHODS

Algorithm development: 1793 historical MUGA images and associated 24-frame segmentations were used for algorithm training. An automated segmentation tool was created using an established network architecture (U-net). The algorithm was packaged as a DICOM service, configured to send segmented images to the NM server where users could check and edit results. Auditing: The time taken for 4 experienced users to process MUGA data using conventional manual methods (in commercial NM software) was assessed through self-reporting for 20 consecutive scans. Following AI tool implementation, the time taken for users to review, edit and approve AI-generated contours and associated LVEF results was automatically captured in a mysql database. The LVEF results generated from the AI contour alone and with the addition of human edits were automatically recorded in the same database. Database records were extracted 6 months after the introduction of AI-assisted processing. Records were screened in order to exclude cases where the outcome of processing wasn't clear.

#### RESULTS

Mean processing time for the manual MUGA processing method was 9.7 min (SD 4.5 min). After the introduction of AI-assisted processing mean processing time reduced to 3.5 min (SD 2.5 min) across 92 cases (56 records were excluded). There was a mean absolute difference in LVEF of 2.1% (SD 2.1%) between MUGA processing with the AI contour alone and following user editing.\*Discussion An AI tool was successfully trained for segmentation of MUGA scans and was subsequently integrated in clinic. Results demonstrated a significant time saving for AI-assisted processing compared to manual processing (6.2 minutes saved per case). Results also showed that LVEF figures calculated from the AI contour alone were very similar to those recorded after user editing. This suggests that much less human interaction is now required for processing MUGA scans, reducing overall inter-operator variability. Results provide impetus for greater use of AI to increase efficiency, and show that it is possible to achieve noticeable performance gains from in-house developed and deployed algorithms.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

T5B-QI-6

### Improving Mammography Positioning at two Community Mammography Centers by Asking Why?

#### Participants

Chirag R. Parghi, MD,MBA, (*Presenter*) Nothing to Disclose

#### METHODS

Two imaging facilities within the same organization in non-contiguous states enrolled in the ACR Learning Collaborative focused on Mammographic Positioning with an emphasis on behavioral modification, which consisted of a 27-week improvement program. Both sites were part of the first cohort of this program and had previously passed all MQSA accreditations over the last 5 years. The collaborative developed a performance measure that consisted of 7 major and 6 minor positioning criteria. Each week, the teams performed an internal audit of at least 45 screening mammograms (after an initial audit of 263 mammograms) according to the identified positioning criteria, and displayed aggregate results on a run chart. The teams participated in a structured improvement program to evaluate the current state, understand root causes of problems, develop and test various interventions and gauge improvement.

#### RESULTS

The baseline audit revealed a pass rate of 55% of total screening mammograms at both facilities. An image auditing process that included participation from the frontline technologists was developed and shared at group and individual levels. Frontline staff empowerment yielded an increase to an 85% of images passing. That level of performance was sustained for 10 weeks through additional interventions such as improving tech and radiologist communication, standardization of new technologist onboarding, and structured and frequent feedback to the technologists.\*Discussion The binary (pass/fail) threshold of MQSA Accreditation is inadequate by itself for quality assessment. Mammography positioning is a dynamic target that is comprised of individual, varying attributes. Identifying root causes with heightened attention to behaviors and conditions can result in sustainable improvement in image quality. Given the success of the facilities that participated in the first cohort of the Mammography Positioning Improvement Collaborative, three additional sites from the same organization have enrolled in the second cohort of the collaborative, with goals of expanding the learnings across the Solis enterprise to over 100 clinics. Applying these lessons at scale requires maintaining the essence of the improvement collaborative while customizing the process in order to minimize resource redundancy.

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## Abstract Archives of the RSNA, 2023

T5B-QI-7

### The impact of new Inflammatory Bowel Disease (IBD)-specific materials on patients' preparedness and image quality of MR Enterography (MRE).

#### METHODS

IBD patients with upcoming MRE scans were asked to participate and assigned to the control (Con) or intervention (Int) cohorts. The proportion of patients with unanswered questions was compared using the Chi-squared test. MRE images were reviewed by a blinded radiologist for image quality. Small bowel distention was scored between 0 (very poor distention) and 4 (excellent); respiratory motion artefact was graded between 0 (significant artefact) and 2 (no artefact) and compared with the Wilcoxon-sign test.

#### RESULTS

152 patients were contacted, 78 Int, and 74 Con; response rate was 36% vs 45% ( $p = 0.35$ ). 36% of the Int cohort were attending their first MR vs 39% of Con ( $p = 0.98$ ). 75% of Int watched all videos before completing the survey. In both groups, 85% of questionnaire respondents read the information provided but in the Con group, 10 / 33 (30%) had unanswered questions compared to 1 / 28 (4%) in the Int group ( $p = 0.02$ ). Free text questions included what the mannitol was, taking medication and what happened following the scan. MRE images from 55 patients from the Int ( $N = 26$ ) or Con ( $N = 29$ ) groups, were included in the image quality analysis. Patients with prior small bowel resection ( $N = 13$ ) were excluded from the TI diameter measurements ( $N = 17$  intervention;  $N = 22$  control). The median (Q1; Q3) respiratory motion score was 2 'No artefact' (2; 2) in the Int and 2 'No artefact' (1; 2) in the Con groups ( $p = 0.49$ ). The median (Q1; Q3) distension score was 3 'Good' (2; 4) in the Int and 3 'Good' (3; 4) in the Con groups ( $p = 0.16$ ). The mean  $\pm$  S.D TI diameter was  $16 \pm 4$  mm in both groups ( $p = 0.85$ ). \*Discussion We had similar response rates across our groups. Our results indicate the new patient-focused materials reduced the number of unanswered questions patients had prior to scans. Given IBD patients have life-long imaging and continuous follow-up, educating them well early in the patient journey is vital for a positive experience. This may improve patient compliance with follow-up imaging, a potential area of study. There was no statistically significant difference seen in this gross assessment of scan quality on this particular study. We believe this is mostly due to methodological limitations including subjective assessment of distention, professional patient cohort (IBD patients for many years) and pathology on scans affecting TI measurements. Developing a validated and objective method to assess small bowel distention in an MR naive cohort as part of a longitudinal study would be useful.

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## Abstract Archives of the RSNA, 2023

T5B-QI-9HC

**How Radiology Dashboard Technology is Transforming Workflow: Enhancing Report Turnaround Time and Patient Satisfaction in Radiology**

### Participants

Danilo Manuel Costa, MD, MBA, Lajinha, Brazil (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

W2-QI

### Quality Improvement Reports Wednesday Poster Discussions

#### Sub-Events

#### W2-QI-1 Optimizing patient safety and clinical work-flow with digital radiation management system

##### METHODS

11 radiologists were enrolled in patient safety optimization program (Fig. 1) from Dec. 2021 to Jan. 2023. The patient radiation information and imaging device information were analyzed using Radimetrics, a digital radiation management system. The patient who cumulative dose over threshold were collected and analyze the primary reason. Among the most common four CT protocols, the number of radiation dose over threshold were recorded every quarter. The device operation information and radiologists working details were also analyzed and improved along the program.

##### RESULTS

The radiation doses of 21,839 CT examinations performed on 15,372 patients from Jan. 2022 to Jan. 2023 were collected and analyzed. The median DLP (mGy.cm) for each scanning region was 225 (heart), 205 (chest), 450 (abdomen) and 610 (head). With dose tracking, the number of radiation dose over threshold constantly decreased among all four CT protocols. The main reasons for over-high radiation dose were shown as follow: improper imaging protocols, wrong patient action, improper imaging operation.\*Discussion The preliminary result shows the program can highly protect patients from excessive radiation dose, and also improve radiologists operation and patient care sense. The program should be promoted to other hospitals.

#### W2-QI-2 Data Driven Strategies for an Education Program to Improve Diversity, Equity, and Inclusion in Radiology

##### METHODS

Events were conducted at an urban, academic medical school and affiliated university. Medical student events included two shadowing/mentorship programs, two faculty-led career advising events, three M4-led post-MATCH panels, five skills workshops, one women and URM in radiology panel, and three procedure workshops; two introduction to radiology events were held for undergraduates. At the end of each event, students completed a demographics and knowledge questionnaire. The demographics questionnaire gathered information regarding gender, race/ethnicity, school year, and radiology exposure; the knowledge questionnaire assessed students' misconceptions and perception of work-life balance along with event quality and future interest. Responses were obtained using a Likert scale. Surveys were analyzed for trends by question type, race/ethnicity, gender, radiology exposure, and school year. There were 222 attendees with a 45% survey completion rate (100 responses). Two-tailed test assessed statistical significance for race/ethnicity, gender, radiology exposure, and year in medical school trends.

##### RESULTS

Data demonstrates a statistically significant positive impact in addressing misconceptions, promoting work-life balance, and increasing interest of undergraduates. Significantly higher positive ranks are seen in procedure workshops and undergraduate events. There was a positive trend in promoting work-life balance for women. Programs were effective; undergraduate events and shadowing/mentorship programs significantly peaked interest.\*Discussion Limitations include limited emphasis on the 5C's coaching and collaborating factors. Future programming includes undergraduate events for women and URM, skills and procedure workshops, and shadowing. Events will be expanded upon in the upcoming semesters. Future data analysis includes results from targeted outreach to underrepresented groups in undergraduate and preclinical medical students.

#### W2-QI-3 Reducing Radiology Reporting Workstation Energy Consumption

##### METHODS

Electricity consumption metered plugs were used to calculate workstation electricity consumption (kWh) over 12 hours. Each workstation consists of a central processing unit (CPU) and two large high resolution diagnostic monitors. Workstation energy states (WES) were categorized as either IN-USE, ACTIVE NOT IN-USE (CPU and monitors switched ON but not in use), IDLE (CPU switched ON but monitors OFF), SLEEP or OFF. The energy states of 41 workstations were manually assessed on three occasions at the end of a working week and taken to represent energy states throughout a night shift. WES for evening/weekend and daytime hours were estimated based on night shift workstation states and the highest number of rostered radiologists on duty during these shifts. Current annual workstation energy consumption was calculated. Workstations cannot be safely switched OFF every night, as essential cybersecurity and software updates cannot be missed. To reduce energy consumption, workstations should ideally be scheduled to SLEEP when not IN-USE. We therefore compared estimated energy savings for scenarios in which all workstations are programmed to either SLEEP or OFF when not IN-USE.

##### RESULTS

The average WES for night shifts (84 h/week) were 3 IN-USE, 17 ACTIVE NOT IN-USE, 15.7 IDLE, 0 SLEEP and 5.3 OFF. For evening/weekend shifts (44 h/week), estimated WES were 6 IN-USE, 14 ACTIVE NOT IN-USE, 15.7 IDLE, 0 SLEEP and 5.3 OFF. During day shifts (40h/week), estimated WES were 41 IN-USE and 0 for all other energy states. Based on the activity of 41 workstations, annual energy consumption totalled 51,414.6 kWh, costing £17,481/y at the current energy cost rate of £0.34/kWh. If workstations are programmed to either SLEEP or OFF when not IN-USE, energy consumption is predicted to fall to 27,440.1

kWh/y (£9,329.6) or 25,291 kWh/y (£8,599) respectively. Annual estimated energy savings are 23,974.4 kWh (£8151.3) or 26,123.5 kWh (£8882) respectively.\*Discussion Long periods of workstations remaining IDLE or ACTIVE NOT IN-USE contribute to high energy consumption in our radiology department. A simple green initiative to programme these workstations to SLEEP when not IN-USE is estimated to reduce departmental energy consumption by approximately 23,974kWh/y, also saving the department £8,151 per year.

#### **W2-QI-4 Improving the Performance of Technicians Using an Artificial Intelligence-Based System for Breast Positioning and Image Quality Control in Mammography**

##### **METHODS**

A total of 90 mammography examinations conducted after the implementation of an AI assisted quality control system were enrolled in this study. The AI system will use machine learning algorithms to analyze images and provide feedback to technicians, enabling them to adjust the breast position and optimize image quality. Images of same view (CC LMO) before and after technical repeat were evaluated by radiologist with the standards of Mammography Quality Standards Act (MQSA) on a four-point-scale (1 = poor, 4 = excellent). Incidence of inadequate positioning, which was defined by AI system as any of the following errors were recorded and compared: incomplete gland coverage, incomplete pectoralis major muscle inclusion, over or insufficient exposure, skin fold, nipple not in the contour line, shoulder overlap shadow, abdominal skin, contralateral breast, and foreign body.

##### **RESULTS**

A total of 70 images were evaluated in this study. The distribution of the image scores showed a significant difference ( $p < 0.001$ ) between the control group ( $M=2.2$ ,  $SD=0.8$ ) and the Technical Repeated group ( $M=3.5$ ,  $SD=0.5$ ). The percentage of mammography images with high quality image was significantly higher in the technical repeat group compared to the control group (96.7% vs. 70%,  $p < 0.001$ ). The proportion of mammograms with inadequate positioning was significantly lower ( $p < 0.001$ ) in the technical repeat group (8%) than in the control group (23%).\*Discussion The use of an automated breast positioning and image quality control system can reduce the likelihood of inadequate positioning and increase the overall image quality of mammography. It can significantly improve the performance of technicians in mammography and assess images faster than radiologists, potentially reducing the time and cost of breast cancer screening quality control.

#### **W2-QI-5 Effect of Senior Resident to Junior Resident Feedback in creating a culture of support and to help avoid reporting Errors and enhance learning: A Prospective Quality Improvement Program.**

Participants

Muhammad Malik, MD, (Presenter) Nothing to Disclose

##### **METHODS**

Methods: -Every R1 class moving on to R2 would receive a lecture series towards the end of the first academic year on how to provide feedback to the incoming class by program directors and faculty. - The feedback would follow the STAROS Model proposed by Dr. Noronha and Dr. Ananthakrishnan, stating feedback should be Specific, Timely, Actionable, Realistic, Observable, and Skills-based. -The session's goal would be to emphasize the importance of formative and summative feedback. To help the new R1s and R2s improve, a 5-point questionnaire will be provided to the R1 class regarding R2 feedback at the end of each rotation to be discussed with the program director at semi-annual and annual evaluations. Proposed Techniques of feedback class for Senior Residents: The classes could consist of case-based scenarios with faculty members and residents, covering important topics such as dealing with errors, professional growth, autonomy, and the extent of supervision. There would be role-play scenarios to promote faculty and resident development and to encourage ideas and discussion.

##### **RESULTS**

Proposed Results -To create a safe and supportive workplace where junior residents feel comfortable addressing their questions to the senior resident without fear or hesitation to avoid reporting errors and improve learning. -To encourage professional academic development amongst senior residents to promote collegiality camaraderie between residents.- Through goal-directed feedback amongst both junior residents and senior residents through evaluations, questionnaires can areas of improvement be identified and create a system of accountability with the aim of self-improvement and safety.\*Discussion •The goal of this proposal is to encourage growth, enhance learning and prepare future educators. Trainees want to feel supported, have someone they can trust, and ask for advice, and the first person they turn to will be their senior. •Through continuous efforts, can there be improvements and increase interest in learning and growth. <!--EndFragment-->

#### **W2-QI-6 Automated Assessment of Breast positioning and Image Quality in digital breast tomosynthesis (DBT) screening using synthetically reconstructed projection images**

##### **METHODS**

A total of 150 mammography examinations were enrolled in this study. Subjects underwent screening mammography including DBT with 2D-SM and FFDM. The AI-assisted system automatically evaluated the quality of breast positioning in each image set. Nine image quality criteria evaluating the appearance of the nipple, breast rotation, pectoral muscle, inframammary fold, pectoral nipple line, shoulder overlap shadow, abdominal skin, contralateral breast and foreign body were used for craniocaudal and mediolateral-oblique views. Image quality of cases were also evaluated with the standards of Mammography Quality Standards Act (MQSA) as grade "adequate" or "inadequate". The performance of the AI system was evaluated using accuracy, sensitivity, and specificity. The inter-rater agreement and comparison of their findings with those reported by the AI system was calculated using Cohen's kappa coefficient.

##### **RESULTS**

The AI algorithm demonstrated high accuracy in distinguishing between adequate and inadequate images, with an overall accuracy of 93%, sensitivity of 94% and specificity of 92% for FFDM and an accuracy of 92%, sensitivity of 95 and specificity of 91% for DBT with 2D-SM. In terms of breast positioning, the AUC of poor imaging quality prediction by AI system according to incomplete gland, incomplete pectoralis muscle, over or insufficient exposure was (0.903 vs 0.937 vs 0.982). Overall accuracy of AI system was 0.958 for FFDM and 0.932 for DBT with 2D-SM. Inter-observer agreement for image quality assessment was found to be 0.82 (95% confidence interval [CI]: 0.77-0.87), indicating substantial agreement between radiologists and AI system using 2D-SM images. The kappa coefficients for breast positioning assessment were also calculated and found to be moderate to substantial, with values ranging from 0.57 to 0.83 (95% CI: 0.48-0.67 and 0.78-0.88, respectively).\*Discussion The results showed a high degree of agreement between the automated and manual assessments, also indicating the performance of the AI tool in assessing breast positioning and image quality in DBT using 2D-SM images was comparable with that in FFDM. The use of synthetic projection images

may be a reliable option for the automated assessment of breast positioning and image quality in DBT screening, but caution should be noted in the interpretation of the diagnostic accuracy of DBT images obtained using synthetic projection images.

## **W2-QI-7 Automating and Integrating Breast Imaging Workflows to Improve Efficiency and Quality**

Participants

Clayton Taylor, MD, Upper Arlington, OH (*Presenter*) Nothing to Disclose

### **METHODS**

Our breast center is a part of a tertiary care academic medical center providing breast cancer screening and diagnostic evaluations as well as supporting busy breast specialty practices. Before our process improvement project, our lead technologists would intermittently drag and drop screening mammograms to static worklists. This was inefficient, time-consuming and led to delays in the assignment of mammograms. Our project addressed this problem by integrating our scheduling software with our worklist application and leveraging a function within our worklist application to immediately, equitably and automatically assign screening mammograms, screening breast ultrasound and breast MRIs to each radiologist working a shift. Separately, our technologists add a modifier to each screening mammogram for patients seen by practitioners in the clinic the same day, moving the study to the diagnostic (immediate interpretation) worklist. At the same time, we deployed a solution allowing radiologists to instantly request priors or ask for technical repeats causing those studies to immediately populate unique worklists monitored by our lead technologists and assistants who upload priors or address the issues before releasing the studies to be assigned automatically once again, creating a closed loop quality workflow.

### **RESULTS**

Our process improvement project has allowed for an automated system that immediately and equally distributes breast imaging cases amongst radiologists and creates closed loop workflows for technical repeats and obtaining prior imaging studies. This has led to a significant reduction in report turnaround times (TAT) for screening mammograms from 109 minutes prior to implementation to 90 minutes post implementation and for breast MRI median from 287 minutes prior to implementation to 169 minutes post implementation. At least 7.5 hours per week of time is saved each week by our lead technologists by the use of these automated workflows.\*Discussion Our improved breast imaging workflows improved efficiency with a direct positive impact on report turnaround times. These changes have also eliminated time consuming manual processes and created closed loop systems to improve quality by obtaining prior imaging studies and addressing technical issues.

## **W2-QI-8HC Optimizing Workflows and Work-Life Balance in General Radiology**

## **W2-QI-9HC Improving first case starts and resource utilization in pediatric interventional radiology (PIR)**

Participants

Seth Vatsky, DO, (*Presenter*) Nothing to Disclose

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## Abstract Archives of the RSNA, 2023

W2-QI-1

### Optimizing patient safety and clinical work-flow with digital radiation management system

#### **METHODS**

11 radiologists were enrolled in patient safety optimization program (Fig. 1) from Dec. 2021 to Jan. 2023. The patient radiation information and imaging device information were analyzed using Radimetrics, a digital radiation management system. The patient who cumulative dose over threshold were collected and analyze the primary reason. Among the most common four CT protocols, the number of radiation dose over threshold were recorded every quarter. The device operation information and radiologists working details were also analyzed and improved along the program.

#### **RESULTS**

The radiation doses of 21,839 CT examinations performed on 15,372 patients from Jan. 2022 to Jan. 2023 were collected and analyzed. The median DLP (mGy.cm) for each scanning region was 225 (heart), 205 (chest), 450 (abdomen) and 610 (head). With dose tracking, the number of radiation dose over threshold constantly decreased among all four CT protocols. The main reasons for over-high radiation dose were shown as follow: improper imaging protocols, wrong patient action, improper imaging operation.\*Discussion The preliminary result shows the program can highly protect patients from excessive radiation dose, and also improve radiologists operation and patient care sense. The program should be promoted to other hospitals.

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## Abstract Archives of the RSNA, 2023

W2-QI-2

### Data Driven Strategies for an Education Program to Improve Diversity, Equity, and Inclusion in Radiology

#### METHODS

Events were conducted at an urban, academic medical school and affiliated university. Medical student events included two shadowing/mentorship programs, two faculty-led career advising events, three M4-led post-MATCH panels, five skills workshops, one women and URM in radiology panel, and three procedure workshops; two introduction to radiology events were held for undergraduates. At the end of each event, students completed a demographics and knowledge questionnaire. The demographics questionnaire gathered information regarding gender, race/ethnicity, school year, and radiology exposure; the knowledge questionnaire assessed students' misconceptions and perception of work-life balance along with event quality and future interest. Responses were obtained using a Likert scale. Surveys were analyzed for trends by question type, race/ethnicity, gender, radiology exposure, and school year. There were 222 attendees with a 45% survey completion rate (100 responses). Two-tailed test assessed statistical significance for race/ethnicity, gender, radiology exposure, and year in medical school trends.

#### RESULTS

Data demonstrates a statistically significant positive impact in addressing misconceptions, promoting work-life balance, and increasing interest of undergraduates. Significantly higher positive ranks are seen in procedure workshops and undergraduate events. There was a positive trend in promoting work-life balance for women. Programs were effective; undergraduate events and shadowing/mentorship programs significantly peaked interest. \*Discussion Limitations include limited emphasis on the 5C's coaching and collaborating factors. Future programming includes undergraduate events for women and URM, skills and procedure workshops, and shadowing. Events will be expanded upon in the upcoming semesters. Future data analysis includes results from targeted outreach to underrepresented groups in undergraduate and preclinical medical students.

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## Abstract Archives of the RSNA, 2023

W2-QI-3

### Reducing Radiology Reporting Workstation Energy Consumption

#### METHODS

Electricity consumption metered plugs were used to calculate workstation electricity consumption (kWh) over 12 hours. Each workstation consists of a central processing unit (CPU) and two large high resolution diagnostic monitors. Workstation energy states (WES) were categorised as either IN-USE, ACTIVE NOT IN-USE (CPU and monitors switched ON but not in use), IDLE (CPU switched ON but monitors OFF), SLEEP or OFF. The energy states of 41 workstations were manually assessed on three occasions at the end of a working week and taken to represent energy states throughout a night shift. WES for evening/weekend and daytime hours were estimated based on night shift workstation states and the highest number of rostered radiologists on duty during these shifts. Current annual workstation energy consumption was calculated. Workstations cannot be safely switched OFF every night, as essential cybersecurity and software updates cannot be missed. To reduce energy consumption, workstations should ideally be scheduled to SLEEP when not IN-USE. We therefore compared estimated energy savings for scenarios in which all workstations are programmed to either SLEEP or OFF when not IN-USE.

#### RESULTS

The average WES for night shifts (84 h/week) were 3 IN-USE, 17 ACTIVE NOT IN-USE, 15.7 IDLE, 0 SLEEP and 5.3 OFF. For evening/weekend shifts (44 h/week), estimated WES were 6 IN-USE, 14 ACTIVE NOT IN-USE, 15.7 IDLE, 0 SLEEP and 5.3 OFF. During day shifts (40h/week), estimated WES were 41 IN-USE and 0 for all other energy states. Based on the activity of 41 workstations, annual energy consumption totalled 51,414.6 kWh, costing £17,481/y at the current energy cost rate of £0.34/kWh. If workstations are programmed to either SLEEP or OFF when not IN-USE, energy consumption is predicted to fall to 27,440.1 kWh/y (£9,329.6) or 25,291 kWh/y (£8,599) respectively. Annual estimated energy savings are 23,974.4 kWh (£8151.3) or 26,123.5 kWh (£8882) respectively. \*Discussion Long periods of workstations remaining IDLE or ACTIVE NOT IN-USE contribute to high energy consumption in our radiology department. A simple green initiative to programme these workstations to SLEEP when not IN-USE is estimated to reduce departmental energy consumption by approximately 23,974kWh/y, also saving the department £8,151 per year.

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## Abstract Archives of the RSNA, 2023

W2-QI-4

### Improving the Performance of Technicians Using an Artificial Intelligence-Based System for Breast Positioning and Image Quality Control in Mammography

#### METHODS

A total of 90 mammography examinations conducted after the implementation of an AI assisted quality control system were enrolled in this study. The AI system will use machine learning algorithms to analyze images and provide feedback to technicians, enabling them to adjust the breast position and optimize image quality. Images of same view (CC LMO) before and after technical repeat were evaluated by radiologist with the standards of Mammography Quality Standards Act (MQSA) on a four-point-scale (1 = poor, 4 = excellent). Incidence of inadequate positioning, which was defined by AI system as any of the following errors were recorded and compared: incomplete gland coverage, incomplete pectoralis major muscle inclusion, over or insufficient exposure, skin fold, nipple not in the contour line, shoulder overlap shadow, abdominal skin, contralateral breast, and foreign body.

#### RESULTS

A total of 70 images were evaluated in this study. The distribution of the image scores showed a significant difference ( $p < 0.001$ ) between the control group ( $M=2.2$ ,  $SD=0.8$ ) and the Technical Repeated group ( $M=3.5$ ,  $SD=0.5$ ). The percentage of mammography images with high quality image was significantly higher in the technical repeat group compared to the control group (96.7% vs. 70%,  $p < 0.001$ ). The proportion of mammograms with inadequate positioning was significantly lower ( $p < 0.001$ ) in the technical repeat group (8%) than in the control group (23%). \*Discussion The use of an automated breast positioning and image quality control system can reduce the likelihood of inadequate positioning and increase the overall image quality of mammography. It can significantly improve the performance of technicians in mammography and assess images faster than radiologists, potentially reducing the time and cost of breast cancer screening quality control.

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## Abstract Archives of the RSNA, 2023

W2-QI-5

**Effect of Senior Resident to Junior Resident Feedback in creating a culture of support and to help avoid reporting Errors and enhance learning: A Prospective Quality Improvement Program.**

### Participants

Muhammad Malik, MD, (*Presenter*) Nothing to Disclose

### METHODS

Methods: -Every R1 class moving on to R2 would receive a lecture series towards the end of the first academic year on how to provide feedback to the incoming class by program directors and faculty. - The feedback would follow the STAROS Model proposed by Dr. Noronha and Dr. Ananthakrishnan, stating feedback should be Specific, Timely, Actionable, Realistic, Observable, and Skills-based. -The session's goal would be to emphasize the importance of formative and summative feedback. To help the new R1s and R2s improve, a 5-point questionnaire will be provided to the R1 class regarding R2 feedback at the end of each rotation to be discussed with the program director at semi-annual and annual evaluations. Proposed Techniques of feedback class for Senior Residents: The classes could consist of case-based scenarios with faculty members and residents, covering important topics such as dealing with errors, professional growth, autonomy, and the extent of supervision. There would be role-play scenarios to promote faculty and resident development and to encourage ideas and discussion.

### RESULTS

Proposed Results -To create a safe and supportive workplace where junior residents feel comfortable addressing their questions to the senior resident without fear or hesitation to avoid reporting errors and improve learning. -To encourage professional academic development amongst senior residents to promote collegiality camaraderie between residents.- Through goal-directed feedback amongst both junior residents and senior residents through evaluations, questionnaires can areas of improvement be identified and create a system of accountability with the aim of self-improvement and safety.\*Discussion •The goal of this proposal is to encourage growth, enhance learning and prepare future educators. Trainees want to feel supported, have someone they can trust, and ask for advice, and the first person they turn to will be their senior. •Through continuous efforts, can there be improvements and increase interest in learning and growth. <!--EndFragment-->

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## Abstract Archives of the RSNA, 2023

W2-QI-6

### Automated Assessment of Breast positioning and Image Quality in digital breast tomosynthesis (DBT) screening using synthetically reconstructed projection images

#### METHODS

A total of 150 mammography examinations were enrolled in this study. Subjects underwent screening mammography including DBT with 2D-SM and FFDM. The AI-assisted system automatically evaluated the quality of breast positioning in each image set. Nine image quality criteria evaluating the appearance of the nipple, breast rotation, pectoral muscle, inframammary fold, pectoral nipple line, shoulder overlap shadow, abdominal skin, contralateral breast and foreign body were used for craniocaudal and mediolateral-oblique views. Image quality of cases were also evaluated with the standards of Mammography Quality Standards Act (MQSA) as grade "adequate" or "inadequate". The performance of the AI system was evaluated using accuracy, sensitivity, and specificity. The inter-rater agreement and comparison of their findings with those reported by the AI system was calculated using Cohen's kappa coefficient.

#### RESULTS

The AI algorithm demonstrated high accuracy in distinguishing between adequate and inadequate images, with an overall accuracy of 93%, sensitivity of 94% and specificity of 92% for FFDM and an accuracy of 92%, sensitivity of 95 and specificity of 91% for DBT with 2D-SM. In terms of breast positioning, the AUC of poor imaging quality prediction by AI system according to incomplete gland, incomplete pectoralis muscle, over or insufficient exposure was (0.903 vs 0.937 vs 0.982). Overall accuracy of AI system was 0.958 for FFDM and 0.932 for DBT with 2D-SM. Inter-observer agreement for image quality assessment was found to be 0.82 (95% confidence interval [CI]: 0.77-0.87), indicating substantial agreement between radiologists and AI system using 2D-SM images. The kappa coefficients for breast positioning assessment were also calculated and found to be moderate to substantial, with values ranging from 0.57 to 0.83 (95% CI: 0.48-0.67 and 0.78-0.88, respectively). \*Discussion The results showed a high degree of agreement between the automated and manual assessments, also indicating the performance of the AI tool in assessing breast positioning and image quality in DBT using 2D-SM images was comparable with that in FFDM. The use of synthetic projection images may be a reliable option for the automated assessment of breast positioning and image quality in DBT screening, but caution should be noted in the interpretation of the diagnostic accuracy of DBT images obtained using synthetic projection images.

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## Abstract Archives of the RSNA, 2023

W2-QI-7

### Automating and Integrating Breast Imaging Workflows to Improve Efficiency and Quality

#### Participants

Clayton Taylor, MD, Upper Arlington, OH (*Presenter*) Nothing to Disclose

#### METHODS

Our breast center is a part of a tertiary care academic medical center providing breast cancer screening and diagnostic evaluations as well as supporting busy breast specialty practices. Before our process improvement project, our lead technologists would intermittently drag and drop screening mammograms to static worklists. This was inefficient, time-consuming and led to delays in the assignment of mammograms. Our project addressed this problem by integrating our scheduling software with our worklist application and leveraging a function within our worklist application to immediately, equitably and automatically assign screening mammograms, screening breast ultrasound and breast MRIs to each radiologist working a shift. Separately, our technologists add a modifier to each screening mammogram for patients seen by practitioners in the clinic the same day, moving the study to the diagnostic (immediate interpretation) worklist. At the same time, we deployed a solution allowing radiologists to instantly request priors or ask for technical repeats causing those studies to immediately populate unique worklists monitored by our lead technologists and assistants who upload priors or address the issues before releasing the studies to be assigned automatically once again, creating a closed loop quality workflow.

#### RESULTS

Our process improvement project has allowed for an automated system that immediately and equally distributes breast imaging cases amongst radiologists and creates closed loop workflows for technical repeats and obtaining prior imaging studies. This has led to a significant reduction in report turnaround times (TAT) for screening mammograms from 109 minutes prior to implementation to 90 minutes post implementation and for breast MRI median from 287 minutes prior to implementation to 169 minutes post implementation. At least 7.5 hours per week of time is saved each week by our lead technologists by the use of these automated workflows.\*Discussion Our improved breast imaging workflows improved efficiency with a direct positive impact on report turnaround times. These changes have also eliminated time consuming manual processes and created closed loop systems to improve quality by obtaining prior imaging studies and addressing technical issues.

Printed on: 04/12/24



## Abstract Archives of the RSNA, 2023

W2-QI-8HC

**Optimizing Workflows and Work-Life Balance in General Radiology**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W2-QI-9HC

**Improving first case starts and resource utilization in pediatric interventional radiology (PIR)**

### Participants

Seth Vatsky, DO, (*Presenter*) Nothing to Disclose

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI

### Quality Improvement Reports Wednesday Poster Discussions I

#### Sub-Events

#### W5A-QI-1 Impact of EHR Driven Force Function on Pregnancy Screening Compliance Rates in Fluoroscopy

##### Participants

Janelle Van Luling, BS, RT, Milford, CT (*Presenter*) Nothing to Disclose

##### METHODS

A team composed of subspecialty radiologists, x-ray technologists and quality improvement specialists worked to identify contributing factors leading to non-compliance in pregnancy screening on fluoroscopy exams. A3 methodology, process mapping, manual chart audits and frontline staff feedback were utilized to focus our interventions. An EHR-driven force function reminder was created using human-centered design principles. This mandatory question only fires on relevant exams (fluoroscopic studies that radiate the abdomen and/or pelvic regions) and a specific patient population (female sex assigned at birth and age 10-55). Interventional Radiology exam codes were excluded. To avoid click fatigue, the hard stop question was designed to incorporate recent negative pregnancy test results within 48 hours (or current hospital stay) creating a targeted, logical reminder. Screening compliance rate was analyzed before and after implementation.

##### RESULTS

Baseline data obtained from February 1, 2022-January 29, 2023, for a randomized cohort of 50 female patients (4-5 patients per month) between ages 10 and 55 with an order for a fluoroscopic exam involving the abdomen/pelvic regions revealed 65% compliance in documenting appropriate pregnancy screening. EHR-driven question was implemented on January 30, 2023. Post intervention random audit of 27 exams performed from February 1 - April 20, 2023 revealed 100% screening documentation compliance (Figure 1). \*Discussion While institutional radiation safety and pregnancy testing policies are designed to optimize patient safety and avoid unintended fetal radiation, compliance in following the policy by front line staff is variable due to environment and human factors. Confusion on who needs pregnancy screening, what exact exams require screening and lack of standard process can all contribute to non-compliance. Originally built for our CT technologists, this QI initiative expanded a successfully implemented logical reminder in our EHR to our fluoroscopy department. This project successfully increased compliance in having pregnancy status verified from 65% to 100%. Following success at our main tertiary center, the initiative was expanded to 4 other hospitals within our health system.

#### W5A-QI-2 Reporting backlog clearance campaign

##### Participants

Pravin Ghadge, MBBS, FRCR, (*Presenter*) Nothing to Disclose

##### METHODS

To tackle this biggest challenge, we introduced a new system for additional reporting with some added monetary incentives, wherein scans would be allocated to individual radiologists, mapping the pattern of unreported scans. We set different worklist configurations named as 'Packets'. Each packet consisting of 12 to 17 scans, about 50-70% of complex/ time consuming scans and remainder with different subspecialty interests. This configuration was intended to prevent preferential reporting as per individual liking. This was not a time bound activity, but we set a goal of completing each packet within 48 hours of assignment with a penalty clause for delay in reporting. We also ensured escalating any new diagnosis or disease progression to be acted upon to keep the patient as safe as possible.

##### RESULTS

Total 22 out of 38 radiologists (58%) participated in this initiative, 7 out of these (18%) newly started contributing to additional reporting, 5 (13%) switched over from traditional system to new system, whereas 10 (26%) participated through both systems with more inclination towards the 'Packets'. Under this activity, we could report 6,229 scans helping 55% of the total backlog with maximum turnaround time being 2 days bringing down the backlog from 11,180 to 476 in 15 weeks. The waiting time for reporting CT and MRI scans from request to report came down to less than 6 weeks. \*Discussion Wider participation from the radiologists showcased motivation and teamwork. Apart from clearing the reporting backlog this project prevented any further addition to the backlog. The improvement has positively impacted multidisciplinary team meetings, overall patient experience, patient care, and patient safety. With the various advantages and success, we have achieved with this project, other NHS Trusts with backlog could also consider this approach while tackling their backlog.

#### W5A-QI-3 Deferral of eGFR testing in low risk patients prior to contrast enhanced CT: Impact on emergency room (ER) imaging throughput

##### Participants

Gowthaman Gunabushanam, MD, New Haven, CT (*Presenter*) Nothing to Disclose

##### METHODS

Baseline (12/28/2021 - 3/7/2022, weeks 1-10) CECT order-to-protocol (O to P) and order-to-exam begin (O to B) times were

measured. A question was added to the ordering screen in the EHR for all CECTs ordered in the ER which allowed providers the option of scanning without an eGFR value if the patient was deemed low risk. Low risk was defined as: (a) no history of chronic kidney disease (CKD), (b) no risk factors for CKD (diabetes, hypertension, prior kidney surgery, etc) or known to be on dialysis, and (c) no risk factors for AKI (sepsis, dehydration, drug toxicity, altered mental status, etc).

## RESULTS

In the initial pilot phase (3/8/2022 - 6/13/2022, weeks 11-24), the EHR question was implemented as optional, resulting in low utilization rates (5-14%). Subsequently, in the launch phase (6/14/2022 - 8/15/2022, weeks 25-33), the question was implemented as a hard-stop requiring an answer to proceed (100% utilization). A total of 16,446 CECT exams were included in this study (4,456 baseline, 6,933 pilot phase, 5,057 launch phase) for 4 ERs within our health system: 2 adult 1 pediatric hospital-based ER, and 1 freestanding ER. In the launch phase, 68% (3,451 of 5,057) studies were categorized by ER providers as low risk for kidney disease (OK to scan without eGFR value). In the launch phase, 0.3% (2/646) studies deemed low risk were completed that had an eGFR subsequently result as < 30 mL/min/1.73m<sup>2</sup>. Median O to P time across all ERs improved from 23.93 min at baseline to 13.02 min in the launch phase. Median O to B time across all ERs improved from 80.34 min at baseline to 76.48 min in the launch phase with median O to B times for low risk patients improving to 72.08 min. Sub analysis showed net improvements in the median O to B were greater in the freestanding ER (36.33 vs. 22.98 min) and pediatric ER (147.65 min vs. 132.80 min).\*Discussion This QI project successfully created an eGFR deferral process embedded into our EHR based on risk factor assessment. Slightly over two-thirds of patients were deemed as low risk and safe to scan without an eGFR value. Patient safety was preserved with only 0.3% of patients having severe renal impairment (eGFR < 30) discovered after CECT that were deemed low risk upon order entry. This project led to improved study CECT order-to-begin times for low risk patients in the ER by 8 minutes, potentially allowing for improved throughput and earlier time to diagnosis.

## W5A-QI-4 Evaluation of a medical decision support system for the prescription of medical imaging examinations: qualitative and quantitative studies with radiologists and radiology residents in France

### METHODS

Qualitative then quantitative studies carried out with radiologists and radiology residents in France to evaluate our tool. The qualitative study consisted of data collection during focus group interviews then thematic analysis using the SWOT technique. Based on this preliminary work, a questionnaire was developed and sent to radiologists on a broader scale to collect their opinions on the website.

### RESULTS

Radiologists' initial opinion of the guide was mostly positive, particularly as to the layout, the ease of use, and the quick turnaround. However, modifications and additions had to be made to the first version in order to accommodate clinicians' requests, i.e. reasons for consultations, optimization of users experience and quality of information. The guide was also redesigned to address a more specialized audience, such as radiologists. In order to promote the use of our guide, its name was modified for a more intuitive one, active promotion and ultimately, the development of a smartphone application were done.\*Discussion Our study has identified many opportunities for improvement to facilitate the use of this tool in order to optimize the relevance and efficiency of imaging examinations for requesting physicians. Learning from other decision support systems, in particular the ACR Appropriateness Criteria (AC), and creating an application with a decision algorithm were found to be useful toward more comprehensive, generalize and optimal care for patients.

## W5A-QI-5 Enhancing Efficiency in MRI Protocoling: A Quality Improvement Initiative

### Participants

Marie Hausner, RT, New Haven, CT (*Presenter*) Nothing to Disclose

### METHODS

The intervention enrolled a selected group of MRI codes, as determined by the QI team and divisional leadership, into an auto-protocol program eliminating the need for manual protocol assignment by radiologists or technologists. Codes that were selected for enrollment were removed from protocol lists. They received a protocol designation in our health system's EHR (Epic, Verona WI) through creation of a programming script that automatically inserted the words "Perform as ordered per policy" into the protocol field. The program was implemented for ten MRI sites across three hospital networks covered by our academic radiology group on 1/12/23. Three months of baseline data was collected (October-December 2022) to assess baseline rate of exams that received a human-assigned manual protocol from a radiologist and to predict the expected reduction in manual protocoling after project launch. Three months of post intervention data (January-April 2023) was collected to assess project impact. A time savings calculation was also calculated.

### RESULTS

The auto-protocol program enrolled 58 of 300 (19% of available MRI codes). Analysis of the baseline data revealed that these codes reflected 23% of the exams protocolled by our academic radiology practice. At baseline 98% of MR orders received a radiologist protocol monthly which decreased to 76-78% (mean = 77%) after project launch (Figure 1). Mean time to protocol an MRI was approximated at 15 seconds. Based on this, we estimated the project would reduce time spent protocoling by 5 hours monthly and 60.5 hours annually.\*Discussion The implementation of an auto-protocol program for MRI exams has been successful in enhancing efficiency and reducing protocol workload for radiologists while maintaining the quality and safety of patient care. The project has resulted in a 21% decrease in the number MRI orders needing manual assignment of a protocol with estimated time savings of 60.5 hours annually.

## W5A-QI-6 Breaking Bad News to Patients on the Breast Imaging Service: Designing a Resident Curriculum.

### METHODS

At the start of the rotation residents will complete a self-evaluation utilizing a 5-point Likert scale determining their comfort level with delivering results. Each resident then undergoes two SP encounters representing common clinical scenarios seen in breast radiology. Residents will be evaluated by an attending with a standardized scoring sheet utilizing the established SPIKES protocol outlining a six-step technique on how to appropriately deliver bad news. An attending will debrief with the resident, providing feedback and constructive criticism. The resident will then watch the educational video. At the end of the rotation, they will undergo two additional SP encounters and again be evaluated by an attending with the same scoring sheet as before. Lastly, the resident will complete the same self-evaluation.



## RESULTS

Resident 1 showed a 20% increase in the SP encounter score while resident 2 showed a 5% increase in the SP encounter score. The overall average percent change between pre- and post-curriculum encounters is +12.5%. Post-curriculum self-evaluation scores showed a general increase in resident confidence in their ability to deliver news to patients. Residents do not begin rotating through breast imaging at UCLA until R2 year. As such there is currently a small sample size as only two new R2's have rotated through the breast department since implementation. There is an anticipated increase in response data beginning July 2023 once the new academic year begins which will give us more data points to analyze.\*Discussion Implementing a standardized curriculum for radiology residents completing their first breast imaging rotation will increase their confidence and ability to effectively deliver patient results. The overall goal is to ease patients allowing them to feel as comfortable and confident with their providers as possible, thus decreasing anxiety when presenting to the breast imaging department. We believe that this standardized curriculum will be successful at our institution, and hope that it will ultimately be adopted by other institutions in training their residents.

### **W5A-QI-7 Iodine Contrast Media Volume and CT Enhancement: When Less is More**

#### **METHODS**

In order to promote CM reduction protocol, this project was developed in the CT unit of a Brazilian tertiary hospital (4 CT scanners) during January 1st and 1st February , 2023. The following steps were implemented: \*Step 1- high iodine concentration CM multidose injection in order to save iodine CM due to Global iodine CM shortage during the study duration; \*Step 2- Optimization of protocol parameters according to manufactures recommendations in order to improve abdominal contrast CT image quality with reduced CM volume; \*Step 3- Application of a new formula to calculate CM volume for abdominal CT exams according to manufactures kVp reduction recommendations; \*Step 4- Qualitative and quantitative data analyses and comparisons.

#### **RESULTS**

100 CT scans were performed during the study period. Our results demonstrated a nearly 40% reduction in CM volume with no image quality loss. We also ensure ideal hepatic parenchyma enhancement level (around 50 HU) as recommend in the literature.\*Discussion Global iodine CM shortage in the second semester of 2022, and beginning of 2023 led to its rational in health centers and clinical practice. It is possible to achieve ideal vessels and parenchyma enhancement with low volume and/or low flow rate injection using high iodine concentration CM. Reducing CM volume is beneficial in patients with risk factors for kidney injury. Reducing CM volume requires a balance between injection flow rate and other protocols parameters, such as kVp modulation and IR technology, in order to improve image diagnostic quality.

### **W5A-QI-8HC Setting the bar higher: Implementing a quality control program to improve US image quality.**

Participants

Aiah Alatoum, MBBS, Iowa City, IA (*Presenter*) Nothing to Disclose

### **W5A-QI-9HC Improving General Radiology Technologist Inequalities Through Standardized Workflows and Expectations**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-1

### Impact of EHR Driven Force Function on Pregnancy Screening Compliance Rates in Fluoroscopy

#### Participants

Janelle Van Luling, BS, RT, Milford, CT (*Presenter*) Nothing to Disclose

#### METHODS

A team composed of subspecialty radiologists, x-ray technologists and quality improvement specialists worked to identify contributing factors leading to non-compliance in pregnancy screening on fluoroscopy exams. A3 methodology, process mapping, manual chart audits and frontline staff feedback were utilized to focus our interventions. An EHR-driven force function reminder was created using human-centered design principles. This mandatory question only fires on relevant exams (fluoroscopic studies that radiate the abdomen and/or pelvic regions) and a specific patient population (female sex assigned at birth and age 10-55). Interventional Radiology exam codes were excluded. To avoid click fatigue, the hard stop question was designed to incorporate recent negative pregnancy test results within 48 hours (or current hospital stay) creating a targeted, logical reminder. Screening compliance rate was analyzed before and after implementation.

#### RESULTS

Baseline data obtained from February 1, 2022-January 29, 2023, for a randomized cohort of 50 female patients (4-5 patients per month) between ages 10 and 55 with an order for a fluoroscopic exam involving the abdomen/pelvic regions revealed 65% compliance in documenting appropriate pregnancy screening. EHR-driven question was implemented on January 30, 2023. Post intervention random audit of 27 exams performed from February 1 - April 20, 2023 revealed 100% screening documentation compliance (Figure 1).\*Discussion While institutional radiation safety and pregnancy testing policies are designed to optimize patient safety and avoid unintended fetal radiation, compliance in following the policy by front line staff is variable due to environment and human factors. Confusion on who needs pregnancy screening, what exact exams require screening and lack of standard process can all contribute to non-compliance. Originally built for our CT technologists, this QI initiative expanded a successfully implemented logical reminder in our EHR to our fluoroscopy department. This project successfully increased compliance in having pregnancy status verified from 65% to 100%. Following success at our main tertiary center, the initiative was expanded to 4 other hospitals within our health system.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-2

### Reporting backlog clearance campaign

#### Participants

Pravin Ghadge, MBBS, FRCR, (*Presenter*) Nothing to Disclose

#### METHODS

To tackle this biggest challenge, we introduced a new system for additional reporting with some added monetary incentives, wherein scans would be allocated to individual radiologists, mapping the pattern of unreported scans. We set different worklist configurations named as 'Packets'. Each packet consisting of 12 to 17 scans, about 50-70% of complex/ time consuming scans and remainder with different subspecialty interests. This configuration was intended to prevent preferential reporting as per individual liking. This was not a time bound activity, but we set a goal of completing each packet within 48 hours of assignment with a penalty clause for delay in reporting. We also ensured escalating any new diagnosis or disease progression to be acted upon to keep the patient as safe as possible.

#### RESULTS

Total 22 out of 38 radiologists (58%) participated in this initiative, 7 out of these (18%) newly started contributing to additional reporting, 5 (13%) switched over from traditional system to new system, whereas 10 (26%) participated through both systems with more inclination towards the 'Packets'. Under this activity, we could report 6,229 scans helping 55% of the total backlog with maximum turnaround time being 2 days bringing down the backlog from 11,180 to 476 in 15 weeks. The waiting time for reporting CT and MRI scans from request to report came down to less than 6 weeks.\*Discussion Wider participation from the radiologists showcased motivation and teamwork. Apart from clearing the reporting backlog this project prevented any further addition to the backlog. The improvement has positively impacted multidisciplinary team meetings, overall patient experience, patient care, and patient safety. With the various advantages and success, we have achieved with this project, other NHS Trusts with backlog could also consider this approach while tackling their backlog.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-3

### Deferral of eGFR testing in low risk patients prior to contrast enhanced CT: Impact on emergency room (ER) imaging throughput

#### Participants

Gowthaman Gunabushanam, MD, New Haven, CT (*Presenter*) Nothing to Disclose

#### METHODS

Baseline (12/28/2021 - 3/7/2022, weeks 1-10) CECT order-to-protocol (O to P) and order-to-exam begin (O to B) times were measured. A question was added to the ordering screen in the EHR for all CECTs ordered in the ER which allowed providers the option of scanning without an eGFR value if the patient was deemed low risk. Low risk was defined as: (a) no history of chronic kidney disease (CKD), (b) no risk factors for CKD (diabetes, hypertension, prior kidney surgery, etc) or known to be on dialysis, and (c) no risk factors for AKI (sepsis, dehydration, drug toxicity, altered mental status, etc).

#### RESULTS

In the initial pilot phase (3/8/2022 - 6/13/2022, weeks 11-24), the EHR question was implemented as optional, resulting in low utilization rates (5-14%). Subsequently, in the launch phase (6/14/2022 - 8/15/2022, weeks 25-33), the question was implemented as a hard-stop requiring an answer to proceed (100% utilization). A total of 16,446 CECT exams were included in this study (4,456 baseline, 6,933 pilot phase, 5,057 launch phase) for 4 ERs within our health system: 2 adult 1 pediatric hospital-based ER, and 1 freestanding ER. In the launch phase, 68% (3,451 of 5,057) studies were categorized by ER providers as low risk for kidney disease (OK to scan without eGFR value). In the launch phase, 0.3% (2/646) studies deemed low risk were completed that had an eGFR subsequently result as  $< 30$  mL/min/1.73m<sup>2</sup>. Median O to P time across all ERs improved from 23.93 min at baseline to 13.02 min in the launch phase. Median O to B time across all ERs improved from 80.34 min at baseline to 76.48 min in the launch phase with median O to B times for low risk patients improving to 72.08 min. Sub analysis showed net improvements in the median O to B were greater in the freestanding ER (36.33 vs. 22.98 min) and pediatric ER (147.65 min vs. 132.80 min).\*Discussion This QI project successfully created an eGFR deferral process embedded into our EHR based on risk factor assessment. Slightly over two-thirds of patients were deemed as low risk and safe to scan without an eGFR value. Patient safety was preserved with only 0.3% of patients having severe renal impairment (eGFR  $< 30$ ) discovered after CECT that were deemed low risk upon order entry. This project led to improved study CECT order-to-begin times for low risk patients in the ER by 8 minutes, potentially allowing for improved throughput and earlier time to diagnosis.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-4

### **Evaluation of a medical decision support system for the prescription of medical imaging examinations: qualitative and quantitative studies with radiologists and radiology residents in France**

#### **METHODS**

Qualitative then quantitative studies carried out with radiologists and radiology residents in France to evaluate our tool. The qualitative study consisted of data collection during focus group interviews then thematic analysis using the SWOT technique. Based on this preliminary work, a questionnaire was developed and sent to radiologists on a broader scale to collect their opinions on the website.

#### **RESULTS**

Radiologists' initial opinion of the guide was mostly positive, particularly as to the layout, the ease of use, and the quick turnaround. However, modifications and additions had to be made to the first version in order to accommodate clinicians' requests, i.e. reasons for consultations, optimization of users experience and quality of information. The guide was also redesigned to address a more specialized audience, such as radiologists. In order to promote the use of our guide, its name was modified for a more intuitive one, active promotion and ultimately, the development of a smartphone application were done.\*Discussion Our study has identified many opportunities for improvement to facilitate the use of this tool in order to optimize the relevance and efficiency of imaging examinations for requesting physicians. Learning from other decision support systems, in particular the ACR Appropriateness Criteria (AC), and creating an application with a decision algorithm were found to be useful toward more comprehensive, generalize and optimal care for patients.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-5

### Enhancing Efficiency in MRI Protocols: A Quality Improvement Initiative

#### Participants

Marie Hausner, RT, New Haven, CT (*Presenter*) Nothing to Disclose

#### METHODS

The intervention enrolled a selected group of MRI codes, as determined by the QI team and divisional leadership, into an auto-protocol program eliminating the need for manual protocol assignment by radiologists or technologists. Codes that were selected for enrollment were removed from protocol lists. They received a protocol designation in our health system's EHR (Epic, Verona WI) through creation of a programming script that automatically inserted the words "Perform as ordered per policy" into the protocol field. The program was implemented for ten MRI sites across three hospital networks covered by our academic radiology group on 1/12/23. Three months of baseline data was collected (October-December 2022) to assess baseline rate of exams that received a human-assigned manual protocol from a radiologist and to predict the expected reduction in manual protocoling after project launch. Three months of post intervention data (January-April 2023) was collected to assess project impact. A time savings calculation was also calculated.

#### RESULTS

The auto-protocol program enrolled 58 of 300 (19% of available MRI codes). Analysis of the baseline data revealed that these codes reflected 23% of the exams protocolled by our academic radiology practice. At baseline 98% of MR orders received a radiologist protocol monthly which decreased to 76-78% (mean = 77%) after project launch (Figure 1). Mean time to protocol an MRI was approximated at 15 seconds. Based on this, we estimated the project would reduce time spent protocoling by 5 hours monthly and 60.5 hours annually.\*Discussion The implementation of an auto-protocol program for MRI exams has been successful in enhancing efficiency and reducing protocol workload for radiologists while maintaining the quality and safety of patient care. The project has resulted in a 21% decrease in the number MRI orders needing manual assignment of a protocol with estimated time savings of 60.5 hours annually.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-6

### Breaking Bad News to Patients on the Breast Imaging Service: Designing a Resident Curriculum.

#### METHODS

At the start of the rotation residents will complete a self-evaluation utilizing a 5-point Likert scale determining their comfort level with delivering results. Each resident then undergoes two SP encounters representing common clinical scenarios seen in breast radiology. Residents will be evaluated by an attending with a standardized scoring sheet utilizing the established SPIKES protocol outlining a six-step technique on how to appropriately deliver bad news. An attending will debrief with the resident, providing feedback and constructive criticism. The resident will then watch the educational video. At the end of the rotation, they will undergo two additional SP encounters and again be evaluated by an attending with the same scoring sheet as before. Lastly, the resident will complete the same self-evaluation.

#### RESULTS

Resident 1 showed a 20% increase in the SP encounter score while resident 2 showed a 5% increase in the SP encounter score. The overall average percent change between pre- and post-curriculum encounters is +12.5%. Post-curriculum self-evaluation scores showed a general increase in resident confidence in their ability to deliver news to patients. Residents do not begin rotating through breast imaging at UCLA until R2 year. As such there is currently a small sample size as only two new R2's have rotated through the breast department since implementation. There is an anticipated increase in response data beginning July 2023 once the new academic year begins which will give us more data points to analyze.\*Discussion Implementing a standardized curriculum for radiology residents completing their first breast imaging rotation will increase their confidence and ability to effectively deliver patient results. The overall goal is to ease patients allowing them to feel as comfortable and confident with their providers as possible, thus decreasing anxiety when presenting to the breast imaging department. We believe that this standardized curriculum will be successful at our institution, and hope that it will ultimately be adopted by other institutions in training their residents.

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5A-QI-7

### Iodine Contrast Media Volume and CT Enhancement: When Less is More

#### METHODS

In order to promote CM reduction protocol, this project was developed in the CT unit of a Brazilian tertiary hospital (4 CT scanners) during January 1st and 1st February, 2023. The following steps were implemented: \*Step 1- high iodine concentration CM multidose injection in order to save iodine CM due to Global iodine CM shortage during the study duration; \*Step 2- Optimization of protocol parameters according to manufactures recommendations in order to improve abdominal contrast CT image quality with reduced CM volume; \*Step 3- Application of a new formula to calculate CM volume for abdominal CT exams according to manufactures kVp reduction recommendations; \*Step 4- Qualitative and quantitative data analyses and comparisons.

#### RESULTS

100 CT scans were performed during the study period. Our results demonstrated a nearly 40% reduction in CM volume with no image quality loss. We also ensure ideal hepatic parenchyma enhancement level (around 50 HU) as recommend in the literature.\*Discussion Global iodine CM shortage in the second semester of 2022, and beginning of 2023 led to its rational in health centers and clinical practice. It is possible to achieve ideal vessels and parenchyma enhancement with low volume and/or low flow rate injection using high iodine concentration CM. Reducing CM volume is beneficial in patients with risk factors for kidney injury. Reducing CM volume requires a balance between injection flow rate and other protocols parameters, such as kVp modulation and IR technology, in order to improve image diagnostic quality.

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## Abstract Archives of the RSNA, 2023

W5A-QI-8HC

**Setting the bar higher: Implementing a quality control program to improve US image quality.**

### Participants

Aiah Alatoum, MBBS, Iowa City, IA (*Presenter*) Nothing to Disclose

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## **Abstract Archives of the RSNA, 2023**

W5A-QI-9HC

**Improving General Radiology Technologist Inequalities Through Standardized Workflows and Expectations**

Printed on: 04/12/24

## Abstract Archives of the RSNA, 2023

W5B-QI

### Quality Improvement Reports Wednesday Poster Discussions II

#### Sub-Events

#### W5B-QI-1 Credenciamento de Qualidade CBR em Mamografia para o diagnóstico correto

##### Participants

Adriano Tachibana, MD, MBA, Sao Paulo, Brazil (*Presenter*) Research Grant, Guerbet SA

##### METHODS

We surveyed the number of clinics that failed the program due to the incorrect BI-RADS classification, from September 2018 to September 2021, a period in which there was no obligation to take the course, and we compared the number of clinics that failed from September 2021 to September 2022, when it was established that the course was mandatory.

##### RESULTS

Of the 106 clinics that participated in the certification process from September 2018 to September 2021, 9 clinics failed the program due to incorrect BI-RADS classification. After the mandatory completion of the course, the clinics that had their exams failed, were informed that all doctors who performed mammography exams at the clinic, were obliged to present the certificate of conclusion of the PEC-BIRADS course, in order to return to the certification program Of Quality. After completing the course, the service could resend new exams for a new quality assessment. This process started in September 2021. Of the 43 clinics that entered the certification process from September 2021 to September 2022, 10 clinics had failed exams in the first evaluation, took the course and were approved in the second post-course evaluation. All clinics achieved quality certification in mammography.\*Discussion We conclude that the implementation of the PEC BI-RADS course was effective, since the physicians who carried out the course were able to correctly classify the BI-RADS in the mammography exams evaluated, avoiding diagnostic errors and failures in indicating the best treatment for the patient.

#### W5B-QI-2 Coronary CTA Retrospective Protocol: Is More Always Better?

##### METHODS

In order to promote improvements in image quality in CCTA exams, protocol parameters optimization in computed tomography (CT) unit of Brazil tertiary hospital (2 dual source CT scanners) were made: use of different iterative reconstruction (IR) algorithm and new protocols implementation according to patient's body mass index (BMI). In order to reduce patient's radiation exposure undergone CCTA retrospective acquisition, it was established the following steps: 1. Data from 120 CCTA retrospective scans were collected; 2. Observed average phase for image reconstruction selected by the CT scanner (FLASH versus FORCE CT); 3. Established shorter acquisition range for each CT dual source scanner according to the average observed; 4. Team update regarding the new range and awareness about increase in dose length product (DLP) when larger ranges were used.

##### RESULTS

A median reduction of 33.9% in Dose-Length Product (DLP) values was observed across all scans, with no apparent compromise to image quality. We observed 30,7% and 36,7% DLP median values reduction in FLASH and FORCE CT scanners, respectively.\*Discussion Greater image quality and reduction of radiation exposure during CCTA exams can be achieved through simple measures, such as good patient positioning, correct planning of the study area and control of cardiac heart rate by the use of beta-blockers. Protocol parameters optimization, as interactive reconstruction and automatic exposure control can also be used. In ECG triggered retrospective acquisition, the maximum radiation dose is given only in a pre-established range of the cardiac cycle, preferably in diastole. Therefore, determining more restricted reconstruction range in this acquisition mode implies in reducing patient's radiation exposure CCTA exams, without compromising image quality. Limitation of our study include use of larger ranges in cases of patients with limitations to perform the exam, as elderly patients with difficulty to follow apnea orders and patients with beta-blockers contraindications.

#### W5B-QI-3 Evaluation of MRI images and reports in an Accreditation Program

##### Participants

Adriano Tachibana, MD, MBA, Sao Paulo, Brazil (*Presenter*) Research Grant, Guerbet SA

##### METHODS

During the year 2022, 72 exams from 6 different services were evaluated. Thirteen criteria were evaluated for each exam, where each criterion was classified as "Adequate" or "Inadequate", regarding the quality of the images, congruence of laterality and efficacy of the report.

##### RESULTS

Of a total of 852 (eight hundred and fifty-two) criteria evaluated, 694 (81%) were considered adequate and 158 (19%) inadequate. Of the evaluated criteria, 40% were considered adequate in terms of image quality, 28% had the congruence of the report considered adequate and 14% of the criteria were adequate in terms of laterality. The item with the highest percentage of inadequate was the Report. The criteria with the highest disapproval were related to the content of the medical report, with 54%

of the evaluated criteria considered inadequate; the criterion related to the description of the pathology in the report had 53% of inadequacy.\*Discussion Most of the problems found in magnetic resonance images and reports concerned the content of the medical report in relation to the demonstration and description of the pathology, respectively.

#### **W5B-QI-4 Implementating a Mindfulness Training Program for Healthcare Professionals at Radiology Department of a Tertiary Hospital: A Brazilian Experience**

Participants

Paula Lucio, MSc, Barueri, Brazil (*Presenter*) Nothing to Disclose

##### **METHODS**

The intervention consisted of an eight-week training program comprising virtual sessions with guided mindfulness practices, supplemented by daily meditation practices, offered to healthcare professionals. Eight workshop sessions were conducted between June and July 2022, and voluntary participation was sought from the target audience. Daily meditative practices were shared, and forums were created for the possibility of clarifying doubts. Information was collected through standardized forms and instruments, including Conscientious Attention Awareness Scale (MAAS) and Perceived Stress Scale (PSS10), in a before-and-after design to assess changes in well-being outcomes

##### **RESULTS**

The final sample was composed of 22 health professionals (mostly nurses and biomedical scientists) that volunteered to participate, and ten professionals (45%) fully adhered to the training (group 1). For the PSS10 questionnaire, all the participants obtained the highest score for question 12 ("Have you been thinking about the things you should do?") before the intervention. Following the intervention, all the participants agreed with two specific statements of MASS: "I tend to walk fast to reach my destination, without paying attention to what I experience on the way" (answer 4) and "I am worried about the future and the past" (answer 13); irrespective of whether they completed all eight sessions (group 1) or not (group 2). Of note, the group 2 had higher response scores for a specific question of MASS after the intervention: "I don't usually notice pain or physical discomfort until they really call my attention"(question 5); when compared to the group 1.\*Discussion The described intervention was related to response changes regarding to the perception of pain and physical discomfort among all participants of the program, even if they were unable to adhere to the eight weeks of practice. Following the intervention, both groups exhibited greater attention to the present moment and reduced concern for future events, indicating that the program may have provided benefits in terms of self-perception and attention. These results suggest that the intervention was effective in enhancing participants' well-being, despite incomplete adherence to the practice.

#### **W5B-QI-5 Technologist experience implementing a mammographic image quality improvement program using automated artificial intelligence based software**

Participants

Melissa L. Hill, PHD, Issy les Moulineaux, France (*Presenter*) Consultant, Volpara Health Technologies Limited

Sally Grady, Kettering, OH (*Presenter*) Nothing to Disclose

##### **METHODS**

The prospective study included 55 Techs at a private breast imaging organization (15 clinics, OH, USA), already using a commercially available AI-based IQ software, Volpara Analytics™, for >2 years prior to study commencement. Hands-on breast positioning training was carried out by Mammography Educators, with feedback individualized for Techs in a Targeted Training Profile (TTP) according to the IQ software's automated performance reports. Five 30-day Evaluation periods were included to measure IQ changes pre (Eval. 1-2) and post-training (Eval. 3-5). Software login frequencies were also measured. Surveys were electronically delivered to Techs pre- and post-training. The pre-training survey captured prior experience. Four post-training surveys (2-5) focused on experience and engagement behaviors with the AI IQ software. Analysis included data from 46 Techs who completed all surveys.

##### **RESULTS**

Immediately post-training, survey responses showed 87% and 91.3% of Techs were satisfied or very satisfied with the TTP consultation and hands-on training, respectively. Furthermore, 71.8% responded that their software engagement would increase. The proportion of Techs that had not used the software reduced from 45.7% to 23.9% post-training (Eval 2-3), with a trend ( $p < 0.05$ ) for persistence of these login behaviors. Post-training survey responses show Techs planned for software use to improve breast positioning (>67%, Survey 3-5) and compression (>73%, Survey 3-5). At baseline, 52.2% of Techs reported physical discomfort believed to be related to acquiring mammograms. Post-training, most Techs (87%) responded that they frequently implemented changes that improved ergonomics. Also, >45% of Techs reported increased frequency of feeling confident in communicating with patients.\*Discussion Following a training intervention, individualized with objectively measured breast positioning metrics, most Techs reported and showed a positive response toward the AI IQ software. While software use and positioning training is explicitly intended to improve IQ, results suggest additional benefits may be realized that support the staff and clinical practice, such as improved ergonomics and confidence in communication. Limitations include analysis did not factor experience level.

#### **W5B-QI-6 Implementation of a Radiology Patient Experience Council in an Academic Institution**

Participants

Stephanie Shieh, RN, MS, Orange, CA (*Presenter*) Nothing to Disclose

##### **METHODS**

Starting in September 2022, a Radiology Patient Experience Council was created at the department of radiology of a tertiary academic health center in southern California. The council had member representation from quality and business systems, imaging modality supervisors, operation managers, radiology physicians, patient experience leaders and a Patient Family Advisory Council member. The council had an hour monthly meeting to review the Department National Research Corporation (NRC) Health data, prioritize patient-centered quality improvement initiatives, and discuss strategies to implement and sustain practice changes. Department NRC data from May to August 2022 was analyzed and patient feedbacks were categorized to determine action plans. We then performed literature review to guide the implementation of the initiatives. The initiatives included improving communication to inform about delays, addressing perception of staff caring and professionalism, increasing comfort during exam, improving scheduling process, improving wayfinding experiences.

## RESULTS

Some of our successful initiatives included training staff on standardized scripting for communication delays and improving patients' comfort in our radiology environment. We have also discussed patient experiences with regard to price transparency, scheduling as well as issues that concern the LGBTQIA+ community. There was an increase in likelihood to recommend the Radiology department from 81.3% in August 2022 to 83.9% in March 2023 (Figure 1). \*Discussion Keeping patient experience as a topic that is at top of mind is critical to improving the patient's experience. Having a dedicated council where the patient experience data is reviewed monthly by the radiology leadership team to ensure that appropriate patient-centric initiatives can be implemented to address patients' concerns and information can be disseminated to the radiology team members will help the entire department keep committed and accountable to improving patient care.

### **W5B-QI-7 AI Automated Opportunistic Screening for Cardiomegaly on CT**

Participants

Asser Abou Elkassem, MD, (*Presenter*) Nothing to Disclose

## METHODS

We manually segmented the heart and inner chest on a multi-institutional set of CT exams (N=1500) to train an AI algorithm (AI Cardiomegaly v1.0) to quantify area-based CTR. The patented algorithm was validated in a large study and implemented on an iMac server receiving all CT exams. The output includes a PDF report and a spreadsheet with CTR and patient information. We assessed the medical records of patients in the top 10th percentile for heart disease management. A startup was formed, and an FDA 510(k) application was submitted in May 2023.

## RESULTS

The AI Cardiomegaly algorithm processes 220 CT exams daily (around 80,000 per year). Over two weeks, we found that 40% of the top 10th percentile (N=3,200 patients) had unmanaged cardiomegaly. Unmanaged cardiomegaly occurs in 4% of routine CT exams, corresponding to nearly 1.6 million patients yearly in the U.S. We expect issued patent claims and FDA 510(k) clearance in late 2023. \*Discussion Opportunistic screening for unmanaged cardiomegaly in routine CT exams could reduce the healthcare burden of CVD. We're partnering with cardiologists to coordinate care and arrange echocardiograms and clinical visits for identified patients. Most patients will receive ongoing care, while a subset will undergo advanced cardiac imaging, stress tests, coronary studies/interventions, valvular heart repair, and pacemaker/defibrillator placement. The average Medicare reimbursement for severe CVD is nearly \$20,000. Providing appropriate management for 25% of patients with unmanaged cardiomegaly detected through screening at our institution could generate \$16M in total reimbursement annually.

### **W5B-QI-8HC Decision Trees automate the scheduling rules for Radiology appointments improving access, efficiency, call times and overall patient experience.**

Participants

Crystal Blank, Ann Arbor, MI (*Presenter*) Nothing to Disclose

### **W5B-QI-9HC Trans-Inclusive Chest Cancer Screening: A Pilot Training for Imaging Professionals**

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## Abstract Archives of the RSNA, 2023

W5B-QI-1

### Credenciamento de Qualidade CBR em Mamografia para o diagnóstico correto

#### Participants

Adriano Tachibana, MD, MBA, Sao Paulo, Brazil (*Presenter*) Research Grant, Guerbet SA

#### METHODS

We surveyed the number of clinics that failed the program due to the incorrect BI-RADS classification, from September 2018 to September 2021, a period in which there was no obligation to take the course, and we compared the number of clinics that failed from September 2021 to September 2022, when it was established that the course was mandatory.

#### RESULTS

Of the 106 clinics that participated in the certification process from September 2018 to September 2021, 9 clinics failed the program due to incorrect BI-RADS classification. After the mandatory completion of the course, the clinics that had their exams failed, were informed that all doctors who performed mammography exams at the clinic, were obliged to present the certificate of conclusion of the PEC-BIRADS course, in order to return to the certification program Of Quality. After completing the course, the service could resend new exams for a new quality assessment. This process started in September 2021. Of the 43 clinics that entered the certification process from September 2021 to September 2022, 10 clinics had failed exams in the first evaluation, took the course and were approved in the second post-course evaluation. All clinics achieved quality certification in mammography.\*Discussion We conclude that the implementation of the PEC BI-RADS course was effective, since the physicians who carried out the course were able to correctly classify the BI-RADS in the mammography exams evaluated, avoiding diagnostic errors and failures in indicating the best treatment for the patient.

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## Abstract Archives of the RSNA, 2023

W5B-QI-2

### Coronary CTA Retrospective Protocol: Is More Always Better?

#### METHODS

In order to promote improvements in image quality in CCTA exams, protocol parameters optimization in computed tomography (CT) unit of Brazil tertiary hospital (2 dual source CT scanners) were made: use of different interactive reconstruction (IR) algorithm and new protocols implementation according to patient's body mass index (BMI). In order to reduce patient's radiation exposure undergone CCTA retrospective acquisition, it was established the following steps: 1. Data from 120 CCTA retrospective scans were collected; 2. Observed average phase for image reconstruction selected by the CT scanner (FLASH versus FORCE CT); 3. Established shorter acquisition range for each CT dual source scanner according to the average observed; 4. Team update regarding the new range and awareness about increase in dose length product (DLP) when larger ranges were used.

#### RESULTS

A median reduction of 33.9% in Dose-Length Product (DLP) values was observed across all scans, with no apparent compromise to image quality. We observed 30,7% and 36,7% DLP median values reduction in FLASH and FORCE CT scanners, respectively. \*Discussion Greater image quality and reduction of radiation exposure during CCTA exams can be achieved through simple measures, such as good patient positioning, correct planning of the study area and control of cardiac heart rate by the use of beta-blockers. Protocol parameters optimization, as interactive reconstruction and automatic exposure control can also be used. In ECG triggered retrospective acquisition, the maximum radiation dose is given only in a pre-established range of the cardiac cycle, preferably in diastole. Therefore, determining more restricted reconstruction range in this acquisition mode implies in reducing patient's radiation exposure CCTA exams, without compromising image quality. Limitation of our study include use of larger ranges in cases of patients with limitations to perform the exam, as elderly patients with difficulty to follow apnea orders and patients with beta-blockers contraindications.

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## Abstract Archives of the RSNA, 2023

W5B-QI-3

### Evaluation of MRI images and reports in an Accreditation Program

#### Participants

Adriano Tachibana, MD, MBA, Sao Paulo, Brazil (*Presenter*) Research Grant, Guerbet SA

#### METHODS

During the year 2022, 72 exams from 6 different services were evaluated. Thirteen criteria were evaluated for each exam, where each criterion was classified as "Adequate" or "Inadequate", regarding the quality of the images, congruence of laterality and efficacy of the report.

#### RESULTS

Of a total of 852 (eight hundred and fifty-two) criteria evaluated, 694 (81%) were considered adequate and 158 (19%) inadequate. Of the evaluated criteria, 40% were considered adequate in terms of image quality, 28% had the congruence of the report considered adequate and 14% of the criteria were adequate in terms of laterality. The item with the highest percentage of inadequate was the Report. The criteria with the highest disapproval were related to the content of the medical report, with 54% of the evaluated criteria considered inadequate; the criterion related to the description of the pathology in the report had 53% of inadequacy.\*Discussion Most of the problems found in magnetic resonance images and reports concerned the content of the medical report in relation to the demonstration and description of the pathology, respectively.

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## Abstract Archives of the RSNA, 2023

W5B-QI-4

### Implementating a Mindfulness Training Program for Healthcare Professionals at Radiology Department of a Tertiary Hospital: A Brazilian Experience

#### Participants

Paula Lucio, MSc, Barueri, Brazil (*Presenter*) Nothing to Disclose

#### METHODS

The intervention consisted of an eight-week training program comprising virtual sessions with guided mindfulness practices, supplemented by daily meditation practices, offered to healthcare professionals. Eight workshop sessions were conducted between June and July 2022, and voluntary participation was sought from the target audience. Daily meditative practices were shared, and forums were created for the possibility of clarifying doubts. Information was collected through standardized forms and instruments, including Conscientious Attention Awareness Scale (MAAS) and Perceived Stress Scale (PSS10), in a before-and-after design to assess changes in well-being outcomes

#### RESULTS

The final sample was composed of 22 health professionals (mostly nurses and biomedical scientists) that volunteered to participate, and ten professionals (45%) fully adhered to the training (group 1). For the PSS10 questionnaire, all the participants obtained the highest score for question 12 ("Have you been thinking about the things you should do?") before the intervention. Following the intervention, all the participants agreed with two specific statements of MASS: "I tend to walk fast to reach my destination, without paying attention to what I experience on the way" (answer 4) and "I am worried about the future and the past" (answer 13); irrespective of whether they completed all eight sessions (group 1) or not (group 2). Of note, the group 2 had higher response scores for a specific question of MASS after the intervention: "I don't usually notice pain or physical discomfort until they really call my attention"(question 5); when compared to the group 1.\*Discussion The described intervention was related to response changes regarding to the perception of pain and physical discomfort among all participants of the program, even if they were unable to adhere to the eight weeks of practice. Following the intervention, both groups exhibited greater attention to the present moment and reduced concern for future events, indicating that the program may have provided benefits in terms of self-perception and attention. These results suggest that the intervention was effective in enhancing participants' well-being, despite incomplete adherence to the practice.

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## Abstract Archives of the RSNA, 2023

W5B-QI-5

### Technologist experience implementing a mammographic image quality improvement program using automated artificial intelligence based software

#### Participants

Melissa L. Hill, PHD, Issy les Moulineaux, France (*Presenter*) Consultant, Volpara Health Technologies Limited  
Sally Grady, Kettering, OH (*Presenter*) Nothing to Disclose

#### METHODS

The prospective study included 55 Techs at a private breast imaging organization (15 clinics, OH, USA), already using a commercially available AI-based IQ software, Volpara Analytics™, for >2 years prior to study commencement. Hands-on breast positioning training was carried out by Mammography Educators, with feedback individualized for Techs in a Targeted Training Profile (TTP) according to the IQ software's automated performance reports. Five 30-day Evaluation periods were included to measure IQ changes pre (Eval. 1-2) and post-training (Eval. 3-5). Software login frequencies were also measured. Surveys were electronically delivered to Techs pre- and post-training. The pre-training survey captured prior experience. Four post-training surveys (2-5) focused on experience and engagement behaviors with the AI IQ software. Analysis included data from 46 Techs who completed all surveys.

#### RESULTS

Immediately post-training, survey responses showed 87% and 91.3% of Techs were satisfied or very satisfied with the TTP consultation and hands-on training, respectively. Furthermore, 71.8% responded that their software engagement would increase. The proportion of Techs that had not used the software reduced from 45.7% to 23.9% post-training (Eval 2-3), with a trend ( $p < 0.05$ ) for persistence of these login behaviors. Post-training survey responses show Techs planned for software use to improve breast positioning (>67%, Survey 3-5) and compression (>73%, Survey 3-5). At baseline, 52.2% of Techs reported physical discomfort believed to be related to acquiring mammograms. Post-training, most Techs (87%) responded that they frequently implemented changes that improved ergonomics. Also, >45% of Techs reported increased frequency of feeling confident in communicating with patients. \*Discussion Following a training intervention, individualized with objectively measured breast positioning metrics, most Techs reported and showed a positive response toward the AI IQ software. While software use and positioning training is explicitly intended to improve IQ, results suggest additional benefits may be realized that support the staff and clinical practice, such as improved ergonomics and confidence in communication. Limitations include analysis did not factor experience level.

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## Abstract Archives of the RSNA, 2023

W5B-QI-6

### Implementation of a Radiology Patient Experience Council in an Academic Institution

#### Participants

Stephanie Shieh, RN, MS, Orange, CA (*Presenter*) Nothing to Disclose

#### METHODS

Starting in September 2022, a Radiology Patient Experience Council was created at the department of radiology of a tertiary academic health center in southern California. The council had member representation from quality and business systems, imaging modality supervisors, operation managers, radiology physicians, patient experience leaders and a Patient Family Advisory Council member. The council had an hour monthly meeting to review the Department National Research Corporation (NRC) Health data, prioritize patient-centered quality improvement initiatives, and discuss strategies to implement and sustain practice changes. Department NRC data from May to August 2022 was analyzed and patient feedbacks were categorized to determine action plans. We then performed literature review to guide the implementation of the initiatives. The initiatives included improving communication to inform about delays, addressing perception of staff caring and professionalism, increasing comfort during exam, improving scheduling process, improving wayfinding experiences.

#### RESULTS

Some of our successful initiatives included training staff on standardized scripting for communication delays and improving patients' comfort in our radiology environment. We have also discussed patient experiences with regard to price transparency, scheduling as well as issues that concern the LGBTQIA+ community. There was an increase in likelihood to recommend the Radiology department from 81.3% in August 2022 to 83.9% in March 2023 (Figure 1). \*Discussion Keeping patient experience as a topic that is at top of mind is critical to improving the patient's experience. Having a dedicated council where the patient experience data is reviewed monthly by the radiology leadership team to ensure that appropriate patient-centric initiatives can be implemented to address patients' concerns and information can be disseminated to the radiology team members will help the entire department keep committed and accountable to improving patient care.

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## Abstract Archives of the RSNA, 2023

W5B-QI-7

### AI Automated Opportunistic Screening for Cardiomegaly on CT

#### Participants

Asser Abou Elkassem, MD, (*Presenter*) Nothing to Disclose

#### METHODS

We manually segmented the heart and inner chest on a multi-institutional set of CT exams (N=1500) to train an AI algorithm (AI Cardiomegaly v1.0) to quantify area-based CTR. The patented algorithm was validated in a large study and implemented on an iMac server receiving all CT exams. The output includes a PDF report and a spreadsheet with CTR and patient information. We assessed the medical records of patients in the top 10th percentile for heart disease management. A startup was formed, and an FDA 510(k) application was submitted in May 2023.

#### RESULTS

The AI Cardiomegaly algorithm processes 220 CT exams daily (around 80,000 per year). Over two weeks, we found that 40% of the top 10th percentile (N=3,200 patients) had unmanaged cardiomegaly. Unmanaged cardiomegaly occurs in 4% of routine CT exams, corresponding to nearly 1.6 million patients yearly in the U.S. We expect issued patent claims and FDA 510(k) clearance in late 2023.\*Discussion Opportunistic screening for unmanaged cardiomegaly in routine CT exams could reduce the healthcare burden of CVD. We're partnering with cardiologists to coordinate care and arrange echocardiograms and clinical visits for identified patients. Most patients will receive ongoing care, while a subset will undergo advanced cardiac imaging, stress tests, coronary studies/interventions, valvular heart repair, and pacemaker/defibrillator placement. The average Medicare reimbursement for severe CVD is nearly \$20,000. Providing appropriate management for 25% of patients with unmanaged cardiomegaly detected through screening at our institution could generate \$16M in total reimbursement annually.

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## Abstract Archives of the RSNA, 2023

W5B-QI-8HC

**Decision Trees automate the scheduling rules for Radiology appointments improving access, efficiency, call times and overall patient experience.**

### Participants

Crystal Blank, Ann Arbor, MI (*Presenter*) Nothing to Disclose

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## **Abstract Archives of the RSNA, 2023**

W5B-QI-9HC

**Trans-Inclusive Chest Cancer Screening: A Pilot Training for Imaging Professionals**

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